X-Series Signal Analyzers

Power Amplifier Mode

N9021B N9030B N9040B N9041B N9042B
M9410A M9411A M9415A M9416A



KEYSIGHT

USER'S & PROGRAMMER'S REFERENCE

Notices

Copyright Notice

© Keysight Technologies 2020-2025

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Keysight Technologies, Inc. as governed by United States and international copyright laws.

Trademarks

WiMAX and Mobile WiMAX are US trademarks of the WiMAX Forum.

Manual Part Number

N9055-90001

Edition

Edition: 8, December 2025
Published in USA

Published by:

Keysight Technologies, Inc.
1400 Fountaingrove Parkway
Santa Rosa, CA 95403

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

U.S. Government Rights

The Software is “commercial computer software,” as defined by Federal Acquisition Regulation (“FAR”) 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement (“DFARS”) 227.7202, the US government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to US government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at http://www.keysight.com/find/sweula. The license set forth in the EULA represents the exclusive authority by which the US government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the US government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED “AS IS,” AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR OF ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT SHALL CONTROL.

Safety Information

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Table Of Contents

Power Amplifier ModeUser's & Programmer's Reference 1
Table Of Contents 3
1 Product Support & Documentation Roadmap 47
1.1 Products Covered by this Document 48
1.2 Product and Solution Cybersecurity 50
1.2.1 Responsible Disclosure Program 50
1.2.2 Report a Product Cybersecurity Issue 50
1.3 Additional Documentation 51
2 User Interface 55
2.1 Screen Tabs 56
2.1.1 Mode/Meas/View Dialog 57
2.1.1.1 Mode 58
2.1.1.2 Application Mode Remote Commands 61
Application Mode Catalog Query (Remote Command Only) 61
Current Application Model (Remote Command Only) 62
Current Application Revision (Remote Command Only) 62
Current Application Options (Remote Command Only) 62
Application Catalog Number of Entries (Remote Command Only) 63
Application Catalog Model Numbers (Remote Command Only) 63
Application Catalog Revision (Remote Command Only) 63
Application Catalog Options (Remote Command Only) 64
ESA SA compatibility command (Remote Command only) 64
GSM Mode compatibility command (Remote Command only) 64
SA compatibility command for EMC (Remote Command only) 65
Receiver compatibility command for EMC (Remote Command only) 65
APD compatibility command for EMC(Remote Command only) 65
IF Mode compatibility command for EMC (Remote Command only) 65
2.1.1.3 Measurement 66
2.1.1.4 View 66
2.1.1.5 Sequencer 68
2.1.1.6 Screen Name 71
2.1.1.7 Delete This Screen 72
2.1.1.8 Delete All But This Screen 72
2.1.1.9 89600 VSA 73

2.1.2 Add Screen 74
2.2 Meas Bar 76
2.3 Measurement Display 80
2.3.1 Window Title 80
2.3.2 Measurement Data 84
2.3.3 Annotation Hotspot 87
2.4 Menu Panel 89
2.4.1 Right-Click Menu 99
2.4.1.1 Add to User Menu 99
2.4.1.2 Help on this setting 99
2.4.2 User Menu 99
2.5 Cancel key 100
2.6 Onscreen Keyboard key 101
2.7 Touch On/Off Key 102
2.8 Tab key 103
2.9 Local Button 104
2.10 Control Bar 105
2.11 Windows 106
2.12 Undo/Redo 107
2.13 File Functions 111
2.13.1 File Explorer 111
2.14 Help 112
2.15 Status Bar 113
2.16 Block Diagram 121
2.17 View Editor 123
2.17.1 To Create a User View 127
2.17.2 To Resize or Rearrange Windows in a View 132
2.17.3 To Delete a Window from a View 135
2.17.4 To Save a User View 137
2.17.5 To Rename a User View 142
2.17.6 To Delete a User View 142
2.17.7 To Delete All User Views 142
2.17.8 Use Case: Displaying Marker and Peak Tables 142

2.17.9 View Editor Remote Commands 143
2.18 Multiscreen 144
2.18.1 Select Screen 146
2.18.2 Screen List (Remote only command) 147
2.19 Fullscreen 148
3 Power Amplifier Mode 149
3.1 Power Amplifier Measurement 150
3.1.1 Measurement Results for n = 3, 4 156
3.1.2 Measurement Results for n = 5, 6 156
3.1.3 Measurement Results for n = 9, 10 158
3.1.4 Measurement Results for n = 11 161
3.1.5 Measurement Results for n = 12 161
3.1.6 Measurement Results for n = 22 163
3.1.7 Measurement Results for n = 26, 27 164
3.1.8 Measurement Results for n = 33, 34 166
3.1.9 Measurement Results for n = 40 168
3.1.10 Views 169
3.1.10.1 Normal 171
3.1.10.2 ACP 171
3.1.10.3 EVM Metrics 171
3.1.10.4 EVM vs. Power 171
3.1.10.5 DPD Iteration 172
3.1.10.6 Delay Alignment 172
3.1.10.7 SEM 172
3.1.10.8 Normal + SEM 172
3.1.11 Windows 173
3.1.11.1 AM-AM 173
3.1.11.2 AM-PM 174
3.1.11.3 ACP Graph 174
3.1.11.4 Numeric Results 174
3.1.11.5 Raw Main Time 174
3.1.11.6 ACP Metrics 174
3.1.11.7 EVM Metrics 174

3.1.11.8 EVM vs. Power Graph 176
3.1.11.9 EVM Error Summary 177
3.1.11.10 EVM vs. Power Metrics 180
3.1.11.11 DPD Iteration Metrics 181
3.1.11.12 DPD Iteration EVM 183
3.1.11.13 DPD Iteration ACP 184
3.1.11.14 Coarse Alignment 184
3.1.11.15 Balance Alignment 185
3.1.11.16 SEM Metrics 186
3.1.11.17 SEM Graph 186
3.1.12 Amplitude 187
3.1.12.1 Y Scale 187
Ref Value 187
Scale/Div 188
Ref Position 190
Auto Scale 190
3.1.12.2 Attenuation 190
Full Range Atten 192
Atten (Mech Atten) 193
Elec Atten 197
Atten >50 GHz 201
Frequency Extender Atten 202
Adjust Atten for Min Clipping 204
Adjust Atten 205
Pre-Adjust for Min Clipping 205
Atten Step (Mech Atten Step) 209
3.1.12.3 Signal Path 210
Presel Center 210
Presel Adjust 212
Internal Preamp 213
LNA 214
µW Path Control 216
Allow Full Bypass in Auto 227
Software Preselection 228
SW Preselection Type 230
SW Preselection BW 231
High Freq Prefilter 231
3.1.13 BW 233
3.1.14 Display 233
3.1.14.1 Meas Display 233
Bar Graph 233

Show Trace 233
AM-AM Normalized 234
AM-AM Coefficient 234
AM-PM Coefficient 234
EVM Carrier Index 235
Report EVM in DB 235
Raw Main Time Points 235
AM-AM/AM-PM Fast Update Scale 236
AM-AM Fast Update Scale Result (Remote Query only) 236
AM-PM Fast Update Scale Result (Remote Query only) 237
SEM Result View 237
Show Abs2 Limit 237
3.1.14.2 View 238
View 238
User View 238
Restore Layout to Default 239
Save Layout as New View 239
Re-Save User View 239
Rename User View 240
Delete User View 240
Delete All User Views 240
View Editor Remote Commands 241
View Listing Query 241
User View Listing Query 241
3.1.14.3 Annotations 242
Graticule 242
Trace Annotation 242
Screen Annotation 243
Control Annotation 243
Meas Bar 244
Display Enable (Remote Command Only) 244
3.1.15 Frequency 245
3.1.15.1 Settings 245
Carrier Reference Frequency 245
3.1.16 Marker 246
3.1.16.1 Select Marker 247
3.1.16.2 Settings 247
Marker X 247
Marker Mode 249
Delta Marker (Reset Delta) 250
Marker Settings Diagram 250
All Markers Off 250
3.1.16.3 Peak Search 250
Marker X 250
Peak Search 250

Next Peak 251
Next Pk Right 251
Next Pk Left 251
Pk-Pk Search 251
Minimum Peak 252
Marker Delta 252
3.1.16.4 Properties 252
Marker X 253
Relative To 253
Marker Trace 253
Marker Settings Diagram 254
3.1.17 Meas Setup 255
3.1.17.1 Settings 255
Meas Type 255
IQ Coherent Averaging 256
IQ Coherent Averaging Number 256
IQ Average Data Acquisition Type 256
Meas Type 257
Power Sweep Config 258
Power Control Mode 258
Single DPD Extraction 258
PA Input Start Power 258
PA Input Stop Power 259
PA Input Power Step 259
PA Input DPD Threshold 260
PA Output Start Power 260
PA Output Stop Power 261
PA Output Power Step 261
PA Output DPD Threshold 262
LNA 262
Apply LNA Below Threshold 262
PA Input LNA Threshold 263
PA Output LNA Threshold 263
Meas Preset 264
Launch MATLAB (GUI Only) 264
3.1.17.2 Meas Standard 264
Radio Std Presets 264
Number of Carriers 265
Configure Carriers 266
Couple to #1 266
Carrier Bandwidth 267
Carrier Frequency Offset 267
Carrier Power Present 268
ACP Carrier Measurement Noise Bandwidth 268
SEM Carrier Measurement Noise Bandwidth 268
Preset from Dependent Measurement 268
3.1.17.3 Signal Generator 272

Connection Management 273
Hostname/IP Address 273
Name (Optional) 273
Add To Generator List 273
Delete Selected Generator 274
Connect/Disconnect 274
Connection State (Remote Query only) 275
Hostname or IP Address of the Connected Signal Generator (Remote Query only) 275
Name of the Connected Signal Generator (Remote Query only) 275
Frequency 275
RF Output 276
RF Off After Meas Preset 277
VXG Channel 277
Advanced 278
Common Parameters 278
DC Calibration 278
ALC State 278
Modulator Attenuation 279
Runtime Scaling 279
VXG Specific Parameters 280
VXG Channel 280
Apply Settings to Signal Generator 281
3.1.17.4 Ref Signal 281
Waveform Type 281
Waveform Location 281
Select Waveform 282
File Type 282
Waveform Name 283
Waveform on Signal Generator 284
Waveform Sample Rate 284
Waveform IQ Data Count 284
Waveform Length 285
Export to Signal Generator 285
Export to Signal Generator Immediately 286
Load from Signal Generator (Remote Command Only) 286
Load from Signal Generator Immediately 287
Load Current Active Waveform from Signal Generator (Remote Command Only) 288
Save Current Waveform IQ Data 288
Refresh All MATLAB Variables 289
Select MATLAB Variable 289
Waveform Processing 289
Common 289
Predefined Resampling Ratio 289
Resampling Ratio 290
Actual Resampling Ratio (Remote Query only) 290
Actual Resampling Ratio as string (Remote Query Only) 291
Head Idle Interval 291
Burst Formation & Mask 292
Burst Shape & Mask State 292

Lead Interval (T1) 293
Waveform Interval (T2) (Remote Query only) 293
Lag Interval (T3) 293
Idle Interval (T4) 294
Duty Cycle 294
Crest Factor Reduction 294
Crest Factor Reduction State 295
CFR Algorithm 295
Target PAPR 295
Max Iteration 296
Max Order 296
Pass Frequency 296
Stop Frequency 297
Passband Ripple 297
Stopband Attenuation 298
Block Size 298
Cancellation Percentage 299
Filter Mask 299
PAPR Before CFR 299
PAPR After CFR 300
CFR Configuration 300
Apply CFR Configuration 300
CFR Configuration Algorithm 300
CFR Configuration Target PAPR 301
CFR Configuration Max Iteration 301
CFR Configuration Max Order 302
CFR Configuration Pass Frequency 302
CFR Configuration Stop Frequency 302
CFR Configuration Passband Ripple 303
CFR Configuration Stopband Attenuation 303
CFR Configuration Block Size 304
CFR Configuration Cancellation Percentage 304
CFR Configuration Edit Filter Mask 305
Selected Filter Mask 305
Go to Row 305
Insert Row Below 305
Delete Row 305
Delete Filter Mask 306
Delete All Filter Masks (Remote Command only) 306
Copy (Remote Command Only) 306
Data (Remote Command Only) 306
Filter Mask Settings 306

3.1.17.5 DPD 307

DPD State 307
DPD Mode 308
PA Model Extraction 308
DPD Method 309
Iteration Number 310
Train & Apply Equalizer 310

Eq Training Signal Type 311
Apply Equalizer 312
Clear Equalizer Coefficients 312
Measure DPD Iteration 312
DPD Algorithm (formerly DPD Model Type) 313
DPD Meas Time 316
DPD Algorithm Configuration (formerly DPD Model Configuration) 317
Look-up Table 317
DPD Mode 319
LUT Type 319
LUT Size 319
LUT AM/AM Polynomial Order 319
LUT AM/PM Polynomial Order 320
Generalized Memory Polynomial Model (GMP) 320
DPD Mode 321
Model Identification Algorithm 321
Sync Nonlinear Order 322
Sync Nonlinear Order Selection 322
Sync Memory Depth 322
Lag Nonlinear Order 323
Lag Nonlinear Order Selection 323
Lag Memory Depth 324
Maximum Lag 324
Lead Nonlinear Order 324
Lead Nonlinear Order Selection 325
Lead Memory Depth 325
Maximum Lead 326
Memory Polynomial 326
DPD Mode 327
Model Identification Algorithm 327
Memory Order 327
Nonlinear Order 328
Odd Orders Only 328
Volterra Series 329
DPD Mode 330
Model Identification Algorithm 330
Memory Order 330
Nonlinear Order 330
Odd Orders Only 330
Cross Term Order 330
MATLAB Scripts 331
DPD Function Name 331
Extract Function Name from .m File 331
DPD Input 331
PA Input 332
PA Output 332
Signal Generator Power 332
Loss In 333
Loss Out 333

DPD Output 333
MATLAB Current Folder (Remote Command Only) 334
Additional Parameter 1-12 (Remote Command Only) 334
Iterative Learning Control (ILC) DPD 334
IQ Coherent Averaging 335
IQ Coherent Averaging Number 335
Iteration Number 335
Gain Expansion 335
Extract DPD Model 336
DPD Model 336
Model Identification Algorithm 336
Memory Order 336
Nonlinear Order 337
Odd Orders Only 337
Cross Term Order 337
Restart DPD Iteration 337
Gain Expansion 337
ILC DPD Threshold 338
3.1.17.6 Amplifier 338
Max Input Power 338
Loss In 339
Loss Out 339
Gain 339
Power Control Mode 340
Input Power 340
Output Power 340
Power Servo 341
Power Servo Tolerance 341
Power Servo Range 342
Max Iteration 342
3.1.17.7 PA Meas 342
AM-AM / AM-PM State 342
SEM State 343
EVM State 343
Radio Format 343
AM-AM / AM-PM 343
AM/AM Polynomial Order 343
AM/PM Polynomial Order 344
Threshold Level 344
AM-AM/AM-PM State 345
ACP 345
General 345
ACP Measure Method 345
Noise Correction 346
RBW 346
ACP Measurement Type 347
Power Ref Type 347
Reference Carrier Index 348

Total Power Reference 348
PSD Ref 349
PSD Unit 349
ACP Meas Time 350
Carrier 350
Number of Carriers 350
Carrier Coupling 350
Carrier Freq Offset 350
Carrier Bandwidth 351
Carrier Pwr Present 351
ACP Carrier Measurement Noise Bandwidth 351
Carrier Method 351
Carrier Filter Alpha 352
Offset 352
Offset Frequency Define 352
Offset Freq 353
Offset Integ BW 353
Offset Side 354
Offset Method 354
Offset Filter Alpha 355
EVM 355
Radio Format 355
EVM State 355
Report EVM in DB 356
Optimize EVM 356
EVM Meas Time 356
Noise Corrected EVM 357
Skip IQ Averaging 357
Meas EVM 358
Allow Full Bypass in Auto 358
Advanced 358
Phase Noise Optimization 358
Spur Avoidance (UXA H1G) 364
IF Gain 365
Other IF Gain 366
Trigger Compensation 366
Synchronization Confidence Level 367
Spectrum Inversion 367
3.1.17.8 Frequency Offset Mode 368
3.1.17.9 Frequency Offset 368
Spectrum Inversion 368
Spectrum Emission Mask 369
General 369
Radio Format 369
SEM State 369
Channel RRC Filter 370
RRC Filter Alpha 370
Channel RBW 370

Measurement Type 371
Power Reference Type 371
Reference Carrier Index 372
Total Power Reference 372
PSD Reference 373
Spectrum Peak 373
SEM Measure Time 373
Carrier 374
Number of Carriers 374
Carrier Coupling 374
Carrier Freq Offset 374
Carrier Bandwidth 374
Carrier Pwr Present 375
SEM Carrier Measurement Noise Bandwidth 375
Offset 375
SEM Offset Frequency Define 375
Offset State 376
Start Frequency 376
Stop Frequency 377
Resolution BW 377
Measure BW 378
Offset Side 378
Limits 378
Start Frequency 378
Stop Frequency 378
Absolute Limit Start 379
Absolute Limit Stop 379
Absolute Limit Stop Coupling 379
Relative Limit Start 380
Relative Limit Stop 380
Relative Limit Stop Coupling 381
Fail Mask 381
Show Abs2 Limit 381
Absolute Limit 2 Start 382
Absolute Limit 2 Stop 382
Absolute Limit 2 Stop Coupling 382
Fail Mask 2 383
3.1.17.10 Envelope Tracking 383
Envelope Tracking State 384
Envelope Source 386
Select Envelope File 386
Envelope File Name 386
Envelope File Data Length 387
Envelope OSR 387
Conversion Input Type 387
Override Absolute RF Amplitude 388
Edit Shaping Table 388
Selected Shaping Table 388
Go to Row 389

Insert Row Below 389
Delete Row 389
Delete Shaping Table 389
Delete All Shaping Tables (Remote Command only) 389
Copy (Remote Command only) 390
Data (Remote Command only) 390
Settings 390
Description 390
Comment 391
Envelope SG & ETPS Configuration 391
Envelope Signal Generator Connection 391
AWG Model Number 391
AWG Slot Number 392
Slot Auto Detection 392
Connect to/Disconnect from M3202A/M5301A Module 393
AWG Module Connection Status (Remote Query Only) 393
Envelope Signal Generator Settings 393
Sample Rate (For Non-User-Defined Envelope Source) 394
Sample Rate (For User-Defined Envelope Source) 394
Voltage Offset (For Non-User-Defined Envelope Source) 395
Voltage Offset (For User-Defined Envelope Source) 395
Pk. Single-Ended ETPS Input Voltage (For Non-User-Defined Envelope Source) 396
Pk. Single-Ended ETPS Input Voltage (For User-Defined Envelope Source) 396
Output State 397
CH1|2 Trigger Source 397
Trigger Source 398
Trigger Delay 399
Envelope Delay 400
Envelope Delay Offset 400
CH1 DC Offset (For Non-User-Defined Envelope Source) 400
CH2 DC Offset (For Non-User-Defined Envelope Source) 400
CH1 DC Offset (For User-Defined Envelope Source) 401
CH2 DC Offset (For User-Defined Envelope Source) 401
Export Envelope File to AWG Module (Remote Command only) 402
ETPS Settings 402
ETPS Gain 402
Vcc Offset 403
Vcm 403
Vcc Clipping 403
Vcc Max 404
Vcc Min 404
ETPS Input Impedance 405
Vout Normalization 405
Vin Normalization 405
PEP Max 406
Envelope Delay Offset 406
Envelope Delay 407
Align ET and RF Signals 408
Alignment Step 409

Coarse Alignment Step Number 409
Balance Alignment Step Number 410
3.1.18 Sweep 410
3.1.18.1 Sweep/Control 410
Sweep/Measure 410
Restart 412
Pause/Resume 415
Abort (Remote Command Only) 415
3.1.18.2 X Scale 416
Ref Value 416
Scale/Div 417
Ref Position 417
Auto Scaling 418
3.1.18.3 Recording 418
3.1.18.4 Playback 419
Playback Mode 420
Playback Start 421
Playback Stop 422
Step Forward 423
Sample Rate 423
3.1.19 Trace 423
4 System 424
4.1 System 426
4.1.1 Show System 426
4.1.1.1 Show System contents (Remote Query Only) 427
4.1.1.2 Computer System description (Remote Query Only) 427
4.1.1.3 CPU (Remote Query Only) 427
4.1.1.4 GPU (Remote Query Only) 427
4.1.2 Show Hardware 428
4.1.3 Show LXI 428
4.1.4 Show Support Subscriptions 428
4.1.5 Show Support ID 429
4.1.6 Control Panel... 430
4.1.7 Web Browser 430
4.1.8 Application Controls (Minimize, Exit) 431
4.1.9 Sounds 431
4.2 I/O Config 433
4.2.1 GPIB 433

4.2.1.1 GPIB Address 433
4.2.1.2 GPIB Controller 433
4.2.2 SCPI LAN 434
4.2.2.1 SCPI Telnet 435
4.2.2.2 SCPI Socket 435
4.2.2.3 SICL Server 436
4.2.2.4 HiSLIP Server 437
4.2.2.5 Verbose SCPI On/Off 437
4.2.2.6 Device Clear on Disconnect 438
4.2.2.7 SCPI Socket Control Port (Remote Query Only) 439
4.2.2.8 SCPI Instrument Port (Remote Query Only) 439
4.2.3 Web Password Reset 439
4.2.4 System IDN Response 440
4.2.4.1 System IDN Response 440
4.2.4.2 User IDN 442
4.2.4.3 SYSTem:PERSona (Remote Commands Only) 442
SYSTem:PERSona:DEFault 443
SYSTem:PERSona:MANufacturer 443
SYSTem:PERSona:MANufacturer:DEFault 443
SYSTem:PERSona:MODel 443
SYSTem:PERSona:MODel:DEFault 444
4.2.5 LXI 444
4.2.5.1 LAN Reset 444
4.2.5.2 Device Identification (Remote Command Only) 445
4.2.6 Restore I/O Config Defaults 445
4.2.7 Query USB Connection (Remote Query Only) 445
4.2.8 USB Connection Status (Remote Query Only) 446
4.2.9 USB Packet Count (Remote Query Only) 446
4.2.10 Lock Remote I/O Session (Remote Command only) 447
4.2.10.1 Lock Remote I/O Request (Remote Query only) 448
4.2.10.2 Unlock Remote I/O Session (Remote Command only) 449
4.2.10.3 Remote I/O Session Lock Name (Remote Query only) 450
4.2.10.4 Remote I/O Session Lock Owner (Remote Query only) 450
4.2.11 Multiple Network Interface Card Configuration (Remote Commands Only) 451

4.2.11.1 Multiple Network Adapters Enabled (Remote Query Only) 451
4.2.11.2 Config IPV4 Address (Remote Command Only) 452
4.2.11.3 Config IPV6 Address (Remote Command Only) 452
4.2.11.4 List All Physical Network Adapter IP Addresses (Remote Query Only) 452
4.3 Preload / Unload Modes 454
4.3.1 Power-On Mode 454
4.3.2 Table of Modes 455
4.3.3 Preload: Select All, Preload: Deselect All 455
4.3.4 Move Up, Move Down 455
4.3.5 Unload 455
4.3.6 Loaded Modes (Remote Query Only) 456
4.4 User Interface 457
4.4.1 Menu Panel Position 457
4.4.2 Menu Panel Tabs 457
4.4.3 Annotations Local Settings/All Off 457
4.4.4 Display Theme 458
4.4.5 Backlight 459
4.4.6 Backlight Intensity 459
4.4.7 Hints 460
4.4.8 Control Size 460
4.4.9 Touch On/Off 460
4.4.10 Simplified Style 461
4.4.11 Transparent Dialogs 461
4.4.12 Transparent Popups 462
4.4.13 Quick Save Mode 462
4.4.14 Screen Tabs Left/Right 463
4.4.15 Hide Screen Tabs in Full Screen 463
4.4.16 2-Screen Orientation 464
4.4.17 Clock Format 466
4.4.18 Numeric Entry Auto Open 466
4.4.19 Language 466
4.4.20 Restore User Interface Defaults 467

4.4.21 User Interface Type (Remote Query Only) 468
4.5 Power On 469
4.5.1 Power On State 469
4.5.2 Power On Application 471
4.5.3 FPGA Configuration 471
4.5.3.1 FPGA Load Preference 474
4.5.3.2 Load FPGA 475
4.5.4 Restore Power On Defaults 476
4.5.5 Configure Applications – Desktop application 476
4.5.6 Configure Applications - Instrument boot-up 479
4.5.7 Configure Applications - Remote Commands 479
4.5.7.1 Configuration list (Remote Command Only) 480
4.5.7.2 Configuration Memory Available (Remote Query Only) 480
4.5.7.3 Configuration Memory Total (Remote Query Only) 480
4.5.7.4 Configuration Memory Used (Remote Query Only) 481
4.5.7.5 Configuration Application Memory (Remote Query Only) 481
4.6 Restore Defaults 482
4.6.1 Input/Output 482
4.6.2 I/O Config 483
4.6.3 User Interface 483
4.6.4 Power On 483
4.6.5 Alignments 484
4.6.6 Misc 484
4.6.7 All 485
4.7 Alignments 487
4.7.1 Auto Align 487
4.7.1.1 Auto Align 487
4.7.1.2 All but RF 491
4.7.1.3 Alert 491
4.7.2 Align Now 494
4.7.2.1 Align Now All 496
4.7.2.2 Align Now All but RF 498
4.7.2.3 Align Now RF 499

4.7.2.4 Align Now Expired 501
4.7.2.5 Align Now Preselector 502
4.7.2.6 Align Now All but RF Preselector 502
4.7.2.7 Align Now RF Presel Only (20 Hz to 3.6 GHz) 503
4.7.2.8 Align Now External Mixer 504
4.7.2.9 Align Source 505
4.7.2.10 Align Receiver 506
4.7.2.11 Align Fast 506
4.7.2.12 Align LO Leakage 507
4.7.2.13 Align IF Cable 507
4.7.2.14 Align RRH Amplitude 507
4.7.2.15 Align Fast RRH Amplitude 508
4.7.2.16 Align RRH LO Power 508
4.7.2.17 Align LO Clock 508
4.7.2.18 Align Noise Power for IQNC 509
4.7.2.19 Align VXT Transceiver 509
4.7.2.20 Align up down converter 510
4.7.2.21 Align M9471A up down converter 510
4.7.2.22 Align Fast Up Down Converter 511
4.7.2.23 Align Specified Freq Ranges 511
Enable Extended Freq Range 512
Frequency Range 513
Enable 514
4.7.2.24 Align External Mixer Path 514
4.7.2.25 Align Low Band 515
4.7.2.26 Align High Band 516
4.7.3 Path Delay Calibration 516
4.7.3.1 Source Path Delay Calibration 517
4.7.3.2 Path Delay Correction On/Off(Remote Command only) 517
4.7.4 Temperature Drift Correction On/Off (Remote Command Only) 518
4.7.5 Show Alignment Statistics 518
4.7.6 Timebase DAC 531
4.7.6.1 Timebase DAC 531
4.7.6.2 User Value 532

4.7.7 Advanced 533
4.7.7.1 Characterize Preselector 533
4.7.7.2 Characterize Reference Clock 535
4.7.7.3 Characterize Noise Floor 537
4.7.7.4 Characterize Noise Floor for IQ Measurement 539
4.7.7.5 Calibration Temperature History 541
4.7.7.6 TDS Alignment 542
4.7.7.7 Backup or Restore Align Data... 542
Alignment Data Wizard (without Flash) 544
Perform Backup (without Flash) (Remote Command Only) 553
Perform Restore (without Flash) (Remote Command Only) 553
Alignment Data Wizard (with Flash) 554
Perform Backup (with Flash) (Remote Command Only) 562
Perform Restore (With Flash) (Remote Command Only) 562
Restore Alignment Defaults 563
4.7.7.8 RF Preselector 563
Align Now, 20 Hz to 30 MHz 564
Align Now, 30 MHz to 3.6 GHz 565
Align Now, 20 Hz to 3.6 GHz 566
Alert 567
4.7.7.9 Scheduler 567
Schedule Setup 568
Task 568
Date/Time 569
Hour 569
Minute 569
Recurrence 570
Number of Weeks 570
Day 570
4.8 Licensing 571
4.8.1 License Manager 571
4.8.2 System Software Version Date 571
4.8.3 Software Support Expiration Date 572
4.8.4 Network Licenses 572
4.8.4.1 Application Licenses 573
4.8.4.2 Instrument Software Options 573
4.8.4.3 License Checked Out Query (Remote Query Only) 573
4.8.4.4 List Licenses Checked Out (Remote Query Only) 574
4.8.4.5 Borrowed Network Licenses 574

4.8.4.6 Borrow a License 575
4.8.4.7 Listing Borrowed Licenses and Return a Borrowed License 576
List Borrowed Licenses (Remote Query Only) 576
Return a Borrowed License (Remote Command Only) 577
4.8.4.8 Enabling Network Checkouts While Borrowed 577
4.8.5 USB Portable Licenses 578
4.8.6 Configuring Network and USB Portable Licenses 578
4.8.7 Floating License Manager 579
4.8.8 Install License (Remote Command Only) 579
4.8.9 Remove License (Remote Command Only) 579
4.8.10 List Licenses (Remote Query Only) 580
4.8.11 Validate License (Remote Query Only) 581
4.8.12 Host ID Query (Remote Query Only) 581
4.9 Security 582
4.9.1 USB Write Protect 582
4.9.2 Restore Security Defaults 582
4.10 Diagnostics 583
4.10.1 Show Hardware Statistics 583
4.10.2 Pathwave Calibration Advisor... 583
4.10.3 Query the Mechanical Relay Cycle Counts (Remote Query Only) 583
4.10.4 Query the Mechanical Relay Names and Cycle Counts (Remote Query Only) 584
4.10.5 Query the Operating Temperature Extremes (Remote Query Only) 585
4.10.6 Query the Elapsed Time since 1st power on (Remote Query Only) 586
4.11 Service 587
4.12 Wake on LAN 588
4.12.1 BIOS/UEFI and Windows Operating System Configuration 588
4.12.2 Network Configuration 588
4.12.3 Procedures to Configure Wake-On-LAN 588
4.12.3.1 BIOS/UEFI and Windows Operating System Configuration Procedure for PC8 and PC9 CPUs 589
BIOS/UEFI Procedure 589
Windows Operating System Procedure 590
4.12.3.2 LAN Port, BIOS/UEFI, and Windows Operating System Configuration Procedure for PCA and PCB CPUs 592

LAN Port Connection 593
BIOS/UEFI Procedure 593
Windows Operating System Procedure 595
4.12.3.3 LAN Port, BIOS/UEFI, and Windows Operating System Configuration Procedure for CP2 CPU 597
LAN Port Connection 598
BIOS/UEFI Procedure 598
Windows Operating System Procedure 599
4.13 System Remote Commands (Remote Commands Only) 602
4.13.1 List installed Options (Remote Query Only) 602
4.13.2 Lock the Front-panel keys (Remote Command Only) 603
4.13.3 Lock Workstation (Remote Command Only) 603
4.13.4 List SCPI Commands (Remote Query Only) 605
4.13.5 Front Panel activity history (Remote Query only) 605
4.13.6 SCPI activity history (Remote Query only) 606
4.13.7 Instrument start time (Remote Query only) 606
4.13.8 SCPI Version Query (Remote Query Only) 607
4.13.9 Date (Remote Command Only) 607
4.13.10 Time (Remote Command Only) 607
4.13.11 Input Overload Enable (Remote Command Only) 608
4.13.12 Power Up (Remote Query Only) 608
5 Preset 609
5.1 Preset Dropdown 612
5.2 Mode Preset 613
5.3 Restore Mode Defaults 615
5.4 Input/Output Preset 616
5.5 Full Mode Preset 617
5.6 User Preset 618
5.7 Save 620
5.8 User Preset All Modes 621
5.9 Restore Defaults All Mode 622
5.10 User Preset Screens 623
5.11 Save 624
5.12 Restore Screen Defaults 625
5.13 Preset Type (Remote Command Only) 626

5.14 Restart Instrument (Shutdown) 627
5.15 Restart Application (Application Shutdown) 628
5.16 System Log Off (Remote Command Only) 629
5.17 Power Standby (Instrument Shutdown) 630
6 Input/Output 631
6.1 RF Source 632
6.1.1 RF Output 632
6.1.2 RF Output Port 632
6.1.3 Half Duplex Output Port 634
6.1.4 RF Power 635
6.1.5 T/R Port High Power Attenuator 635
6.1.6 Amplitude Setup 636
6.1.6.1 RF Power 637
6.1.6.2 Set Reference Power 641
6.1.6.3 Power Ref 642
6.1.6.4 Power Unit 643
6.1.6.5 Amptd Offset 643
6.1.6.6 Amplitude Increment 644
6.1.7 Frequency 644
6.1.8 List Sequencer 645
6.1.8.1 Sequencer 645
6.1.8.2 Initiate Sequence 646
6.1.8.3 Repetition 646
6.1.8.4 Trig Out Type 646
6.1.8.5 Select Data Marker 647
6.1.8.6 Manual Trigger Now 647
6.1.8.7 List Sequencer Setup 647
Number of Steps 647
Go To Step 648
Insert Step Before 648
Delete Step 648
Clear List 648
Step Trigger 649
Transition Time 649
Band 650
Device 654

Freq/Chan 655
Power 656
Waveform 657
Waveform File 658
Step Duration 658
Duration Time 659
Play Count 660
Trig Out 660
Step Configuration (Remote Command Only) 661
Step Configuration of Step Trigger parameter list (Remote Command Only) 663
Step Configuration of Transition Time parameter list (Remote Command Only) 663
Step Configuration of Radio Band parameter list (Remote Command Only) 664
Step Configuration of Radio Band Link parameter list (Remote Command Only) 664
Step Configuration of Frequency/Channel Number parameter list (Remote Command Only) 665
Step Configuration of Power parameter list (Remote Command Only) 666
Step Configuration of Waveform parameter list (Remote Command Only) 666
Step Configuration of Step Duration parameter list (Remote Command Only) 667
Step Configuration of Duration Time or Play Count parameter list (Remote Command Only) 667
Step Configuration of Output Trigger parameter list (Remote Command Only) 668
Clear List (Remote Command Only) 669
6.1.8.8 Remote Software Trigger (Remote command Only) 669
6.1.8.9 Query List Sequence Initiation Armed Status (Remote Query Only) 669
6.1.9 Frequency Setup 669
6.1.9.1 Frequency 670
6.1.9.2 Channel 670
6.1.9.3 Radio Setup 675
Radio Standard/Radio Band 675
Radio Band Link 680
6.1.9.4 Set Reference Frequency 680
6.1.9.5 Freq Reference 681
6.1.9.6 Freq Offset 682
6.1.9.7 Freq Increment 682
6.1.9.8 Rx/Tx Coupling 683
6.1.9.9 Rx/Tx Offset 684
6.1.10 Modulation 684
6.1.11 Modulation Setup 685
6.1.11.1 AM 685
6.1.11.2 AM Mod Depth 685

6.1.11.3 AM Rate 686
6.1.11.4 AM Rate Increment 686
6.1.11.5 FM 686
6.1.11.6 FM Deviation 687
6.1.11.7 FM Rate 687
6.1.11.8 FM Rate Increment 687
6.1.11.9 PM 688
6.1.11.10 PM Deviation 688
6.1.11.11 PM Rate 689
6.1.11.12 PM Rate Increment 689
6.1.11.13 ARB Setup 689
Basic Control 689
ARB State 690
Sample Rate 690
Run-Time Scaling 694
Baseband Freq Offs 695
Baseband Power 695
Mkr 1-4 Polarity 696
Clear Marker (Remote Command Only) 696
Pulse/RF Blank 697
ALC Hold 698
Trigger Type 699
Continuous trigger 699
Single trigger 700
Segment Advance trigger 701
Trigger Source 702
Bus Trigger Command (Remote Command Only) 702
Sync to Trigger Source 703
External Trigger Delay 704
External Trigger Polarity 705
Select PXI Line 706
PXI Trigger Delay 706
PXI Trigger Polarity 707
I/Q Adjustments 707
I/Q Gain 708
I/Q Delay 708
RMS 709
RMS Calculation Mode 709
Calculate 710
Use Header RMS 710
Real-Time 5G NR Compensation 711
SCS 712
Filter 712
Filter Bandwidth 712

Select Waveform 713
Segments in ARB Memory 714
Recall Waveform 714
Delete Segment From ARB Mem 714
Delete All From ARB Memory 714
Query ARB Memory File List (Remote Query Only) 714
Query ARB Memory Full File List (Remote Query Only) 715
Waveform Sequences 715
Build New Sequence 716
Segment 716
Waveform 716
Repetitions 716
Marker 1 – Marker 4 716
Sync Seq File 716
Insert Waveform 717
Segments in ARB Memory 718
Delete Segment From ARB Mem 718
Delete All From ARB Memory 718
Delete Segment 718
Save Sequence 718
Build New Sequence (Remote Command Only) 718
Edit Selected Sequence 721
Segment 721
Waveform 721
Repetitions 721
Marker 1 – Marker 4 722
Sync Seq File 722
Insert Waveform 723
Segments in ARB Memory 723
Delete Segment From ARB Mem 723
Delete All From ARB Memory 723
Delete Segment 723
Waveform Utilities 723
Add Waveform 724
Replace Selected Waveform 724
Clear Waveform from Slot 725
Lock Waveform in Slot 725
Slot Status Query (Remote Command Only) 726
Slots Free Query (Remote Query Only) 726
Slots Used Query (Remote Query Only) 727
Slot Waveform Name Query (Remote Command Only) 727
Slot Waveform Unique ID Query (Remote Command Only) 727
Locked Waveform Name List Query (Remote Query Only) 728
Locked Waveform Unique ID List Query (Remote Query Only) 728
Multi-Pack License multi-module control state (Remote Command Only) 728
Header Utilities 729
Clear Header 729
Save Header 729
Query Waveform Unique ID (Remote Query Only) 729

Query Selected Waveform Header info (Remote Query Only) 730
6.1.12 Trigger Initiate 731
6.1.13 Source Sync 731
6.1.13.1 Sync Config 731
6.1.13.2 Sync Type 732
6.1.13.3 Sync Settings 733
Secondary Module List 733
Sync Settings 734
Sync Segment 2 735
Segment 2 Frequency 735
IP Address 736
SCPI Socket Port 736
Add Secondary Module 736
Delete Secondary Module 736
Sync Runtime Settings (Remote Command Only) 737
6.1.13.4 Sync Start 737
6.1.13.5 Sync Stop 737
6.1.13.6 Sync Connected (Remote Query Only) 738
6.1.14 Source Preset 738
6.2 Input 739
6.2.1 Select Input 739
6.2.2 RF Input Port 748
6.2.3 SA Frequency Extender Firmware Update (Front Panel Only) 759
6.2.4 SA Frequency Extender Cable Correction 760
6.2.5 Half Duplex Input Port 760
6.2.6 Port Information (Remote Command Only) 761
6.2.7 RF Preselector 762
6.2.8 Notch Filter 763
6.2.9 RF Calibrator 763
6.2.10 RF Coupling 764
6.2.11 Input Z Correction 766
6.2.12 All Screens Use Same Input 767
6.2.13 External Mixer Setup 768
6.2.13.1 Mixer Presets 772
6.2.13.2 Mixer Bias 777
6.2.13.3 Table Type 778

6.2.13.4 Select VDI CCD Correction 779
6.2.13.5 Delete All VDI CCD Corrections 779
6.2.13.6 Harmonic 780
6.2.13.7 LO Doubler 781
6.2.13.8 Refresh USB Mixer Connection 781
6.2.14 Mixer Path 781
6.2.15 User IF Freq 783
6.2.16 Signal ID On/Off 783
6.2.17 Signal ID Mode 784
6.2.18 Cable IF Loss 785
6.2.19 I/Q Path 786
6.2.20 Reference Z 788
6.2.21 I/Q Setup 788
6.2.21.1 I Setup 788
Differential 788
Input Z 789
Skew 790
Combined Differential/Input Z (Remote Command Only) 790
6.2.21.2 I Probe 791
Attenuation 792
Offset 792
Coupling 793
Clear Calibration 793
6.2.21.3 Calibrate 793
I/Q Isolation Calibration 794
I/Q Isolation Calibration Time (Remote Query Only) 794
I Port 794
I Port Probe Calibration Time (Remote Query Only) 795
I-bar Port 795
I-bar Port Probe Calibration Time (Remote Query Only) 795
6.2.21.4 Q Setup 796
Q Same as I 796
Differential 796
Input Z 797
Skew 798
6.2.21.5 Q Probe 798
Attenuation 799
Offset 799
Coupling 800
Clear Calibration 800

6.2.21.6 Calibrate 801
Q Port 802
Q Port Probe Calibration Time (Remote Query Only) 802
Q-bar Port 803
Q-bar Probe Calibration Time (Remote Query Only) 803
6.2.22 I/Q Cable Calibrate 803
6.2.22.1 I Port 804
6.2.22.2 I-bar Port 805
6.2.22.3 Q Port 805
6.2.22.4 Q-bar Port 806
6.2.22.5 I/Q Cable Calibration Time (Remote Query Only) 806
6.2.23 Audio Input Channel 806
6.2.24 Audio Calibrator 807
6.2.25 Audio Coupling 807
6.2.26 Audio Input Ground 807
6.2.27 Audio In Impedance 807
6.2.28 Input/Output Preset 808
6.3 External Gain 809
6.3.1 External Preamp 809
6.3.2 External Gain - MS 811
6.3.3 External Gain - BTS 812
6.3.4 I Ext Gain 813
6.3.5 Q Ext Gain 814
6.3.6 Q Gain in I+jQ 814
6.4 Data Source 816
6.4.1 Data Source 826
6.4.2 Current Meas -> Capture Buffer 827
6.5 Correction 828
6.5.1 Select Correction 829
6.5.2 Correction On/Off 830
6.5.3 Correction Port 830
6.5.4 Correction Direction 832
6.5.5 Edit Correction 833
6.5.5.1 Select Correction 834

6.5.5.2 Frequency 834
6.5.5.3 Amplitude 837
6.5.5.4 Go to Row 837
6.5.5.5 Insert Row Below 838
6.5.5.6 Delete Row 838
6.5.5.7 Scale X Axis 838
6.5.5.8 Delete Correction 839
6.5.5.9 Correction Graph 839
6.5.6 Edit Correction Settings 840
6.5.6.1 Select Correction 840
6.5.6.2 Freq Interpolation 840
6.5.6.3 Transducer Unit 842
6.5.6.4 Description 843
6.5.6.5 Comment 843
6.5.7 Complex Corrections 844
6.5.7.1 Go To Row (Select Correction) 845
6.5.7.2 Delete Row 845
6.5.7.3 Delete All 845
6.5.7.4 Correction On 845
6.5.7.5 Correction Port 846
6.5.7.6 Direction 847
6.5.7.7 Description 848
6.5.7.8 Comment 848
6.5.7.9 File 849
6.5.7.10 Freq Interpolation (Remote Command Only) 849
6.5.7.11 Set Data (Remote Command Only) 849
6.5.8 Apply Corrections 850
6.5.9 Delete All Corrections 851
6.5.10 Correction Group On/Off 851
6.5.11 Break 852
6.5.12 Reload Corrections From Files 855
6.5.13 Edit Correction Group 855
6.5.13.1 Go to Row 855

6.5.13.2 Insert Row Below 855
6.5.13.3 Delete Row 856
6.5.13.4 Select File 856
6.5.13.5 Specify File 856
6.5.13.6 Remove File 856
6.5.13.7 Correction Trace Display 857
6.5.13.8 Description 857
6.5.13.9 Comment 857
6.5.13.10 Start Frequency 858
6.5.13.11 Stop Frequency 858
6.5.14 Merge Correction Data (Remote Command Only) 858
6.5.15 Set (Replace) Data (Remote Command Only) 859
6.5.16 Correction Group Range Data (Remote Command Only) 859
6.5.17 Delete Correction Group Range (Remote Command Only) 860
6.6 Freq Ref Input 861
6.6.1 Freq Ref Input 861
6.6.2 Ext Ref Freq 866
6.6.3 Default External Ref Freq 867
6.6.4 LO Ref Input 867
6.6.5 Ref Lock BW 868
6.6.6 Reference Oscillator On/Off (Remote Command Only) 869
6.6.6.1 Select Ref 869
6.6.6.2 Freq Ref In 870
6.6.6.3 External Freq Ref 870
6.6.6.4 Ext Ref Locked (Remote Query Only) 870
6.7 Output 872
6.7.1 Analog Out 872
6.7.2 Screen Video Level 876
6.7.3 Digital Bus Out 877
6.7.4 Wideband Digital Bus 877
6.7.5 Data Stream 880
6.7.6 I/Q Cal Out 880
6.7.7 Aux IF Out 881

6.7.8 Arbitrary IF Freq 883
6.7.9 Ext/Wide IF Out 883
6.7.10 IF2 Out 884
6.7.11 REF Out 885
6.7.12 LO Ref Out 885
6.8 Trigger Output 887
6.8.1 Trig 1 – 4 Out 887
6.8.2 Trig 1 – 4 Out Polarity 889
6.8.3 Trig 1 – 4 Out Device 890
6.8.4 Src PXI Trig Out 890
6.8.5 Src Trig Out Polarity 891
6.8.6 Select Src PXI Line 891
6.8.7 Analyzer PXI Trig Out 892
6.8.8 Analyzer Trig Out Polarity 893
6.8.9 Select Analyzer PXI Line 893
6.8.10 Source Internal Trig Out 893
6.8.11 Source Internal Trig Out Polarity 894
6.9 Calibration 896
6.9.1 Configuration 896
6.9.1.1 Cal Group 898
6.9.1.2 Calibrate Checked Rows 898
6.9.1.3 Apply Cal Group 899
6.9.1.4 Abort Calibration 899
6.9.1.5 Copy From Cal Group 900
6.9.1.6 Copy 900
6.9.1.7 Tone Spacing Multiplier (Remote Command Only) 901
6.9.1.8 Cal Input 901
6.9.1.9 Freq Offset 902
6.9.1.10 Select Calibrator 903
6.9.1.11 Identify RCal Module 903
6.9.1.12 RCal Module Serial Number (Remote Query Only) 903
6.9.1.13 RCal Reference 903
6.9.1.14 RCal Status 904

RCal Status (Remote Query Only) 905
All RCal Status (Remote Query Only) 905
6.9.1.15 Go to Row 905
6.9.1.16 Insert Row Below 905
6.9.1.17 Description 906
6.9.1.18 Use Current Meas 906
6.9.1.19 Duplicate Row 906
6.9.1.20 Delete Row 907
6.9.1.21 Delete All 907
6.9.1.22 Calibrate 907
6.9.1.23 Apply 907
6.9.1.24 Name 908
6.9.1.25 Last Cal 908
6.9.1.26 Cal Applied 909
6.9.1.27 Cal Type 909
6.9.1.28 Start Freq 910
6.9.1.29 Stop Freq 910
6.9.1.30 Freq Step 911
6.9.1.31 Freq Points 912
6.9.1.32 Mech Atten Type 912
6.9.1.33 Mech Atten Start 913
6.9.1.34 Mech Atten Stop 913
6.9.1.35 Mech Atten Step 914
6.9.1.36 Elec Atten Type 914
6.9.1.37 Elec Atten Start 915
6.9.1.38 Elec Atten Stop 916
6.9.1.39 Elec Atten Step 917
6.9.1.40 Full Range Atten Type 917
6.9.1.41 Full Range Atten Start 918
6.9.1.42 Full Range Atten Stop 918
6.9.1.43 Frequency Extender Attenuation Type 919
6.9.1.44 Frequency Extender Attenuation Start 919
6.9.1.45 Frequency Extender Attenuation Stop 920

6.9.1.46 Frequency Extender Atten Step 920
6.9.1.47 IF Path 921
6.9.1.48 IF Gain 922
6.9.1.49 Preamp 922
6.9.1.50 Low Noise Amplifier (LNA) 923
6.9.1.51 µW Path Control 923
6.9.1.52 Coupling 924
6.9.1.53 Phase Noise Optimization 924
6.9.1.54 Phase Noise Optimization All Option 930
6.9.1.55 Mixing Mode 931
6.9.1.56 Match State 931
6.9.2 Cal Group 932
6.9.3 Apply Cal Group 932
6.9.4 All Apply Cal Group Off 932
6.9.5 Connection 933
6.10 Calibrator Control 934
6.10.1 Cal Source 934
6.10.2 Output 934
6.10.3 Frequency 935
6.10.4 Signal 935
6.10.5 Cal Comb Spacing 935
6.10.6 Calibrator Reference 936
6.11 Advanced 937
6.11.1 T/R Port High Power Attenuator 937
6.12 Aux I/O Control 938
6.12.1 Data 0 – Data 7 938
6.12.2 Aux IO Control (Remote Command Only) 938
7 Save/Recall/Print 939
7.1 Quick Save 940
7.2 Recall 943
7.2.1 Recall From File / Open 944
7.2.2 State 945
7.2.2.1 Recall Type 946

7.2.2.2 Register 1 thru Register 16 947
7.2.2.3 Edit Register Names 947
7.2.3 Trace+State 948
7.2.3.1 Recall To Trace 949
7.2.3.2 Register 1 thru Register 16 949
7.2.3.3 Edit Register Names 950
7.2.4 Screen Config + State 950
7.2.5 Measurement Data 950
7.2.5.1 Data Type 951
7.2.6 Limit 951
7.2.6.1 Select Limit 952
7.2.7 Correction 952
7.2.7.1 Select Correction 953
7.2.8 Complex Correction 953
7.2.8.1 Select Complex Correction 954
7.2.9 Recall VDI CCD Correction 954
7.2.10 Mask 955
7.2.11 Sequence 955
7.2.12 Waveform 955
7.2.12.1 Load Segment to ARB Memory 957
7.2.12.2 Delete Segment From ARB Mem 958
7.2.12.3 Delete All From ARB Memory 959
7.2.12.4 Set Default Directory (Remote Command Only) 959
7.2.12.5 Query ARB Memory File List (Remote Query Only) 959
7.2.12.6 Query ARB Memory Full File List (Remote Query Only) 960
7.2.13 Power Sensor Cal Factor 960
7.2.14 DPD Model 961
7.2.14.1 Shaping Table 961
7.2.14.2 Filter Mask 962
7.2.14.3 Memory Polynomial and Volterra Coefficients Files 962
Sample file 962
Coefficient Lengths 964
How to apply the coefficients to signal 965
7.2.15 Loss Comp 967

7.2.16 Shaping Table 968
7.2.17 Filter Mask 968
7.2.18 Memory Polynomial and Volterra Coefficients Files 969
7.2.18.1 Sample file 969
7.2.18.2 Coefficient Lengths 971
7.2.18.3 How to apply the coefficients to signal 972
7.3 Save 975
7.3.1 Save to File / Save As 975
7.3.2 State 977
7.3.2.1 Register 1 thru Register 16 978
7.3.2.2 Edit Register Names 979
7.3.3 Trace+State 980
7.3.3.1 Save From Trace 982
7.3.3.2 Register 1 thru Register 16 982
7.3.3.3 Edit Register Names 983
7.3.4 Screen Config + State 983
7.3.5 Measurement Data 984
7.3.5.1 Save From 985
7.3.5.2 Data Type 985
Meas Results 985
7.3.6 Limit 987
7.3.6.1 Select Limit 991
7.3.7 Correction 991
7.3.7.1 Select Correction 995
7.3.8 Mask 995
7.3.9 Waveform Sequence 995
7.3.10 Screen Image 995
7.3.10.1 Theme 997
7.3.11 Power Sensor Cal Factor 998
7.3.12 DPD Results 998
7.3.12.1 Save DPD Model 1000
7.3.12.2 Save Pre-distorted Waveform 1000
7.3.12.3 Save PA Model 1001

7.3.12.4 Shaping Table 1001
7.3.12.5 Trace 1001
7.3.12.6 Filter Mask 1006
7.3.13 Shaping Table 1006
7.3.14 Trace 1006
7.3.15 Filter Mask 1011
7.3.16 Remote Only Commands 1011
7.3.16.1 Mass Storage Catalog (Remote Query Only) 1011
7.3.16.2 Mass Storage Change Directory (Remote Command Only) 1011
7.3.16.3 Mass Storage Copy (Remote Command Only) 1012
7.3.16.4 Mass Storage Device Copy (Remote Command Only) 1012
7.3.16.5 Mass Storage Delete (Remote Command Only) 1012
7.3.16.6 Mass Storage Data (Remote Command Only) 1013
7.3.16.7 Mass Storage Make Directory (Remote Command Only) 1013
7.3.16.8 Mass Storage Move (Remote Command Only) 1013
7.3.16.9 Mass Storage Remove Directory (Remote Command Only) 1014
7.3.16.10 Mass Storage Determine Removable Media (Remote Query Only) 1014
7.3.16.11 Mass Storage Determine Removable Media Label (Remote Command Only) 1014
7.3.16.12 Mass Storage Determine Removable Media Write-protect status (Remote Query Only) 1015
7.3.16.13 Mass Storage Determine Removable Media size (Remote Query Only) 1015
7.3.16.14 :SYSTem:SET (Remote Command Only) 1015
7.4 Print 1017
7.5 Page Setup 1018
8 Trigger 1020
8.1 Trigger 1021
8.1.1 Select Trig Source 1021
8.1.1.1 Free Run 1033
8.1.1.2 Video 1033
8.1.1.3 ADC 1034

8.1.1.4 Line 1035
8.1.1.5 External 1/Trig 1 1035
8.1.1.6 External 2/Trig 2 1036
8.1.1.7 External 3/Trig 3 1037
8.1.1.8 Trig 4 1038
8.1.1.9 Trig 5 1039
8.1.1.10 Audio External 1039
8.1.1.11 RF Burst 1040
8.1.1.12 Periodic 1041
8.1.1.13 I/Q Mag 1043
8.1.1.14 Input I 1043
8.1.1.15 Input Q 1044
8.1.1.16 I (Demodulated) 1044
8.1.1.17 Q (Demodulated) 1045
8.1.1.18 Aux I/Q Mag 1045
8.1.1.19 PXI 1046
8.1.1.20 Internal 1046
8.1.1.21 Prot Channel Detection 1047
8.1.1.22 Prot Frame Aligned 1047
8.1.1.23 Prot Event 1048
8.1.2 Trigger Level 1048
8.1.3 Trigger Delay 1051
8.1.4 Trigger Slope 1054
8.1.5 Trigger Level Absolute/Relative 1055
8.1.6 Absolute Trig Level 1056
8.1.7 Relative Trig Level 1057
8.1.8 Period 1058
8.1.9 Offset 1059
8.1.10 Reset Offset Display 1060
8.1.11 Offset Adjust (Remote Command Only) 1060
8.1.12 Sync Source 1061
8.1.13 TV Line 1062
8.1.14 Field 1062

8.1.15 Standard 1063
8.1.16 Trigger Center Frequency 1064
8.1.17 Trigger BW 1064
8.1.18 Zero Span Delay Compensation 1065
8.1.19 Select PXI Line 1066
8.1.20 Reset Sync Monitor 1066
8.1.21 Trigger Optimization 1067
8.1.22 Trigger Settings Diagram 1069
8.2 Gate Source 1070
8.2.1 Select Gate Source 1070
8.2.2 Sync Holdoff 1071
8.3 Gate Settings 1073
8.3.1 Gate On/Off 1073
8.3.2 Gate View 1074
8.3.3 Gate Delay 1076
8.3.4 Gate Length 1077
8.3.5 Gate Method 1078
8.3.6 Control Edge/Level 1079
8.3.7 Gate Holdoff 1080
8.3.8 Gate View Sweep Time 1082
8.3.9 Gate View Start Time 1083
8.3.10 Gate Delay Compensation 1083
8.3.11 Min Fast Position Query (Remote Query Only) 1085
8.3.12 Gate Preset (Remote Command Only) 1085
8.3.13 Gate Level (Remote Command Only) 1086
8.3.14 Gate Polarity (Remote Command Only) 1086
8.4 Hardware-accelerated Stepped FFT Gating (Display only) 1088
8.5 Periodic Sync Src 1089
8.5.1 Select Periodic Timer Sync Source 1089
8.6 Auto/Holdoff 1090
8.6.1 Trig Holdoff 1090
8.6.2 Auto Trig 1091
8.6.3 Holdoff Type 1091

9 Programming the Instrument 1093
9.1 List of Supported SCPI Commands 1094
* 1094
A 1094
C 1094
D 1098
F 1099
H 1099
I 1099
L 1100
M 1100
O 1101
R 1102
S 1102
T 1118
U 1119
9.2 IEEE 488.2 Common Commands 1120
9.2.1 *CAL? - Calibration Query 1120
9.2.2 *CLS - Clear Status 1121
9.2.3 *ESE - Standard Event Status Enable 1121
9.2.4 *ESR? - Standard Event Status Register Query 1122
9.2.5 *IDN? - Identification Query 1122
9.2.6 *OPC? - Operation Complete 1123
9.2.7 *OPT? - Query Instrument Options 1124
9.2.8 *RCL - Recall Instrument State 1124
9.2.9 *RST - Reset 1124
9.2.10 *SAV - Save Instrument State 1125
9.2.11 *SRE - Service Request Enable 1125
9.2.12 *STB? - Status Byte Query 1126
9.2.13 *TRG - Trigger 1126
9.2.14 *TST? - Self Test Query 1126
9.2.15 *WAI - Wait-to-Continue 1127
9.3 SCPI Operation and Results Query 1128

9.3.1 Mode Control 1128
9.3.2 Measurement Control 1128
9.3.2.1 CONFigure 1129
9.3.2.2 INITiate 1130
9.3.2.3 FETCh 1130
9.3.2.4 READ 1131
9.3.2.5 MEASure 1132
9.3.2.6 Unselected Measurements' Parameter Values 1133
9.3.3 Trace Formatting Commands 1133
9.3.3.1 Clear Trace (Remote Command Only) 1133
9.3.3.2 Send/Query Trace Data (Remote Command Only) 1134
9.3.3.3 Format Data: Numeric Data (Remote Command Only) 1136
9.3.3.4 Format Data: Byte Order (Remote Command Only) 1137
9.3.3.5 Calculate/Compress Trace Data Query (Remote Command Only) 1137
9.3.3.6 Calculate Peaks of Trace Data (Remote Command Only) 1143
9.3.3.7 Smooth Trace Data (Remote Command Only) 1145
9.3.3.8 Number of Points for Smoothing (Remote Command Only) 1147
9.3.3.9 Mean Trace Data (Remote Command Only) 1148
9.4 Status Register System & STATus Subsystem 1149
9.4.1 Status Register System Diagram 1149
9.4.2 Status Register Hierarchy 1151
9.4.3 Status Register SCPI Commands 1153
9.4.4 How to Use Status Registers 1154
9.4.4.1 Polling Method 1154
Monitoring Options 1155
9.4.4.2 Service Request (SRQ) Method 1155
Using the Service Request (SRQ) Method 1155
9.4.5 Status Register Bit Parameters 1157
9.4.6 Status Subsystem Registers and Commands 1158
9.4.6.1 Status Byte Register 1158
Service Request Enable Register 1161
Preset the Status Byte 1161
9.4.6.2 Standard Event Status Register 1162
Standard Event Status Enable Register 1163

9.4.6.3 Operation Register 1164
Operation Condition Query 1165
Operation Enable 1166
Operation Event Query 1166
Operation Negative Transition 1167
Operation Positive Transition 1167
9.4.6.4 Operation Instrument Register 1168
Operation Instrument Condition 1168
Operation Instrument Enable 1169
Operation Instrument Event Query 1169
Operation Instrument Negative Transition 1170
Operation Instrument Positive Transition 1170
9.4.6.5 Questionable Register 1171
Questionable Condition 1172
Questionable Enable 1172
Questionable Event Query 1173
Questionable Negative Transition 1173
Questionable Positive Transition 1173
9.4.6.6 Questionable Power Register 1174
Questionable Power Condition 1175
Questionable Power Enable 1175
Questionable Power Event Query 1176
Questionable Power Negative Transition 1176
Questionable Power Positive Transition 1176
9.4.6.7 Questionable Temperature Register 1177
Questionable Temperature Condition 1178
Questionable Temperature Enable 1178
Questionable Temperature Event Query 1179
Questionable Temperature Negative Transition 1179
Questionable Temperature Positive Transition 1179
9.4.6.8 Questionable Frequency Register 1180
Questionable Frequency Condition 1181
Questionable Frequency Enable 1181
Questionable Frequency Event Query 1182
Questionable Frequency Negative Transition 1182
Questionable Frequency Positive Transition 1183
9.4.6.9 Questionable Calibration Register 1183
Questionable Calibration Condition 1184
Questionable Calibration Enable 1185
Questionable Calibration Event Query 1185
Questionable Calibration Negative Transition 1186
Questionable Calibration Positive Transition 1186
9.4.6.10 Questionable Calibration Extended Needed Register 1187
Questionable Calibration Extended Needed Condition 1188
Questionable Calibration Extended Needed Enable 1188

Questionable Calibration Extended Needed Event Query 1189
Questionable Calibration Extended Needed Negative Transition 1189
Questionable Calibration Extended Needed Positive Transition 1189
9.4.6.11 Questionable Calibration Extended Failure Register 1190
Questionable Calibration Extended Failure Condition 1191
Questionable Calibration Extended Failure Enable 1191
Questionable Calibration Extended Failure Event Query 1192
Questionable Calibration Extended Failure Negative Transition 1192
Questionable Calibration Extended Failure Positive Transition 1193
9.4.6.12 Questionable Calibration Skipped Register 1193
Questionable Calibration Skipped Condition 1194
Questionable Calibration Skipped Enable 1195
Questionable Calibration Skipped Event Query 1195
Questionable Calibration Skipped Negative Transition 1195
Questionable Calibration Skipped Positive Transition 1196
9.4.6.13 Questionable Integrity Register 1196
Questionable Integrity Condition 1198
Questionable Integrity Enable 1198
Questionable Integrity Event Query 1199
Questionable Integrity Negative Transition 1199
Questionable Integrity Positive Transition 1199
9.4.6.14 Questionable Integrity Signal Register 1200
Questionable Integrity Signal Condition 1201
Questionable Integrity Signal Enable 1201
Questionable Integrity Signal Event Query 1202
Questionable Integrity Signal Negative Transition 1202
Questionable Integrity Signal Positive Transition 1203
9.4.6.15 Questionable Integrity Output Register 1203
Questionable Integrity Output Condition 1204
Questionable Integrity Output Enable 1204
Questionable Integrity Output Event Query 1205
Questionable Integrity Output Negative Transition 1205
Questionable Integrity Output Positive Transition 1206
9.4.6.16 Questionable Integrity Uncalibrated Register 1206
Questionable Integrity Uncalibrated Condition 1207
Questionable Integrity Uncalibrated Enable 1208
Questionable Integrity Uncalibrated Event Query 1208
Questionable Integrity Uncalibrated Negative Transition 1208
Questionable Integrity Uncalibrated Positive Transition 1209
10 Hardware-Accelerated Fast Power Measurement (Remote Command Only) 1210
10.1 Reset Fast Power Measurement (Remote Command Only) 1211
10.2 Define Fast Power Measurement (Remote Command Only) 1212
10.2.1 Acquisition Time 1212

10.2.2 Center Frequency 1212
10.2.3 DC Coupled 1212
10.2.4 Detector Type 1213
10.2.5 Do Noise Correction 1213
10.2.6 Do Spur Suppression 1213
10.2.7 Electronic Attenuator Bypass 1214
10.2.8 Electronic Attenuation 1214
10.2.9 External Reference Frequency 1214
10.2.10 Frequency Reference Source 1215
10.2.11 IF Gain 1215
10.2.12 IF Type 1215
10.2.13 Include Power Spectrum 1215
10.2.14 Mechanical Attenuation 1216
10.2.15 Preamp Mode 1216
10.2.16 Resolution Bandwidth Mode 1216
10.2.17 Resolution Bandwidth 1217
10.2.18 Trigger Delay 1217
10.2.19 Trigger Level 1217
10.2.20 Trigger Slope 1217
10.2.21 Trigger Source 1217
10.2.22 Trigger Timeout 1218
10.2.23 Signal Input 1218
10.2.24 Use Preselector 1218
10.2.25 Channel Bandwidth Array 1218
10.2.26 Channel Filter Type Array 1219
10.2.27 Channel Filter Alpha Array 1219
10.2.28 Channel Measurement Function Array 1219
10.2.29 Channel Offset Frequency Array 1220
10.2.30 Channel Occupied Bandwidth Percent Array 1220
10.2.31 Channel x-dB Bandwidth Array 1220
10.3 Define Fast Power Measurement Query (Remote Query Only) 1222
10.4 Configure Fast Power Measurement (Remote Command Only) 1223
10.5 Initiate Fast Power Measurement (Remote Command Only) 1224

10.6 Fetch Fast Power Measurement (Remote Command Only) 1225
10.7 Execute Fast Power Measurement (Remote Command Only) 1226
10.8 Binary Read Fast Power Measurement (Remote Command Only) 1227
10.9 Diagnostic Binary Read Fast Power Measurement (Remote Command Only) 1228

1 Product Support & Documentation Roadmap

This section describes the Keysight products covered by this document, and provides links to available support resources and related documentation.

- "Products Covered by this Document" on page 48
- "Where to Find the Latest Information" on page 49
- "Product and Solution Cybersecurity" on page 50
- "Additional Documentation" on page 51

1.1 Products Covered by this Document

For the full list of instrument models covered by this documentation, see the title page: "Power Amplifier ModeUser's & Programmer's Reference" on page 1.

Where to Find the Latest Information

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

http://www.keysight.com/find/techsupport

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, navigate to the URL above, then in the Support by Product Model Number box, enter the Product Number of your instrument (for example, N9040B) and click Find:

To receive the latest updates by email, subscribe to Keysight Email Updates:

http://www.keysight.com/find/emailupdates

Information on preventing instrument damage can be found at:

http://www.keysight.com/find/PreventingInstrumentRepair

Is your product software up-to-date?

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

http://www.keysight.com/find/techsupport

1.2 Product and Solution Cybersecurity

Keysight complies with multinational regulations for the cybersecurity of its own products and is committed to providing information to assist you in protecting your products and solutions from external cyberthreats. For more information, see:

https://www.keysight.com/us/en/about/quality-and-security/security/product-and-solution-cyber-security.html

Keysight also recommends that you secure your IT environments using appropriate third-party tools. For instruments that run the Microsoft Windows operating system, Keysight concurs with Microsoft's recommendations for ensuring that the instrument is protected:

- Get the latest critical Windows updates
- For network-connected instruments, use an internet firewall (in Keysight instruments, Windows Firewall is enabled by default)
- For network-connected instruments, use up-to-date antivirus and anti-spyware software

1.2.1 Responsible Disclosure Program

Keysight recommends that security researchers share the details of any suspected vulnerabilities across any asset owned, controlled, or operated by Keysight (or that would reasonably impact the security of Keysight and our users) using this form:

https://www.keysight.com/us/en/contact/responsible-disclosure-program.html

1.2.2 Report a Product Cybersecurity Issue

If you discover a cybersecurity issue that you suspect may involve Keysight's proprietary software, or third-party software supplied by Keysight as part of a product, or that may affect the operation of Keysight products, we encourage you to report it to us using this form:

https://www.keysight.com/us/en/about/quality-and-security/security/product-and-solution-cyber-security/report-a-product-cybersecurity-issue.html

1.3 Additional Documentation

If your instrument or computer has an internet connection, then you can access the latest editions of all relevant X-Series documentation via the links below.

This document is available in 3 formats:

- Embedded Help, in the instrument
- Online Help, at Keysight's web site

  For information on this Mode, browse to:

  http://rfmw.em.keysight.com/wireless/helpfiles/PAMode/FlexUI.htm
- Users & Programmers Reference, in downloadable PDF format

  For information on this Mode, download from:

  https://www.keysight.com/us/en/assets/9921-02267/user-manuals/Power-Amplifier-Mode-Users-and-Programmers-Reference.pdf

The following documents are available online at keysight.com:

X-Series Messages Guide

The following documents are in downloadable PDF format:

Getting Started Guides, Programming & Security

- N90x0B Getting Started & Troubleshooting Guide
- N9041B Getting Started & Troubleshooting Guide
- N9042B Getting Started & Troubleshooting Guide
- X-Series Status Register System Diagram
- Security Features & Statement of Volatility
- Initialization Instructions: Option SF2
- Initialization Instructions: Option SF3

Specifications Guides & Data Sheets

- N9000B CXA Specifications Guide
- N9010B EXA Specifications Guide
- N9020B MXA Specifications Guide
- N9030B PXA Specifications Guide
- N9040B UXA Specifications Guide
- N9041B UXA Specifications Guide
- N9030B Data Sheet

Measurement Guides

- Analog Demod Measurement Application Measurement Guide
- EMI Measurement Application Measurement Guide
- Noise Figure Measurement Guide
- Phase Noise Measurement Application Measurement Guide
- Real-Time Spectrum Analyzer Measurement Guide
- Spectrum Analyzer Mode Measurement Guide
- M9484C VXG Signal Generator and X-Series Signal Analyzers Measurement Guide

Service Guides

- N9010B EXA Service Guide
- N9020B MXA Service Guide
- N9030B PXA Service Guide
- N9040B UXA Service Guide

Application Notes

- Faster Spectrum Measurements for X-Series Signal Analyzers
- Full Bypass Path, Option FBP

- How to Get the Most Out of Your X-Series Signal Analyzer
- Optimizing Fast-Power ACLR Measurements with N9042B-N9032B X-Series Signal Analyzers
- Time Gated Spectral Analysis with X-Series Signal Analyzers
- Using Noise Floor Extension in an X-Series Signal Analyzer

Installation Notes

- N9042B Power Supply Upgrade Option HW1
- N9042B X-Series Signal Analyzer 4-GHz Analysis Bandwidth Option B14 B16 and B17
- Option PC8 and PC9 Processor Assembly Upgrade Windows 10
- Option PCA and PCB Processor Assembly Upgrade Windows 10
- Option PCS Processor Assembly Upgrade Windows 10
- Option SF1
- Option SF2
- Option SF3
- Option SS1
- Option SS3
- Option SS4
- Option SS5
- Option SSD Windows 7
- PC6 and PC7 CPU Replacement Procedure

Technical Overviews

- N6141C EMI Receiver X-Series Measurement Application
- N9068EM0E Phase Noise X-Series Measurement Application
- N9069C Noise Figure X-Series Measurement Application

- N9077C WLAN 802.11a/b/g/j/p/n/ac/af/ah/ax X-Series Measurement Application
- N9080B and N9082B LTE and LTE-Advanced FDD/TDD X-Series Measurement Application
- N9081C Bluetooth X-Series Measurement Application
- N9084EM0E Short Range Communication and IoT X-Series Measurement Application
- N9092EM0E Avionics X-Series Measurement Application

2 User Interface

Here are the basic elements of the Multitouch User Interface. For more information, tap a topic.

Included in this section are also topics for several front panel keys not described in other topics. Tap one of these topics for more information.



"Cancel key" on page 100



"Onscreen Keyboard key" on page 101



"Touch On/Off Key" on page 102



"Tab key" on page 103

2.1 Screen Tabs

In the X-Series Multitouch User Interface (or Multitouch UI), you can run many different Measurement Applications, or “Modes”. Examples are Spectrum Analyzer Mode, LTE-A FDD Mode, IQ Analyzer Mode, and Real Time Spectrum Analyzer Mode. Each Mode has its own set of controls, windows and SCPI commands.

Each Mode runs within a “Screen”. The Multitouch UI supports multiple “Screens” (see "Multiscreen" on page 144 for more information). Each screen displays one Measurement in one Mode. The set of configured screens is shown across the top of the display as a set of Screen Tabs, with a + tab at the right for adding new Screens:



You can see up to six tabs at a time on UXA, and 4 at a time on CXA, EXA, MXA, PXA, XA5 and XA6. If there are more Screens configured than this, arrows appear to the left and right of the Screen Tabs; pressing the arrows scrolls the Screen Tabs to the left or right. A scroll bar also appears at the bottom of the Screen Tabs, indicating that you can scroll the tabs by dragging them with your finger; you can also scroll them by dragging the scroll bar.

Pressing a Screen Tab selects that screen for operation. Pressing the blue (selected) Screen Tab is the same as pressing the Mode/Meas front panel key.



Both actions open the "Mode/Meas/View Dialog" on page 57. In addition, if you have a PC keyboard plugged in, the sequence CTL-SHIFT-M will open up this dialog.

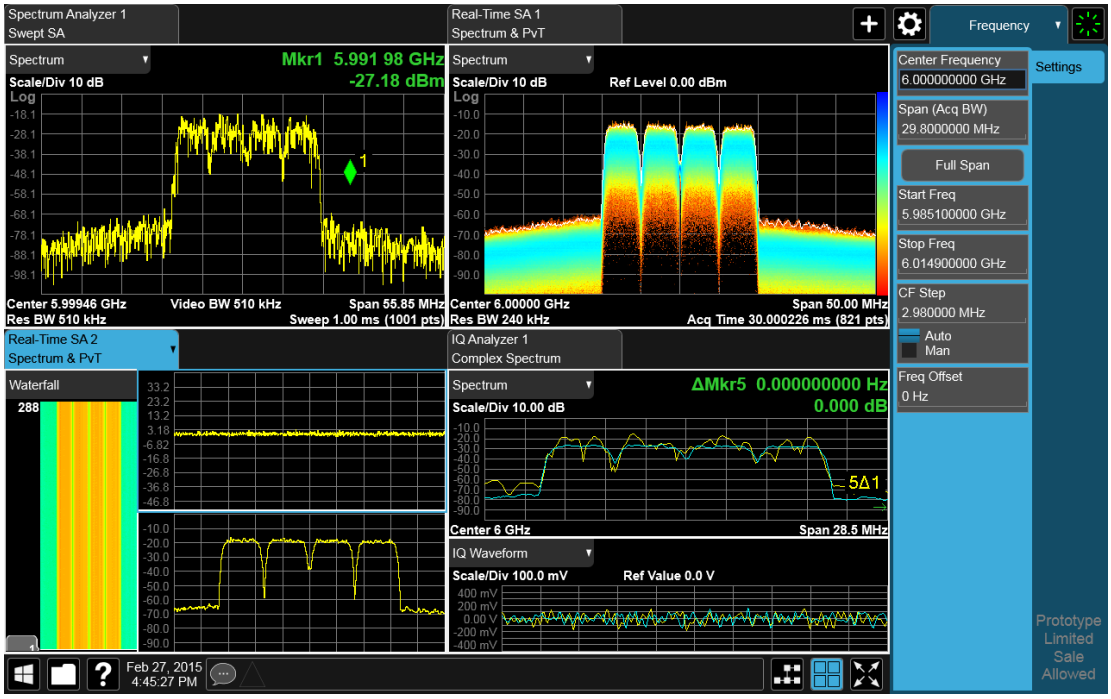
The + tab at the right of the Screen Tabs bar adds a new Screen by cloning the current screen. The new Screen has the identical setup and settings as the current Screen. You can then change the Mode, Measurement and/or settings of the new Screen.

You can define up to 16 screens at once.

Example Multiscreen View

The example below shows a four-screen display in Multiscreen view.

The Screen called “Real-Time SA 2” is selected, as indicated by its blue tab. Touching any other screen or tab selects the screen for that tab and brings it to the foreground.



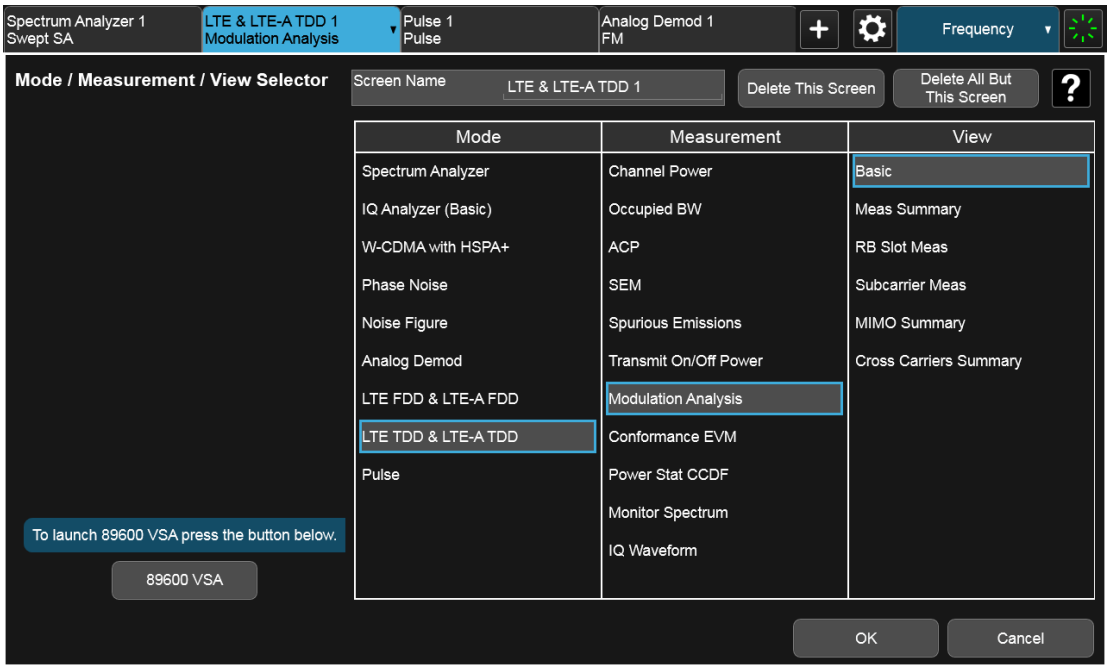
The following topics provide more information:

- "Mode/Meas/View Dialog" on page 57
- "Add Screen" on page 74
- "Multiscreen" on page 144

2.1.1 Mode/Meas/View Dialog

The Mode/Meas/View dialog opens when you press the selected (blue) Screen tab (see "Screen Tabs" on page 56) or the **Mode/Meas** front panel key.

This dialog displays lists of available Modes, Measurements and Views, as well as the "Sequencer" on page 68 control for configuring Screens.



2.1.1.1 Mode

The first column in the Mode/Meas/View Selector lets you select the desired Mode from those currently licensed in your instrument.

Modes, also known as “measurement applications”, are collections of measurement capabilities packaged together to provide you with an instrument personality specific to your measurement needs. Each Mode is ordered separately by Model Number, and must be licensed for availability in the instrument.

You select the Mode you want to run using the Mode/Meas/View Selector. Once a Mode is selected, only the commands that are valid for that mode can be executed

For more information on Modes, preloading Modes, and memory requirements for Modes, see "More Information" on page 60

`:INSTrument[:SELect]` is used to remotely select a Mode by sending the instrument a parameter which represents the name of the desired Mode. The Mode Names may be found in the table under "Index to Modes" on page 60.

`:INSTrument:NSELect` is used to remotely select a Mode by sending the Mode Number of the desired Mode. See "Instrument Number Select" on page 59. The Mode Numbers may be found in the table under "Index to Modes" on page 60.

`:INSTrument:CONFigure` causes a Mode and Measurement switch at the same time. This generally results in faster overall switching than sending `:INSTrument:SELect` and `CONFigure` separately. See "Mode and Measurement Select" on page 59.

Remote Command	`:INSTrument[:SELect] <mode_id>`
	where `<mode_id>` is *one* of the values listed in "Index to Modes" on page 60 below
	`:INSTrument[:SELect]?`

Example	`:INST SA`
Notes	A list of valid Mode options is returned by `:INST:CAT?`
Preset	The default Mode is set as follows by **Restore System Defaults->All**:
State Saved	Saved in instrument state
Annunciation	Application Title is in the Screen Tab

N8973B, N8974B, N8975B, N8976B	`NFIG`
E7760	`BASIC`
All others	`SA`

Instrument Number Select

Remote Command	`:INSTrument:NSELect <integer>` `:INSTrument:NSELect?`
Example	`:INST:NSEL 1`
Notes	Mode Numbers are listed in the table under "Index to Modes" on page 60 The command is sequential: that is, continued parsing of commands cannot proceed until the instrument select is complete and the resultant SCPI trees are available
Preset	The default Mode is set to `1` by **Restore System Defaults**, **All**, unless noted in the table above
State Saved	Saved in instrument state

Mode and Measurement Select

Remote Command	`:INSTrument:CONFigure:<mode>:<meas>` where `<mode>` is a valid parameter for the `:INST:SEL` command and `<meas>` is a valid parameter for the `:CONF` command in the Mode specified by `<mode>`

Example	Select Spectrum Analyzer Mode and the Swept SA measurement:
	`:INST:CONF:SA:SAN`
	Select WCDMA Mode and the Mod Accuracy measurement:
	`:INST:CONF:WCDMA:RHO`

Notes	The available parameters for `<mode>` depend on installed and licensed applications resident in the instrument. The available parameters for `<meas>` depend on the `<mode>` parameter, and the valid measurements available for that Mode, which can depend on model numbers and installed options In general, this command executes more quickly than sending the equivalent separate `:INST:SEL` and `:CONF` commands

Index to Modes

The Mode Number in the table below is the parameter for use with the `:INSTrument:NSELect` command. The Mode Parameter is the parameter for use with the `:INSTrument[:SELect]` command. Your actual choices will depend upon which applications are installed in your instrument.

Mode	Mode Number	Mode Parameter <mode_id>
5G NR	109	`NR5G`
89601 VSA	101	`VSA89601`
Analog Demod	234	`ADEMOD`
Avionics	232	`AVIONIC`
Bluetooth	228	`BTooth`
Channel Quality / Group Delay	161	`CQM`
EMI Receiver	141	`EMI`
GSM/EDGE/EDGE Evo	13	`EDGEGSM`
I/Q Analyzer (Basic)	8	`BASIC`
LTE FDD & LTE-A FDD	107	`LTEAFDD`
LTE TDD & LTE-A TDD	108	`LTEATDD`
Measuring Receiver	233	`MRECEIVE`
MSR	106	`MSR`
Noise Figure	219	`NFIGure`
Phase Noise	14	`PNOISE`
Power Amplifier	81	`PA`
Pulse	151	`PULSEX`
Radio Test	300	`RTS`
Real Time Spectrum Analyzer	2	`RTSA`
Remote Language Compatibility	266	`RLC`
SCPI Language Compatibility	270	`SCPILC`
Sequence Analyzer	123	`SEQAN`
Short Range Comms	218	`SRCOMMS`
Spectrum Analyzer	1	`SA`
Vector Modulation Analyzer	200	`VMA`
WCDMA with HSPA+	9	`WCDMA`
WLAN	217	`WLAN`

More Information

The Mode name appears on the Screen Tab, followed by a number identifying which instance of the Mode appears on that screen. Each screen contains one Mode.

It is possible to specify the order in which the Modes appear in the Mode menu, using the Configure Applications utility on the Desktop. It is also possible, using the same utility, to specify a subset of the available applications to load into memory at startup time, which can decrease the startup time of the instrument and the amount of memory consumed.

Each application (Mode) that runs in an X-Series instrument consumes virtual memory. The various applications consume varying amounts of virtual memory, and as more applications run, the memory consumption increases. Keysight characterizes each Mode and assigns a memory usage quantity based on a conservative estimate. The Configure Applications utility shows an estimate for how much memory each Mode will consume.

You can still run a Mode even if it is not preloaded into memory – during runtime, the first time an application that is not loaded into memory is selected (by either pressing that applications Mode key or sending that application's `:INST:SEL` command over SCPI), the Application will be loaded, but this takes a few seconds. The instrument will pause while loading the application while displaying a message box that says: "Loading application, please wait..." Preloading the application eliminates this wait time but consumes additional memory.

2.1.1.2 Application Mode Remote Commands

This section contains a number of remote commands that are provided for programming convenience and remote compatibility.

Application Mode Catalog Query (Remote Command Only)

Returns a string containing a comma-separated list of names of all the installed and licensed measurement modes (applications). These names can only be used with `:INSTrument[:SELect]`.

Remote Command	`:INSTrument:CATalog?`
Example	`:INST:CAT?`
Notes	Query returns a quoted string of the installed and licensed modes separated with a comma. Example: `"SA,PNOISE,WCDMA"`
Backwards Compatibility Notes	VSA (E4406A): `:INSTrument:CATalog?` returned a list of installed `INSTrument:SELECT` items as a comma separated list of string values, for example: `"BASIC","GSM","EDGEGSM","CDMA","SERVICE"` X-Series uses the ESA/PSA compatible query of a string contain comma separated values: `"SA,PNOISE,NFIG,BASIC"`

Current Application Model (Remote Command Only)

Returns a string that is the Model Number of the currently selected application (mode). This information is also displayed in the Show System screen.

Remote Command	`:SYSTem:APPLication[:CURRent][:NAME]?`
Example	`:SYST:APPL?`
Notes	Query returns a quoted string that is the Model Number of the currently selected application (Mode). Example: "N9060A" String length between 6 to 9 characters.
Preset	Not affected by Preset
State Saved	Not saved in state, the value will be the selected application when a Save is done.

Current Application Revision (Remote Command Only)

Returns a string that is the Revision of the currently selected application (mode). This information is also displayed in the Show System screen

Remote Command	`:SYSTem:APPLication[:CURRent]:REVision?`
Example	`:SYST:APPL:REV?`
Notes	Query returns a quoted string that is the Revision of the currently selected application (Mode). Example: "1.0.0.0" String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points) The format is Major.Minor.Build.Compile, where Major must correspond to the Integer portion of the Version in the license file for the application.
Preset	Not affected by a Preset
State Saved	Not saved in state, the value will be the selected application when a Save is done.

Current Application Options (Remote Command Only)

Returns a string that is the Options list of the currently selected application (Mode). This information is also displayed in the Show System screen

Remote Command	`:SYSTem:APPLication[:CURRent]:OPTion?`
Example	`:SYST:APPL:OPT?`
Notes	Query returns a quoted string that is the Option list of the currently selected application (Mode). The

	format is the name as the *OPT? or SYSTem:OPTion command: a comma separated list of option identifiers. Example: "1FP,2FP" String length is a maximum of 255 characters.
Preset	Not affected by a Preset
State Saved	Not saved in state per se, the value will be the selected application when a Save is invoked.

Application Catalog Number of Entries (Remote Command Only)

Returns the number of installed and licensed applications (Modes).

Remote Command	`:SYSTem:APPLication:CATalog[:NAME]:COUNt?`
Example	`:SYST:APPL:CAT:COUN?`
Preset	Not affected by Preset
State Saved	Not saved in instrument state.

Application Catalog Model Numbers (Remote Command Only)

Returns a list of Model Numbers for the installed and licensed applications (Modes).

Remote Command	`:SYSTem:APPLication:CATalog[:NAME]?`
Example	`:SYST:APPL:CAT?`
Notes	Returned value is a quoted string of a comma separated list of Model Numbers. Example, if SAMS and Phase Noise are installed and licensed: "N9060A,N9068A" String length varies based on licenses. Licenses are between 6 and 9 characters. So the string length will be between COUNt * 7 – 1 and COUNt * 10 – 1. (7 & 10 = Model Number length + 1 for comma. -1 = no comma for the 1st entry.)
Preset	Not affected by a Preset
State Saved	Not saved in instrument state.

Application Catalog Revision (Remote Command Only)

Returns the Revision of the provided Model Number.

Remote Command	`:SYSTem:APPLication:CATalog:REVision? <model>`
Example	`:SYST:APPL:CAT:REV? 'N9060A'`
Notes	Returned value is a quoted string of revision for the provided Model Number. The revision will be a null-

	string ("") if the provided Model Number is not installed, licensed, and loaded. Example, if SAMS is installed and licensed: "1.0.0.0" String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points)
Preset	Not affected by a Preset.
State Saved	Not saved in instrument state.

Application Catalog Options (Remote Command Only)

Returns a list of Options for the provided Model Number

Remote Command	`:SYSTem:APPLication:CATalog:OPTion? <model>`
Example	`:SYST:APPL:CAT:OPT? 'N9060A'`
Notes	Returned value is a quoted string of a comma separated list of Options, in the same format as *OPT? or :SYSTem:OPTion?. If the provided Model Number is not installed and licensed a null-string ("") will be returned. Example, if SAMS is installed and licensed: "2FP" String length is a maximum of 255 characters.
Preset	Not affected by a Preset
State Saved	Not saved in instrument state.

ESA SA compatibility command (Remote Command only)

Provided for backwards compatibility with ESA. When this command is received, the analyzer aliases it to the appropriate Mode.

Remote Command	`:INSTrument[:SELect] 'SA' | 'PNOISE' | 'EDGE' | 'GSM' | 'BASIC'`
Example	`:INST 'SA'`
Notes	The query is not a quoted string. It is an enumeration as indicated in the Instrument Select table above

GSM Mode compatibility command (Remote Command only)

Provided for backwards compatibility. When this command is received, the analyzer aliases it to the following:

`:INST:SEL EDGEGSM`

Remote Command	`:INSTrument[:SELect] GSM`
Example	`:INST GSM`

SA compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL SCPILC
```

This results in the analyzer being placed in SCPI Language Compatibility Mode, in order to emulate the ESU Spectrum Analyzer Mode.

Remote Command	`:INSTrument[:SELect] SANalyzer`
Example	`:INST SAN`

Receiver compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the instrument aliases it to the following:

```
:INST:SEL EMI
:CONF FSC
```

This results in the instrument being placed in the EMI Receiver Mode, running the Frequency Scan measurement, in order to emulate the ESU Receiver Mode.

Remote Command	`:INSTrument[:SELect] RECeiver`
Example	`:INST REC`

APD compatibility command for EMC(Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL EMI
:CONF APD
```

This results in the analyzer being placed in the EMI Receiver Mode, running the APD measurement, in order to emulate the ESU APD Mode.

Remote Command	`:INSTrument[:SELect] APDistribution`
Example	`:INST APD`

IF Mode compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL EMI
:CONF MON
```

This results in the analyzer being placed in the EMI Receiver Mode, running the Monitor Spectrum measurement, in order to emulate the ESU IF Mode.

Remote Command	`:INSTrument[:SELect] IFANalyzer`
Example	`:INST IFAN`

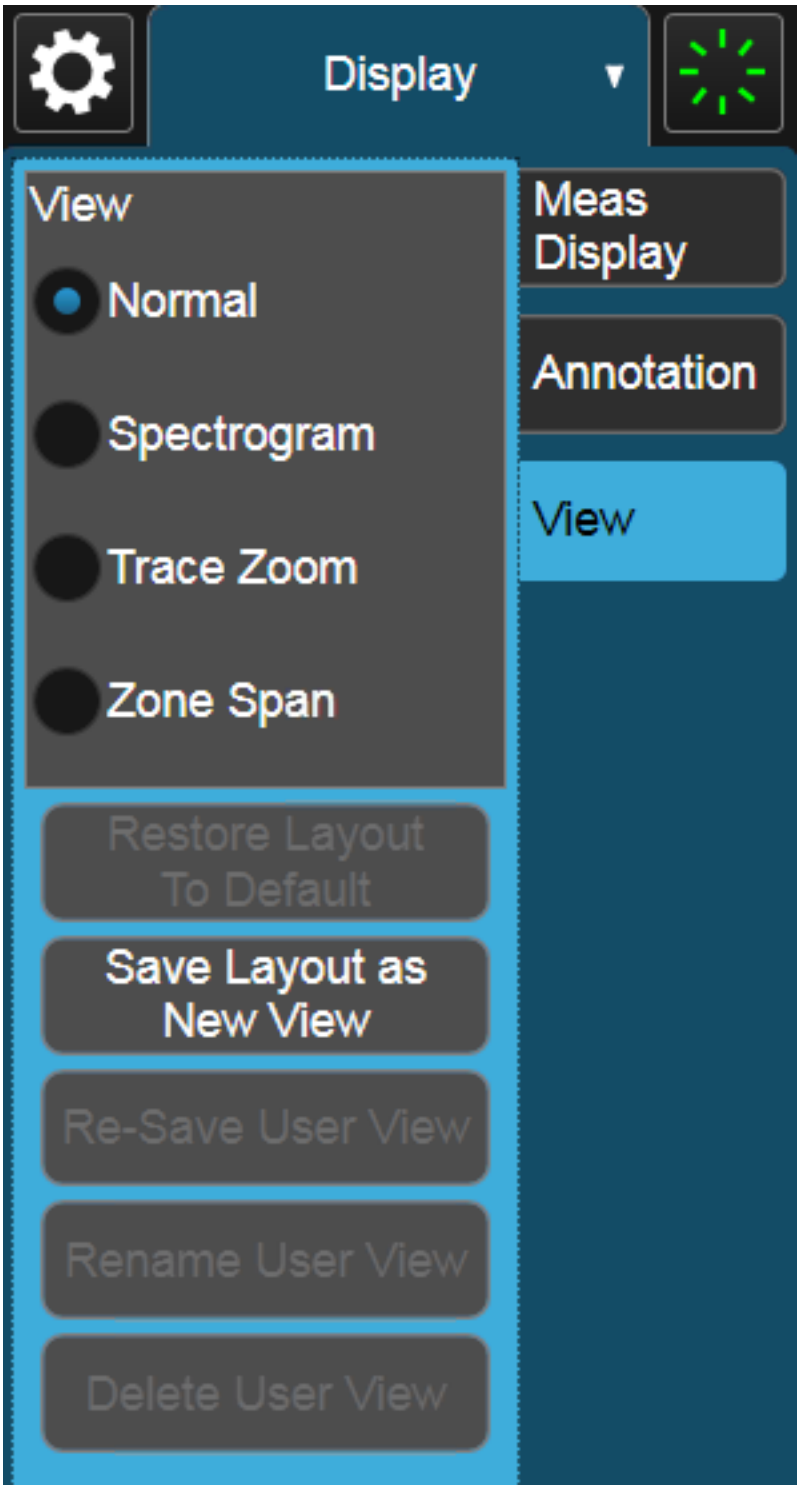
2.1.1.3 Measurement

The Measurement column of the Mode/Meas/View dialog shows all the Measurements available for the Mode which is selected in the first column. Select a Measurement in the second column and the View column will show all the Views available for that measurement. Once you have the Mode, Measurement and View selected, press OK to change the current Screen to that Mode, Measurement and View.

2.1.1.4 View

A View is a collection of Result Windows. The View column of the "Mode/Meas/View Dialog" on page 57 shows all the Views available for the Measurement which is selected in the second column. Once you have the Mode, Measurement and View selected, press OK to change the current Screen to that Mode, Measurement and View.

The View may also be set by using the View tab on the Display menu. The View tab is the last tab on the Display menu for every measurement. The Views are the same as those listed in the "Mode/Meas/View Dialog" on page 57.


Display
View
Normal
Spectrogram
Trace Zoom
Zone Span
Restore Layout To Default
Save Layout as New View
Re-Save User View
Rename User View
Delete User View
Meas Display
Annotation
View

2.1.1.5 Sequencer

Allows multiple Screens to update sequentially while in "Multiscreen" on page 144 display mode. Each Screen updates in sequence, and when all have updated, the sequence will start again.

To start the Sequencer, you must have more than one Screen defined, and you must have Multiscreen selected (see "Screen Tabs" on page 56).

If you want each Screen to use a different input, you must turn off **All Screens Use Same Input** under **Input/Output**, **Input**.

CAUTION **Differences in hardware settings between the Screens may cause switches and/or attenuators to cycle as you go from one Screen to another. This could potentially reduce the life of these components. To avoid this, make sure Attenuation, µW Path Control and other switch settings are the same in each Screen.**

NOTE **When the Sequencer is running, the destination of remote commands is unpredictable, so you should stop the Sequencer before sending any measurement-related commands. Once the Sequencer has stopped, select a specific Screen using `:INSTrument:SCReen:SELect`, before sending any further commands. See "Select Screen" on page 146**

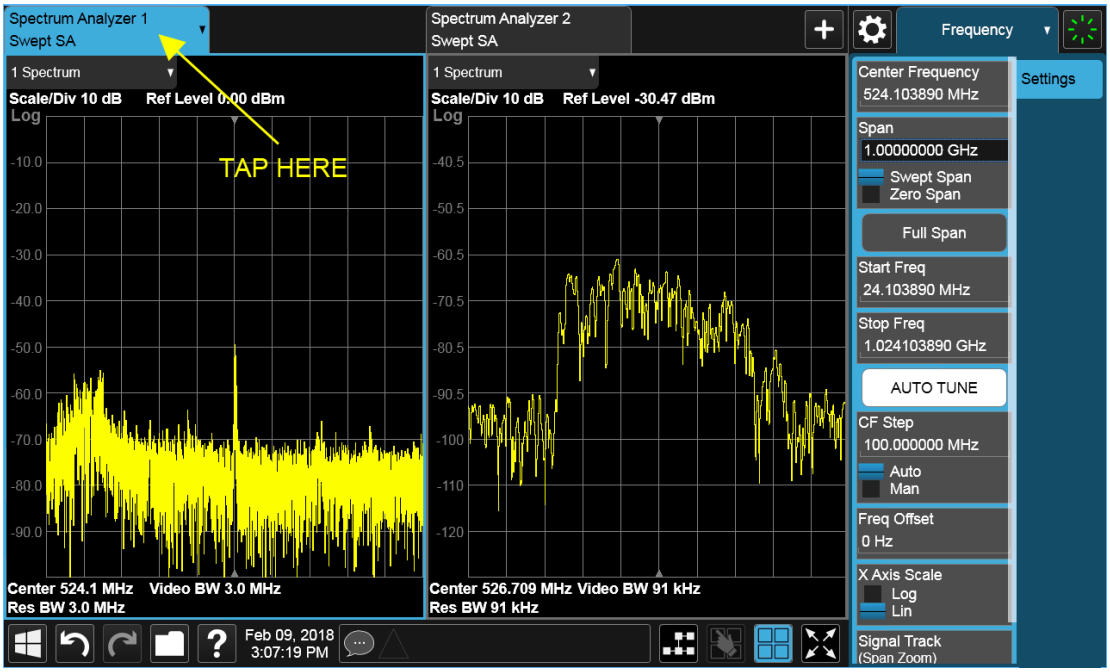
NOTE **When the Sequencer is running, Auto alignment is temporarily disabled. A pending auto alignment might be executed when the sequencer is stopped.**

See "More Information" on page 68

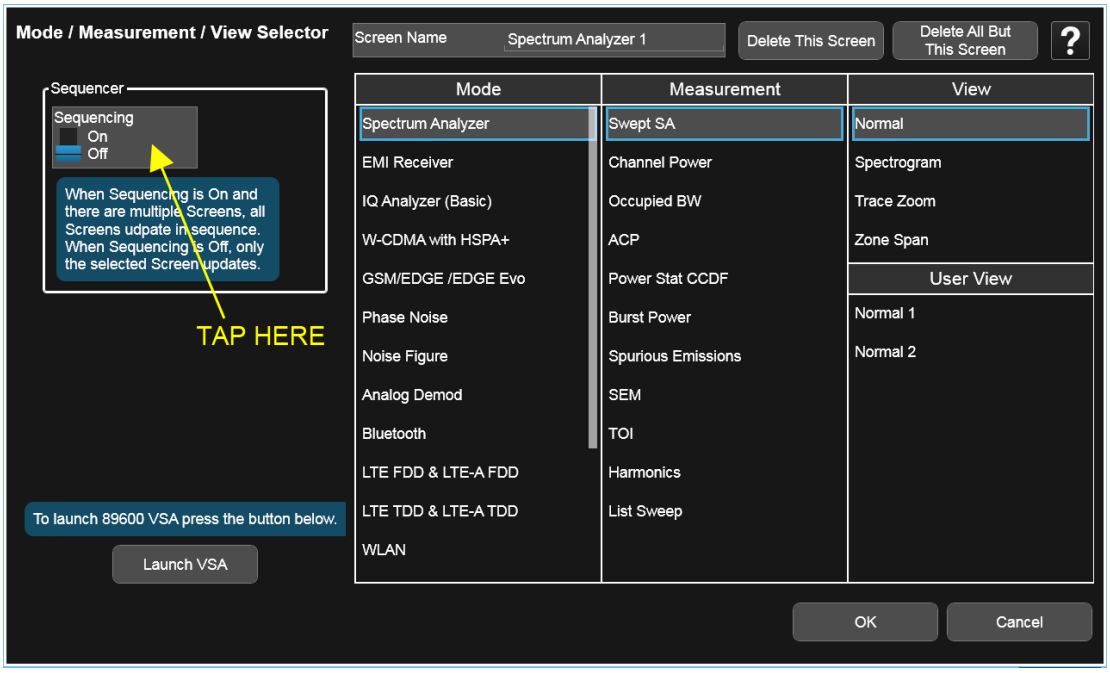
Remote Command	`:SYSTem:SEQuencer ON | OFF | 1 | 0` `:SYSTem:SEQuencer?`
Example	`:SYST:SEQ ON`
Notes	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated
Dependencies	To start the Sequencer, you must have more than one Screen defined and you must have Multiscreen selected
Preset	`OFF`

More Information

To start the Sequencer, tap the current (blue) Screen tab to go into the Mode/Meas/View Dialog:

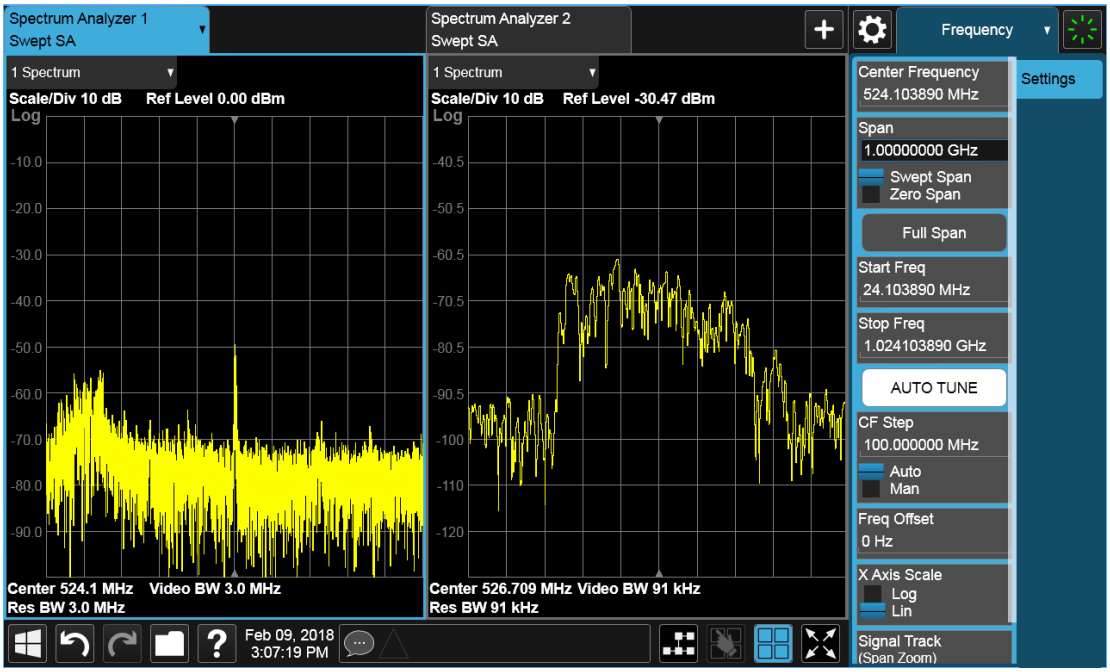


In the Sequencer block in the upper left hand corner, tap the Sequencing switch to turn it On:

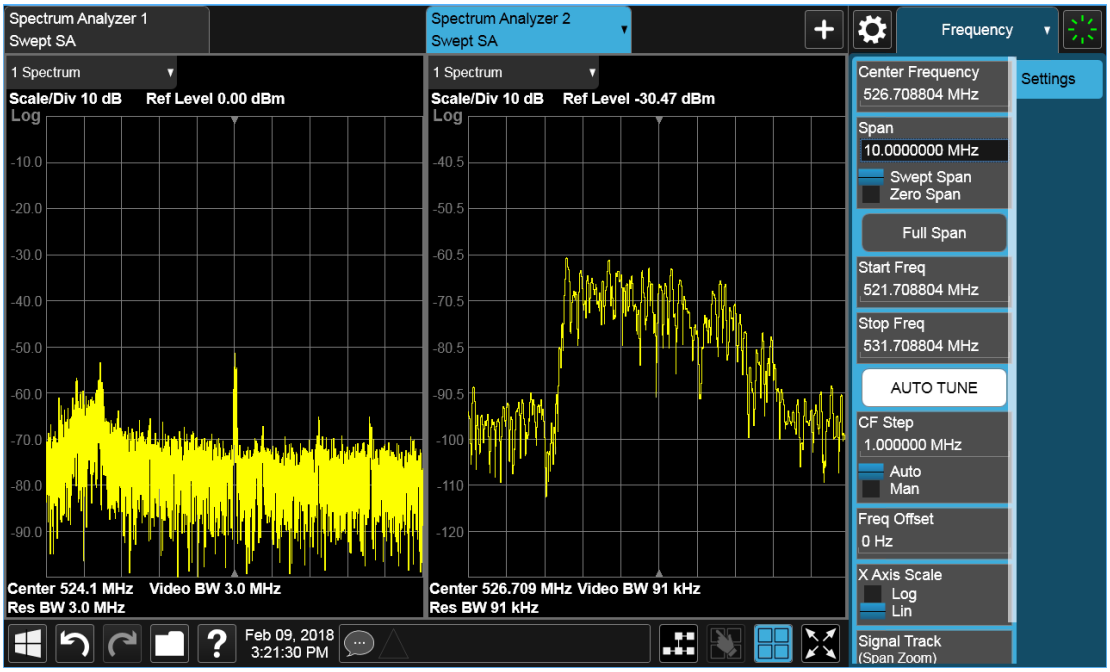


The instrument will immediately exit the Mode/Meas/View Dialog and begin making measurements in each of the screens, one after the other. When a measurement is being made in a particular Screen, that Screen's tab will be blue.

Measurement being made in Screen 1:



Measurement being made in Screen 2:



Touching any key or control on the display will cause the Sequencer to stop, so that you can make desired changes. When this happens, the message “Sequencer stopped” is displayed.

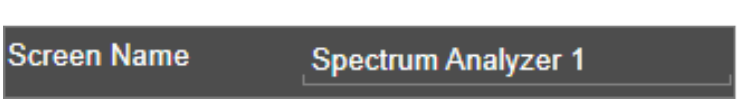
When the Sequencer is running, the screens update in the order in which they were created.

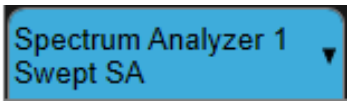
Each Screen takes one measurement then passes control to the next Screen. Each Screen updates as though it were in Single Sweep or Single Measurement mode. Thus, if Averaging is on, a Screen may take multiple sweeps before moving on to the next Screen.

2.1.1.6 Screen Name

By default, the screen name is the Mode (Application) name followed by a number indicating the instance of the application.

You may change the name displayed on the Screen Tab of any screen. The control to do this appears in the "Mode/Meas/View Dialog" on page 57:





When you touch this control an onscreen keyboard appears, allowing you to change the name. Whatever you change it to appears on the Tab, even if you subsequently change the screen to a different Mode.



To reset the name, delete the screen name entirely.

Each Screen Name must be unique; you cannot give the same name to more than one screen.

Remote Command	`:INSTrument:SCReen:REName <alphanumeric>`
Example	`:INST:SCR:REN "Baseband"`
Notes	The currently active screen is renamed. If the `<alphanumeric>` specifying the new name is already present in the list of screen names, the error message "-224, Illegal parameter value; New name <name> already exists" appears If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" appears

2.1.1.7 Delete This Screen

Pressing this button deletes the current Screen (the one with the blue tab). Deleting a screen removes it from view and selects the next lower screen in the list of screens. If only one screen is configured, it cannot be deleted.

If you press the Delete This Screen button, a prompt appears:

"This function will delete the current screen and its settings. This action cannot be undone. Do you want to proceed?"

Pressing OK or Enter deletes the screen, pressing Cancel or ESC does not.

Remote Command	`:INSTrument:SCReen:DELete`
Example	`:INST:SCR:DEL`
Notes	The currently active screen is deleted If the screen you are attempting to delete is the only configured screen, the error message "-221, Settings conflict; Last screen cannot be deleted" is displayed If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated

2.1.1.8 Delete All But This Screen

Pressing this control deletes all the Screens except the current Screen (the one with the blue tab).

If you press the Delete All But This Screen button, a prompt appears:

"This function will delete all defined screens and their settings, except for the current screen. This action cannot be undone. Do you want to proceed?"

Pressing OK or Enter deletes the screen, pressing Cancel or ESC does not.

Remote Command	`:INSTrument:SCReen:DELete:ALL`
Example	`:INST:SCR:DEL:ALL`
Notes	You can reset the instrument to the power-on configuration by invoking `:INST:SCR:DEL:ALL` followed by `:SYSTem:DEFault ALL` If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" appears

2.1.1.9 89600 VSA

Pressing this button launches the 89600 VSA software. The 89600 VSA software is powerful, PC-based software, offering the industry's most sophisticated general purpose and standards specific signal evaluation and troubleshooting tools for R&D engineers. Even for proprietary and non-standard signals in SATCOM or MILCOM applications, you can make signal quality measurements with customized IQ constellation.

The 89600 VSA software offers the following features:

- Over 35 general-purpose analog and digital demodulators ranging from 2FSK to 4096QAM
- Flexible and custom IQ and OFDM signal analysis for single carrier
- Standards specific modulation analysis including:
  - Cellular: GSM/EDGE, cdma2000, W-CDMA, TD-SCDMA, LTE(FDD/TDD)
  - LTE-Advanced and more
  - Wireless networking: 802.11a/b/g, 802.11n, 802.ac, 802.16 WiMAX (fixed/mobile), WiSUN (MR-FSK PHY)
  - RFID
  - Digital satellite video and other satellite signals, radar, LMDS
- Up to 400K bin FFT, for the highest resolution spectrum analysis
- A full suite of time domain analysis tools, including signal capture and playback, time gating, and CCDF measurements
- 20 simultaneous trace displays and the industry's most complete set of marker

functions

– Easy-to-use Microsoft Windows graphical user interface

For more information, see the Keysight 89600 Series VSA web site at www.keysight.com/find/89600vsa

To learn more about how to use the 89600 VSA in the instrument, start the 89600 VSA software, then open the 89600 VSA Help and navigate to the topic "About Keysight X-Series Signal Analyzer with 89600 VSA Software".

Example	`:INST:SEL VSA89601` `:INST:NSEL 101`

2.1.2 Add Screen

On X-Series analyzers you can configure up to 16 different Screens at one time. Each Screen contains one Mode, each Mode contains one Measurement, and each Measurement contains a number of Windows.

You can add screens by pressing the “+” icon in the "Screen Tabs" on page 56 panel. The icon is shown below:



Every time you add a Screen, the instrument “clones” or “copies” the current Screen into the new Screen. If desired, you can then use the "Mode/Meas/View Dialog" on page 57 to change the Mode, Measurement and/or View of the new Screen, or simply operate a second copy of your previous Screen, thus preserving the settings of your previous Screen.

When you have defined the maximum number of Screens (16), the “+” icon disappears.

For more information about operating the instrument with multiple screens configured, see "Multiscreen" on page 144.

Remote Command	`:INSTrument:SCReen:CREate`
Example	`:INST:SCR:CRE`
Notes	The maximum number of screens is 16. If an attempt to add a screen occurs when the maximum have been defined, the error message “-221, Settings conflict; Screen limit reached” appears When you create a new screen the Screen Name is the current Mode name followed by a number indicating the instance of the Mode.

If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" appears

2.2 Meas Bar

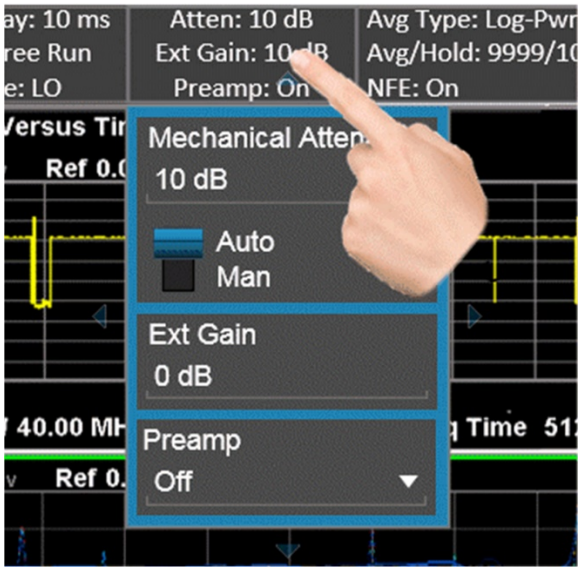
The Meas Bar is used to display annotation for the current measurement. There are three primary uses for the Meas Bar:

1. To show annotation for the most important parameters in the measurement so you can see them at a glance
2. To show the annotation that you will most want to have recorded in a screen dump
3. To give you quick access to settings.



The Meas Bar is made up of a number of annotation panels, each of which, when pressed, opens up a dialog below it which contains controls for those settings.

For example, here is what the display looks like when you touch one of the regions of the Meas Bar:



Touching anywhere off the hotspot panel or pressing any hardkey except Save or Quick Save closes the hotspot panel.

In a hotspot panel, the control in black with the blue border is the active function. Each panel may have its own default active function.

Settings that are colored amber are those that you need to be particularly aware of; for example, if Alignments are off, this is shown in amber, so you will know that you may not be meeting spec. Similarly, if DC coupling is on, this is shown amber, to alert you to be careful what voltage you put on the input.

You can turn the Meas Bar on and off with a switch on the Annotation tab of the Display menu.

System Control Panel

The leftmost panel holds the GPIB/Remote annunciators, the Single/Continuous symbol/control, the LXI indicator and the PASS/FAIL indicator. Tapping this panel drops down controls for Single/Continuous, Pause/Resume and restart.



GPIB/Remote annunciators

The GPIB/Remote annunciators are shown as the letters KRLTS. Each letter is shown if the state is true and is not shown if the state is false, as follows:

K	Keylock indicator	This is shown when the instrument is in the Keylock state (turned on and off by the SYST:KLOCk command)
R	Remote annunciator	Shown when the instrument is in the remote state, as when being controlled via the IEEE-488 bus (GPIB) or TCP/IP connections
L	GPIB Listen annunciator	Shown when addressed to listen via GPIB orTCP/IP
T	GPIB Talk annunciator	Shown when addressed to talk via GPIB or TCP/IP
S	GPIB SRQ annunciator	Shown when the instrument is asserting SRQ on GPIB. This annunciator is an amber color

Single/Continuous symbol/control

This annunciator shows as an arrow on an oval line when in Continuous, or an arrow on a straight line when in Single.

LXI indicator

This indicator displays in green when LAN is connected, in white when LAN is not connected, and in red when LAN is connected but has a connection problem.

PASS/FAIL indicator

This annunciator displays when Limits are turned on. It is green if all Limits are passing, and a red FAIL if any limit is not passing.

The following command queries the status of the current measurement limit testing. It returns a 0 if the measured results pass when compared with the current limits. It returns a 1 if the measured results fail any limit tests.

Remote Command	`:CALCulate:CLIMits:FAIL?`
Example	`:CALC:CLIM:FAIL?` queries the current measurement to see if it fails the defined limits Returns a 0 or 1: 0 it passes, 1 it fails

Trace Detector Settings Panel

In the Swept SA and some other measurements, there is a special panel summarizing the settings for the traces in the measurement:



There is one column for each trace. The rows are as follows:

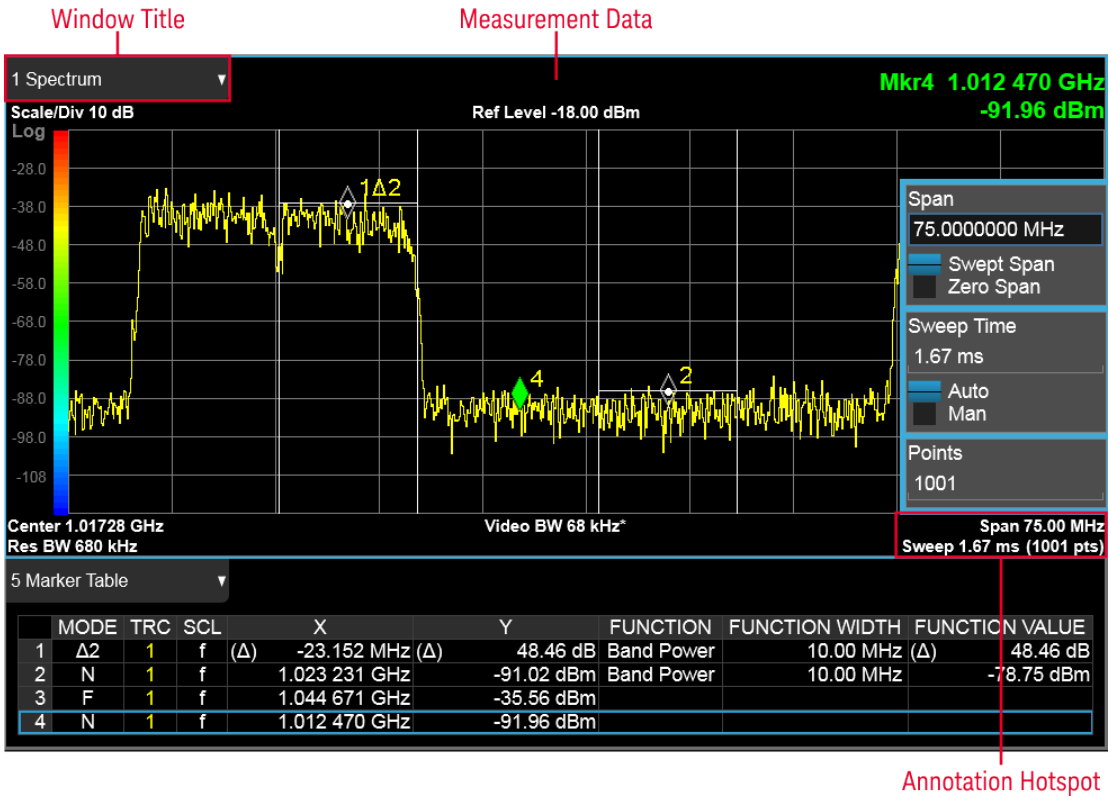
- The top row shows the Trace Number, in the trace color.
- The second row shows the Trace Type for each trace (W=Clear/Write, A=Trace Average, M=Max Hold, m=Min Hold); this letter is in white if the trace is Active, in gray if the trace is inactive; there is a bar through the letter if the trace is not being displayed
- The third row shows the detector for each trace (N=Normal, S=Sample, A=Average, P=peak, p=negative peak, Q=Quasi Peak, E=EMI Average, R=RMS Average, f=math function)

In the example above, trace 1 is active, visible, and in Average using the Sample detector, the other traces are inactive, blanked and in Clear/Write using the Normal detector.

Tapping this panel drops down controls for the Traces.

2.3 Measurement Display

The Measurement Display contains one or more data windows displaying the result of the current measurement. These may be graphical or textual windows.



Each window in the Measurement display contains a "Window Title" on page 80, "Measurement Data" on page 84, and graphical windows also may contain "Annotation Hotspot" on page 87.

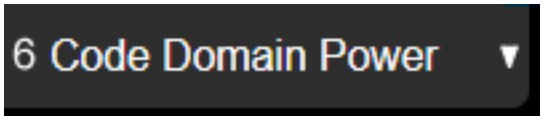
The selected window in the Measurement Display is indicated by a blue border. Window-dependent controls in the menu panel always refer to the selected window.

2.3.1 Window Title

The Window Title appears in the upper left hand corner of the window, and includes a title describing the measurement data currently being displayed in the window. The title may also contain additional information about the data in the window, for example in the LTE measurement supplication, the component carrier being displayed in the window will be indicated (e.g., “CC0”).

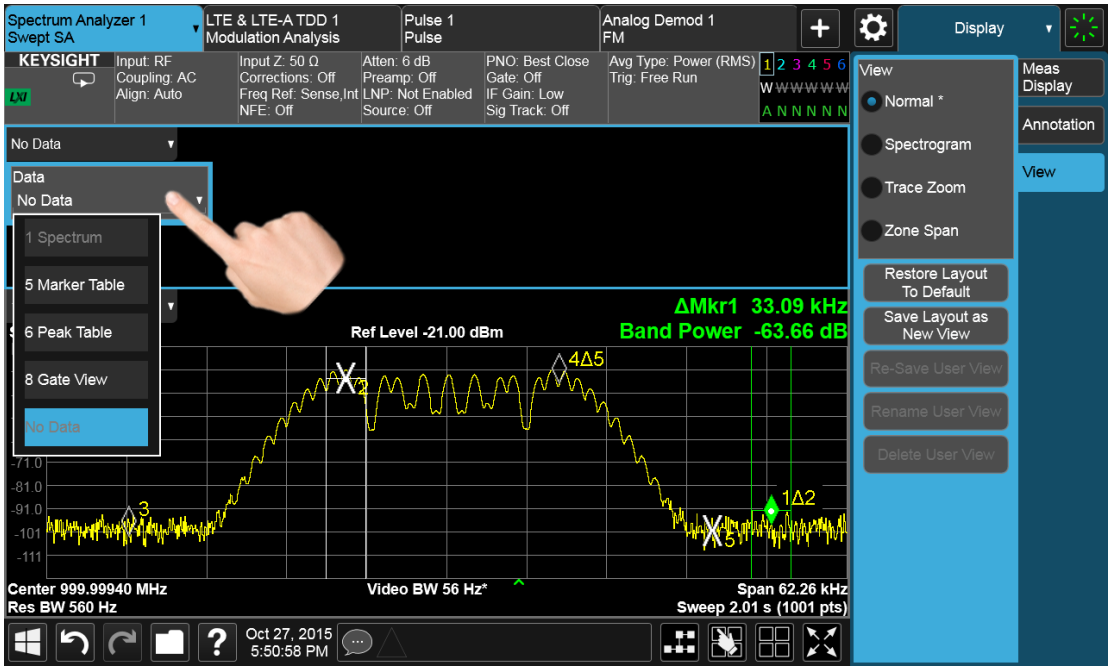
Measurements that support User Views (see "View Editor" on page 123) also display the Window Number in the Window Title, to enable window addressing from SCPI. The number is the number that will be used in the SCPI command to address that window, for example, in the WCDMA Mod Accuracy measurement, Code Domain Power is assigned window number 6, so you address it with the following SCPI command:

```
:DISP:RHO:WIND6:TRAC:Y:RLEV 0.0
```

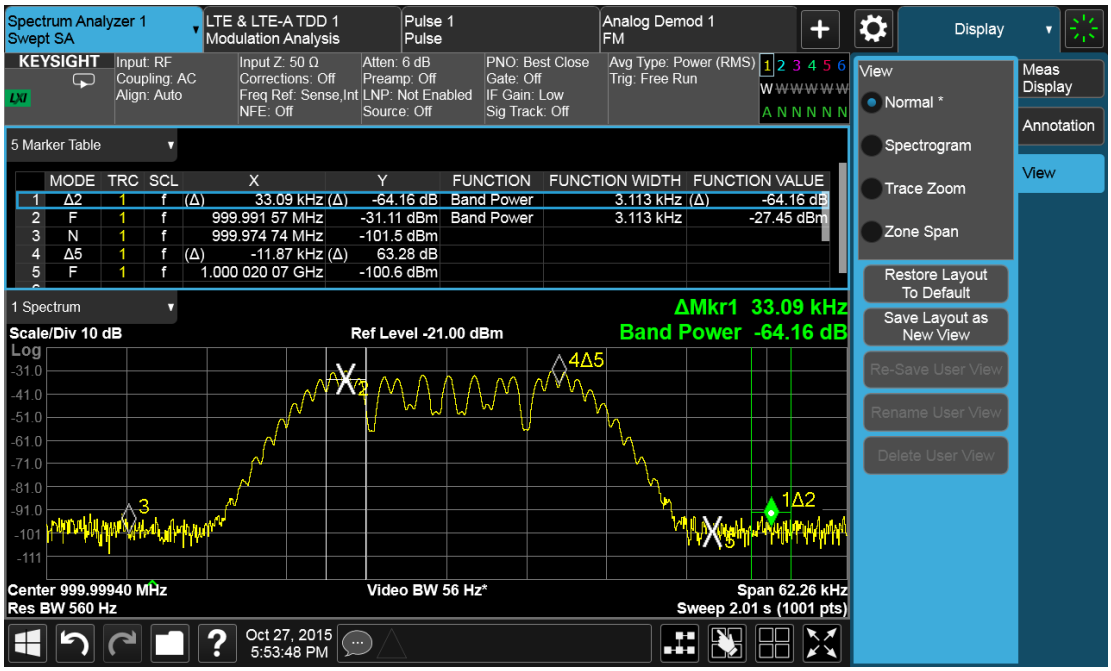


Note the arrow pointing down on the right side of the Window Title. This indicates that touching the Window Title will display a dropdown, which enables you to select the Measurement Data to be displayed in the window.

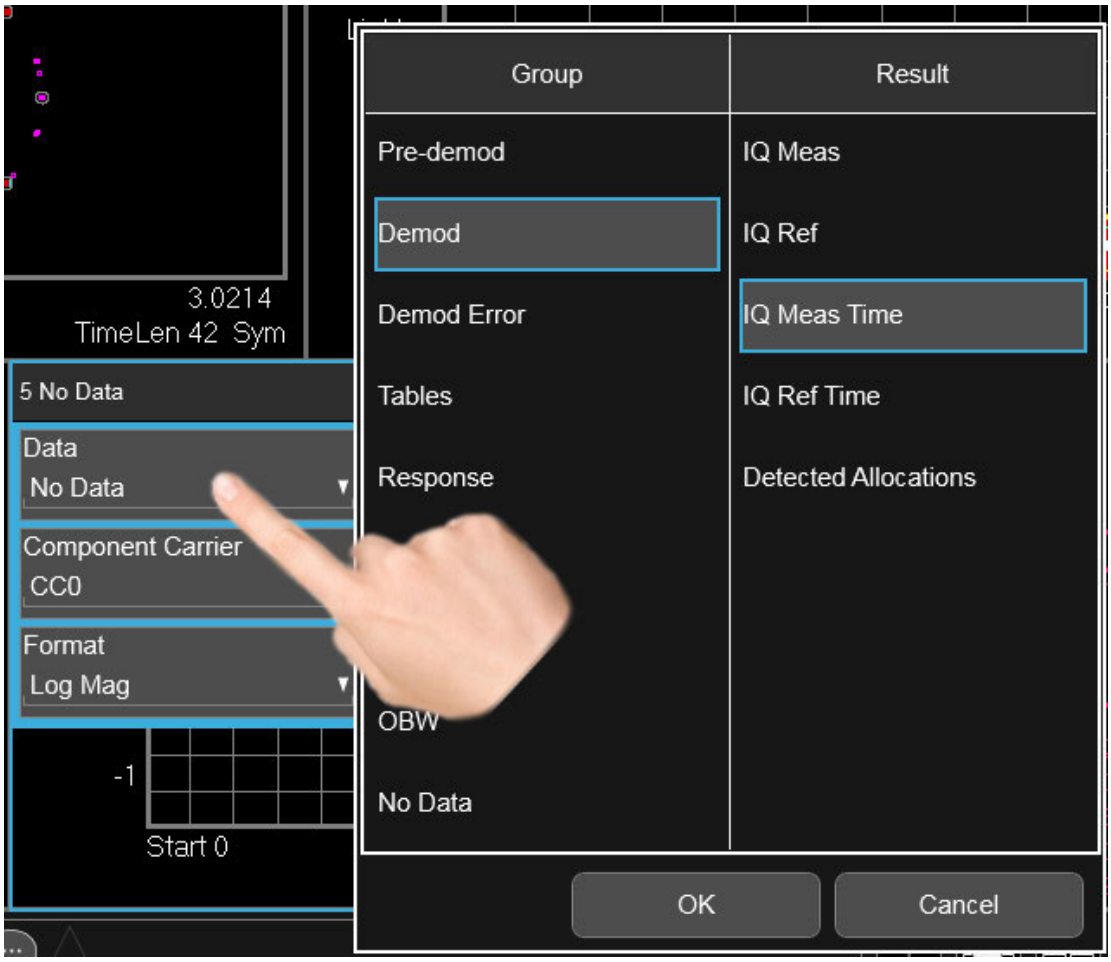
For example, if we wish to assign the results of the upper window in the display below to the Marker Table, we would touch the window title and then the “Data” control that is revealed, as shown:



And then select Marker Table, yielding the result below:



Note also that the Window Data dropdown can be a cascaded list, if the number of available results requires categorization to hold them all:



Note also that the Window Data dropdown sometimes includes controls for further configuring the window, for example, in LTE choosing the desired Component Carrier and Data format.



Touching a window's title dropdown also selects the window.

2.3.2 Measurement Data

The Measurement Data region shows graphical or textual data for the Data selected in the Window Title Data control. Below you can see examples of both graphical and textual windows in a four-window display.



There are many gestures which you can use to interact with a measurement display window. They are detailed below.

Swipe

There are several swipe actions, as listed below. One of the most important actions is swiping a spectrum window to the left or right, or up or down, to adjust the frequency and level of the spectrum, as shown below.



Swipe actions are summarized in the table below. Not all of these may be available, depending on the measurement.

Object	Action
Spectrum Trace Left/Right	Drag trace (change Center Frequency)
Spectrum Trace up/down	Drag trace (change Ref Level)
Marker Left/Right	Drag marker along trace
Fixed Marker Left/Right/Up/Down	Drag marker in space
Scrollable area	Scroll vertically or horizontally. Scrollable areas include the Menu Panel (if overfull), tables and lists. A scrollable area is indicated by a vertical or horizontal translucent white bar which can also be dragged by a mouse When scrolling a table: – Row headers remain in place when the table is scrolled horizontally, and scroll with the table when the table is scrolled vertically – Column headers remain in place when the table is scrolled vertically, and scroll with the table when the table is scrolled horizontally

Object	Action
Toggle control	Toggle in that direction

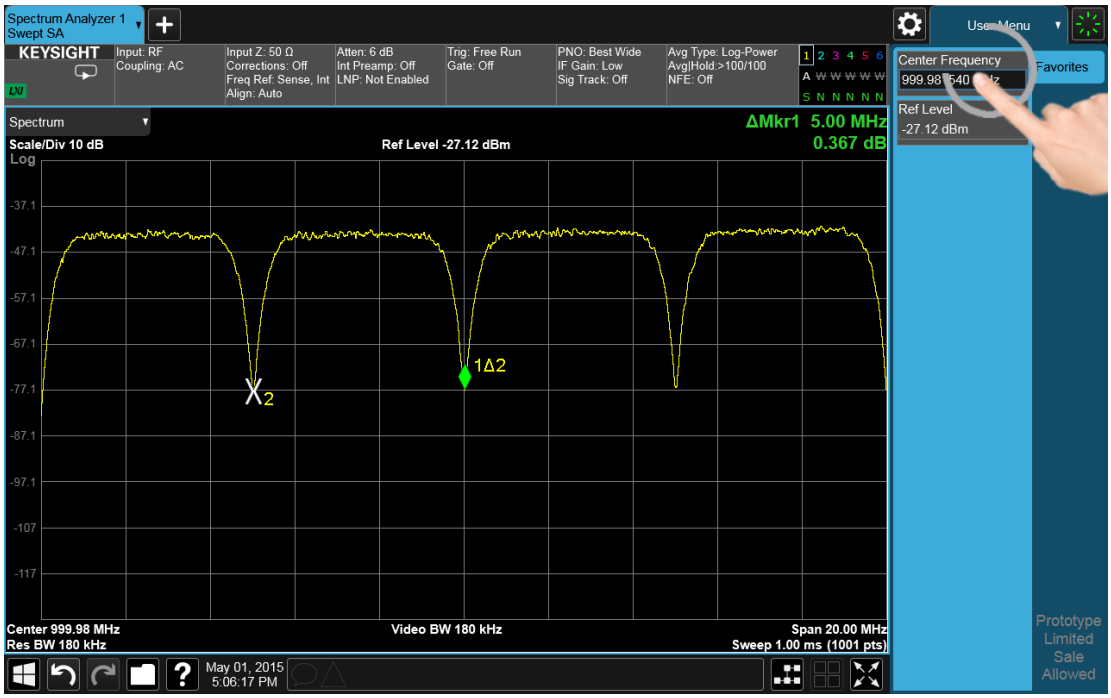
Pinch

You can also pinch in or out either horizontally or vertically to zoom in the x-axis or y-axis dimension. For example, a pinch horizontally lets you adjust the Span of the Spectrum window. Also, pinching on the wings of a Band Power or other Band Function allows you to widen or narrow that Band Function.

Pinching may sometimes be easier if you use the index finger of each hand, rather than pinching with one hand.

Touch-and-Hold

You can also touch-and-hold the display, that is, touch it and hold your finger on the display. A circle is drawn, and when the drawing completes, a right-click gesture is performed that depends on the screen feature touched, as listed in the table below.



Right Click on a Trace	Peak Search, Trace Type (Clear/Write, Trace Average, Max Hold, Min Hold), Trace View/Blank (Active, View, Blank, Background). Not all of these may be available, depending on the measurement
Right Click on a Marker	Marker Mode (Normal. Delta, Fixed, Off), Peak Search, Next Peak, Next Pk Right, Next Pk Left). Not all of these may be available, depending on the measurement

Right Click on the Background	Lets you select Help
Right Click on a Menu Panel control	Lets you add or remove that control from the User Menu or get Help on that control

Tap

Tapping an object causes the actions defined in the table below:

Object	Action
Marker	Select
Marker (repeated taps on stacked)	Cycle through stacked markers
Trace	Select. In addition if Marker is the active function, move the selected marker to the point where you tapped
Trace (repeated taps on stacked)	Cycle through stacked traces
Window	Select if unselected
Screen	Select if unselected

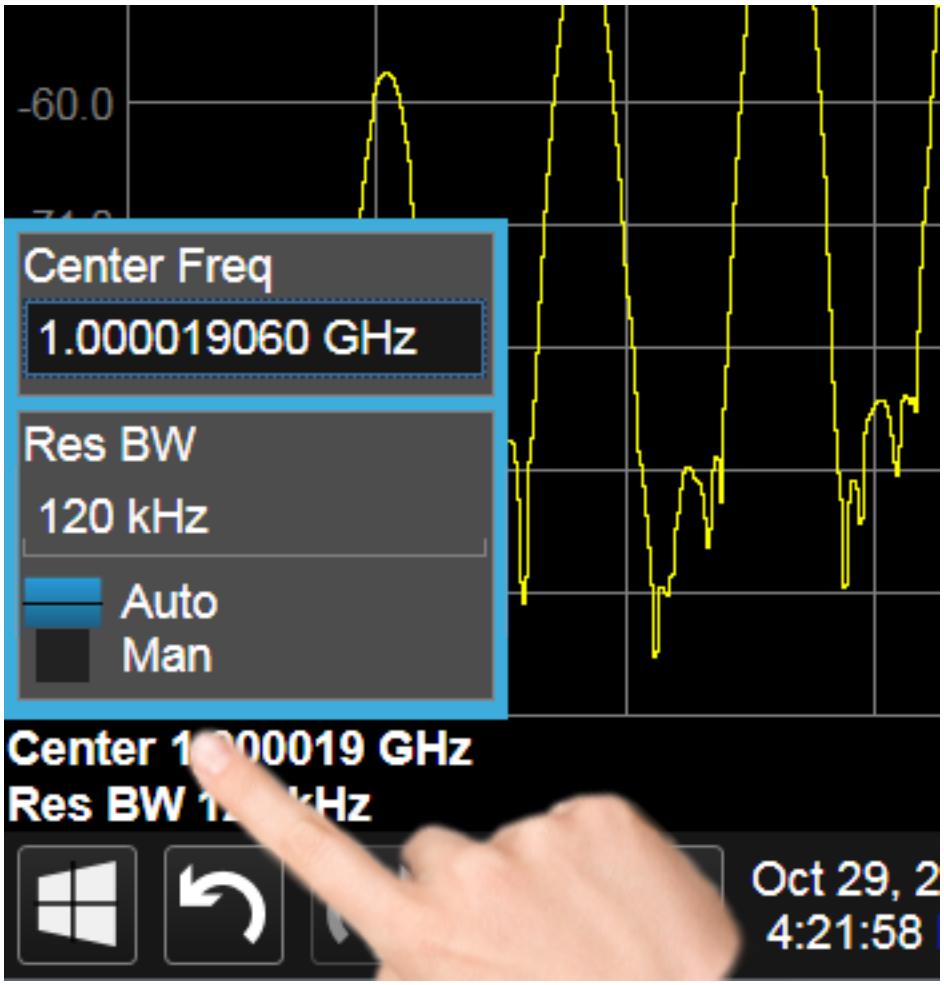
Double Tap

Double-tapping an object causes the actions defined in the table below:

Object	Action
Window	Zoom/Unzoom

2.3.3 Annotation Hotspot

You can tap on a graticule annotation to modify one of the fields in that annotation. For example if you tap on the region with Center Freq and Res BW in it, a menu panel pops up with just those settings on it.



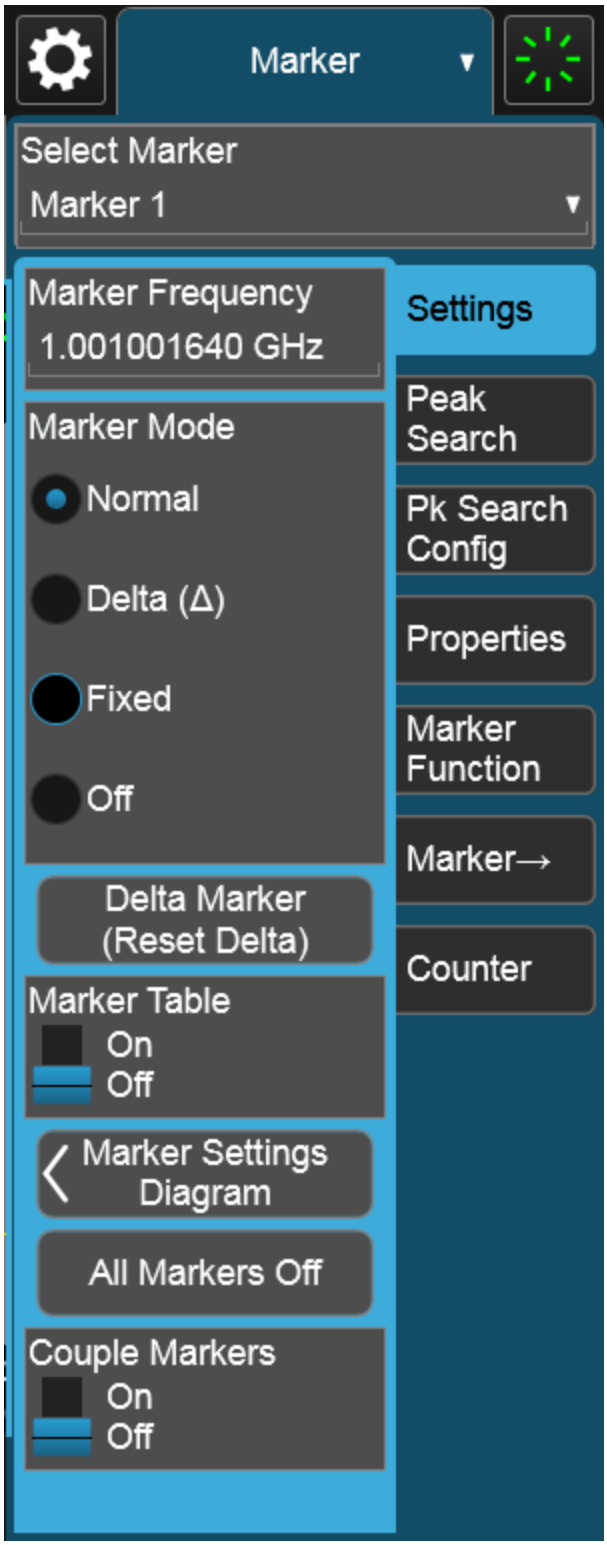
Touching anywhere off the hotspot panel or pressing any hardkey except Save or Quick Save closes the hotspot panel.

Annotation which is not currently able to be adjusted is not grayed out on the display, but the control in the hotspot that drops down or pops up is grayed out.

In a hotspot panel, the control in black with the blue border is the active function. Each panel may have its own default active function

2.4 Menu Panel

The menu panel is the main focus of the X-Series Multitouch user interface. The controls include active functions, dropdowns, action buttons, radio buttons and toggles.

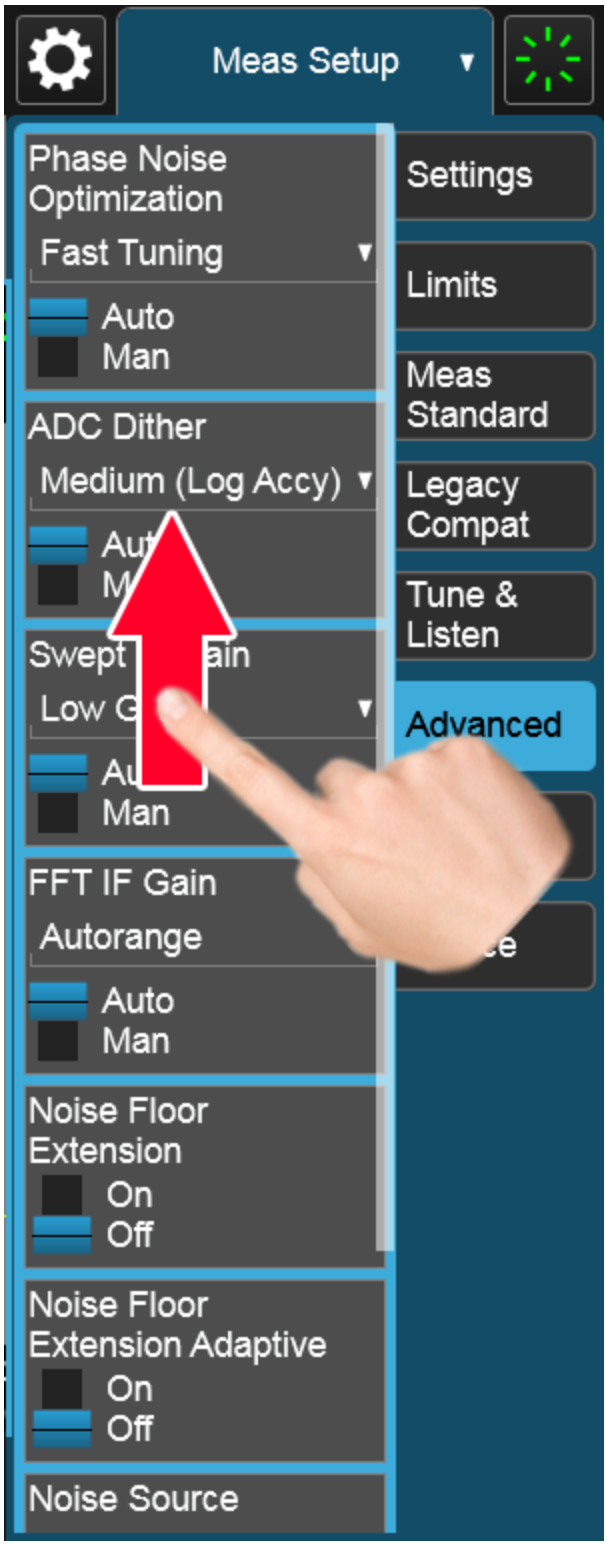

Marker
Select Marker
Marker 1
Marker Frequency
1.001001640 GHz
Marker Mode
Normal
Delta (Δ)
Fixed
Off
Delta Marker (Reset Delta)
Marker Table
On
Off
Marker Settings Diagram
All Markers Off
Couple Markers
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter

The menu panel normally appears on the right side of the display and consists of a rectangular panel with multiple “sub-panels” lying on top of each other, each sub-panel being accessed by a tab on the right.

You press a front panel key (or “hardkey”) to access a particular menu. On the front panel there are twelve “measurement hardkeys” (the ones in the shaded region in the figures below) – these are the hardkeys that open up menus in the menu panel.

With a menu open, tap a tab to access the controls on its sub-panel. Whenever you press the front panel key associated with a menu, the default (top) tab is selected.

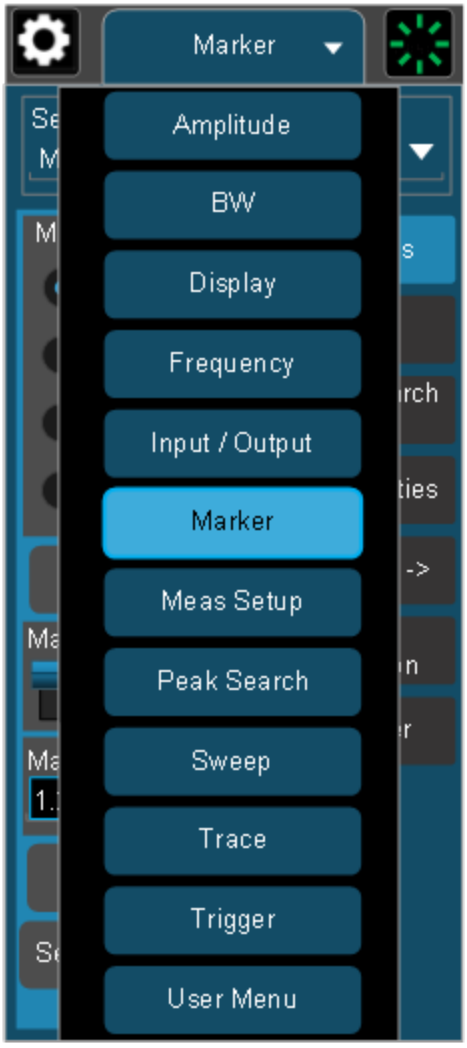
If the number of controls on a panel exceeds the height of the panel, scrolling is enabled, which is indicated by a white bar on the left that fades away after a few seconds. You swipe up or down with your finger to scroll the panel, or you can grab the white bar with a mouse.


Meas Setup
Phase Noise Optimization
Fast Tuning
Auto
Man
ADC Dither
Medium (Log Accy)
Swept
Low G
Man
FFT IF Gain
Autorange
Auto
Man
Noise Floor Extension
On
Off
Noise Floor Extension Adaptive
On
Off
Noise Source
Settings
Limits
Meas Standard
Legacy Compat
Tune & Listen
Advanced

If you move to a different menu panel or sub-panel and then come back to a previous panel, the previous panel is always reset to be scrolled all the way back to the top.

Accessing Menus Without Using Front-Panel Keys

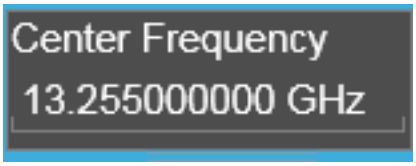
You can access the menu panels without using the front panel keys, as you would need to do if you were operating the instrument using Remote Desktop. Touch or click on the menu title, as shown below. A dropdown containing the twelve measurement hardkeys appears. Selecting a hardkey from the dropdown displays the corresponding menu, and the dropdown disappears.



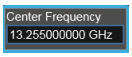
Entering Numeric Values

Many controls on the menu panel allow you to enter numeric values. These are called “active functions.” An active function control displays a number and a suffix,

for example 13.255 GHz, as in the example below:



An active function is “active” if the numeric value is surrounded by a black background with a blue border, as below. In this state, it is ready to receive numeric input from the number pad on the front panel, the knob, or the step keys.



When an active function is in the active state, you can start typing or pressing the number keys on the front panel, which causes the Numeric Entry Panel to appear, as shown below. The Numeric Entry Panel displays the typed value, and the terminators to complete the entry.

Here we see a UXA with an active function control in the active state. Although no Numeric Entry Panel is displayed, you can just touch the “2” key:



This causes the Numeric Entry Panel to pop up to receive the numbers you are typing:



Type in as many digits as required, then touch one of the unit terminator buttons in the Numeric Entry Panel to complete the entry. In this case, 2 GHz was the desired entry, so you just touch the “GHz” terminator:



The Numeric Entry Panel disappears and, in the example, the active function value becomes 2 GHz.



It is important to note that you can always pop up the Numeric Entry Panel by touching an active function control while it is active; for example, if you were to touch it in the figure above, the Numeric Entry Panel would pop up right next to the control:


UXA
Frequency
Center Frequency
2.000000000 GHz
Settings
Span
4.16000000 GHz
Swept Span
Zero Span
Full Span
Start Freq
-80.000000 MHz
Stop Freq
4.080000000 GHz
Auto Tune
CF Step
416.000000 MHz
Auto
Man
Freq Offset
0 Hz
Signal Track
(Span Zoom)
On
Off
Span 4.160 GHz
Sweep 6.93 ms (1001 pts)
Measurement
Channel
FREQ
Marker
Peak Search
Mode Preset
Y Scale
AMPTD
BW
Trace
User Preset
X Scale
SWEEP
Trigger
Input/ Output
Recall
MEAS SETUP
Display
User Menu
Save
MODE/ MEAS
Single/ Cont
Restart
Quick Save
Enter
Local
System
Cancel (Esc)
Bk Sp
Del
Ctrl
Alt
Ctrl=Redo
Undo
Touch On/Off
Tab


UXA
Center Frequency
2.000000000 GHz
GHz
MHz
kHz
Hz
Frequency
Settings
Span
4.16000000 GHz
Swept Span
Zero Span
Full Span
Start Freq
-80.000000 MHz
Stop Freq
4.080000000 GHz
Auto Tune
CF Step
416.000000 MHz
Auto
Man
Freq Offset
0 Hz
Signal Track
(Span Zoom)
On
Off
Span 4.160 GHz
Sweep 6.93 ms (1001 pts)
Measurement
Enter
Local
Cancel (Esc)
Bk Sp
Del
Ctrl
Alt
Undo
Touch On/Off
Tab

You can display the Numeric Entry Panel by touching any active function control while it is active, but you don't have to pop up the Numeric Entry Panel first, you can just start typing and it will pop up on its own, thus saving you a keystroke.

You can also adjust a value without displaying the Numeric Entry panel by turning the knob or using the step keys while an active function is active. If you turn the knob or use the step keys while the Numeric Entry Panel is displayed, it disappears, allowing you to see the entire screen while you are making the adjustment.

You can also drag the Numeric Entry Panel to another part of the display if it is covering something that you wish to see while it is on the screen.

2.4.1 Right-Click Menu

If you click with the right mouse button on any of the menus in measurements, a popup menu appears, which includes:

The items in this menu are:

- "Add to User Menu" on page 99
- "Help on this setting" on page 99

2.4.1.1 Add to User Menu

For details, see "User Menu" on page 99.

2.4.1.2 Help on this setting

For details, see "Help" on page 112.

2.4.2 User Menu

Lets you create your own menu, to include controls that you frequently use. You can have one User Menu for each measurement, and all User Menus survive a power cycle.

You add a control to the User Menu for the current measurement by right-clicking on the control, then selecting "Add to User Menu" on page 99. You can also remove the control from the User Menu using the same right-click menu item.

User Menu appears at the bottom of the menu drop-down panel.

2.5 Cancel key



This front-panel key has the same functions as the Windows **Esc** (Escape) key. It does the following:

- Cancels dialogs
- Cancels active functions (unless there is an entry in progress, in which case it cancels that, and reverts to the previous value)
- Resets input overloads
- Aborts print operations
- Cancels certain other operations (such as alignments)
- Returns you to Local Control (if in Remote)
- If the backlight is off, turns on the backlight, and does nothing else

Most of this functionality is the same as earlier X-Series models and similar to ESA and PSA operation.

When the instrument is in Remote, any hardkey that is pressed on the front panel displays this message:

```
Analyzer is in Remote. Press ESC to return to Local
```

The exception is the **Cancel (ESC)** key, which takes the instrument out of Remote.

When the instrument is also in the LLO (local lockout state), the **Local** key is locked out as well. When this is the case, and the **Local** key is pressed, this message is displayed:

```
Local key is locked out by remote computer. Cancel Local Lockout on computer or
release remote control
```

When you see this message, you should disconnect the remote computer, or use it to take the instrument out of the Local Lockout state.

2.6 Onscreen Keyboard key



This key turns the onscreen alpha keyboard (OSK) on and off.

There are two onscreen keyboards:

- The Multitouch OSK, which pops up automatically if, while using the analyzer application, a text field becomes the active function
- The Windows OSK, which you must open manually when a text field must be entered while interacting with Windows or other apps

2.7 Touch On/Off Key



This front-panel key turns the display touch functionality on and off. If off, you can turn it back on using the front panel Touch On/Off key. When the touch functionality is off, you can still use a mouse as a pointer.

When toggled, a dialog box appears midscreen that confirms “Touchscreen On” or “Touchscreen Off”.

This function remains in effect until it is turned off or until the app shuts down. The app always starts up with Touch enabled.

2.8 Tab key



This key has the same function as the Tab key on a PC keyboard.

You can use this key to display the Windows Taskbar, as follows.

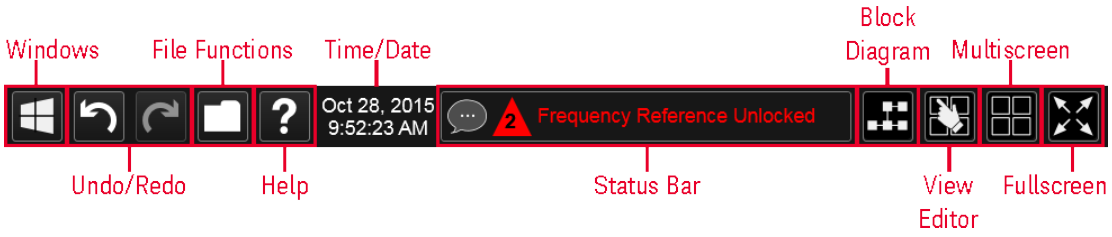
- Alt-Tab to the Desktop
- Touch the desktop
- Touch TAB
- The Taskbar appears

2.9 Local Button

Appears in the Menu Panel when the instrument is in remote, and can be brought back to local via the **Local (ESC)** Key. See also "Cancel key" on page 100.

2.10 Control Bar

The Control Bar contains controls and readouts that let you control instrument functions independent of the current measurement.



2.11 Windows

Pressing the Windows icon on the "Control Bar" on page 105 has the same effect as pressing the Windows icon on the Windows taskbar. It displays the Windows taskbar and Start Menu, which allows you to launch Windows programs and access features such as the Control Panel.

2.12 Undo/Redo

The Undo button in the "Control Bar" on page 105,



and the Undo front panel key,



are used to undo the most recently executed function.

If you Undo a function, and then decide you should not have done so, you can use the Redo button in the "Control Bar" on page 105 to put it back the way it was. The Redo function may also be executed by pressing Ctrl+Undo (holding the Ctrl key down while pressing the Undo font panel key).



Undo allows you to restore a setting, which you had previously set, back to its value before you changed it. When you press the Undo button or front panel key, the last setting you changed is “undone”, that is, its previous setting is restored. You are notified of this fact with an advisory pop up message; for example, if the Center Frequency had been 300 MHz, and you changed it to 1 GHz and then pressed Undo, the message would show:

```
UNDO: Center Freq 1 GHz -> 300 MHz
```

The instrument can store 5 levels of action for Undo.

To truly understand Undo and Redo, it helps to think of two “stacks”, an Undo stack and a Redo stack,

UNDO stack	REDO stack

Whenever you perform an action, it is placed on the Undo stack. So for example, if you set the Center Frequency to 1 GHz, then set the RBW to 1 MHz, then set the Detector to Peak, each of these actions gets “pushed” onto the Undo stack:

UNDO stack	REDO stack
Det = Peak	
RBW = 1MHz	
CF = 1 GHz	

When you press Undo, the top item on the Undo stack is removed, the action represented by that item is undone, and the item is placed on the Redo stack. So pressing Undo once in the above case would undo the setting of the peak detector, and the stacks would look like this:

UNDO stack	REDO stack
RBW = 1MHz	Det = Peak
CF = 1 GHz	

Now pressing Undo again would undo the RBW = 1 MHz action, and the stacks would look like this:

UNDO stack	REDO stack
CF = 1 GHz	RBW = 1MHz
	Det = Peak

Now pressing Redo would Redo the RBW = 1 MHz action, and the stacks would again look like this:

UNDO stack	REDO stack
RBW = 1MHz	Det = Peak
CF = 1 GHz	

Also, whenever you set a value, the Redo stack is cleared; you can't redo an action once you have interrupted the original flow of actions. Think of the Undo stack as the past, and the Redo stack as the future; if you have items in both stacks it means you have gone back to a time in the past; if you then *do* something you have changed the future, so the old future (the Redo stack) gets cleared.

For example, in the example above, if you now were to change another setting, such as VBW = 1 kHz, the Redo stack gets cleared, and the stacks would look like this:

UNDO stack	REDO stack
VBW = 1 kHz	
RBW = 1MHz	
CF = 1 GHz	

Undo can undo changes you make with the knob or step keys, however all contiguous events that affect the same parameter are aggregated into one event for the sake of Undo. For example, if CF is the active function and is 1 GHz, and you turn the knob back and forth, then enter a value, then use the step keys, when you press Undo, the instrument returns to CF = 1 GHz.

Actions that Cannot be Undone

There are some actions that cannot be undone, because these clear the Undo/Redo stack:

- Restore Mode Defaults clears the stack for that Mode in that Screen
- Sending SCPI commands clears the stack for that Mode in that Screen
- Loading a state file (including User Preset) clears the stack for that Mode in that Screen
- Deleting a Screen clears all the stacks in that screen
- Changing Views

Undo/Redo works within the context of a Mode. Each Mode in each Screen keeps its own record. Settings in the Control Panel or System Settings menus are not undoable.

There are several actions that may change many parameters. Among these are Auto Tune, and Adjust Atten for Min Clipping. After executing such a function, Undo sets all parameters back to their value before the function was selected. Auto Tune appears to be a single action, even though the instrument executes it in several steps.

Redo reverses the effect of the last Undo action, assuming that no other settings have been changed since the last Undo. Changing a setting after an Undo clears memory of all settings after that Undo, that is, it clears the Redo stack, as explained above.

When you press the Redo icon or Ctl and the Undo hardkey, you are notified with an advisory popup message; for example, if the Center Frequency had been 300 MHz, and you changed it to 1 GHz and then pressed Undo, the message would say:

```
UNDO: Center Freq 1 GHz -> 300 MHz
```

If you then press Redo, the message will say:

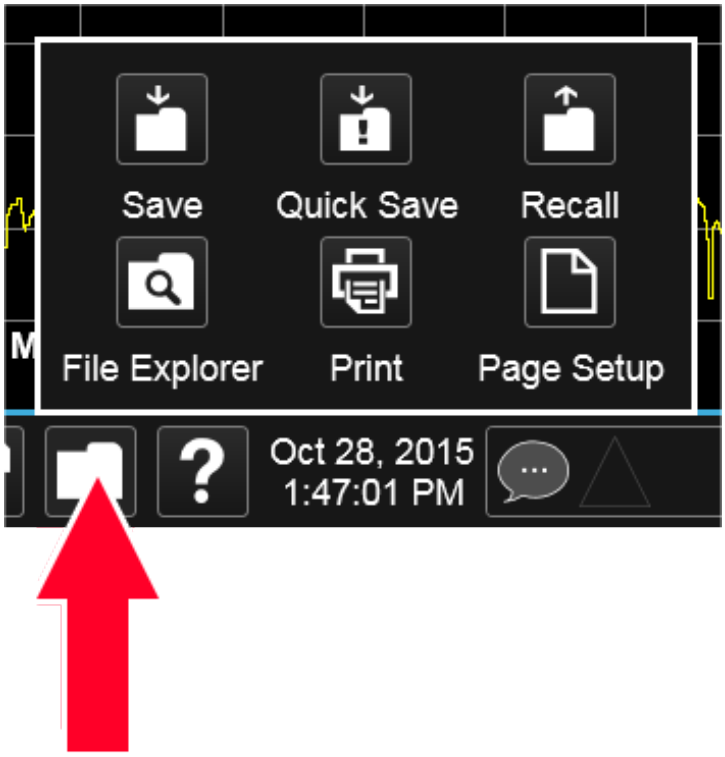
```
REDO: Center Freq 300 MHz -> 1 GHz
```

Neither Undo nor Redo perform any navigation, and have no effect on which menu panel is displayed nor which function is active.

2.13 File Functions

The File Functions popup contains controls for executing Save, Recall, File and Print operations. You display the File Functions popup by tapping the File Functions icon in the "Control Bar" on page 105.

For more information on a control, tap an icon in the image below.



Tapping this folder icon displays the File Functions popup

2.13.1 File Explorer

Pressing the File Explorer button in the "File Functions" on page 111 dialog opens the Windows File Explorer, which allows you to perform operating system file functions such as Move, Copy and Delete.

File Explorer also allows you to map network drives to drive letters on your PC or intranet, in order to more easily save screen images, states and other data, and load them back into the instrument.

2.14 Help



Pressing the **Help** button in the "Control Bar" on page 105, the **Help** front panel key, or the **F1** key if you have a PC keyboard connected, opens the context-sensitive help system. The **Help** button appears in the "Control Bar" on page 105 and in the banner of full-screen dialogs

You can also use the Help window's Contents pane to navigate to Help for any function in the instrument

You can also touch-and-hold a specific control to display a "right-click" menu, in which one of the choices is **Help on this setting**

2.15 Status Bar

The Status Panel (or Status Bar) appears at the bottom of the display and contains three fields:



The Message Balloon appears on the left side of the Status Panel and lets you know when there is an unread message in the queue.



No unread messages Unread messages

The Message Balloon has a gray outline and no fill if there are no unread messages; it has a gray fill and a white outline and displays a white ellipsis in the middle if there are unread messages.

The Condition Indicator appears to the right of the Message Balloon and shows the current number of open conditions. Below are some examples of what the Condition Indicator can look like:



The triangle is unfilled if no there are no open conditions, filled with yellow if all open conditions are warnings, and filled with red if at least one open condition is an error. The number displayed is the total number of open conditions.

Touching the Condition Indicator opens up the Show Status dialog (see below) with the Current Conditions tab selected. Touching anywhere else on the Status Bar opens up the Show Status dialog with the History tab selected.

The Condition Message appears to the right of the Condition Indicator. In the example below, the cCondition Message is “Align All, Now required”:

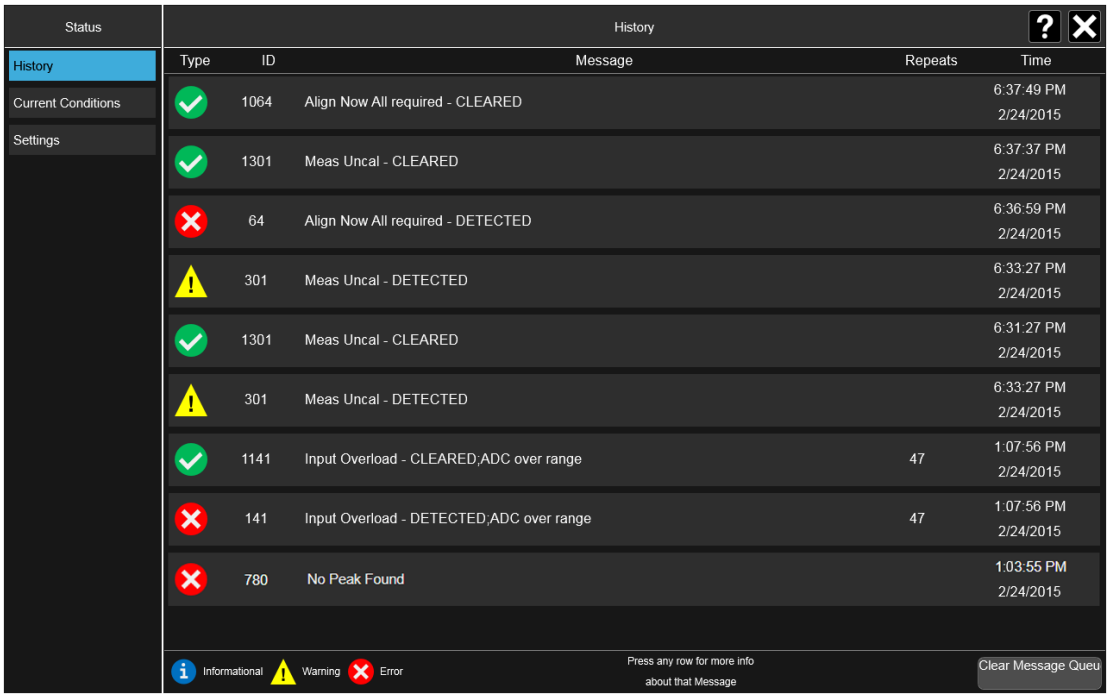


Warning condition messages display in yellow, error condition messages display in red.

If there is more than 1 open condition, the Condition Message cycles through the display of all of the open conditions, one at a time. Each message is displayed for 2 seconds, then the next for 2 seconds, and so on.

Show Status Dialog

The Show Status dialog appears if you tap anywhere in the Status Bar. Touching the Condition Indicator (the triangle in the Status Bar) opens up the Show Status dialog with the Current Conditions tab selected. Touching anywhere else on the Status Bar opens up the Show Status dialog with the History tab selected.



If the display fills up, scrolling is enabled just as in other X-Series Multi-touch UI displays.

The Status dialog automatically refreshes as new messages and conditions occur.

At the bottom of the screen is a Clear Message Queue button. This button clears all errors in all error queues.

Note the following:

- Clear Message Queue does not affect the current status conditions
- Mode Preset does not clear the message queue
- Restore System Defaults (Super Preset) will clear all message queues
- *CLS only clears the queue if it is sent remotely and *RST does not affect any error queue
- Switching Modes does not affect any error queues

See "More Information" on page 116

Remote Command	`:SYSTem:ERRor[:NEXT]?`
Example	`:SYST:ERR?`
Notes	The return string has the format:

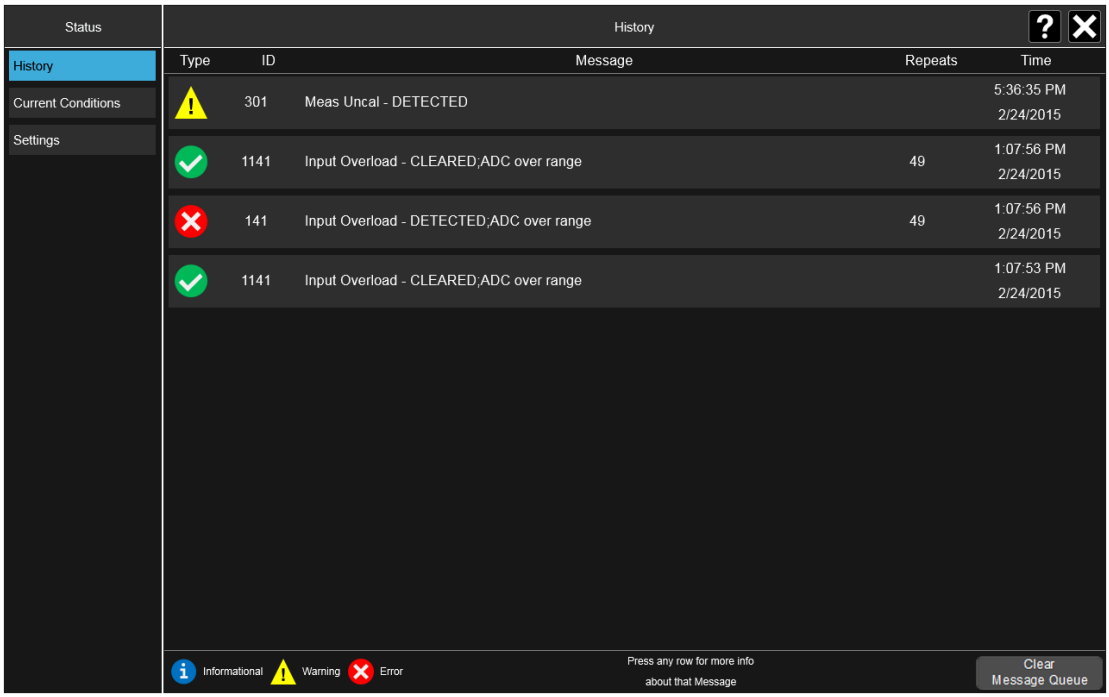
	`<Error Number>,<Error>` Where `<Error Number>` and `<Error>` are those shown on the Show Errors screen
Backwards Compatibility Notes	In some legacy analyzers, the Repeat field shows the number of times the message has repeated since the last time the error queue was cleared. In the X-Series, the Repeat field shows the number of times the error has repeated since the last intervening error. So the count may very well be different than in the past even for identical signal conditions Unlike previous analyzers, in the X-Series all errors are reported through the Message or Status lines and are logged to the event queue. They never appear as text in the graticule area (as they sometimes do in previous analyzers) and they are never displayed in the settings panel at the top of the screen (as they sometimes do, by changing color, in previous analyzers) As a consequence of the above, the user can only see one status condition (the most recently generated) without looking at the queue. In the past, at least in the Spectrum Analyzer, multiple status conditions might display on the right side of the graticule In general, there is no backwards compatibility specified or guaranteed between the error numbers in the X-Series and those of earlier products. Error, event, and status processing code in customers' software will probably need to be rewritten to work with X-Series In the legacy analyzers, some conditions report as errors and others simply turn on status bits. Conditions that report as errors often report over and over as long as the condition exists. In the X-series, all conditions report as start and stop events. Consequently, software that repeatedly queries for a condition error until it stops reporting will have to be rewritten for the X-series

More Information

The Status Dialog has two screens, selectable by the tabs on the right: History and Current Conditions:

History

History brings up a screen displaying the front panel message queue in chronological order, with the newest event at the top. Remember that the front panel queue contains all of the events generated by front panel actions as well as error events from all of the SCPI queues. A typical History display appears below:



The fields on the History display are:

Type	Displays the icon identifying the event or condition as an error or warning
ID	Displays the error number
Message	Displays the message text
Repeat (RPT)	This field shows the number of consecutive instances of the event, uninterrupted by other events. In other words, if an event occurs 5 times with no other intervening event, the value of repeat will be 5 If the value of Repeat is 1 the field does not display. If the value of Repeat is >1, the time and date shown are those of the most recent occurrence. If the value of repeat reaches 999,999 it stops there. The Repeat field can run into some pretty large numbers when apps (like the GSM app) report things like “GSM sync burst not found” as events rather than conditions, which is actually fairly common Note that the repeat count is unavailable over SCPI
Time	Shows the most recent time (including the date) at which the event occurred. Time is displayed to the second

To understand the History dialog, and to properly program the instrument’s messaging system, remember that there are two types of occurrences, events and conditions:

– An event is an occurrence of zero duration. Events generate messages which are displayed in the center of the display for a period of time and then fade away. These may be of an advisory nature or may represent errors, for example “No

peak found”

– A condition is an occurrence of finite duration, that is, it has a start and an end. Conditions are states of the analyzer characterized by some combination of settings or some kind of failure that the user needs to be told about while it is happening, but then can stop being told once it goes away; for example “Input overload; ADC over range”

The error queue contains error events as well as the DETECTED and CLEARED events for condition errors, as seen in the figure above.

DETECTED events have numbers less than 1000 and CLEARED events have the same number plus 1000. For example,

301, Meas Uncal – DETECTED

and later

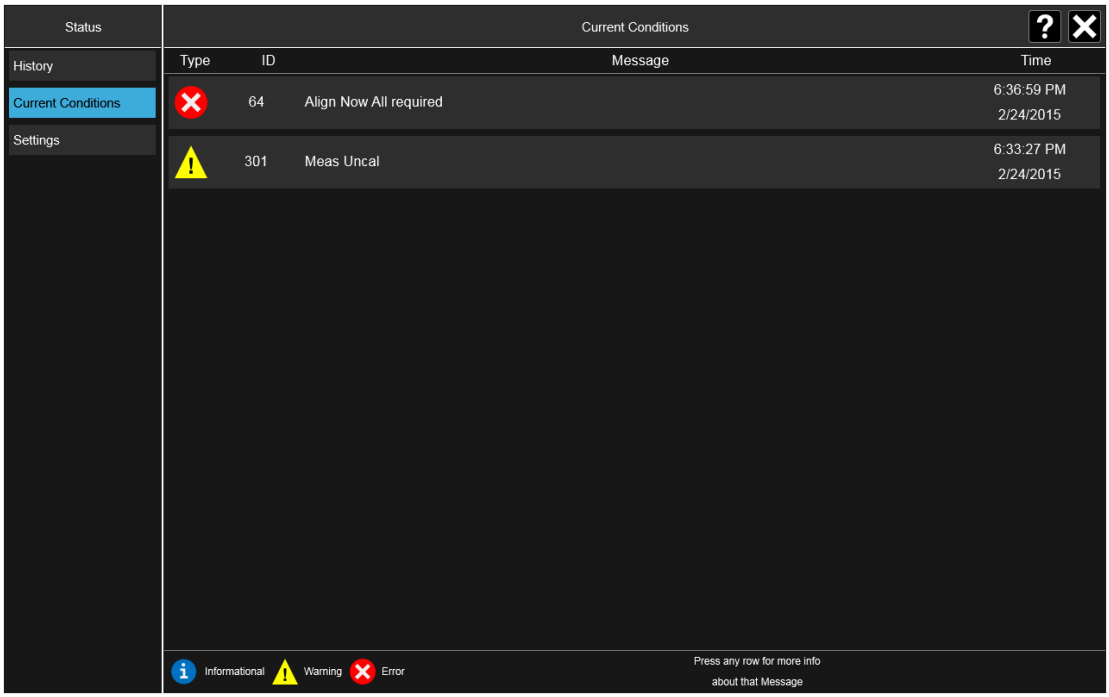
1301, Meas Uncal – CLEARED

To detect a condition error over SCPI, you should read the error queue and note any DETECTED error which is not followed eventually by an associated CLEARED error. This means the condition is still in effect. It is not sufficient to simply read the error queue until you get “No Errors” back. You may still have the condition error; the condition may still be in effect, and if that is the case, all you have done by clearing the error queue is to remove the first event (the DETECTED event) from the queue. For a condition error, you have to read the error queue until you see the CLEARED event for that condition. THEN you know that the condition is gone.

Current Conditions

The Current Conditions display shows all of the open conditions in the instrument. An open condition is a condition error or warning for which a start (detected) event has occurred but for which no corresponding stop (cleared) event has occurred.

An example of the Current Conditions screen appears below:

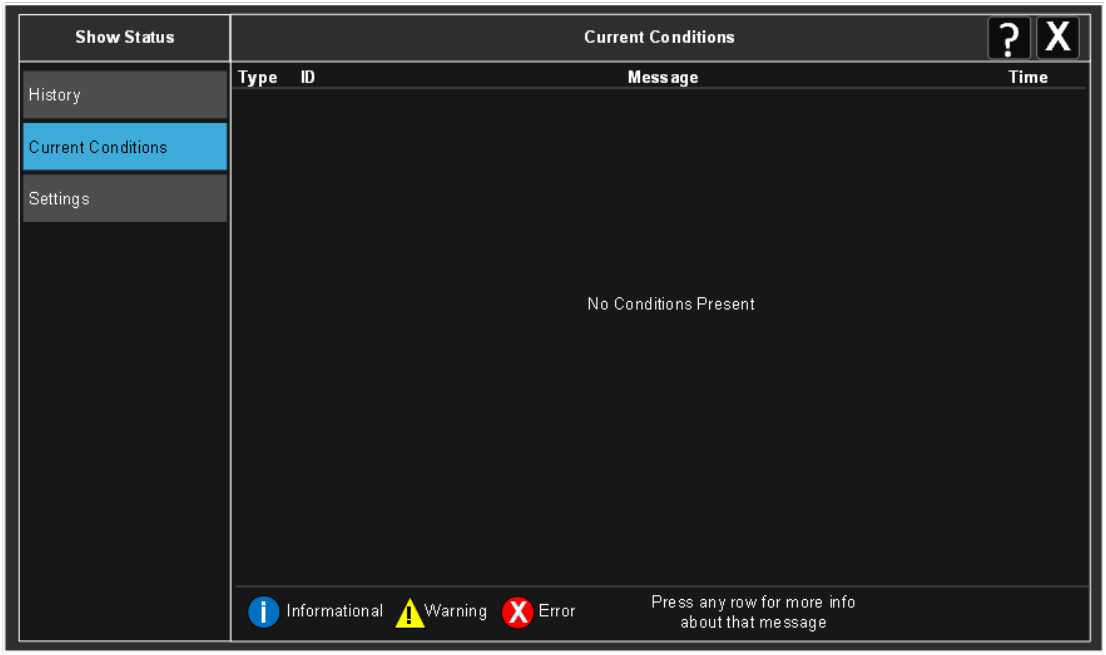


The fields on the Current Conditions display are:

Type	Displays the icon identifying the event or condition as an error or warning or informational
ID	Displays the error number
Message	Displays the message text
Time	Shows the most recent time (including the date) at which the event occurred. Time is displayed to the second

Touching a condition message expands the display of that message. Touching again collapses it. The description is the same as the one that appears on the message dialog. An example of this is shown in the History section, below.

When there are no open conditions, the display is as shown below:


Show Status
Current Conditions
History
Current Conditions
Settings
Type
ID
Message
Time
No Conditions Present
Informational
Warning
Error
Press any row for more info about that message

2.16 Block Diagram

When you press the Block Diagram button in the "Control Bar" on page 105, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.



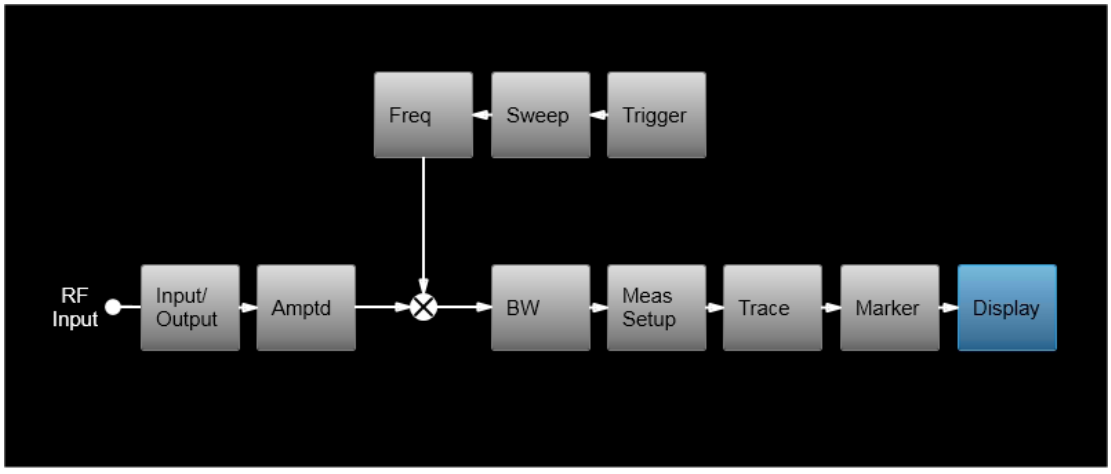
When you press the Block Diagram button, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.

While in the Block Diagram display, the button is blue colored, as:

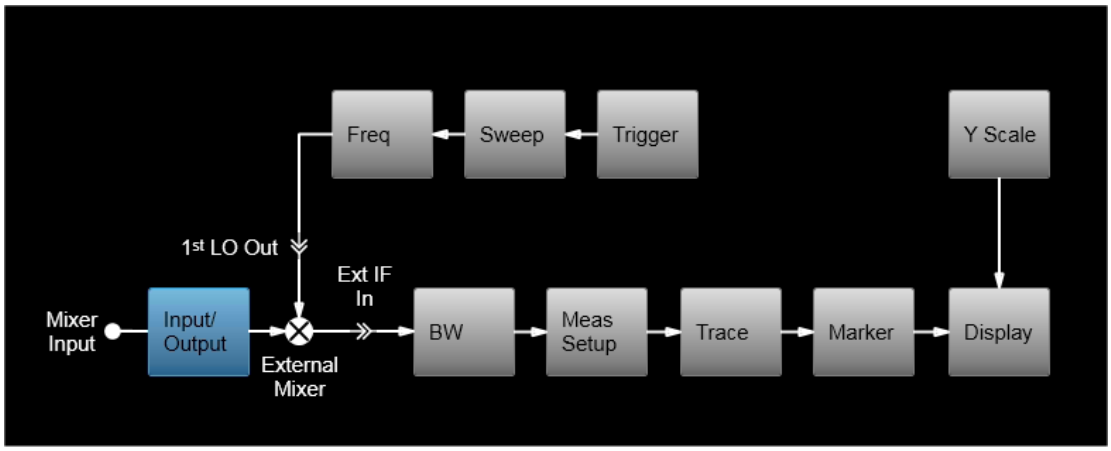


To exit the Block Diagram display, tap the button again.

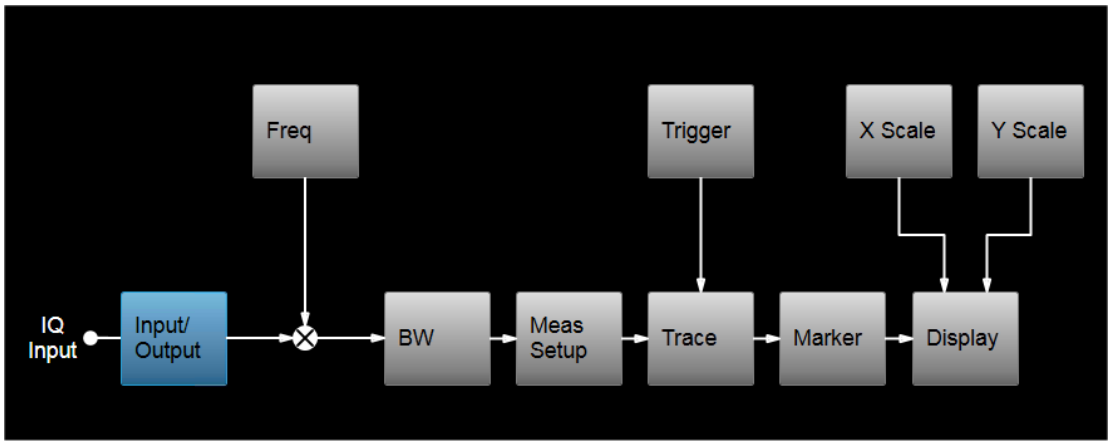
The Block Diagram display is not meant to be a completely accurate representation, but one which can show differences as you change the hardware setup. For example, here is the basic RF Block Diagram:



And here is the Block Diagram when External Mixing is selected:



And here is the Block Diagram when the I/Q inputs are selected:

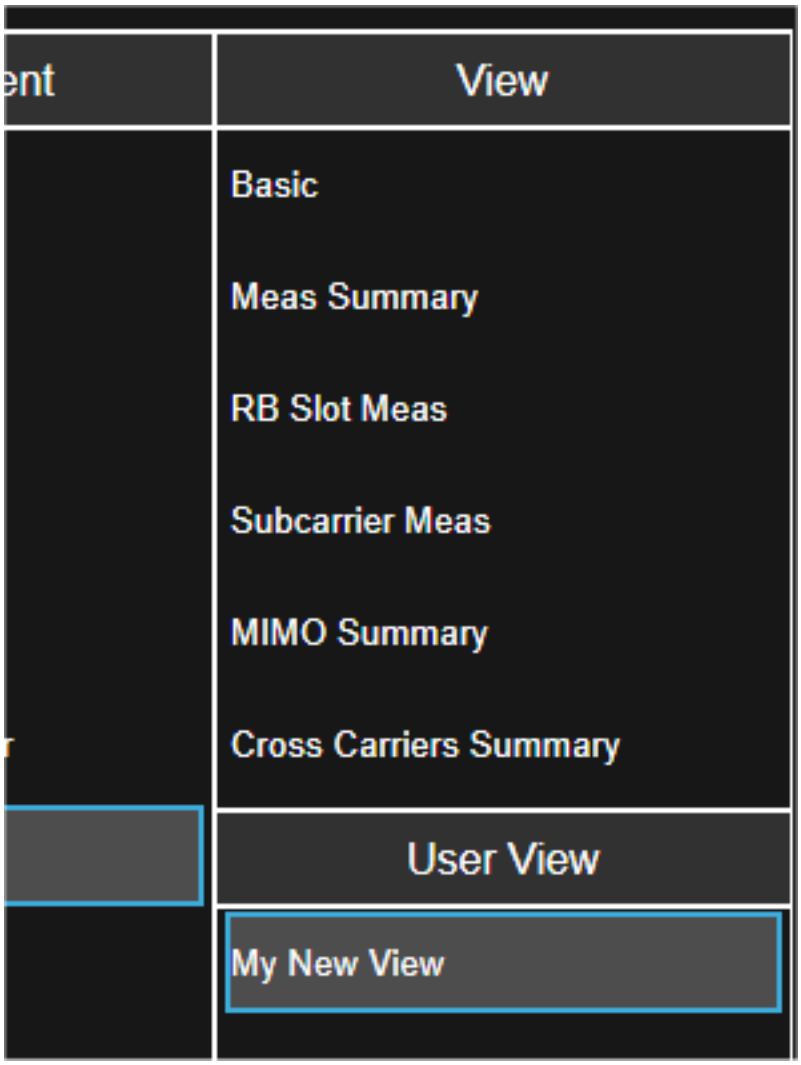


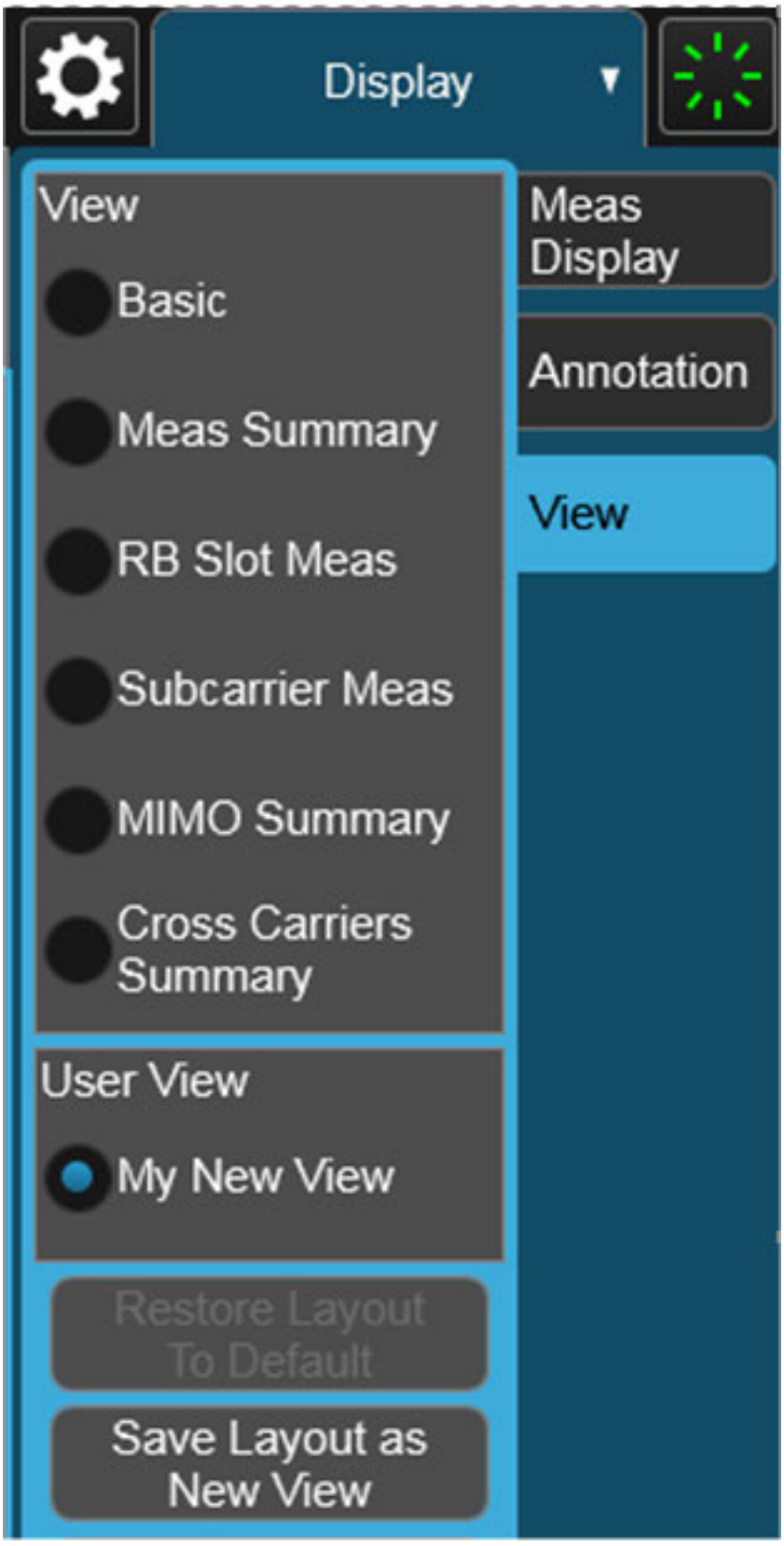
2.17 View Editor

This section describes the use of the View Editor, which allows you to:

- Add windows to and delete windows from the current measurement
- Resize and rearrange windows
- Create User Views

User Views are custom Views that you create by adding, deleting, rearranging, resizing, or changing the contents of the windows in an existing View, and then saving the edited View as a new View. The instrument lists the current User Views for a measurement after the Predefined Views, in the Mode/Meas dialog and on the View menu panel under Display:


ent
View
Basic
Meas Summary
RB Slot Meas
Subcarrier Meas
MIMO Summary
Cross Carriers Summary
User View
My New View

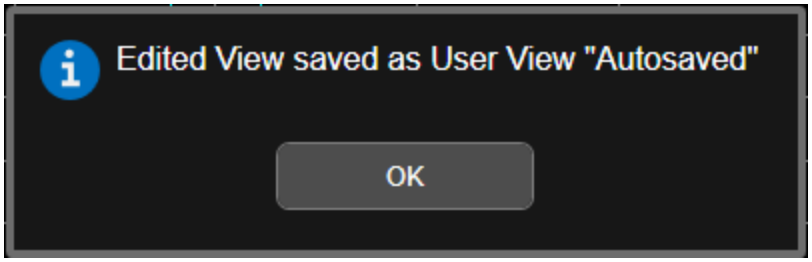

Display
View
Basic
Meas Summary
RB Slot Meas
Subcarrier Meas
MIMO Summary
Cross Carriers Summary
User View
My New View
Restore Layout To Default
Save Layout as New View
Meas Display
Annotation
View

You can save an edited View using the Save Layout as New View control in the View menu (see "To Save a User View" on page 137).

On occasion, the instrument may automatically save an edited View for you. If you have edited a View, so that the * is displaying next to the View name, you must save that View as a User View before you save State or switch measurements. If you forget that you have made changes to a View, then to keep from losing your edited View when you switch measurements, the instrument will save it for you. If you have an edited View that has not been saved and you try to do any of the following:

- Enter the “Save” menu
- Switch Measurements
- Switch Modes
- Switch Screens

the edited view will be saved for you with the name “Autosaved”. When this happens, you will receive the following message:



If an Autosaved User View already exists, the User View called “Autosaved” will be overwritten with the currently edited view. If you have multiple edited views, the selected edited view will be Autosaved. If there is not an edited view selected the last selected edited view will be Autosaved.

To Open the View Editor



Pressing the View Editor button (shown above) in the "Control Bar" on page 105, at the bottom right of the screen, opens the View Editor.

While in the View Editor, the icon is blue colored, as:



Pressing the View Editor button again exits the View Editor.

To Close the View Editor

Tap the View Editor button again.

The user chooses the desired View through the use of the Mode/Meas/View dialog (see "Mode/Meas/View Dialog" on page 57) or the View menu (a tab under the **Display** key). The View menu allows the user to browse the views in the current measurement. The View menu contains a list of Predefined Views for you to use. If you wish to modify a Predefined View or create your own, new View, you use the View Editor.

User Views & Predefined Views

A User View is any View that is not in the list of predefined Views for the current measurement. For example, the Swept SA measurement has four predefined Views: Normal, Spectrogram, Zone Span, and Trace Zoom.

User Views allow you to add, delete, change and rearrange the windows of a predefined View, creating a new custom view.

2.17.1 To Create a User View

Whenever you add or delete a window to/from a predefined View, or change what is being displayed in a Predefined View's window, the Predefined View is marked with an asterisk (*), to show that it has been modified.

For example, to edit the View shown below, you press the Edit View icon.



When you do this, you get the View Editor screen, which appears as below. The menu panel switches to the View menu. Here we see that we are in the Predefined View called “Basic”.



Each window has two arrows containing + signs. Pressing either of the “+” symbols adds a new window on that side. For example, let’s say you press the + symbol on the right of the lower left window:

You would then see this:



A fifth window has been added, and is automatically assigned the number 5. (The window number, which is displayed in the Window Title region, is used when sending SCPI commands to that window).

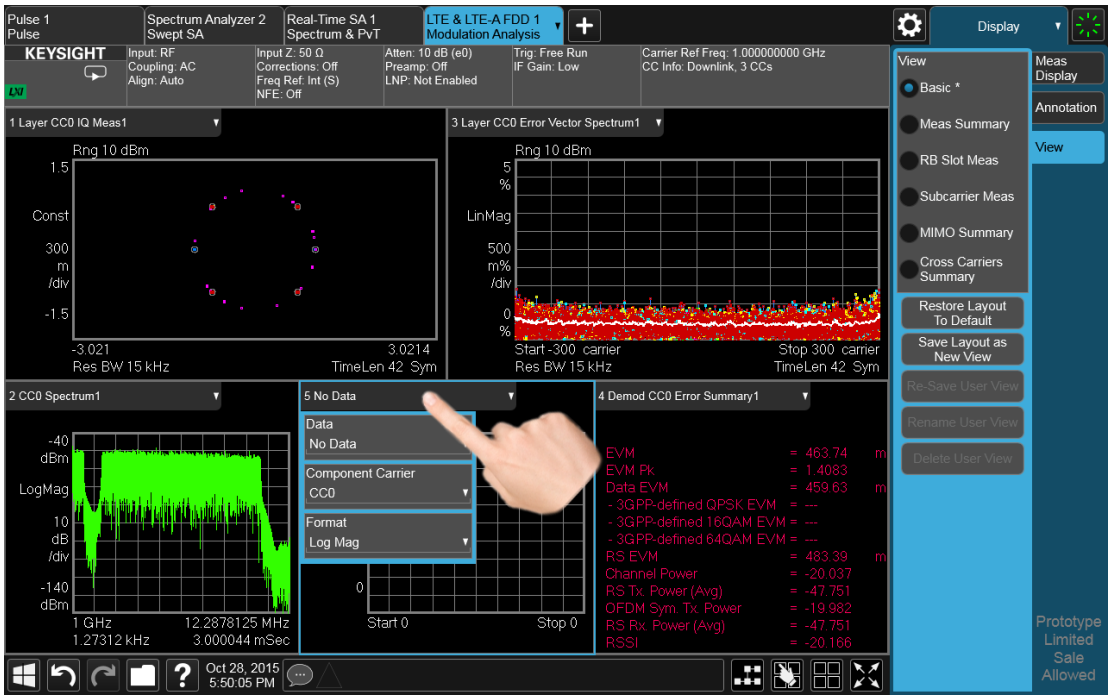
Note the * that now appears next to Basic in the View menu, indicating that you are now in the modified Basic View. You see the * if you add, delete or rearrange windows, but simply resizing windows does not display the *. The * means you are in a modified View, which must be saved as a User View before you leave the measurement (if you don't save it, the instrument will save it for you).

Note also that the Restore Layout to Default control is no longer grayed out. If you press this control it restores the Basic View to its default state. Restore Layout to Default becomes available when you add, delete or rearrange windows and when you resize them; otherwise it is grayed out.

You can add more windows with the "+" arrow symbols. Note that the "+" arrow symbols only appear if the current measurement has more windows available to display. If you are already displaying all the measurement's windows, the "+" symbols disappear.

You can exit the View Editor by again tapping the Edit View icon.

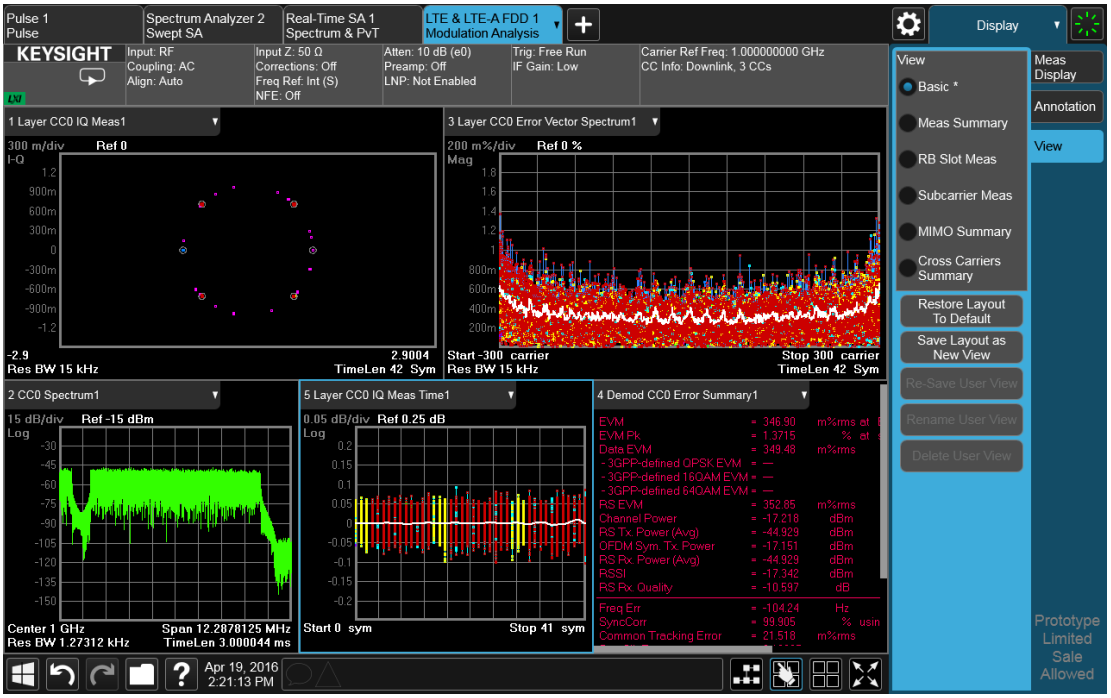
You can specify which result you want to see in the new window by tapping its title region.



A panel drops down, containing a Data control for specifying window results. Some measurements, such as LTE-A in this example, also provide controls on this dropdown for specifying other window parameters, such as the Component Carrier and Data Format, Tap the Data control and you will see a list of available results for the window. In some cases, as in LTE-A, this will be a cascading list, due to the number of results available:



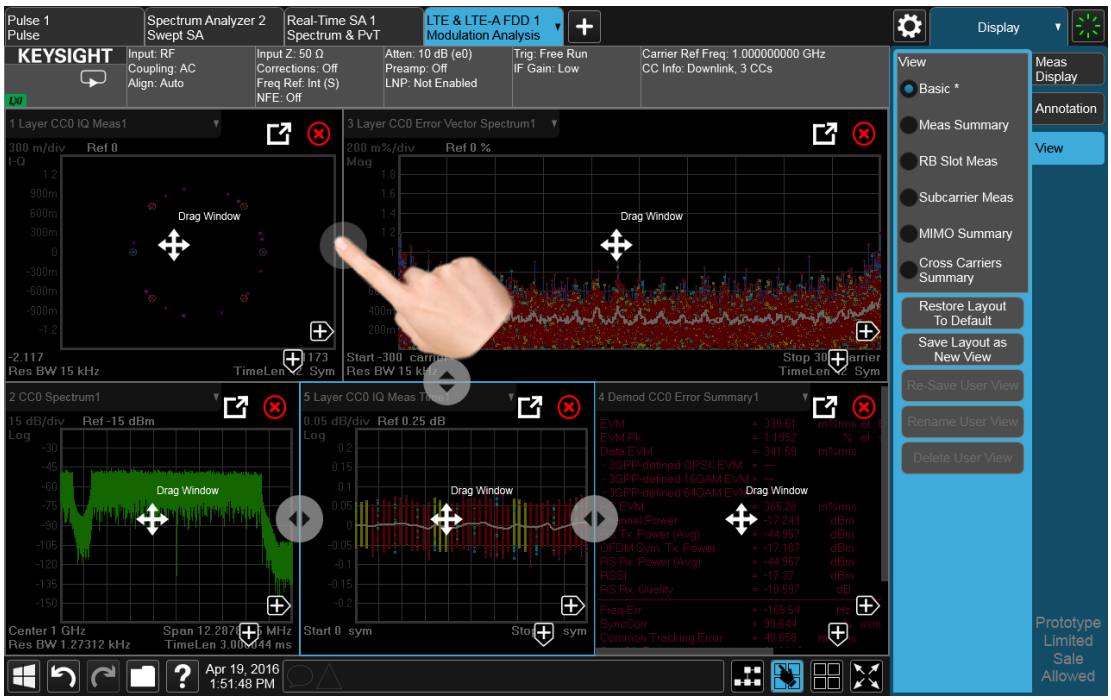
Choose the result you want and tap OK. Here we have chosen IQ Meas Time from the Demod group:



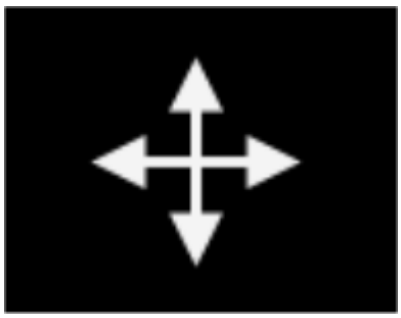
Your new, edited User View is now ready to use.

2.17.2 To Resize or Rearrange Windows in a View

Sometimes you may wish to resize a window. To do this go back into the View Editor and note the large, translucent white circles along the edges of the draggable borders. These are the “resize handles”. You can resize the windows by dragging these handles. Note that in their quiescent state they are slightly translucent; when you touch one it turns solid white, indicating that it is draggable. If you touch and drag one of them it moves the axis to which it is attached.



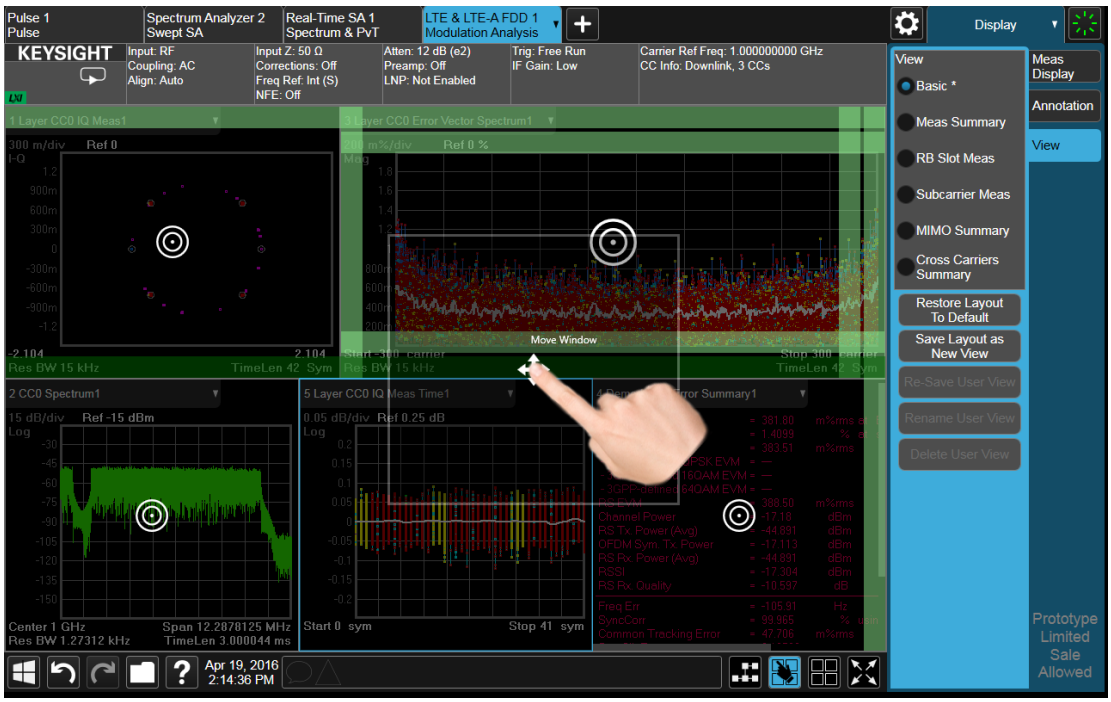
Another feature that comes with the View Editor is the ability to move windows around. You do this by dragging the four-arrow objects in the center of the window; the whole window goes along. Actually you can touch and drag anywhere in the window (except on one of the arrows or the delete circle) and it will drag, but the four-arrow objects give you an indication and a convenient finger target.



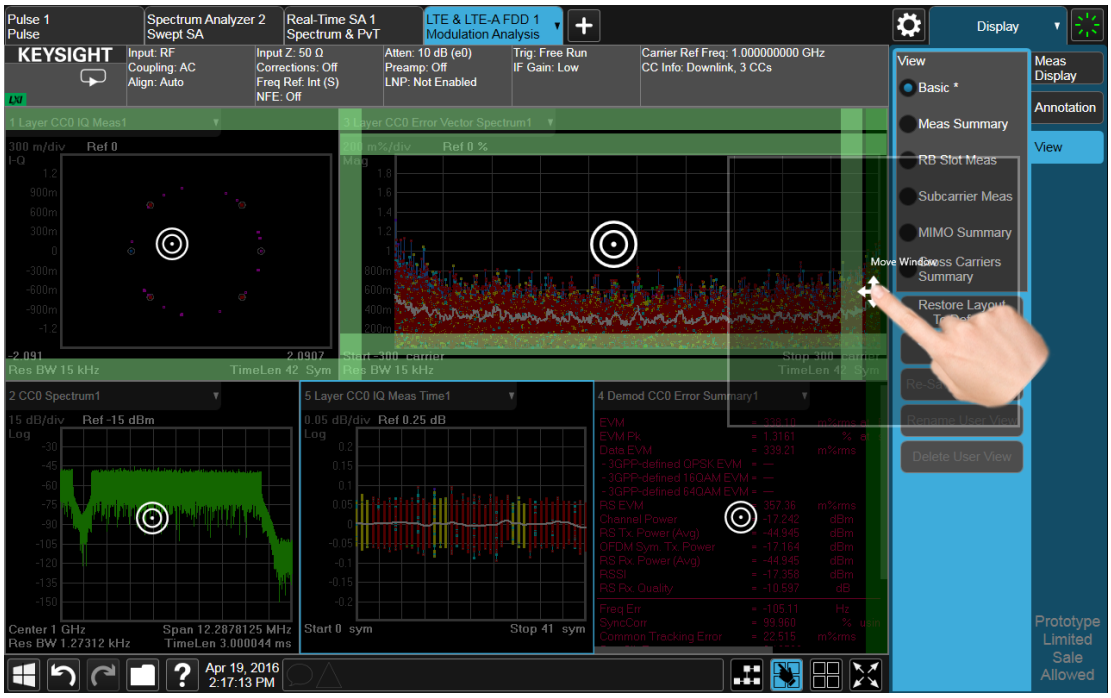
The outline of the window appears as it is being dragged. When you start to drag a window, target symbols appear in the other windows:

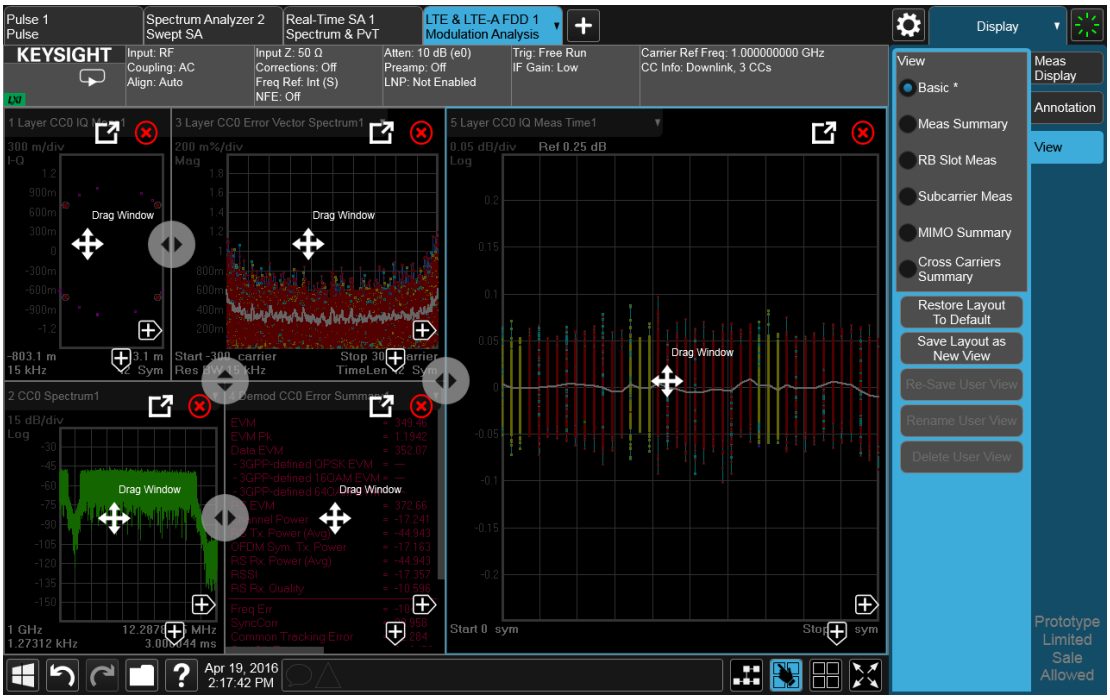


If you drop a window on one of the targets, it swaps positions with the target window. If you drag a window's center into another window, green stripes appear on the edges to show you where the window will go when you release it:



When you hover over one of the stripes it gets dimmer, to show the position the window being dragged will take on. If you release a window over an inner stripe, the window you are dragging and the window over which you were hovering resize to share the space the target window originally occupied. If you release a window over an outer stripe, as shown below, the window you are dragging takes on a new position outside the array of other windows:



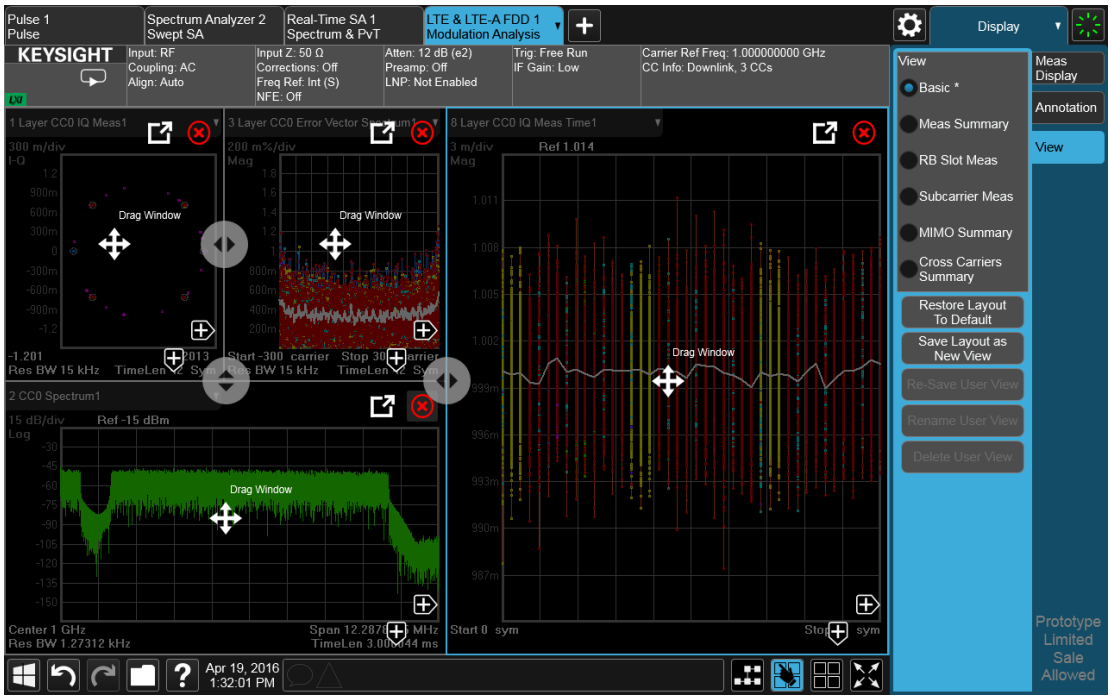


In either case, one or more of the remaining windows resize to occupy the space formerly occupied by the window you were dragging.

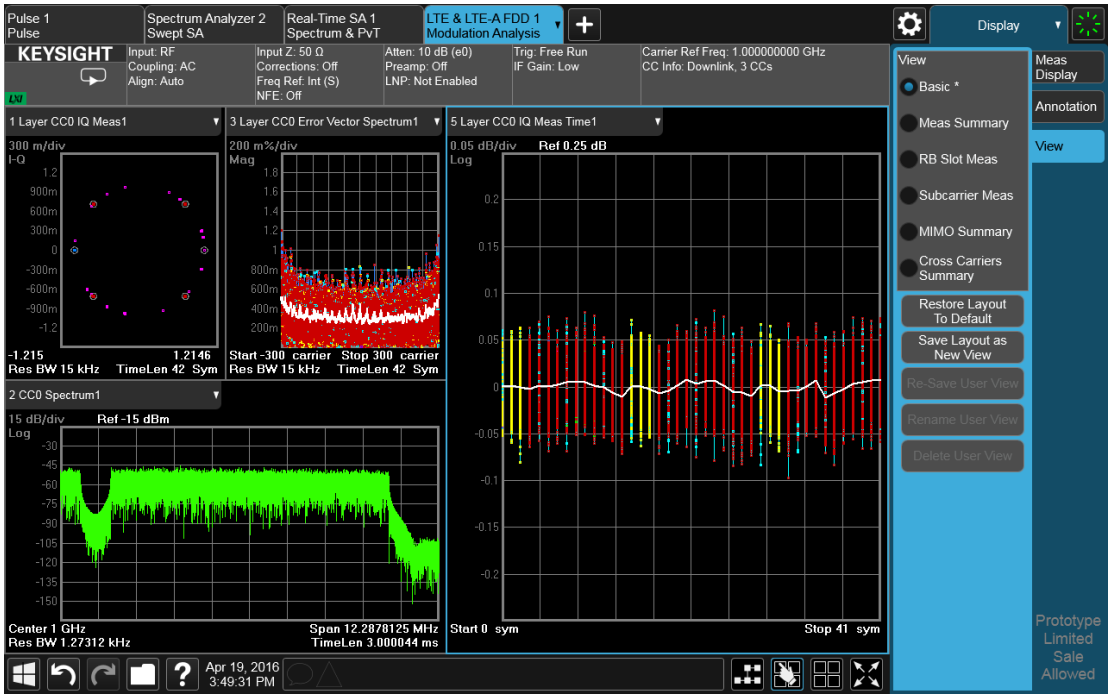
2.17.3 To Delete a Window from a View

The View Editor also lets you delete a window. To do this, tap one of the circled red X's, as shown below.

There has to be more than one window for you to see the circled red Xs.



Now press the View Editor button (the blue hand) to exit the View Editor. At this point, you have an edited Predefined View, as shown by the * next to Basic:



When you are finished with it, you can restore the Layout to the default for Basic by pressing “Restore Layout to Default”. Or you can save your edited View as a “User

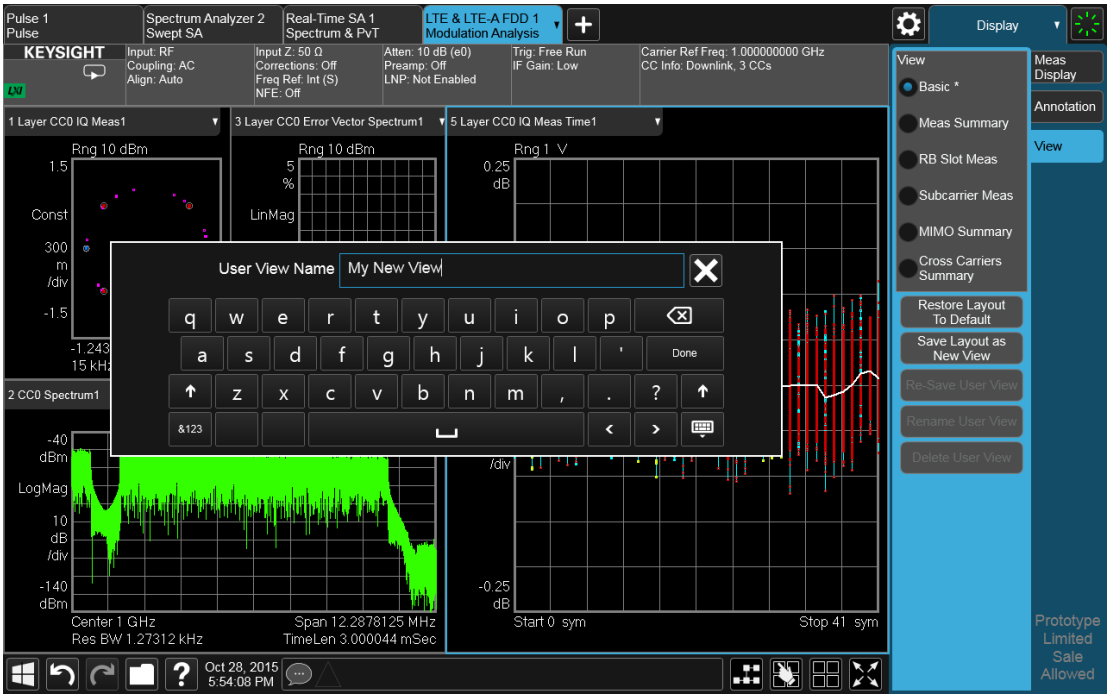
View" (if you exit the measurement without saving the edited View, the instrument will save it for you as a User View called "Autosaved").

If you clone the current Screen by pressing the "+" tab, the modified Predefined View will be saved as a User View called "Autosaved", and it will be available in the new Screen.

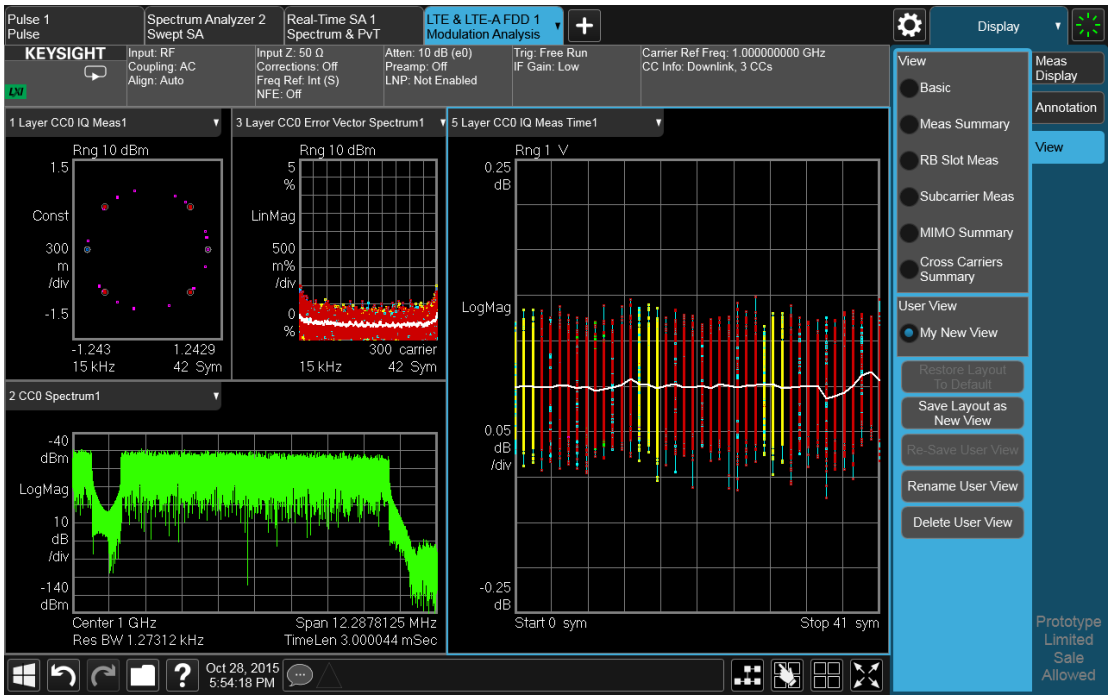
2.17.4 To Save a User View

See also "Transferring User Views Between Instruments" on page 139

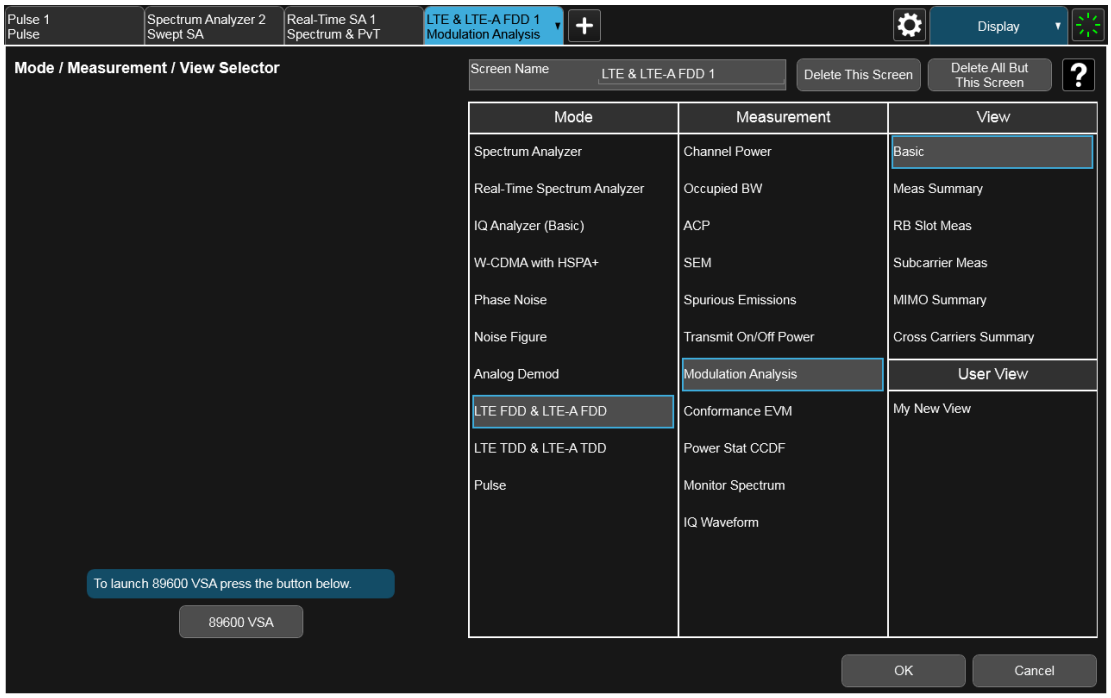
To save your new View as a User View, tap the "Save Layout as New View" control. You will get an alpha keyboard that lets you name your new View; the default is the old View name with a number. Below, we have typed in "My New View":



When you tap "Done", the View is saved:



Notice the User View region which has appeared on the menu panel above, with the new User View called “My New View. Notice also that “Basic” has returned to its original, unedited state and the * is gone from its name. Note also that “Restore Layout to Default” is grayed out. Note also that if you go to the Mode/Meas dialog, you will see the User View there as well:



When naming a new View, you must choose a name that is not already in use for any User View in any measurement; this is because User Views get written to permanent memory and are available to all instances of the Measurement in any screen. They survive a Mode Preset and also survive shutdown and restart of the application.

Transferring User Views Between Instruments

To transfer a User View to another instrument, you must copy the desired file to a portable drive or to your network and then copy it to the target instrument.

When you save a User View, a file is created (or updated if it already exists) containing all the User Views for the current measurement. All of these files are saved on the D: drive in the instrument, in the folder:

`D:\Users\Instrument\My Documents\UserViews`

(assuming you are logged in as Instrument, which is the default).

Look for the file for your measurement. The file naming convention is:

`ModeName.MeasName.layout`

Where `ModeName` is the long-form SCPI parameter for the `:INST:SEL` command for your Mode, and `MeasName` is the long-form SCPI parameter for the `:CONF` command for your Measurement.

For a full list of all `ModeName` parameters, see Index to Modes in "Mode" on page 58.

The following is a full list of all `MeasName` parameters.

Measurement Name	SCPI ID
ACP, Adjacent Channel Power	`ACPower`
AM	`AM`
AM Depth	`AMD`
Amplitude Probability Distribution	`APD`
Audio Distortion	`AUDDist`
Audio Frequency	`AUDFreq`
Audio Level	`AUDLevel`
Audio SINAD	`AUDSinad`
Automatic Direction Finder	`ADF`
Channel Power	`CHPower`
Code Domain	`CDPower`
Combined GSM	`CGSM`
Combined WCDMA	`CWCDma`
Complex Spectrum	`SPECtrum`
Conformance EVM	`CEVM`
Custom OFDM	`OFDM`

Measurement Name	SCPI ID
Digital Demod	DDEMod
Disturbance Analyzer	DANalyzer
EDR In-band Spurious Emissions	IBSPurious
EVM	EEVM
Fast Capture	FCAPture
Fast Spectrum	FSPectrum
FM	FM
FM Deviation	FMDeviation
FM Stereo	FMStereo
Frequency Counter	FCOunter
Frequency Scan	FSCan
GMSK Phase & Freq Error	PFERror
Group Delay	GDELay
Harmonics	HARMonics
HRP UWB Demodulation	HUWB
Instrument Landing System	ILS
IQ Waveform	WAVeform
LE In-band Emissions	IBEMissions
List Power Step	LPSTep
List Sequencer	LSEQuencer
List Sweep	LIST
Log Plot	LPLot
LoRa (CSS) Demodulation	LORA
Marker Beacon	MBE
Mod Accuracy	RHO
Modulation Analysis	EVM
Modulation Distortion	MODDist
Modulation Rate	MODRate
Modulation SINAD	MODSinad
Monitor Spectrum	MONitor
Noise Figure	NFIGure
Occupied BW / Output Spectrum BW	OBWidth
Output RF Spectrum	EORFspectr
Phase and Amplitude vs Time	PAVTime

Measurement Name	SCPI ID
PM	PM
PM Deviation	PMDeviation
Power Amplifier	PAMPlifier
Power Control	PCONtrol
Power Stat CCDF	PSTatistic
Power vs Time	EPVTime
Pulse	PULSe
QPSK EVM	EVMQpsk
Real Time Scan	RTSC
RF Power	RFPower
SEM	SEMask
Spectral Flatness	FLATness
Spectrum & PvT	RTSA
Spot Frequency	SFRequency
Spurious Emissions	SPURious
Streaming	STReaming
Strip Chart	SCHart
Swept SA	SANalyzer
TOI	TOI
Transmit Analysis	TX
Transmit On/Off Power	PVTime
Transmit Power (Burst Power)	TXPower
Tuned RF Level	TRFLevel
Tuned RF Level with Tracking	TTRF
Tx Band Spur	ETSPur
VHF Omni-Directional Range	VOR

Examples:

- The User View file for the Swept SA measurement is `SA.SANalyzer.layout`
- The User View file for the ACP measurement in the WCDMA mode is `WCDMA.ACPower.layout`

Copy the desired file to a thumb drive or to your network. Then go to the target instrument and copy the file into the `D:\Users\Instrument\My Documents\UserViews` directory on that instrument (again, assuming you are logged in as Instrument).

Note that copying this file to another instrument will overwrite the file already in that instrument, if any, and will destroy any User Views that might have been created on that instrument.

Note that when you delete the last User View for a measurement, the file is removed.

2.17.5 To Rename a User View

You can rename a User View by selecting that View and tapping “Rename User View.” You can also re-edit a User View; if you do this, an asterisk will appear next to the User View’s name. You can then tap “Re-Save User View to save it back to its existing name, or “Save Layout as New View” to add another, new User View.

2.17.6 To Delete a User View

You can delete a User View by doing the following:

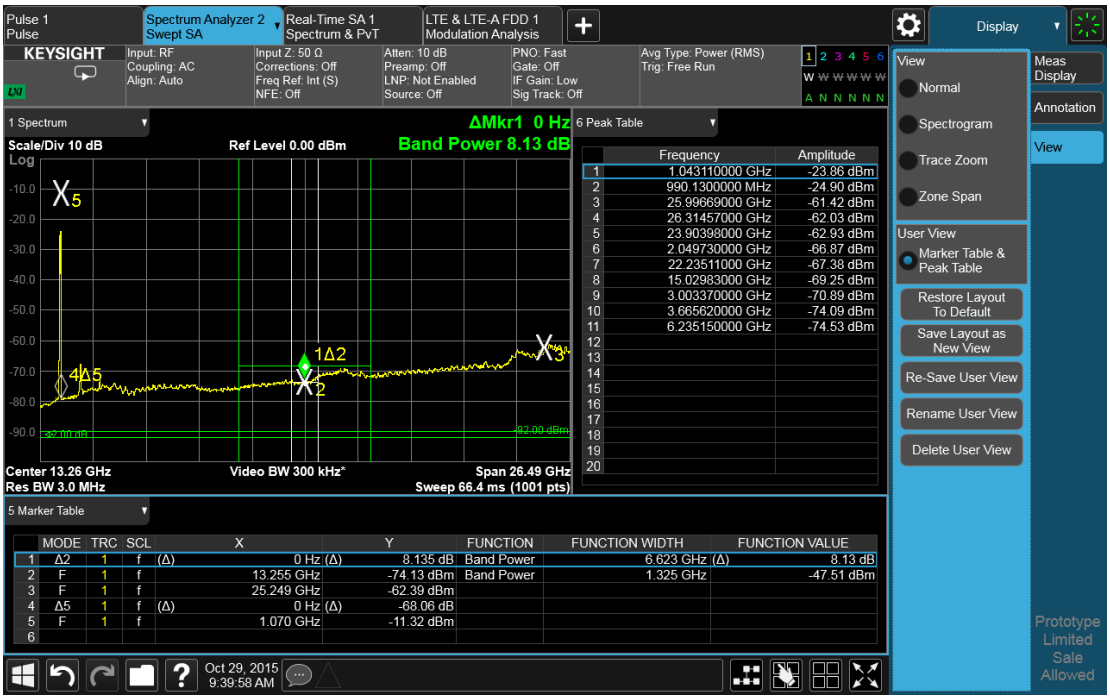
1. From the "Mode/Meas/View Dialog" on page 57, *or* from the View menu, select the User View that you want to delete
2. Switch to the Display menu
3. Select the View tab
4. Tap Delete User View

2.17.7 To Delete All User Views

You can delete all User Views by tapping “Delete All User Views.” The default view becomes the current view for the Measurement if a User View was the current view when this control was pressed.

2.17.8 Use Case: Displaying Marker and Peak Tables

One common application for User Views is to create a View that allows the Spectrum Analyzer to display both a Marker Table and a Peak Table at the same time. To do this, simply add a Marker Table Window and a Peak Table window to the Spectrum window of the Swept SA measurement. The result is shown below; note that the new View has been named “Marker Table & Peak Table”:



NOTE: There are legacy displays like Marker Table, Peak Table, Measure at Marker and Gate View, which are not Views but special display modes. These are retained for backwards compatibility, however they are turned on and off with switches and do not use the View system. Turning on one of these switches does not create a modified View, it merely adds the specified window to the current View; turning the switch back off removes the window. While the switch is on, NO View shows as selected in the View menu. These switches are grayed out if you are in a modified View or a User View. Since only one of these switches can be on at a time, and because these switches turn off on a Preset, User Views offer a superior way of adding windows than using the switches.

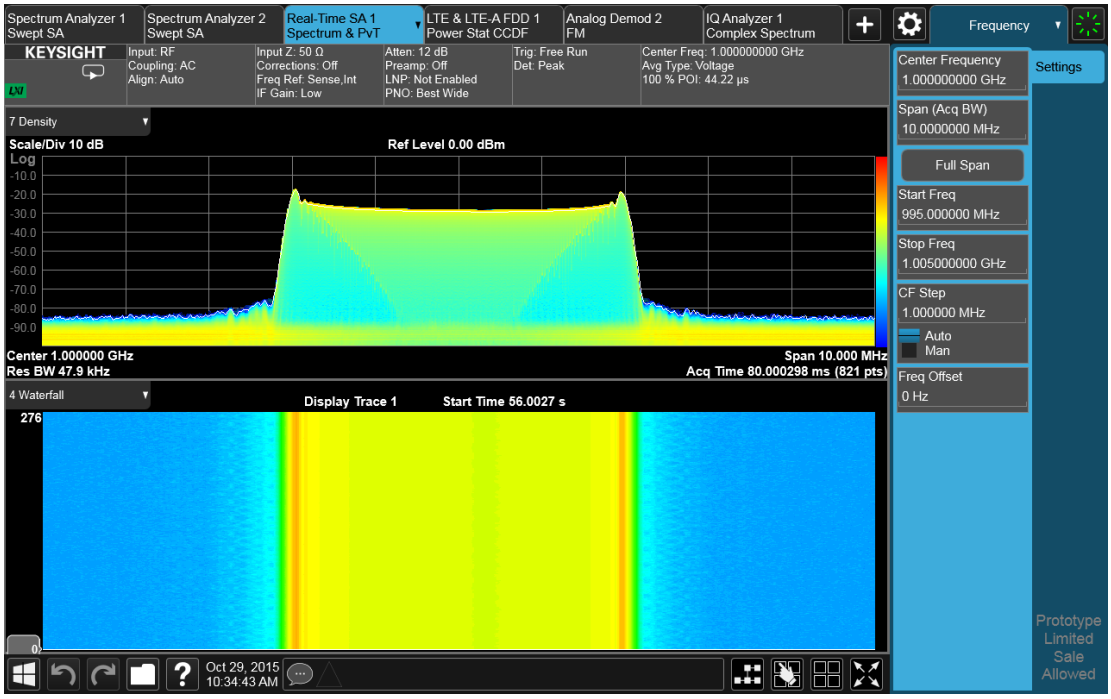
Some measurements do not support User Views; these do not allow adding, deleting or rearranging windows, however they do allow resizing windows. In these measurements you can get into the View Editor but the Add icons, Delete icons and Move icons will not appear. You can still resize the windows and in some cases (e.g. Noise Figure) you can still change window contents.

2.17.9 View Editor Remote Commands

Remote Commands for User Views can be found in the documentation for the **Display, View** tab.

2.18 Multiscreen

You can configure up to 16 different Screens at a time. Normally, you only see one Screen, and the set of configured screens is shown across the top of the display in a series of "Screen Tabs" on page 56. Touching any screen's tab brings it to the foreground, makes it the current Screen and starts it updating.



Multiscreen view lets you display all of the configured Screens at once.

You can switch to Multiscreen View by pressing this button in the "Control Bar" on page 105 at the bottom right of the screen:



Multiscreen View looks like this:



While in Multiscreen View, the button changes from a black background to a blue background:



To exit Multiscreen view, tap the button again.

Multiscreen View cannot be activated if only one screen is configured.

Each Screen contains one Mode, each Mode contains one Measurement, and each Measurement contains a number of Windows arranged in Views. You can configure multiple instances of the same Mode along with any combination of other Modes.

In Multiscreen View, just as in Single Screen View, only one screen is active.

You switch Screens by tapping the Screen Tab you want, or when in Multiscreen View, you can tap the Screen itself. When you switch Screens, the current Screen's state and measurement results are preserved, the new Screen's previous state and data are loaded, and the new Screen starts running its Mode.

In Multiscreen View:

- The Meas Bar does not display
- The Screens are presented in an array of equal size boxes, except where the number of Screens means some have to be different sizes (as when you have 3 Screens, 5 Screens, etc.).

- Each Screen has a tab that contains the name of the Mode and Measurement in the box and a number associated with the instance of that Mode. You can enter a custom Screen name that replaces the Mode name, by going into the Mode/Meas dialog
- There is always one and only one selected Screen. It is indicated by a blue tab. Only the selected Screen is actually running a measurement and updating its display
- The selected window in the selected screen is the context for the current menus. It is the only window on the display with a blue border
- As you go from screen to screen, each screen remembers the last menu that was active in that screen and restores it as the active menu

In Multiscreen View, as in Single Screen View, tapping the blue tab or pressing the Mode/Meas front panel key opens the "Mode/Meas/View Dialog" on page 57 which allows you to change the Mode (or Measurement or View) being displayed in that Screen.

Remote Command	`:INSTrument:SCReen:MULTiple[:STATe] OFF | ON | 0 | 1` `:INSTrument:SCReen:MULTiple?`
Example	`:INST:SCR:MULT ON`
Notes	If only one screen is configured, attempting to set Multi-Screen ON generates the error "-221, Settings conflict; Multi-Screen requires >1 screen"
Preset	OFF

For more information, see the following:

- "Select Screen" on page 146
- "Screen List (Remote only command)" on page 147

2.18.1 Select Screen

You can select a screen by touching its tab or, in "Multiscreen" on page 144 mode, touching the screen itself. Selecting the Screen activates the screen and suspends the previously selected screen (if any).

Remote Command	`:INSTrument:SCReen:SELect <screen name>` `:INSTrument:SCReen:SELect?`
Example	`:INST:SCR:SEL "Baseband"`
Notes	If the <screen name> is specified but not found in the list of Screens, the error message "-224, Illegal parameter value; Screen Name not found" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated

Preset	Returns the name of the active screen

2.18.2 Screen List (Remote only command)

You can obtain a list of currently configured Screens. This permits your remote program to manage screens for selection, renaming, or deletion.

Remote Command	`:INSTrument:SCReen:CATalog?`
Example	`:INST:SCR:CAT?`
Notes	The query response is a comma separated list of Screen Names. If only 1 Screen is configured, there is no trailing comma For R&S compatibility, the following query is also available: `:INSTrument:SCReen:LIST?`
Preset	Returns list of currently configured Screens

2.19 Fullscreen

This button is in the "Control Bar" on page 105, at the lower right corner of the display.



When **Full Screen** is pressed, the measurement window expands horizontally over the entire instrument display. The screen graticule area expands to fill the available display area.

It turns off the display of the menu panel, but the controls that drop down from the **Meas Bar** and on-screen annotation are still available, and you can still drag the trace and markers and perform a pinch zoom, so you can still operate the instrument.

Pressing **Full Screen** again while Full Screen is in effect cancels Full Screen.

You can get even more screen area for your data display by turning off the **Meas Bar**.

Full Screen is canceled by the **Preset** key.

Remote Command	`:DISPlay:FSCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:FSCReen[:STATe]?`
Preset	Unaffected by Preset but set to `OFF` by **Restore Misc Defaults** or shutdown and restart
State Saved	Not saved in instrument state
Backwards Compatibility SCPI	`:DISPlay:MENU[:STATe] OFF | ON | 0 | 1` This emulates ESA full screen functionality, which is the same as the `FSCReen` command in PSA except that the sense of on/off is reversed (that is, `OFF` means the menus are off, so **Fullscreen** is `ON`) and the default is on(meaning **Fullscreen** is `OFF`)
Backwards Compatibility Notes	In ESA/PSA, Full Screen was turned on with a softkey, so pressing any other key turned Full Screen off. In X-Series, because a hardkey is provided to turn this function on and off, pressing any other key no longer turns off **Full Screen**

3 Power Amplifier Mode

Power Amplifier Mode is intended for testing the nonlinearity of power amplifiers, and provides DPD technology to compensate for the nonlinear behavior of power amplifiers.

There is only one measurement in this Mode: "Power Amplifier Measurement" on page 150.

Example	`:INSTrument[:SELect] PA`
	`:INSTrument[:SELect]?`
	`:INSTrument:NSELect 81`
	`:INSTrument:NSELect?`

Dependencies	The Mode must be installed and licensed with Option N9055EM0E in your instrument before it is available for use
Status Bits/OPC dependencies	Changing Modes resets all SCPI status registers and mask registers to their power-on defaults. Therefore, event or condition register masks must be re-established after a Mode change

Software Options

The Power Amplifier Mode model number is N9055EM0E. It is only supported by certain hardware platforms. Its EVM measurement borrows most of the demodulation-related parameters from 5GNR/WLAN/LTEA-FDD Modes. Therefore, to enable demodulation in N9055EM0E, the following licenses are required in advance:

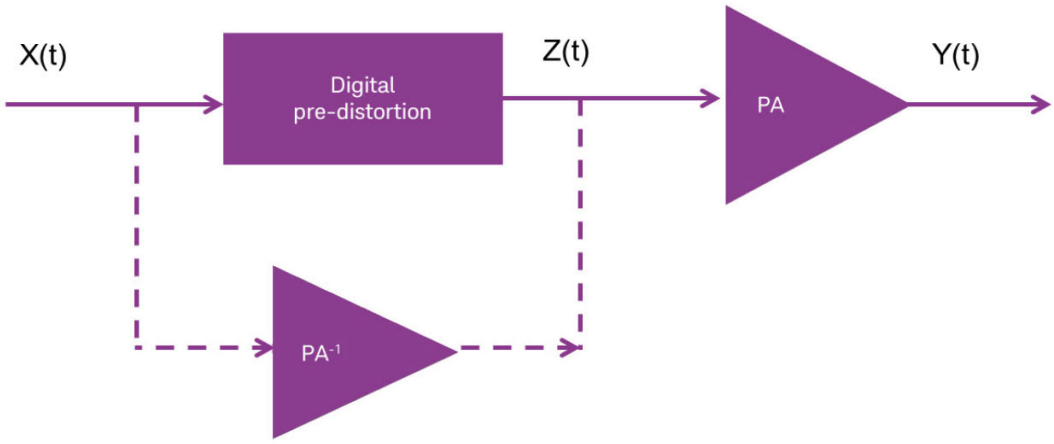
Demodulation in Power Amplifier Application (N9055EM0E)	Required License
5GNR	N9085EM0E
WLAN 802.11ac/ax	N9077EM1E
WLAN 802.11be/bn	N9077EM2E
LTEA-FDD	N9080EM0E

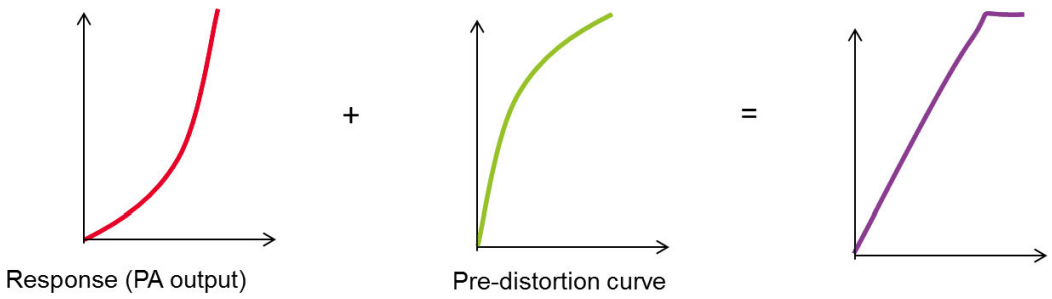
3.1 Power Amplifier Measurement

The Power Amplifier measurement is used to test the nonlinearity of power amplifiers, and implements DPD technology to compensate for the nonlinear behavior of power amplifiers. The measurement calculates AM-AM, AM-PM, ACP, delta EVM and standard EVM results for the pre-DPD signal and the post-DPD signal to show DPD effects.

Power amplifiers (PA) with high Peak-to-Average Ration (PAR) signals can create non-linearity problems. When a high-power signal is applied to the PA input, the PA cannot linearly amplify the signal, possibly resulting in gain saturation and distortion, and ultimately leading to signal quality degradation, such as worse ACP and EVM. Digital Pre-Distortion (DPD) technology can be used to compensate for the non-linear behavior of the PA. DPD applies “inverse” distortion to the PA input signal to cancel the distortion generated by the PA. There are several types of DPD methods, including memoryless and memory, which convey the memory effect on a PA. The following four methods are supported:

- Look-up table (extract or user-defined)
- Memory polynomial
- Volterra series
- Customer defined algorithms





DPD is one of the most cost-effective linearization techniques, which adds an expanding nonlinearity in the baseband that complements the compressing characteristic of the RF power amplifier. Ideally, the cascade of the pre-distorter and the power amplifier becomes linear, and the original input is amplified by a constant gain. With the pre-distorter, the power amplifier can be utilized up to its saturation point while still maintaining good linearity, thereby significantly increasing its efficiency.

DPD can be seen as an “inverse” of the PA. The DPD algorithm must model the PA behavior accurately and efficiently for successful DPD deployment. We support two kinds of DPD modes:

Extract and apply

The DPD model is extracted from the captured signal and then is applied to the reference signal to compensate the distortion. Four PA model types are supported: Memory polynomial, Volterra series, Look-up table and Customer defined algorithm. To extract the DPD model, you can specify the number of iterations, for memory polynomial and Volterra series memory model types, and specify the memory order and non-linear order. The extracted DPD model can be exported for further verification.

Apply only

The DPD model does not need to be extracted from the captured signal and you can input the DPD model. For Look-Up-Table, you provide the AM In (V) – AM Out (V) shaping and AM (V) - PM Out (deg) shaping table. For Memory polynomial and Volterra, coefficient file import is supported.

Measurement Commands

These commands are used to initialize the measurement, and to retrieve results.

The general functionality of "CONFigure" on page 1129, "INITiate" on page 1130, "FETCh" on page 1130, "MEASure" on page 1132, and "READ" on page 1131 are described in the section **SCPI Operation and Results Query** in the topic **Programming the Instrument**.

`:INITiate:PAMPlifier`	Initiates a trigger cycle for the measurement, but does not return any data Does not change any measurement settings
`:CONFigure:PAMPlifier`	Selects the measurement with **Meas Setup** settings in their preset states. This is the same as "Meas Preset" on page 264
`:CONFigure:PAMPlifier:NDEFault`	Selects `the` measurement *without* affecting settings
`:CONFigure?`	Returns the name of the measurement: `PAMP`

The following queries are used to retrieve the results:

`:FETCh:PAMPlifier?`	Retrieves the data specified by `n`
`:MEASure:PAMPlifier [n]?`	Switches to `PAMP` measurement, restores default values, starts the measurement, then retrieves the data specified by `n`
`:READ:PAMPlifier[n]?`	Starts the measurement, then retrieves the data specified by `n`

Remote Command Results

For the `FETCh`, `MEAS`, and `READ` queries listed above, the results returned depend on the value of `n`. This table summarizes results formats for all values of `n`. In some cases, the results format depends on certain measurement settings, in which case the details appear in sub-tables for readability.

n	Results Returned	
1	1	Pre-DPD delta EVM
	2	Pre-DPD Power In
	3	Pre-DPD Power Out
	4	Pre-DPD Gain
	5	Pre-DPD Crest Factor in
	6	Pre-DPD Crest Factor out
	7	Pre-DPD Peak Power In
	8	Pre-DPD Peak Power Out
	9	Post-DPD delta EVM
	10	Post-DPD Power In
	11	Post-DPD Power Out
	12	Post-DPD Gain
	13	Post-DPD Crest Factor in
	14	Post-DPD Crest Factor out
	15	Post-DPD Peak Power In
	16	Post-DPD Peak Power Out
2	Reserved for future use	

n	Results Returned
3	Returns 3 comma-separated scalar results for ACP (*pre*-DPD) Depends on **ACP Measurement Type** and **Power Ref Type**. See "Measurement Results for n = 3, 4" on page 156
4	Returns 3 comma-separated scalar results for ACP (*post*-DPD) Depends on **ACP Measurement Type** and **Power Ref Type**. See "Measurement Results for n = 3, 4" on page 156
5	Returns 60 comma-separated scalar ACP results (*pre*-DPD) Depends on **ACP Measurement Type**. See "Measurement Results for n = 5, 6" on page 156
6	Returns 60 comma-separated scalar ACP results (*post*-DPD) Depends on **ACP Measurement Type**. See "Measurement Results for n = 5, 6" on page 156
7	Returns the pre-DPD ACP spectrum (2001 points)
8	Returns the post-DPD ACP spectrum (2001 points)
9	Returns comma-separated scalar EVM results (*pre*-DPD) Depends on **Radio Format**. See "Measurement Results for n = 9, 10" on page 158
10	Returns comma-separated scalar EVM results (*post*-DPD) Depends on **Radio Format**. See "Measurement Results for n = 9, 10" on page 158
11	Returns the trace of EVM vs Power Depends on **Radio Format** and **Meas Type**. See "Measurement Results for n = 11" on page 161
12	Returns comma-separated scalar EVM vs. Power results Depends on **Radio Format**. See "Measurement Results for n = 12" on page 161
13	Reserved for future use
14	Reserved for future use
15	Returns the Pre-DPD IQ raw data The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values
16	Returns post-DPD IQ raw data The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values
17	Returns the power readouts displayed in the EVM vs. Power Metrics window. The unit of the power readouts is dBm. The array is always arranged from low power level to high

"Radio Format" on page 343	Results
WLAN	The power is the averaged burst power
NR5G LTEAFDD	The power is the RMS power of the carrier specified by "EVM Carrier Index" on page 235

18	Returns AM-AM polynomial coefficients for pre-DPD The number of coefficients is: "LUT AM/AM Polynomial Order" on page 319 + 1 If any coefficient is *not* valid, returns –999.0

n	Results Returned
	Example: If **AM/AM Polynomial Order** = 5, returns 6 values (1.0, 2.0, 3.0, 4.0, 5.0, 6.0), specifying the polynomial: $6.0x^5 + 5.0x^4 + 4.0x^3 + 3.0x^2 + 2.0x + 1.0$
19	Returns AM-AM polynomial coefficients for post-DPD The number of coefficients is: "LUT AM/AM Polynomial Order" on page 319 + 1 If any coefficient is *not* valid, returns –999.0 **Example**: If **AM/AM Polynomial Order** = 5, returns 6 values (1.0, 2.0, 3.0, 4.0, 5.0, 6.0), specifying the polynomial: $6.0x^5 + 5.0x^4 + 4.0x^3 + 3.0x^2 + 2.0x + 1.0$
20	Returns AM-PM polynomial coefficients for pre-DPD The number of coefficients is: "AM/PM Polynomial Order" on page 344 + 1 If any coefficient is *not* valid, returns –999.0 **Example**: If **AM/PM Polynomial Order** = 5, returns 6 values (1.0, 2.0, 3.0, 4.0, 5.0, 6.0), specifying the polynomial: $6.0x^5 + 5.0x^4 + 4.0x^3 + 3.0x^2 + 2.0x + 1.0$
21	Returns AM-PM polynomial coefficients for post-DPD The number of coefficients is: "AM/PM Polynomial Order" on page 344 + 1 If any coefficient is *not* valid, returns –999.0 **Example**: If **AM/PM Polynomial Order** = 5, returns 6 values (1.0, 2.0, 3.0, 4.0, 5.0, 6.0), specifying the polynomial: $6.0x^5 + 5.0x^4 + 4.0x^3 + 3.0x^2 + 2.0x + 1.0$
22	Returns the trace of RMS EVM vs DPD Iteration Depends on **Radio Format** and **Measure DPD Iteration**. See "Measurement Results for n = 22" on page 163
23	If "Measure DPD Iteration" on page 312 is **ON**, returns the trace of the relative power of the lower band of ACP Offset A vs DPD Iteration, in dBc units If "Measure DPD Iteration" on page 312 is **OFF**, returns –999
24	If "Measure DPD Iteration" on page 312 is **ON**, returns the trace of the relative power of the upper band of ACP Offset A vs DPD Iteration, in dBc units If "Measure DPD Iteration" on page 312 is **OFF**, returns –999
25	If "Measure DPD Iteration" on page 312 is **ON**, returns the trace of delta EVM vs DPD Iteration. The unit is either dB or % depending on "Report EVM in DB" on page 356 If "Measure DPD Iteration" on page 312 is **OFF**, returns –999
26	Returns comma-separated scalar EVM results (*pre*-DPD) Depends on **Radio Format**. See "Measurement Results for n = 26, 27" on page 164
27	Returns comma-separated scalar EVM results (*post*-DPD) Depends on **Radio Format**. See "Measurement Results for n = 26, 27" on page 164
28	If "Measure DPD Iteration" on page 312 is **ON**, returns the trace of the relative power of the lower band of ACP Offset B vs DPD Iteration in dBc units

n	Results Returned
	If **Measure DPD Iteration** is OFF, returns –999
29	If "Measure DPD Iteration" on page 312 is ON, returns the trace of the relative power of the upper band of ACP Offset B vs DPD Iteration in dBc units
	If **Measure DPD Iteration** is OFF, returns –999
30	If "Measure DPD Iteration" on page 312 is ON, returns the trace of gain vs DPD Iteration in dB units
	If **Measure DPD Iteration** is OFF, returns –999
31	If "Measure DPD Iteration" on page 312 is ON, returns the trace of Output Power vs DPD Iteration in dBm units
	If **Measure DPD Iteration** is OFF, returns –999
32	If "Measure DPD Iteration" on page 312 is ON, returns the trace of crest factor out vs DPD Iteration in dB units
	If **Measure DPD Iteration** is OFF, returns –999
33	Returns 140 comma-separated scalar SEM results (pre-DPD) See "Measurement Results for n = 33, 34" on page 166
34	Returns 140 comma-separated scalar SEM results (post-DPD) See "Measurement Results for n = 33, 34" on page 166
35	Returns the pre-DPD SEM spectrum (2001 points)
36	Returns the post-DPD SEM spectrum (2001 points)
37	Returns the absolute limit line (2001 points)
38	Returns the relative limit line (2001 points)
39	Returns the combined limit line (2001 points)
40	If "Measure DPD Iteration" on page 312 is ON, returns some SEM scalar results vs DPD Iteration If "Measure DPD Iteration" on page 312 is OFF, returns –999 See "Measurement Results for n = 40" on page 168
41	If the following conditions are met: 1. "Measure DPD Iteration" on page 312 is ON 2. Radio Format is WLAN 3. NC-EVM is ON Returns the trace of WLAN NC-EVM vs DPD Iteration. The unit is either dB or %, depending on "Report EVM in DB" on page 356 Otherwise, returns –999
42	If the following conditions are met: 4. Meas Type is Power Sweep 5. Radio Format is WLAN 6. NC-EVM is ON Returns the trace of WLAN NC-EVM vs PA Power. The unit is either dB or %, depending on "Report EVM in DB" on

n	Results Returned
	page 356 Otherwise, returns –999

3.1.1 Measurement Results for n = 3, 4

Returns 3 comma-separated scalar results in the following order.

- Specifying n = 3 returns pre-DPD results
- Specifying n = 4 returns post-DPD results

"ACP Measurement Type" on page 347	"Power Ref Type" on page 347	#	Item	Unit, if any
TPRef	*Not*LRCarriers	1	Total carrier power	dBm
		2	Reference carrier power	dBm
		3	–999	
TPRef	LRCarriers	1	Total carrier power	dBm
		2	Left Reference carrier power	dBm
		3	Right Reference carrier power	dBm
PSDRef	*Not*LRCarriers	1	Total carrier power	dBm/Hz or dBm/MHz
		2	Reference carrier power	dBm/Hz or dBm/MHz
		3	–999	
PSDRef	LRCarriers	1	Total carrier power ()	dBm/Hz or dBm/MHz
		2	Left Reference carrier power	dBm/Hz or dBm/MHz
		3	Right Reference carrier power	dBm/Hz or dBm/MHz

3.1.2 Measurement Results for n = 5, 6

Returns 60 comma-separated scalar ACP results in the following order.

- Specifying n = 5 returns pre-DPD results
- Specifying n = 6 returns post-DPD results

If any result is invalid, returns –999.0.

"ACP Measurement Type" on page 347	#	Item	Unit, if any
TPRef	1	1. Channel (1) - relative power	dB
	2	Channel (1) - absolute power	dBm
	3	Channel (2) - relative power	dB
	4	Channel (2) - absolute power	dBm
	...		
	35	Channel (18) - relative power	dB
	36	Channel (18) - absolute power	dBm
	37	Lower offset A - relative power	dB
	38	Lower offset A - absolute power	dBm
	39	Upper offset A - relative power	dB
	40	Upper offset A - absolute power	dBm
	41	Lower offset B - relative power	dB
	42	Lower offset B - absolute power	dBm
	43	Upper offset B - relative power	dB
	44	Upper offset B - absolute power	dBm
	...		
	57	Lower offset F - relative power	dB
	58	Lower offset F - absolute power	dBm
	59	Upper offset F - relative power	dB
	60	Upper offset F - absolute power	dBm

"ACP Measurement Type" on page 347	#	Item	Unit, if any
PSDRef	1	Channel (1) - relative power	dB
	2	Channel (1) - absolute power	dBm/Hz or dBm/MHz
	3	Channel (2) - relative power	dB
	4	Channel (2) - absolute power	dBm/Hz or dBm/MHz
	...		
	35	Channel (18) - relative power	dB
	36	Channel (18) - absolute power	dBm/Hz or dBm/MHz
	37	Lower offset A - relative power	dB
	38	Lower offset A - absolute power	dBm/Hz or dBm/MHz
	39	Upper offset A - relative power	dB
	40	Upper offset A - absolute power	dBm/Hz or dBm/MHz
	41	Lower offset B - relative power	dB
	42	Lower offset B - absolute power	dBm/Hz or dBm/MHz
	43	Upper offset B - relative power	dB
	44	Upper offset B - absolute power	dBm/Hz or dBm/MHz
	...		
	57	Lower offset F - relative power	dB
	58	Lower offset F - absolute power	dBm/Hz or dBm/MHz
	59	Upper offset F - relative power	dB
	60	Upper offset F - absolute power	dBm/Hz or dBm/MHz

3.1.3 Measurement Results for n = 9, 10

Returns comma-separated scalar EVM results:

- Specifying n = 9 returns pre-DPD results
- Specifying n = 10 returns post-DPD results

"Radio Format" on page 343	Results
WLAN	When NC-EVM is OFF: Returns 9 comma-separated scalar EVM results in the following order

#	Item	Unit, if any
1	RMS EVM	%
2	Peak EVM	%

"Radio Format" on page 343	Results

#	Item	Unit, if any
3	Pilot EVM	%
4	Data EVM	%
5	Frequency error	Hz
6	Symbol clock error	
7	IQ origin offset	
8	Peak burst power	dBm
9	Average burst power	dBm

When NC-EVM is ON:

Returns 10 comma-separated scalar EVM results in the following order

#	Item	Unit, if any
1	RMS EVM	%
2	Peak EVM	%
3	Pilot EVM	%
4	Data EVM	%
5	Frequency error	Hz
6	Symbol clock error	
7	IQ origin offset	
8	Peak burst power	dBm
9	Average burst power	dBm
10	ncEVM	%

NR5G

Returns [16 * **Number of Carriers**] comma-separated scalar EVM results, in the following order

In the table below, the value of C is from 1 to "Number of Carriers" on page 265

#	Item	Unit, if any
(C – 1) + 1	Channel power	dBm
(C – 1) + 2	Active channel power	dBm
(C – 1) + 3	Composite EVM	%
(C – 1) + 4	Peak EVM	%
(C – 1) + 5	RMS frequency error	Hz
(C – 1) + 6	Symbol clock error	
(C – 1) + 7	IQ offset	dB
(C – 1) + 8	Clock error	
(C – 1) + 9	Sync source:	

"Radio Format" on page 343	Results		
	#	**Item**	**Unit, if any**
		0 Auto	
		1 SS Block	
		2 PDSCH DMRS	
		3 PUSCH DMRS	
		4 PUCCH DMRS	
		5 PRACH	
		6 SRS	
	(C – 1) + 10	Magnitude error	%
	(C – 1) + 11	Phase error	rad
	(C – 1) + 12	Gain imbalance	dB
	(C – 1) + 13	Quad error	°
	(C – 1) + 14	Timing skew	ps
	(C – 1) + 15	Cell ID	
	(C – 1) + 16	3GPP frequency error	Hz

LTEAFDD

Returns [18 * Number of Carriers] comma-separated scalar EVM results, in the following order

In the table below, the value of C is from 1 to "Number of Carriers" on page 265

#	Item	Unit, if any
(C – 1) + 1	EVM	%
(C – 1) + 2	Peak EVM	%
(C – 1) + 3	EVM peak index	
(C – 1) + 4	EVM peak subcarrier index	
(C – 1) + 5	Data EVM	%
(C – 1) + 6	3GPP-defined QPSK EVM	%
(C – 1) + 7	3GPP-defined 16QAM EVM	%
(C – 1) + 8	3GPP-defined 64QAM EVM	%
(C – 1) + 9	3GPP-defined 256QAM EVM	%
(C – 1) + 10	3GPP-defined 1024QAM EVM	%
(C – 1) + 11	Frequency error	Hz
(C – 1) + 12	IQ offset	dB
(C – 1) + 13	IQ gain imbalance	dB
(C – 1) + 14	IQ quad error	°
(C – 1) + 15	IQ timing skew	s

"Radio Format" on page 343	Results		
	#	Item	Unit, if any
	(C – 1) + 16	Channel power	dBm
	(C – 1) + 17	Symbol clock error	ppm
	(C – 1) + 18	Cell ID	

When Radio Format is NR5G or LTEAFDD, power is the RMS power of the carrier specified by "EVM Carrier Index" on page 235.

3.1.4 Measurement Results for n = 11

Returns the trace of EVM vs Power.

"Radio Format" on page 343	"Meas Type" on page 257	Results
WLAN	PSWeep	Returns the trace of EVM vs Power The unit is either dB or %, depending on "Report EVM in DB" on page 356
	All others	Returns –999
NR5G	PSWeep	Returns the trace of EVM vs Power of the displayed component carrier The unit is either dB or %, depending on "Report EVM in DB" on page 356
	All others	Returns –999
LTEAFDD	PSWeep	Returns the trace of EVM vs Power of the displayed component carrier The unit is either dB or %, depending on "Report EVM in DB" on page 356
	All others	Returns –999

3.1.5 Measurement Results for n = 12

Returns comma-separated scalar EVM vs. Power results.

"Radio Format" on page 343	Results
WLAN	Returns comma-separated EVM vs. power results, in the following order In the table below, the value p is from 1 to number of power levels When NC-EVM is OFF:

"Radio Format" on page 343	Results		
	#	Item	Unit, if any
	1	Radio Format – 1: WLAN	
	2	Number of power levels	
	3	Number of scalar results for each power level (4)	
	4 * p	Power level at the p^{th} power point	dBm
	4 * p + 1	DPD status at the p^{th} power point – 0: DPD not applied – 1: DPD applied	
	4 * p + 2	Average burst power at the p^{th} power point	dBm
	4 * p + 3	EVM at the p^{th} power point	%
	When NC-EVM is ON:		
	#	Item	Unit, if any
	1	Radio Format – 1: WLAN	
	2	Number of power levels	
	3	Number of scalar results for each power level (5)	
	5 * p - 1	Power level at the p^{th} power point	dBm
	5 * p	DPD status at the p^{th} power point – 0: DPD not applied – 1: DPD applied	
	5 * p + 1	Average burst power at the p^{th} power point	dBm
	5 * p + 2	RMS EVM at the p^{th} power point	%
	5 * p + 3	ncEVM at the p^{th} power point	%
	The units of RMS EVM and ncEVM vary, depending on "Report EVM in DB" on page 356		
NR5G / LTEAFDD	Returns comma-separated EVM vs. power results, in the following order In the table below, the value of c is from 1 to "Number of Carriers" on page 265. The value p is from 1 to number of power levels		

"Radio Format" on page 343	Results		
	#	Item	Unit, if any
	1	Radio Format – 0: NR5G – 2: LTEAFDD	
	2	Number of power levels	
	3	Number of scalar results for each power level (2 * Number of Carriers + 2)	
	4 + (p - 1) * (Number of Carriers * 2 + 2)	Power level at the p^{th} power point	dBm
	5 + (p - 1) * (Number of Carriers * 2 + 2)	DPD status at the p^{th} power point – 0: DPD not applied – 1: DPD applied	
	6 + (p - 1) * (Number of Carriers * 2 + 2) + (c – 1) * 2	Carrier power of the c^{th} CC at the p^{th} power point	dBm
	7 + (p - 1) * (Number of Carriers * 2 + 2) + (c – 1) * 2	RMS EVM of the c^{th} CC at the p^{th} power point	%

The units of RMS EVM vary, depending on "Report EVM in DB" on page 356

3.1.6 Measurement Results for n = 22

Returns the trace of RMS EVM vs DPD Iteration

"Radio Format" on page 343	"Measure DPD Iteration" on page 312	Results
WLAN	ON	Returns the trace of RMS EVM vs DPD Iteration The unit is either dB or %, depending on "Report EVM in DB" on page 356
	OFF	Returns –999
NR5G	ON	Returns the trace of RMS EVM vs DPD Iteration of the displayed component carrier The unit is either dB or %, depending on "Report EVM in DB" on page 356
	OFF	Returns –999
LTEAFDD	ON	Returns the trace of EVM vs DPD Iteration of the displayed component carrier The unit is either dB or %, depending on "Report EVM in DB" on

"Radio Format" on page 343	"Measure DPD Iteration" on page 312	Results
		page 356
	OFF	Returns –999

3.1.7 Measurement Results for n = 26, 27

Returns comma-separated scalar EVM results.

- Specifying n = 26 returns pre-DPD results
- Specifying n = 27 returns post-DPD results

"Radio Format" on page 343	Results
WLAN	When NC-EVM is OFF: Returns 9 comma-separated scalar EVM results in the following order:

1	RMS EVM	%
2	Peak EVM	%
3	Pilot EVM	%
4	Data EVM	%
5	Frequency error	Hz
6	Symbol clock error	
7	IQ origin offset	
8	Peak burst power	dBm
9	Average burst power	dBm

When NC-EVM is ON:

Returns 10 comma-separated scalar EVM results in the following order

#	Item	Unit, if any
1	RMS EVM	%
2	Peak EVM	%
3	Pilot EVM	%
4	Data EVM	%
5	Frequency error	Hz
6	Symbol clock error	
7	IQ origin offset	
8	Peak burst power	dBm

"Radio Format" on page 343	Results

#	Item	Unit, if any
9	Average burst power	dBm
10	ncEVM	%

The units of RMS EVM, Peak EVM, Pilot EVM, Data EVM, and ncEVM vary, depending on "Report EVM in DB" on page 356

NR5G

Returns [16 * **Number of Carriers**] comma-separated scalar EVM results, in the following order

In the table below, the value of C is from 1 to "Number of Carriers" on page 265

#	Item	Unit, if any
(C – 1) + 1	Channel power	dBm
(C – 1) + 2	Active channel power	dBm
(C – 1) + 3	Composite EVM	%
(C – 1) + 4	Peak EVM	%
(C – 1) + 5	RMS frequency error	Hz
(C – 1) + 6	Symbol clock error	
(C – 1) + 7	IQ offset	dB
(C – 1) + 8	Clock error	
(C – 1) + 9	Sync source:	
	0 Auto	
	1 SS Block	
	2 PDSCH DMRS	
	3 PUSCH DMRS	
	4 PUCCH DMRS	
	5 PRACH	
	6 SRS	
(C – 1) + 10	Magnitude error	%
(C – 1) + 11	Phase error	rad
(C – 1) + 12	Gain imbalance	dB
(C – 1) + 13	Quad error	°
(C – 1) + 14	Timing skew	ps
(C – 1) + 15	Cell ID	
(C – 1) + 16	3GPP frequency error	Hz

The units of Composite EVM and Peak EVM vary, depending on "Report EVM in DB" on page 356

LTEAFDD

Returns [18 * **Number of Carriers**] comma-separated EVM scalar results, in the following order

In the table below, the value of C is from 1 to "Number of Carriers" on page 265

"Radio Format" on page 343	Results

#	Item	Unit, if any
(C – 1) + 1	EVM	%
(C – 1) + 2	Peak EVM	%
(C – 1) + 3	EVM peak index	
(C – 1) + 4	EVM peak subcarrier index	
(C – 1) + 5	Data EVM	%
(C – 1) + 6	3GPP-defined QPSK EVM	%
(C – 1) + 7	3GPP-defined 16QAM EVM	%
(C – 1) + 8	3GPP-defined 64QAM EVM	%
(C – 1) + 9	3GPP-defined 256QAM EVM	%
(C – 1) + 10	3GPP-defined 1024QAM EVM	%
(C – 1) + 11	Frequency error	Hz
(C – 1) + 12	IQ offset	dB
(C – 1) + 13	IQ gain imbalance	dB
(C – 1) + 14	IQ quad error	°
(C – 1) + 15	IQ timing skew	s
(C – 1) + 16	Channel power	dBm
(C – 1) + 17	Symbol clock error	ppm
(C – 1) + 18	Cell ID	

The units of EVM, Peak EVM, Data EVM, 3GPP-defined QPSK EVM, 3GPP-defined 16QAM EVM, 3GPP-defined 64QAM EVM, 3GPP-defined 256QAM EVM , and 3GPP-defined 1024QAM EVM vary, depending on "Report EVM in DB" on page 356

3.1.8 Measurement Results for n = 33, 34

Returns 140 comma-separated scalar SEM results, in the following order.

- Specifying n = 33 returns pre-DPD results
- Specifying n = 34 returns post-DPD results

If any result is invalid, returns –999.0.

#	Result	Unit, if any
1	Number of the numeric results contained by this SCPI query 139 for the current version	
2	Reserved	

#	Result	Unit, if any
3	Total carrier power	dBm
4	Total carrier bandwidth	Hz
5	Total PSD	dBm/Hz
6	RF-BW	Hz
7	Ref carrier1 index	
8	Ref carrier1 power	dBm
9	Ref carrier1 bandwidth	Hz
10	Ref carrier1 PSD	dBm/Hz
11	Ref carrier1 peak power	dBm
12	Ref carrier2 index	
13	Ref carrier2 power	dBm
14	Ref carrier2 bandwidth	Hz
15	Ref carrier2 PSD	dBm/Hz
16	Ref carrier2 peak power	dBm
17	Reserved	
18	Reserved	
19	Reserved	
20	Reserved	
21	Offset A start frequency	Hz
22	Offset A stop frequency	Hz
23	Offset A integration BW	Hz
24	Minimum margin from limit line in the lower offset A	dB
25	Absolute peak power of the lower offset A (Total Power Reference, Spectrum Peak Reference) Absolute power spectrum density of the lower offset A (PSD Reference) The unit differs with Measurement Type; Total Power Reference, PSD Reference, Spectrum Peak Reference	dBm, dBm/Hz, dBm
26	Peak power offset frequency from the center or carrier edge frequency in the lower offset A, impacted by Offset Frequency Define	Hz
27	Lower offset A limit test – 0: Pass – 1: Fail	
28	Minimum margin from limit line in upper offset A	dB
29	Absolute peak power of the upper offset A (Total Power Reference, Spectrum Peak Reference) Absolute power spectrum density of the upper offset A (PSD Reference) The unit differs with Measurement Type; Total Power Reference, PSD Reference, Spectrum Peak Reference	dBm, dBm/Hz, dBm

#	Result	Unit, if any
30	Peak power offset frequency from the center or carrier edge frequency in the upper offset A, impacted by Offset Frequency Define	Hz
31	Upper offset A limit test – 0: Pass – 1: Fail	
32	Relative peak power of the lower offset A (Total Power Reference, Spectrum Peak Reference) Relative PSD of the lower offset A (PSD Ref) The unit differs with Measurement Type; Total Power Reference, PSD Reference, Spectrum Peak Reference	dBc, dB, dB
33	Relative peak power of the upper offset A (Total Power Reference, Spectrum Peak Reference) Relative PSD of the upper offset A (PSD Ref) The unit differs with Measurement Type; Total Power Reference, PSD Reference, Spectrum Peak Reference	dBc, dB, dB
34	Absolute integrated power of the lower offset A Returns invalid result for Spectrum Peak Reference	dBm
35	Absolute integrated power of the upper offset A Returns invalid result for Spectrum Peak Reference	dBm
36	Relative integrated power of the lower offset A The unit differs with Measurement Type; Total Power Reference, PSD Reference Returns invalid result for Spectrum Peak Reference	dBc, dB
37	Relative integrated power of the upper offset A The unit differs with Measurement Type; Total Power Reference, PSD Reference, Spectrum Peak Reference Returns invalid result for Spectrum Peak Reference	dBc, dB
38	Offset A reserved	
39	Offset A reserved	
40	Offset A reserved	
41 – 500	21 – 40 repeats for each offset (B-F)	

3.1.9 Measurement Results for n = 40

Returns [12 * DPD Iteration Number] comma-separated scalar SEM results, in the following order.

In the table, the value of I ranges from 1 to DPD Iteration Number.

If "Measure DPD Iteration" on page 312 is OFF, returns –999.

#	Item	Unit, if any
(I – 1) + 1	Peak power offset frequency from the center or carrier edge frequency in lower offset A of the DPD iteration counter I, impacted by Offset Frequency Define	Hz
(I – 1) + 2	Minimum margin from limit line in lower offset A of the DPD iteration counter I	dB
(I – 1) + 3	Peak power offset frequency from the center or carrier edge frequency in upper offset A of the DPD iteration counter I, impacted by Offset Frequency Define	Hz
(I – 1) + 4	Minimum margin from limit line in upper offset A of the DPD iteration counter I	dB
(I – 1) + 5	Peak power offset frequency from the center or carrier edge frequency in lower offset B of the DPD iteration counter I, impacted by Offset Frequency Define	Hz
(I – 1) + 6	Minimum margin from limit line in lower offset B of the DPD iteration counter I	dB
(I – 1) + 7	Peak power offset frequency from the center or carrier edge frequency in upper offset B of the DPD iteration counter I, impacted by Offset Frequency Define	Hz
(I – 1) + 8	Minimum margin from limit line in upper offset B of the DPD iteration counter I	dB
(I – 1) + 9	Peak power offset frequency from the center or carrier edge frequency in lower offset C of the DPD iteration counter I, impacted by Offset Frequency Define	Hz
(I – 1) + 10	Minimum margin from limit line in lower offset C of the DPD iteration counter I	dB
(I – 1) + 11	Peak power offset frequency from the center or carrier edge frequency in upper offset C of the DPD iteration counter I, impacted by Offset Frequency Define	Hz
(I – 1) + 12	Minimum margin from limit line in upper offset C of the DPD iteration counter I	dB

3.1.10 Views

The following table lists all predefined views for this measurement, and the windows in each view:

View	SCPI	Windows
"Normal" on page 171	NORMal	"AM-AM" on page 173 "AM-PM" on page 174 "ACP Graph" on page 174 "Numeric Results" on page 174 "Raw Main Time" on page 174 "EVM Error Summary" on page 177
"ACP" on page 171	ACPower	"ACP Graph" on page 174 "ACP Metrics" on page 174

View	SCPI	Windows
"EVM Metrics" on page 171	EVMMetrics	"ACP Graph" on page 174
		"EVM Metrics" on page 174
"EVM vs. Power" on page 171	EVMPower	"EVM vs. Power Graph" on page 176
		"EVM vs. Power Metrics" on page 180
"DPD Iteration" on page 172	DITeration	"DPD Iteration Metrics" on page 181
		"DPD Iteration EVM" on page 183
		"DPD Iteration ACP" on page 184
"Delay Alignment" on page 172	DALignment	"Coarse Alignment" on page 184
		"Balance Alignment" on page 185
"SEM" on page 172	SEMask	"ACP Graph" on page 174
		"ACP Metrics" on page 174
"Normal + SEM" on page 172	NSEM	"AM-AM" on page 173
		"AM-PM" on page 174
		"ACP Graph" on page 174
		"Numeric Results" on page 174
		"Raw Main Time" on page 174
		"EVM Error Summary" on page 177
		"SEM Graph" on page 186

Some of these are multiple-window views. When in a multiple-window view, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the view changes, the default menu is Frequency, unless otherwise specified in the View description.

View - Selection by Name

Remote Command	`:DISPlay:PAMPlifier:VIEW[:SELect] NORMal | ACPower | EVMMetrics | EVMPower | DITeration | DALignment | SEMask | NSEM` `:DISPlay:PAMPlifier:VIEW[:SELect]?`
Example	`:DISP:PAMP:VIEW NORM` `:DISP:PAMP:VIEW?`
Dependencies	`DALignment` is only visible in M9010A/11A/15A/16A
Preset	`NORM`
State Saved	Saved in instrument state
Range	Normal | ACP | EVM Metrics | EVM vs. Power | DPD Iteration | Delay Alignment | SEM | Normal + SEM

3.1.10.1 Normal

Windows:

- "AM-AM" on page 173
- "AM-PM" on page 174
- "ACP Graph" on page 174
- "Numeric Results" on page 174
- "Raw Main Time" on page 174
- "EVM Error Summary" on page 177

Example `:DISP:PAMP:VIEW NORM`

3.1.10.2 ACP

Dual-window view. The windows are:

- "ACP Graph" on page 174
- "ACP Metrics" on page 174

Example `:DISP:PAMP:VIEW ACP`

3.1.10.3 EVM Metrics

Dual-window view. The windows are:

- "ACP Graph" on page 174
- "EVM Metrics" on page 174

Example `:DISP:PAMP:VIEW EVMM`

3.1.10.4 EVM vs. Power

Dual-window view. The windows are:

- "EVM vs. Power Graph" on page 176
- "EVM vs. Power Metrics" on page 180

Example `:DISP:PAMP:VIEW EVMP`

3.1.10.5 DPD Iteration

This view includes the following windows:

- "AM-AM" on page 173
- "AM-PM" on page 174
- "ACP Graph" on page 174
- "Raw Main Time" on page 174
- "DPD Iteration Metrics" on page 181
- "DPD Iteration EVM" on page 183
- "DPD Iteration ACP" on page 184

Example `:DISP:PAMP:VIEW DIT`

3.1.10.6 Delay Alignment

Dual-window view. The windows are:

- "Coarse Alignment" on page 184
- "Balance Alignment" on page 185

Example `:DISP:PAMP:VIEW DAL`

3.1.10.7 SEM

Dual-window view. The windows are:

- "SEM Graph" on page 186
- "SEM Metrics" on page 186

Example `:DISP:PAMP:VIEW SEM`

3.1.10.8 Normal + SEM

Windows:

- "AM-AM" on page 173
- "AM-PM" on page 174
- "ACP Graph" on page 174
- "Numeric Results" on page 174
- "Raw Main Time" on page 174
- "EVM Error Summary" on page 177
- "SEM Graph" on page 186

Example `:DISP:PAMP:VIEW SEMN`

3.1.11 Windows

The windows provided by this measurement and their indices are listed below:

#	Window
1	"AM-AM" on page 173
2	"AM-PM" on page 174
3	"ACP Graph" on page 174
4	"Numeric Results" on page 174
5	"Raw Main Time" on page 174
6	"EVM Error Summary" on page 177
7	"ACP Metrics" on page 174
8	"EVM Metrics" on page 174
9	"EVM vs. Power Graph" on page 176
10	"EVM vs. Power Metrics" on page 180
11	"DPD Iteration Metrics" on page 181
12	"DPD Iteration EVM" on page 183
13	"DPD Iteration ACP" on page 184
14	"Coarse Alignment" on page 184
15	"Balance Alignment" on page 185
16	"SEM Metrics" on page 186
17	"SEM Graph" on page 186

3.1.11.1 AM-AM

Window #1

Displays nonlinear effects of the DUT. It shows the amplitude at the DUT input versus the amplitude at the DUT output.

Available only when "Meas Type" on page 257 is `SPOWer`.

3.1.11.2 AM-PM

Window #2

Displays nonlinear effects of the DUT. It shows the phase difference between DUT input and output for each sample of the synchronized measurement signal.

Available only when "Meas Type" on page 257 is `SPOWer`.

3.1.11.3 ACP Graph

Window #3

Displays the ACP spectrum and bar results.

Available only when "Meas Type" on page 257 is `SPOWer`.

3.1.11.4 Numeric Results

Window #4

Displays Delta EVM and Power results.

Available only when "Meas Type" on page 257 is `SPOWer`.

3.1.11.5 Raw Main Time

Window #5

Displays the envelope of the captured raw data vs time.

3.1.11.6 ACP Metrics

Window #7

Displays ACP numeric results.

Available only when "Meas Type" on page 257 is `SPOWer`.

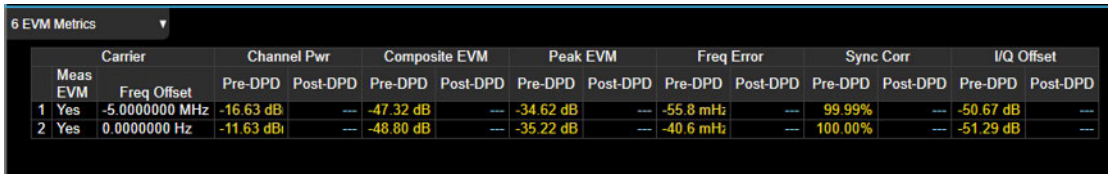
3.1.11.7 EVM Metrics

Window #8

Displays some underlying numeric results of demodulation. Both pre-DPD results and post-DPD results are displayed side by side.

The content of the window varies according to "Radio Format" on page 343

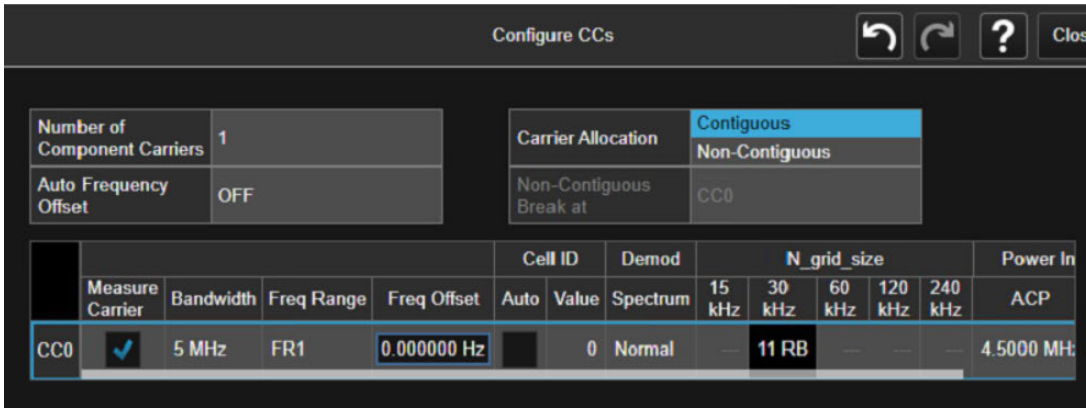
When **Radio Format** is NR5G, the following results are presented for all component carriers:



Meas EVM flag
: Synchronized with the Meas Carrier flag in the **Configure CCs** dialog of the EVM measurement of 5GNR Mode

When the flag is **No**, all demodulation results pertaining to this component carrier are not displayed

Frequency Offset



Channel Power

Composite EVM

Peak EVM

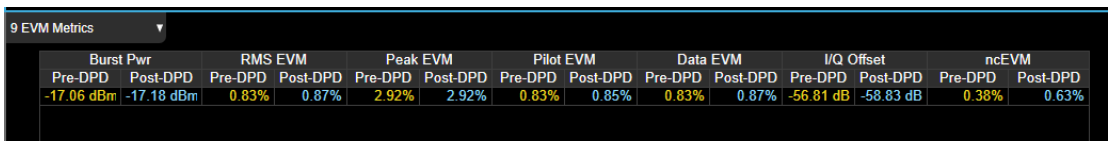
Frequency Error

Sync Corr

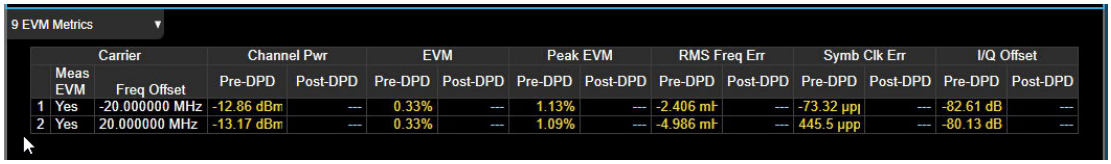
I/Q Offset

When **Radio Format** is WLAN, the following results are displayed:

Burst Power, RMS EVM, Peak EVM, Pilot EVM, Data EVM, I/Q Offset, and ncEVM.

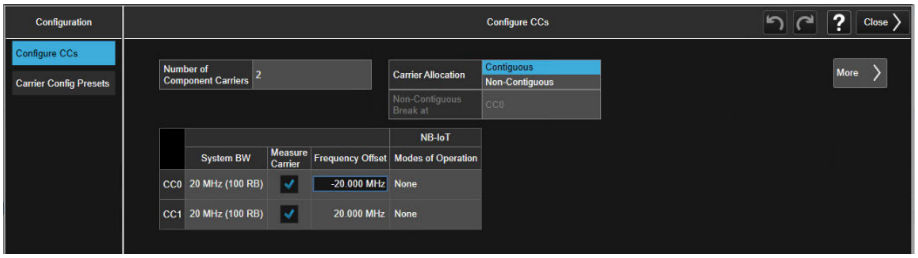


When **Radio Format** is `LTEAFDD`, the following results are presented for all component carriers:



Meas EVM flag
: Always Yes for LTEA-FDD demodulation in PA Mode

Frequency Offset
: Synchronized with **Freq Offset** in the **Configure CCs** dialog of the EVM measurement of LTEA-FDD Mode



Channel Power
:

Composite EM
:

EVM
:

Peak EV
:

Frequency Error
:

Symbol Clock Error
:

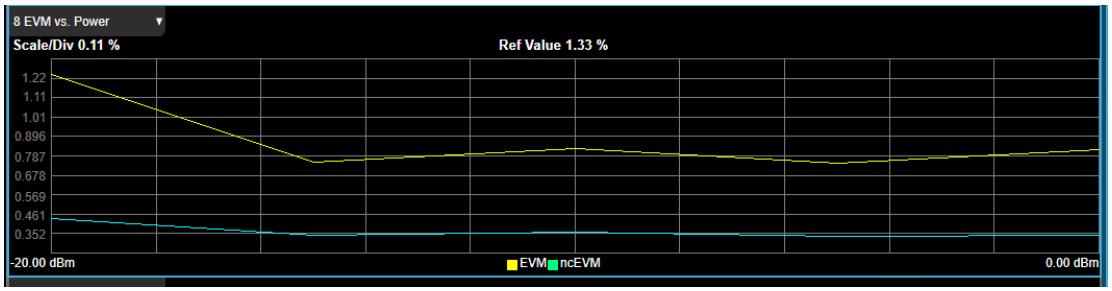
I/Q Offset
:

3.1.11.8 EVM vs. Power Graph

Window #9

Displays the trace of EVM vs. power, and the trace of ncEVM vs. power. The X axis represents either the input or the output power of the PA, depending on "Power Control Mode" on page 340. It is arranged in ascending order from low to high power level.

The Y axis represents the EVM result. The unit of the coordinate is either % or dB, depending on "Report EVM in DB" on page 356.



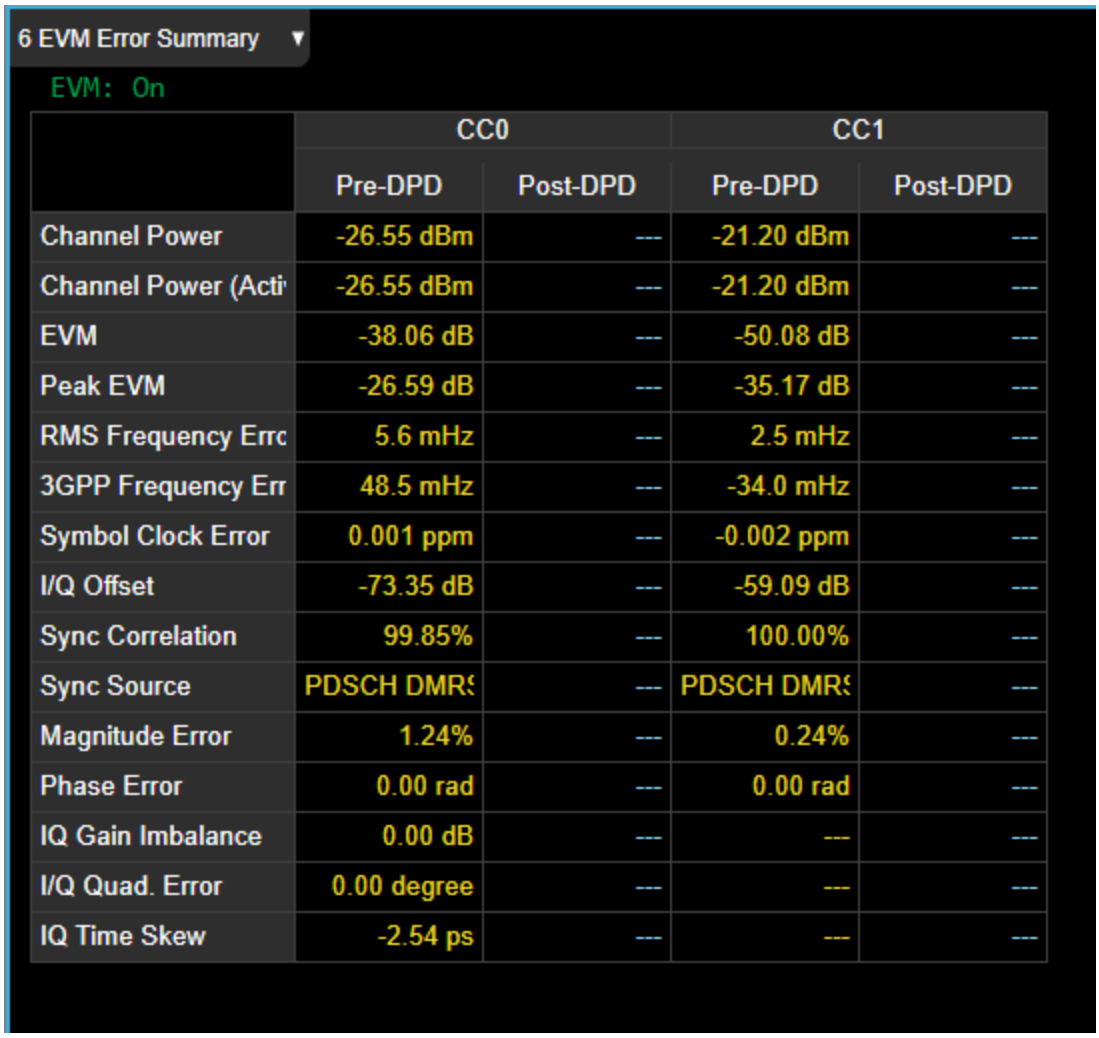
3.1.11.9 EVM Error Summary

Window #6

Displays multiple numeric demodulation results. Both pre- and post-DPD results are displayed side by side.

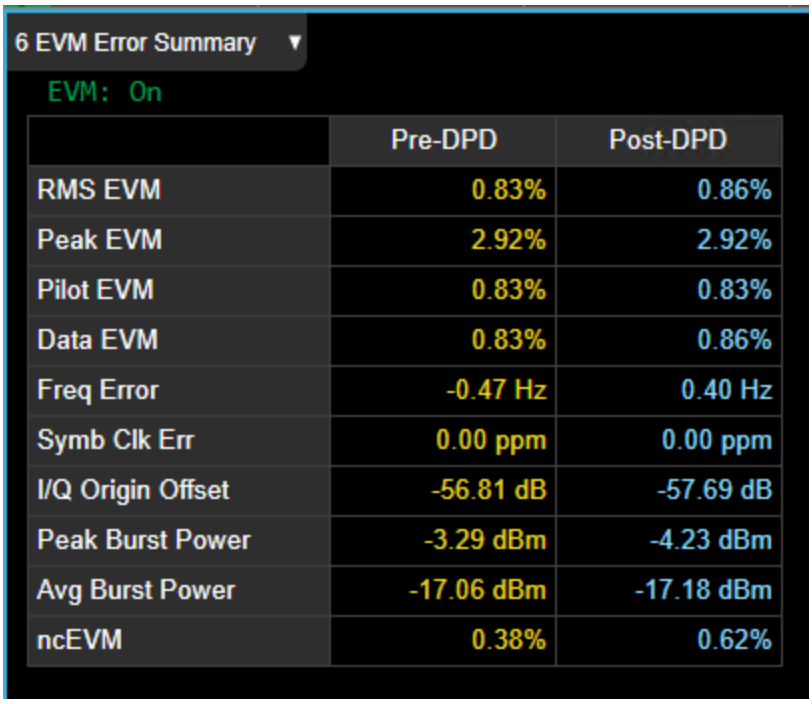
The content of the window varies according to "Radio Format" on page 343

When Radio Format is NR5G, the following numeric results of the all the component carriers are presented: Channel Power, Channel Power (Active), EVM, Peak EVM, RMS Frequency Error, 3GPP Frequency Error, Symbol Clock Error, I/Q Offset, Sync Correlation, Magnitude Error, Phase Error, I/Q Gain Imbalance, I/Q Quad Error, I/Q Time Skew, and Cell ID, etc.



	CC0		CC1	
	Pre-DPD	Post-DPD	Pre-DPD	Post-DPD
Channel Power	-26.55 dBm	---	-21.20 dBm	---
Channel Power (Acti	-26.55 dBm	---	-21.20 dBm	---
EVM	-38.06 dB	---	-50.08 dB	---
Peak EVM	-26.59 dB	---	-35.17 dB	---
RMS Frequency Erro	5.6 mHz	---	2.5 mHz	---
3GPP Frequency Err	48.5 mHz	---	-34.0 mHz	---
Symbol Clock Error	0.001 ppm	---	-0.002 ppm	---
I/Q Offset	-73.35 dB	---	-59.09 dB	---
Sync Correlation	99.85%	---	100.00%	---
Sync Source	PDSCH DMRS	---	PDSCH DMRS	---
Magnitude Error	1.24%	---	0.24%	---
Phase Error	0.00 rad	---	0.00 rad	---
IQ Gain Imbalance	0.00 dB	---	---	---
I/Q Quad. Error	0.00 degree	---	---	---
IQ Time Skew	-2.54 ps	---	---	---

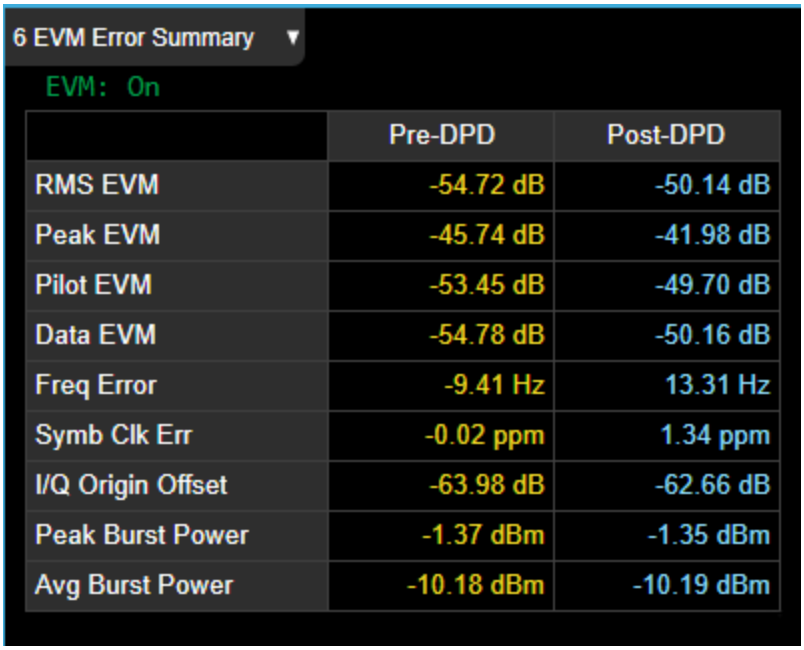
When **Radio Format** is WLAN, the following numeric results are displayed: RMS EVM, Peak EVM, Pilot EVM, Data EVM, Frequency Error, Symbol Clock Error, I/Q Origin Offset, Peak Burst Power, Avg Burst Power, and ncEVM, etc.



6 EVM Error Summary

EVM: On

	Pre-DPD	Post-DPD
RMS EVM	0.83%	0.86%
Peak EVM	2.92%	2.92%
Pilot EVM	0.83%	0.83%
Data EVM	0.83%	0.86%
Freq Error	-0.47 Hz	0.40 Hz
Symb Clk Err	0.00 ppm	0.00 ppm
I/Q Origin Offset	-56.81 dB	-57.69 dB
Peak Burst Power	-3.29 dBm	-4.23 dBm
Avg Burst Power	-17.06 dBm	-17.18 dBm
ncEVM	0.38%	0.62%

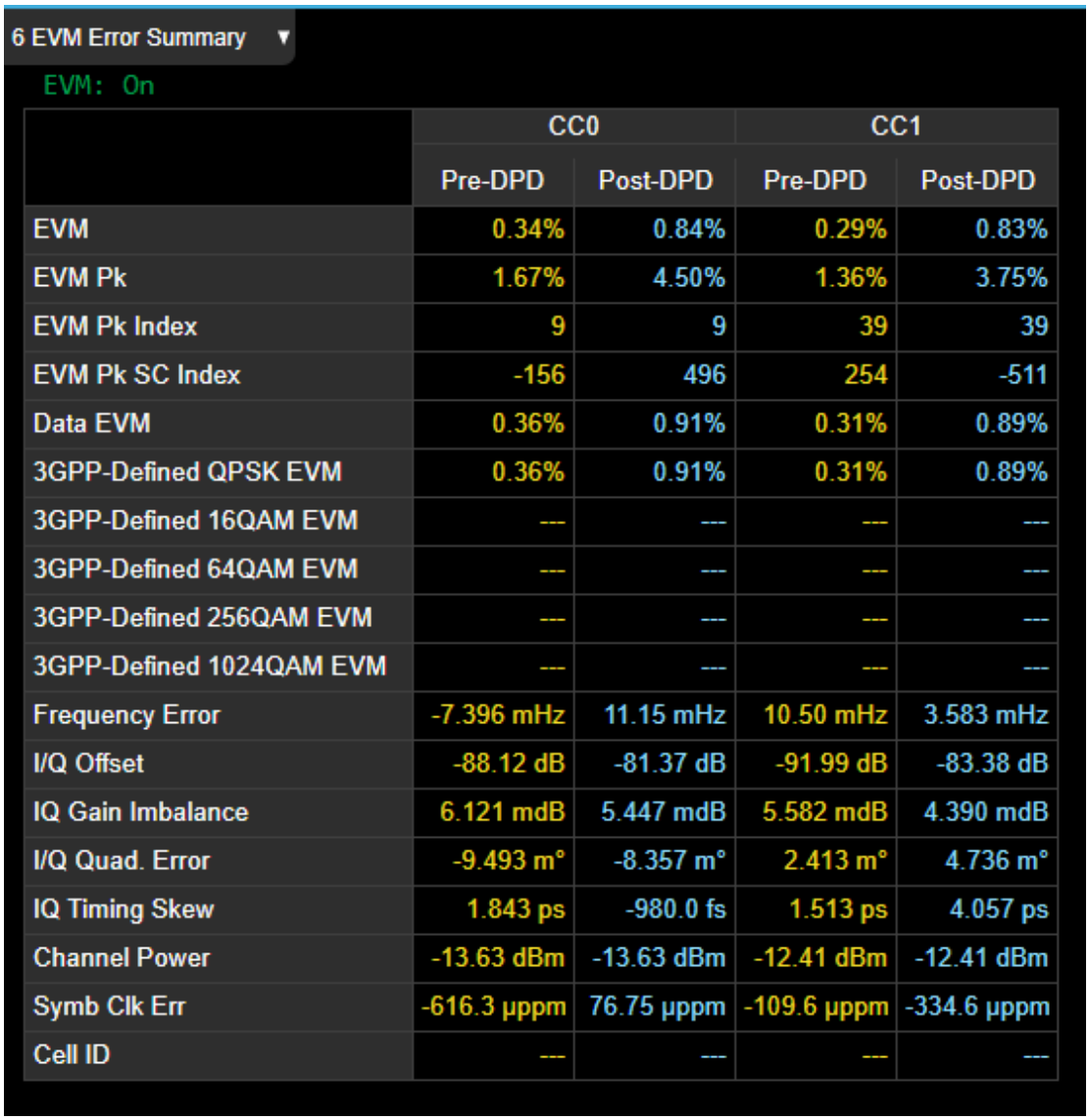


6 EVM Error Summary

EVM: On

	Pre-DPD	Post-DPD
RMS EVM	-54.72 dB	-50.14 dB
Peak EVM	-45.74 dB	-41.98 dB
Pilot EVM	-53.45 dB	-49.70 dB
Data EVM	-54.78 dB	-50.16 dB
Freq Error	-9.41 Hz	13.31 Hz
Symb Clk Err	-0.02 ppm	1.34 ppm
I/Q Origin Offset	-63.98 dB	-62.66 dB
Peak Burst Power	-1.37 dBm	-1.35 dBm
Avg Burst Power	-10.18 dBm	-10.19 dBm

When Radio Format is LTEAFDD, the following numeric results of all the component carriers are presented: EVM, peak EVM, EVM peak index, EVM peak subcarrier index, data EVM, 3GPP-defined QPSK EVM, 3GPP-defined 16QAM EVM, 3GPP-defined 64QAM EVM, 3GPP-defined 256QAM EVM, 3GPP-defined 1024QAM EVM, frequency error, IQ offset, IQ gain imbalance, IQ quad error, IQ timing skew, channel power, symbol clock error, and cell ID, etc.



6 EVM Error Summary

EVM: On

	CC0		CC1	
	Pre-DPD	Post-DPD	Pre-DPD	Post-DPD
EVM	0.34%	0.84%	0.29%	0.83%
EVM Pk	1.67%	4.50%	1.36%	3.75%
EVM Pk Index	9	9	39	39
EVM Pk SC Index	-156	496	254	-511
Data EVM	0.36%	0.91%	0.31%	0.89%
3GPP-Defined QPSK EVM	0.36%	0.91%	0.31%	0.89%
3GPP-Defined 16QAM EVM	---	---	---	---
3GPP-Defined 64QAM EVM	---	---	---	---
3GPP-Defined 256QAM EVM	---	---	---	---
3GPP-Defined 1024QAM EVM	---	---	---	---
Frequency Error	-7.396 mHz	11.15 mHz	10.50 mHz	3.583 mHz
I/Q Offset	-88.12 dB	-81.37 dB	-91.99 dB	-83.38 dB
IQ Gain Imbalance	6.121 mdB	5.447 mdB	5.582 mdB	4.390 mdB
I/Q Quad. Error	-9.493 m°	-8.357 m°	2.413 m°	4.736 m°
IQ Timing Skew	1.843 ps	-980.0 fs	1.513 ps	4.057 ps
Channel Power	-13.63 dBm	-13.63 dBm	-12.41 dBm	-12.41 dBm
Symb Clk Err	-616.3 µppm	76.75 µppm	-109.6 µppm	-334.6 µppm
Cell ID	---	---	---	---

3.1.11.10 EVM vs. Power Metrics

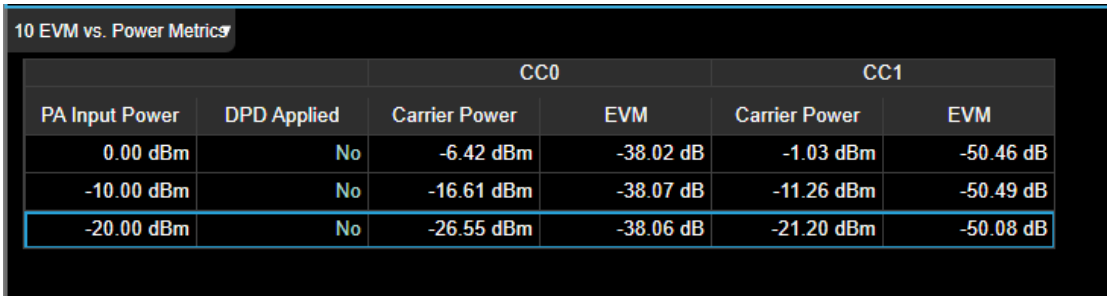
Window #10

Displays the power-EVM pairs composing the EVM vs. power trace in a table. The content of the window varies slightly with "Radio Format" on page 343. The results in the table are refreshed along with the power sweep status from the top to the bottom.

When Radio Format is NR5G or LTEAFDD, the columns of the table are:

PA Input Power or PA Output Power	Depends on "Power Control Mode" on page 340

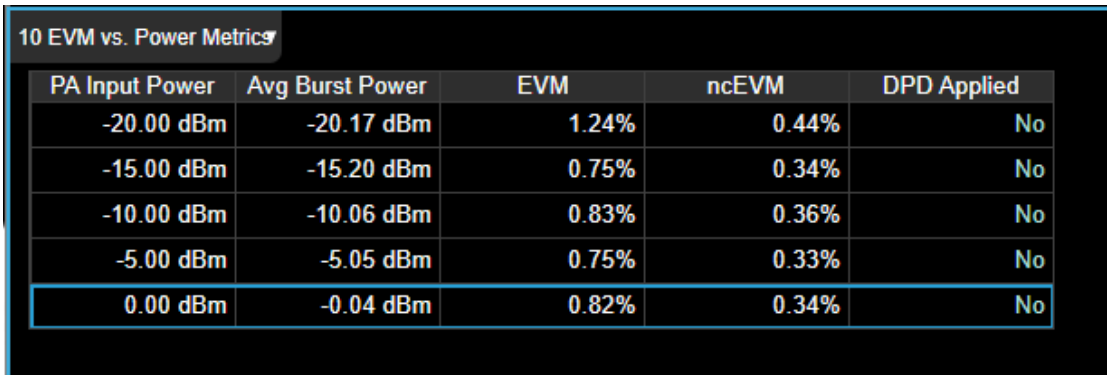
Carrier Power	The RMS power of each component carrier
EVM	The RMS EVM of each component carrier
DPD Applied Status	



		CC0		CC1	
PA Input Power	DPD Applied	Carrier Power	EVM	Carrier Power	EVM
0.00 dBm	No	-6.42 dBm	-38.02 dB	-1.03 dBm	-50.46 dB
-10.00 dBm	No	-16.61 dBm	-38.07 dB	-11.26 dBm	-50.49 dB
-20.00 dBm	No	-26.55 dBm	-38.06 dB	-21.20 dBm	-50.08 dB

When Radio Format is WLAN, the columns of the table are:

Total Power	Either the input or the output power of the PA specified by "Power Control Mode" on page 340
Average Burst Power	The RMS burst power
EVM	The RMS EVM
ncEVM	The result of NC-EVM
DPD Applied Status	



PA Input Power	Avg Burst Power	EVM	ncEVM	DPD Applied
-20.00 dBm	-20.17 dBm	1.24%	0.44%	No
-15.00 dBm	-15.20 dBm	0.75%	0.34%	No
-10.00 dBm	-10.06 dBm	0.83%	0.36%	No
-5.00 dBm	-5.05 dBm	0.75%	0.33%	No
0.00 dBm	-0.04 dBm	0.82%	0.34%	No

3.1.11.11 DPD Iteration Metrics

Window #11

Displays a table showing the intermediate ACP/EVM/AM-AM/AM-PM measurement results during the DPD iteration.

The corresponding results obtained when DPD was off (if any) are also displayed on this window.

DPD Iteration	The index of the DPD iteration ranging between 1 and the iteration number
ACP Lower Offset A Relative Power	The relative power of the lower band of Offset A for each DPD iteration loop This column is only visible when the lower band of Offset A is enabled
ACP Upper Offset A Relative Power	The relative power of the upper band of Offset A for each DPD iteration loop This column is only visible when the upper band of Offset A is enabled
ACP Lower Offset B Relative Power	The relative power of the lower band of Offset B for each DPD iteration loop This column is only visible when the lower band of Offset B is enabled
ACP Upper Offset B Relative Power	The relative power of the upper band of Offset B for each DPD iteration loop This column is only visible when the upper band of Offset B is enabled
Delta EVM	The delta EVM result of each DPD iteration loop. This column is only visible when the AM-AM/AM-PM measurements are enabled
RMS EVM	The RMS EVM result of each DPD iteration loop. No result is displayed if "EVM State" on page 355 is OFF, or if the demodulation procedure failed For 5GNR and LTEA FDD, the RMS EVM results of all the component carriers are displayed This column is only visible when **EVM State** is ON
Output Power	The output power readout of each DPD iteration loop. This column is only visible when the AM-AM/AM-PM measurements are enabled
Gain	The gain readout of each DPD iteration loop. This column is only visible when the AM-AM/AM-PM measurements are enabled
Crest Factor Out	The crest factor out readout of each DPD iteration loop. This column is only visible when the AM-AM/AM-PM measurements are enabled
WLAN NC-EVM	The WLAN noise corrected EVM result of each DPD iteration loop This column is only visible when the following conditions are met at the same time: **EVM State** is ON Radio Format is WLAN NC-EVM is ON
SEM Lower Offset A Delta Limit	Minimum margin from limit line in lower offset A of each DPD iteration loop
SEM Lower Offset A Frequency	Peak power offset frequency from the center or carrier edge frequency in lower offset A of each DPD iteration loop, impacted by Offset Frequency Define
SEM Upper Offset A Delta Limit	Minimum margin from limit line in upper offset A of each DPD iteration loop
SEM Upper Offset A	Peak power offset frequency from the center or carrier edge frequency in upper offset A of each DPD iteration loop, impacted by Offset Frequency Define

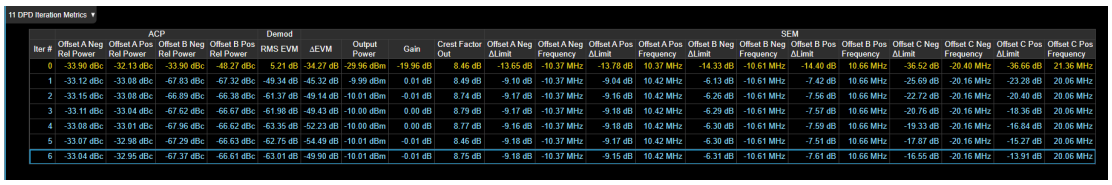
Frequency	
SEM Lower Offset B Delta Limit	Minimum margin from limit line in lower offset B of each DPD iteration loop
SEM Lower Offset B Frequency	Peak power offset frequency from the center or carrier edge frequency in lower offset B of each DPD iteration loop, impacted by Offset Frequency Define
SEM Upper Offset B Delta Limit	Minimum margin from limit line in upper offset B of each DPD iteration loop
SEM Upper Offset B Frequency	Peak power offset frequency from the center or carrier edge frequency in upper offset B of each DPD iteration loop, impacted by Offset Frequency Define
SEM Lower Offset C Delta Limit	Minimum margin from limit line in lower offset C of each DPD iteration loop
SEM Lower Offset C Frequency	Peak power offset frequency from the center or carrier edge frequency in lower offset C of each DPD iteration loop, impacted by Offset Frequency Define
SEM Upper Offset C Delta Limit	Minimum margin from limit line in upper offset C of each DPD iteration loop
SEM Upper Offset C Frequency	Peak power offset frequency from the center or carrier edge frequency in upper offset C of each DPD iteration loop, impacted by Offset Frequency Define

When **Radio Format** is `NR5G` or `LTEAFDD`:


11 DPD Iteration Metrics

	ACP				Demod						SEM													
Iter #	Offset A Neg Rel Power	Offset A Pos Rel Power	Offset B Neg Rel Power	Offset B Pos Rel Power	CC0 RMS EVM	CC1 RMS EVM	ΔEVM	Output Power	Gain	Crest Factor Out	Offset A Neg ΔLimit	Offset A Neg Frequency	Offset A Pos ΔLimit	Offset A Pos Frequency	Offset B Neg ΔLimit	Offset B Neg Frequency	Offset B Pos ΔLimit	Offset B Pos Frequency	Offset C Neg ΔLimit	Offset C Neg Frequency	Offset C Pos ΔLimit	Offset C Pos Frequency
0	-61.42 dBc	-58.58 dBc	-61.42 dBc	-54.45 dBc	0.16%	0.16%	6.93%	-9.49 dBm	0.51 dB	9.88 dB	-60.94 dB	-15.00 kHz	-61.42 dB	15.00 kHz	-75.67 dB	-1.556 MHz	-72.12 dB	1.500 MHz	-73.33 dB	-10.33 MHz	-70.50 dB	5.537 MHz
1	-41.19 dBc	-34.81 dBc	-58.47 dBc	-54.51 dBc	1.44%	1.87%	2.01%	-9.50 dBm	0.50 dB	10.08 dB	-55.77 dB	-15.00 kHz	-54.58 dB	597.1 kHz	-55.30 dB	-1.500 MHz	-49.78 dB	4.357 MHz	-50.51 dB	-9.371 MHz	-44.78 dB	6.790 MHz
2	-38.04 dBc	-36.97 dBc	-58.38 dBc	-54.47 dBc	1.86%	1.95%	2.30%	-9.49 dBm	0.51 dB	10.18 dB	-53.71 dB	-15.00 kHz	-55.81 dB	15.00 kHz	-51.94 dB	-1.500 MHz	-51.30 dB	3.767 MHz	-49.25 dB	-12.61 MHz	-48.08 dB	6.790 MHz
3	-37.08 dBc	-36.11 dBc	-58.40 dBc	-54.65 dBc	2.00%	2.06%	2.47%	-9.49 dBm	0.51 dB	10.19 dB	-54.52 dB	-15.00 kHz	-54.73 dB	15.00 kHz	-51.83 dB	-1.556 MHz	-50.92 dB	2.809 MHz	-48.04 dB	-12.84 MHz	-48.26 dB	11.14 MHz
4	-37.45 dBc	-36.64 dBc	-58.44 dBc	-54.58 dBc	1.65%	1.63%	2.08%	-9.50 dBm	0.50 dB	10.00 dB	-55.29 dB	-15.00 kHz	-57.10 dB	15.00 kHz	-54.18 dB	-1.850 MHz	-53.88 dB	3.989 MHz	-47.57 dB	-13.20 MHz	-47.28 dB	14.53 MHz
5	-37.41 dBc	-36.74 dBc	-57.93 dBc	-54.30 dBc	1.48%	1.48%	1.87%	-9.50 dBm	0.50 dB	10.09 dB	-55.32 dB	-15.00 kHz	-58.08 dB	15.00 kHz	-54.74 dB	-1.500 MHz	-54.69 dB	3.767 MHz	-47.06 dB	-13.20 MHz	-46.67 dB	14.61 MHz
6	-37.37 dBc	-36.87 dBc	-58.01 dBc	-54.45 dBc	1.50%	1.53%	1.87%	-9.49 dBm	0.51 dB	10.17 dB	-55.46 dB	-15.00 kHz	-57.24 dB	15.00 kHz	-54.45 dB	-1.500 MHz	-54.24 dB	3.767 MHz	-46.66 dB	-13.20 MHz	-46.15 dB	14.61 MHz

When **Radio Format** is WLAN:


11 DPD Iteration Metrics

	ACP				Demod						SEM													
Iter #	Offset A Neg Rel Power	Offset A Pos Rel Power	Offset B Neg Rel Power	Offset B Pos Rel Power	RMS EVM	ΔEVM	Output Power	Gain	Crest Factor Out	Offset A Neg ΔLimit	Offset A Neg Frequency	Offset A Pos ΔLimit	Offset A Pos Frequency	Offset B Neg ΔLimit	Offset B Neg Frequency	Offset B Pos ΔLimit	Offset B Pos Frequency	Offset C Neg ΔLimit	Offset C Neg Frequency	Offset C Pos ΔLimit	Offset C Pos Frequency
0	-33.90 dBc	-32.13 dBc	-33.90 dBc	-48.27 dBc	5.21 dB	-34.27 dB	-29.96 dBm	-19.96 dB	8.46 dB	-13.65 dB	-10.37 MHz	-13.78 dB	10.37 MHz	-14.33 dB	-10.61 MHz	-14.40 dB	10.66 MHz	-36.52 dB	-20.40 MHz	-36.66 dB	21.36 MHz
1	-33.12 dBc	-33.08 dBc	-67.83 dBc	-67.32 dBc	-49.34 dB	-45.32 dB	-9.99 dBm	0.01 dB	8.49 dB	-9.10 dB	-10.37 MHz	-9.04 dB	10.42 MHz	-6.13 dB	-10.61 MHz	-7.42 dB	10.66 MHz	-25.69 dB	-20.16 MHz	-23.28 dB	20.06 MHz
2	-33.15 dBc	-33.08 dBc	-66.89 dBc	-66.38 dBc	-61.37 dB	-49.14 dB	-10.01 dBm	-0.01 dB	8.74 dB	-9.17 dB	-10.37 MHz	-9.16 dB	10.42 MHz	-6.26 dB	-10.61 MHz	-7.56 dB	10.66 MHz	-22.72 dB	-20.16 MHz	-20.40 dB	20.06 MHz
3	-33.11 dBc	-33.04 dBc	-67.62 dBc	-66.67 dBc	-61.98 dB	-49.43 dB	-10.00 dBm	0.00 dB	8.79 dB	-9.17 dB	-10.37 MHz	-9.18 dB	10.42 MHz	-6.29 dB	-10.61 MHz	-7.57 dB	10.66 MHz	-20.76 dB	-20.16 MHz	-18.36 dB	20.06 MHz
4	-33.08 dBc	-33.01 dBc	-67.96 dBc	-66.62 dBc	-63.35 dB	-52.23 dB	-10.00 dBm	0.00 dB	8.77 dB	-9.16 dB	-10.37 MHz	-9.18 dB	10.42 MHz	-6.30 dB	-10.61 MHz	-7.59 dB	10.66 MHz	-19.33 dB	-20.16 MHz	-16.84 dB	20.06 MHz
5	-33.07 dBc	-32.98 dBc	-67.29 dBc	-66.63 dBc	-62.75 dB	-54.49 dB	-10.01 dBm	-0.01 dB	8.46 dB	-9.18 dB	-10.37 MHz	-9.17 dB	10.42 MHz	-6.30 dB	-10.61 MHz	-7.51 dB	10.66 MHz	-17.87 dB	-20.16 MHz	-15.27 dB	20.06 MHz
6	-33.04 dBc	-32.95 dBc	-67.37 dBc	-66.61 dBc	-63.01 dB	-49.90 dB	-10.01 dBm	-0.01 dB	8.75 dB	-9.18 dB	-10.37 MHz	-9.15 dB	10.42 MHz	-6.31 dB	-10.61 MHz	-7.61 dB	10.66 MHz	-16.55 dB	-20.16 MHz	-13.91 dB	20.06 MHz

3.1.11.12 DPD Iteration EVM

Window #12

Displays the delta EVM results obtained during the DPD iterations.

The RMS EVM results obtained during the DPD iterations are also displayed on this window if "EVM State" on page 355 is ON.

For 5G NR, only the RMS EVM of the selected component carrier is displayed (Display-EVM Carrier Index) pm in this window.

The X axis indicates the index of the DPD iteration loop.

The unit of the Y axis depends on "Report EVM in DB" on page 356:

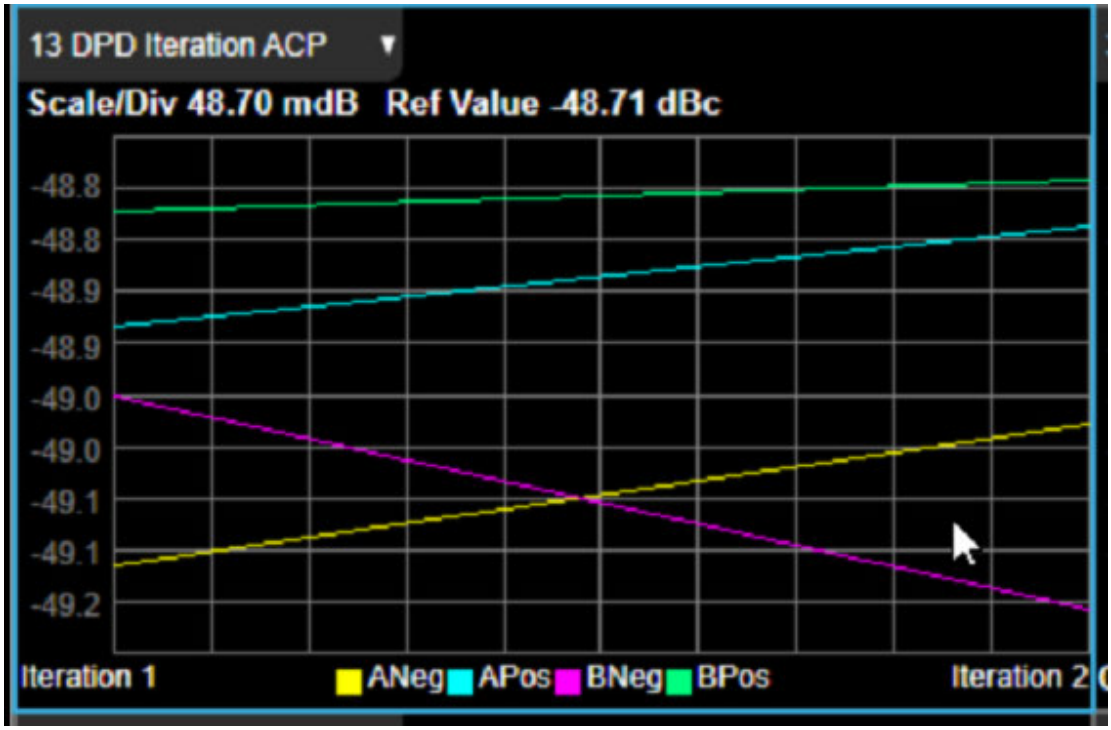
Report EVM in dB	Unit
OFF	%
ON	dB

3.1.11.13 DPD Iteration ACP

Window #13

Displays the relative power readouts of the offset A and B obtained during the DPD iterations.

The state of the lower/upper band of Offset A/B is set via ACP offset's settings.



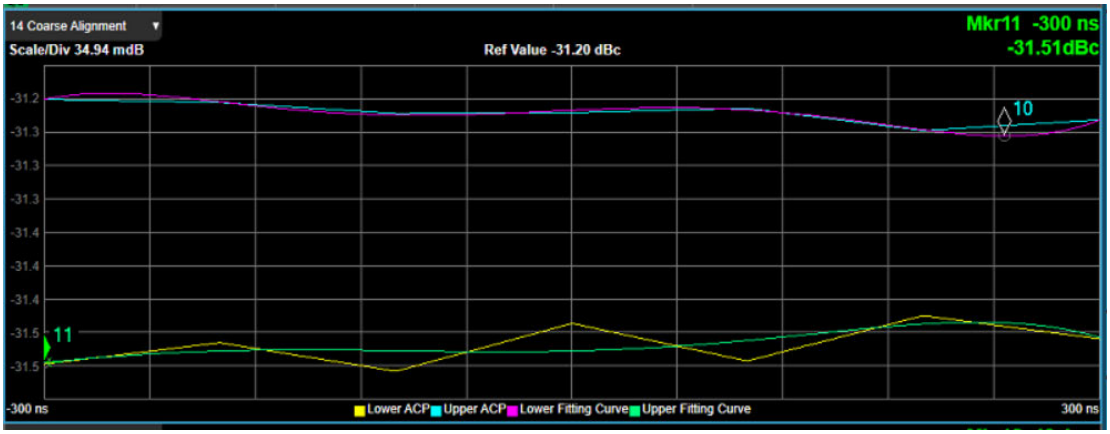
3.1.11.14 Coarse Alignment

Window #14

Displays the relative offset A power readouts of the ACP measurement (both the lower and upper offset) of each coarse delay alignment iteration. The yellow trace displays the relative readouts varying with the envelope delay for the lower offset, and the cyan trace displays the upper.

The other two traces (lower fitting curve in magenta, and upper fitter curve in green) are the products of the least-square method applied to the lower and upper ACP traces, respectively, which demonstrate the trend of the variation of the ACP relative power with the envelope delay.

Two Normal markers (10 and 11) are placed on each of the two fitting curves to pinpoint the envelope delay values resulting in the minimum relative power. Each of the points is marked with a circle, respectively.

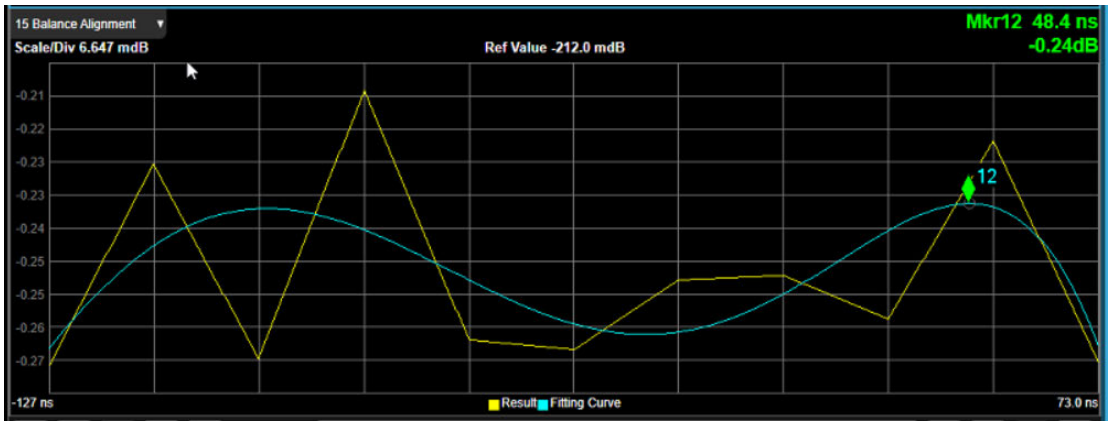


3.1.11.15 Balance Alignment

Window #15

Displays in yellow the difference of the relative power readouts of the lower and upper offset A of the ACP measurements performed during the balance alignment. Its fitting curve is displayed in the same window, in cyan.

Marker 12 (a Normal marker) is placed on the fitting curve pinpointing the envelope delay resulting in a minimum absolute value of the difference between the lower and upper power readouts. The point is marked with a circle. The envelope delay is then set to the measurement as the optimum envelope delay.

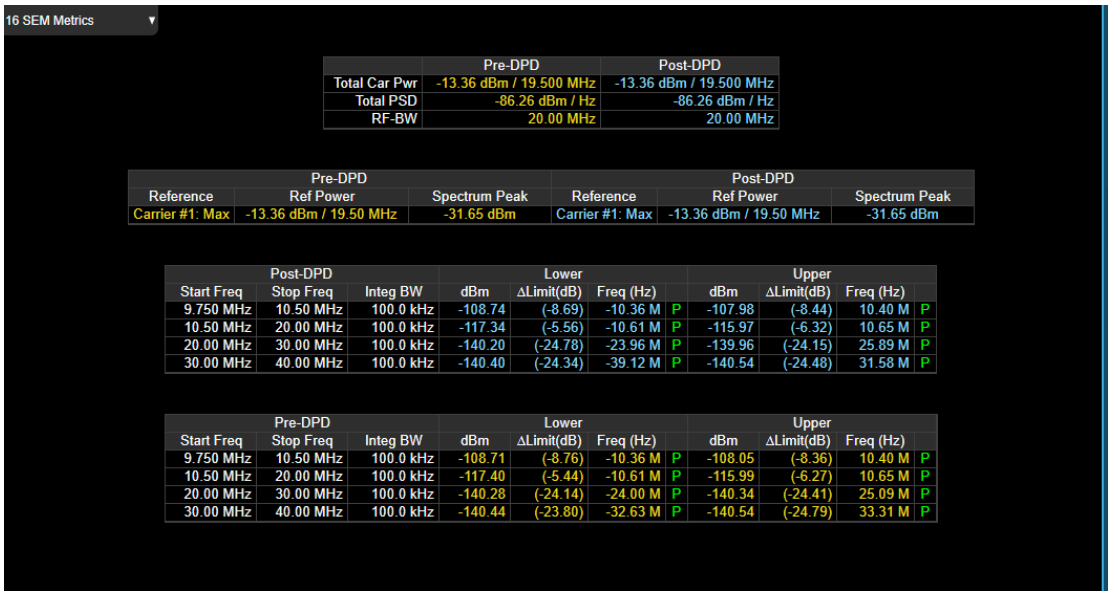


3.1.11.16 SEM Metrics

Window #16

Displays the SEM numeric results. Its content differs between views.

Available only when "Meas Type" on page 257 is `SPOWer`.



	Pre-DPD	Post-DPD
Total Car Pwr	-13.36 dBm / 19.500 MHz	-13.36 dBm / 19.500 MHz
Total PSD	-86.26 dBm / Hz	-86.26 dBm / Hz
RF-BW	20.00 MHz	20.00 MHz

Pre-DPD			Post-DPD		
Reference	Ref Power	Spectrum Peak	Reference	Ref Power	Spectrum Peak
Carrier #1: Max	-13.36 dBm / 19.50 MHz	-31.65 dBm	Carrier #1: Max	-13.36 dBm / 19.50 MHz	-31.65 dBm

Post-DPD			Lower				Upper			
Start Freq	Stop Freq	Integ BW	dBm	ΔLimit(dB)	Freq (Hz)		dBm	ΔLimit(dB)	Freq (Hz)	
9.750 MHz	10.50 MHz	100.0 kHz	-108.74	(-8.69)	-10.36 M	P	-107.98	(-8.44)	10.40 M	P
10.50 MHz	20.00 MHz	100.0 kHz	-117.34	(-5.56)	-10.61 M	P	-115.97	(-6.32)	10.65 M	P
20.00 MHz	30.00 MHz	100.0 kHz	-140.20	(-24.78)	-23.96 M	P	-139.96	(-24.15)	25.89 M	P
30.00 MHz	40.00 MHz	100.0 kHz	-140.40	(-24.34)	-39.12 M	P	-140.54	(-24.48)	31.58 M	P

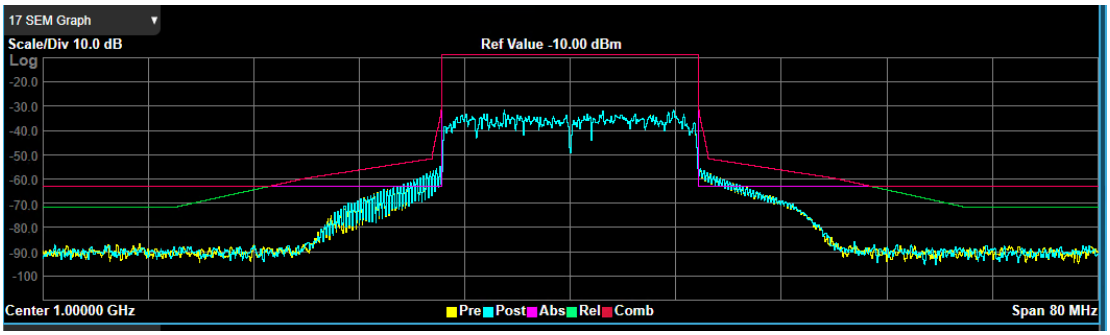
Pre-DPD			Lower				Upper			
Start Freq	Stop Freq	Integ BW	dBm	ΔLimit(dB)	Freq (Hz)		dBm	ΔLimit(dB)	Freq (Hz)	
9.750 MHz	10.50 MHz	100.0 kHz	-108.71	(-8.76)	-10.36 M	P	-108.05	(-8.36)	10.40 M	P
10.50 MHz	20.00 MHz	100.0 kHz	-117.40	(-5.44)	-10.61 M	P	-115.99	(-6.27)	10.65 M	P
20.00 MHz	30.00 MHz	100.0 kHz	-140.28	(-24.14)	-24.00 M	P	-140.34	(-24.41)	25.09 M	P
30.00 MHz	40.00 MHz	100.0 kHz	-140.44	(-23.80)	-32.63 M	P	-140.54	(-24.79)	33.31 M	P

3.1.11.17 SEM Graph

Window #17

Displays the SEM spectrum and limit lines.

Available only when "Meas Type" on page 257 is `SPOWer`.



3.1.12 Amplitude

Activates the **Amplitude** menu and selects **Ref Level** or **Ref Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements, and their controls are blanked or grayed-out in measurements that do not support the feature.

3.1.12.1 Y Scale

Contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

Ref Value

Specifies the amplitude of a signal displayed on the reference graticule line. The reference line is at the top, center, or bottom of the graticule, depending on the value of the Ref Position function.

The **Ref Value** applies only to the selected window. If the table type window is selected, this control is unavailable. The functionality depends on the selected window.

Remote Command	`:DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:RLEVel <real>`
	`:DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:RLEVel?`
	Window numbers are defined in "Windows" on page 173

Example	Set the Y ref value of the third window to 20:
	`:DISP:PAMP:WIND3:TRAC:Y:RLEV 20`
	Query the Y ref value of the third window:
	`:DISP:PAMP:WIND3:TRAC:Y:RLEV?`

Dependencies	For the windows "EVM vs. Power Graph" on page 176 and "DPD Iteration EVM" on page 183, the unit

	of Y Ref Value can be either % or dB, depending on "Report EVM in DB" on page 356

Report EVM in DB	Y Axis Unit
ON	dB
OFF	%

Preset	See "Ref Value Parameters" on page 188 below
State Saved	Saved in instrument state
Min/Max	See "Ref Value Parameters" on page 188 below
Annotation	The reference value is displayed above the graticule with the title “Ref Value”

Ref Value Parameters

Window	Preset	Min	Max	Unit Terminator	Resolution
Raw Main Time	10	–250	250	dBm	0.01
ACP Graph	10	–250	250	dBm	0.01
AM-AM	20	–250	250	dBm	0.01
AM-PM	50	–250	250	deg	0.01
EVM vs. Power DPD Iteration EVM (Report EVM in dB: On)	0	–200	200	dB	0.01
EVM vs. Power DPD Iteration EVM (Report EVM in dB: Off)	100	0.001	200	%	0.01
DPD Iteration ACP	0	–100	100	dBc	0.01
EVM vs. Power (Report EVM in dB: On)	0	–200	200	dB	0.01
EVM vs. Power (Report EVM in dB: Off)	100	0.001	200	%	0.01
SEM Graph	10	–250	250	dBm	0.01

Scale/Div

Controls the Y scale per division of the selected trace.

Remote Command	`:DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:PDIVision <real>` `:DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:PDIVision?`

Example	`:DISP:PAMP:WIND3:TRAC:Y:PDIV 10`
	Set the Y Scale/Div of the third window to 10
	`:DISP:PAMP:WIND3:TRAC:Y:PDIV?`
	Query the Y Scale/Div of the third window

Dependencies	For the windows "EVM vs. Power Graph" on page 176 and "DPD Iteration EVM" on page 183, the unit of Scale/Div can be either % or dB, depending on "Report EVM in DB" on page 356
Preset	See "Scale/Div Parameters" on page 189 below
State Saved	Saved in instrument state
Min/Max	See "Scale/Div Parameters" on page 189 below
Annotation	Upper left corner of trace grid, same gray as grid

Report EVM in DB	Scale/Div
ON	dB
OFF	%

Scale/Div Parameters

Window	Default	Min	Max	Unit Terminator	Resolution
Raw Main Time	10	0.01	20	dB	0.01
ACP Graph	10	0.1	20	dB	0.1
AM-AM	10	0.001	100	dB	0.01
AM-PM	10	0.001	100	deg	0.01
EVM vs. Power	10	0.0001	10	dB	0.01
DPD Iteration EVM (Report EVM in dB: On)					
EVM vs. Power	10	0.0001	10	%	0.01
DPD Iteration EVM (Report EVM in dB: Off)					
DPD Iteration ACP	10	0.0001	50	dB	0.01
SEM Graph	10	0.1	20	dB	0.1

Ref Position

Positions the reference level at the top, center, or bottom of the Y Scale display. Changing the reference position does not change the reference level value.

Remote Command	`:DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:RPOSition TOP | CENTer | BOTTom` `:DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:RPOSition?`

Example	Set the Y ref position of the third window to `TOP:`
	`:DISP:PAMP:WIND3:TRAC:Y:RPOS TOP`
	Query the Y ref position of the third window:
	`:DISP:PAMP:WIND3:TRAC:Y:RPOS?`

Preset	`TOP`
State Saved	Saved in instrument state
Range	Top | Ctr | Bot

Auto Scale

Changes the Y reference value and Scale per Division so the full trace is displayed without clipping.

Remote Command	`:DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:COUPle 0 | 1 | OFF | ON` `:DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:COUPle?`
Example	`:DISP:PAMP:WIND:TRAC:Y:COUP OFF` `:DISP:PAMP:WIND:TRAC:Y:COUP?`
Preset	Window-dependent: AM/AM, AM/PM: `OFF` ACP, Raw Main Time, and EVM vs. Power, DPD Iteration EVM, and DPD Iteration ACP: `ON`
State Saved	Saved in instrument state
Range	On | Off

3.1.12.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in X-Series. One is a Dual-Attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined

mechanical and electronic sections that controls all the attenuation functions. Different models in X-Series support different configurations.

- See "Dual-Attenuator Configurations" on page 191
- See "Single-Attenuator Configuration" on page 192

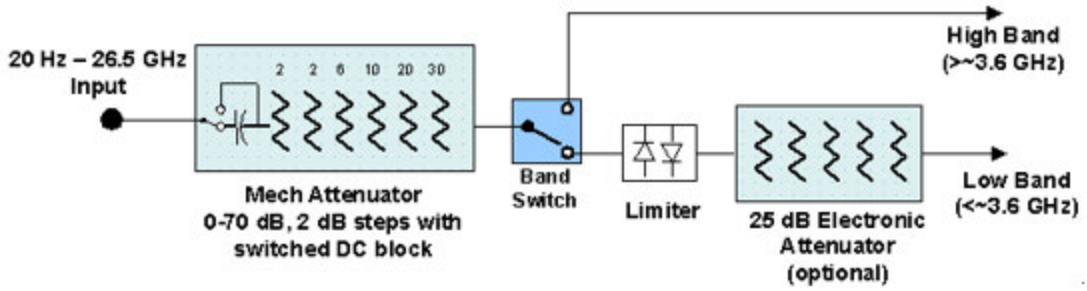
Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

Only available when the hardware set includes an input attenuator, which is typically only the case for Keysight’s benchtop instruments. For example, this group does *not* appear in VXT models M9420A/10A/11A/15A/16A, M9410E/11E/15E/16E, nor in UXM. In UXM, all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

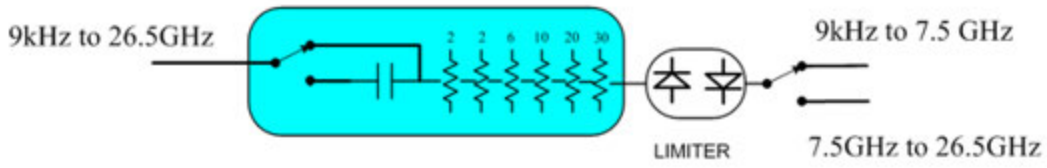
Dependencies	In measurements that support the I/Q inputs, unavailable when I/Q is the selected input. Replaced by the Range tab in that case

Dual-Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

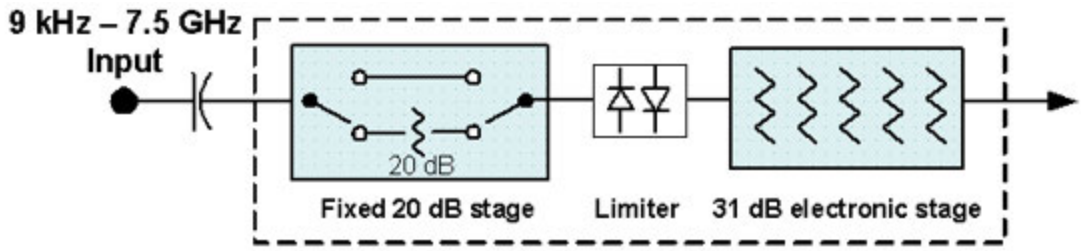


Configuration 2: Mechanical attenuator, no optional electronic attenuator



Note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator Option EA3, therefore for the sake of this document it is grouped into the “Dual-Attenuator” configuration.

Single-Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opens the Attenuation menu. If the first control in the Attenuation menu says **Mech Atten** you have the Dual-Attenuator configuration. If the first control says **Atten** you have the Single-Attenuator configuration.



Dual Attenuator **Single Attenuator**

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control.)

In the Single-Attenuator configuration, you control the attenuation with a single control, as the fixed stage has only two states. In the Dual-Attenuator configuration, both stages have significant range, so you are given separate control of the mechanical and electronic attenuator stages.

When you have the Dual-Attenuator configuration, you may still have only a Single-Attenuator, because unless Option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

Full Range Atten

This control and **Attenuator Summary** only appear in N9041B, when the RF input is selected, the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed. The Full Range Attenuator adds a second input attenuator in front of RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

Remote Command `[:SENSe]:POWer[:RF]:FRATten <rel_ampl>`

`[:SENSe]:POWer[:RF]:FRATten?`

Note that this is the same command as that for "Atten >50 GHz" on page 201 in N9042B

Example	`:POW:FRAT 14` `:POW:FRAT?`
Notes	When you enter an amplitude value that falls between valid values, the value will be incremented to the next smallest valid value
Dependencies	Available on N9041B UXA Only appears if input RF is selected, RF Input Port 2 is selected, and the Full Range Attenuator exists
Couplings	This value is never changed by any coupling, but other couplings use this value. See **Reference Level** and "Atten (Mech Atten)" on page 193 command descriptions
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB
Annotation	When the **Input** is **RF**, and the **Input Port** is **RF Input 2**, and the Full Range Attenuator is installed: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten + Full Range Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Full Range Atten – If the sweep straddles 50 GHz, the value shown after “Atten:” is preceded by the symbol “>=” and is equal to Full Range Atten In the **Amplitude**, "Y Scale" on page 187 menu, and the Atten **Meas Bar** dropdown menu panel, a summary is displayed as follows: “Total Atten below 50 GHz” followed by the value of Full Range Atten + Mech Atten + Elec Atten “Total Atten above 50 GHz” followed by the value of Full Range Atten For example, if Mech Atten = 6 dB, Elec Atten = 4 dB, and Full Range Atten = 20 dB, the summary below is shown: – Attenuator summary: – Total Atten below 50 GHz: 30 dB – Total Atten above 50 GHz: 20 dB

Atten (Mech Atten)

Labeled **Atten** in SA6210A Opt.002, and some Single-Attenuator instruments. Labeled **Mech Atten** in other instruments. In the Dual-Attenuator configuration, this control only affects the mechanical attenuator.

Lets you modify the attenuation applied to the RF input signal path. This value is normally auto-coupled to **Ref Level**, "Internal Preamp" on page 213 Gain, any External Gain that is entered, and Max Mixer Level, as described in the table below.

See "Attenuator Configurations and Auto/Man" on page 196

Remote Command	For general single port instruments:
	`[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]:ATTenuation?`
	For SA6210A Opt.002
	`[:SENSe]:POWer[:RF]|:RF2:ATTenuation <rel_ampl>`
	`[:SENSe]:POWer[:RF]|:RF2:ATTenuation?`

Example	`:POW:ATT 20`
	Dual-Attenuator configuration: sets the mechanical attenuator to 20 dB
	Single-Attenuator mode: sets the main attenuation to 20 dB (see below for definition of "main" attenuation)
	In either case, if the attenuator was in Auto, it is set to Manual
	`:POW:RF2:ATT 20`
	`:POW:PORT4:ATT 70`

Dependencies	Available on benchtop models Some measurements do not support **Auto** setting of **Atten**. In these measurements, the **Auto/Man** selection is not available, and the **Auto/Man** toggle function is not available In Dual-Attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting, and the **Auto/Man** toggle function is not available. The state of **Auto/Man** is remembered and restored when the electronic attenuator is once again disabled. This is described in more detail in "Elec Atten" on page 197 See "Attenuator Configurations and Auto/Man" on page 196 for more information on the **Auto/Man** functionality If the command is sent to a port that is unavailable, an advisory message is generated. The following error is generated: -241, "Hardware missing; not available for this model number"
Couplings	If the RF Input Port is the RF Input: – If the USB Preamp is connected to USB, use 0 dB for **Atten** – Otherwise compute the auto-selected value of **Atten** based on **Reference Level**, **Int Preamp**, **External Gain**, **Ref Level Offset**, **Max Mixer Level**, **µW Path Control** and **IF Gain** settings. Limit this value to be no less than 6 dB (total attenuation below 6 dB can never be chosen by Auto) – In N9041B, if the RF Input Port is RF Input 2, use the formula above and subtract the value of "Full Range Atten" on page 192 from the result to determine the **Atten**. Limit the value so that it is never lower than 0 dB and so that total attenuation, including **Full Range Atten**, is never less than 6 dB (total attenuation, including **Full Range Atten** below 6 dB, can never be chosen by Auto) In External Mixing and BBIQ, where the attenuator is not in the signal path, the attenuator setting changes as described above when **Atten** is in **Auto**, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input For CXA-m with Option FSA (Fine-Step Attenuator or 2 dB steps), the FSA-like behavior is only available when the frequency setting is <= 7.5 GHz. So, when the frequency is changed from below 7.5 GHz to above 7.5 GHz, the attenuation setting changes to a multiple of 10 dB that is no smaller than the previous setting. For example, 4 dB attenuation changes to 10 dB

Preset	Auto value if Auto/Manual function is supported The Auto value is various 10 dB if Auto/Manual function is not supported
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. Values below 6 dB must be directly entered from the keypad or via SCPI. This protects against setting a dangerously small attenuation value, which can put the instrument at risk of damage to input circuitry. If the current mechanical attenuation is below 6 dB, it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB SA6210A: 46 dB All other models: 70 dB Note that in the Single-Attenuator configuration, the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	The current value for Total Atten is displayed in the Measurement Bar at the top of the display. A value appears for Electronic Attenuation only if the Electronic Attenuator is enabled. The annotation appears as: *Atten: <total> dB (e<elec>)* The e letter is in amber in Single-Attenuator configurations For example: Dual-Attenuator configuration: *Atten: 24 dB (e14)* Indicating the total attenuation is at 24 dB and the electronic attenuation is at 14 dB Single-Attenuator configuration: *A: 24 dB (e14)* Indicating the total attenuation is at 24 dB and the “soft” attenuation is at 14 dB (see below for definition of “soft” attenuation) When in Manual, a # sign appears in front of Atten in the annotation

Auto Function

Remote Command	For general single port instruments:
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:ATTenuation:AUTO?`
	For SA6210A Opt 002
	`[:SENSe]:POWer[:RF]|:RF2:ATTenuation:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]|:RF2:ATTenuation:AUTO?`

Example	Turn **Auto Mech Atten**ON:
	`:POW:ATT:AUTO ON`
	`:POW:RF2:ATT:AUTO ON`

Dependencies	Available on benchtop models Available in: – Spectrum Analyzer Mode – Swept SA measurement – Real-Time Spectrum Analyzer Mode – Spectrum & PvT measurement – Remote Language Compatibility Mode – Swept SA measurement (Remote command depends on Compatibility Model setting) – SCPI Language Compatibility Mode – Swept SA measurement (Remote command depends on Compatibility Model setting) – Avionics Mode – all measurements – Measuring Receiver Mode – all measurements except for Audio measurements
Preset	ON

Attenuator Configurations and Auto/Man

As described under "Attenuation" on page 190, there are two distinct attenuator configurations available in X-Series, the Single Attenuator and Dual-Attenuator configurations.

In Dual-Attenuator configurations, we have mechanical attenuation and electronic attenuation, and current total attenuation is the sum of electronic + mechanical attenuation.

In Single-Attenuator configurations, we refer to the attenuation set using "Atten (Mech Atten)" on page 193 (or `:POW:ATT`) as the “main” attenuation; and the attenuation that is set by `:POW:EATT` as the “soft” attenuation (`:POW:EATT` is honored even in the Single-Attenuator configuration, for compatibility purposes). Then current total attenuation is the sum of main + soft attenuation.

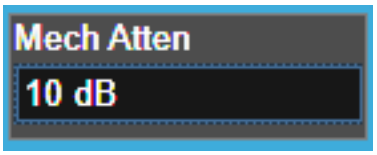
See "Elec Atten" on page 197 for more about “soft” attenuation.

NOTE **In some measurements, the Atten control has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the Atten control:**



Note that in configurations that include an Electronic Attenuator, this switch is only shown when the Electronic Attenuator is disabled.

In other measurements, **Atten** has no **Auto/Man** function. In these measurements, no switch is shown on the **Atten** control:



Mech Atten also appears with no switch, as above, in configurations that include an Electronic Attenuator but when the Electronic Attenuator is enabled.

Elec Atten

Controls the Electronic Attenuator in Dual-Attenuator configurations. Does not appear in Single-Attenuator configurations, because the control of both the mechanical and electronic stages of the Single-Attenuator is integrated into the single **Atten** control.

This control includes an **Enable/Disable** toggle switch; it is only possible to enter a value for the Electronic Attenuator when this switch is in the **Enable** position.

For more details of the Electronic Attenuator, see "More Information" on page 199

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation <rel_ampl>` `[:SENSe]:POWer[:RF]:EATTenuation?`
Example	`:POW:EATT 10` `:POW:EATT?`
Notes	Electronic Attenuation's specification is defined only when **Atten** is 6 dB
Dependencies	Only appears in Dual-Attenuator models with an Electronic Attenuator installed and licensed. Does not appear in models with the Single-Attenuator configuration, because in the Single-Attenuator configuration there is no "electronic attenuator"; there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the Single-Attenuator configuration, `EATT` SCPI commands are accepted for compatibility with other X-series instruments, and set a "soft" attenuation. The "soft" attenuation is treated as an addition to the "main" attenuation value set by the **Attenuation** control or `:POW:ATT`, and affects the total attenuation displayed on the **Attenuation**

	control and the Meas Bar The electronic attenuator, and the "soft" attenuation function provided in Single-Attenuator configurations, are unavailable above the low band (0-3.6 GHz, 0-3.4 GHz, 0-3 GHz, depending on the model). If the low band range is from 0-3.6 GHz, and Stop Frequency of the instrument is > 3.6 GHz, then the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed-out If "Internal Preamp" on page 213 is ON (that is, set to Low Band or Full), the electronic attenuator (and the "soft" attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed-out If either of the above is true, and the SCPI command is sent, an error indicating that the electronic attenuator is unavailable is returned If both the above are true, pressing the control generates error message -221, in other words, the frequency range lockout takes precedence If the electronic/soft Attenuator is enabled, then the **Stop Freq** of the instrument is limited to 3.6 GHz and **Internal Preamp** is unavailable If "Internal Preamp" on page 213 is ON, the electronic attenuator (and the "soft" attenuation function provided in Single-Attenuator configurations) is unavailable. In this case the **Enabled/Disabled** section of the **Elec Atten** control will be OFF and grayed-out. This coupling works in the following modes/measurements: – Channel Power, Occupied BW, ACP, SEM, Spurious Emissions, Power Stat CCDF measurements in all Modes – Transmit On|Off Power measurement in 5GNR Mode – Power vs. Time and Transmit Power measurement in GSM/EDGE Mode – Burst Power measurement in Spectrum Analyzer Mode The SCPI-only "soft" electronic attenuation for the single-attenuator configuration is not available in all measurements; in particular, it is not available in the Swept SA measurement
Couplings	Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in Dual-Attenuator configurations). This is described in more detail below and in "Mechanical Attenuator Transition Rules" on page 199
Preset	0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Dual-Attenuator configuration: 24 dB Single-Attenuator configuration: the total of ATT and EATT cannot exceed 50 dB. So, if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
Annotation	See Annotation under the **Atten** control description

Auto Function

Remote Command	`[:SENSe]:POWer[:RF]:EATTenuation:STATe OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:EATTenuation:STATe?`

Example	`:POW:EATT:STAT ON` `:POW:EATT:STAT?`
Preset	`OFF` (Disabled) for Swept SA measurement `ON` (Enabled) for all other measurements that support the electronic attenuator

NOTE **The maximum Center frequency for Low Band can change based on the selected IFBW for measurements that support IFBW (for example, Waveform measurement across all Modes that support it). In certain models (such as N9042B & N9032B), IFBW values <= 40 MHz have a maximum Low Band frequency of 3.6 GHz, while 40 MHz < IFBW <= 1 GHz have a maximum of 3.3 GHz, and 1 GHz < IFBW <= 1.5 GHz have a maximum of 3.5 GHz. This frequency is reflected in the disabled message displayed for electronic attenuator. For N9032B and N9042B IFBW values > 1.5 GHz do not support a Center frequency that can reach the Low Band maximum frequency. In these cases, the electronic attenuator will remain disabled no matter the Center Frequency.**

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See "Using the Electronic Attenuator: Pros and Cons" on page 200 for a detailed discussion of the pros and cons of using the electronic attenuator.

For the Single-Attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the Dual-Attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See "Atten (Mech Atten)" on page 193

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below *only* applies to the Dual-Attenuator configurations, and *only* when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state:

- The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode
- The Auto/Man state of (Mech) Atten is saved

- The Auto/Man toggle on the (Mech) Atten control disappears, and the auto rules are disabled
- The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the Dual-Attenuator configuration:

- Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled
- Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled
- Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state:

- The Elec Atten control is grayed out
- The Auto/Man state of (Mech) Atten is restored
- If now in Auto, (Mech) Atten recouples
- If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting - (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the instrument dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression, and noise) and instrument performance are less well-known with the electronic attenuator. With the mechanical attenuator, TOI, SHI, and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the instrument calibration.

Atten >50 GHz

Only appears in N9042B with Option 575 installed.

Modifies the attenuation applied to the internal frequency extender’s frequency path above 50 GHz to 75 GHz. This setting is applicable without an external frequency extender connected.

Remote Command	`[:SENSe]:POWer[:RF]:FRATten <rel_ampl>`
	`[:SENSe]:POWer[:RF]:FRATten?`
	Note that this is the same command as that for "Full Range Atten" on page 192 in N9041B

Example	`:POW:FRAT 14` `:POW:FRAT?`
Dependencies	Only appears in N9042B with Option 575, if input RF is selected, and RF Input Port is selected
Preset	10 dB
State Saved	Saved in instrument state
Min	0 dB
Max	26 dB
Annotation	When **Input** is **RF**, **Input Port** is **RF Input**, and the Option 575 Internal Frequency Extender is present: On the Meas Bar, the field “Atten” displays as follows: – If the sweep is entirely < 50 GHz, the value shown after “Atten:” is equal to Mech Atten + Elec Atten – If the sweep is entirely > 50 GHz, the value shown after “Atten:” is equal to Atten > 50 GHz – If the sweep straddles 50 GHz, the value shown after “Atten:” is the Mech Atten + Elec Atten value, followed by “ | ” then the Atten >50 GHz. Example “Atten: 20 dB | 24 dB” In the **Amplitude**, "Y Scale" on page 187 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: “Attenuation below 50 GHz” followed by the value of Mech Atten + Elec Atten

"Attenuation above 50 GHz" followed by the value of Atten > 50 GHz

For example, if "Atten (Mech Atten)" on page 193 = 6 dB, Elec Atten = 4 dB, Atten > 50 GHz = 20 dB, the summary below is shown:

- Attenuator summary:
- Attenuation below 50 GHz: 10 dB
- Attenuation above 50 GHz: 20 dB

Frequency Extender Atten

Lets you modify the attenuation applied to the frequency extender's high frequency input signal path (for example, with a V3050A frequency extender, the high frequency path is 50 GHz to 110 GHz). This value is normally auto-coupled to **Ref Level** and any External Gain that is entered, as described in the following table.

See "Frequency Extender Attenuator Configurations and Auto/Man" on page 204.

Remote Command	For general single port instruments:
	`[:SENSe]:POWer[:RF]:FEXTender:ATTen <rel_ampl>`
	`[:SENSe]:POWer[:RF]:FEXTender:ATTen?`
	For SA6210A Opt 002
	`[:SENSe]:POWer[:RF]|:RF2:FEXTender:ATTen <rel_ampl>`
	`[:SENSe]:POWer[:RF]|:RF2:FEXTender:ATTen?`

Example	Set the frequency extender's attenuator to 20 dB: `:POW:FEXT:ATT 20`
Dependencies	Available on benchtop models Some measurements do not support the **Auto** setting of **Frequency Extender Atten**. In these measurements, the **Auto/Man** selection is not available, and the **Auto/Man** toggle function is not available See "Frequency Extender Attenuator Configurations and Auto/Man" on page 204 for more information on the **Auto/Man** functionality If the Frequency Extender is not connected, error -241, "Hardware missing; Input not available" is generated
Couplings	Only applies, and only visible, when the External RF (`ERFIN`) input is selected The auto-selected value of **Frequency Extender Atten** depends on **Ref Level**, External Gain, Ref Level Offset, and Frequency Extender Presel Bypass settings
Preset	Auto value if Auto/Manual function is supported. The Auto value varies 10 dB if Auto/Manual function is not supported
State Saved	Saved in instrument state
Min	0 dB

Max	V3050A: 26 dB
Annotation	When **Input** is **RF**, and **Input Port** is **External RF**, and the Frequency Extender is connected: On the Meas Bar, the field "Atten" displays as follows: – If the sweep is entirely < the extended frequency start, the value shown after "Atten:" is equal to Mech Atten + Elec Atten – If the sweep is entirely > the extended frequency start, the value shown after "Atten:" is equal to Frequency Extender Atten – If the sweep straddles the extended frequency start, the value shown after "Atten:" is the Mech Atten + Elec Atten value, followed by " | " then the Frequency Extender Atten. Example "Atten: 20 dB | 24 dB" When in **Manual** and **Auto** is available, a # sign appears in front of Atten in the annotation In the **Amplitude**, "Y Scale" on page 187 menu, and the Atten Meas Bar dropdown menu panel, a summary is displayed as follows: "Attenuation below <ext freq start>" followed by the value of Mech Atten + Elec Atten "Attenuation above <ext freq start>" followed by the value of Frequency Extender Atten For example, if "Atten (Mech Atten)" on page 193 = 6 dB, Elec Atten = 4 dB, and Frequency Extender Atten = 20 dB, and the extended frequency start is 50 GHz, the summary below is shown: – Attenuator summary: – Attenuation below 50 GHz: 10 dB – Attenuation above 50 GHz: 20 dB

Auto Function

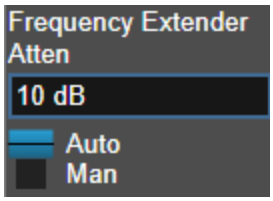
Remote Command	For general single port instruments:
	`[:SENSe]:POWer[:RF]:FEXTender:ATTen:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]:FEXTender:ATTen:AUTO?`
	For SA6210A Opt.002:
	`[:SENSe]:POWer[:RF]|:RF2:FEXTender:ATTen:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:POWer[:RF]|:RF2:FEXTender:ATTen:AUTO?`

Example	Turn Auto **Frequency Extender Atten**ON: `:POW:FEXT:ATT:AUTO ON`
Dependencies	Available on benchtop models Available in: – Spectrum Analyzer Mode – Swept SA measurement – Real-Time Spectrum Analyzer Mode – Spectrum & PvT measurement
Preset	ON

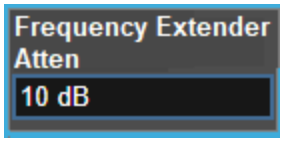
Frequency Extender Attenuator Configurations and Auto/Man

NOTE

In some measurements, **Mech Atten** has an Auto/Man function. In these measurements, an Auto/Man switch is shown on the **Frequency Extender Atten** control:



In other measurements, **Frequency Extender Atten** has no Auto/Man function. In these measurements, no switch is shown on the **Frequency Extender Atten** control:



Adjust Atten for Min Clipping

Sets the combination of mechanical and electronic attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an immediate action function, that is, it executes once, when the control is pressed.

The algorithms that are used for the adjustment are documented under "Pre-Adjust for Min Clipping" on page 205.

Remote Command	For general single port instruments
	`[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate`
	For SA6210A Opt 002
	`[:SENSe]:POWer:[RF]|RF2|ALL:RANGe:OPTimize IMMediate`

Example	For general single port instruments `:POW:RANG:OPT IMM` For SA6210A Opt.002:

`:POW:RANG:OPT IMM`	Adjusts only RF port
`:POW:RF2:RANG:OPT IMM`	Adjusts only RF2 port
`:POW:ALL:RANG:OPT IMM`	Adjusts all ports which are used in the measurement

Notes	Executing **Adjust Atten for Min Clipping** initiates the measurement

Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements If this SCPI is sent to a port that is unavailable, an advisory message is generated. If the equivalent SCPI command is sent, error –241 is generated, "Hardware missing; not available for this model number"

Adjust Atten

Lets you select;

- Electronic attenuator only
- Combination of Electronic attenuator and Mechanical attenuator

when `[:SENSe]:POWer[:RF]:RANGe:OPTimize IMMediate` is executed.

Remote Command	`[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE EONLy | COMBined` `[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE?`
Example	`:POW:RANG:OPT:TYPE EONL` `:POW:RANG:OPT:TYPE?`
Dependencies	Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements Appears in the Waveform measurement in BASIC and 5G NR Modes Not available in SA6210A
Preset	`COMBined`
State Saved	Saved in instrument state

Pre-Adjust for Min Clipping

If this function is `ON`, it applies the adjustment described under "Adjust Atten for Min Clipping" on page 204 each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

In Dual-Attenuator models, you can set **Elec+Mech Atten**, in which case both attenuators participate in the autoranging, or **Elec Atten Only**, in which case the mechanical attenuator does not participate in the autoranging. This latter case results in less wear on the mechanical attenuator and is usually faster.

See "Adjustment Algorithm" on page 206

Selection	SCPI	Note
Off	`OFF`	This is the default setting
On	`ON`	Available in Single-Attenuator instruments. For compatibility with models that do not have an input attenuator, the `ON` parameter is supported and mapped to `COMBined`

Selection	SCPI	Note
Elec Atten Only	ELECtrical	Selects only the electronic attenuator to participate in auto ranging. This offers less wear on the mechanical attenuator and is usually faster
Elec+Mech Atten	COMBined	In Dual-Attenuator models, this selects both attenuators to participate in the autoranging

Remote Command	[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF | ON | ELECtrical | COMBined [:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?
Example	:POW:RANG:OPT:ATT OFF :POW:RANG:OPT:ATT?
Notes	The parameter option ELECtrical sets this function to ON in Single-Attenuator models The parameter option COMBined is mapped to ELECtrical in Single-Attenuator models. If you send COMBined, it sets the function to ON and returns ELEC to a query For SCPI compatibility with models that do not have an input attenuator, the ON parameter is honored and mapped to COMBined
Dependencies	Only appears in Dual-Attenuator models with an Electronic Attenuator installed In instruments with Dual-Attenuator model, when "Elec Atten" on page 197 is OFF or grayed-out, "Pre-Adjust for Min Clipping" on page 205 is grayed out Does not appear in the Swept SA, RTSA, Monitor Spectrum and Complex Spectrum measurements Appears in the Waveform measurement in BASIC and 5G NR Modes Not available in SA6210A
Preset	OFF when Elec Atten is Disabled at preset, otherwise ELEC
State Saved	Saved in instrument state
Range	Dual-Attenuator models: Off | Elec Atten Only | Mech + Elec Atten Single-Attenuator models: Off | On

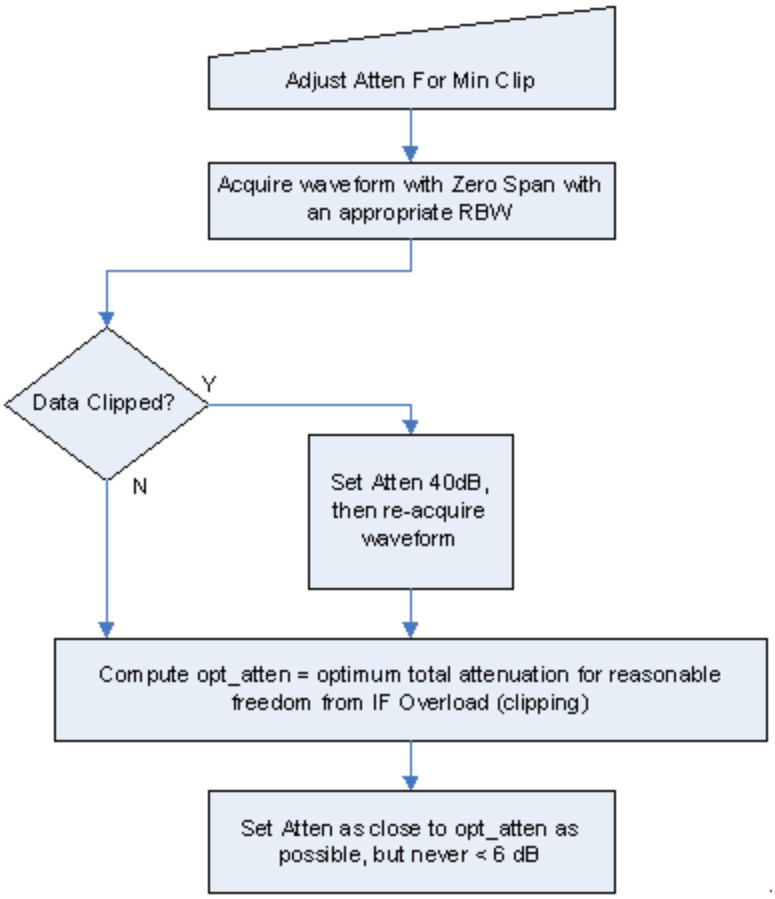
Backwards Compatibility Command

Notes	ON aliases to "Elec Atten Only" (:POW:RANG:OPT:ATT ELEC) OFF aliases to "Off" (:POW:RANG:OPT:ATT OFF) :POW:RANG:AUTO? returns true if :POW:RANG:OPT:ATT is not OFF
Backwards Compatibility SCPI	[:SENSe]:POWer[:RF]:RANGe:AUTO ON|OFF|1|0 [:SENSe]:POWer[:RF]:RANGe:AUTO?

Adjustment Algorithm

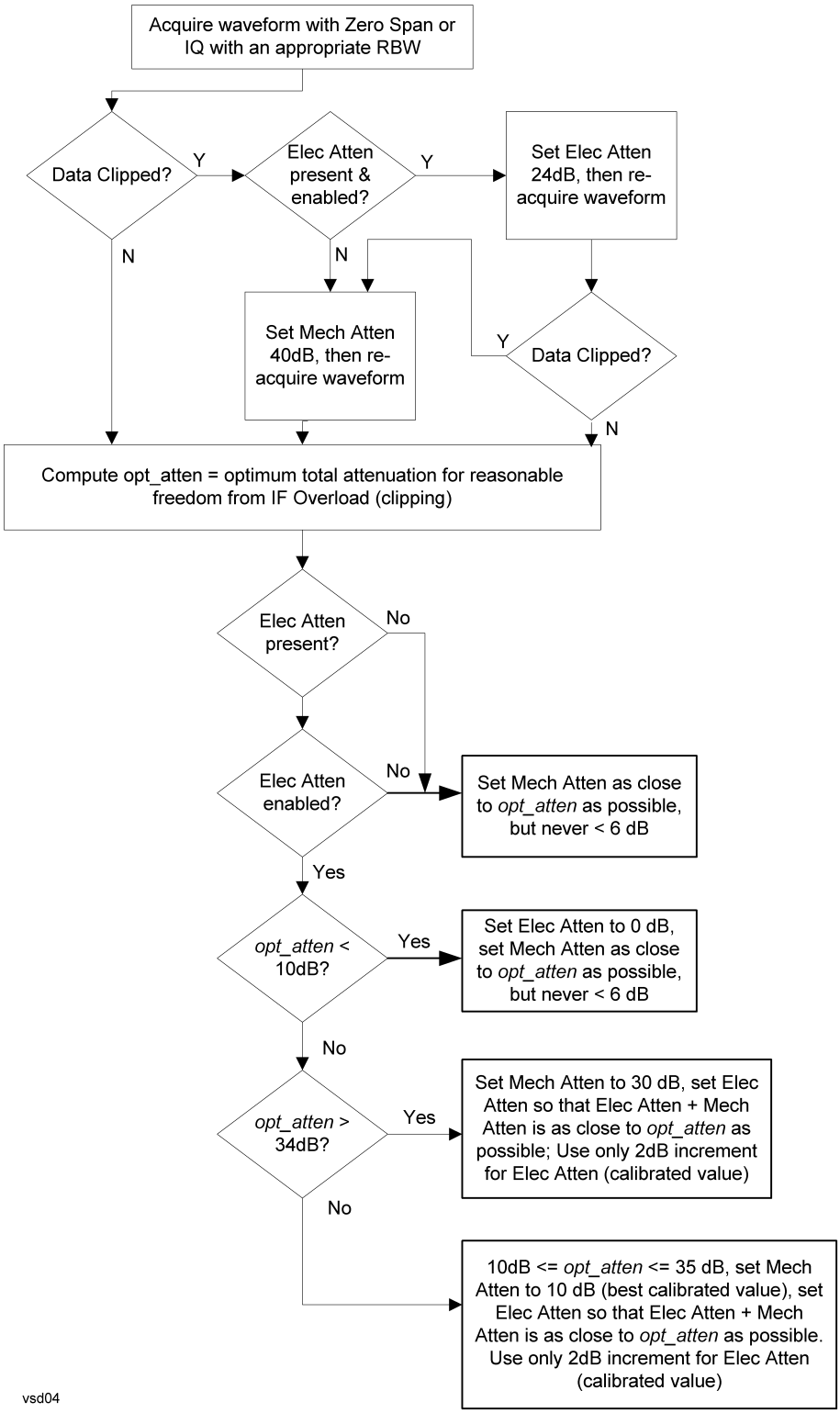
The algorithms for the adjustment are documented below:

Single-Attenuator Models



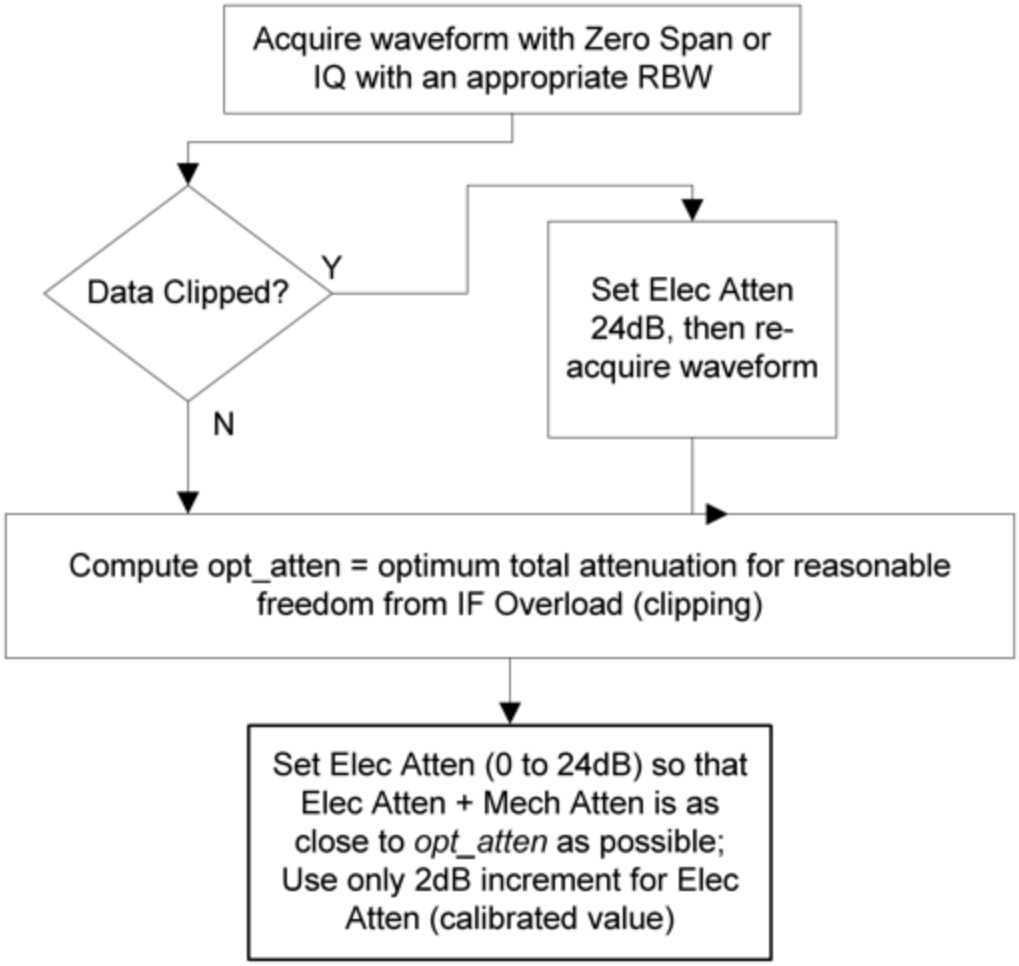
Dual-Attenuator models

"Adjust Atten for Min Clipping" on page 204 or "Pre-Adjust for Min Clipping" on page 205 selection is Mech + Elec Atten:


Acquire waveform with Zero Span or IQ with an appropriate RBW
Data Clipped?
Y
Elec Atten present & enabled?
Y
Set Elec Atten 24dB, then re-acquire waveform
N
N
Set Mech Atten 40dB, then re-acquire waveform
Y
Data Clipped?
N
Compute opt_atten = optimum total attenuation for reasonable freedom from IF Overload (clipping)
Elec Atten present?
No
Elec Atten enabled?
No
Set Mech Atten as close to opt_atten as possible, but never < 6 dB
Yes
opt_atten < 10dB?
Yes
Set Elec Atten to 0 dB, set Mech Atten as close to opt_atten as possible, but never < 6 dB
No
opt_atten > 34dB?
Yes
Set Mech Atten to 30 dB, set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible; Use only 2dB increment for Elec Atten (calibrated value)
No
10dB <= opt_atten <= 35 dB, set Mech Atten to 10 dB (best calibrated value), set Elec Atten so that Elec Atten + Mech Atten is as close to opt_atten as possible. Use only 2dB increment for Elec Atten (calibrated value)
vsd04

"Pre-Adjust for Min Clipping" on page 205 selection is Elec Only.

Note that the Mech Atten value is not adjusted, and the value previously set is used. Therefore, there is a case that IF Overload is still observed depending on the input signal level and the Mech Atten setting.



Atten Step (Mech Atten Step)

Controls the step size used when making adjustments to the input attenuation. Labeled Mech Atten Step in some instruments. In the Dual-Attenuator configuration, only affects the step size of the mechanical attenuator.

Remote Command	`[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement] 10 | 2 DB`
Example	`:POW:ATT:STEP 2`

	:POW:ATT:STEP?
Notes	Has a toggle control on the menu panel, but takes a specific value (in dB) when used remotely. The only valid values are 2 and 10
Dependencies	Blanked in EXA, CXA and CXA-m if Option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI yield an error Blanked in SA6210A
Couplings	When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if step is set to 10 dB, mech atten is increased if necessary so it is a multiple of 10 dB
Preset	EXA, CXA and CXA-m: 10 dB (2 dB with Option FSA): 1 dB All other models: 2 dB
State Saved	Saved in instrument state

3.1.12.3 Signal Path

Contains controls that pertain to the routing of the signal through the front end of the instrument.

In general, only appears in instruments whose hardware supports this signal routing. For example, this group does not appear in many modular instrument products, including VXT Model M9420A, or UXM.

This group *does* appear in VXT Models M9410A/11A/15A/16A and M9410E/11E/15E/16E, because "Software Preselection" on page 228 is in this group, and VXT Models M9410A/11A/15A/16A and M9410E/11E/15E/16E implement a version of Software Preselection.

Presel Center

Adjusts the centering of the preselector filter to optimize the amplitude accuracy.

When Presel Center is pressed, the instrument performs centering on the measurements center frequency.

For the Swept SA measurement of the Spectrum Analyzer (SA) Mode, Presel Center adjusts the centering of the preselector filter to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when Presel Center is pressed, the instrument turns on the selected marker, performs a peak search, and then performs centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the instrument, the instrument performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start and Stop, the instrument first performs a peak search, and then performs centering on the marker's center frequency.

The value displayed on "Presel Adjust" on page 212 changes to reflect the new preselector tuning.

Certain considerations should be observed to ensure proper operation, as detailed in "Proper Preselector Operation" on page 211.

Remote Command	`[:SENSe]:POWer[:RF]:PCENter`
Example	`:POW:PCEN`
Notes	In SA6210A Opt 002, this action applies only to the port selected by "RF Input Port" on page 748 The rules outlined above under the control description apply for the remote command as well as the key. The result of the command depends on marker position, etc. Any message generated by the control press is also generated in response to the remote command
Dependencies	Does not appear in CXA-m, nor in VXT Models M9410A/11A/15A/16A, M9410E/11E/15E/16E Grayed-out if the microwave preselector is off – If the selected marker's frequency is below Band 1, an advisory message is generated "Preselector not used in this frequency range" and no action is taken – Grayed-out if entirely in Band 0, that is, if **Stop** is below about 3.6 GHz Grayed-out if entirely above 50 GHz, that is, if **Start** is above 50 GHz – Blanked in models that do not include a preselector, such as Option 503. If the remote command is sent in these instruments, accepted without error, and the query always returns 0 – Grayed-out in the **Spectrogram** View
Couplings	The active marker position determines where the centering will be attempted If the instrument is in a measurement such as averaging when centering is initiated, the act of centering the preselector restarts averaging, but the first average trace will not be taken until the centering is completed The offset applied to do the centering appears in "Presel Adjust" on page 212
Status Bits/OPC dependencies	When centering the preselector, `*OPC` does not return true until the process is complete and a subsequent measurement has completed, nor are results returned in response to `:READ` or `:MEASure` queries The `Measuring` bit remains set (true) while this command is operating, and does not go false until the subsequent sweep/measurement has completed

Proper Preselector Operation

Certain considerations should be observed to ensure proper operation:

1. If the selected marker is **Off**, the instrument turns on a marker, performs a peak search, and adjusts the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on-screen in a preselected range for the peak search to find

2. If the selected marker is already **On**, the instrument attempts the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz, so if the marker is on a signal below 3.6 GHz, no centering is attempted, and an advisory message is generated
3. In some models, the preselector can be bypassed. If it is bypassed, no centering is attempted in that range, and a message is generated

Presel Adjust

Lets you manually adjust the preselector filter frequency to optimize its response to the signal of interest. Only available when "Presel Center" on page 210 is available.

For general purpose signal analysis, using **Presel Center** is recommended. Centering the filter minimizes the impact of long-term preselector drift. **Presel Adjust** can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

When **Presel Center** is performed, the offset applied to do the centering becomes the new value of **Presel Adjust**.

Remote Command	`[:SENSe]:POWer[:RF]:PADJust <freq>`
	`[:SENSe]:POWer[:RF]:PADJust?`
	For SA6210A Opt 002:
	`[:SENSe]:POWer[:RF]|:RF2:PADJust <freq>`
	`[:SENSe]:POWer[:RF]|:RF2:PADJust?`

Example	`:POW:PADJ 100KHz` `:POW:PADJ?`
Notes	The value on the control is displayed to 0.1 MHz resolution
Dependencies	– Does not appear in CXA-m – Does not appear in VXT Models M9410A/11A/15A/16A – Does not appear in M9410E/11E/15E/16E – Grayed-out if microwave preselector is off – Grayed-out if entirely in Band 0, that is, if Stop Freq is lower than about 3.6 GHz – Grayed-out if entirely above 50 GHz, that is, if **Start** is higher than 50 GHz – Blank in models that do not include a preselector, such as Option 503. If the command is sent in these instruments, it is accepted without error, and the query always returns 0 – Grayed-out in the **Spectrogram** View

Preset	0 MHz
State Saved	The **Presel Adjust** value set by "Presel Center" on page 210, or by manually adjusting **Presel Adjust** Not saved in instrument state, and does not survive a Preset or power cycle
Min/Max	–/+500 MHz

Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PADJust`
	`[:SENSe]:POWer[:RF]:MMW:PADJust`
	Backwards Compatibility Command

Notes	The command has no effect, and the query always returns `MWAVe`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:PADJust:PRESelector MWAVe|MMWave|EXTernal` `[:SENSe]:POWer[:RF]:PADJust:PRESelector?`

Internal Preamp

Accesses a menu of controls for the internal preamps. Turning on the preamp gives a better noise figure, but a poorer inter-modulation distortion (TOI) to noise floor dynamic range. You can optimize this setting for your measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp, the instrument will also account for that. The displayed result always reflects the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example, for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

Selection	Example	Note
Off	`:POW:GAIN OFF`	
Low Band	`:POW:GAIN ON` `:POW:GAIN:BAND LOW`	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	`:POW:GAIN ON` `:POW:GAIN:BAND FULL`	Sets the internal preamp to use its full range. The low band (0-3.6 GHz, 0-3.4 GHz, 0-3 GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the **Full Range** selection in the dropdown. If the high band option is not installed, the **Full Range** selection does not appear

NOTE The maximum **Center** frequency for **Low Band**, displayed in square brackets, can change based on the selected IFBW for measurements that support IFBW (for example, Waveform measurement across all Modes that support it). In certain models (such as N9042B & N9032B), IFBW values <= 40 MHz have a maximum **Low Band** frequency of 3.6 GHz, while 40 MHz < IFBW <= 1 GHz have a maximum of 3.3 GHz, and 1 GHz < IFBW <= 1.5 GHz have a maximum of 3.5 GHz. IFBW values > 1.5 GHz do not support a **Center** frequency that can reach the **Low Band** maximum frequency. In these cases, **N/A** is displayed in the square brackets for **Low Band**.

Remote Command	`[:SENSe]:POWer[:RF]:GAIN:BAND LOW | FULL` `[:SENSe]:POWer[:RF]:GAIN:BAND?`
Example	`:POW:GAIN:BAND LOW` `:POW:GAIN:BAND?`
Dependencies	Not available on all hardware platforms. If the preamp is not present or is unlicensed, this control is not shown Does not appear in VXT Models M9410A/11A/15A/16A, M9410E/11E/15E/16E Not available in SA6210A If `:POW:GAIN:BAND FULL` is sent when a low band preamp is available, the preamp band parameter is set to `LOW` instead of `FULL`, and an "Option not installed" message is generated Not available when the electronic/soft attenuator is enabled
Preset	`LOW`
State Saved	Saved in instrument state
Annotation	When the USB Preamp is not connected to USB, the Preamp annotation in the Meas Bar says “Off” if the preamp is off and displays the frequency range of the low band or full range preamp depending on the setting. For example, if the Preamp is set to **Low Band** and the Low Band is 3.6 GHz the annotation says “3.6 GHz”. If it is a 13.6 GHz preamp and it is set to **Full Range** the annotation says “13.6 GHz” When the USB Preamp is connected to USB, the Preamp annotation says “Preamp: USB” if the internal preamp is off or “Preamp: USB, Int” if the internal preamp is on (only for measurements that support the USB preamp)

Auto Function

Remote Command	`[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN[:STATe]?`
Example	`:POW:GAIN OFF` `:POW:GAIN?`
Preset	`OFF`

LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

LNA is an additional preamplifier that provides superior DANL and frequency range compared to "Internal Preamp" on page 213. LNA provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

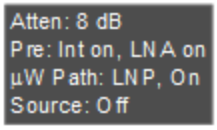
For best possible sensitivity, LNA can be turned on *together* with "Internal Preamp" on page 213, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

For more details about annotation, see "More Information" on page 215

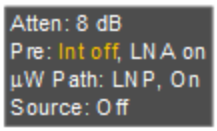
Remote Command	`[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?`
Example	`:POW:GAIN:LNA ON`
Dependencies	Requires Option LNA, except for VXT models M9415A/16A Does not appear in SA6210A, VXT models M9420A/10A/11A Supported in M9410E/11E/15E/16E May not appear in some measurements LNA is not available when the electronic/soft attenuator is enabled
Preset	`OFF`
State Saved	Saved in State

More Information

When LNA is installed, the preamp annotation changes to show the state of both LNA and Internal Preamp. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if LNA is on, Internal Preamp is switched off (even if you have its switch set to ON). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the Internal Preamp annotation displays in amber, to warn you that the actual state of Internal Preamp does not match its switch control display:



µW Path Control

Options for this control include µW Preselector Bypass (Option MPB), Low Noise Path (Option LNP) and Full Bypass Enable in the High Band path circuits.

When the µW Preselector is bypassed, flatness is improved, but will be subject to spurs from out of band interfering signals. When Low Noise Path Enable is selected, the instrument automatically bypasses certain circuitry in the high frequency bands that can contribute to noise, when it is appropriate based on other instrument settings.

For most applications, the preset state is Standard Path, which provides the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is µW Preselector Bypass, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose Low Noise Path Enable for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does Low Noise Path Enable, but the preamp's compression threshold and third-order intercept are much poorer than that of Low Noise Path Enable.

A fourth choice is Full Bypass Enable, which combines µW Preselector Bypass and Low Noise Path Enable. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. Full Bypass Enable is only available if both options LNP and MPB are present, as well as option FBP.

Path	SCPI	Note
Standard Path	`STD`	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	`LNPath`	See "Low Noise Path Enable" on page 222 Not available in SA6210A
µW Preselector Bypass	`MPBypass`	See "µW Preselector Bypass" on page 224
Full Bypass Enable	`FULL`	See "Full Bypass Enable" on page 225 Not available in SA6210A

Path	SCPI	Note
Wideband Preselector Enable	WPR	See "Wideband Preselector Enable" on page 226 Available only in SA6210A

Remote Command	[:SENSe]:<meas>:POWer:MWPath STD | LNPath | MPBypass | FULL | WPReselector [:SENSe]:<meas>:POWer:MWPath?
Example	Enable the Low Noise path: :POW:MWP LNP :POW:MWP?
Notes	When "Presel Center" on page 210 is performed, the instrument momentarily switches to the Standard Path, regardless of the setting of µW Path Control The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is Low Noise Path Enable or Full Bypass Enable. In the case where the DC Block is switched in, the instrument is now AC-coupled. However, if you selected DC coupling, the UI would still behave as though it were DC-coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the instrument could switch out the low noise path at any time and hence go back to being DC-coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m, VXT Models M9410A/11A/15A/16A, nor in M9410E/11E/15E/16E, BBIQ and External Mixing – Low Noise Path Enable does not appear unless Option LNP is present and licensed – µW Preselector Bypass does not appear unless Option MPB is present and licensed – Full Bypass Enable does not appear unless options LNP and MPB are both present as well as option FBP – Wideband Preselector Enable only appears in SA6210A In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated Low Noise Path Enable and Full Bypass Enable are grayed-out if the current measurement does not support them Low Noise Path Enable and Full Bypass Enable are not supported in Avionics and MMR Modes (non-modulation measurements). In any of these cases (that is, the feature is not supported in either measurement or Mode), if the SCPI command is sent, the following error is generated: -221, "Setting Conflict; Feature not supported for this measurement" Sending the SCPI command to a port that is unavailable issues the error -241, "Hardware missing; not available for this model number"

Preset

Mode	Value
IQ Analyzer	MPB option present and licensed: MPB
Pulse	MPB option not present and licensed: STD

	Mode	**Value**
	RTSA Avionics	
	All other Modes	`STD` Or, depends on auto-rule when "µW Path Control Auto State" is available and its Preset value is Auto
	–	
State Saved	Save in instrument state	
Range	Standard Path | Low Noise Path Enable | µW Presel Bypass | Full Bypass Enable | Wideband Preselector Enable	
Annotation	In the Meas Bar, if the Standard path is chosen: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch *is* thrown: µW Path: LNP,On If the preselector is bypassed: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch *is* thrown: µW Path: FByp,On If Wideband Preselector Enable is selected: µW Path: WB	

Backwards Compatibility SCPI	Backwards Compatibility SCPI #1
	`[:SENSe]:POWer[:RF]:MW:PATH`
	The command sets the specified value to all measurements in the Mode. The query returns the current measurement's value
	Backwards Compatibility SCPI #2
	`[:SENSe]:<meas>:POWer:MW:PATH`
	For the Swept SA measurement in SA Mode only:
	Most SCPI commands for the Swept SA measurement do not have a `<meas>` node, but for *this* setting, `SAN` (or `SANalyzer` in long form) is *required* to specify the target measurement of the command
	If `SANalyzer` is omitted from this command, it is interpreted as a Backwards Compatibility SCPI command #1 shown above, which has a different behavior	

µW Path Control Auto

In VMA, WLAN, 5G NR, CQM Modes, an Auto/Man switch is added to µW Path Control:



This allows the function to automatically switch based on certain Auto Rules as shown below:

VMA Mode (All except SA6210A)

Measurement	µW Path Control Auto behavior
Digital Demod	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Custom OFDM	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Presel Bypass
SEM	Always Presel Bypass
Spurious Emissions	Always Standard Path

VMA Mode (SA6210A)

Measurement	µW Path Control Auto behavior
Monitor Spectrum	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
IQ Waveform	If tuned frequency <=8.4 GHz, use Standard Path If tuned frequency > 8.4 GHz, use Wideband Preselector unless IFBW > 1 GHz or 9.5 GHz < tuned frequency < 12.5 GHz
Channel Power	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector

Measurement	µW Path Control Auto behavior
Occupied BW	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
CCDF	If tuned frequency <=8.4 GHz, use Standard Path If tuned frequency > 8.4 GHz, use Wideband Preselector unless IFBW > 1 GHz or 9.5 GHz < tuned frequency < 12.5 GHz
ACP	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
SEM	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
Spurious Emissions	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector

WLAN Mode

Measurement	µW Path Control Auto behavior
Modulation Analysis	Always Presel Bypass
Spectral Flatness	Always Presel Bypasss
Power vs Time	Always Presel Bypass
Monitor Spectrum	Always Presel Bypass
IQ Waveform	Always Presel Bypass
Channel Power	Always Presel Bypass
Occupied BW	Always Presel Bypass
CCDF	Always Presel Bypass
SEM	For 11be 320M, when 'Enabled Wideband IF for FFT' is OFF or 'Sweep Type Rule' is Best Dynamic Range, auto µW path is standard For other cases, auto µW path is presel bypass if presel bypass is enabled, auto µW path is standard if presel bypass is not enabled
Spurious Emissions	Always Standard Path

5G NR Mode

Measurement	µW Path Control Auto behavior
Modulation Analysis	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass

Measurement	µW Path Control Auto behavior
Channel Power	Always Standard Path
Occupied BW	Always Standard Path
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
ACP	Always Standard Path
SEM	Always Standard Path
Spurious Emissions	Always Standard Path
Transmit On|Off Power	Use Standard Path unless tuned frequency > 3.6 GHz and Info BW > 15 MHz, in which case choose Preselector Bypass

5G NR Mode (SA6210A)

Measurement	µW Path Control Auto behavior
Modulation Analysis	If tuned frequency <=8.4 GHz, use Standard Path If tuned frequency > 8.4 GHz, use Wideband Preselector unless IFBW > 1 GHz or 9.5 GHz < tuned frequency < 12.5 GHz
Monitor Spectrum	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
IQ Waveform	If tuned frequency <=8.4 GHz, use Standard Path If tuned frequency > 8.4 GHz, use Wideband Preselector unless IFBW > 1 GHz or 9.5 GHz < tuned frequency < 12.5 GHz
Channel Power	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
Occupied BW	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
CCDF	If tuned frequency <=8.4 GHz, use Standard Path If tuned frequency > 8.4 GHz, use Wideband Preselector unless IFBW > 1 GHz or 9.5 GHz < tuned frequency < 12.5 GHz
ACP	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
SEM	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
Spurious Emissions	Use Standard Path unless RBW > 15 MHz, otherwise select Wideband Preselector
Transmit On|Off Power	If tuned frequency <=8.4 GHz, use Standard Path If tuned frequency > 8.4 GHz, use Wideband Preselector unless IFBW > 1 GHz or 9.5 GHz < tuned frequency < 12.5 GHz

Channel Quality Mode

Measurement	µW Path Control Auto behavior
Group Delay	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Full Bypass if conditions warrant(FBP Option is available and "Allow Full Bypass in Auto" is On), otherwise choose Preselector Bypass
Monitor Spectrum	Always Standard Path
IQ Waveform	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass
CCDF	Use Standard Path unless tuned frequency > 3.6 GHz and IFBW > 15 MHz, in which case choose Preselector Bypass

Auto Function

Remote Command	`[:SENSe]:<meas>:POWer:MWPath:AUTO ON | OFF | 1 | 0` `[:SENSe]:<meas>:POWer:MWPath:AUTO?`
Example	`:POW:MWP:AUTO ON` `:POW:MWP:AUTO?`
Dependencies	Only appears in VMA, WLAN, 5G NR and CQM Modes Sending the command to a port that is unavailable generates error –241, "Hardware missing; not available for this model number"
Couplings	See "µW Path Control Auto" on page 219 above
Preset	`ON`
Range	`ON|OFF`

Backwards Compatibility SCPI	Backwards Compatibility SCPI #1
	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO`
	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO?`
	The command sets the specified value to all measurements in the Mode. The query returns the current measurement's value
	Backwards Compatibility SCPI #2
	`[:SENSe]:<meas>:POWer:MW:PATH:AUTO`
	For the Swept SA measurement in SA Mode only:
	Most SCPI commands for the Swept SA measurement do not have a `<meas>` node, but for *this* setting, `SAN` (or `SANalyzer` in long form) is *required* to specify the target measurement of the command
	If `SANalyzer` is omitted from this command, it is interpreted as a Backwards Compatibility SCPI command #1 shown above, which has a different behavior

Low Noise Path Enable

SCPI: `LNPath`

Provides a lower noise floor under some circumstances, particularly when operating in the 21– 26.5 GHz region. With the Low Noise Path enabled, the low band/high

band switch and microwave preamp are bypassed whenever *all* the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz
- The internal preamp is not installed, or if installed, is set to Off or Low Band

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the Low Noise Path Enable is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the Low Noise Path Enable is selected in the user interface. The only time the Low Noise Path is used is when Low Noise Path Enable is selected, the sweep is completely in High Band (> 3.6 GHz), and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when Center Frequency is in High Band (> 3.6 GHz), and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFTs in the Swept SA measurement; they use the same rules as swept measurements.

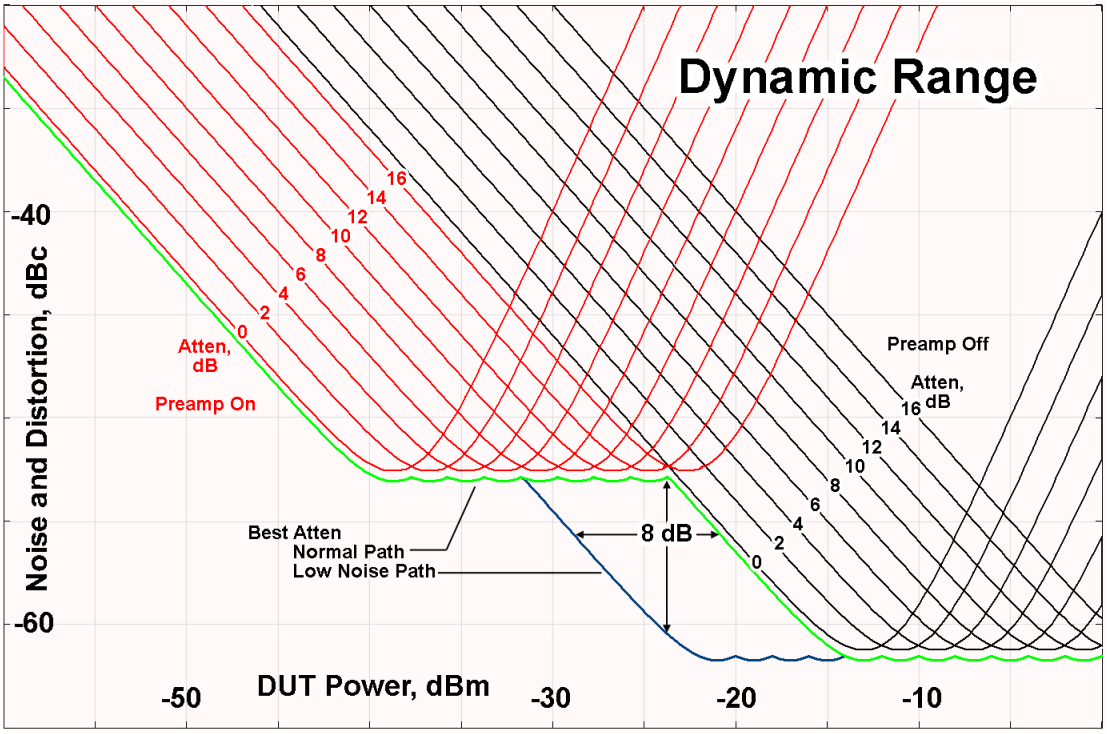
Note that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

Note also that the bypass switch is a mechanical switch and has finite life, so if the Low Noise Path Enable is selected, it is possible to cause frequent cycling of this switch by frequently changing instrument settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the Standard Path, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the instrument performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the “Low Noise Path.” However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an instrument at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both instrument noise and instrument TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the instrument input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

SCPI: `MPBypass`

Toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the instrument.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1 (Fast Sweep Capability) is enabled, the image response in the Swept SA measurement appears lower in amplitude and has a much wider shape factor compared to the real signal.

Full Bypass Enable

SCPI: FULL

The microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever *all* the following are true:

- The instrument is not in the Low Band, meaning:
- the start frequency is above 3.5 GHz and
- the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or if installed, is set to Off or Low Band

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the Full Bypass Enable is selected in the user

interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

CAUTION **When Full Bypass Enable is selected, and "Y Scale" on page 187 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band, or Off). This puts the first converter at considerable risk of being damaged by high AC power. Consequently, whenever Full Bypass Enable is selected, a warning message appears in the status bar:**

"Full Bypass Enabled, maximum safe input power reduced"

Wideband Preselector Enable

In SA6210A, the Wideband Preselector can be selected. When it's selected, the signal path is switched to a filter bank with a 1 GHz analysis bandwidth. If the analysis bandwidth is set to exceed 1 GHz, the filter bank is bypassed.

The filter bank is a collection of bandpass filters that decompose the input signal into multiple frequency bands.

Microwave Preselector Bypass Backwards Compatibility

Notes	Included for Microwave Preselector Bypass backwards compatibility The `ON` parameter sets the `STD` path (`:POW:MW:PATH STD`) The `OFF` parameter sets path `MPB` (`:POW:MW:PATH MPB`)
Preset	`ON`
Backwards Compatibility SCPI	`[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe] ON|OFF|0|1` `[:SENSe]:POWer[:RF]:MW:PRESelector[:STATe]?`
Backwards Compatibility SCPI Example	Bypass the microwave preselector: `:POW:MW:PRES OFF`

Frequency Extender Preselection Bypass

Only applies to the high frequency path of the Frequency Extender, and only if the Frequency Extender allows it. For example, the V3050A high frequency path is 50 – 110 GHz and *does* allow control of the preselector bypass.

When the Frequency Extender's preselection is bypassed, flatness is improved, but will be subject to spurs from out-of-band interfering signals. For bandwidths greater

than 2.5 [GHz], it is recommended that the signal bypass the Frequency Extender Preselector since the max bandwidth of the Preselector can be as narrow as 2.5 [GHz].

For most applications, the preset state is OFF, which gives the best remote-control throughput, minimizes acoustic noise from switching, minimizes out of band spurs, and minimizes the risk of wear in the hardware switches.

Preselector and Bandwidth Conflict

When the Frequency Extender Preselector is applied and the signal bandwidth is greater than 2.5 [GHz], then a settings alert message will show to warn the user that the signal may be distorted due to the limitation of the Frequency Extender Preselector bandwidth.

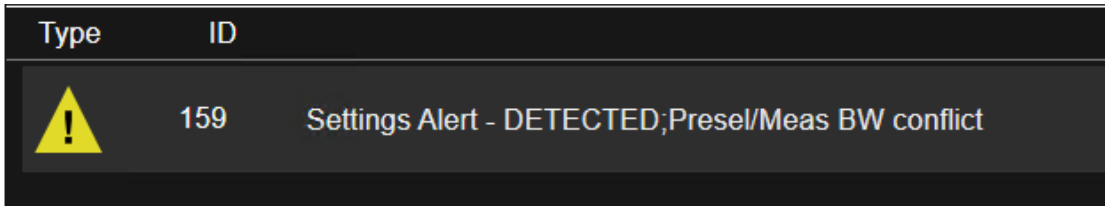
An example of the settings alert message is shown below.

Settings Alert message in the Status Bar at the bottom of the display.



Settings Alert message in the error queue

.



Allow Full Bypass in Auto

Enables or disables full bypass in µW Path Auto rule. See "µW Path Control" on page 216.

When this function is ON, and "µW Path Control" on page 216 is in AUTO, it is possible for the auto rules to select the FULL Bypass state, which bypasses both the Preamp and the Microwave Preselector. Otherwise, the auto rules never select the FULL Bypass state. This is convenient when making wideband measurements, but it also adds some risk of damage to the first converter.

CAUTION **When Full Bypass Enable is selected, and "Y Scale" on page 187 is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq > 3.6 GHz and the**

Preamp is either not licensed, set to **Low Band** or **Off**). This puts the first converter at considerable risk of being damaged by high AC power. Consequently, whenever **Full Bypass Enable** is selected, a warning message appears in the status bar:

"Full Bypass Enabled, maximum safe input power reduced"

Remote Command	`[:SENSe]:POWer[:RF]:MW:PATH:AUTO:FULL ON | OFF | 1 | 0` `[:SENSe]:POWer[:RF]:MW:PATH:AUTO:FULL?`
Example	`:POW:MW:PATH:AUTO:FULL ON` `:POW:MW:PATH:AUTO:FULL?`
Dependencies	Only appears if Option FBP is installed, and in the following measurements – 5GNR Mode: Modulation Analysis and IQ Waveform – WLAN Mode: IQ Waveform – Channel Quality Mode: Group Delay and Noise Power Ratio
Preset	`OFF`
State Saved	Saved in instrument state

Software Preselection

Provided in some instruments, either to compensate for issues with provided hardware preselection, or to provide the preselection function when there is no hardware preselector.

N9041B

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

In N9041B, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for RF Input 2. Even if turned on, it is not used for other inputs, and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note "(>~50 GHz)".

Note that in N9041B, in Swept SA measurement, Software Preselection works even if the measurement is using an FFT Sweep Type. In measurements other than Swept SA, Software Preselection is not used if the measurement is using an FFT sweep type.

N9042B+V3050A

Software Preselection compensates for the frequency range limit of the microwave preselector. Since the microwave preselector only goes up to 50 GHz, software preselection must be used to suppress and separate images above 50 GHz. The specific algorithm used for software preselection is specified by the SW Preselection Type selection – Normal or Advanced.

For N9042B+V3050A, Software Preselection only applies for frequencies above 50 GHz, therefore it is only used for External RF. Even if it is turned on, it will not be used for other inputs and never for frequencies below 50 GHz. This is why the label of this control contains the parenthetical note "(>~50 GHz)".

Note that for N9042B+V3050A, in the Swept SA measurement, Software Preselection works even if the measurement is using an FFT Sweep Type. In measurements other than Swept SA, Software Preselection is not used if the measurement is using an FFT Sweep Type.

VXT models M941xA and M941xE

Software Preselection is used to provide the preselection function, as there is no hardware preselector in these models. Two background traces are taken and compared point by point, and the point with the lowest amplitude from the two traces is used. This provides a method to reduce spurs that are internally generated within the VXT, but note the following when using Software Preselection:

- There is some speed cost due to the need to take multiple captures
- Taking the point with the lowest amplitude in each trace will make the average noise level lower at all points that do not have a spur. This can reduce the accuracy of the measurement of noise and noise-like signals

Because of the difficulty in identifying spurs manually, you are recommended to leave Software PreselectionON at all times in VXT models. If you turn it off to speed up your measurement or improve noise accuracy, be aware of unwanted onscreen spurs.

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:STATe 0 | 1 | ON | OFF` `[:SENSe]:POWer[:RF]:SWPresel:STAT?`
Example	`:POW:SWPR:STAT 1` `:POW:SWPR:STAT?`
Dependencies	Only appears in N9041B, N9042B+V2050A, VXT models M941xA and M941xE Does not appear in all measurements
Couplings	Affects Sweep Time Auto Tune supports Software Preselection, so Auto Tune should be performed after setting the Software Preselection state

Preset	N9041B	OFF
	N9042B+V3050A	ON
	M941xA and M941xE	ON
State Saved	Saved in instrument state	

SW Preselection Type

Specifies the algorithm used for software preselection.

Two hidden sweeps occur in succession. The second sweep is offset in LO frequency by 2 * IF / N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The **Peak** detector is auto-selected to improve image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals. Other signals are images, which are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

- `NORMal` - mathematically removes all image and multiple responses of signals present at the input
- `ADVanced` - any trace processing (such as “max hold” or trace averaging) is performed on the points of both candidate traces before the “select minimum” operation occurs. This form of processing works better for non-stationary signals, such as pulsed-RF signals

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel NORMal | ADVanced`	
	`[:SENSe]:POWer[:RF]:SWPResel?`	
Example	`:POW:SWPR NORM`	
	`:POW:SWPR?`	
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method	
	Grayed-out when "Software Preselection" on page 228 is `OFF`. The grayout message is “Unavailable unless SW Presel enabled”	
Preset	N9041B	ADVanced
	N9042B+V3050A	NORMal
State Saved	Saved in instrument state	

SW Preselection BW

Specifies the effective bandwidth to be used for "Software Preselection" on page 228.

The options are:

- NORMal – when making Swept measurements, a software preselection algorithm is used which takes up to 4 background acquisitions, then post-processes the result. This algorithm can remove images from signals with an occupied bandwidth up to around 3 GHz. (Default/Preset setting). When making FFT measurements, this algorithm is not used, instead the same algorithm is used as for NARRow (below)
- NARRow– a software preselection algorithm is used which takes two background acquisitions, then post-processes the result to detect and remove images from wideband signals with occupied bandwidths up to 2 GHz. This increases the risk of images failing to be rejected, but improves the measurement speed

Remote Command	`[:SENSe]:POWer[:RF]:SWPResel:BW NORMal | NARRow` `[:SENSe]:POWer[:RF]:SWPResel:BW?`
Example	`:POW:SWPR:BW NARR`
Dependencies	Only appears in N9041B and N9042B+V3050A. Only appears in measurements that use the Swept method Grayed-out when "Software Preselection" on page 228 is OFF. The grayout message is “Unavailable unless SW Presel enabled” For N9042B+V3050A, the parameter is SCPI-only, and always set to NARRow when **Software Preselection** is enabled
Preset	N9041B: NORMal N9042B+V3050A: NARRow
State Saved	Saved in instrument state

High Freq Prefilter

Lets you set the state of Prefilter for center frequencies above 1310 MHz.

In VXT Models M9410A/11A, M9410E/11E and S9110E in bypass frequency range (1310MHz~5GHz), the Receiver RF path has a bank of filters that come after the RF Attenuator in the signal path. Since this bank of filters precedes the mixer they are known as the “Prefilter” bank. Their purpose is to eliminate unwanted in-band mixing products by filtering out all but the desired frequencies before the signals get to the mixer. There are 13 prefilter bands to cover the frequencies between 9 kHz

and 6000 MHz. The Prefilter provides the necessary rejection of the unwanted signal.

Remote Command	`[:SENSe]:<measurement>:PFILter[:STATe] ON | OFF | 1 | 0` `[:SENSe]:<measurement>:PFILter[:STATe]?`

Example	Enable **High Freq Prefilter** for the Complex Spectrum Measurement in `BASIC` Mode:
	`:SPEC:PFIL ON`
	Enable **High Freq Prefilter** for the IQ Waveform Measurement, in any of several Modes:
	`:WAV:PFIL ON`
	Enable **High Freq Prefilter** for the Swept SA Measurement in `SA` Mode:
	`:SAN:PFIL ON`

Dependencies	Only appears in instruments based on M9410A/11A, e.g. M9411E, S9110E and S9110A. This control is only functional in limited frequency ranges:
Preset	See "Prefilter Presets" on page 232 below
State Saved	Saved in instrument state

Frequency range	Products or Port
Above 1310 MHz	M9410A/11A
1310 MHz to 5000 MHz	M9410E/11E RF port on S9110E

Prefilter Presets

Meas	Mode	Preset
SPEC	BASIC	OFF
WAV	BASIC, WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
MON	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA	OFF
RHO	WCDMA	OFF
CDP	WCDMA	OFF
PCON	WCDMA	OFF
EVMQ	WCDMA	OFF
CHP	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
OBW	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
ACP	WCDMA, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
SEM	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PST	WCDMA, WLAN, LTEAFDD, LTEATDD, 5GNR, VMA, SA	OFF
PVT	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
EVM	WLAN, LTEAFDD, LTEATDD, 5GNR	OFF
FLAT	WLAN	OFF
EVMM	WLAN	OFF
CEVM	LTEAFDD, LTEATDD	OFF

Meas	Mode	Preset
PAVT	5GNR, VMA	OFF
DDEM	VMA	OFF
OFDM	VMA	OFF
SAN	SA	ON
HARM	SA	ON

3.1.13 BW

Not supported in this measurement. The menu is blank.

3.1.14 Display

Opens the Display menu, which lets you configure display items for the current Mode, Measurement, View, or Window.

3.1.14.1 Meas Display

Contains controls for setting up the display for the current Measurement, View, or Window.

Bar Graph

Toggles the state of the bar(s) displayed in "ACP Graph" on page 174.

Remote Command	:DISPlay:PAMPlifier:BGRaph[:STATe] OFF | ON | 0 | 1 :DISPlay:PAMPlifier:BGRaph[:STATe]?
Example	:DISP:PAMP:BGR OFF :DISP:PAMP:BGR?
Preset	ON
State Saved	Saved in instrument state
Range	OFF|ON

Show Trace

Selects the trace(s) to be displayed in the windows: "Raw Main Time" on page 174, "ACP Graph" on page 174, "AM-AM" on page 173, and "AM-PM" on page 174.

Remote Command	:DISPlay:PAMPlifier:TRACe PREDpd | POSTdpd | BOTH

	`:DISPlay:PAMPlifier:TRACe?`
Example	`:DISP:PAMP:TRAC PRED` `:DISP:PAMP:TRAC?`
Preset	`BOTH`
State Saved	Saved in instrument state
Range	Pre-DPD | Post-DPD | Both

AM-AM Normalized

Specifies whether to display the normalized AM-AM results.

Remote Command	`:DISPlay:PAMPlifier:AMAM:NORMalized OFF | ON | 0 | 1` `:DISPlay:PAMPlifier:AMAM:NORMalized?`
Example	`:DISP:PAMP:AMAM:NORM OFF` `:DISP:PAMP:AMAM:NORM?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	On | Off

AM-AM Coefficient

Specifies whether to display AM-AM's coefficients at the bottom of "AM-AM" on page 173.

Remote Command	`:DISPlay:PAMPlifier:AMAM|AMPM:SHOW:COEFficient OFF | ON | 0 | 1` `:DISPlay:PAMPlifier:AMAM|AMPM:SHOW:COEFficient?`
Example	`:DISP:PAMP:AMAM:SHOW:COEF OFF` `:DISP:PAMP:AMAM:SHOW:COEF?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`

AM-PM Coefficient

Specifies whether to display AM-PM's coefficients at the bottom of "AM-PM" on page 174.

Remote Command	`:DISPlay:PAMPlifier:AMPM:SHOW:COEFficient OFF | ON | 0 | 1` `:DISPlay:PAMPlifier:AMPM:SHOW:COEFficient?`

Example	:DISP:PAMP:AMPM:SHOW:COEF OFF :DISP:PAMP:AMPM:SHOW:COEF?
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|ON

EVM Carrier Index

Selects the index of the component carrier of which the demodulation results are displayed in the windows: "EVM Error Summary" on page 177, "EVM vs. Power Graph" on page 176, "EVM vs. Power Metrics" on page 180, and "EVM Metrics" on page 174, when "Radio Format" on page 343 is NR5G or LTEAFDD.

Remote Command	:DISPlay:PAMPlifier:EVM:CARRier:INDex <integer> :DISPlay:PAMPlifier:EVM:CARRier:INDex?
Example	:DISP:PAMP:EVM:CARR:IND 1 :DISP:PAMP:EVM:CARR:IND?
Dependencies	Enabled only when Radio Format is NR5G or LTEAFDD and the number of component carriers is greater than 1. Grayed-out otherwise
Preset	1
State Saved	Saved in instrument state
Min	1
Max	Adjusted dynamically with the number of carriers

Report EVM in DB

See "Report EVM in DB" on page 356 under Meas Setup.

Raw Main Time Points

Sets the point number of the raw main time trace.

Remote Command	:DISPlay:PAMPlifier:TRACe:RFENvelope:POINt <integer> :DISPlay:PAMPlifier:TRACe:RFENvelope:POINt?
Example	:DISP:PAMP:TRAC:RFEN:POIN 2001 :DISP:PAMP:TRAC:RFEN:POIN?
Preset	2001
State Saved	Saved in instrument state
Min	501
Max	100001

AM-AM/AM-PM Fast Update Scale

Sometimes, the AM-AM/AM-PM trace will include more than 10,000,000 points, which negatively impacts display speed. This setting can decrease the point number to be displayed to be a degree that does not have significant impact on the display effect.

For example, if the scale value is 10, the whole display area is considered as a grid that includes 1000*1000 sub-grids. Each sub-grid only displays one point. The MAX point number to be displayed will be 1,000,000.

Remote Command	`:DISPlay:PAMPlifier:UPDate:FAST:SCALe <integer>` `:DISPlay:PAMPlifier:UPDate:FAST:SCALe?`
Example	`:DISPlay:PAMPlifier:UPDate:FAST:SCALe 10`
Notes	Changing this parameter triggers a new trace update
Couplings	There is no coupling between the scale value and the scale state
Preset	10
State Saved	Saved in instrument state
Min	1
Max	10

Auto Function

Remote Command	`:DISPlay:PAMPlifier:UPDate:FAST[:STATe] 1 | 0 | ON | OFF` `:DISPlay:PAMPlifier:UPDate:FAST[:STATe]?`
Preset	OFF
State Saved	Yes

AM-AM Fast Update Scale Result (Remote Query only)

Returns the AM-AM fast Update Scale result, which includes the original point number and the displayed point number.

Remote Command	`:DISPlay:PAMPlifier:UPDate:FAST:AMAM:RESult?`
Example	`:DISPlay:PAMPlifier:UPDate:FAST:AMAM:RESult?`
State Saved	No

AM-PM Fast Update Scale Result (Remote Query only)

Returns the AM-PM fast Update Scale result, which includes the original point number and the displayed point number.

Remote Command	`:DISPlay:PAMPlifier:UPDate:FAST:AMPM:RESult?`
Example	`:DISPlay:PAMPlifier:UPDate:FAST:AMPM:RESult?`
State Saved	No

SEM Result View

Selects the result view displayed in the window "SEM Metrics" on page 186.

View Name	Enumerated ID	Details
Abs Pwr Freq	`APFReq`	Displays the absolute power levels in dBm and the corresponding frequencies in the text window
Rel Pwr Freq	`RPFReq`	Displays the relative power levels in dBc and the corresponding frequencies in the text window
Integrated Power	`IPOWer`	Displays the absolute and relative power levels integrated throughout the bandwidths between the start and stop frequencies in the text window

View Selection by Name

Remote Command	`:DISPlay:PAMPlifier:SEMask:VIEW[:SELect] APFReq | RPFReq | IPOWer` `:DISPlay:PAMPlifier:SEMask:VIEW[:SELect]?`
Example	`:DISP:PAMP:SEM:VIEW IPOW` `:DISP:PAMP:SEM:VIEW?`
Preset	`APFReq`
State Saved	Saved in instrument state
Range	Abs Pwr Freq | Rel Pwr Freq | Integrated Power

Show Abs2 Limit

Shows or hides Abs2 limit parameters.

Remote Command	`:DISPlay:PAMPlifier:SEMask:OFFSet:SABSolute ON | OFF | 1 | 0` `:DISPlay:PAMPlifier:SEMask:OFFSet:SABSolute?`

Example	`:DISP:PAMP:SEM:OFFS:SABS 1` `:DISP:PAMP:SEM:OFFS:SABS?`
Preset	0
State Saved	Yes
Range	`ON|OFF`

3.1.14.2 View

Contains controls for selecting the current **View**, and for editing User Views.

View

See "Views" on page 169

User View

Lets you choose a View from the saved User Views for the current measurement. This panel only appears if a User View exists for the current measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:SELect <alphanumeric>` `:DISPlay:VIEW:ADVanced:SELect?`
Example	Select Baseband as the current View `:DISP:VIEW:ADV:SEL "Baseband"`

Notes	You must be in the measurement whose View you are trying to set to send the command. You can only set Views for the current measurement using this command
	For predefined views, the parameter is derived from the view name that is shown in the View list in the user interface. For example, if you are trying to select the Trace Zoom view in the Swept SA measurement, you send:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	because "Trace Zoom" is the name of the View as seen in the Mode/Meas dialog or in the Display, View menu
	You *cannot* use the legacy View parameter (which in this case would be `TZOom`) with `:DISP:VIEW:ADV:SEL`
	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. Thus, both of the following forms work:
	`:DISP:VIEW:ADV:SEL "Trace Zoom"`
	`:DISP:VIEW:ADV:SEL "TRACE ZOOM"`
	If the specified view is not a valid View, the query returns the `error message "-224, Illegal parameter value; View with the name <alphanumeric> does not exist"`
	If the display is disabled (via `:DISP:ENAB OFF`) then the `error message "-221, Settings`

	`conflict; View SCPI cannot be used while Display is disabled"` is generated
Backwards Compatibility SCPI	The legacy node `:DISPlay:VIEW[:SELect]` is retained for backwards compatibility, but it only supports predefined views

Restore Layout to Default

Restores the Layout to the default for Basic.

Modified Views are very temporary; if you exit the current measurement they are discarded, and they are not saved in State. To retain this View for later use, and to be able to return easily to your original Basic View, you can save your edited View as a "User View".

Save Layout as New View

Saves your new View as a User View. An alpha keyboard appears, which lets you name your new View; the default is the old View name plus a number.

Remote Command	`:DISPlay:VIEW:ADVanced:NAME <alphanumeric>`
Example	`:DISP:VIEW:ADV:NAME "Baseband"` Creates a new View named `Baseband` from the current View, and selects it as the current View
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If `<alphanumeric>` name already exists as a View, the error message "-224, Illegal parameter value; View <alphanumeric> already exists" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; User View SCPI cannot be used while Display is disabled" is generated

Re-Save User View

You can re-edit a User View; if you make changes, then an asterisk will appear next to the User View's name. You can then tap Re-Save User View to save it back to its existing name, or Save Layout as New View to add another, new User View.

This is a front panel function only, there is no remote command available to perform this function. To do this remotely, you must first perform Save Layout as New View, then delete the old User View and rename the new one with the name of the View you just deleted.

Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, an error occurs.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN "Baseband"`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` specifying the new name is already present in the list of View names, the `error message "-224, Illegal parameter value; View <alphanumeric> already exists"` is generated If the current View is a Predefined View, the `error message "-224, Illegal parameter value; Cannot rename a Predefined View`" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the `error message "-221, Settings conflict; View SCPI cannot be used while Display is disabled"` is generated

Delete User View

You can delete the current View if it is a User View. The default view becomes the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	`<alphanumeric>` is case insensitive; you can specify mixed case, however the name will be evaluated on a single case If the `<alphanumeric>` is not present in the list of View names, the `error message "-224, Illegal parameter value; View <alphanumeric> does not exist"` is generated If the current View is a Predefined View, the error message `"-224, Illegal parameter value; Cannot delete a Predefined View"` is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message `"-221, Settings conflict; View SCPI cannot be used while Display is disabled" is generated`

Delete All User Views

Deletes all previously saved User Views. The default view becomes the current view for the Measurement if a User View was the current view when this command was executed.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete:ALL`
Example	`:DISP:VIEW:ADV:DEL:ALL`
Notes	Disabled if there are no User Views

View Editor Remote Commands

The following remote commands help you manage Views and User Views. Note that the SCPI node for User Views handles both Predefined and User Views. The legacy nodes, `:DISPlay:VIEW[:SELect]` and `:DISPlay:VIEW:NSEL`, are retained for backwards compatibility, but they only support predefined views.

View Listing Query

Returns a string containing a comma-separated list of names for *all* the Views, including User Views, available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:CATalog?`
Example	`:DISP:VIEW:ADV:CAT?`
Notes	Returns a quoted string of the available Views for the current measurement, separated by commas. The list includes names for *all* the Views, including User Views, available for the current Measurement Example: `"Normal,Trace Zoom,Spectrogram,Baseband,myView1,yourView1"` No distinction is made between Predefined and User Views If you switch measurements with the display disabled (via `:DISP:ENAB OFF`), then query the list of available Views, the result is undefined

User View Listing Query

Returns a string containing a comma-separated list of names for *only* the User Views available for the current Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:USER:CATalog?`
Example	`:DISP:VIEW:ADV:USER:CAT?`
Notes	Returns a quoted string of the available User Views for the current measurement, separated by commas Example: `"Baseband,myView1,yourView1"` If you switch measurements with the display disabled (see "Display Enable (Remote Command Only)" on page 244), then query the list of available Views, the result is undefined

3.1.14.3 Annotations

Contains controls for setting up the annotation for the current Mode or Measurement.

Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

Remote Command	`:DISPlay:GRATicule[:STATe] OFF | ON | 0 | 1` `:DISPlay:GRATicule[:STATe]?`
Example	`:DISP:GRAT OFF`
Notes	The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis
Preset	`ON`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF|ON|0|1`
	`:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?`
	This command is accepted for backwards compatibility with older instruments, but the `WINDow`, `TRACe` and `GRID` parameters are ignored

Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the Trace section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ….

Remote Command	`:DISPlay:ANNotation:TRACe[:STATe] ON | OFF | 1 | 0` `:DISPlay:ANNotation:TRACe[:STATe]?`
Example	`:DISP:ANN:TRAC OFF`

Preset	WCDMA Modes	ON
	Other Modes	OFF
State Saved	Saved in instrument state	

Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When OFF, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the Trace section.

Remote Command	:DISPlay:ANNotation:SCReen[:STATe] OFF | ON | 0 | 1 :DISPlay:ANNotation:SCReen[:STATe]?
Example	:DISP:ANN:SCR OFF
Dependencies	Grayed-out and forced to OFF when System Display Settings, Annotation is OFF
Preset	ON This remains OFF through a Preset when System Display Settings, Annotation is set to OFF
State Saved	Saved in instrument state

Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

Remote Command	:DISPlay:ACTivefunc[:STATe] ON | OFF | 1 | 0 :DISPlay:ACTivefunc[:STATe]?
Example	:DISP:ACT OFF
Dependencies	Grayed out and forced to OFF when System Display Settings, Annotation is OFF
Preset	ON This remains OFF through a Preset when System Display Settings, Annotation is set to OFF
State Saved	Saved in instrument state

Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When OFF, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

Remote Command	:DISPlay:ANNotation:MBAR[:STATe] OFF | ON | 0 | 1 :DISPlay:ANNotation:MBAR[:STATe]?
Example	:DISP:ANN:MBAR OFF
Dependencies	Grayed out and forced to OFF when System Display Settings, Annotation is OFF
Preset	ON This remains OFF through a Preset when System Display Settings, Annotation is set to OFF
State Saved	Saved in instrument state

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. Theare three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending :SYSTem:DEFaults MISC or :DISPlay:ENABle ON (neither *RST nor :SYSTem:PRESet enable the display)
- and you are in remote operation, the display can be turned back on by pressing the Local or Esc keys, or by sending :SYSTem:DEFaults MISC or :DISPlay:ENABle ON (neither *RST nor :SYSTem:PRESet enable the display)
- and you are using either the :SYSTem:KLOCk command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely

If the display is OFF, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” or “221, Settings conflict; View SCPI cannot be used while Display is disabled”. These commands include:

Name	Command
Select User View	`:DISPlay:VIEW:ADVanced:SELect`
Rename User View	`:DISPlay:VIEW:ADVanced:REName`
Delete User View	`:DISPlay:VIEW:ADVanced:DELete`
Create User View	`:DISPlay:VIEW:ADVanced:NAME`
Select Screen	`:INSTrument:SCReen:SELect`
Delete Screen	`:INSTrument:SCReen:DELete`
Delete All But This Screen	`:INSTrument:SCReen:DELete:ALL`
Add Screen	`:INSTrument:SCReen:CREate`
Rename Screen	`:INSTrument:SCReen:REName`
Sequencer On/Off	`:SYSTem:SEQuencer`

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	`:DISP:ENAB OFF` turns Backlight `OFF` and `:DISP:ENAB ON` turns Backlight `ON`, but changing Backlight settings does *not* change the state of `:DISP:ENAB`
Preset	`ON` Set by `:SYST:DEF MISC`, but not affected by `*RST` or `:SYSTem:PRESet`
State Saved	Not saved in instrument state
Backwards Compatibility Notes	`:SYST:PRES` no longer turns on `:DISPlay:ENABle` as it did in legacy analyzers

3.1.15 Frequency

Opens the Frequency menu, which contains controls that let you control the frequency parameters of the instrument.

3.1.15.1 Settings

Lets you control the frequency parameters of the instrument.

Carrier Reference Frequency

Sets the reference frequency for all carriers. The center frequencies of carriers are defined as offset frequencies from this value.

Remote Command	`[:SENSe]:CCARrier:REFerence <freq>`

	`[:SENSe]:CCARrier:REFerence?`
Example	`:CCAR:REF 2GHz` `:CCAR:REF?`
Dependencies	The value synchronizes with the following parameters according to "Radio Format" on page 343: **Radio Format** / **Synchronizes to** `NR5G` — Carrier Reference Frequency of the EVM measurement in 5GNR Mode `WLAN` — Center Frequency of the Modulation Accuracy measurement in WLAN Mode `LTEAFDD` — Carrier Reference Frequency of the EVM measurement in LTEA-FDD Mode See "EVM State" on page 355
Preset	1GHz
State Saved	Saved in instrument state
Min/Max	Depends on instrument minimum/maximum center frequency. Same as **Center Frequency**

3.1.16 Marker

Lets you select, set up, and control markers for the measurement.

If there is no active marker, pressing **Marker** enables marker 1, sets it to **Normal**, and places it at the default position on the screen.

The default position of a marker in this measurement depends on the marker trace, as in the table below:

Marker Trace	Default Position
ACP (Pre-DPD)	The horizontal center of the trace
ACP (Post-DPD)	
SEM (Pre-DPD)	
SEM (Post-DPD)	
Raw Main Time (Pre-DPD)	The left-most position of the trace
Raw Main Time (Post-DPD)	
EVM vs. Power	
WLAN NC-EVM vs. Power	
DPD Iteration RMS EVM	
DPD Iteration Delta EVM	
DPD Iteration Offset A Lower	
DPD Iteration Offset A Upper	
DPD Iteration Offset B Lower	
DPD Iteration Offset B Upper	
Coarse Alignment Fitting Curve Lower	The current envelope delay value displayed on the GUI

Marker Trace	Default Position
Coarse Alignment Fitting Curve Upper	
Balance Alignment Fitting Curve	

3.1.16.1 Select Marker

Specifies the selected marker that is affected when users change the marker settings, perform a peak search, etc., on the GUI.

This control appears above the menu panel, indicating that it applies to all controls on the marker menu panels.

In any menu that includes Select Marker, the first control is always Marker X.

Preset	Marker 1
State Saved	The number of the selected marker is saved in the instrument state

3.1.16.2 Settings

Includes the Marker X active function, a radio button for selecting of the marker control mode (Normal, Delta, or Off) of the specified marker, as well as some additional functions that facilitate the users using the markers.

Marker X

Sets the Marker X position of a specified marker in the current X-axis unit. If the marker is Off, the remote command has no effect.

The label and the value of the control change if the marker moves to a trace of another domain.

If the marker mode is Normal, the Marker X value indicates the absolute position of the marker on a trace.

If the mode is Delta, the Marker X value indicates the relative position to its reference marker.

The valid X positions are the actual data points on the trace; markers cannot be located between points. If you send a command that attempts to place the marker between two adjacent points, the X value snaps to the closest one.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:X <real>` `:CALCulate:PAMPlifier:MARKer[1]|2|…|12:X?`
Example	`:CALC:PAMP:MARK:X 0.325` `:CALC:PAMP:MARK:X?`

Notes	Suffix representing the unit is not supported by this command. The default unit of **Marker X** varies with the marker trace:

Marker Trace	Normal Marker	Delta Marker
ACP (Pre-DPD) ACP (Post-DPD) SEM (Pre-DPD) SEM (Post-DPD)	Hz	Hz
Raw Main Time (Pre-DPD) Raw Main Time (Post-DPD) Coarse Alignment Fitting Curve Lower Coarse Alignment Fitting Curve Upper Balance Alignment	s	s
EVM vs. Power WLAN NC-EVM vs. Power	dBm	dB
DPD Iteration RMS EVM DPD Iteration Delta EVM DPD Iteration ACP Offset A Lower DPD Iteration ACP Offset A Upper DPD Iteration ACP Offset B Lower DPD Iteration ACP Offset B Upper	No unit	No unit

If any suffix is sent, an error "suffix not allowed" is generated

State Saved	Saved in instrument state
Min/Max	–/+infinity

Marker X Axis Position (Remote Command only)

Sets the marker X position in absolute trace point number. Has no effect if the marker is **Off**.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:X:POSition <real>` `:CALCulate:PAMPlifier:MARKer[1]|2|…|12:X:POSition?`
Example	`:CALC:PAMP:MARK10:X:POS 500` `:CALC:PAMP:MARK10:X:POS?`
Notes	The query returns the absolute index of the point on which the marker is placed
Preset	Markers are turned **Off**, so the query returns Not a Number (NAN)
State Saved	No
Min/Max	–/+infinity

Marker Y-Axis Value (Remote Query only)

Returns the marker Y-Axis value.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:Y?`
Example	`:CALC:PAMP:MARK11:Y?`
State Saved	No

Marker Mode

Sets the marker control mode to Normal, Delta, or Off. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the specified marker is Off, pressing Marker sets it to Normal and places it at the default position on the trace.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:MODE POSition | DELTa | OFF` `:CALCulate:PAMPlifier:MARKer[1]|2|…|12:MODE?`
Example	`:CALC:PAMP:MARK:MODE POS` `:CALC:PAMP:MARK:MODE?`
Preset	`OFF`
State Saved	Saved in instrument state
Range	`Normal|Delta|Off`
Annotation	Mkr # <X value> and <Marker value> upper right on graph

Backwards Compatibility SCPI

Sets or queries the state of the specified marker. Setting a marker that is `OFF` to `ON` (1) puts it in Normal mode and places it at the default position on its marker trace.

Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`
Backwards Compatibility SCPI	`:CALCulate:PAMPlifier:MARKer[1] | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12:STATe OFF | ON | 0 | 1` `:CALCulate:PAMPlifier:MARKer[1] | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12:STATe?`
Backwards Compatibility SCPI Example	`:CALC:PAMP:MARK3:STAT ON` `:CALC:PAMP:MARK3:STAT?`

Delta Marker (Reset Delta)

Changes the selected marker into a **Delta** marker. If the selected marker is already a **Delta** marker, its reference marker is moved to the current position of the selected marker, thus resetting the delta to zero.

Marker Settings Diagram

Lets you configure the marker system using a visual utility.

All Markers Off

Turns off all markers.

Remote Command	`:CALCulate:PAMPlifier:MARKer:AOFF`
Example	`:CALC:PAMP:MARK:AOFF`

3.1.16.3 Peak Search

The controls on this tab let you move a specified marker to a desired peak position of the signal.

Marker X

This is the fundamental control for moving a marker around on the trace. It is the same as "Marker X" on page 247 on the **Settings** tab.

Peak Search

Moves the specified marker to the trace point that has the maximum y-axis value on the trace on which the marker is placed.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:MAXimum`
Example	`:CALC:PAMP:MARK2:MAX`
Notes	Sending this command selects the subopcoded marker

Next Peak

Moves the specified marker to the peak that is next lower in amplitude than the current marker value. Only peaks that meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, a “no peak found” message is generated, and the marker is not moved.

If the specified marker was Off, then it is turned on as a Normal marker and a peak search is performed.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:MAXimum:NEXT`
Example	`:CALC:PAMP:MARK2:MAX:NEXT`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of the saved state

Next Pk Right

Moves the specified marker to the nearest peak right of the current marker.

If the specified marker was Off, then it is turned on as a Normal marker and a peak search is performed.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:MAXimum:RIGHt`
Example	`:CALC:PAMP:MARK2:MAX:RIGH`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of the saved state

Next Pk Left

Moves the specified marker to the nearest peak left of the current marker.

If the specified marker was Off, then it is turned on as a Normal marker and a peak search is performed.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:MAXimum:LEFT`
Example	`:CALC:PAMP:MARK2:MAX:LEFT`
State Saved	Not part of the saved state

Pk-Pk Search

Calculates and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis values. The specified marker is

placed at the minimum value on its marker trace, and the reference marker of the specified marker at the maximum.

This function turns on the reference marker and sets its mode to **Normal** if it is not on.

If the specified marker is **Off**, a **Delta** type marker is turned on and the peak-to-peak search is done. If the specified marker is on, but it is not a **Delta** marker, then it is changed to delta, which turns on its reference marker as well if needed, and then it performs the peak-to-peak function.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:PTPeak`
Example	`:CALC:PAMP:MARK:PTP`
Notes	Turns on the Marker D active function Sending this command selects the subopcoded marker
Couplings	The specified marker becomes a **Delta** marker if not already in delta mode
State Saved	Not part of the saved state

Minimum Peak

Moves the specified marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches do not have to meet the peak search criteria. The search looks for the lowest y-axis value. If the specified marker is **Off**, it is turned on before the minimum search is performed.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:MINimum`
Example	`:CALC:PAMP:MARK:MIN`
Notes	Sending this command selects the subopcoded marker
State Saved	Not part of saved state

Marker Delta

Pressing this control has exactly the same effect as pressing **Delta** in "Marker Mode" on page 249 on the **Settings** tab. The selected marker becomes a **Delta** marker. If the selected marker is already a **Delta** marker, the reference marker is moved to the current position of the selected marker, thus resetting the delta to zero.

The control is duplicated here to allow you to conveniently perform a peak search and change the marker's control mode to **Delta** without having to access two separate menus.

3.1.16.4 Properties

The controls on this tab are used to set certain properties of the selected marker.

Marker X

This is the fundamental control for moving a marker around on the trace. It is the same as "Marker X" on page 247 on the **Settings** tab.

Relative To

Selects the marker to which the specified marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the "reference marker" for that marker. This attribute is set by the **Marker**, **Properties**, **Relative To** key. The marker must be a Delta marker to make this attribute relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:REFerence <integer>` `:CALCulate:PAMPlifier:MARKer[1]|2|…|12:REFerence?`
Example	`:CALC:PAMP:MARK:REF 8` `:CALC:PAMP:MARK:REF?`
Notes	This command causes the marker specified with the subopcode to become selected Range (for remote command): 1 to 12. If the range is exceeded, the value is clipped A marker cannot be relative to itself, so that choice is not available, and if sent from SCPI generates error -221: "Settings conflict; marker cannot be relative to itself" The query returns a single value (the specified marker numbers relative marker)
Couplings	If the reference marker is **Off**, it is turned on in **Normal** mode at the delta marker location
Preset	The preset default **Relative To** marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then its default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1 Set to default by **Restore Mode Defaults**. Not reset by **Marker Off**, **All Markers Off**, or **Preset**
State Saved	Saved in instrument state. Not affected by **Marker Off** and hence not affected by **Preset** or power cycle
Min	1
Max	12
Annunciation	Appears in the marker label of a **Delta** marker

Marker Trace

Assigns the specified marker to the designated trace:

Trace	SCPI
ACP [Pre-DPD]	ACPPRE
Raw Main Time [Pre-DPD]	RMTPRE
ACP [Post-DPD]	ACPPOST
Raw Main Time [Post-DPD]	RMTPOST
EVM vs. Power	EVMPower
DPD Iteration RMS EVM	REVMITER
DPD Iteration Delta EVM	DEVMITER
DPD Iteration ACP Offset A Lower	ACPLower
DPD Iteration ACP Offset A Upper	ACPUpper
Coarse Alignment Fitting Curve Lower	CAFLower
Coarse Alignment Fitting Curve Upper	CAFUpper
Balance Alignment Fitting Curve	BAFCurve
DPD Iteration ACP Offset B Lower	ACPBLower
DPD Iteration ACP Offset B Upper	ACPBUpper
WLAN NC-EVM vs. Power	NEVPower
SEM [Pre-DPD]	SEMPRE
SEM [Post-DPD)	SEMPOST

Remote Command	`:CALCulate:PAMPlifier:MARKer[1]|2|…|12:TRACe ACPPRE | RMTPRE | ACPPOST | RMTPOST | EVMPower | REVMITER | DEVMITER | ACPLower | ACPUpper | CAFLower | CAFUpper | BAFCurve | ACPBLower | ACPBUpper | SEMPRE | SEMPOST` `:CALCulate:PAMPlifier:MARKer[1]|2|…|12:TRACe?`
Example	`:CALC:PAMP:MARK:TRAC RMTPRE` `:CALC:PAMP:MARK:TRAC?`
Preset	ACPPRE
State Saved	Yes
Range	ACP (Pre-DPD) | Raw Main Time (Pre-DPD) | ACP (Post-DPD) | Raw Main Time (Post-DPD) | EVM vs. Power | DPD Iteration RMS EVM | DPD Iteration Delta EVM | DPD Iteration ACP Offset A Lower | DPD Iteration ACP Offset A Upper| Coarse Alignment Fitting Curve Lower| Coarse Alignment Fitting Curve Upper| Balance Alignment Fitting Curve| DPD Iteration ACP Offset B Lower | DPD Iteration ACP Offset B Upper | SEM (Pre-DPD) | SEM (Post-DPD)

Marker Settings Diagram

Lets you configure the marker system using a visual utility. The same as "Marker Settings Diagram" on page 250 on the **Settings** tab.

3.1.17 Meas Setup

Contains functions for setting up the measurement parameters.

3.1.17.1 Settings

Contains **Meas Setup** basic functions.

Meas Type

Single Power	SPOWer	The measurement is only performed on the power defined by Amplifier settings
Power Sweep	PSWeep	The measurement is performed on each power level specified by "Power Sweep Config" on page 258. At each level, EVM (if "EVM State" on page 355 is ON) of the signal at PA output is measured. After completion of sweeping, a trace of EVM vs. Power (if **EVM State** is ON) becomes available

Remote Command	`[:SENSe]:PAMPlifier:MEAS:TYPE SPOWer | PSWeep` `[:SENSe]:PAMPlifier:MEAS:TYPE?`
Example	`:PAMP:MEAS:TYPE SPOW` `:PAMP:MEAS:TYPE?`
Dependencies	Only enabled when EVM is available, which includes the following: – 5GNR Mode (N9085) is preloaded when Radio Format is NR5G – WLAN Mode (N9077) is preloaded when Radio Format is WLAN – LTEA-FDD Mode (N9080) is preloaded when Radio Format is LTEAFDD **Meas Type** changes back to SPOWer when "EVM State" on page 355 is switched off **Power Sweep** switches off and is disabled after envelope tracking is on. It is enabled after envelope tracking is off
Couplings	The measurement is put into **Single** mode when **Meas Type** is PSWeep **View** changes to "EVM vs. Power" on page 171 when **Meas Type** is PSWeep, and changes to "Normal" on page 171 when **Meas Type** is SPOWer, if the active view is not **Normal** **EVM State** switches ON automatically when **Meas Type** is PSWeep, if EVM is available "Measure DPD Iteration" on page 312 is OFF and disabled when **Power Sweep** is ON
Preset	SPOWer
State Saved	Saved in instrument state
Range	Single Power | Power Sweep

IQ Coherent Averaging

If this setting is ON, the total capture time is multiplied by the IQ coherent averaging number. The captured data is then divided into multiple segments. Phases of each segment are corrected before I data and Q data are averaged separately. This feature aims to reduce the impact of the noise and help you to evaluate the impact of distortions.

Remote Command	`[:SENSe]:PAMPlifier:IQ:AVERage[:STATe] ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:IQ:AVERage[:STATe]?`
Example	`:PAMP:IQ:AVER ON` `:PAMP:IQ:AVER?`
Dependencies	Switched ON when "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `ILControl`
Couplings	"Burst Shape & Mask State" on page 292 and ACP "Noise Correction" on page 346 are disabled and switched OFF when **IQ coherent averaging** is ON, and are enabled otherwise
Preset	OFF
State Saved	Saved in instrument state

IQ Coherent Averaging Number

Sets the number for IQ coherent averaging.

Remote Command	`[:SENSe]:PAMPlifier:IQ:AVERage:COUNt <integer>` `[:SENSe]:PAMPlifier:IQ:AVERage:COUNt?`
Example	`:PAMP:IQ:AVER:COUN 10` `:PAMP:IQ:AVER:COUN?`
Dependencies	Changes to 6 when "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `ILControl`
Preset	10
State Saved	Saved in instrument state
Min	2
Max	50 For debug bits, the maximum value is 10000

IQ Average Data Acquisition Type

Toggles the data acquisition type of "IQ Coherent Averaging" on page 256.

Simultaneous (Direct)	SDIRect	The sample rate applied by each sub-measurement is increased to an integral multiple of the sample rate the reference waveform from the original sample rate applied

			by the sub-measurement when **IQ Coherent Averaging** was `OFF` This allows the effective acquired data of each average iteration to be extracted directly from the entire data chunk and averaged directly. This method is more intuitive, and may be (not necessarily) faster than Simultaneous (Filtered)
	Simultaneous (Filtered)	`SFILtered`	The sample rate does not change after **IQ Coherent Averaging** is `ON`. Since the sample rate of the sub-measurement is not necessarily an integral multiple of that of the reference waveform, some rounding errors will occur when the acquired data of each averaging iteration is extracted from the data chunk. A fractional delay filter is applied to compensate for the trivial delay before the data is averaged

Remote Command	`[:SENSe]:PAMPlifier:IQ:AVERage:TYPE SDIRect | SFILtered` `[:SENSe]:PAMPlifier:IQ:AVERage:TYPE?`
Example	`:PAMP:IQ:AVER:TYPE SFIL` `:PAMP:IQ:AVER:TYPE?`
Preset	`SFILtered`
State Saved	Saved in instrument state
Range	Simultaneous (Direct) | Simultaneous (Filtered)

Meas Type

Single Power	`SPOWer`	The measurement is only performed on the power defined by Amplifier settings
Power Sweep	`PSWeep`	The measurement is performed on each power level specified by "Power Sweep Config" on page 258. At each level, EVM (if "EVM State" on page 355 is `ON`) of the signal at PA output is measured. After completion of sweeping, a trace of EVM vs. Power (if **EVM State** is `ON`) becomes available

Remote Command	`[:SENSe]:PAMPlifier:MEAS:TYPE SPOWer | PSWeep` `[:SENSe]:PAMPlifier:MEAS:TYPE?`
Example	`:PAMP:MEAS:TYPE SPOW` `:PAMP:MEAS:TYPE?`
Dependencies	Only enabled when EVM is available, which includes the following: – 5GNR Mode (N9085) is preloaded when Radio Format is `NR5G` – WLAN Mode (N9077) is preloaded when Radio Format is `WLAN` – LTEA-FDD Mode (N9080) is preloaded when Radio Format is `LTEAFDD`

	Meas Type changes back to `SPOWer` when "EVM State" on page 355 is switched off **Power Sweep** switches off and is disabled after envelope tracking is on. It is enabled after envelope tracking is off
Couplings	The measurement is put into **Single** mode when **Meas Type** is `PSWeep` **View** changes to "EVM vs. Power" on page 171 when **Meas Type** is `PSWeep`, and changes to "Normal" on page 171 when **Meas Type** is `SPOWer`, if the active view is not **Normal** **EVM State** switches `ON` automatically when **Meas Type** is `PSWeep`, if EVM is available "Measure DPD Iteration" on page 312 is `OFF` and disabled when **Power Sweep** is `ON`
Preset	`SPOWer`
State Saved	Saved in instrument state
Range	Single Power | Power Sweep

Power Sweep Config

Power Control Mode

See "Power Control Mode" on page 340 under **Amplifier**.

Single DPD Extraction

Specifies whether the DPD model extraction is performed just at the first power level, or at each power level above Min Power with DPD when "Meas Type" on page 257 is `PSWeep`.

Remote Command	`[:SENSe]:PAMPlifier:DPD:SINGle:EXTRaction ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:DPD:SINGle:EXTRaction?`
Example	`:PAMP:DPD:SING:EXTR 1` `:PAMP:DPD:SING:EXTR?`
Preset	`OFF`
State Saved	Saved in instrument state

PA Input Start Power

Specifies the start power level of the power sweep when "Power Control Mode" on page 340 is `PAINput`.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:IN:STARt <real>` `[:SENSe]:PAMPlifier:POWer:SWEep:IN:STARt?`
Example	`:PAMP:POW:SWE:IN:STAR 0`

	`:PAMP:POW:SWE:IN:STAR?`
Dependencies	The maximum value of this parameter depends on the Max Input Power, Gain, Loss Out and the maximum input level of the spectrum analyzer as follows: The maximum value = min of (Max Input Power, Maximum input power level of the spectrum analyzer - Gain + Loss Out) Visible only when "Power Control Mode" on page 340 is `PAINput`
Couplings	Affects the minimum value of "PA Input Power Step" on page 259 as follows: The minimum of **PA Input Power Step** = (**PA Input Start Power** – **PA Input Stop Power**) / 1000
Preset	–20
State Saved	Saved in instrument state
Min	–100
Max	0

PA Input Stop Power

Specifies the stop power level of the power sweep when "Power Control Mode" on page 340 is `PAINput`.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:IN:STOP <real>` `[:SENSe]:PAMPlifier:POWer:SWEep:IN:STOP?`
Example	`:PAMP:POW:SWE:IN:STOP 0` `:PAMP:POW:SWE:IN:STOP?`
Dependencies	The maximum value of this parameter depends on the Max Input Power, Gain, Loss Out and the maximum input level of the spectrum analyzer as follows: The maximum value = min of (Max Input Power, Maximum input power level of the spectrum analyzer - Gain + Loss Out) Visible only when "Power Control Mode" on page 340 is `PAINput`
Couplings	Affects the minimum value of "PA Input Power Step" on page 259 as follows: The minimum of **PA Input Power Step** = (**PA Input Start Power** – **PA Input Stop Power**) / 1000
Preset	0
State Saved	Saved in instrument state
Min	–100
Max	0

PA Input Power Step

Specifies the power increment value of the power sweep when "Power Control Mode" on page 340 is `PAINput`.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:IN:STEP <real>`

	`[:SENSe]:PAMPlifier:POWer:SWEep:IN:STEP?`
Example	`:PAMP:POW:SWE:IN:STEP 1` `:PAMP:POW:SWE:IN:STEP?`
Dependencies	The minimum of **PA Input Power Step** = (**PA Input Start Power** – **PA Input Stop Power**) / 1000 Visible only when "Power Control Mode" on page 340 is `PAINput`
Preset	1
State Saved	Saved in instrument state
Min	0
Max	20

PA Input DPD Threshold

Specifies the DPD threshold level when "Power Control Mode" on page 340 is `PAINput`. DPD model is only applied when the PA Input Power is greater than or equals to the DPD threshold level during the power sweep if "DPD State" on page 307 is `ON`.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:IN:DTHReshold <real>` `[:SENSe]:PAMPlifier:POWer:SWEep:IN:DTHReshold?`
Example	`:PAMP:POW:SWE:IN:DTHR 0` `:PAMP:POW:SWE:IN:DTHR?`
Dependencies	Visible only when "Power Control Mode" on page 340 is `PAINput`
Preset	–20
State Saved	Saved in instrument state
Min/Max	–/+100

PA Output Start Power

Specifies the start power level of the power sweep when "Power Control Mode" on page 340 is `PAOutput`.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:OUT:STARt <real>` `[:SENSe]:PAMPlifier:POWer:SWEep:OUT:STARt?`
Example	`:PAMP:POW:SWE:OUT:STAR 0` `:PAMP:POW:SWE:OUT:STAR?`
Dependencies	The maximum value of this parameter depends on the Max Input Power, Gain, Loss Out and the maximum input level of the spectrum analyzer as follows: The maximum value = min of (Max Input Power + Gain, the maximum input power level of the spectrum analyzer + Loss Out)

	Visible only when "Power Control Mode" on page 340 is PAOutput
Couplings	Affects the minimum value of the PA Output Power Step as follows: The minimum of PA Output Power Step = (PA Output Start Power – PA Output Stop Power) / 1000
Preset	–20
State Saved	Saved in instrument state
Min	–100
Max	0

PA Output Stop Power

Specifies the stop power level of the power sweep when "Power Control Mode" on page 340 is PAOutput.

Remote Command	[:SENSe]:PAMPlifier:POWer:SWEep:OUT:STOP <real> [:SENSe]:PAMPlifier:POWer:SWEep:OUT:STOP?
Example	:PAMP:POW:SWE:OUT:STOP 0 :PAMP:POW:SWE:OUT:STOP?
Dependencies	The maximum value of this parameter depends on the Max Input Power, Gain, Loss Out and the maximum input level of the spectrum analyzer as follows: The maximum value = min of (Max Input Power + Gain, the maximum input power level of the spectrum analyzer + Loss Out) Visible only when "Power Control Mode" on page 340 is PAOutput
Couplings	Affects the minimum value of the PA Output Power Step as follows: The minimum of PA Output Power Step = (PA Output Start Power – PA Output Stop Power) / 1000
Preset	0
State Saved	Saved in instrument state
Min	–100
Max	0

PA Output Power Step

Specifies the power increment value of the power sweep when "Power Control Mode" on page 340 is PAOutput.

Remote Command	[:SENSe]:PAMPlifier:POWer:SWEep:OUT:STEP <real> [:SENSe]:PAMPlifier:POWer:SWEep:OUT:STEP?
Example	:PAMP:POW:SWE:OUT:STEP 1 :PAMP:POW:SWE:OUT:STEP?
Dependencies	The minimum of PA Output Power Step = (PA Output Start Power – PA Output Stop Power) / 1000

	Visible only when "Power Control Mode" on page 340 is `PAOutput`
Preset	1
State Saved	Saved in instrument state
Min	0
Max	20

PA Output DPD Threshold

Specifies the DPD threshold level when "Power Control Mode" on page 340 is `PAOutput`. DPD model is only applied when the PA Output Power is greater than or equal to the DPD threshold level during the power sweep if "DPD State" on page 307 is `ON`.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:OUT:DTHReshold <real>` `[:SENSe]:PAMPlifier:POWer:SWEep:OUT:DTHReshold?`
Example	`:PAMP:POW:SWE:OUT:DTHR 0` `:PAMP:POW:SWE:OUT:DTHR?`
Dependencies	Only visible when "Power Control Mode" on page 340 is `PAOutput`
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+100

LNA

Only visible in M9415A/M9416A with LNA installed.

See "LNA" on page 214

Apply LNA Below Threshold

Available in M9415A, M9416A, M9415E, M9416E, S9115A, and M9410E, M9411E in frequency range 100K~380M and 5G~26.5G.

When the general LNA state is off, LNA can be applied to the data acquisition when the power level is less than or equals to the LNA threshold during the power sweep if the Apply LNA Below Threshold state is on. The LNA threshold is subjected to either the PA Input LNA Threshold or the PA Output LNA Threshold based on **Power Control Mode**.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:ALNA[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:POWer:SWEep:ALNA[:STATe]?`

Example	`:PAMP:POW:SWE:ALNA ON` `:PAMP:POW:SWE:ALNA?`
Dependencies	Only available in M9415A, M9416A Switched off and disabled when the LNA is on; enabled otherwise
Preset	`OFF`
State Saved	Saved in instrument state

PA Input LNA Threshold

Specifies the LNA threshold of the power sweep when "Power Control Mode" on page 340 is `PAINput`.

If **Apply LNA Below Threshold** is on during the power sweep when the PA Control Mode is PA Input, LNA will be applied to the data acquisition when the PA input power is lower than or equal to the LNA Threshold. LNA is not applied otherwise.

Only available in M9415A, M9416A.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:IN:LTHReshold <real>` `[:SENSe]:PAMPlifier:POWer:SWEep:IN:LTHReshold?`
Example	`:PAMP:POW:SWE:IN:LTHR 0` `:PAMP:POW:SWE:IN:LTHR?`
Dependencies	Visible only when "Power Control Mode" on page 340 is `PAINput`
Preset	–30
State Saved	Saved in instrument state
Min/Max	–/+100

PA Output LNA Threshold

Specifies the LNA threshold of the power sweep when "Power Control Mode" on page 340 is `PAOutput`.

If **Apply LNA Below Threshold** is `ON` during the power sweep, LNA will be applied to the data acquisition when the PA output power is lower than or equals to the LNA threshold. LNA is not applied otherwise.

Only available in M9415A, M9416A.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SWEep:OUT:LTHReshold <real>` `[:SENSe]:PAMPlifier:POWer:SWEep:OUT:LTHReshold?`
Example	`:PAMP:POW:SWE:OUT:LTHR 0` `:PAMP:POW:SWE:OUT:LTHR?`

Dependencies	Only visible when "Power Control Mode" on page 340 is `PAOutput`
Preset	–10
State Saved	Saved in instrument state
Min/Max	–/+100

Meas Preset

Restores all measurement parameters to their default values.

Remote Command	`:CONFigure:PAMPlifier`
Example	`:CONF:PAMP`
Notes	Restore all defaults of parameters

Launch MATLAB (GUI Only)

Starts a new MATLAB instance. If MATLAB is not installed on the spectrum analyzer, generates an error message “MATLAB cannot be launched” during the procedure.

The application then attempts to connect the MATLAB instance after MATLAB launches successfully. An information message “MATLAB is connected” appears if the connection succeeds. Error message “MATLAB cannot be connected” appears otherwise.

Any other error occurring during the procedure is displayed in one error message.

3.1.17.2 Meas Standard

Contains Radio Std and Carriers settings.

Radio Std lets you configure the analyzer to match the measurement standard of your signal. When you change the Radio Std, BW will be applied to each Carrier. Furthermore, any new Carriers will use the same BW you have applied.

Carriers configuration let you configure the analyzer to match the carriers of your signal.

Radio Std Presets

Presets the following parameters according to the selected radio format:

Number of Carriers, Carrier Bandwidth, Carrier Frequency Offset, Carrier Coupling, Carrier Pwr Present, Carrier Measurement Noise Bandwidth, Carrier Method, Carrier Filter Alpha, Offset Frequency Define, Offset Frequency, Offset Integration Bandwidth, Offset Side, Offset Method, Offset Filter Alpha, and Radio Format, etc.

EVM is switched off before preset.

Remote Command	`[:SENSe]:PAMPlifier:RADio:STANdard NRBS5F1 | NRBS10F1 | NRBS15F1 | NRBS20F1 | NRBS25F1 | NRBS30F1 | NRBS40F1 | NRBS50F1 | NRBS50F2 | NRBS60F1 | NRBS70F1 | NRBS80F1 | NRBS90F1 | NRBS100F1 | NRBS100F2 | NRBS200F2 | NRBS400F2 | NRMS5F1 | NRMS10F1 | NRMS15F1 | NRMS20F1 | NRMS25F1 | NRMS30F1 | NRMS40F1 | NRMS50F1 | NRMS50F2 | NRMS60F1 | NRMS70F1 | NRMS80F1 | NRMS90F1 | NRMS100F1 | NRMS100F2 | NRMS200F2 | NRMS400F2 | AG | N20 | N40 | AC20 | AC40 | AC80 | AC160 | AX20 | AX40 | AX80 | AX160 | BE20 | BE40 | BE80 | BE160 | BE320 | BN20 | BN40 | BN80 | BN160 | BN320 | LTEFBSB1M4 | LTEFBSB3M | LTEFBSB5M | LTEFBSB10M | LTEFBSB15M | LTEFBSB20M | LTEFMSB1M4 | LTEFMSB3M | LTEFMSB5M | LTEFMSB10M | LTEFMSB15M | LTEFMSB20M`  `[:SENSe]:PAMPlifier:RADio:STANdard?`

Example	`:PAMP:RAD:STAN NRBS100F1`
	
	`:PAMP:RAD:STAN?`

Couplings	The 5GNR Frequency Range is automatically preset to Standard for backwards compatibility when the selected radio standard is one of 5GNR's
Preset	`NRBS100F1`
State Saved	Saved in instrument state
Range	`NR_BS_FR1_5M | NR_BS_FR1_10M | NR_BS_FR1_15M | NR_BS_FR1_20M | NR_BS_FR1_25M | NR_BS_FR1_30M | NR_BS_FR1_40M | NR_BS_FR1_50M | NR_BS_FR2_50M | NR_BS_FR1_60M | NR_BS_FR1_70M | NR_BS_FR1_80M | NR_BS_FR1_90M | NR_BS_FR1_100M | NR_BS_FR2_100M | NR_BS_FR2_200M | NR_BS_FR2_400M | NR_MS_FR1_5M | NR_MS_FR1_10M | NR_MS_FR1_15M | NR_MS_FR1_20M | NR_MS_FR1_25M | NR_MS_FR1_30M | NR_MS_FR1_40M | NR_MS_FR1_50M | NR_MS_FR2_50M | NR_MS_FR1_60M | NR_MS_FR1_70M | NR_MS_FR1_80M | NR_MS_FR1_90M | NR_MS_FR1_100M | NR_MS_FR2_100M | NR_MS_FR2_200M | NR_MS_FR2_400M | 802.11a/g/j/p (OFDM 20 MHz) | 802.11n (20 MHz) | 802.11n (40 MHz) | 802.11ac (20 MHz) | 802.11ac (40 MHz) | 802.11ac (80 MHz) | 802.11ac (160MHz) | 802.11ax (20 MHz) | 802.11ax (40 MHz) | 802.11ax (80 MHz) | 802.11ax (160MHz) | 802.11be (20 MHz) | 802.11be (40 MHz) | 802.11be (80 MHz) | 802.11be (160MHz) | 802.11be (320MHz) | 802.11bn (20 MHz) | 802.11bn (40 MHz) | 802.11bn (80 MHz) | 802.11bn (160MHz) | 802.11bn (320MHz) | FDDLTE_BS_B1M4 (6RB) | FDDLTE_BS_B3M (15RB) | FDDLTE_BS_B5M (25RB) | FDDLTE_BS_B10M (50RB) | FDDLTE_BS_B15M (75RB) | FDDLTE_BS_B20M (100RB) | FDDLTE_MS_B1M4 (6RB) | FDDLTE_MS_B3M (15RB) | FDDLTE_MS_B5M (25RB) | FDDLTE_MS_B10M (50RB) | FDDLTE_MS_B15M (75RB) | FDDLTE_MS_B20M (100RB)`

Number of Carriers

Specifies the number of carriers to be measured.

Remote Command	`[:SENSe]:PAMPlifier:CARRier:COUNt`

Example	`:PAMP:CARR:COUN 1`
	
	`:PAMP:CARR:COUN?`

Dependencies	Grayed-out when "EVM State" on page 355 is ON, because the carrier-related settings are synchronized to one of the following according to "Radio Format" on page 343:

	Radio Format	Synchronized to
	WLAN	Modulation Accuracy measurement of N9077E
	NR5G	EVM measurement of N9085E
	LTEAFDD	EVM measurement of N9080E
Preset	1	
State Saved	Saved in instrument state	
Min/Max	1/18	

Configure Carriers

Specifies the configuration of the carriers.

The columns of the table in the **Carrier Configuration** dialog are:

- "Couple to #1" on page 266
- "Carrier Bandwidth" on page 267
- "Carrier Frequency Offset" on page 267
- "Carrier Power Present" on page 268
- "ACP Carrier Measurement Noise Bandwidth" on page 268
- "SEM Carrier Measurement Noise Bandwidth" on page 268

Couple to #1

Couples carrier settings to carrier #1. The coupled parameters are Carrier Power Present, Carrier Bandwidth, Carrier Measurement Noise Bandwidth, Carrier Method, and Carrier Filter Alpha.

Remote Command	`[:SENSe]:PAMPlifier:CARRier:LIST:COUPle OFF | ON | 0 | 1, …` `[:SENSe]:PAMPlifier:CARRier:LIST:COUPle?`
Example	`:PAMP:CARR:LIST:COUP OFF` `:PAMP:CARR:LIST:COUP?`
Notes	When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, so if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged, unless the number of values sent is greater than the number of carriers, in which case subsequent values are ignored
Couplings	When `ON`, the carrier settings are coupled to carrier #1. Coupled parameters are Carrier Power Present, Carrier Spacing, Carrier Measurement Noise Bandwidth, Carrier Method, and Carrier Filter Alpha When a setting is changed, Coupling is set to `OFF` automatically

	Carrier #1 is always ON and cannot be changed
Preset	ON
State Saved	Saved in instrument state

Carrier Bandwidth

Sets the bandwidth of carriers.

Remote Command	[:SENSe]:PAMPlifier:CARRier:LIST:WIDTh <freq>, … [:SENSe]:PAMPlifier:CARRier:LIST:WIDTh?
Example	:PAMP:CARR:LIST:WIDT 25kHz :PAMP:CARR:LIST:WIDT?
Notes	When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, so if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged, unless the number of values sent is greater than the number of carriers, in which case subsequent values are ignored
Couplings	Carrier Bandwidth of each carrier is always greater than or equal to the maximum value of the ACP Carrier Measurement Bandwidth and the SEM Carrier Measurement Bandwidth of the same carrier
Preset	100 MHz
State Saved	Saved in instrument state
Min/Max	10 Hz/ 2 GHz

Carrier Frequency Offset

Sets the carrier center frequency as offset from Carrier Ref Frequency.

Remote Command	[:SENSe]:PAMPlifier:CARRier:LIST:OFFSet <freq>, … [:SENSe]:PAMPlifier:CARRier:LIST:OFFSet?
Example	:PAMP:CARR:LIST:OFFS 10MHz :PAMP:CARR:LIST:OFFS?
Notes	When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, so if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged, unless the number of values sent is greater than the number of carriers, in which case subsequent values are ignored
Preset	0 Hz
State Saved	Saved in instrument state
Min/Max	–/+1GHz

Carrier Power Present

Configures the carrier present state of each carrier for the power measurements (ACP and SEM).

If you set **Carrier Power Present** of a carrier to `NO` when that carrier is currently configured as the reference carrier, the next carrier to the left (or the right if there are no carriers to the left) becomes the reference carrier.

Remote Command	`[:SENSe]:PAMPlifier:CARRier:LIST:PPResent YES | NO,…` `[:SENSe]:PAMPlifier:CARRier:LIST:PPResent?`
Example	`:PAMP:CARR:LIST:PPR YES` `:PAMP:CARR:LIST:PPR?`
Notes	When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, so if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged, unless the number of values sent is greater than the number of carriers, in which case subsequent values are ignored
Preset	`YES`
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:PPResent YES|NO,…` `[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:PPResent?`

ACP Carrier Measurement Noise Bandwidth

See "ACP Carrier Measurement Noise Bandwidth" on page 351 under ACP.

SEM Carrier Measurement Noise Bandwidth

See "SEM Carrier Measurement Noise Bandwidth" on page 375 under SEM.

Preset from Dependent Measurement

Presets the carrier-related and power-measurement-related parameters according to the settings of the dependent demodulation measurement, as specified by the selected "Radio Format" on page 343.

When **Radio Format** = `NR5G`, this function does the following:

Step	Action
1	Copies the following parameters from the Modulation Analysis measurement of 5G NR Application (N9085EM0E) to their counterparts in the PA measurement:

Step	Action	
	EVM measurement of 5GNR	PA Test
	Number of Component Carriers	Number of Carriers
	Carrier Ref Frequency	Carrier Ref Frequency
	Measure Carrier	Meas EVM
	Freq Offset of CC	Carrier Frequency Offset
2	Presets Carrier Spacing, ACP and SEM Carrier Integration BW based on the radio standard settings of the Modulation Analysis measurement of 5GNR Mode (N9085EM0E) For calculating the integration BW, the frequency range and the subcarrier spacing are required, and they are both taken from 5G NR Mode's Modulation Analysis measurement. Note that the subcarrier spacing taken from 5G NR Mode represents the minimum subcarrier spacing of a component carrier	
3	Synchronizes EVM Meas Time in the Power Amplifier measurement with the maximum search length among all the component carriers of the Modulation Analysis measurement of 5G NR Application (N9085EM0E)	
4	Presets ACP settings as follows:	
	Meas Time	Auto
	Offset Frequency Define	Carrier Center to Meas BW Center
	Offset Frequency State	On, Off, Off, Off, Off, Off
	Offset Frequency	The value of Carrier Spacing of the first CC*
	Offset Integ BW	The value of Carrier Integ BW of the first CC*
	Offset Method	Integration BW
	Offset Filter Alpha	0.22
	Offset Side	Both
	* For multi-CC case scenarios, when the component carriers are not configured with the identical settings, which result in different carrier spacing or different carrier integration bandwidth, the ACP offset in Power Amplifier measurement will be set based on the first component carrier	
5	Presets SEM settings as follows	
	Meas Time	Auto
	Channel RRC Filter	Off
	Filter Alpha	0.22
	Show Abs2 Limit	Off (FR1, FR2(MS)) / On (FR2(BS))
	Offset Frequency Define	Carrier Edge to Meas BW Center (FR1, FR2(MS)) RF Bandwidth Edge to Meas BW Center (FR2(BS))
	Measurement Type	Total Power Reference
	Power Reference Type	Max Power Carrier (FR1(BS))/ RF Bandwidth (FR1(MS), FR2)

Step	Action	
	Offset Frequency State	On, On, On, On, Off, Off (FR1) On, On, On, Off, Off, Off (FR2(BS)) On, On, Off, Off, Off, Off (FR2(MS))
	Offset Side	Both
	Fail Mask	Absolute
	Fail Mask 2	Off (FR1, FR2(MS)) / OR Abs2 (FR2(BS))
	Those not included in the table above depend on the radio standard of the first CC	

When Radio Format = WLAN, this function does the following:

Step	Action	
1	Sets the following parameters in the Power Amplifier measurement based on the settings of Modulation Accuracy measurement of WLAN Mode (N9077):	
	Power Amplifier	Modulation Accuracy of WLAN
	Number of Carriers	1
	Carrier Ref Frequency	Center Frequency
	Carrier Frequency Offset	0 Hz
	If the radio standard selected in the Modulation Accuracy measurement of WLAN Mode (N9077) is not supported by the Power Amplifier measurement, the execution stops and returns	
2	Presets Carrier Spacing, ACP and SEM Carrier Integration BW based on the radio standard selected in the Modulation Accuracy measurement of WLAN (N9077)	
3	Synchronizes EVM Meas Time in the Power Amplifier measurement with the search length of the Modulation Accuracy measurement of WLAN (N9077)	
4	Presets ACP settings as follows:	
	Meas Time	Auto
	Offset Frequency Define	Carrier Center to Meas BW Center
	Offset Frequency State	On, Off, Off, Off, Off, Off
	Offset Frequency	The value of Carrier Spacing
	Offset Integ BW	The value of Carrier Integ BW
	Offset Method	Integration BW
	Offset Filter Alpha	0.22
	Offset Side	Both
5	Presets SEM settings as follows	
	Meas Time	Auto

Step	Action	
	Channel RRC Filter	Off
	Filter Alpha	0.22
	Show Abs2 Limit	Off
	Offset Frequency Define	Carrier Center to Meas BW Center
	Measurement Type	Spectrum Peak Reference
	Power Reference Type	Max Power Carrier
	Offset Frequency State	On, On, On, On, Off, Off
	Offset Side	Both
	Fail Mask	Abs AND Rel
	Fail Mask 2	Off
	Those not included in the table above depend on the radio standard	

When Radio Format = LTEAFDD, this function does the following:

Step	Action	
1	Copies the following parameters from the Modulation Analysis measurement of the LTEA-FDD Mode (N9080EM0E) to their counterparts in the PA measurement:	
	EVM measurement of LTEA-FDD	PA Test
	Number of Component Carriers	Number of Carriers
	Carrier Ref Frequency	Carrier Ref Frequency
	Freq Offset of CC	Carrier Frequency Offset
	For multi-CC demodulation, all the component carriers configured in the EVM measurement of the LTEA-FDD application will be measured regardless the Meas Carrier State set therein	
2	Presets Carrier Spacing, ACP and SEM Carrier Integration BW based on the radio standard settings of the Modulation Analysis measurement of the LTEA-FDD Mode (N9080EM0E)	
3	Synchronizes EVM Meas Time in the Power Amplifier measurement with the maximum automatically calculated data acquisition time among all the component carriers of the Modulation Analysis measurement of the LTEA-FDD Mode (N9080EM0E)	
4	Presets ACP settings as follows:	
	Meas Time	Auto
	Offset Frequency Define	Carrier Center to Meas BW Center
	Offset Frequency State	On, Off, Off, Off, Off, Off
	Offset Frequency	The value of Carrier Spacing of the first CC*
	Offset Integ BW	The value of Carrier Integ BW of the first CC*

Step	Action	
	Offset Method	Integration BW
	Offset Filter Alpha	0.22
	Offset Side	Both
	* For multi-CC case scenarios, when the component carriers are not configured with the identical settings, which result in different carrier spacing or different carrier integration bandwidth, the ACP offset in Power Amplifier measurement will be set based on the first component carrier	
5	Presets SEM settings as follows	
	Meas Time	Auto
	Channel RRC Filter	Off
	Filter Alpha	0.22
	Show Abs2 Limit	Off
	Offset Frequency Define	Carrier Edge to Meas BW Center
	Measurement Type	Spectrum Peak Reference
	Power Reference Type	Max Power Carrier
	Offset Frequency State	On, On, On, On, Off, Off (BS) On, On, On, Off, Off, Off (MS)
	Offset Side	Both
	Fail Mask	Absolute
	Fail Mask 2	Off
	Those not included in the table above depend on the radio standard	

Remote Command	`[:SENSe]:PAMPlifier:RADio:SYNC`
Example	`:PAMP:RAD:SYNC`
Dependencies	Only enabled when the following conditions are met: – 5GNR Mode is preloaded and **Radio Format** is `NR5G` – WLAN Mode is preloaded, and **Radio Format** is `WLAN` – LTEA-FDD Mode is preloaded, and **Radio Format** is `LTEAFDD`

3.1.17.3 Signal Generator

Lets you configure the signal generator list, and connect to the selected signal generator.

Connection Management

Configures the signal generator list, and connects one signal generator.

Notes	This control and its submenu are not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect

Hostname/IP Address

Specifies the hostname or IP address of a new signal generator, which is to be added into the signal generator list.

Hostname can be used for the connection *only* when the signal generator model is VXG (version A.06 or later).

Notes	You can input any string, but only a valid hostname or IP address will work when connecting a signal generator This setting cannot be empty when it is added to the signal generator list Hostname can be used for the connection *only* when the signal generator model is VXG (version A.06 or later)
Preset	Unaffected by Preset
State Saved	No

Name (Optional)

Specifies a name of a new signal generator, which will be added into the signal generator list.

This setting is used only to help you to remember the signal generator.

Notes	The hostname or IP address is used to connect a signal generator. This setting is an alias for the hostname or IP address, to help you to remember the signal generator This setting can be empty when the IP address of a new signal generator is added to the signal generator list
Preset	Unaffected by Preset
State Saved	No
Min/Max	1/32

Add To Generator List

Adds the selected hostname or IP address and the name of a new signal generator into the signal generator list.

Notes	If the hostname or IP address of the new signal generator already exists in the signal generator list, it cannot be added into the list and an error message is displayed. For example, “Parameter error;146.208.172.103 already exists” When this operation succeeds, a message is displayed. For example, “146.208.172.103 is inserted into the list”

Delete Selected Generator

Remove the hostname or IP address and name of the selected signal generator from the signal generator list.

Notes	If a connected signal generator is to be deleted, it will firstly be disconnected automatically, and then deleted After the signal generator is deleted, a message is displayed. For example, “146.208.172.103 is successfully released and deleted”

Connect/Disconnect

Connects the selected signal generator in the signal generator list, or disconnects the currently connected Signal Generator.

Notes	If a connected signal generator is to be deleted, you must disconnect it first Before any signal generator is connected, the label of the button is **Connect** and no information is displayed in the information area. After the selected signal generator is successfully connected, the label of the button becomes **Disconnect**. The details of the connected signal generator are displayed in the information area in green. The color of the connected signal generator in the signal generator list is also green. If there is already a connected signal generator when the **Connection Management** dialog is opened, the connected signal generator in the signal generator list is highlighted and the color of the connected signal generator in the signal list is green.
Remote Command	`[:SENSe]:SOURce:CONNect <string>`
Example	`:SOUR:CONN “146.208.172.103”`
Notes	If the hostname or IP address does not exist in the signal generator list and the connection is established successfully, it will be inserted into the signal generator list If this operation fails, an error message is displayed. For example, “Execution error; Cannot connect 146.208,172.103”
Remote Command	`[:SENSe]:SOURce:DISConnect`

Example	`:SOUR:DISC`
Notes	If there is no connected signal generator, this operation does nothing

Connection State (Remote Query only)

Checks whether any signal generator is connected.

Remote Command	`[:SENSe]:SOURce:CONNect:STATe?`
Example	`:SOUR:CONN:STAT?`
Notes	There is a field in the Meas Bar that shows the connection state
Preset	Unaffected by Preset
State Saved	No

Hostname or IP Address of the Connected Signal Generator (Remote Query only)

Gets the hostname or IP address of the currently connected signal generator.

Remote Command	`[:SENSe]:SOURce:ADDRess?`
Example	`:SOUR:ADDR?`
Preset	Unaffected by Preset
State Saved	No

Name of the Connected Signal Generator (Remote Query only)

Gets the name of the currently connected signal generator.

Remote Command	`[:SENSe]:SOURce:NAME?`
Example	`:SOUR:NAME?`
Preset	Unaffected by Preset
State Saved	No

Frequency

Specifies the RF frequency of the signal generator.

Remote Command	`[:SENSe]:SOURce:FREQuency <freq>` `[:SENSe]:SOURce:FREQuency?`
Example	`:SOUR:FREQ 50MHz` `:SOUR:FREQ?`

Notes	Changing this parameter does not have an immediate impact on the connected signal generator The change takes effect only after you press **Apply Settings to Signal Generator** or send `SOUR:SETT:APPL`
Couplings	If `:SOUR:FREQ:AUTO` is `ON`, automatically coupled with the Carrier Ref Frequency when the Frequency of the signal generator changes from manual to auto The RF output is switched off if the frequency changes, to prevent damage to a sensitive amplifier
Preset	1.0 GHz
State Saved	Saved in instrument state
Min/Max	Depends on the MIN/MAX frequency of the connected signal generator

Auto Function

Remote Command	`[:SENSe]:SOURce:FREQuency:AUTO 1 | 0 | ON | OFF` `[:SENSe]:SOURce:FREQuency:AUTO?`
Preset	`ON`
State Saved	Yes

RF Output

Sets the RF output state of the signal generator.

Remote Command	`[:SENSe]:SOURce:OUTPut 1 | 0 | ON | OFF` `[:SENSe]:SOURce:OUTPut?`
Example	`:SOUR:OUTP OFF` `:SOUR:OUTP?`
Notes	Changing this parameter does not have an immediate impact on the connected signal generator The change takes effect only after you press **Apply Settings to Signal Generator** or send `SOUR:SETT:APPL` When this setting is `ON`, the “Modulation”, “ARB” and “Output” settings in the signal generator will all be `ON` When this setting is `OFF`, the “Modulation”, “ARB” and “Output” settings in the signal generator will all be `OFF`
Dependencies	The center frequency of the PA measurement is synchronized with the carrier reference frequency of either 5GNR EVM or LTEA-FDD EVM, or the center frequency of WLAN modulation accuracy measurement depending on "Radio Format" on page 343. The synchronization happens under the following circumstances: – Switching to PA Mode when PA measurement’s "EVM State" on page 355 is `ON` – Switching on **EVM State** – Toggle **Radio Format** when *EVM State* is `ON`

	– Running **Preset from 5GNR EVM**, "**Preset from WLAN Mod. Accuracy**, or **Preset from LTEA-FDD EVM**, depending on **Radio Format** – Running **Preset to Standard** when "EVM State" on page 355 is ON If the state of Signal Generator Frequency is auto, the frequency of the signal generator is coupled with the center frequency of the PA test measurement. RF output is switched off when an unwitting change of the frequency happens, to avoid the situation where the abrupt change of frequency damages a sensitive amplifier Moreover, when the Frequency of the signal generator changes from manual to auto, **RF Output** is also switched off if the frequency changes As from XA34, a new power-on-persistent setting "RF Off After Meas Preset" on page 277 has been implemented. **RF Output** switches off after a measurement preset if the power-on-persistent setting is ON
Preset	ON
State Saved	Saved in instrument state

RF Off After Meas Preset

This power-on-persistent parameter aims at preventing the connected signal generator (for benchtop instruments) or the internal source (for M9010A/11A/15A/16A) from damaging a sensitive PA following a preset.

After this parameter changes to ON, "RF Output" on page 276 is switched OFF following a measurement preset.

Note that for M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A, the measurement stops, because when **RF Output** is OFF, there is no longer a valid internal trigger.

Remote Command	`[:SENSe]:SOURce:PRESet:OFF 1 | 0 | ON | OFF` `[:SENSe]:SOURce:PRESet:OFF?`
Example	`:SOUR:PRES:OFF 1` `:SOUR:PRES:OFF?`
Notes	This is a power-on-persistent setting
Preset	Unaffacted by Preset. Initial value is 0
State Saved	Yes

VXG Channel

See "VXG Channel" on page 280 under **Meas Setup**, **Signal Generator**.

Advanced

Configures the advanced parameters of the connected signal generator.

Common Parameters

Configures the common advanced parameters of the connected signal generator.

Notes	Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A

DC Calibration

Enables or disables DC calibration before each measurement.

Remote Command	`[:SENSe]:SOURce:CALibration:IQ:DC[:STATe] 1 | 0 | ON | OFF` `[:SENSe]:SOURce:CALibration:IQ:DC[:STATe]?`
Example	`:SOUR:CAL:IQ:DC OFF` `:SOUR:CAL:IQ:DC?`
Notes	Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect
Preset	`ON`
State Saved	Saved in instrument state

ALC State

Enables or disables ALC.

Not supported in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A.

Remote Command	`[:SENSe]:SOURce:ALC[:STATe] 1 | 0 | ON | OFF` `[:SENSe]:SOURce:ALC[:STATe]?`
Example	`:SOUR:ALC OFF` `:SOUR:ALC?`
Notes	Changing this parameter has no immediate impact on the connected signal generator The change takes effect only after you press **Apply Settings to Signal Generator** or send `SOUR:SETT:APPL` Always `OFF` when the connected signal generator is N5186A In this case, if you attempt to turn ALC on, via SCPI for example, the error “ALC is not supported for N5186A” is displayed

	When the connected signal generator is VXB-B, and the frequency is lower than 20 GHz, ALC is always OFF and cannot be turned on If you attempt to turn ALC on when **Center Frequency** is lower than 20 GHz, via SCPI for example, the error "ALC switches off when the center frequency is below 20 GHz on VXG-B." is displayed
Preset	ON
State Saved	Saved in instrument state

Modulator Attenuation

Gets and sets the modulator attenuation and the state of the modulator attenuation.

Remote Command	[:SENSe]:SOURce:WAVeform:MODulation:ATTenuation <rel_ampl> [:SENSe]:SOURce:WAVeform:MODulation:ATTenuation?
Example	:SOUR:WAV:MOD:ATT 5.37 :SOUR:WAV:MOD:ATT?
Dependencies	Disabled in the user interface when the connected signal generator is not MXG
Couplings	When the value of the modulator attenuation is changed, the state of the modulator attenuation changes to false
Preset	6.0
State Saved	Saved in instrument state
Min/Max	0.0 / 50.0

Auto Function

Remote Command	[:SENSe]:SOURce:WAVeform:MODulation:ATTenuation:AUTO 1 | 0 | ON | OFF [:SENSe]:SOURce:WAVeform:MODulation:ATTenuation:AUTO?
Example	:SOUR:WAV:MOD:ATT:AUTO ON :SOUR:WAV:MOD:ATT:AUTO?
Notes	When the value of the modulator attenuation is changed, the state of the modulator attenuation changes to false
Preset	ON
State Saved	Yes

Runtime Scaling

Sets and gets the scaling value of the signal generator, which will be applied to the waveform while it is playing. Use scaling to get the best dynamic range without overflowing the I and Q digital-to-analog converters (DAC) and to reduce the overshoot associated with the DAC interpolation filter.

Waveform Runtime Scaling does not change the data in the waveform file.

Remote Command	`[:SENSe]:SOURce:RUNTime:SCALing <double>` `[:SENSe]:SOURce:RUNTime:SCALing?`
Example	`:SOUR:RUNT:SCAL 50` `:SOUR:RUNT:SCAL?`
Notes	Changing this parameter has no immediate impact on the connected signal generator Each time after playing a waveform, the runtime scaling is applied After reading a local waveform or loading a waveform from the signal generator, if the waveform header contains the runtime scaling field and its value is valid, the value of this parameter will be set to be the value of the runtime scaling in the waveform header After presetting the Radio Std, if the new standard is one of the 5GNR or LTEA-FDD formats, the value of this parameter will be set to be 85%. If the new standard is one of the WLAN formats, the value of this parameter will be set to be 70%
Preset	70
State Saved	Saved in instrument state
Min	1
Max	100

VXG Specific Parameters

Configures VXG specific parameters.

Notes	This control and its submenu are not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect

VXG Channel

Sets and gets the active channel of VXG.

Remote Command	`[:SENSe]:SOURce:CHANnel CH1 | CH2` `[:SENSe]:SOURce:CHANnel?`
Example	`:SOUR:CHAN CH1` `:SOUR:CHAN?`
Notes	Changing this parameter has a direct and immediate impact on the connected signal generator only when there is a connected signal generator If there is no connected signal generator, the setting takes effect when the signal generator-related parameters are applied to the signal generator
Dependencies	Only enabled and visible when a VXG that has more than 1 channel has been connected to the PA measurement. Disabled and invisible otherwise `CH2` is selected after the envelope tracking is `ON`. Meanwhile, `CH1` is assigned for the generation of the envelope signals and its RF output is switched off

Preset	CH1
State Saved	Saved in instrument state
Range	Channel 1 | Channel 2

Apply Settings to Signal Generator

Configure the connected signal source with the settings.

Remote Command	[:SENSe]:SOURce:SETTings:APPLy
Example	:SOUR:SETT:APPL
Notes	Generates an error message if there is no connected signal generator. For example, “Execution error; No connected signal generator” Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect

3.1.17.4 Ref Signal

Configures the reference signal.

Waveform Type

Gets and sets the waveform type that will be used as the reference signal.

Signal Studio Waveform	SSWaveform	Generated by Signal Studio
User Defined Waveform	USER	User-created format
MATLAB Variable	MVARiable	Waveform defined in the MATLAB workspace

Remote Command	[:SENSe]:SOURce:WAVeform:TYPE SSWaveform | USER | MVARiable [:SENSe]:SOURce:WAVeform:TYPE?
Example	:SOUR:WAV:TYPE SSW :SOUR:WAV:TYPE?
Preset	SSWaveform
State Saved	Saved in instrument state
Range	Signal Studio Waveform | User Defined Waveform | MATLAB Variable

Waveform Location

When "Waveform Type" on page 281 is SSWaveform, the waveform file can be specified either in the local Spectrum Analyzer or in the Signal Generator. This

function gets and sets the waveform location.

Local	LOCal
Signal Generator	SOURce

Remote Command	[:SENSe]:SOURce:WAVeform:LOCation LOCal | SOURce [:SENSe]:SOURce:WAVeform:LOCation?
Example	:SOUR:WAV:LOC LOC :SOUR:WAV:LOC?
Notes	Valid only when **Waveform Type** is SSWaveform Changing **Waveform Location** from **Local** to **Signal Generator**, resets **Predefined Resampling Ratio**" to 1, and resets the state of **Predefined Resampling Ratio** to ON Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect
Preset	LOC
State Saved	Saved in instrument state
Range	Local | Signal Generator

Select Waveform

Selects the waveform file.

Notes	Available only when "Waveform Type" on page 281 is SSWaveform and "Waveform Location" on page 281 is LOCal, or **Waveform Type** is USER In M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A, when **Waveform Type** is SSWaveform , there will be a new shortcut for "ARB Memory". When a waveform is selected, it will be played immediately

File Type

Gets and sets the file type when "Waveform Type" on page 281 is USER.

Option	SCPI	Extension	Details
CSV/Text	CSVText	*.csv *.txt	In the file, I/Q data is interleaved and delimited by commas Example: 1.235,-3.123
Binary	BINary	*.bin	16 Bits, Big Endian. For unencrypted waveforms. It is I/Q DAC bit value, and the leftmost bit is MSB I and Q are interleaved
MATLAB	MATLab	*.mat *.hdf	An IQ data file in the MATLAB format, including the following information:

Option	SCPI	Extension	Details
			1. XDelta: The sample period. The sample rate is the reciprocal of XDelta 2. Y: The data. Must be a complex single array

This parameter has been removed from the GUI, but the SCPI command is retained for backwards compatibility.

Remote Command	`[:SENSe]:SOURce:WAVeform:FTYPe BINary | CSVText | MATLab` `[:SENSe]:SOURce:WAVeform:FTYPe?`
Example	`:SOUR:WAV:FTYPe CSVT` `:SOUR:WAV:FTYPe?`
Notes	Valid only when **Waveform Type** is `USER`
Preset	`CSVText`
State Saved	Saved in instrument state
Range	Binary | CSV/Text | MATLAB

Waveform Name

Gets and sets the waveform name.

Remote Command	`[:SENSe]:SOURce:WAVeform:NAME <string>` `[:SENSe]:SOURce:WAVeform:NAME?`
Example	`:SOUR:WAV:NAME "C:\Demo\5GNRDemo.wfm"` `:SOUR:WAV:NAME?`
Dependencies	Always read-only in GUI, but can be set using the "Select Waveform" on page 282 dialog or SCPI If the waveform is a local file, the whole path of this waveform file is required If the waveform is in the signal generator, the waveform name should have a header, which is one of `NVWFM` or `SNVWFM` For example, `SNVWFM:5GNRDemo.WFM` `NVWFM` or `SNVWFM` means the waveform is in non-volatile memory. `S` means a secured waveform that is encrypted If the waveform is a MATLAB variable, only the MATLAB variable name is required If the waveform is a local file, the file extension is required. For example, `.wfm` is assumed to be an encrypted signal studio waveform. If the waveform is a local one and there is no file extension, it will be assumed to be a MATLAB variable
State Saved	Saved in instrument state

Waveform on Signal Generator

Gets and sets whether to load the current active waveform in the signal generator or a waveform in a specific folder in the signal generator.

Remote Command	`[:SENSe]:SOURce:WAVeform:LOCation:SOURce CURRent | SPECific` `[:SENSe]:SOURce:WAVeform:LOCation:SOURce?`
Example	`:SOUR:WAV:LOC:SOUR CURR` `:SOUR:WAV:LOC:SOUR?`
Preset	`CURR`
State Saved	Saved in instrument state
Range	Current Wfm | Specific Location

Waveform Sample Rate

Gets the waveform sample rate when the waveform is loaded successfully.

Every time that Waveform Type, Waveform Location or File Type changes, Waveform Sample Rate is reset to 1 Hz.

Remote Command	`[:SENSe]:SOURce:WAVeform:SRATe <freq>` `[:SENSe]:SOURce:WAVeform:SRATe?`
Example	`:SOUR:WAV:SRAT 5.0MHZ` `:SOUR:WAV:SRAT?`
Dependencies	Can be set only when "Waveform Type" on page 281 is `USER` Valid only when the waveform is loaded successfully
Preset	1Hz
State Saved	No

Waveform IQ Data Count

Gets the IQ data count in a waveform after the waveform is loaded successfully.

Every time that Waveform Type, Waveform Location or File Type changes, Waveform IQ Data Count is reset to 0.

Remote Command	`[:SENSe]:SOURce:WAVeform:IQCount?`
Example	`:SOUR:WAV:IQC?`
Notes	Valid only when the waveform is loaded successfully

Preset	0
State Saved	No

Waveform Length

Gets the waveform length after the waveform is loaded successfully.

Every time that **Waveform Type**, **Waveform Location** or **File Type** changes, **Waveform Length** is reset to 0.

Remote Command	`[:SENSe]:SOURce:WAVeform:LENGth?`
Example	`:SOUR:WAV:LENG?`
Notes	Valid only when the waveform is loaded successfully Unit is seconds
Preset	0s
State Saved	No

Export to Signal Generator

Exports a local waveform to the connected Signal Generator.

Remote Command	`[:SENSe]:SOURce:WAVeform:EXPort <string>`
Example	`:SOUR:WAV:EXP "D:\Test.wfm"`

Notes	This command, `SOURC:WAV:EXP "D\WFM\WAVEFORM.WFM"`, is equivalent to the following SCPI sequence:
	`SOUR:WAV:TYPE WFM`
	`SOUR:WAV:LOC LOC`
	`SOUR:WAV:NAME "D:\WFM\WAVEFORM.WFM"`
	`SOUR:WAV:EXP:IMM`
	If there is no connected signal generator, generates error message. For example, "Execution error; No connected signal generator"
	If this operation fails, displays an error message. For example, "Execution error; Cannot export waveform"
	If this operation is successful, displays a message. For example, "Successfully exported waveform"
	If the waveform is a local file, the file extension is required. For example, `.wfm` is assumed to be an encrypted signal studio waveform. If the waveform is a local one and there is no file extension, it is assumed to be a MATLAB variable

Couplings	Changing this setting clears "Waveform Name" on page 283 After this Immediate Action is executed,

1. "Waveform Type" on page 281 changes to `SSWaveform`
2. "Waveform Location" on page 281 changes to `LOCal`
3. **Waveform Name** changes to the name of the selected waveform

Export to Signal Generator Immediately

Exports the selected local waveform to the connected Signal Generator.

Remote Command	`[:SENSe]:SOURce:WAVeform:EXPort:IMMediate`
Example	`:SOUR:WAV:EXP:IMM`
Notes	This immediate-action function executes only when "Waveform Type" on page 281 is `SSWaveform`, "Waveform Location" on page 281 is `LOCal`, and "Waveform Name" on page 283 is valid In this case, the command is equivalent to `:SOUR:WAV:EXP`, but no parameter is needed If there is no valid waveform, generates an error message. For example, "Execution error; No selected waveform" If there is no connected signal generator, generates an error message. For example, "Execution error; No connected signal generator" If this operation fails, displays an error message. For example, "Execution error; Cannot export waveform" If this operation is successful, displays a message. For example, "Waveform is exported successfully"

Load from Signal Generator (Remote Command Only)

Loads a waveform that is already in the connected Signal Generator.

Remote Command	`[:SENSe]:SOURce:WAVeform:LOAD <string>`
Example	`:SOUR:WAV:LOAD "SNVWFM:Test.wfm"`

Notes	This command, `SOUR:WAV:LOAD "SNVWFM:WAVEFORM.WFM"`, is equivalent to the following SCPI sequence:
	`SOUR:WAV:TYPE WFM`
	`SOUR:WAV:LOC SOUR`
	`SOUR:WAV:LOC:SOUR SPEC`
	`SOUR:WAV:NAME "SNVWFM:WAVEFORM.WFM"`
	`SOUR:WAV:LOAD:IMM`
	If there is no connected signal generator, generates an error message. For example, "Execution error; No connected signal generator"
	If this operation fails, displays an error message. For example, "Execution error; Cannot load waveform"

	If this operation is successful, displays a message. For example, “Successfully loaded waveform” In this case, if the resample ratio is not 1, the message is “Waveform is loaded and resampled successfully” The waveform name should have a header, which is one of `NVWFM` or `SNVWFM`, for example, `SNVWFM:5GNRDemo.WFM` `NVWFM` or `SNVWFM` means the waveform is in non-volatile memory `S` indicates a secure waveform that is encrypted In M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A, the SCPI commands have no effect
Couplings	After this Immediate Action is executed: 1. "Waveform Type" on page 281 changes to `SSWaveform` 2. "Waveform Location" on page 281 changes to `SOURce` 3. "Waveform on Signal Generator" on page 284 changes to `SPECific` 4. "Waveform Name" on page 283 changes to the name of the selected waveform

Load from Signal Generator Immediately

Loads a selected waveform that is already in the connected Signal Generator and transfers the waveform from the signal generator to the signal analyzer.

Remote Command	`[:SENSe]:SOURce:WAVeform:LOAD:IMMediate`
Example	`:SOUR:WAV:LOAD:IMM`
Notes	This immediate-action function executes only when "Waveform Type" on page 281 is `SSWaveform`, and "Waveform Location" on page 281” is `SOURce` If "Waveform on Signal Generator" on page 284 is `SPECific` and there is no selected waveform, generates an error message. For example, “Execution error; No selected waveform”. In this case, the SCPI is equivalent to `:SOUR:WAV:LOAD` but no parameter is needed If "Waveform on Signal Generator" on page 284 is `CURRent`, the waveform name is unnecessary. In this case, the SCPI is equivalent to `:SOUR:WAV:LOAD:CURR` If there is no connected signal generator, generates an error message. For example, “Execution error; No connected signal generator” If this operation fails, displays an error message. For example, “Execution error; Waveform cannot be loaded” If this operation is successful, displays a message. For example, “Waveform is loaded successfully.” In this case, if the resample ratio is not 1, the message is “Waveform is loaded and resampled successfully” After this operation, the error queue in the signal generator is checked. If there is any error, displays the message “The signal generator has some errors” Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect

Load Current Active Waveform from Signal Generator (Remote Command Only)

Loads the current active waveform in the connected Signal Generator and transfers the waveform back from the signal generator.

Remote Command	`[:SENSe]:SOURce:WAVeform:LOAD:CURRent`
Example	`:SOUR:WAV:LOAD:CURR`

Notes	This SCPI command, `:SOUR:WAV:LOAD:CURR`, is equivalent to the following SCPI sequence:
	`SOUR:WAV:TYPE WFM`
	`SOUR:WAV:LOC SOUR`
	`SOUR:WAV:LOC:SOUR CURR`
	`SOUR:WAV:LOAD:IMM`
	If there is no connected signal generator, generates an error message. For example, “Execution error; No connected signal generator”
	If this operation fails, displays an error message. For example, “Execution error; Waveform cannot be loaded”
	If this operation is successful, displays a message. For example, “Waveform is loaded successfully.”. In this case, if the resample ratio is not 1, the message is “Waveform is loaded and resampled successfully”
	After this operation, the error queue in the signal generator is checked. If there is any error, displays the message “The signal generator has some errors”
	When VXG is connected, this operation will fail with an error message, which is “-224,"Illegal parameter value; The value CurrentWfm is disabled."”
	In M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A, the SCPI commands have no effect

Couplings	After this immediate-action function is executed: 1. "Waveform Type" on page 281 changes to `SSWaveform` 2. "Waveform Location" on page 281 changes to `SOURce` 3. "Waveform on Signal Generator" on page 284 changes to `CURRent` 4. "Waveform Name" on page 283 changes to the name of the selected waveform

Save Current Waveform IQ Data

Loads the current active waveform in the connected Signal Generator and transfers the waveform back from the signal generator.

Notes	Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect

Refresh All MATLAB Variables

Retrieves all MATLAB complex variables from the MATLAB workspace and displays them in the MATLAB variable list.

If MATLAB is not launched or connected, displays an error message.

Select MATLAB Variable

Selects a MATLAB complex variable in the MATLAB variable list.

If MATLAB is not launched or connected, displays an error message.

Notes	Equivalent to the following 2 SCPI commands:
	`:SOUR:WAV:TYPE MVAR`
	`:SOUR:WAV:NAME "<MATLAB variable name>"`

Waveform Processing

Configures the waveform processing parameters of the waveform.

Common

Configures common parameters for waveform processing.

Predefined Resampling Ratio

Gets and sets the predefined resampling ratio and the state of the predefined resampling ratio.

Remote Command	`[:SENSe]:SOURce:WAVeform:RRATio:PREDefined R1 | R3 | R5 | R3D10 | R1D2 | R1D3 | R2D3 | R3D2 | R4D3` `[:SENSe]:SOURce:WAVeform:RRATio:PREDefined?`
Example	`:SOUR:WAV:RRAT:PRED R1` `:SOUR:WAV:RRAT:PRED?`
Dependencies	Enabled only when **Predefined Resampling Ratio** state is `ON`
Couplings	Enabled only when **Predefined Resampling Ratio** state is `ON` If "Waveform Location" on page 281 changes from `LOCal` to `SOURce`, **Predefined Resampling Ratio** is reset to 1 and **Predefined Resampling Ratio** state is set to `ON`
Preset	`R1`

State Saved	Saved in instrument state
Range	1 | 3 | 5 | 0.3 | 1/2 | 1/3 | 2/3 | 3/2 | 4/3

Auto Function

Remote Command	`[:SENSe]:SOURce:WAVeform:RRATio:PREDefined:AUTO 1 | 0 | ON | OFF` `[:SENSe]:SOURce:WAVeform:RRATio:PREDefined:AUTO?`
Example	`:SOUR:WAV:RRAT:PRED:AUTO ON` `:SOUR:WAV:RRAT:PRED:AUTO?`
Notes	When `ON`, the predefined resampling ratio can be selected When `OFF`, the resampling ratio can be an arbitrary value
Preset	`ON`
State Saved	Yes

Resampling Ratio

Gets and sets the resampling ratio when the state of the predefined resampling ratio is `OFF`.

Remote Command	`[:SENSe]:SOURce:WAVeform:RRATio <double>` `[:SENSe]:SOURce:WAVeform:RRATio?`
Example	`:SOUR:WAV:RRAT 1.0` `:SOUR:WAV:RRAT?`
Notes	Enabled only when **Predefined Resampling Ratio** state is `OFF` The final actual resampling ratio cannot have any arbitrary value. Every time that you change the resampling ratio when the **Predefined Resampling Ratio** state is `OFF`, the firmware calculate the most reasonable resampling ratio for this measurement The UI displays the final actual resampling ratio, which can also be retrieved via two SCPI commands
Preset	1
State Saved	Saved in instrument state

Actual Resampling Ratio (Remote Query only)

Gets the actual resampling ratio, as a `double` numeric value.

Remote Command	`[:SENSe]:SOURce:WAVeform:RRATio:ACTual?`
Example	`:SOUR:WAV:RRAT:ACT?`
Notes	When **Predefined Resampling Ratio** state is `OFF`, you can input any arbitrary value as the resampling ratio, but not all arbitrary values can be the final actual resampling ratio. Every time that you change the resampling ratio when the **Predefined Resampling Ratio** state is `OFF`, the firmware calculate the most

	reasonable resampling ratio for this measurement When **Predefined Resampling Ratio** state is `OFF`, the predefined resampling ratio can be the final actual resampling ratio Use this query to get the final actual resampling ratio in `double` format. For example, if you input "2.11", the final actual resampling ratio will be "19/9". This query returns "2.11111111"
State Saved	Saved in instrument state

Actual Resampling Ratio as string (Remote Query Only)

Gets the actual resampling ratio, as a string.

Remote Command	`[:SENSe]:SOURce:WAVeform:RRATio:ACTual:STRing?`
Example	`:SOUR:WAV:RRAT:ACT:STRing?`
Notes	When **Predefined Resampling Ratio** state is `OFF`, you can input any arbitrary value as the resampling ratio, but not all arbitrary values can be the final actual resampling ratio. Every time that you change the resampling ratio when the **Predefined Resampling Ratio** state is `OFF`, the firmware calculate the most reasonable resampling ratio for this measurement When **Predefined Resampling Ratio** state is `OFF`, the predefined resampling ratio can be the final actual resampling ratio Use this query to get the final actual resampling ratio as a string. For example, if you input "2.11", the final actual resampling ratio will be "19/9". This query returns "19/9"
State Saved	Saved in instrument state

Head Idle Interval

Sets the idle interval ahead of frames in unit of seconds. Only visible in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A.

Remote Command	`[:SENSe]:SOURce:WAVeform:IDLE:HEAD <time>` `[:SENSe]:SOURce:WAVeform:IDLE:HEAD?`
Example	`:SOUR:WAV:IDLE:HEAD 200ns` `:SOUR:WAV:IDLE:HEAD?`
Dependencies	Grayed-out when "Burst Shape & Mask State" on page 292 is `ON`; enabled otherwise
Preset	500 ns
State Saved	Saved in instrument state
Min	0
Max	500 ns

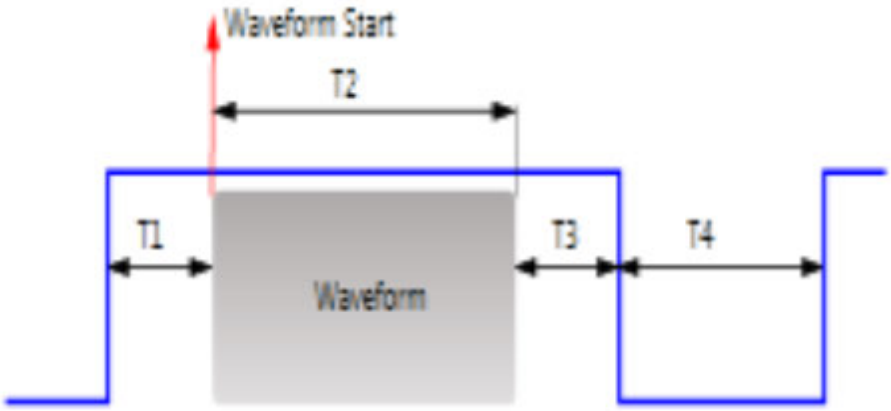
Burst Formation & Mask

Configures the parameters of the waveform processing to reconstruct the reference waveform and its mask signals.

Burst Shape & Mask State

Enables or disables the reconstruction of the reference waveform and its mask signals for users to evaluate the impact of the power supply of the PA on the EVM readouts.

When **Burst Shape & Mask State** is ON, zeros are added before (@T1) and after (@T3 + T4) the resampled reference waveform as well as its Marker 1 signal (for Event1). A PA Enable Mask (the blue waveform in the diagram below) is constructed during the procedure so that a cyclic burst, of which the period is T1 + T2 + T3 + T4 and the duty cycle is (T1 + T2 + T3) / the period * 100%, is yielded and fed to the switch of the power supply of the PA under test.



Remote Command	`[:SENSe]:SOURce:WAVeform:BSHape[:STATe] ON | OFF | 1 | 0` `[:SENSe]:SOURce:WAVeform:BSHape[:STATe]?`
Example	`:SOUR:WAV:BSH 1` `:SOUR:WAV:BSH?`
Dependencies	Supported on both benchtop and modular platforms. For benchtop VXG instruments, only VXG-C (M9484C) is supported as of A.34.00 Not supported on VXG-B (M9384B) due to some hardware limitations
Couplings	The measurement switches to single mode after **Burst Shape & Mask State** turns ON
Preset	OFF
State Saved	Saved in instrument state

Lead Interval (T1)

Specifies the time interval ahead of the reference waveform for the reconstruction of the waveform.

Remote Command	`[:SENSe]:SOURce:WAVeform:BSHape:T1 <time>` `[:SENSe]:SOURce:WAVeform:BSHape:T1?`
Example	`:SOUR:WAV:BSH:T1 1ms` `:SOUR:WAV:BSH:T1?`
Preset	1 us
State Saved	Saved in instrument state
Min	0
Max	1 ms

Waveform Interval (T2) (Remote Query only)

Returns the time elapse of the reference waveform.

Remote Command	`[:SENSe]:SOURce:WAVeform:BSHape:T2?`
Example	`:SOUR:WAV:BSH:T2?`
Dependencies	Synced with "Waveform Length" on page 285
Preset	0
State Saved	Saved in instrument state
Min	0
Max	120 s

Lag Interval (T3)

Specifies the time interval after the reference waveform for the reconstruction of the waveform.

Remote Command	`[:SENSe]:SOURce:WAVeform:BSHape:T3 <time>` `[:SENSe]:SOURce:WAVeform:BSHape:T3?`
Example	`:SOUR:WAV:BSH:T3 1ms` `:SOUR:WAV:BSH:T3?`
Preset	1 us
State Saved	Saved in instrument state
Min	0
Max	1 ms

Idle Interval (T4)

Specifies the idle interval added to the reference waveform for the reconstruction of the waveform.

Remote Command	`[:SENSe]:SOURce:WAVeform:BSHape:T4 <time>` `[:SENSe]:SOURce:WAVeform:BSHape:T4?`
Example	`:SOUR:WAV:BSH:T4 1ms` `:SOUR:WAV:BSH:T4?`
Preset	1 ms
State Saved	Saved in instrument state
Min	0
Max	60 s

Duty Cycle

Returns the duty cycle applied when "Burst Shape & Mask State" on page 292 is ON.

Calculated based on the following equation:

Duty Cycle = T2 / (T1 + T2 +T3 +T4) * 100%

It is presumed that the reference waveform does not contain any idle parts before switching on Burst Shape and Formation state.

Remote Command	`[:SENSe]:SOURce:WAVeform:BSHape:DCYCle?`
Example	`:SOUR:WAV:BSH:DCYC?`
Dependencies	Only visible when "Burst Shape & Mask State" on page 292 is ON
Preset	0
State Saved	Saved in instrument state
Min	0
Max	100

Crest Factor Reduction

Enables the reduction of PAPR of the reference waveform.

With proper configuration, the PAPR of the waveform can be suppressed to a specified level with certain damage.

Crest Factor Reduction State

Enables the crest factor reduction applied to the reference waveform.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction[:STATe] ON | OFF | 1 | 0` `[:SENSe]:SOURce:WAVeform:CFReduction[:STATe]?`
Example	`:SOUR:WAV:CFR 1` `:SOUR:WAV:CFR?`
Preset	`OFF`
State Saved	Saved in instrument state

CFR Algorithm

Specifies the algorithm for CFR operation.

Clipping and Filtering	`CFILtering`	Time domain clipping on the IQ samples
Peak Cancellation	`PCANcel`	Subtracting the signal peaks

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:ALGorithm CFILtering | PCANcel` `[:SENSe]:SOURce:WAVeform:CFReduction:ALGorithm?`
Example	`:SOUR:WAV:CFR:ALG CFIL` `:SOUR:WAV:CFR:ALG?`
Notes	Read-only on the GUI
Preset	`PCANcellation`
State Saved	Saved in instrument state
Range	Clipping & Filtering | Peak Cancellation

Target PAPR

Specifies the expected PAPR value after the CFR operation.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:PAPR:TARGet <real>` `[:SENSe]:SOURce:WAVeform:CFReduction:PAPR:TARGet?`
Example	`:SOUR:WAV:CFR:PAPR:TARG 9` `:SOUR:WAV:CFR:PAPR:TARG?`
Notes	Read-only on the GUI
Preset	8
State Saved	Saved in instrument state

Min	3
Max	100

Max Iteration

Specifies the maximum number of iterations for the CFR operation.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:MITeration <int>` `[:SENSe]:SOURce:WAVeform:CFReduction:MITeration?`
Example	`:SOUR:WAV:CFR:MIT 9` `:SOUR:WAV:CFR:MIT?`
Notes	Read-only on the GUI
Preset	10
State Saved	Saved in instrument state
Min	1
Max	1000

Max Order

Specifies the maximum filter length of the filter when "CFR Algorithm" on page 295 is `CFILtering`.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:MORDer <int>` `[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:MORDer?`
Example	`:SOUR:WAV:CFR:FILT:MORD 100` `:SOUR:WAV:CFR:FILT:MORD?`
Notes	Read-only on the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering`
Preset	300
State Saved	Saved in instrument state
Min	1
Max	2048

Pass Frequency

Specifies the pass frequency of the filter.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:FREQuency:PASS <freq>` `[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:FREQuency:PASS?`

Example	`:SOUR:WAV:CFR:FILT:FREQ:PASS 40e6` `:SOUR:WAV:CFR:FILT:FREQ:PASS?`
Notes	Read-only on the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering` The value of **Pass Frequency** is not greater than Stop Frequency – 1Hz
Preset	1.25 MHz
State Saved	Saved in instrument state
Min	1 Hz
Max	999.999999 MHz

Stop Frequency

Specifies the stop frequency of the filter.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:FREQuency:STOP <freq>` `[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:FREQuency:STOP?`
Example	`:SOUR:WAV:CFR:FILT:FREQ:STOP 50e6` `:SOUR:WAV:CFR:FILT:FREQ:STOP?`
Notes	Read-only on the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering` The value of **Stop Frequency** is not less than Pass Frequency + 1Hz
Preset	1.5625 MHz
State Saved	Saved in instrument state
Min	2 Hz
Max	1 GHz

Passband Ripple

Specifies the maximum ripple amplitude of the passband.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:PRIPple <real>` `[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:PRIPple?`
Example	`:SOUR:WAV:CFR:FILT:PRIP 1` `:SOUR:WAV:CFR:FILT:PRIP?`
Notes	Read-only on the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering`
Preset	0.01 dB

State Saved	Saved in instrument state
Min	0.001 dB
Max	5 dB

Stopband Attenuation

Specifies the stopband attenuation of the filter.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:SATTenuation <real>` `[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:SATTenuation?`
Example	`:SOUR:WAV:CFR:FILT:SATT 10` `:SOUR:WAV:CFR:FILT:SATT?`
Notes	Read-only on the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering`
Preset	50 dB
State Saved	Saved in instrument state
Min	6 dB
Max	200 dB

Block Size

The range in which a single cancellation pulse is identified.

If waveform length is `L`, and block size is `B`, the number of blocks `N` is:

`N` = floor(`L/B`) + 1

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:BSIZe <int>` `[:SENSe]:SOURce:WAVeform:CFReduction:BSIZe?`
Example	`:SOUR:WAV:CFR:BSIZ 100` `:SOUR:WAV:CFR:BSIZ?`
Notes	Read-only on the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `PCANcel`
Preset	1000
State Saved	Saved in instrument state
Min	20
Max	Infinity

Cancellation Percentage

Specifies the percentage that the cancellation pulses can be removed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CPCT <real>` `[:SENSe]:SOURce:WAVeform:CFReduction:CPCT?`
Example	`:SOUR:WAV:CFR:CPCT 90` `:SOUR:WAV:CFR:CPCT?`
Notes	Read-only on the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `PCANcel`
Preset	100
State Saved	Saved in instrument state
Min	0
Max	100

Filter Mask

Sets filter mask array for the CFR operation when "CFR Algorithm" on page 295 is `PCANcel`.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:FMASk <real,real>, …` `[:SENSe]:SOURce:WAVeform:CFReduction:FMASk?`
Example	`:SOUR:WAV:CFR:FMAS -20e6,-1,-10e6,-0.5,10e6,0.5,30e6,-2` `:SOUR:WAV:CFR:FMAS?`
Notes	For each `<real, real>` pair, the first item is frequency, the second is relative amplitude The maximum number of `<real, real>` pairs is 100 Read-only on the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `PCANcel`
Preset	0, 0
State Saved	Saved in instrument state
Min/Max	–/+infinity

PAPR Before CFR

Returns the PAPR of the resampled reference waveform before the CFR operation.

Only available when "Crest Factor Reduction State" on page 295 is `ON`.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:PAPR:BEFore?`

Example	`:SOUR:WAV:CFR:PAPR:BEF?`
Notes	Read-only on the GUI
Dependencies	Only visible when "Crest Factor Reduction State" on page 295 is ON, otherwise returns –999
State Saved	No

PAPR After CFR

Returns the PAPR of the resampled reference waveform after the CFR operation.

Only available when "Crest Factor Reduction State" on page 295 is ON.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:PAPR:AFTer?`
Example	`:SOUR:WAV:CFR:PAPR:AFT?`
Notes	Read-only on the GUI
Dependencies	Only visible when "Crest Factor Reduction State" on page 295 is ON, otherwise returns –999
State Saved	No

CFR Configuration

The parameters described in this section do not take immediate effect on the CFR operation, unless Apply CFR Configuration is executed.

Apply CFR Configuration

The underlying parameters applied by the CFR operation are synchronized with the parameters under the CFR configuration section after this immediate-action function is performed. This action triggers the update of the reference waveform if "Crest Factor Reduction State" on page 295 is ON.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:APPLy`
Example	`:SOUR:WAV:CFR:CONF:APPL`
Dependencies	Any change to any parameter under CFR configuration changes the color of the control to gold. The color changes back to normal after **Apply CFR Configuration** is performed

CFR Configuration Algorithm

Specifies the algorithm for CFR configuration. CFR algorithm is synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Clipping and Filtering	`CFILtering`	Time domain clipping on the IQ samples
Peak Cancellation	`PCANcel`	Subtracting the signal peaks

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:ALGorithm CFILtering | PCANcel` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:ALGorithm?`
Example	`:SOUR:WAV:CFR:CONF:ALG CFIL` `:SOUR:WAV:CFR:CONF:ALG?`
Preset	`PCANcel`
State Saved	Saved in instrument state
Range	Clipping & Filtering | Peak Cancellation

CFR Configuration Target PAPR

Specifies the target PAPR for the CFR configuration. The Target PAPR will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:PAPR:TARGet <real>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:PAPR:TARGet?`
Example	`:SOUR:WAV:CFR:CONF:PAPR:TARG 9` `:SOUR:WAV:CFR:CONF:PAPR:TARG?`
Preset	8
State Saved	Saved in instrument state
Min	3
Max	100

CFR Configuration Max Iteration

Specifies the maximum iteration for the CFR configuration. The Max Iteration will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:MITeration <int>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:MITeration?`
Example	`:SOUR:WAV:CFR:CONF:MIT 9` `:SOUR:WAV:CFR:CONF:MIT?`
Preset	10
State Saved	Saved in instrument state
Min	1
Max	1000

CFR Configuration Max Order

Specifies the maximum order of the filter for the CFR configuration. The Max Order will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:MORDer <int>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:MORDer?`
Example	`:SOUR:WAV:CFR:CONF:FILT:MORD 100` `:SOUR:WAV:CFR:CONF:FILT:MORD?`
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering`
Preset	300
State Saved	Saved in instrument state
Min	1
Max	2048

CFR Configuration Pass Frequency

Specifies the pass frequency of the filter for the CFR configuration. The Pass Frequency will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:FREQuency:PASS <freq>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:FREQuency:PASS?`
Example	`:SOUR:WAV:CFR:CONF:FILT:FREQ:PASS 40e6` `:SOUR:WAV:CFR:CONF:FILT:FREQ:PASS?`
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering` The value of Pass Frequency is not greater than CFR Configuration Stop Frequency – 1Hz
Preset	1.25 MHz
State Saved	Saved in instrument state
Min	1 Hz
Max	999.999999 MHz

CFR Configuration Stop Frequency

Specifies the stop frequency of the filter for the CFR configuration. The Stop Frequency will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:FREQuency:STOP <freq>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:FREQuency:STOP?`
Example	`:SOUR:WAV:CFR:CONF:FILT:FREQ:STOP 40e6` `:SOUR:WAV:CFR:CONF:FILT:FREQ:PASS?`
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering` The value of Stop Frequency is not less than CFR Configuration Pass Frequency + 1Hz
Preset	1.5625 MHz
State Saved	Saved in instrument state
Min	2 Hz
Max	1 GHz

CFR Configuration Passband Ripple

Specifies the passband ripple of the filter for the CFR configuration. The Passband Ripple will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:PRIPple <real>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:PRIPple?`
Example	`:SOUR:WAV:CFR:CONF:FILT:PRIP 1` `:SOUR:WAV:CFR:CONF:FILT:PRIP?`
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering`
Preset	0.01 dB
State Saved	Saved in instrument state
Min	0.001 dB
Max	5 dB

CFR Configuration Stopband Attenuation

Specifies the stopband attenuation of the filter for the CFR configuration. The Stopband Attenuation will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:SATTenuation <real>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:SATTenuation?`
Example	`:SOUR:WAV:CFR:CONF:FILT:SATT 10` `:SOUR:WAV:CFR:CONF:FILT:SATT?`
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering`

Preset	50 dB
State Saved	Saved in instrument state
Min	6 dB
Max	200 dB

CFR Configuration Block Size

Specifies the block size for the CFR configuration. The Block Size will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:BSIZe <int>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:BSIZe?`
Example	`:SOUR:WAV:CFR:CONF:BSIZ 100` `:SOUR:WAV:CFR:CONF:BSIZ?`
Dependencies	Only visible when "CFR Algorithm" on page 295 is `CFILtering`
Preset	1000
State Saved	Saved in instrument state
Min	20
Max	Infinity

CFR Configuration Cancellation Percentage

Specifies the cancellation percentage for the CFR configuration. The Cancellation Percentage will be synchronized with this parameter after "Apply CFR Configuration" on page 300 is performed.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:CPCT <real>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:CPCT?`
Example	`:SOUR:WAV:CFR:CONF:CPCT 90` `:SOUR:WAV:CFR:CONF:CPCT?`
Notes	Read-only in the GUI
Dependencies	Only visible when "CFR Algorithm" on page 295 is `PCANcel`
Preset	100
State Saved	Saved in instrument state
Min	0
Max	100

CFR Configuration Edit Filter Mask

Opens a dialog box for you to manually input the filter mask used for Peak Cancellation CFR configuration.

Only visible when CFR Configuration CFR Algorithm is Peak Cancellation.

The parameters described in this section are power-on-persistent.

Selected Filter Mask

Specifies the selected filter Mask. The selected filter mask does not take effect until "Apply CFR Configuration" on page 300 is executed once via either the GUI or the SCPI command.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk:INDex:SELect <integer>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk:INDex:SELect?`
Example	`:SOUR:WAV:CFR:CONF:FMAS:IND:SEL 2` `:SOUR:WAV:CFR:CONF:FMAS:IND:SEL?`
Preset	1
State Saved	Saved in instrument state
Min	1
Max	12

Go to Row

Navigates the highlighted row in a selected filter mask.

Min	0
Max	2000

Insert Row Below

A duplicate row is created under the current row and becomes selected. The new row does not take effect until it is edited.

Delete Row

Deletes the selected row.

Delete Filter Mask

Deletes the selected filter mask.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:DELete`
Example	`:SOUR:WAV:CFR:CONF:FMAS5:DEL`

Delete All Filter Masks (Remote Command only)

Purges all the filter masks.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk:ALL:DELete`
Example	`:SOUR:WAV:CFR:CONF:FMAS:ALL:DEL`

Copy (Remote Command Only)

Copies a specified filter mask to another.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:COPY <integer>`
Example	`:SOUR:WAV:CFR:CONF:FMAS3:COPY 5` Copy the 5th filter mask to the 3rd
Notes	The source filter mask is specified by the `<integer>` parameter of the command

Data (Remote Command Only)

Sets and queries the specified filter mask data. The data is a series of `<Frequency, Relative Amplitude>` pairs.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:DATA <Freq>,<Rel Amp>, <Freq>,<Rel Amp>,…,<Freq>,<Rel Amp>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:DATA?`
Example	`:SOUR:WAV:CFR:CONF:FMAS2:DATA -1E6,-10,1E6,-10` `:SOUR:WAV:CFR:CONF:FMAS2:DATA?`
Notes	The maximum number of points contained by a filter mask is 100

Filter Mask Settings

Lets you select a filter mask to edit the description and comment. See:

– "Filter Mask Description" on page 307
– "Filter Mask Comment" on page 307

Filter Mask Description

Inputs a description for the selected filter mask of up to 60 characters.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:DESCription <string>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:DESCription?`
Example	`:SOUR:WAV:CFR:CONF:FMAS5:DESC “This is the description.”` `:SOUR:WAV:CFR:CONF:FMAS5:DESC?`
Dependencies	60 characters max
State Saved	Saved in instrument state

Filter Mask Comment

Sets an ASCII comment field, which will be stored in an exported file.

Remote Command	`[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:COMMent <string>` `[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:COMMent?`
Example	`:SOUR:WAV:CFR:CONF:FMAS5:COMM “This is the comment.”` `:SOUR:WAV:CFR:CONF:FMAS5:COMM?`
Dependencies	60 characters max
State Saved	Saved in instrument state

3.1.17.5 DPD

Contains all the settings to extract and apply the DPD model.

DPD State

Enables/disables DPD functionality.

`ON`	DPD is modeled
`OFF`	DPD functionalities are bypassed

Remote	`[:SENSe]:PAMPlifier:DPD[:ENABle] ON | OFF | 1 | 0`

Command	`[:SENSe]:PAMPlifier:DPD[:ENABle]?`
Example	`:PAMP:DPD ON` `:PAMP:DPD?`
Couplings	If you change the relevant settings of the reference signal, **DPD State** is automatically switched to `OFF`, and only pre-DPD results are displayed and calculated for every sweep The relevant settings of the reference signal include reference signal waveform, power, carrier reference frequency, and radio standard When not 'user defined', the envelope source is coupled with **DPD State** as follows: – The envelope source changes to non-pre-distorted waveform when **DPD State** is `OFF`. The enumeration entry pre-distorted waveform is disabled – The envelope source and **DPD State** are not coupled when the envelope source is 'user-defined' – The envelope source changes to pre-distorted waveform when **DPD State** is `ON`
Preset	`OFF`
State Saved	Saved in instrument state

DPD Mode

The PA measurement supports two DPD modes:

Extract & Apply	`EAPPly`	With the knowledge of PA device input signal and the acquired PA device output signal, the PA model is extracted using the algorithm and parameters that are defined by controls in the DPD tab. Then, the waveform is pre-distorted based on the extracted model to compensate the non-linearity introduced by the PA device
Apply Only	`APPLy`	The waveform is directly pre-distorted with a user-provided Look Up Table (LUT), or the coefficient file

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODE EAPPly | APPLy` `[:SENSe]:PAMPlifier:DPD:MODE?`
Example	`:PAMP:DPD:MODE EAPP` `:PAMP:DPD:MODE?`
Couplings	"Measure DPD Iteration" on page 312 is `OFF` and disabled when **DPD Mode** is `APPLy`
Preset	`EAPP`
State Saved	Saved in instrument state

PA Model Extraction

PA Model is the inverse of DPD model extracted from PA In and PA Out signals.

ON	PA model is extracted along with DPD model extraction
OFF	PA model is *not* extracted

Remote Command	`[:SENSe]:PAMPlifier:PAModel[:ENABle] ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:PAModel[:ENABle]?`
Example	`:PAMP:PAM 1` `:PAMP:PAM?`
Notes	The PA model type is the same as "DPD Algorithm (formerly DPD Model Type)" on page 313 except for MATLAB Scripts
Dependencies	Only enabled when both the following conditions are met: – "DPD State" on page 307 = ON – "DPD Mode" on page 308 = EAPPly
Preset	OFF
State Saved	Saved in instrument state

DPD Method

As DPD model is acquired, one of two methods are used to apply the DPD model.

Generator	GENerator	The connected VXG or N5186A applies the DPD model acquired from Power Amplifier application to reference signal This method is only enabled when a VXG (version A.06 or later) or N5186A is connected and "Burst Shape & Mask State" on page 292 is OFF, otherwise, the method is disabled Not available when DPD Algorithm is GMP
Pre-Distorted Waveform	PWAVeform	Power Amplifier Application acquires the DPD model then applies the model to reference signal to generate the waveform file and transfer the file to signal source to play

Remote Command	`[:SENSe]:PAMPlifier:DPD:METHod GENerator | PWAVeform` `[:SENSe]:PAMPlifier:DPD:METHod?`
Example	`:PAMP:DPD:METH PWAV` `:PAMP:DPD:METH?`
Dependencies	The Generator is enabled when the connected Signal Generator can support DPD, such as VXG (version A.06 or later) or N5186A As from A.34.00, benchtop instruments support **Burst Shape & Mask State** on a VXG. The method GENerator is also disabled when **Burst Shape & Mask State** is ON Not visible in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A, because GENerator is not supported GENerator method is disabled when DPD Algorithm is GMP

Couplings	In a benchtop instrument with a VXG is connected, the envelope tracking state is influenced by **DPD Method**. The envelope tracking state is only enabled when all the following conditions are met: – **DPD Method** is `GENerator` – The VXG version is A.08 or higher – The number of channels of the connected VXG is greater than 1 – **Burst Shape & Mask State** is `OFF` DPD Method = Generator, DPD Algorithm GMP is disabled
Preset	`PWAV`
State Saved	Saved in instrument state

Iteration Number

Specifies the iteration number for the DPD process.

Remote Command	`[:SENSe]:PAMPlifier:DPD:ITERation <integer>` `[:SENSe]:PAMPlifier:DPD:ITERation?`
Example	`:PAMP:DPD:ITER 2` `:PAMP:DPD:ITER?`
Couplings	"Measure DPD Iteration" on page 312 is `OFF` and disabled when **Iteration Number** is 1
Preset	1
State Saved	Saved in instrument state
Min	1
Max	100

Train & Apply Equalizer

This is an "immediate action" function. It is used to extract equalizer coefficients and apply the equalizer to the signal under test.

The equalizer coefficients are created from the channel response, which is estimated by some pilot signals. The pilot signals are automatically loaded and played back when the key is pressed.

After the "immediate action" is completed, the waveform played back is the equalized signal.

Remote Command	`[:SENSe]:PAMPlifier:EQUalizer:TRAin`
Example	`:PAMP:EQU:TRA`
Dependencies	Appears in N9032B, N9042B, M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A,

S9108A, S9110A, S9115A models

Disabled if reference signal is not yet loaded and played back

Eq Training Signal Type

Equalizer coefficients are calculated from channel response. The channel response is estimated by some pilot signals.

The parameter is used to select the type of pilot signal. There are 2 types:

Option	SCPI	Details
Full BW Signal	FBW	The pilot signal is to be selected from the waveforms below, the pilot signal is designed to fully cover one of the hardware bandwidths, that is, KEYS_EQ_300MHz.wfm covers DIF 255M path, KEYS_EQ_1875 MHz.wfm covers DIF 1500 MHz path. The specific waveform is automatically selected by sampling rate of reference signal when **Train & Apply Equalizer** is pressed – KEYS_EQ_300MHz.wfm – KEYS_EQ_1200MHz.wfm – KEYS_EQ_1500MHz.wfm – KEYS_EQ_1875MHz.wfm – KEYS_EQ_2500MHz.wfm – KEYS_EQ_4800MHz.wfm
Current Signal	CURRent	The pilot signal is the current reference signal previously loaded. When **Current Signal** is selected, the equalizer only works on in-band bandwidth of the reference signal and does not affect the out-band of the reference signal. For example, if the reference signal is oversampled by 3, and you want to equalize not only in-band but the out-band of the reference signal, select the **Full BW Signal** option

Remote Command	[:SENSe]:PAMPlifier:EQUalizer:SIGNal[:TYPE] CURRent | FBW See above for option details [:SENSe]:PAMPlifier:EQUalizer:SIGNal[:TYPE]?
Example	:PAMP:EQU:SIGN FBW :PAMP:EQU:SIGN?
Dependencies	Appears in N9032B, N9042B, M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A models Disabled if reference signal is not yet loaded and played back
Preset	No
State Saved	Current Signal | Full BW Signal
Range	Eq Training Signal Type

Apply Equalizer

When **Train & Apply Equalizer** is pressed and the action is completed, there are two reference signals in signal source, one is the original reference signal (named `RefWaveform.wfm`) and the other is the equalized reference signal (named `RefWaveform_Eq.wfm`). The key is used to select either `RefWaveform.wfm` or `RefWaveform_Eq.wfm`.

- If **Apply Equalizer** = Off, `RefWaveform.wfm` is selected to play
- If **Apply Equalizer** = On, `RefWaveform_Eq.wfm` is selected to play

Remote Command	`[:SENSe]:PAMPlifier:EQUalizer[:ENABle] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:EQUalizer[:ENABle]?`
Example	`:PAMP:EQU ON` `:PAMP:EQU?`
Dependencies	1. Appears in N9032B, N9042B, M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A models 2. Disabled if reference signal is not yet loaded and played back 3. When **Center Frequency** is changed, this key is disabled, and **Apply Equalizer** is set to `OFF` 4. Disabled if the equalizer coefficients do not exist. In this case, you must press **Train & Apply Equalizer** to enable it
Preset	`OFF`
State Saved	Saved in instrument state

Clear Equalizer Coefficients

Used to delete the equalizer coefficients previously calculated.

Remote Command	`[:SENSe]:PAMPlifier:EQUalizer:CLEar`
Example	`:PAMP:EQU:CLE`
Dependencies	Appears in N9032B, N9042B, M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A models Disabled if reference signal is not yet loaded and played back

Measure DPD Iteration

Remote Command	`[:SENSe]:PAMPlifier:DPD:ITERation:MEASure[:STATe] ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:DPD:ITERation:MEASure[:STATe]?`

Example	`:PAMP:DPD:ITER:MEAS ON` `:PAMP:DPD:ITER:MEAS?`
Dependencies	Only enabled when the following conditions are met: – "DPD Mode" on page 308 is `EAPPly` – **Power Sweep** is Off (see "Meas Type" on page 257) – "Iteration Number" on page 310 is greater than 1 For all other circumstances, **Measure DPD Iteration** is switched `OFF` and disabled
Couplings	The measurement View changes to "DPD Iteration" on page 172 when **Measure DPD Iteration** and **DPD State** are both `ON`, and changes to "Normal" on page 171 when **Measure DPD Iteration** is `OFF` if the active view is not **Normal**
Preset	`OFF`
State Saved	Saved in instrument state

DPD Algorithm (formerly DPD Model Type)

Used to select the PA model extraction algorithm:

Option	SCPI	Description
Look-up Table (LUT)	`LUT`	PAs with negligible memory effects can be easily linearized with a simple LUT (Look-Up Table) DPD algorithm. LUT stores precomputed values that represent the inverse of the PA's nonlinear characteristics which are measured as PA gain and phase across different power levels. When a signal is sent to the PA, the DPD system uses the LUT to modify the signal before amplification, so the output is corrected In practice, LUT is best for PAs exhibiting primarily static AM/AM and AM/PM distortion. A good first choice for Class AB amplifiers with negligible memory effects The default settings for LUT are: – LUT Size=128 – AM/AM Order=5 – AM/PM Order=5
Memory Polynomial (MP)	`MPOLynomial`	In PAs with memory, the instantaneous output signal of the PA is a function not only of the present input signal but also of the past input signal. MP balances performance with computational efficiency, so it is industry standard for many applications Memory Polynomial (MP) model is a well-known structure

Option	SCPI	Description
		for memory and nonlinearity compensation. See "Memory Polynomial" on page 326 for the equation In practice, MP is recommended for PAs showing moderate memory effects where output depends on recent input history. MP is a good starting point for commercial PAs operating below severe compression Typical settings for MP are: – Memory Order=3-5 (how many past samples affect current output), – Nonlinear Order=5-7 (polynomial degree), – Odd-Only=ON to reduce coefficients
Volterra Series (VS)	`VOLTerra`	Volterra Series (VS) Model here is a simplified/pruned version of the standard Volterra Series model Compared to MP, VS includes cross-term interactions between signal and its delayed versions, which captures complex mixing products that MP misses. VS is more accurate but significantly has more coefficients than MP In practice, VS is recommended when PA exhibits interactions between signal and its delayed versions that MP cannot capture adequately See "Volterra Series" on page 329 for the equation Typical settings for VS are: – Memory Order = 3 – Nonlinear Order = 5 – Cross Term Order = 2 Increase cross-terms if performance reaches a plateau
GMP	`GMP`	Generalized Memory Polynomial (GMP) extends the Memory Polynomial (MP) model by incorporating lagging and leading cross terms In practice, GMP is suitable for PAs exhibiting both leading (anticipatory) and lagging (memory) effects, especially in Doherty and Envelop Tracking (ET) architectures The GMP has a three-part structure: – Combines aligned terms (standard MP) – Lagging cross-terms (thermal/bias memory), – Leading cross-terms (impedance/matching effects) GMP is most flexible but most complex

Option	SCPI	Description
		See "Generalized Memory Polynomial Model (GMP)" on page 320 for the equation Typical settings for GMP are: – Sync: Order=5, Memory = 3 – Lag/Lead: Order = 3, Memory = 2, Max Lag/Lead = 2
MATLAB Script	`MATLab`	MATLAB Script is for proprietary algorithms, research implementations or when standard models do not fit your PA's unique characteristics. It requires a MATLAB license and programming expertise The workflow for MATLAB Script is: 1. Provide .m file with DPD algorithm 2. System captures PA input/output 3. MATLAB code processes data 4. Returns coefficients or pre-distorted waveform to firmware Typical applications for MATLAB Script are: – Neural network DPD – Adaptive algorithms – Joint DPD-CFR optimization, or – Porting existing proprietary code – Expect functions handling complex I/Q arrays
ILC DPD	`ILControl`	Iterative Learning Control (ILC) DPD is a technique to use an iterative learning algorithm to find the optimal PA input signal that produces the desired linear output response, instead of focusing on identifying the parameters of the pre-distorter ILC DPD does not model PA behavior mathematically. Instead, it iteratively adjusts the input signal until output meets linearity targets In practice, this is useful when PA characteristics are unknown, or when you need to quickly verify if DPD can help before selecting a specific model. ILC DPD is ideal for initial feasibility testing Typical settings for ILC DPD are: – IQ Averaging=ON (typically 6-10 averages to reduce noise)

Option	SCPI	Description
		– Gain Expansion = 2 dB (default) – typical convergence in 3-6 iterations (default=6) Note that the DPD model (Memory polynomial or Volterra Series) *cannot* be extracted automatically unless "Extract DPD Model" on page 336 under DPD AlgorithmConfiguration, Iterative Learning Control(ILC) DPD is ON

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel[:TYPE] LUT | MPOLynomial | VOLTerra | GMP | MATLab | ILControl` `[:SENSe]:PAMPlifier:DPD:MODel[:TYPE]?`
Example	`:PAMP:DPD:MOD LUT` `:PAMP:DPD:MOD?`
Dependencies	If Ref Signal, "Waveform Type" on page 281 is `SSWaveform`, `MATLab` is disabled If "DPD State" on page 307 is `OFF`, or if "DPD Mode" on page 308 is `APPLy`, `MATLab` is disabled If DPD Mode is `APPLy`, `ILControl` is disabled
Preset	`LUT`
State Saved	Saved in instrument state
Range	Look-up Table | Memory Polynomial | Volterra Series | GMP | MATLAB Script | ILC DPD

DPD Meas Time

Specifies the total measurement acquisition length in seconds over which DPD, AM-AM, AM-PM will be performed.

When this parameter is set to Auto:

– If the reference signal has *not* been loaded, DPD Meas Time is 100 us

– If the reference signal *has* been loaded, DPD Meas Time is set to reference signal length

The measurement time starts from trigger offset.

Remote Command	`[:SENSe]:PAMPlifier:DPD:TIME:LENGth <time>` `[:SENSe]:PAMPlifier:DPD:TIME:LENGth?`
Example	`:PAMP:DPD:TIME:LENG 100us` `:PAMP:DPD:TIME:LENG?`
Preset	If the reference signal has *not* been loaded: 100 us If the reference signal *has* been loaded: Reference signal length

State Saved	Saved in instrument state
Min	0.1 us
Max	If the reference signal has *not* been loaded, the minimum of (1000s, hardware dependent) If the reference signal *has* been loaded, the minimum of (reference signal length, hardware dependent)

Auto Function

Remote Command	`[:SENSe]:PAMPlifier:DPD:TIME:AUTO ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:DPD:TIME:AUTO?`
Example	`:PAMP:DPD:TIME:AUTO 1` `:PAMP:DPD:TIME:AUTO?`
Preset	`ON`

DPD Algorithm Configuration (formerly DPD Model Configuration)

Opens a dialog that lets you set the parameters for different PA model extraction algorithms.

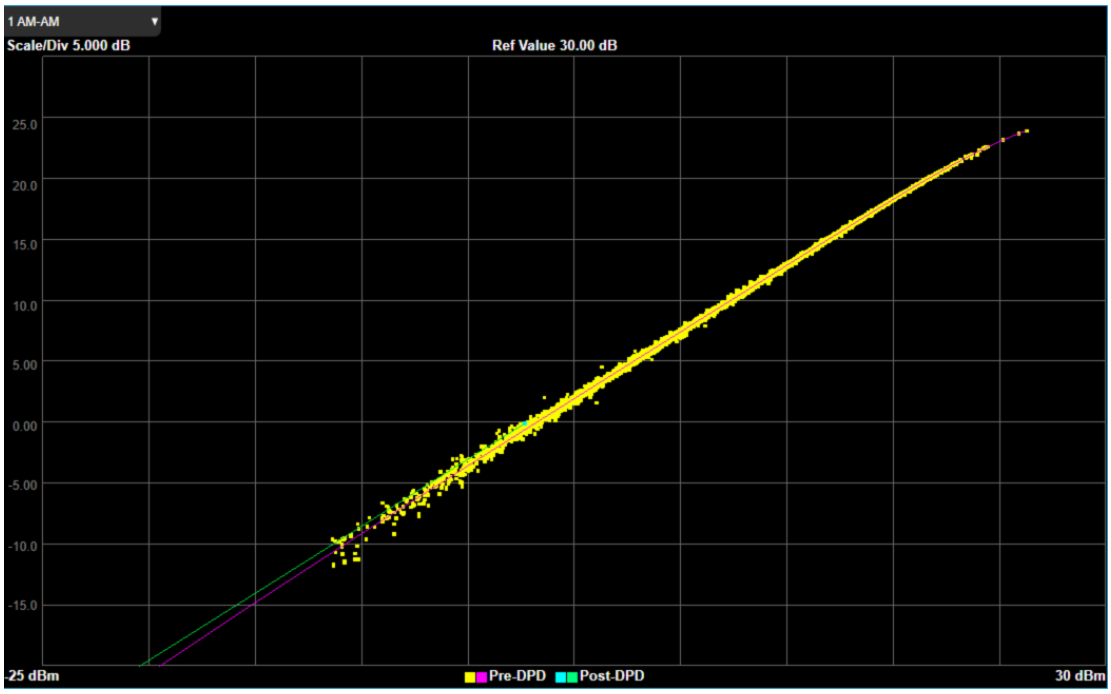
For details of each control, see:

- "Look-up Table" on page 317
- "Generalized Memory Polynomial Model (GMP)" on page 320
- "Memory Polynomial" on page 326
- "Volterra Series" on page 329
- "MATLAB Scripts" on page 331

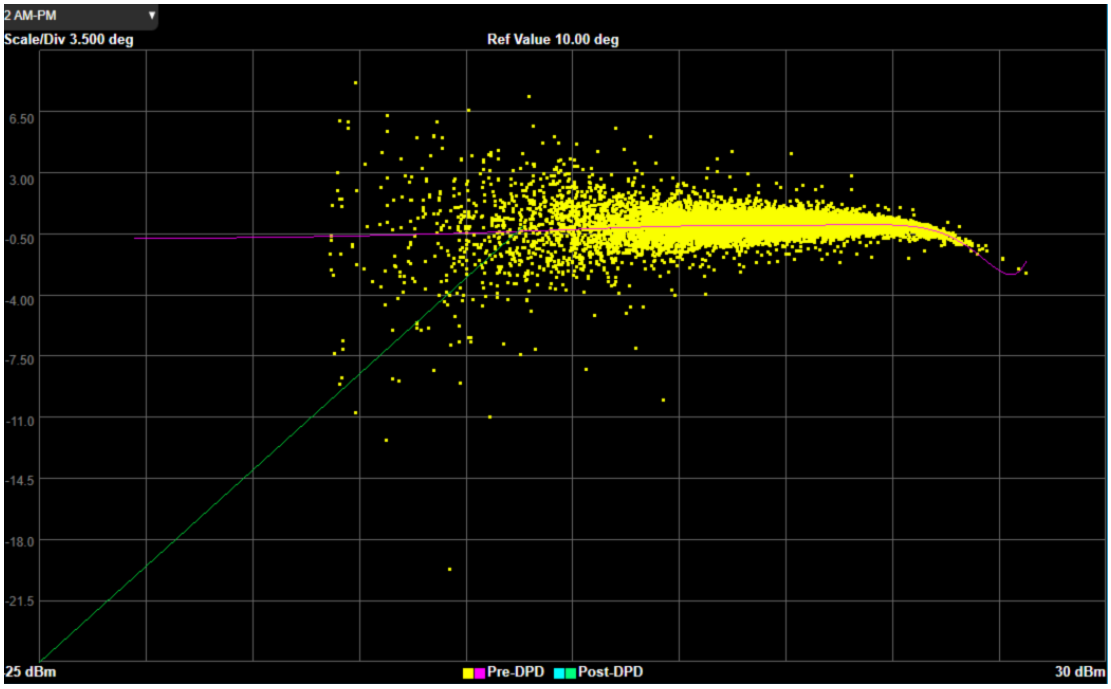
Look-up Table

To calculate a DPD LUT, the test bench must first characterize the AM-AM and AM-PM behavior of the device; see AM/AM trace and AM/PM trace. From AM/AM and AM/PM trace, we can utilize a polynomial fit to derive AM/AM and AM/PM curve separately. We can divide the input signal power evenly into LUT size segments from max to min. Then, by sending each power level into the curve, we obtain the corresponding output power. This relationship forms an AM/AM table. Similarly, by sending each signal power level into the AM/PM curve, we can obtain the corresponding phase output. This relationship forms an AM/PM table.

AM/AM Trace:



AM/PM Trace:



The controls in this menu let you set the corresponding parameters for LUT model generation.

DPD Mode

Same as "DPD Mode" on page 308 under **DPD**.

LUT Type

When generating the AM/AM and AM/PM table, the input signal power can take two forms: absolute or normalized. Absolute means the original signal power, ranging from max to min. Normalized means scaling the original signal by its maximum value, ranging from [1, min/max].

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:LUT[:TYPE] NORMalized | ABSolute` `[:SENSe]:PAMPlifier:DPD:MODel:LUT[:TYPE]?`
Example	`:PAMP:DPD:MOD:LUT NORM` `:PAMP:DPD:MOD:LUT?`
Preset	`NORMalized`
State Saved	Saved in instrument state

LUT Size

Sets the size of the look-up table. The range of the PA input signal is evenly divided into LUT size segments.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:LUT:SIZE <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:LUT:SIZE?`
Example	`:PAMP:DPD:MOD:LUT:SIZE 10` `:PAMP:DPD:MOD:LUT:SIZE?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `LUT`
Preset	128
State Saved	Saved in instrument state
Min	1
Max	3000

LUT AM/AM Polynomial Order

Sets the order for the polynomial fit of the AM/AM curve.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:LUT:AMAM:PORDer <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:LUT:AMAM:PORDer?`

Example	`:PAMP:DPD:MOD:LUT:AMAM:PORD 5` `:PAMP:DPD:MOD:LUT:AMAM:PORD?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `LUT`
Preset	5
State Saved	Saved in instrument state
Min	3
Max	12

LUT AM/PM Polynomial Order

Sets the order for the polynomial fit of the AM/PM curve.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:LUT:AMPM:PORDer <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:LUT:AMPM:PORDer?`
Example	`:PAMP:DPD:MOD:LUT:AMPM:PORD 5` `:PAMP:DPD:MOD:LUT:AMPM:PORD?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `LUT`
Preset	5
State Saved	Saved in instrument state
Min	1
Max	12

Generalized Memory Polynomial Model (GMP)

This is a more sophisticated version of the "Memory Polynomial" on page 326 Model, which combines the memory polynomial with cross terms between the signal and lagging and/or leading exponentiated envelope terms.

The complex baseband representation of the GMP-based pre-distorter is as below:

$$y[n] = \sum_{q=0}^{Q_a} \sum_{k=0}^{K_a-1} a_q x[n-q]|x[n-q]|^k + \sum_{q=0}^{Q_b} \sum_{m=1}^{M_b} \sum_{k=1}^{K_b} b_{mqk} x[n-q]|x[n-q-m]|^k + \sum_{m=1}^{M_c} \sum_{q=m}^{Q_c} \sum_{k=1}^{K_c} c_{mqk} x[n-q]|x[n-q+m]|^k$$

where:

K_a is sync order
Q_a is sync memory depth
K_b is lag order
Q_b is lag memory depth
M_b is maximum lag
K_c is lead order
Q_c is lead memory depth
M_c is maximum lead

Please note,

1. The equation above is for Nonlinear Order Selection = all (Sync term, Lag term and Lead term), for Nonlinear Order Selection = Even/Odd, please see the table below to show k representation for Sync/Lag/Lead term,
2. Here, Even/Odd means (k+1), so if k+1 is Odd, then k is even, if k+1 is even, k is odd. The table below is for k.

	All	Odd	Even
Sync	k= 0,1,2,3, ..., Ka -1	k= 0,2,4,...,Ka -1	k= 1,3,5,..., Ka -1
Lag	k= 1,2,3, ..., Kb	k= 2,4,6,...,Kb	k= 1,3,5,..., Kb
Lead	k= 1,2,3, ..., Kc	k= 2,4,6,...,Kc	k= 1,3,5,..., Kc

The controls in this menu let you set the corresponding parameters for GMP model generation.

DPD Mode

Same as "DPD Mode" on page 308 under DPD.

Model Identification Algorithm

Same as "Model Identification Algorithm" on page 327 under DPD, Memory Polynomial.

Sync Nonlinear Order

Sets the sync nonlinear order for the GMP DPD model, it is the k in the 1st term in GMP equation above.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SYNC <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SYNC?`
Example	`:PAMP:DPD:MOD:GMP:ORD:NONL:SYNC 5` `:PAMP:DPD:MOD:GMP:ORD:NONL:SYNC?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	5
State Saved	Saved in instrument state
Min	0
Max	20

Sync Nonlinear Order Selection

Sets the sync nonlinear order selection to All, Odd or Even.

	All	Odd	Even
Sync	k= 0,1,2,3, ..., Ka -1	k= 0,2,4,...,Ka -1	k= 1,3,5,..., Ka -1

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:SYNC ALL | ODD | EVEN` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:SYNC?`
Example	`:PAMP:DPD:MOD:GMP:ORD:NONL:SEL:SYNC ALL` `:PAMP:DPD:MOD:GMP:ORD:NONL:SEL:SYNC?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	`ALL`
State Saved	Saved in instrument state
Range	All | Odd | Even

Sync Memory Depth

Sets the sync memory depth for the GMP DPD model.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:SYNC <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:SYNC?`

Example	`:PAMP:DPD:MOD:GMP:ORD:MEM:SYNC 5` `:PAMP:DPD:MOD:GMP:ORD:MEM:SYNC?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	1
State Saved	Saved in instrument state
Min	0
Max	20

Lag Nonlinear Order

Sets the lag nonlinear order for the GMP DPD model, it is the k in the 2nd term in GMP equation above.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:LAG <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:LAG?`
Example	`:PAMP:DPD:MOD:GMP:ORD:NONL:LAG 5` `:PAMP:DPD:MOD:GMP:ORD:NONL:LAG?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	0
State Saved	Saved in instrument state
Min	0
Max	20

Lag Nonlinear Order Selection

Sets the lag nonlinear order selection to All, Odd or Even.

	All	Odd	Even
Lag	k= 1,2,3, ..., Kb	k= 2,4,6,...,Kb	k= 1,3,5,..., Kb

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:LAG ALL | ODD | EVEN` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:LAG?`
Example	`:PAMP:DPD:MOD:GMP:ORD:NONL:SEL:LAG ALL` `:PAMP:DPD:MOD:GMP:ORD:NONL:SEL:LAG?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP

Preset	ALL
State Saved	Saved in instrument state
Range	All | Odd | Even

Lag Memory Depth

Sets the lag memory depth for the GMP DPD model.

Remote Command	[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:LAG <integer> [:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:LAG?
Example	:PAMP:DPD:MOD:GMP:ORD:MEM:LAG 5 :PAMP:DPD:MOD:GMP:ORD:MEM:LAG?
Dependencies	Available only when "DPD Mode" on page 308 is set to EAPPly and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	0
State Saved	Saved in instrument state
Min	0
Max	20

Maximum Lag

Sets the maximum lag for the GMP DPD model.

Remote Command	[:SENSe]:PAMPlifier:DPD:MODel:GMP:MAXimum:LAG <integer> [:SENSe]:PAMPlifier:DPD:MODel:GMP:MAXimum:LAG?
Example	:PAMP:DPD:MOD:GMP:MAX:LAG 5 :PAMP:DPD:MOD:GMP:MAX:LAG?
Dependencies	Available only when "DPD Mode" on page 308 is set to EAPPly and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	0
State Saved	Saved in instrument state
Min	0
Max	20

Lead Nonlinear Order

Sets the lead nonlinear order for the GMP DPD model, it is the k in the 3rd term in GMP equation above.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:LEAD <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:LEAD?`
Example	`:PAMP:DPD:MOD:GMP:ORD:NONL:LEAD 5` `:PAMP:DPD:MOD:GMP:ORD:NONL:LEAD?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	0
State Saved	Saved in instrument state
Min	0
Max	20

Lead Nonlinear Order Selection

Sets the lead nonlinear order selection to All, Odd or Even.

	All	Odd	Even
Lead	k= 1,2,3, ..., Kc	k= 2,4,6,...,Kc	k= 1,3,5,..., Kc

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:LEAD ALL | ODD | EVEN` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:LEAD?`
Example	`:PAMP:DPD:MOD:GMP:ORD:NONL:SEL:LEAD ALL` `:PAMP:DPD:MOD:GMP:ORD:NONL:SEL:LEAD?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	`ALL`
State Saved	Saved in instrument state
Range	All | Odd | Even

Lead Memory Depth

Sets the lead memory depth for the GMP DPD model.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:LEAD <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:LEAD?`
Example	`:PAMP:DPD:MOD:GMP:ORD:MEM:LEAD 5` `:PAMP:DPD:MOD:GMP:ORD:MEM:LEAD?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP

Preset	0
State Saved	Saved in instrument state
Min	0
Max	20

Maximum Lead

Sets the maximum lead for the GMP DPD model.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:GMP:MAXimum:LEAD <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:GMP:MAXimum:LEAD?`
Example	`:PAMP:DPD:MOD:GMP:MAX:LEAD 5` `:PAMP:DPD:MOD:GMP:MAX:LEAD?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to GMP
Preset	0
State Saved	Saved in instrument state
Min	0
Max	20

Memory Polynomial

The MP Model is a well-known structure for memory and nonlinearity compensation, as shown in Equation below:

$$Y(n) = \sum_{m=0}^{M} A_m \mathbf{x}(\mathbf{n}-\mathbf{m}) + \sum_{m=0}^{M}\sum_{i=2}^{N} B_{mi}\,\mathbf{x}(\mathbf{n}-\mathbf{m})\left|\mathbf{x}(\mathbf{n}-\mathbf{m})\right|^{i-1}$$

M is Memory Order

N is Nonlinear Order

$\sum_{m=0}^{M} A_m \mathbf{x}(\mathbf{n}-\mathbf{m})$ is linear term

$\sum_{m=0}^{M}\sum_{i=2}^{N} B_{mi}\,\mathbf{x}(\mathbf{n}-\mathbf{m})\left|\mathbf{x}(\mathbf{n}-\mathbf{m})\right|^{i-1}$ is nonlinear term

i is the order of Nonlinear term for Odd Order Only = True/False, as in the table below:

Odd Orders only= True	Odd Orders only = False
i = 3,5,7, ..., N	i = 2,3,4,5,6,,...,N

The controls in this menu let you set the corresponding parameters below for MP model generation:

- Model Identification Algorithm
- Memory Order
- Nonlinear Order
- Odd Orders Only

DPD Mode

Same as "DPD Mode" on page 308 under DPD.

Model Identification Algorithm

Selects the model identification algorithm:

LSE using QR	QR
LSE using SVD	SVD

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:IALGorithm QR | SVD` `[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:IALGorithm?`
Example	`:PAMP:DPD:MOD:MPV:IALG QR` `:PAMP:DPD:MOD:MPV:IALG?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `MPOLynomial` or `VOLTerra`
Preset	QR
State Saved	Saved in instrument state

Memory Order

Sets the memory depth for the DPD model

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:MEMory <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:MEMory?`
Example	`:PAMP:DPD:MOD:MPV:ORD:MEM 10` `:PAMP:DPD:MOD:MPV:ORD:MEM?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `MPOLynomial` or `VOLTerra`
Preset	1

State Saved	Saved in instrument state
Min	0
Max	20

Nonlinear Order

Sets the nonlinear order for the DPD model.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:NONLinear <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:NONLiear?`
Example	`:PAMP:DPD:MOD:MPV:ORD:NONL 5` `:PAMP:DPD:MOD:MPV:ORD:NONL?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `MPOLynomial` or `VOLTerra`
Preset	5
State Saved	Saved in instrument state
Min	1
Max	20

Odd Orders Only

Specifies whether to use only the odd orders of the nonlinear terms.

Odd Orders only	**i**
True	3,5,7,...,N
False	2, 3,4,5,6,...,N

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:ODD ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:ODD?`
Example	`:PAMP:DPD:MOD:MPV:ORD:ODD OFF` `:PAMP:DPD:MOD:MPV:ORD:ODD?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `MPOLynomial` or `VOLTerra`
Preset	`OFF`
State Saved	Saved in instrument state

Volterra Series

This is a simplified/pruned version of standard Volterra Series model. Compared with memory polynomial model, it adds some cross terms shown in the equation below :

$$Y(n) = \sum_{m=0}^{M} A_m \mathbf{x}(\mathbf{n}-\mathbf{m}) + \sum_{m=0}^{M}\sum_{i=2}^{N} B_{mi}\,\mathbf{x}(\mathbf{n}-\mathbf{m})|\mathbf{x}(\mathbf{n}-\mathbf{m})|^{i-1} + \sum_{i=2}^{N}\sum_{\substack{k=2 \\ even}}^{i-1}\sum_{m=1}^{Mc} C_{ikm}\mathbf{x}(\mathbf{n})|\mathbf{x}(\mathbf{n})|^{i-k-1}|\mathbf{x}(\mathbf{n}-\mathbf{m})|^{k}$$

M is Memory Order

N is Nonlinear Order

Mc is Cross term order

$\sum_{m=0}^{M} A_m \mathbf{x}(\mathbf{n}-\mathbf{m})$ is linear term

$\sum_{m=0}^{M}\sum_{i=2}^{N} B_{mi}\,\mathbf{x}(\mathbf{n}-\mathbf{m})|\mathbf{x}(\mathbf{n}-\mathbf{m})|^{i-1}$ is nonlinear term

$\sum_{i=2}^{N}\sum_{\substack{k=2 \\ even}}^{i-1}\sum_{m=1}^{Mc} C_{ikm}\mathbf{x}(\mathbf{n})|\mathbf{x}(\mathbf{n})|^{i-k-1}|\mathbf{x}(\mathbf{n}-\mathbf{m})|^{k}$ is cross term

i is the order of Nonlinear term for Odd Order Only = True/False, as in the table below:

Odd Orders only	i
True	3,5,7,...,N
False	2,3,4,5,6,...,N

k in the cross term is the nonlinear order of the envelope of the memory terms in the cross terms, it is always even and not greater than i - 1.

The controls in this menu let you set the corresponding parameters below for VS model generation:

- Model Identification Algorithm
- Memory Order
- Nonlinear Order
- Odd Orders Only
- Cross Term Order

DPD Mode

Same as "DPD Mode" on page 308 under **DPD**.

Model Identification Algorithm

Same as "Model Identification Algorithm" on page 327 under **DPD**, **Memory Polynomial**.

Memory Order

Same as "Memory Order" on page 327 under **DPD**, **Memory Polynomial**.

Nonlinear Order

Same as "Nonlinear Order" on page 328 under **DPD**, **Memory Polynomial**.

Odd Orders Only

Same as "Odd Orders Only" on page 328 under **DPD**, **Memory Polynomial**.

Cross Term Order

Sets the order of the cross terms in the Volterra Series algorithm.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:CTERm <integer>` `[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:CTERm?`
Example	`:PAMP:DPD:MOD:MPV:ORD:CTER 5` `:PAMP:DPD:MOD:MPV:ORD:CTER?`
Dependencies	Available only when "DPD Mode" on page 308 is set to `EAPPly` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `VOLTerra` *Not* available if **DPD Algorithm** is Memory Polynomial)
Preset	0
State Saved	Saved in instrument state
Min	0
Max	10

MATLAB Scripts

When "DPD Algorithm (formerly DPD Model Type)" on page 313 is set to `MATLab`, you provide the DPD extraction algorithm as a MATLAB function. The PA application invokes this function via the MATLAB API.

Assumes that the script (`.m`) file is under the MATLAB working path. The function name (for example, `dpd`) should be the same as the MATLAB function name, the input variable names (for example, `dpdIn`, `paIn`, `paOut`) and output variable name (for example, `dpdOut`) should match the settings under this tab.

DPD Function Name

The name of function in MATLAB that implements the DPD extraction algorithm.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:COMMand <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:COMMand?`
Example	`:PAMP:DPD:MOD:SCR:COMM “dpd_Out = DPD(xx,zz,y)”` `:PAMP:DPD:MOD:SCR:COMM?`
Preset	`"dpdOut = dpd(dpdIn,paIn,paOut)"`
State Saved	Saved in instrument state

Extract Function Name from .m File

Displays a file browser, allowing you to select the `.m` file that contains the DPD function name. The DPD function name can be extracted and applied to "DPD Function Name" on page 331.

Notes	The directory of the selected `.m` file is treated as the MATLAB current directory. The MATLAB working directory is changed to this directory at runtime GUI only

DPD Input

Sets the variable name for the DPD input waveform. The waveform is the baseband I/Q waveform without DPD (Reference signal). The user-supplied MATLAB script applies the extracted DPD model to the DPD input waveform to generate the pre-distorted baseband waveform.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:DPD <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:DPD?`
Example	`:PAMP:DPD:MOD:SCR:INP:DPD “dpdIn”`

	`:PAMP:DPD:MOD:SCR:INP:DPD?`
Preset	`"dpdIn"`
State Saved	Saved in instrument state

PA Input

Sets the variable name for PA Input signal. You can use the **PA Input** signal and the **PA Output** signal to extract the DPD model.

The **DPD Input** signal should be the signal at signal source output port. The **PA Input** signal should be the signal at PA input port.

PA Input signal = DPD Input signal * Math.Pow(10.0, (PA In Power – avgPower of DPD Input) / 20.0)

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:PA <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:PA?`
Example	`:PAMP:DPD:MOD:SCR:INP:PA “paIn”` `:PAMP:DPD:MOD:SCR:INP:PA?`
Preset	`"paIn"`
State Saved	Saved in instrument state

PA Output

Sets the variable name for the **PA Output** signal, which is the signal is the signal captured by instrument.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:PA <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:PA?`
Example	`:PAMP:DPD:MOD:SCR:OUTP:PA “paOut”` `:PAMP:DPD:MOD:SCR:OUTP:PA?`
Preset	`"paIn"`
State Saved	Saved in instrument state

Signal Generator Power

Sets the variable name for **Signal Generator Power**. The variable value is the Amplitude level of the Signal Generator, which it will be written into MATLAB workspace.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:SGPower <string>`

	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:SGPower?`
Example	`:PAMP:DPD:MOD:SCR:INP:SGP “sgPower”` `:PAMP:DPD:MOD:SCR:INP:SGP?`
Preset	`"sgPower"`
State Saved	Saved in instrument state

Loss In

Set the variable name for **Loss In**. The **Loss In** value under the **Amplifier** tab will be written into the MATLAB workspace.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:LOSS <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:LOSS?`
Example	`:PAMP:DPD:MOD:SCR:INP:LOSS “lossIn”` `:PAMP:DPD:MOD:SCR:INP:LOSS?`
Preset	`"lossIn"`
State Saved	Saved in instrument state

Loss Out

Sets the variable name for **Loss Out**. The **Loss Out** value under the **Amplifier** tab will be written into the MATLAB workspace.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:LOSS <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:LOSS?`
Example	`:PAMP:DPD:MOD:SCR:OUTP:LOSS “lossOut”` `:PAMP:DPD:MOD:SCR:OUTPINP:LOSS?`
Preset	`"lossOut"`
State Saved	Saved in instrument state

DPD Output

Sets the variable name for the pre-distorted waveform.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:DPD <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:DPD?`
Example	`:PAMP:DPD:MOD:SCR:OUTP:DPD “dpdOut”` `:PAMP:DPD:MOD:SCR:OUTP:DPD?`
Preset	`"dpdOut"`
State Saved	Saved in instrument state

MATLAB Current Folder (Remote Command Only)

Specifies the current MATLAB workspace folder, which is where the `.m` file for the "DPD Algorithm (formerly DPD Model Type)" on page 313 is located.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:FOLDer <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:FOLDer?`
Example	`:PAMP:DPD:MOD:SCR:FOLD "C:\TEMP"` `:PAMP:DPD:MOD:SCR:FOLD?`
Preset	`"C:\TEMP"`
State Saved	Saved in instrument state

Additional Parameter 1-12 (Remote Command Only)

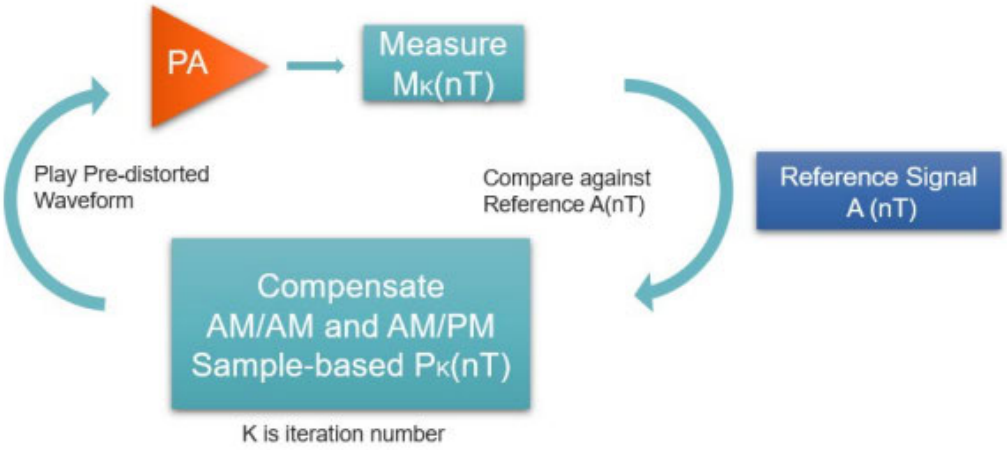
Sets the name, data type and data for additional parameter n (where n = 1–12) in the MATLAB function.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:PARM1|…|12 <string>` `[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:PARM1|…|12?`
Example	`:PAMP:DPD:MOD:SCR:INP:PARM1 "param1, DoubleArray, 1.0, 2.0, 3.0, 4.0"` `:PAMP:DPD:MOD:SCR:INP:PARM1?`
Notes	The string contains 3 comma-separated fields. The whole string is enclosed within one pair of double quotes. The 3 fields are: 1. Parameter name 2. Data type (String | Double | DoubleArray | ComplexArray) 3. Data (comma-separated values) In the SCPI example above, the three fields are: 1. Parameter name: param1 2. Data type: DoubleArray 3. Data: 1.0, 2.0, 3.0, 4.0
Preset	`"Param1,String,my parameter 1"`
State Saved	Saved in instrument state

Iterative Learning Control (ILC) DPD

Iterative Learning Control (ILC) DPD is a DPD algorithm that is not based on DPD models. It compares the PA output vector with the reference (ideal) vector iteratively

in the time domain, to generate the pre-distorted waveform to bring the output closer to the reference vector. The graphic below shows this sample-based iterative approach.



It allows the modeling of any memory effect without increasing the complexity, because any pre-distortion P(nT) depends only on the measured sample M(nT), where the memory effect of the device is present in the measured samples M. Since ILC DPD is not based on models, it generates the pre-distorted waveform and downloads this waveform to the signal source. It is obvious that a single execution of this step is not sufficient, especially when the DUT shows significant memory effect or significant non-linear behavior. Therefore, an iterative approach is necessary.

IQ Coherent Averaging

See "IQ Coherent Averaging" on page 256 under **Settings**.

IQ Coherent Averaging Number

See "IQ Coherent Averaging Number" on page 256 under **Settings**.

Iteration Number

See "Iteration Number" on page 310 under **Settings**.

Gain Expansion

See "Gain Expansion" on page 337 under **Settings**.

Extract DPD Model

ILC DPD can generate the optimal predistorted waveform after some iterations, and it is possible to extract a Memory Polynomial or Volterra Series model from the predistorted waveform. This control specifies whether to extract the model or not. If the model has been extracted, it can be exported or applied at the same way as a Memory Polynomial or Volterra Series model.

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:ILControl:ENABle ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:DPD:MODel:ILControl[:ENABle]?`
Example	`:PAMP:DPD:MOD:ILC:ENAB ON` `:PAMP:DPD:MOD:ILC:ENAB?`
Preset	`OFF`
State Saved	Saved in instrument state

DPD Model

Selects which model will be extracted from optimal predistorted waveform: Memory Polynomial (`MPOLynomial`) or Volterra Series (`VOLTerra`).

Remote Command	`[:SENSe]:PAMPlifier:DPD:MODel:ILControl[:TYPE] MPOLynomial | VOLTerra` `[:SENSe]:PAMPlifier:DPD:MODel:ILControl[:TYPE]?`
Example	`:PAMP:DPD:MOD:ILC MPOL` `:PAMP:DPD:MOD:ILC?`
Dependencies	Only visible when "Extract DPD Model" on page 336 is `ON`
Preset	`MPOLynomial`
State Saved	Saved in instrument state

Model Identification Algorithm

Same as "Model Identification Algorithm" on page 327 under **Memory Polynomial**.

Visible for ILC DPD only when "Extract DPD Model" on page 336 is `ON`.

Memory Order

Same as "Memory Order" on page 327 under **Memory Polynomial**.

Visible for ILC DPD only when "Extract DPD Model" on page 336 is `ON`.

Nonlinear Order

Same as "Nonlinear Order" on page 328 under **Memory Polynomial**.

Visible for ILC DPD only when "Extract DPD Model" on page 336 is `ON`.

Odd Orders Only

Same as "Odd Orders Only" on page 328 under **Memory Polynomial**.

Visible for ILC DPD only when "Extract DPD Model" on page 336 is `ON`.

Cross Term Order

Same as "Cross Term Order" on page 330 under **Volterra Series**.

Visible for ILC DPD only when "Extract DPD Model" on page 336 is `ON` and "DPD Algorithm (formerly DPD Model Type)" on page 313 is `VOLTerra`.

Restart DPD Iteration

This is an immediate action function to coercively restart DPD iteration measurements.

Remote Command	`[:SENSe]:PAMPlifier:DPD:ITERation:MEASure:RESTart`
Example	`:PAMP:DPD:ITER:MEAS:REST`
Dependencies	Only enabled when "Measure DPD Iteration" on page 312 is `ON`

Gain Expansion

Defines how much the power of predistorted waveform can increase relative to the peak power of the reference signal.

Remote Command	`[:SENSe]:PAMPlifier:DPD:GEXPansion <real>` `[:SENSe]:PAMPlifier:DPD:GEXPansion?`
Example	`:PAMP:DPD:GEXP 2.0` `:PAMP:DPD:GEXP?`
Preset	2.0
State Saved	Saved in instrument state
Min/Max	–/+10.0

ILC DPD Threshold

The Iterative Learning Control for Digital Pre-Distortion (ILC DPD) process compares the PA Output signal to the ideal reference signal on a sample-by-sample basis, to determine correction factors for non-linearity. However, if the power of some samples is very low, these samples will not go through the PA non-linearly, so they do not need to be accounted for by ILC DPD. This parameter is used to indicate the sample level below which the samples will not be included in the ILC DPD calculation.

Samples are *excluded* from the ILC DPD calculation if:

Sample level ≤ (Peak Level + Threshold)

- ILC DPD Threshold is a negative number, so the addition in the formula above is effectively a subtraction
- Peak Level is the peak of the captured PA out signal

Remote Command	`[:SENSe]:PAMPlifier:DPD:ILControl:THReshold <real>` `[:SENSe]:PAMPlifier:DPD:ILControl:THReshold?`
Example	`:PAMP:DPD:ILC:THR -35.0` `:PAMP:DPD:ILC:THR?`
Dependencies	*Only* visible when "DPD Algorithm (formerly DPD Model Type)" on page 313 is `ILControl`
Preset	–36.0
State Saved	Saved in instrument state
Min	–100.0
Max	0.0

3.1.17.6 Amplifier

Contains all Amplifier settings.

Max Input Power

Specifies the maximum power level that the PA allows at the input, to protect the PA from damage.

Remote Command	`[:SENSe]:PAMPlifier:POWer:IN:MAX <real>` `[:SENSe]:PAMPlifier:POWer:IN:MAX?`
Example	`:PAMP:POW:IN:MAX 0` `:PAMP:POW:IN:MAX?`

Preset	0
State Saved	Saved in instrument state
Min	–100
Max	50

Loss In

Specifies the path loss between the RF Signal Generator and the PA.

Remote Command	`[:SENSe]:PAMPlifier:POWer:LOSS:IN <real>` `[:SENSe]:PAMPlifier:POWer:LOSS:IN?`
Example	`:PAMP:POW:LOSS:IN 0` `:PAMP:POW:LOSS:IN?`
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+100

Loss Out

Specifies the power loss between the PA and the Spectrum Analyzer. Duplicate of the external gain.

Remote Command	`[:SENSe]:PAMPlifier:POWer:LOSS:OUT <real>` `[:SENSe]:PAMPlifier:POWer:LOSS:OUT?`
Example	`:PAMP:POW:LOSS:OUT 0` `:PAMP:POW:LOSS:OUT?`
Couplings	Loss Out is coupled to **Input/Output**, **External Gain**, **External Preamp** by: Loss Out = –External Preamp
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+120 dB

Gain

Specifies the PA gain.

Remote Command	`[:SENSe]:PAMPlifier:POWer:GAIN <real>` `[:SENSe]:PAMPlifier:POWer:GAIN?`
Example	`:PAMP:POW:GAIN 10` `:PAMP:POW:GAIN?`

Preset	20
State Saved	Saved in instrument state
Min	0
Max	100

Power Control Mode

Controls the power at PA input or PA output.

Remote Command	`[:SENSe]:PAMPlifier:POWer:CONTrol:MODE PAINput | PAOutput` `[:SENSe]:PAMPlifier:POWer:CONTrol:MODE?`
Example	`:PAMP:POW:CONT:MODE PAIN` `:PAMP:POW:CONT:MODE?`
Preset	`PAINput`
State Saved	Saved in instrument state
Range	PA Input | PA Output

Input Power

Specifies the PA input power used by the measurement when "Power Control Mode" on page 340 is `PAINput` and "Meas Type" on page 257 is `SPOWer`.

Remote Command	`[:SENSe]:PAMPlifier:POWer:IN <real>` `[:SENSe]:PAMPlifier:POWer:IN?`
Example	`:PAMP:POW:IN -10` `:PAMP:POW:IN?`
Preset	–10
State Saved	Saved in instrument state
Min	–100
Max	Max = Min PA Max Input Power, SA Max Input Power - PA Gain + Loss Out

Output Power

Specifies the PA output power used by the measurement when "Power Control Mode" on page 340 is `PAOutput` and "Meas Type" on page 257 is `SPOWer`.

Remote Command	`[:SENSe]:PAMPlifier:POWer:OUT <real>` `[:SENSe]:PAMPlifier:POWer:OUT?`

Example	`:PAMP:POW:OUT -10` `:PAMP:POW:OUT?`
Preset	–10
State Saved	Saved in instrument state
Min	–100
Max	Max = Min PA Max Input Power + PA Gain, SA Max Input Power + Loss Out

Power Servo

If ON, Power Servo is performed to obtain an accurate PA output power. Power Servo is a loop that measures the PA output power with the Signal Analyzer, then adjusts the PA input power accordingly. Iterating this process gradually converges the PA output power to the target power within the limit of Power Tolerance.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SERVo[:STATe] ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:POWer:SERVo[:STATe]?`
Example	`:PAMP:POW:SERV 1` `:PAMP:POW:SERV?`
Dependencies	Only enabled after the reference waveform is loaded
Preset	`OFF`
State Saved	Saved in instrument state

Power Servo Tolerance

Specifies the accuracy of the Power Servo operation. The PA output power should be within the range of target power ± Power Servo Tolerance.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SERVo:TOLerance <real>` `[:SENSe]:PAMPlifier:POWer:SERVo:TOLerance?`
Example	`:PAMP:POW:SERV:TOL 0.1` `:PAMP:POW:SERV:TOL?`
Dependencies	Only visible when "Power Control Mode" on page 340 is `PAOutput`
Preset	1
State Saved	Saved in instrument state
Min	0.01
Max	3

Power Servo Range

A positive value representing the maximum tolerable difference between the expected PA output power and the actual PA output power. The Power Servo operation quits if the expected PA output power is greater than the sum of the actual PA output power and the Power Servo Range.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SERVo:RANGe <real>` `[:SENSe]:PAMPlifier:POWer:SERVo:RANGe?`
Example	`:PAMP:POW:SERV:RANG 0.1` `:PAMP:POW:SERV:RANG?`
Dependencies	Only visible when "Power Control Mode" on page 340 is `PAOutput`
Preset	10
State Saved	Saved in instrument state
Min	0.1
Max	100

Max Iteration

Specifies the maximum iteration number for the Power Servo operation.

Remote Command	`[:SENSe]:PAMPlifier:POWer:SERVo:MITeration <integer>` `[:SENSe]:PAMPlifier:POWer:SERVo:MITeration?`
Example	`:PAMP:POW:SERV:MIT 2` `:PAMP:POW:SERV:MIT?`
Dependencies	Only visible when "Power Control Mode" on page 340 is `PAOutput`
Preset	10
State Saved	Saved in instrument state
Min	1
Max	100

3.1.17.7 PA Meas

Contains all settings for performing the measurement.

AM-AM / AM-PM State

See "AM-AM/AM-PM State" on page 345 under AM-AM / AM-PM.

SEM State

See "SEM State" on page 369 under Spectrum Emission Mask.

EVM State

See "EVM State" on page 355 under EVM.

Radio Format

Specifies the radio format for both the SEM and EVM measurements.

Remote Command	`[:SENSe]:PAMPlifier:EVM:FORMat NR5G | WLAN | LTEAFDD` `[:SENSe]:PAMPlifier:EVM:FORMat?`
Example	`:PAMP:EVM:FORM NR5G` `:PAMP:EVM:FORM?`
Dependencies	Automatically preset when Radio Std Presets is executed
Couplings	"EVM State" on page 355 is affected by Radio Format as follows:

Radio Format	Coupling
`NR5G`	Enabled after 5GNR Mode is preloaded and is set false and disabled otherwise
`WLAN`	Enabled after WLAN Mode is preloaded and is set false and disabled otherwise
`LTEAFDD`	Enabled after LTEA-FDD Mode is preloaded and is set false and disabled otherwise

"Optimize EVM" on page 356 is disabled and set to off when Radio Format is `LTEAFDD`, and is enabled otherwise

"EVM Meas Time" on page 356 is disabled when Radio Format is `LTEAFDD`, and is enabled otherwise

Preset	`NR5G`
State Saved	Saved in instrument state
Range	5GNR | WLAN | LTEA-FDD

AM-AM / AM-PM

Opens a dialog that lets you set the parameters for AM-AM/AM-PM.

AM/AM Polynomial Order

Specifies the order for the polynomial approximation of the AM/AM curve.

Remote Command	`[:SENSe]:PAMPlifier:PORDer:AMAM <integer>` `[:SENSe]:PAMPlifier:PORDer:AMAM?`
Example	`:PAMP:PORD:AMAM 5` `:PAMP:PORD:AMAM?`
Preset	5
State Saved	Saved in instrument state
Min	1
Max	12

AM/PM Polynomial Order

Specifies the order for the polynomial approximation of the AM/PM curve.

Remote Command	`[:SENSe]:PAMPlifier:PORDer:AMPM <integer>` `[:SENSe]:PAMPlifier:PORDer:AMPM?`
Example	`:PAMP:PORD:AMPM 5` `:PAMP:PORD:AMPM?`
Preset	5
State Saved	Saved in instrument state
Min	1
Max	12

Threshold Level

Specifies the threshold level relative to the peak power for calculating the Output Power and PAPR. This threshold level is displayed on the Raw Main Time trace in green. Only the points above the threshold line participate in the calculation of the Output Power. This parameter also has impact on the generation of envelopes when Envelope Tracking is enabled on M9410A, M9411A, M9415A, M9416A.

Remote Command	`[:SENSe]:PAMPlifier:POWer:THReshold <real>` `[:SENSe]:PAMPlifier:POWer:THReshold?`
Example	`:PAMP:POW:THR -50` `:PAMP:POW:THR?`
Preset	–36
State Saved	Saved in instrument state
Min	–100
Max	–0.1

AM-AM/AM-PM State

Toggles the state of the AM-AM/AM-PM measurements in PA measurements. When this setting is OFF, the content of the following windows in the Normal View does *not* update:

- "AM-AM" on page 173
- "AM-PM" on page 174
- "Numeric Results" on page 174
- "Raw Main Time" on page 174

Note that when the power servo is turned on, the PA output power in the Numeric Results window is shown with results, even when the state of the AM-AM/AM-PM measurement is OFF.

Remote Command	`[:SENSe]:PAMPlifier:AMAM[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:AMAM[:STATe]?`
Example	`:PAMP:AMAM ON` `:PAMP:AMAM?`
Preset	ON
State Saved	Saved in instrument state

ACP

Opens a dialog that lets you set parameters for ACP.

General

Sets the general parameters for ACP measurement.

ACP Measure Method

Specifies the method for making the ACP measurements. If Narrow Band (NBANd) is selected, the ACP measurement is made on the narrowband DIF through multiple data acquisitions, and the span is not restricted by the maximum IF bandwidth of the spectrum analyzer.

Not supported in M9410A, M911A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:METHod NORMal | NBANd` `[:SENSe]:PAMPlifier:ACPower:METHod?`
Example	`:PAMP:ACP:METH NORM` `:PAMP:ACP:METH?`
Dependencies	Changes to `NORMal` when the measurement switches to **Continuous** mode
Couplings	When `NBANd` is selected, "Noise Correction" on page 346 is switched off and disabled, but is otherwise enabled The measurement switches to **Single** mode when the selected measure method is `NBANd`
Preset	`NORM`
State Saved	Saved in instrument state
Range	Normal | Narrow Band

Noise Correction

Toggles the state of noise correction.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:NCORrection[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:ACPower:NCORrection[:STATe]?`
Example	`:PAMP:ACP:NCOR ON` `:PAMP:ACP:NCOR?`
Dependencies	In benchtop instruments, **Noise Correction** is switched off and disabled when "ACP Measure Method" on page 345 is `NBANd`, and is enabled otherwise
Preset	`OFF`
State Saved	Saved in instrument state

RBW

Sets the resolution bandwidth of the ACP spectrum.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:BANDwidth:RESolution <freq>` `[:SENSe]:PAMPlifier:ACPower:BANDwidth:RESolution?`
Example	`:PAMP:ACP:BAND:RES 30kHz` `:PAMP:ACP:BAND:RES?`
Preset	100 kHz
State Saved	Saved in instrument state
Min/Max	1 Hz/8 MHz

ACP Measurement Type

Changes the reference used for ACP measurement. This lets you make absolute and relative power measurements of either total power, or the power normalized to the measurement bandwidth.

Total Pwr Ref	TPRef	Sets the reference to the total carrier power
PSD Ref	PSDRef	Sets the reference to the power spectral density of the carrier

Remote Command	[:SENSe]:PAMPlifier:ACPower:TYPE TPRef | PSDRef [:SENSe]:PAMPlifier:ACPower:TYPE?
Example	:PAMP:ACP:TYPE PSDR :PAMP:ACP:TYPE?
Preset	TPRef
State Saved	Saved in instrument state
Range	TPRef | PSDRef

Power Ref Type

Selects the power reference type.

Left & Right Carriers	LRCarriers	Powers of leftmost and rightmost carriers with Measure Carrier ON are the references of left and right sides respectively. Left and right carriers are determined based on the carrier center frequencies If Measure Carriers of all the carriers are OFF, the reference power in the sub-block and all the relative power results are NaN
Max Power Carrier	MPCarrier	Maximum carrier power among the carriers of Measure Carrier ON is the reference of measurement If Measure Carriers of all the carriers are OFF, the reference power and all the relative power results are NaN
Manual	MANual	Power or PSD specified by the user is the reference of measurement
Carrier Index	CINDex	Power of the specified carrier is the reference of measurement If Measure Carriers of this carrier index is OFF, the reference power and all the relative power results are NaN
Total Multi-Carriers	TMCarriers	Total power of multi-carriers is the power reference of measurement. Each carrier power is calculated with its own carrier configuration settings
Min Power	MINPcarrier	Minimum carrier power among the carriers of Measure Carrier

Carrier	ON is the reference of measurement If Measure Carriers of all the carriers are OFF, the reference power and all the relative power results are NaN

Remote Command	[:SENSe]:PAMPlifier:ACPower:PREFerence:TYPE LRCarriers | MPCarrier | CINDex | MANual | TMCarriers | MINPcarrier [:SENSe]:PAMPlifier:ACPower:PREFerence:TYPE?
Example	:PAMP:ACP:PREF:TYPE LRC :PAMP:ACP:PREF:TYPE?
Preset	MPCarrier
State Saved	Saved in instrument state
Range	L & R Carriers | Max Pwr Carriers | Carrier Index | Manual Power | Total Multicarriers | Min Power Carrier

Reference Carrier Index

Sets the carrier index for the reference power. The power of the carrier selected by this index becomes the reference power when "Power Ref Type" on page 347 is CINDex.

Remote Command	[:SENSe]:PAMPlifier:ACPower:CARRier:RCARrier <integer> [:SENSe]:PAMPlifier:ACPower:CARRier:RCARrier?
Example	:PAMP:ACP:CARR:RCAR 1 :PAMP:ACP:CARR:RCAR?
Dependencies	Only enabled when "Power Ref Type" on page 347 is CINDex, otherwise disabled
Preset	1
State Saved	Saved in instrument state
Min	1
Max	The value of Number of Carriers

Total Power Reference

Sets manual total power reference.

Used when "Power Ref Type" on page 347 is MANual and "ACP Measurement Type" on page 347 is TPRef.

Remote Command	[:SENSe]:PAMPlifier:ACPower:CARRier[:POWer] <real> [:SENSe]:PAMPlifier:ACPower:CARRier[:POWer]?
Example	:PAMP:ACP:CARR 10 :PAMP:ACP:CARR?

Dependencies	Available only when **ACP Measurement Type** is `TPRef` and **Power Ref Type** is `MANual` power
Preset	0.0
State Saved	Saved in instrument state
Min/Max	–/+200 dBm

PSD Ref

Sets the manual PSD reference. Used when "Power Ref Type" on page 347 is `MANual` and "ACP Measurement Type" on page 347 is `PSDRef`.

Sets the power spectral density in the carrier (main channel) that is used to compute the relative power spectral density values for the offsets.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:CARRier:CPSD <real>` `[:SENSe]:PAMPlifier:ACPower:CARRier:CPSD?`
Example	`:PAMP:ACP:CARR:CPSD 25` `:PAMP:ACP:CARR:CPSD?`
Dependencies	Enabled when "Power Ref Type" on page 347 is `MANual` and "ACP Measurement Type" on page 347 is `PSDRef`
Couplings	Automatically converted when "PSD Unit" on page 349 is changed
Preset	0.0
State Saved	Saved in instrument state
Min/Max	–/+999

PSD Unit

Sets the unit bandwidth for Power Spectral Density. The available units are dBm/Hz (`DBMHZ`) and dBm/MHz (`DBMMHZ`).

Remote Command	`:UNIT:PAMPlifier:ACPower:POWer:PSD DBMHZ | DBMMHZ` `:UNIT:PAMPlifier:ACPower:POWer:PSD?`
Example	`:UNIT:PAMP:ACP:POW:PSD DBMMHZ` `:UNIT:PAMP:ACP:POW:PSD?`
Dependencies	Enabled when "ACP Measurement Type" on page 347 is `PSDRef`
Preset	`DBMHZ`
State Saved	Saved in instrument state
Range	dBm/Hz | dBm/MHz

ACP Meas Time

Sets the data acquisition time for ACP measurement.

If **Auto** is ON, the measure time is automatically calculated, based on Resolution Bandwidth.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:TIME <time>` `[:SENSe]:PAMPlifier:ACPower:TIME?`
Example	`:PAMP:ACP:TIME 100us` `:PAMP:ACP:TIME?`
Dependencies	Coupled with "Waveform Length" on page 285 if the auto-calculated **ACP Meas Time** is greater than **Waveform Length** when **ACP Meas Time** is in **Auto** and the reference waveform has been loaded
Preset	185.39 us
State Saved	Saved in instrument state
Min	1 us
Max	Hardware dependent

Auto Function

Remote Command	`[:SENSe]:PAMPlifier:ACPower:TIME:AUTO ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:ACPower:TIME:AUTO?`
Example	`:PAMP:ACP:TIME:AUTO 1` `:PAMP:ACP:TIME:AUTO?`
Preset	`ON`

Carrier

Sets the carrier parameters for ACP measurement.

Number of Carriers

See "Number of Carriers" on page 265 under **Meas Standard**.

Carrier Coupling

See "Couple to #1" on page 266 under **Meas Standard**.

Carrier Freq Offset

See "Carrier Frequency Offset" on page 267 under **Meas Standard**.

Carrier Bandwidth

See "Carrier Bandwidth" on page 267 under Meas Standard.

Carrier Pwr Present

See "Carrier Power Present" on page 268 under Meas Standard.

ACP Carrier Measurement Noise Bandwidth

Specifies the measurement noise bandwidth used to calculate the power of each carrier.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:BANDwidth[:INTegration] <freq>, …` `[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:BANDwidth[:INTegration]?`
Example	`:PAMP:ACP:CARR:LIST:BAND 25kHz` `:PAMP:ACP:CARR:LIST:BAND?`
Notes	When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, so if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged, unless the number of values sent is greater than the number of carriers, in which case subsequent values are ignored
Dependencies	Carrier Bandwidth of each carrier is always greater than or equal to the maximum value of the ACP Carrier Measurement Bandwidth and the SEM Carrier Measurement Bandwidth of the same carrier
Preset	98.28 MHz
State Saved	Saved in instrument state
Min/Max	10 Hz/ 2 GHz

Carrier Method

Toggles the state of the RRC filter. If the method of a carrier is set to `RRC` Weighted, an extra RRC filter (for which the alpha is set by "Carrier Filter Alpha" on page 352) is applied to the spectrum in the frequency domain before calculating the integration power of the carrier.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:METHod IBW | RRC,…` `[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:METHod?`
Example	`:PAMP:ACP:CARR:LIST:METH IBW,RRC,IBW` `:PAMP:ACP:CARR:LIST:METH?`
Notes	When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, so if you want to change values 2 and 6, you must send all values up to 6.

	Subsequent values remain unchanged, unless the number of values sent is greater than the number of carriers, in which case subsequent values are ignored
Preset	`IBW`
State Saved	Saved in instrument state
Range	Integration BW | RRC Weighted

Carrier Filter Alpha

Sets the alpha value of the filter described in "Carrier Method" on page 351 for each carrier.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:FILTer:ALPHa <real>,…` `[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:FILTer:ALPHa?`
Example	`:PAMP:ACP:CARR:LIST:FILT:ALPH 0.5` `:PAMP:ACP:CARR:LIST:FILT:ALPH?`
Notes	When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, so if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged, unless the number of values sent is greater than the number of carriers, in which case subsequent values are ignored
Preset	0.22
State Saved	Saved in instrument state
Min/Max	0.01/1.0

Offset

Sets the offset parameters for ACP measurement.

Offset Frequency Define

Defines the meaning of Offset Frequency for all offsets:

`CTOCenter`	From the center of the carrier closest to the adjacent channel to the center of the adjacent channel Offset Integ BW
`CTOEdge`	From the center of the carrier closest to the adjacent channel to the edge of the closest adjacent channel Offset Integ BW
`ETOCenter`	From Center Frequency - Carrier Spacing / 2 (for lower offset), Center Frequency + Carrier Spacing / 2 (for upper offset) of the carrier closest to the adjacent channels to the center of the adjacent channel Offset Integ BW
`ETOEdge`	From Center Frequency - Carrier Spacing / 2 (for lower offset), Center Frequency + Carrier Spacing / 2 (for upper offset) of the carrier closest to the adjacent channels to the edge of the closest adjacent channel Offset Integ BW

Remote Command	`[:SENSe]:PAMPlifier:ACPower:OFFSet:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge` `[:SENSe]:PAMPlifier:ACPower:OFFSet:TYPE?`
Example	`:PAMP:ACP:OFFS:TYPE ETOC` `:PAMP:ACP:OFFS:TYPE?`
Preset	`CTOCenter`
State Saved	Saved in instrument state
Range	Carrier Center To Meas BW Center | Carrier Center To Meas BW Edge | Carrier Edge To Meas BW Center | Carrier Edge To Meas BW Edge

Offset Freq

Sets the frequency offset of each offset channel for calculating the center frequency of each offset channel. The actual meaning of this parameter is defined by "Offset Frequency Define" on page 352.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST[:FREQuency] <freq>,…` `[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST[:FREQuency]?`
Example	`:PAMP:ACP:OFFS:LIST 0,0,0,0,0,0` `:PAMP:ACP:OFFS:LIST?`
Preset	100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz, 100 MHz
State Saved	Saved in instrument state
Min/Max	0 Hz/Depends on instrument maximum IFBW

Auto Function

Remote Command	`[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:STATe OFF | ON | 0 | 1,…` `[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:STATe?`
Example	`:PAMP:ACP:OFFS:LIST:STAT 1,1,0,0,0,0` `:PAMP:ACP:OFFS:LIST:STAT?`
Preset	`ON, OFF, OFF, OFF, OFF, OFF`
State Saved	Yes
Range	`OFF|ON`

Offset Integ BW

Sets the integration bandwidth for offset channels.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:BANDwidth[:INTegration] <freq>,…` `[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:BANDwidth[:INTegration]?`

Example	:PAMP:ACP:OFFS:LIST:BAND 2MHz,2MHz,2MHz,2MHz,2MHz,2MHz :PAMP:ACP:OFFS:LIST:BAND?
Preset	98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz, 98.28 MHz
State Saved	Saved in instrument state
Min/Max	10 Hz/ 2 GHz

Offset Side

Specifies the sideband(s) to be measured for offset channels.

NEGative	Negative (lower) sideband only
BOTH	Both the negative (lower) and positive (upper) sidebands
POSitive	Positive (upper) sideband only

Remote Command	[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:SIDE NEGative | BOTH | POSitive,… [:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:SIDE?
Example	:PAMP:ACP:OFFS:LIST:SIDE BOTH :PAMP:ACP:OFFS:LIST:SIDE?
Notes	If you set POSitive or NEGative for an offset, the result for the inactive side is –999
Preset	BOTH, BOTH, BOTH, BOTH, BOTH, BOTH
State Saved	Saved in instrument state
Range	NEGative|BOTH|POSitive

Offset Method

Toggles the state of the RRC filter. If the method of an offset channel is set to RRC Weighted, an extra RRC filter, of which the alpha is set in Offset Filter Alpha will be applied to the spectrum in the frequency domain before calculating the integration power of the offset channel.

Remote Command	[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:METHod OFF | ON,… [:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:METHod?
Example	:PAMP:ACP:OFFS:LIST:METH ON,OFF,ON :PAMP:ACP:OFFS:LIST:METH?
Preset	OFF
State Saved	Saved in instrument state
Range	Integration BW|RRC Weighted

Offset Filter Alpha

Sets the alpha value of the RRC Filter for each offset channel.

Remote Command	`[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:FILTer:ALPHa <real>,…` `[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:FILTer:ALPHa?`
Example	`:PAMP:ACP:OFFS:LIST:FILT:ALPH 0.5,0.5,0.5,0.5,0.5,0.5` `:PAMP:ACP:OFFS:LIST:FILT:ALPH?`
Preset	0.22
State Saved	Saved in instrument state
Min/Max	0.01/1.00

EVM

Opens a dialog that lets you set parameters for EVM.

Radio Format

See "Radio Format" on page 343 under PA Meas.

EVM State

Toggles the state of the EVM measurement in PA measurements.

Remote Command	`[:SENSe]:PAMPlifier:EVM[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:EVM[:STATe]?`
Example	`:PAMP:EVM ON` `:PAMP:EVM?`
Dependencies	EVM State is affected by "Radio Format" on page 343 as follows:

Radio Format	Coupling
NR5G	Enabled after 5GNR Mode is preloaded and is set false and disabled otherwise
WLAN	Enabled after WLAN Mode is preloaded and is set false and disabled otherwise
LTEAFDD	Enabled after LTEA-FDD Mode is preloaded and is set false and disabled otherwise

When Power Sweep is switched ON, EVM State is automatically switched ON

Couplings	When EVM State is switched OFF, power sweep is automatically switched OFF
Preset	OFF
State Saved	Saved in instrument state

Report EVM in DB

Specifies the unit of the EVM readouts in the windows: EVM Error Summary, EVM Metrics, EVM vs. Power Metrics.

Specifies the unit of the Y-axis parameters in the EVM vs. Power Graph window.

The unit is dB when Report EVM in DB is On and is % otherwise.

Remote Command	`[:SENSe]:PAMPlifier:EVM:REPort:DB OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:EVM:REPort:DB?`
Example	`:PAMP:EVM:REP:DB ON` `:PAMP:EVM:REP:DB?`
Preset	`OFF`
State Saved	Yes
Range	`OFF|ON`

Optimize EVM

Aims at obtaining the best EVM results by improving SNR and avoid ADC overload through toggling the preamplifier, the attenuation and IF gain value based on measured signal peak level.

Remote Command	`[:SENSe]:PAMPlifier:EVM:OPTimize[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:EVM:OPTimize[:STATe]?`
Example	`:PAMP:EVM:OPT ON` `:PAMP:EVM:OPT?`
Notes	Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect
Dependencies	In benchtop instruments, set to `OFF` and disabled when "Radio Format" on page 343 is `LTEAFDD`, and is enabled otherwise
Preset	`OFF`
State Saved	Yes
Range	`OFF|ON`

EVM Meas Time

Remote Command	`[:SENSe]:PAMPlifier:EVM:TIME <time>` `[:SENSe]:PAMPlifier:EVM:TIME?`
Example	`:PAMP:EVM:TIME 100us`

	`:PAMP:EVM:TIME?`
Dependencies	When "Radio Format" on page 343 is `WLAN` or `NR5G`, **EVM Meas Time** is automatically updated with the measurement time set in the dependent demodulation measurement when the following conditions are met: – "EVM State" on page 355 is `ON` – Run Preset from WLAN Mod. Accuracy/ 5GNR EVM When **Radio Format** is `LTEAFDD`, **EVM Meas Time** is disabled because data acquisition time is automatically calculated by the LTEA-FDD EVM measurement
Preset	22ms
State Saved	Saved in instrument state
Min	1us
Max	Hardware dependent

Noise Corrected EVM

Toggles the state of **Noise Corrected EVM**. This control is only visible in M9415A/M9416A and is enabled only when **Radio Format** is **WLAN**. When it is `ON`, some extra data acquisitions are made for the noise.

Remote Command	`[:SENSe]:PAMPlifier:EVM:WLAN:NCORrection[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:EVM:WLAN:NCORrection[:STATe]?`
Example	`:PAMP:EVM:WLAN:NCOR ON` `:PAMP:EVM:WLAN:NCOR?`
Notes	Only available in M9415A/M9416A
Dependencies	Only enabled when **Radio Format** is **WLAN**
Couplings	"Skip IQ Averaging" on page 357 is `ON` and grayed-out when `Noise Corrected EVM` is `ON`, but is enabled otherwise
Preset	`OFF`
State Saved	Yes
Range	`OFF|ON`

Skip IQ Averaging

Specifies whether the EVM measurement applies IQ averaging when **IQ Averaging** is `ON`.

Remote Command	`[:SENSe]:PAMPlifier:EVM:IQAVg:SKIP[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:EVM:IQAVg:SKIP[:STATe]?`
Example	`:PAMP:EVM:IQAV:SKIP OFF`

	`:PAMP:EVM:IQAV:SKIP?`
Dependencies	`ON` and grayed-out when "Noise Corrected EVM" on page 357 is `ON`. Enabled otherwise
Preset	`OFF`
State Saved	Yes
Range	`OFF|ON`

Meas EVM

This is a read only setting and is only available when "Radio Format" on page 343 is `NR5G`.

When "EVM State" on page 355 is `ON`, this setting is synchronized with Meas Carrier of EVM measurement of 5G NR Mode (N9085EM0E).

Remote Command	`[:SENSe]:PAMPlifier:CARRier:LIST:EVM[:STATe]?`
Example	`:PAMP:CARR:LIST:EVM?`
State Saved	Saved in instrument state

Allow Full Bypass in Auto

Enables or disables Full Bypass in µW Path Auto Rule.

Advanced

Opens a dialog that lets you set advanced parameters.

Phase Noise Optimization

Lets you select the LO (local oscillator) phase noise behavior for various operating conditions.

Remote Command	`[:SENSe]:PAMPlifier:FREQuency:SYNThesis[:STATe] 1 | … | 5`
	For the meaning of each numeric option value, see "Parameter Options, Installed Options & Auto Rules" on page 359 below
	`[:SENSe]:PAMPlifier:FREQuency:SYNThesis[:STATe]?`

Example	`:PAMP:FREQ:SYNT 1` `:PAMP:FREQ:SYNT?`
Notes	Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect
Dependencies	Not available in VXT, UXM or M941xE

Preset	2
State Saved	Saved in instrument state
Range	See "Ranges" on page 363 below

Auto Function

Remote Command	`[:SENSe]:PAMPlifier:FREQuency:SYNThesis:AUTO[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:FREQuency:SYNThesis:AUTO[:STATe]?`
Example	`:PAMP:FREQ:SYNT:AUTO ON`
Preset	`ON`

Parameter Options, Installed Options & Auto Rules

The Phase Noise Optimization control lets you optimize the setup and behavior of the Local Oscillator (LO) depending on your specific measurement conditions. You may wish to trade off noise and speed, for example, to make a measurement faster without regard to noise or with optimum noise characteristics without regard to speed.

Parameter Values Summary

Option	#	Description
"Balanced" on page 360	1	– In instruments with EP0, balances close-in phase noise with spur avoidance – In instruments without EP0 optimizes phase noise for small frequency offsets from the carrier
"Best Wide-offset" on page 361	2	Optimizes phase noise for wide frequency offsets from the carrier
"Fast Tuning" on page 361	3	Optimizes LO for tuning speed
"Best Close-in" on page 360	4 or 1*	– In instruments with EP0, emphasizes close-in phase noise performance without regard to spur avoidance – In instruments without EP0, this setting is accepted but no action is taken
"Best Spurs" on page 360	5	– In instruments with EP0, emphasizes spur avoidance over close-in phase noise performance – In instruments without EP0, this setting is accepted but no action taken
Auto	-	Automatically selects LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions

*Dependent on Option EP0 installation. See "Best Close-in" on page 360 below.

The actual behavior varies somewhat depending on model number and option; for example, you always get Fast Tuning by choosing Option #3, but in some models, "Fast Tuning" on page 361 is identical in effect to "Best Close-in" on page 360.

Best Close-in

Without option EP0

```
:FREQ:SYNT 1
```

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out.

The actual frequency offset within which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset <20 kHz]

With option EP0

```
:FREQ:SYNT 4
```

In instruments with Option EP0, the LO is configured for the best possible close-in phase noise (offsets up to 600 kHz from the carrier), regardless of spurious products that occur with some center frequencies. Because this is generally less desirable for close-in measurements than the "Balanced" on page 360 setting, parameter 1 selects "Balanced" on page 360 in EP0 instruments, in the interests of optimizing code compatibility across the family. Parameter 4 selects "Best Close-in" on page 360, which is usually not as good a choice as "Balanced" on page 360.

Balanced

```
:FREQ:SYNT 1
```

In instruments with EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Best Spurs

```
:FREQ:SYNT 5
```

In instruments with EP0, the LO is configured for better phase noise than the "Best Wide-offset" on page 361 case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-in" on page 360 case mostly within ±1 octave around 300 kHz offset. Spurs are even lower than in the "Balanced" on page 360 case at better than –90 dBc, whether or not the carrier is on-screen.

This setting is never selected when Phase Noise Optimization is in Auto, you must select it manually.

Best Wide-offset

```
:FREQ:SYNT 2
```

The LO phase noise is optimized for wider offsets from the carrier. Optimization is especially improved for offsets from 70 kHz to 300 kHz. Closer offsets are compromised and the throughput of measurements (especially remote measurements where the center frequency is changing rapidly), is reduced.

The actual frequency offset beyond which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset >30 kHz]

In instruments with Option EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Fast Tuning

```
:FREQ:SYNT 3
```

In this mode, the LO behavior compromises phase noise at many offsets from the carrier in order to allow rapid measurement throughput when changing the center frequency or span. The term "Fast Tuning" on page 361 refers to the time it takes to move the local oscillator to the start frequency and begin a sweep; this setting does not impact the actual sweep time in any way.

In instruments with EP1, the LO behavior compromises phase noise at offsets below 4 MHz in order to improve measurement throughput. The throughput is especially affected when moving the LO more than 2.5 MHz and up to 10 MHz from the stop frequency to the next start frequency.

In instruments with Option EP0, this is the same configuration as "Best Spurs" on page 360. It is available with the "Fast Tuning" on page 361 label for convenience, and to make the user interface more consistent with other X-Series instrument family members.

(In models whose hardware does not provide for a "Fast Tuning" on page 361 option, the settings for "Best Close-in" on page 360 are used if "Fast Tuning" on page 361 is selected. This gives the fastest possible tuning for that hardware set.)

Auto

```
:FREQ:SYNT:AUTO ON
```

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. The selection rules are as follows.

Auto Optimization Rules

X-Series instruments have several grades of LO, offering different configurations when in the Auto Mode. The rules for Auto selection are as follows:

Models with Option	Conditions	Selection
EP0 Models with option EP0 have a two stage local oscillator, which switches to a single loop for fast tuning (available in UXA)	Center frequency is < 699.9 kHz	"Balanced" on page 360
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 361
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 361
	Other conditions	"Balanced" on page 360
EP1 Models with option EP1 have a two-loop local oscillator, which switches to a single loop for fast tuning (available in XA6/PXA)	Span > 44.44 MHz, *or* RBW > 1.9 MHz, *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 361
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 360
	All other conditions	"Best Wide-offset" on page 361
EP2 Models with option EP2 use a different loop bandwidth for the fast-tuning choice, which is a compromise between tuning speed and phase noise, giving good tuning speed at all offsets. Although not as good as for "Best Close-in" on page 360; this is useful when you have to look across a wide range of spans (available, for example, in XA5/MXA for excellent phase noise)	CF < 130 kHz , *or* CF > 12 MHz *and* Span < 495 kHz *and* RBW < 40 kHz	"Best Close-in" on page 360
	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 361
	All other conditions	"Best Wide-offset" on page 361
EP4 (available in CXA for improved phase noise)	Span > 101 MHz *or* RBW > 1.15 MHz *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 361
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 360

Models with Option	Conditions	Selection
	All other conditions	"Best Wide-offset" on page 361
All Other Models Note that in these models, the hardware does not actually provide for an extra-fast tuning option, so the settings for "Fast Tuning" on page 361 are actually the same as "Best Close-in" on page 360, but the rules are implemented this way so that the user who doesn't care about phase noise but does care about tuning speed doesn't have to remember which of the other two settings gives faster tuning	Span > 12.34 MHz, *or* RBW > 250 kHz, *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 361
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 360
	All other conditions	"Best Wide-offset" on page 361

In all the above cases:

- The RBW to be used in the calculations is the equivalent –3 dB bandwidth of the current RBW filter
- The rules apply whether in swept spans, zero span, or FFT spans

Ranges

Option	Option #	Phase Noise Option	Range
No EPx Option	1	Best Close-in	[offset < 20 kHz]
	2	Best Wide-offset	[offset > 30 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP0	4	Best Close-in	[offset < 600 kHz]
	1	Balanced	[offset < 600 kHz]
	5	Best Spurs	[offset < 600 kHz]
	2	Best Wide-offset	[offset > 800 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP1	1	Best Close-in	[offset < 140 kHz]
	2	Best Wide-offset	[offset > 160 kHz]
	3	Fast Tuning	[single loop]

Option	Option #	Phase Noise Option	Range
EP2, EP3, EP5	1	Best Close-in	[offset < 70 kHz]
	2	Best Wide-offset	[offset > 100 kHz]
	3	Fast Tuning	[medium loop bw]
EP4	1	Best Close-in	[offset < 90 kHz]
	2	Best Wide-offset	[offset > 130 kHz]
	3	Fast Tuning	[same as Best Close-In]
SA6210A with EPB	4	Best Close-in	[offset < 10 kHz]
	1	Balanced	[offset < 10 kHz]
	5	Best Spurs	[offset < 10 kHz]
	2	Best Wide-offset	[offset < 10 MHz]
	3	Fast Tuning	[same as Best Close-In]

Spur Avoidance (UXA H1G)

UXA H1G has spur at –50MHz offset of CF, this Spur Avoidance function is provided to eliminate this spur.

Auto	ON	Moves the spur completely out of analysis bandwidth The trade-offs are that available analysis bandwidth will be reduced to 400MHz and EVM could be worse as the edge of passband is used for analysis
Manual	OFF	Moves the spur by specified value. You can turn off this feature by setting the value to 0

Remote Command	`[:SENSe]:PAMPlifier:SAVoid:FREQuency <freq>` `[:SENSe]:PAMPlifier:SAVoid:FREQuency?`
Example	`:PAMP:SAV:FREQ 50MHz` `:PAMP:SAV:FREQ?`
Couplings	Grayed-out when **Mixer Mode** is Alternate When Acquisition mode is changed from Sequential to Simultaneous, this setting is reset (manual, 0 Hz) for all component carriers
Preset	0 Hz
State Saved	Saved in instrument state
Min/Max	–/+(1GHz – BW)/2

Auto Function

Remote Command	`[:SENSe]:PAMPlifier:SAVoid:AUTO ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:SAVoid:AUTO?`
Example	`:PAMP:SAV:AUTO ON`

	`:PAMP:SAV:AUTO?`
Preset	`OFF`
State Saved	Yes
Range	Auto | Manual

IF Gain

Selects the range of IF gain.

High Gain	`HIGH`	Sets 10dB IF gain for better noise level measurements
Low Gain	`LOW`	Sets 0dB IF gain for large signals
Other	`OTHer`	Sets arbitrary IF gain value within –12dB to 12dB. This selection is not available for B25 IF bandwidth option

When this parameter is changed, "IF Gain Auto" on page 365 becomes Manual (`OFF`).

Remote Command	`[:SENSe]:PAMPlifier:IF:GAIN:SELect LOW | HIGH | OTHer` `[:SENSe]:PAMPlifier:IF:GAIN:SELect?`
Example	`:PAMP:IF:GAIN:SEL LOW` `:PAMP:IF:GAIN:SEL?`
Notes	Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect
Preset	`LOW`
State Saved	Yes
Range	`LOW|HIGH|OTHer`

IF Gain Auto

Activates the auto rules for IF Gain

Remote Command	`[:SENSe]:PAMPlifier:IF:GAIN:AUTO[:STATe] ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:IF:GAIN:AUTO[:STATe]?`
Example	`:PAMP:IF:GAIN:AUTO OFF` `:PAMP:IF:GAIN:AUTO?`
Couplings	When either the auto attenuation works (for example, with electrical attenuator), or the optimized mechanical attenuator range is requested, the IF Gain setting is changed as follows: – **Auto** sets **IF Gain** to `ON` if the input attenuator is set to 0 dB – For other settings, **Auto** sets **IF Gain** to `OFF`

Preset	OFF
State Saved	Yes
Range	Auto | Man

Other IF Gain

Specifies the IF gain value. This value is used when "IF Gain" on page 365 is set to OTHer.

Remote Command	[:SENSe]:PAMPlifier:IF:GAIN:LEVel <rel_ampl> [:SENSe]:PAMPlifier:IF:GAIN:LEVel?
Example	:PAMP:IF:GAIN:LEV -10 :PAMP:IF:GAIN:LEV?
Notes	Not available for B25 IF bandwidth option Not available in M9410A, M9411A, M9415A, M9416A, S9100A, S9101A, S9106A, S9108A, S9110A, S9115A. Related SCPI commands have no effect
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+32 dB

Trigger Compensation

Synchronization requires 2 steps:

- The first step is to compensate the trigger interpolation time from hardware to the captured signal
- The second step is to correlate the compensated signal with the reference signal to find the right synchronization position

This parameter controls whether the first step is taken or not.

Remote Command	[:SENSe]:PAMPlifier:TRIGger:COMPensation[:STATe] ON | OFF | 1 | 0 [:SENSe]:PAMPlifier:TRIGger:COMPensation[:STATe]?
Example	:PAMP:TRIG:COMP ON :PAMP:TRIG:COMP?
Preset	OFF
State Saved	Saved in instrument state

Synchronization Confidence Level

The synchronization cross-correlation coefficient is a number that describes how closely the reference signal is correlated with the measured signal after synchronization.

Synchronization Confidence Level is a user-predefined threshold that ranges from 0.0 to 100.00%. If the synchronization cross-correlation coefficient is greater than the Synchronization Confidence Level, the synchronization is successful, otherwise, it fails.

Remote Command	`[:SENSe]:PAMPlifier:SYNC:CONFidence <double>` `[:SENSe]:PAMPlifier:SYNC:CONFidence?`
Example	`:PAMP:SYNC:CONF 95.00` `:PAMP:SYNC:CONF?`
Preset	98.00
State Saved	Saved in instrument state
Min	0.0
Max	100.00

Spectrum Inversion

If `INVert` is selected, the captured complex time-domain waveform is conjugated, which has the effect of flipping the spectrum around the center frequency. This feature is useful when the PA out signal is inverted or flipped due to a PA up-conversion.

Note that this setting does not affect EVM demodulation in Power Amplifier Mode. This is because the settings for EVM demodulation in Power Amplifier are synchronized with the EVM settings for the corresponding Modes. For example, 5GNR EVM in Power Amplifier gets its settings from 5GNR Mode. To apply spectrum inversion in 5GNR EVM in Power Amplifier, you must select spectrum inversion in 5GNR Mode first.

The Spectrum Inversion setting in Power Amplifier Mode is only effective in DPD, AM/AM, AM/PM, ACP, and SEM measurements.

Remote Command	`[:SENSe]:PAMPlifier:SPECtrum INVert | NORMal` `[:SENSe]:PAMPlifier:SPECtrum?`
Example	`:PAMP:SPEC INV` `:PAMP:SPEC?`
Preset	`NORMal`

State Saved	Saved in instrument state
Range	Normal | Invert

3.1.17.8 Frequency Offset Mode

Specifies how to handle the frequency offset for the PA system.

There are 2 available modes:

Manual	`MANual`	If you know the frequency offset, you can specify it explicitly. Frequency offset can then be compensated before making PA measurements
Off	`OFF`	No estimation or compensation of the frequency offset

Remote Command	`[:SENSe]:PAMPlifier:FREQuency:OFFSet:MODE MANual | OFF` `[:SENSe]:PAMPlifier:FREQuency:OFFSet:MODE?`
Example	`:PAMP:FREQ:OFFS:MODE MAN` `:PAMP:FREQ:OFFS:MODE?`
Preset	`OFF`
State Saved	Saved in instrument state

3.1.17.9 Frequency Offset

The frequency offset for the PA system.

When Frequency Offset Mode = `MANual`, you can specify the value explicitly.

Remote Command	`[:SENSe]:PAMPlifier:FREQuency:OFFSet <freq>` `[:SENSe]:PAMPlifier:FREQuency:OFFSet?`
Example	`:PAMP:FREQ:OFFS 30kHz` `:PAMP:FREQ:OFFS?`
Dependencies	Not visible when Frequency Offset Mode is `OFF`
Preset	0.0000 Hz
State Saved	Saved in instrument state
Min/Max	–/+1.0000 MHz

Spectrum Inversion

If `INVert` is selected, the captured complex time-domain waveform is conjugated, which has the effect of flipping the spectrum around the center frequency. This

feature is useful when the PA out signal is inverted or flipped due to a PA up-conversion.

Note that this setting does not affect EVM demodulation in Power Amplifier Mode. This is because the settings for EVM demodulation in Power Amplifier are synchronized with the EVM settings for the corresponding Modes. For example, 5GNR EVM in Power Amplifier gets its settings from 5GNR Mode. To apply spectrum inversion in 5GNR EVM in Power Amplifier, you must select spectrum inversion in 5GNR Mode first.

The Spectrum Inversion setting in Power Amplifier Mode is only effective in DPD, AM/AM, AM/PM, ACP, and SEM measurements.

Remote Command	`[:SENSe]:PAMPlifier:SPECtrum INVert | NORMal` `[:SENSe]:PAMPlifier:SPECtrum?`
Example	`:PAMP:SPEC INV` `:PAMP:SPEC?`
Preset	`NORMal`
State Saved	Saved in instrument state
Range	Normal | Invert

Spectrum Emission Mask

Opens a dialog that lets you set parameters for SEM.

General

Sets the general parameters for SEM measurement.

Radio Format

See "Radio Format" on page 343 under PA Meas.

SEM State

Toggles the state of the SEM measurements in PA measurements.

Remote Command	`[:SENSe]:PAMPlifier:SEMask[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:SEMask[:STATe]?`
Example	`:PAMP:SEM ON` `:PAMP:SEM?`
Preset	`OFF`
State Saved	Saved in instrument state

Channel RRC Filter

Toggles the state of the Root Raised Cosine (RRC) filtering of the carriers.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:FILTer[:RRC][:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:SEMask:FILTer[:RRC][:STATe]?`
Example	`:PAMP:SEM:FILT ON` `:PAMP:SEM:FILT?`
Preset	`OFF`
State Saved	Saved in instrument state

RRC Filter Alpha

Sets the alpha value (roll-off) for the RRC Filter.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:FILTer[:RRC]:ALPHa <real>` `[:SENSe]:PAMPlifier:SEMask:FILTer[:RRC]:ALPHa?`
Example	`:PAMP:SEM:FILT:ALPH 0.3` `:PAMP:SEM:FILT:ALPH?`
Preset	0.22
State Saved	Saved in instrument state
Min/Max	0.01/1.0

Channel RBW

Sets the maximum RBW of the channel for the SEM measurement. The actual RBW of the channel is the minimum value of Channel RBW and the minimum Offset Resolution Bandwidth of all the enabled offsets.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:CARRier:BANDwidth:RESolution <freq>` `[:SENSe]:PAMPlifier:SEMask:FILTer[:RRC]:ALPHa?`
Example	`:PAMP:SEM:CARR:BAND:RES 30e3` `:PAMP:SEM:CARR:BAND:RES?`
Preset	910 kHz
State Saved	Saved in instrument state
Min/Max	1kHz / 8MHz

Measurement Type

Specifies one of the following measurement reference types:

Total Power Ref	TPRef	Sets the reference to the total carrier power and the measured data is shown in dBc and dBm
PSD Ref	PSDRef	Sets the reference to the mean power spectral density of the carrier and the measured data is shown in dB and dBm/Hz
Spectrum Peak Ref	SPRef	Sets the reference to the spectrum peak power of the carrier and the measured data is shown in dB and dBm

Remote Command	`[:SENSe]:PAMPlifier:SEMask:TYPE PSDRef | TPRef | SPRef` `[:SENSe]:PAMPlifier:SEMask:TYPE?`
Example	`:PAMP:SEM:TYPE PSDR` `:PAMP:SEM:TYPE?`
Preset	TPRef
State Saved	Saved in instrument state
Range	Total Power Reference | PSD Reference | Spectrum Peak Reference

Power Reference Type

Specifies the power reference type:

Option	SCPI	Description
Left & Right Carriers	LRCarriers	Powers of leftmost and rightmost carriers with Measure Carrier On in a sub-block are the references of left and right sides respectively. Only the frequency ranges of leftmost and rightmost carriers are swept and measured. Other frequency ranges in the RFBW are not measured. Left and right carriers are determined based on the carrier center frequencies If Measure Carriers of all the carriers in a sub-block are off, the reference power in a sub-block and all the relative power results are NaN. Relative limits are not evaluated
Max Power Carrier	MPCarrier	Maximum carrier power is the reference of measurement. All the configured carriers are measured If Measure Carriers of all the carriers are off, the reference power and all the relative power results are NaN. Relative limits are not evaluated
Carrier Index	CINDex	Power of the specified carrier is the reference of measurement. Only the frequency range of the specified carrier is swept and measured, and other frequency ranges in the RFBW are not measured If Measure Carriers of this carrier index is off, the reference power and all the relative power results are NaN. Relative limits are not evaluated
Manual	MANual	Power or PSD specified by the user is the reference of measurement. No carriers

Option	SCPI	Description
		are measured, and the manually specified value is used as reference
RF Bandwidth	RFBandwidth	Power or PSD of total of the RF bandwidth is the reference of measurement. Power not only in the carrier bands but also carrier gaps is integrated into the reference power. Measure Carrier On/Off does not affect the reference power frequency range because RF bandwidth is determined by the carrier configuration

Remote Command	[:SENSe]:PAMPlifier:SEMask:CARRier:PREFerence:TYPE LRCarriers | MPCarrier | CINDex | MANual | RFBandwidth [:SENSe]:PAMPlifier:SEMask:CARRier:PREFerence:TYPE?
Example	:PAMP:SEM:CARR:PREF:TYPE CIND :PAMP:SEM:CARR:PREF:TYPE?
Dependencies	RFBandwidth is disabled when Radio Format is WLAN and enabled otherwise
Preset	MPCarrier
State Saved	Saved in instrument state
Range	Left & Right Carriers | Max Power Carriers | Carrier Index | Manual | RF Bandwidth

Reference Carrier Index

Sets carrier index of the reference power. The power of the carrier selected by this index becomes reference power when Power Reference Type is CINDex.

Remote Command	[:SENSe]:PAMPlifier:SEMask:CARRier:INDex <integer> [:SENSe]:PAMPlifier:SEMask:CARRier:INDex?
Example	:PAMP:SEM:CARR:IND 1 :PAMP:SEM:CARR:IND?
Dependencies	The value of this setting is not greater than the number of the carriers Only enabled when Power Reference Type is CINDex
Preset	1
State Saved	Saved in instrument state
Min/Max	18

Total Power Reference

Sets the power that is used to compute the relative power values for the offsets.

Remote Command	[:SENSe]:PAMPlifier:SEMask:CARRier[:POWer] <real> [:SENSe]:PAMPlifier:SEMask:CARRier[:POWer]?
Example	:PAMP:SEM:CARR 100dBm :PAMP:SEM:CARR?

Dependencies	Only active when **Measurement Type** is set to TPRef and **Power Reference Type** is set to **Manual**. Grayed-out otherwise
Preset	–200 dBm
State Saved	Saved in instrument state
Min/Max	–/+200 dBm

PSD Reference

Sets the power spectral density that is used to compute the relative power spectral density values for the offsets.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:CARRier:CPSD <real>` `[:SENSe]:PAMPlifier:SEMask:CARRier:CPSD?`
Example	`:PAMP:SEM:CARR:CPSD 10` `:PAMP:SEM:CARR:CPSD?`
Dependencies	Only active when **Measurement Type** is set to PSDRef and **Power Reference Type** is set to **Manual**. Grayed-out otherwise
Preset	200 dBm
State Saved	Saved in instrument state
Min/Max	–/+200 dBm

Spectrum Peak

Sets the spectrum peak power that is used to compute the relative power spectral density values for the offsets when "Measurement Type" on page 371 is Spectrum Peak.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:CARRier:PEAK[:POWer] <real>` `[:SENSe]:PAMPlifier:SEMask:CARRier:PEAK[:POWer]?`
Example	`:PAMP:SEM:CARR:PEAK -80` `:PAMP:SEM:CARR:PEAK:POWER?`
Dependencies	Only active when **Measurement Type** is set to `SPRef` and **Power Reference Type** is set to **Manual**. Grayed-out otherwise
Preset	–200
State Saved	Saved in instrument state
Min/Max	–/+200

SEM Measure Time

Sets the data acquisition time for SEM measurement.

If **Auto** is ON, the measure time is automatically calculated based on the minimum value of the RBW of the channel and those of all the enabled offsets.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:TIME <time>` `[:SENSe]:PAMPlifier:SEMask:TIME?`
Example	`:PAMP:SEM:TIME 100us` `:PAMP:SEM:TIME?`
Dependencies	Coupled with "Waveform Length" on page 285 if the auto-calculated **SEM Meas Time** is greater than **Waveform Length** when **SEM Meas Time** is in **Auto** and the reference waveform has been loaded
Preset	363.52 us
State Saved	Saved in instrument state
Min	1 us
Max	Hardware dependent

Auto Function

Remote Command	`[:SENSe]:PAMPlifier:SEMask:TIME:AUTO ON | OFF | 1 | 0` `[:SENSe]:PAMPlifier:SEMask:TIME:AUTO?`
Example	`:PAMP:SEM:TIME:AUTO 1` `:PAMP:SEM:TIME:AUTO?`
Preset	ON

Carrier

Sets the carrier parameters for SEM measurement.

Number of Carriers

See "Number of Carriers" on page 265 under **Meas Standard**.

Carrier Coupling

See "Couple to #1" on page 266 under **Meas Standard**.

Carrier Freq Offset

See "Carrier Frequency Offset" on page 267 under **Meas Standard**.

Carrier Bandwidth

See "Carrier Bandwidth" on page 267 under **Meas Standard**.

Carrier Pwr Present

See "Carrier Power Present" on page 268 under Meas Standard.

SEM Carrier Measurement Noise Bandwidth

Specifies the measurement noise bandwidth used to calculate the power of each carrier.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:CARRier:LIST:BANDwidth[:INTegration] <freq>, …` `[:SENSe]:PAMPlifier:SEMask:CARRier:LIST:BANDwidth[:INTegration]?`
Example	`:PAMP:SEM:CARR:LIST:BAND 25kHz` `:PAMP:SEM:CARR:LIST:BAND?`
Notes	When setting these values remotely, the position in the list sent corresponds to the carrier. Missing values are not permitted, so if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged, unless the number of values sent is greater than the number of carriers, in which case subsequent values are ignored
Dependencies	Carrier Bandwidth of each carrier is always greater than or equal to the maximum value of the ACP Carrier Measurement Bandwidth and the SEM Carrier Measurement Bandwidth of the same carrier
Preset	100 MHz
State Saved	Saved in instrument state
Min/Max	10 Hz/ 2 GHz

Offset

Sets the offset parameters for SEM measurement.

SEM Offset Frequency Define

Sets the offset frequency definition.

`CTOCenter`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the center of offset measuring filter*
`CTOEdge`	From the lowermost carrier center frequency (for lower offset), the uppermost carrier center frequency (for upper offset) to the nominal -3 dB point of the offset measuring filter* closer to the carrier
`ETOCenter`	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the center frequency of offset measuring filter*
`ETOEdge`	From the lowermost carrier center frequency - spacing of this carrier /2 (for lower offset), the uppermost carrier center frequency + spacing of this carrier /2 (for upper offset) to the nominal -3 dB point of the offset measuring filter* closer to the carrier

RTOCenter	From either the lower or upper RF BW** edge frequency to the center frequency of offset measuring filter*
RTOEdge	From either the lower or upper RF BW** edge frequency to the nominal -3 dB point of the offset measuring filter* closer to the carrier
RCTOCenter	From the center frequency of RF BW to the center frequency of offset measuring filter*

*Measuring filter = Meas BW (N) x Res BW

** RF BW = $BW_{channel,CA}$ which is defined in each 3GPP standard, regardless of "Measure Carrier" for the uppermost and the lowermost carriers being Enabled or Disabled. When Number of Component Carriers = 1, RF BW = $BW_{channel}$ = 2 x $F_{offset,RAT}$

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:TYPE CTOCenter | CTOEdge | ETOCenter | ETOEdge | RTOCenter | RTOEdge | RCTOCenter` `[:SENSe]:PAMPlifier:SEMask:OFFSet:TYPE?`
Example	`:PAMP:SEM:OFFS:TYPE ETOC` `:PAMP:SEM:OFFS:TYPE?`
Dependencies	`CTOCenter`, `CTOEdge`, `ETOCenter`, and `ETOEdge` are supported by all radio formats `RTOCenter` and `RTOEdge` are only enabled when Radio Format is either LTEA-FDD or 5GNR `RCTOCenter` is only enabled when Radio Format is 5GNR
Preset	`ETOCenter`
State Saved	Saved in instrument state
Range	Carrier Center to Meas BW Center | Carrier Center to Meas BW Edge | Carrier Edge to Meas BW Center | Carrier Edge to Meas BW Edge | RF BW Edge to Meas BW Center | RF BW Edge to Meas BW Edge | RF BW Center to Meas BW Center

Offset State

Toggles the state of the offset(s).

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STATe ON | OFF | 1 | 0, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STATe?`
Example	`:PAMP:SEM:OFFS:LIST:STAT ON, ON, ON, OFF, OFF, OFF` `:PAMP:SEM:OFFS:LIST:STAT?`
Preset	`ON, ON, ON, OFF, OFF, OFF`
State Saved	Saved in instrument state

Start Frequency

Specifies the start frequency of the offset(s).

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:FREQuency:STARt <freq>, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:FREQuency:STARt?`
Example	`:PAMP:SEM:OFFS:LIST:FREQ:STAR 2.515 MHz, 2.715 MHz, 3.515 MHz, 4.00 MHz, 8.00 MHz, 12.50 MHz` `:PAMP:SEM:OFFS:LIST:FREQ:STAR?`
Couplings	Coupled to "Stop Frequency" on page 377. When **Start Frequency** exceeds **Stop Frequency**, **Stop Frequency** is automatically adjusted to **Start Frequency** plus 100kHz
Preset	50kHz, 5.05MHz, 10.5MHz, 40MHz, 100MHz, 100MHz
State Saved	Saved in instrument state
Min/Max	0 Hz / 1GHz

Stop Frequency

Specifies the stop frequency of the offset(s).

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:FREQuency:STOP <freq>, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:FREQuency:STOP?`
Example	`:PAMP:SEM:OFFS:LIST:FREQ:STOP 2.515 MHz, 2.715 MHz, 3.515 MHz, 4.00 MHz, 8.00 MHz, 12.50 MHz` `:PAMP:SEM:OFFS:LIST:FREQ:STOP?`
Couplings	Coupled to "Start Frequency" on page 376. When **Stop Frequency** becomes less than **Start Frequency**, **Start Frequency** is automatically adjusted to **Stop Frequency** minus 100kHz
Preset	5.05MHz, 10.05MHz, 40MHz, 100MHz, 500MHz, 500MHz
State Saved	Saved in instrument state
Min/Max	0 Hz / 1GHz

Resolution BW

Specifies which Resolution BW filter for the offset(s).

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:BANDwidth[:RESolution] <bandwidth>, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:BANDwidth[:RESolution]?`
Example	`:PAMP:SEM:OFFS:LIST:BAND 30.0 kHz, 30.0 kHz, 30.0 kHz, 1.00 MHz,1.00 MHz, 1.00 MHz` `:PAMP:SEM:OFFS:LIST:BAND?`
Preset	51 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz, 100 kHz
State Saved	Saved in instrument state
Min	1 Hz
Max	8 MHz

Measure BW

Specifies a multiplier of Res BW for the measurement integration bandwidth for the offset(s).

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:BANDwidth:IMULti <integer>, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:BANDwidth:IMULti?`
Example	`:PAMP:SEM:OFFS:LIST:BAND:IMUL 1,1,1,1,1,1` `:PAMP:SEM:OFFS:LIST:BAND:IMUL?`
Preset	2, 1, 1, 1, 1, 1
State Saved	Yes
Min/Max	1/1000

Offset Side

Specifies which side to measure for the offset(s).

`BOTH`	Both negative (lower) and positive (upper) sidebands
`NEGative`	Negative (lower) sideband only
`POSitive`	Positive (upper) sideband only

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:SIDE BOTH | NEGative | POSitive, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:SIDE?`
Example	`:PAMP:SEM:OFFS:LIST:SIDE BOTH, NEG, NEG, POS, POS, POS` `:PAMP:SEM:OFFS:LIST:SIDE?`
Preset	`BOTH, BOTH, BOTH, BOTH, BOTH, BOTH`
State Saved	Saved in instrument state
Range	`BOTH|NEGative|POSitive`

Limits

Sets the power limits for the offset(s).

Start Frequency

See "Start Frequency" on page 376 under **Offset**.

Stop Frequency

See "Stop Frequency" on page 377 under **Offset**.

Absolute Limit Start

Sets the absolute power level limit at the start frequency for the offset(s). The absolute power level limit ranges from –200 to +50 dBm.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STARt:ABSolute <real>, …` `[:SENSe]:SEMask:OFFSet:LIST:STARt:ABSolute?`
Example	`:PAMP:SEM:OFFS:LIST:STAR:ABS -12.50 dBm, -12.50 dBm, -24.50 dBm, -11.50 dBm, -11.50 dBm` `:PAMP:SEM:OFFS:LIST:STAR:ABS?`
Preset	-5.5 dBm, -12.5 dBm, -16.0 dBm, -16.0 dBm, -16.0 dBm, -16.0 dBm
State Saved	Saved in instrument state
Min/Max	–200 dBm / 50 dBm

Absolute Limit Stop

Sets the absolute power level limit at the stop frequency for the offset(s). The absolute power level limit ranges from –200 to +50 dBm.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:ABSolute <real>, …` `[:SENSe]:SEMask:OFFSet:LIST:STOP:ABSolute?`
Example	`:PAMP:SEM:OFFS:LIST:STOP:ABS -12.50 dBm, -12.50 dBm, -24.50 dBm, -11.50 dBm, -11.50 dBm` `:PAMP:SEM:OFFS:LIST:STOP:ABS?`
Preset	-12.5 dBm, -12.5 dBm, -16.0 dBm, -16.0 dBm, -16.0 dBm, -16.0 dBm
State Saved	Saved in instrument state
Min/Max	–200 dBm/50 dBm

Absolute Limit Stop Coupling

Specifies whether Absolute Limit Stop couples with Absolute Limit Start for the offset(s). Setting it to `ON` results in a flat absolute limit line. If set to `OFF`, Absolute Start Limit and Absolute Stop Limit may take different values, which may result in a sloped absolute limit line.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:ABSolute:COUPle ON | OFF | 1 | 0, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:ABSolute:COUPle?`
Example	`:PAMP:SEM:OFFS:LIST:STOP:ABS:COUP ON, OFF, ON, ON, ON, ON` `:PAMP:SEM:OFFS:LIST:STOP:ABS:COUP?`
Preset	`OFF, ON, ON, ON, ON, ON`
State Saved	Saved in instrument state
Range	`ON|OFF`

Relative Limit Start

Sets the relative power level limit at the start frequency for the offset(s). The relative power level limit ranges from –200 to +50dB.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STARt:RCARrier <real>, …` `[:SENSe]:SEMask:OFFSet:LIST:STARt:RCARrier?`
Example	`:PAMP:SEM:OFFS:LIST:STAR:RCAR -20, -20, -20, -20, -20, -20` `:PAMP:SEM:OFFS:LIST:STAR:RCAR?`
Preset	0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB
State Saved	Saved in instrument state
Min/Max	–200 dB / 50 dB

Relative Limit Stop

Sets the relative power level limit at the stop frequency for the offset(s). The relative power level limit ranges from –200 to +50dB.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:RCARrier <real>, …` `[:SENSe]:SEMask:OFFSet:LIST:STOP:RCARrier?`
Example	`:PAMP:SEM:OFFS:LIST:STOP:RCAR -20, -20, -20, -20, -20, -20` `:PAMP:SEM:OFFS:LIST:STOP:RCAR?`
Preset	0 dB, 0 dB, 0 dB, 0 dB, 0 dB, 0 dB
State Saved	Saved in instrument state
Min/Max	–200 dB / 50 dB

Relative Limit Stop Coupling

Specifies whether Relative Limit Stop couples with Relative Limit Start for the offset (s). Setting it to ON results in a flat relative limit line. If set to OFF, Relative Start Limit and Relative Stop Limit may take different values, which may result in a sloped relative limit line.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:RCARrier:COUPle ON | OFF | 1 | 0, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:RCARrier:COUPle?`
Example	`:PAMP:SEM:OFFS:LIST:STOP:RCAR:COUP ON, OFF, ON, ON, ON, ON` `:PAMP:SEM:OFFS:LIST:STOP:RCAR:COUP?`
Preset	`ON, ON, ON, ON, ON, ON`
State Saved	Saved in instrument state
Range	`ON|OFF`

Fail Mask

Selects one of the logics for fail conditions between the measurement results and the test limits:

- `ABSolute` and `RELative` both check the results against the respective limit.
- `OR` checks against both limits, failing if either of the limits is broken.
- `AND` only displays a “FAIL” if both limits are broken.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:TEST ABSolute | AND | OR | RELative, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:TEST?`
Example	`:PAMP:SEM:OFFS:LIST:TEST ABS, ABS, ABS, ABS, ABS, ABS` `:PAMP:SEM:OFFS:LIST:TEST?`
Preset	`ABS, ABS, ABS, ABS, ABS, ABS`
State Saved	Saved in instrument state
Range	Absolute | Relative |Abs AND Rel | Abs OR Rel

Show Abs2 Limit

See "Show Abs2 Limit" on page 237 under **Display** > **Meas Display**.

Absolute Limit 2 Start

Sets the second absolute power level limit at the start frequency for the offset(s). The absolute power level limit ranges from –200 to +50 dBm.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STARt:SABSolute <real>, …` `[:SENSe]:SEMask:OFFSet:LIST:STARt:SABSolute?`
Example	`:PAMP:SEM:OFFS:LIST:STAR:SABS -12.50 dBm, -12.50 dBm, -24.50 dBm, -11.50 dBm, -11.50 dBm` `:PAMP:SEM:OFFS:LIST:STAR:SABS?`
Preset	0 dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm
State Saved	Saved in instrument state
Min/Max	–200 dBm / 50 dBm

Absolute Limit 2 Stop

Sets the second absolute power level limit at the stop frequency for the offset(s). The absolute power level limit ranges from –200 to +50 dBm.

When sending the remote command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:SABSolute <real>, …` `[:SENSe]:SEMask:OFFSet:LIST:STOP:SABSolute?`
Example	`:PAMP:SEM:OFFS:LIST:STOP:SABS -12.50 dBm, -12.50 dBm, -24.50 dBm, -11.50 dBm, -11.50 dBm` `:PAMP:SEM:OFFS:LIST:STOP:SABS?`
Preset	0 dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm, 0 dBm
State Saved	Saved in instrument state
Min/Max	–200 dBm / 50 dBm

Absolute Limit 2 Stop Coupling

Specifies whether Absolute Limit 2 Stop couples with Absolute Limit 2 Start for the offset(s). Setting it to `ON` results in a flat absolute limit line. If set to `OFF`, Absolute Start 2 Limit and Absolute Stop 2 Limit may take different values, which may result in a sloped absolute limit line.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:SABSolute:COUPle ON | OFF | 1 | 0, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:SABSolute:COUPle?`
Example	`:PAMP:SEM:OFFS:LIST:STOP:SABS:COUP ON, OFF, ON, ON, ON, ON` `:PAMP:SEM:OFFS:LIST:STOP:SABS:COUP?`
Preset	`ON, ON, ON, ON, ON, ON`
State Saved	Saved in instrument state
Range	`ON|OFF`

Fail Mask 2

Selects the logic operation for fail conditions between the measurement results and the test limits:

(Primary Fail Mask selection) OR Abs2	`OR`	Checks against both Primary and Abs2 limits. The test fails if either of the limits is broken
(Primary Fail Mask selection) AND Abs2	`AND`	Checks against both Primary and Abs2 limits. The test fails if both limits are broken
Abs2 Disabled	`OFF`	Fail Mask2 is disabled

Note that the Primary Fail Mask selection is set via Fail Mask.

When sending the command, missing values are not permitted; that is, if you want to change values 2 and 6, you must send all values up to 6. Subsequent values remain unchanged. The query returns 14 values for WLAN Mode, or 12 values for other Modes.

Remote Command	`[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:TEST:SABSolute AND | OR | OFF, …` `[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:TEST:SABSolute?`
Example	`:PAMP:SEM:OFFS:LIST:TEST:SABS AND, AND, OR, OFF, OFF, OFF` `:SEM:OFFS:LIST:TEST:SABS?`
Notes	Comma-separated list of values
Preset	`OFF, OFF, OFF, OFF, OFF, OFF`
State Saved	Saved in instrument state
Range	OR Abs2 | AND Abs2 | Off

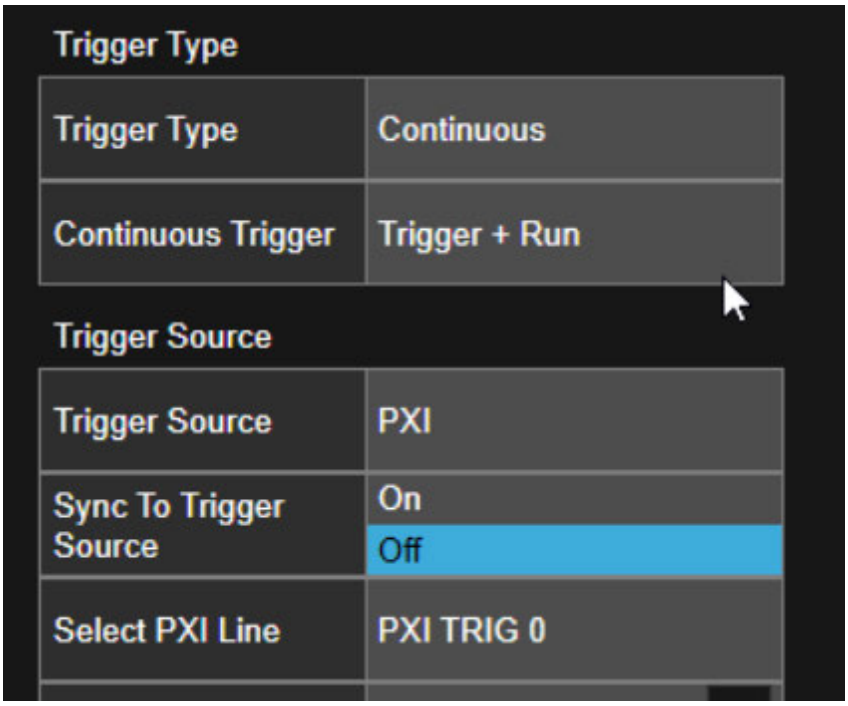
3.1.17.10 Envelope Tracking

This tab is for configuring the envelope tracking-related parameters. Envelope tracking is not supported on S91 platform.

Envelope Tracking State

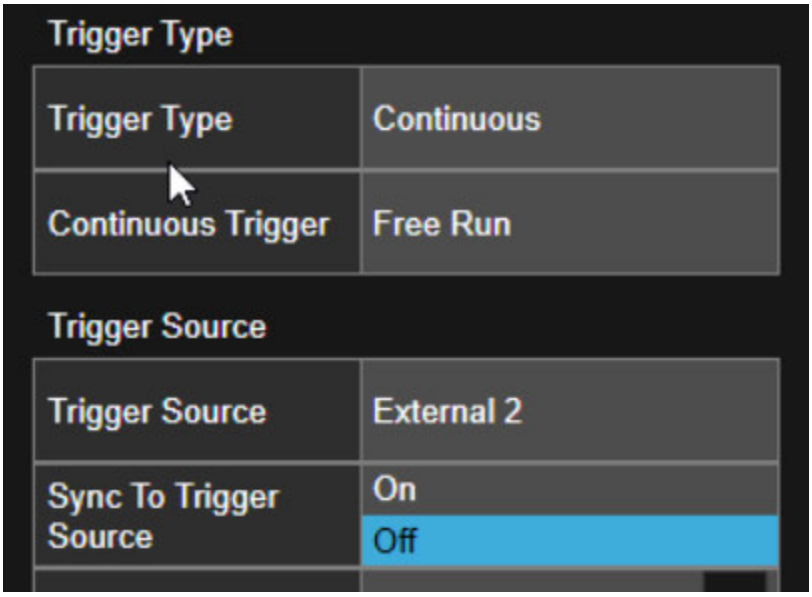
Toggles the state of the envelope tracking function.

Remote Command	`[:SENSe]:PAMPlifier:ET[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:ET[:STATe]?`
Example	`:PAMP:ET ON` `:PAMP:ET?`
Dependencies	For Benchtop instruments with VXG, only enabled when the following requirements are met: 1. A reference waveform is loaded 2. A VXG supporting envelope tracking is connected 3. The measure type is 'single sweep' 4. "DPD Method" on page 309 is `GENerator` (with **Burst Shape & Mask State** set to `OFF`) For M9410A/11A/15A/16A with M3202A/M5301A, only enabled when the following requirements are met: 1. A reference waveform is loaded 2. An M3202A AWG supporting envelope tracking is connected 3. The measure type is 'single sweep' 4. "Burst Shape & Mask State" on page 292 is `OFF` 5. A user-defined waveform file must be selected when "Envelope Source" on page 386 is 'user-defined waveform'
Couplings	For Benchtop instruments with VXG: When **Envelope Tracking State** is `ON`, the RF channel of the connected VXG is switched to Ch2, and the power sweep state and power servo state are switched off. The controls for RF channel, power sweep mode (the measure type), and power servo state is disabled. They are enabled when **Envelope Tracking State** is `OFF` For M9410A/11A/15A/16A with M3202A/M5301A: When **Envelope Tracking State** is `ON`: 1. The power sweep is switched off and disabled 2. The trigger type and Continuous Trigger of the internal source are set to Continuous and Trigger + Run, respectively 3. The trigger source of the internal source changes to PXI and the Select PXI Line changes to the same PXI line as the ET Trigger Source. If the AWG model is M3202A, the trigger source of CH1/2 of the AWG can be chosen from PXI_TRIG0, PXI_TRIG3, PXI_TRIG4, PXI_TRIG5, PXI_TRIG6, and PXI_TRIG7. If the model is M5301A, the trigger source is PXI_TRIG6, and cannot be changed



When **Envelope Tracking State** is OFF:

1. The power sweep state is enabled
2. Continuous Trigger and Trigger Source of the internal source are set to Free Run and External 2, respectively



Preset	OFF
State Saved	Saved in instrument state

Envelope Source

Specifies the source of the envelope signal.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:SOURce NPWaveform | PWAVeform | USER` `[:SENSe]:PAMPlifier:ET:ENVelope:SOURce?`
Example	`:PAMP:ET:ENV:SOUR PWAV` `:PAMP:ET:ENV:SOUR?`
Dependencies	`PWAVeform` is only enabled when DPD is enabled Only on Benchtop instruments, the envelope source is coupled with "DPD State" on page 307 as follows: – Pre-distorted waveform (after DPD is on) – Non-pre-distorted waveform (after DPD is off)
Preset	For Benchtop with VXG: `NPWaveform` For M9410A/11A/15A/16A with M3202A/M5301A: `USER`
State Saved	Saved in instrument state
Range	Non-Pre-distorted Wfm | Pre-distorted Wfm | User Defined

Select Envelope File

Only available in M9410A/11A/15A/16A with M3202A.

Opens a dialog to let you select a file containing the envelope data.

Only visible when Source is `USER`.

Envelope File Name

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

Specifies the full path of the envelope file. The SCPI is query-only.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:FILE:NAME?`
Example	`:PAMP:ET:ENV:FILE:NAME?`
Dependencies	Only visible when "Envelope Source" on page 386 is `USER` Read-only on the GUI
State Saved	Yes

Envelope File Data Length

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

Queries the data length of the selected envelope file.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:FILE:DLENgth?`
Example	`:PAMP:ET:ENV:FILE:DLEN?`
Dependencies	Only visible when "Envelope Source" on page 386 is `USER`
Preset	0
Min/Max	0/Infinity

Envelope OSR

For Benchtop with VXG:

Specifies the oversampling ratio for the connected VXG to generate the envelope signal when the envelope source is not user-defined.

The data rate of the envelope data will be the product of the envelope OSR, and the waveform sample rate displayed on the ref signal tab. The final sample rate should not exceed the limit of the VXG's sample rate.

For M9410A/11A/15A/16A with M3202A, it specifies the oversampling ratio for resampling the non-user-defined envelope data.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:OSRatio <integer>` `[:SENSe]:PAMPlifier:ET:ENVelope:OSRatio?`
Example	`:PAMP:ET:ENV:OSR 1` `:PAMP:ET:ENV:OSR?`
Dependencies	Not visible when "Envelope Source" on page 386 is `USER`
Preset	3
State Saved	Saved in instrument state
Min/Max	1/32

Conversion Input Type

Specifies the conversion input type for generating the envelope signal.

Normalized I/Q Ampl	`NORMalized`
Abs RF Output Volt	`ABSVoltage`
Override Abs RF	`OARF`

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:CONVersion:TYPE NORMalized | ABSVoltage | OARF` `[:SENSe]:PAMPlifier:ET:ENVelope:CONVersion:TYPE?`
Example	`:PAMP:ET:ENV:CONV:TYPE NORM` `:PAMP:ET:ENV:CONV:TYPE?`
Dependencies	Not visible when "Envelope Source" on page 386 is `USER`
Couplings	In M9410A/11A/15A/16A with M3202A/M5301A, when Conversion Input Type switches to Normalized I/Q Amplitude, Vin Normalization switches off and is grayed-out Vin Normalization is enabled when Conversion Input Type switches from Normalized I/Q Amplitude to any other value
Preset	`NORMalized`
State Saved	Saved in instrument state
Range	Normalized I/Q Ampl | Abs RF Output Volt | Override Abs RF

Override Absolute RF Amplitude

Sets the absolute RMS power for generating the envelope signal when "Conversion Input Type" on page 387 is `OARF`.

`:UTILity:NCORrection:ENVelope:OARF <amp>`

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:CONVersion:AMPLitude <amp>` `[:SENSe]:PAMPlifier:ET:ENVelope:CONVersion:AMPLitude?`
Example	`:PAMP:ET:ENV:CONV:AMPL 0` `:PAMP:ET:ENV:CONV:AMPL?`
Dependencies	Only enabled when **Conversion Input Type** is `OARF`
Preset	10 dBm
State Saved	Saved in instrument state
Min/Max	–144 dBm / 30 dBm

Edit Shaping Table

Opens a dialog to let you manually input the shaping tables to generate the envelope signal.

Only visible when "Envelope Source" on page 386 is `USER`.

The parameters in this menu are power-on-persistent.

Selected Shaping Table

Specifies the selected shaping table.

Remote Command	[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing:INDex:SELect <integer> [:SENSe]:PAMPlifier:ET:ENVelope:SHAPing:INDex:SELect?
Example	:PAMP:ET:ENV:SHAP:IND:SEL 2 :PAMP:ET:ENV:SHAP:IND:SEL?
Preset	1
State Saved	Saved in instrument state
Min	1
Max	12

Go to Row

Navigates to the highlighted row in a selected shaping table.

Min	0
Max	2000

Insert Row Below

A duplicate row is created under the current row and becomes selected. The new row does not take effect until it is edited.

Delete Row

Deletes the selected row.

Delete Shaping Table

Deletes the selected shaping table.

Remote Command	[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:DELete
Example	:PAMP:ET:ENV:SHAP5:DEL

Delete All Shaping Tables (Remote Command only)

Purges all the shaping tables.

Remote Command	[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing:ALL:DELete
Example	:PAMP:ET:ENV:SHAP:ALL:DEL

Copy (Remote Command only)

Copies a specified shaping table.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:COPY <integer>`
Example	`:PAMP:ET:ENV:SHAP3:COPY 5` Copy the 5th shaping table to the 3rd
Notes	The source shaping table is specified by the `<integer>` parameter of the command

Data (Remote Command only)

Sets and queries the specified shaping table data. The data is a series of `<RF voltage, ET voltage>` pairs.

`:UTILity:NCORrection:ENVelope:STABle:DATA <value>,<value>,...`

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:DATA <RF voltage>,<ET voltage>,<RF voltage>,<ET voltage>,…,<RF voltage>,<ET voltage>` `[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:DATA?`
Example	`:PAMP:ET:ENV:SHAP3:DATA 0.001,2,0.22,3` `:PAMP:ET:ENV:SHAP3:DATA?`
Notes	The maximum number of points contained by a shaping table is 1000

Settings

Lets you select a shaping table to edit the description and comment.

Description

Inputs a description for the selected shaping table of up to 60 characters.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:DESCription <string>` `[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:DESCription?`
Example	`:PAMP:ET:ENV:SHAP5:DESC “This is the description.”` `:PAMP:ET:ENV:SHAP5:DESC?`
Dependencies	60 characters max
State Saved	Saved in instrument state

Comment

Sets an ASCII comment field, which will be stored in an exported file.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:COMMent <string>` `[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:COMMent?`
Example	`:PAMP:ET:ENV:SHAP5:COMM "This is the comment."` `:PAMP:ET:ENV:SHAP5:COMM?`
Dependencies	60 characters max
State Saved	Saved in instrument state

Envelope SG & ETPS Configuration

For Benchtop with VXG, this control opens a dialog to let you configure the envelope signal generator (that is, Ch1 of the connected VXG) and the ETPS.

For M9410A/11A/15A/16A with M3202A/M5301A, opens a dialog for connecting and configuring an M3202A/M5301A module, which is used as the envelope signal generator on the same chassis.

Envelope Signal Generator Connection

Only available in M9410A/11A/15A/16A with M3202A/M5301A. An AWG M3202A/M5301A used as the envelope source installed on the same chassis can be identified and connected via the settings described in this section.

AWG Model Number

Specifies the model number of the AWG. The parameter is power-on-persistent.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:ETSG:MODel M3202A | M5301A` `[:SENSe]:PAMPlifier:ET:ENVelope:ETSG:MODel?`
Example	`:PAMP:ET:ENV:ETSG:MOD M3202A` `:PAMP:ET:ENV:ETSG:MOD?`
Dependencies	Disabled after the connection to an AWG is established. Enabled otherwise
Couplings	Slot Auto Detection is `OFF` and invisible when AWG Model Number is M5301A, but is visible otherwise
Preset	Unaffected by Preset
State Saved	No
Range	`M3202A|M5301A`

AWG Slot Number

Specifies the slot # where the AWG module is mounted on the chassis.

Slot Auto Detection is only available when the AWG model is M3202A, and is otherwise disabled and invisible.

For M3202A, when Slot Auto Detection is ON, the PA measurement looks for the first M3202A module in the chassis, starting from the first to the last slot. The value of the control is updated by the slot number location of the connected M3202A module. If there is no eligible M3202A module in the chassis, an error message appears. Otherwise, the PA measurement attempts to establish a connection with the designated slot. Again, if there is no eligible M3202A module in the chassis, an error message appears.

For M5301A, the PA measurement attempts to reach out the specified slot. An error message appears if there is no eligible M5301A module in the chassis.

Remote Command	`[:SENSe]:SOURce:AWG:SLOT <integer>` `[:SENSe]:SOURce:AWG:SLOT?`
Example	`:SOUR:AWG:SLOT 1` `:SOUR:AWG:SLOT?`
Couplings	AWG Slot Auto Detection is OFF after AWG Slot Number is changed
Preset	1
State Saved	No
Min	1
Max	18

Slot Auto Detection

Specifies whether to automatically probe the slot in which an M3202A module is installed. This control is invisible when AWG Model Number is M5301A.

Remote Command	`[:SENSe]:SOURce:AWG:SLOT:AUTO 1 | 0 | ON | OFF` `[:SENSe]:SOURce:AWG:SLOT:AUTO?`
Example	`:SOUR:AWG:SLOT:AUTO ON` `:SOUR:AWG:SLOT:AUTO?`
Dependencies	Slot Auto Detection is `OFF` after AWG Slot Number is changed Slot Auto Detection is `OFF` and invisible when AWG Model Number is M5301A. Visible otherwise
Preset	Unaffected by Preset
State Saved	No

Connect to/Disconnect from M3202A/M5301A Module

Connect

Establishes a connection with an eligible M3202A/M5301A module on the chassis. Once the connection is established, the product name, serial number, slot number, hardware, and firmware versions are displayed in the "Envelope Signal Generator Connection" on page 391 dialog. Additionally, the label for this control changes to Disconnect.

NOTE The 2-channel M3202A module is not supported.

Remote Command	`[:SENSe]:SOURce:AWG:CONNect`
Example	`:SOUR:AWG:CONN`

Disconnect

Ends the connection to the M3202A/M5301A module. The previously used channels of the M3202A/M5301A module are switched off after the disconnection. The label for this control returns to Connect.

Remote Command	`[:SENSe]:SOURce:AWG:DISConnect`
Example	`:SOUR:AWG:DISC`

AWG Module Connection Status (Remote Query Only)

Returns the connection status of AWG.

Remote Command	`[:SENSe]:SOURce:AWG:CONNect:STATe?`
Example	`:SOUR:AWG:CONN:STAT?`
Preset	Unaffected by Preset
State Saved	No

Envelope Signal Generator Settings

The controls in this menu let you set more parameters of the envelope signal generator.

In M9010A/11A/15A/16A, a diagram illustrating the envelope delay, Vcm, and the envelope signal voltage level is displayed. The related arrow line of the selected parameter is highlighted in the diagram in red.

Sample Rate (For Non-User-Defined Envelope Source)

For Benchtop with VXG, this setting displays the sample rate of the envelope played by the first channel of the VXG, which is a product of the sample rate of the reference waveform and the envelope OSR.

For M9410A/11A/15A/16A with M3202A, the setting displays the sample rate of the envelope applied by the envelope generation, which is a product of the sample rate of the reference waveform and the envelope OSR. The envelope is then resampled to 1GS/s and played by the M3202A module

For M9410A/11A/15A/16A with M5301A, the setting displays the sample rate of the envelope applied by the envelope generation, which is a product of the sample rate of the reference waveform and the envelope OSR. The envelope is then resampled to 2.4GSa/s and played by the M5301A module.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:SRATe?`
Example	`:PAMP:ET:ETSG:SRAT?`
Dependencies	Only visible when "Envelope Source" on page 386 is `USER` Always read-only, and the value of the parameter is coupled to the product of the sample rate of the reference waveform and the Envelope OSR
Preset	15 MSa/s
State Saved	Saved in instrument state
Min/Max	0 to Infinity

Sample Rate (For User-Defined Envelope Source)

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

For M9410A/11A/15A/16A + M3202A/M5301A, specifies the sample rate of the envelope file data. The envelope data is resampled to 1GSa/s or 2.4GSa/s before it is loaded into the connected M3202A or M5301A module, respectively.

Remote Command	`[:SENSe]:PAMPlifier:ET:ENVelope:USER:SRATe <freq>` `[:SENSe]:PAMPlifier:ET:ENVelope:USER:SRATe?`
Example	`:PAMP:ET:ENV:USER:SRAT 20e6` `:PAMP:ET:ENV:USER:SRAT?`
Dependencies	Only visible when "Envelope Source" on page 386 is `USER`
Preset	For M9410A/11A/15A/16A with M3202A/M5301A: 1 GSa/s
State Saved	Saved in instrument state

Min/Max	For M9410A/11A/15A/16A with M3202A/M5301A: 10 MSa/s to 1 GSa/s

Voltage Offset (For Non-User-Defined Envelope Source)

For Benchtop \with VXG, this setting displays the common-mode I offset voltage of the connected VXG when "Envelope Source" on page 386 is not USER.

Its value is coupled with ETPS's common-mode voltage (Vcm).

For M9410A/11A/15A/16A with M3202A/M5301A, the first and second channels of the connected M3202A/M5301A module are used for outputting two complementary envelope signals. The voltage offset is the common-mode voltage of the two signals, which is represented by (Vch1 + Vch2)/2. The value of the voltage offset is coupled with ETPS's common-mode voltage (Vcm).

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:VOLTage:OFFSet?`	
Example	`:PAMP:ET:ETSG:VOLT:OFFS?`	
Dependencies	Always read-only, and its value is identical to Vcm for ETPS	
Preset	0	
State Saved	Saved in instrument state	
Min/Max	Benchtop with VXG	0 / 1V
	M9410A/11A/15A/16A with M3202A/M5301A	–/+1.5V

Voltage Offset (For User-Defined Envelope Source)

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

For M9410A/11A/15A/16A with M3202A/M5301A, the first and second channels of the connected M3202A/M5301A module are used for outputting two complementary envelope signals. The voltage offset is the common-mode voltage of the two signals, which is represented by (Vch1 + Vch2)/2.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:USER:VOLTage:OFFSet <voltage>` `[:SENSe]:PAMPlifier:ET:ETSG:USER:VOLTage:OFFSet?`
Example	`:PAMP:ET:ETSG:USER:VOLT:OFFS 1` `:PAMP:ET:ETSG:USER:VOLT:OFFS?`
Dependencies	Only visible when "Envelope Source" on page 386 is USER
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+1.5V

Pk. Single-Ended ETPS Input Voltage (For Non-User-Defined Envelope Source)

For Benchtop with VXG, sets the peak single-ended voltage of the first channel of the VXG. The value is calculated and set automatically based on the generated envelope.

For M9410A/11A/15A/16A with M3202A/M5301A, sets the peak single-ended voltage of the first and second channel of the M3202A/M5301A module The value is calculated and set automatically based on the generated envelope.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:VOLTage:PEAK?`	
Example	`:PAMP:ET:ETSG:VOLT:PEAK?`	
Dependencies	Always read-only, and its value is automatically updated with the peak differential voltage value in the generated envelope signal	
Preset	0.4V	
State Saved	Saved in instrument state	
Min/Max	Benchtop with VXG	0.1V / 1.6V
	M9410A/11A/15A/16A with M3202A/M5301A	0V / 1.5V

Pk. Single-Ended ETPS Input Voltage (For User-Defined Envelope Source)

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

Sets the peak ETPS single-ended input voltage of the envelope signal generator when "Envelope Source" on page 386 is `USER`.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:USER:VOLTage:PEAK <voltage>` `[:SENSe]:PAMPlifier:ET:ETSG:USER:VOLTage:PEAK?`
Example	`:PAMP:ET:ETSG:USER:VOLT:PEAK 1` `:PAMP:ET:ETSG:USER:VOLT:PEAK?`
Dependencies	Only visible when "Envelope Source" on page 386 is `USER`
Preset	0.4V
State Saved	Saved in instrument state
Min/Max	For M9410A/11A/15A/16A with M3202A: 0V/1.5V For M9410A/11A/15A/16A with M5301A: 0V/2.5V

Output State

For Benchtop with VXG, this setting toggles the state of the I+/- output of Ch1 of the connected VXG.

For M9410A/11A/15A/16A with M3202A/M5301A, this setting enables/disables the output of the first and second channels of the connected M3202A/M5301A module.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:OUTPut[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:ET:ETSG:OUTPut[:STATe]?`
Example	`:PAMP:ET:ETSG:OUTP ON` `:PAMP:ET:ETSG:OUTP?`
Notes	Changing this parameter has a direct impact on the connected signal generator
Preset	`ON`
State Saved	Saved in instrument state

CH1|2 Trigger Source

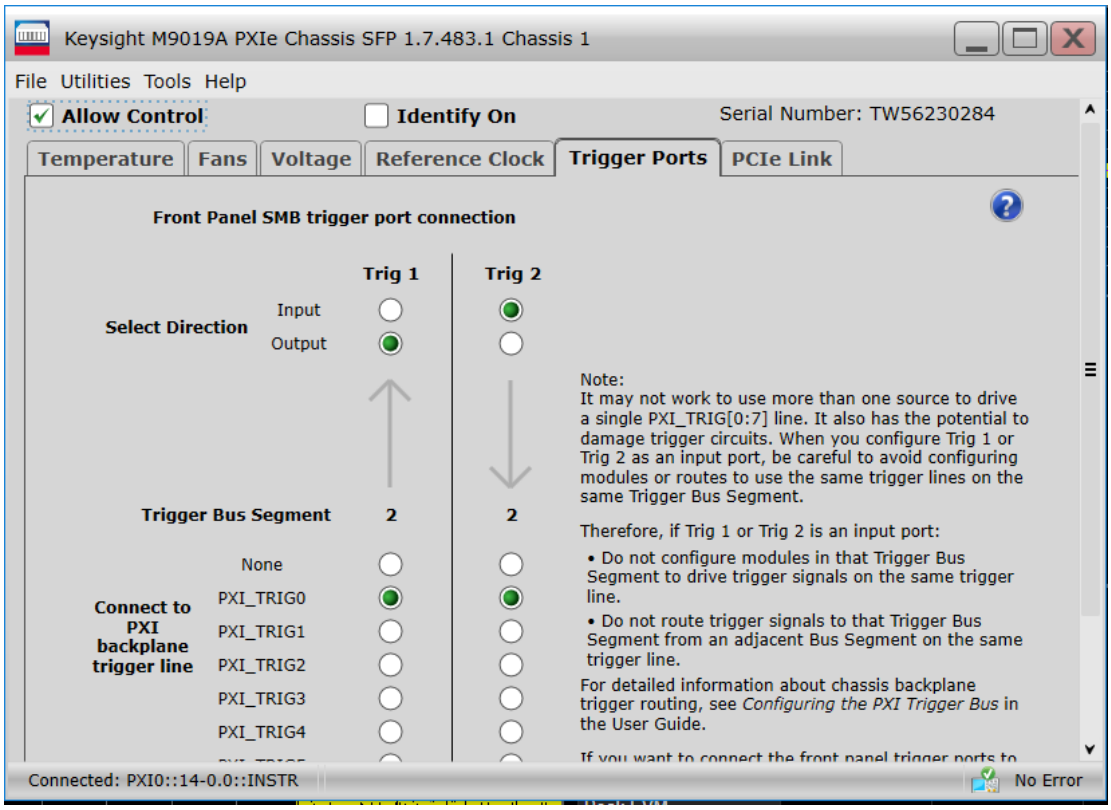
Only available in M9410A/11A/15A/16A with M3202A/M5301A.

Specifies the PXI trigger line adopted for triggering both the internal source and the first two channels of the connected M3202A module.

For M5301A, the PXI trigger line is always `PXI_TRIG6` and the control is grayed-out.

NOTE **For M3202A, when the ET trigger source is changed, you must manually re-route the port of the chassis associated with the third channel of the connected M3202A module to the selected PXI trigger via Keysight M9019A PXIe Chassis SFP.**

The M5301A module feeds the periodic trigger signal automatically onto `PXI_TRIG6`. Therefore, there is no need to route the trigger out via the SFP of the M9046A chassis, unless for observation.



Remote Command	`[:SENSe]:PAMPlifier:ET:TRIGger:SOURce PXI0 | … | PXI7` `[:SENSe]:PAMPlifier:ET:TRIGger:SOURce?`
Example	`:PAMP:ET:TRIG:SOUR PXI0` `:PAMP:ET:TRIG:SOUR?`
Dependencies	Disabled and set to `PXI_TRIG6` when AWG Model Number is M5301A Enabled when AWG Model Number is M3202A
Preset	M3202A: `PXI0` M5301A: `PXI6`
State Saved	Saved in instrument state
Range	`PXI TRIG 0 | PXI TRIG 3 | PXI TRIG 4 | PXI TRIG 5 | PXI TRIG 6 | PXI TRIG 7`

Trigger Source

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

For M3202A, specifies the trigger source of the 3rd channel of the connected M3202A module. The channel aims at playing a periodic trigger signal, of which the period equals that of the reference waveform.

When the trigger source is Free Run, the channel starts to play the periodic trigger signal right after it's configured. The periodic trigger signal aligns with a 400ns interval clock, which synchronizes to the chassis 10MHz reference, generated within the FPGA of the M3202A module.

When the trigger source changes to External, the 3rd channel waits for a rising edge fed to the Trig In/Out connector on the front panel of the M3202A module before starting to play the periodic trigger signal. The periodic trigger signal still aligns with the 400ns interval clock.

For M5301A, specifies the trigger source for instigating a periodic trigger signal generated by M5301A internally and directly fed to `PXI_TRIG6`. The periodic trigger signal has the same period with the reference waveform.

When the trigger source is Free Run, the periodic trigger signal is played by the M5301A module right after it's configured. The periodic trigger signal aligns with a 400ns interval clock, which synchronizes to the chassis 10MHz reference, generated within the FPGA of the M5301A module.

When the trigger source changes to External, the M5301A module waits for the rising edge of an external pulse fed to `PXI_TRIG1` from one of the eight connectors on the rear panel of the M9046A chassis via the SFP before starting to play the periodic trigger signal. The periodic trigger signal still aligns with the 400ns interval clock.

Remote Command	`[:SENSe]:PAMPlifier:ET:PTRigger:SOURce EXTernal | IMMediate` `[:SENSe]:PAMPlifier:ET:PTRigger:SOURce?`
Example	`:PAMP:ET:PTR:SOUR IMM` `:PAMP:ET:PTR:SOUR?`
Preset	`IMMediate`
State Saved	Saved in instrument state
Range	`External|Free Run`

Trigger Delay

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

This delay specifies the offset that the start of the periodic trigger lags the rising edge of the 400ns burst that the start of the periodic trigger aligns with.

Remote Command	`[:SENSe]:PAMPlifier:ET:PTRigger:DELay <time>` `[:SENSe]:PAMPlifier:ET:PTRigger:DELay?`
Example	`:PAMP:ET:PTR:DEL 100ns` `:PAMP:ET:PTR:DEL?`
Couplings	When AWG Model Number is M3202A, the value of the delay rounds to the closest integral multiple of 10 ns

	When AWG Model Number is M5301A, the value of the delay rounds to the closest integral multiple of $3\frac{1}{3}\ ns$
Preset	0 s
State Saved	Saved in instrument state
Min	0 s
Max	1 ms

Envelope Delay

See "Envelope Delay" on page 407.

Envelope Delay Offset

See "Envelope Delay Offset" on page 406

CH1 DC Offset (For Non-User-Defined Envelope Source)

Only available in M9410A/11A/15A/16A with M3202A/M5301A. Sets the DC offset for the 1st channel of the M3202A/M5301A module (signal HI(+)) for compensation when **Envelope Source** is pre-distorted waveform or non-pre-distorted waveform.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:DC:OFFSet:HIGH <voltage>` `[:SENSe]:PAMPlifier:ET:ETSG:DC:OFFSet:HIGH?`
Example	`:PAMP:ET:ETSG:DC:OFFS:HIGH 100e-3` :PAMP:ET:ETSG:DC:OFFS:HIGH?
Dependencies	Only visible when **Envelope Source** is pre-distorted waveform or non-pre-distorted waveform The max/min value of this parameter couples with **Voltage Offset** (For User-Defined Envelope Source) in the following way: Max value = **Voltage Offset** (For Non-User-Defined Envelope Source) + 1.5V Min value = **Voltage Offset** (For Non-User-Defined Envelope Source) – 1.5V
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+1.5V

CH2 DC Offset (For Non-User-Defined Envelope Source)

Only available in M9410A/11A/15A/16A with M3202A/M5301A. Sets the DC offset for the 2nd channel of the M3202A/M5301A module (signal LO(-)) for compensation when **Envelope Source** is pre-distorted waveform or non-pre-distorted waveform.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:DC:OFFSet:LOW <voltage>` `[:SENSe]:PAMPlifier:ET:ETSG:DC:OFFSet:LOW?`
Example	`:PAMP:ET:ETSG:DC:OFFS:LOW 100e-3` :PAMP:ET:ETSG:DC:OFFS:LOW?
Dependencies	Only visible when **Envelope Source** is pre-distorted waveform or non-pre-distorted waveform The max/min value of this parameter couples with **Voltage Offset** (For User-Defined Envelope Source) in the following way: Max value = **Voltage Offset** (For Non-User-Defined Envelope Source) + 1.5V Min value = **Voltage Offset** (For Non-User-Defined Envelope Source) – 1.5V
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+1.5V

CH1 DC Offset (For User-Defined Envelope Source)

Only available in M9410A/11A/15A/16A with M3202A/M5301A. Sets the DC offset for the 1st channel of the M3202A/M5301A module (signal HI(+)) for compensation when **Envelope Source** is pre-distorted waveform or non-pre-distorted waveform.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:USER:DC:OFFSet:HIGH <voltage>` `[:SENSe]:PAMPlifier:ET:ETSG:USER:DC:OFFSet:HIGH?`
Example	`:PAMP:ET:ETSG:USER:DC:OFFS:HIGH 100e-3` :PAMP:ET:ETSG:USER:DC:OFFS:HIGH?
Dependencies	Only visible when **Envelope Source** is User Defined The max/min value of this parameter couples with **Voltage Offset** (For User-Defined Envelope Source) in the following way: Max value = **Voltage Offset** (For User-Defined Envelope Source) + 1.5V Min value = **Voltage Offset** (For User-Defined Envelope Source) – 1.5V
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+1.5V

CH2 DC Offset (For User-Defined Envelope Source)

Only available in M9410A/11A/15A/16A with M3202A/M5301A. Sets the DC offset for the 2nd channel of the M3202A/M5301A module (signal LO(-)) for compensation when **Envelope Source** is pre-distorted waveform or non-pre-distorted waveform.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:USER:DC:OFFSet:LOW <voltage>`

	`[:SENSe]:PAMPlifier:ET:ETSG:USER:DC:OFFSet:LOW?`
Example	`:PAMP:ET:ETSG:USER:DC:OFFS:LOW 100e-3` :PAMP:ET:ETSG:USER:DC:OFFS:LOW?
Dependencies	Only visible when **Envelope Source** is User Define The max/min value of this parameter couples with **Voltage Offset** (For User-Defined Envelope Source) in the following way: Max value = **Voltage Offset** (For User-Defined Envelope Source) + 1.5V Min value = **Voltage Offset** (For User-Defined Envelope Source) – 1.5V
Preset	0
State Saved	Saved in instrument state
Min/Max	–/+1.5V

Export Envelope File to AWG Module (Remote Command only)

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

Exports an envelope data file to the connected AWG module.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETSG:EXPort <string>`
Example	`:PAMP:ET:ETSG:EXP "c:\envelope.csv"`
Notes	The `<string>` parameter must supply the full path of the envelope data file. The supported formats are files with extensions: `.bin`, `.txt`, `.csv`

ETPS Settings

ETPS Gain

Sets the gain of the ETPS when "Envelope Source" on page 386 is not `USER`.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETPS:GAIN <rel_amp>` `[:SENSe]:PAMPlifier:ET:ETPS:GAIN?`
Example	`:PAMP:ET:ETPS:GAIN 10` `:PAMP:ET:ETPS:GAIN?`
Dependencies	Disabled when "Envelope Source" on page 386 is `USER`
Preset	7 dB
State Saved	Saved in instrument state
Min/Max	–/+20 dB

Vcc Offset

Sets the Vcc offset of the ETPS when "Envelope Source" on page 386 is not USER.

:UTILity:NCORrection:ENVelope:ETPS:VCC:OFFSet

Remote Command	[:SENSe]:PAMPlifier:ET:ETPS:VCC:OFFSet <voltage> [:SENSe]:PAMPlifier:ET:ETPS:VCC:OFFSet?
Example	:PAMP:ET:EPTS:VCC:OFFS 1 :PAMP:ET:ETPS:VCC:OFFS?
Dependencies	Disabled when "Envelope Source" on page 386 is USER
Preset	2.75 V
State Saved	Saved in instrument state
Min/Max	0V /5V

Vcm

Sets the common-mode voltage specified in the eTrak specification Disabled when "Envelope Source" on page 386 is not USER.

Remote Command	[:SENSe]:PAMPlifier:ET:ETPS:VCM <voltage> [:SENSe]:PAMPlifier:ET:ETPS:VCM?	
Example	:PAMP:ET:ETPS:VCM 1 :PAMP:ET:ETPS:VCM?	
Dependencies	Disabled when "Envelope Source" on page 386 is USER	
Couplings	When "Envelope Source" on page 386 is not USER, the value of this parameter is set to the Voltage Offset of the envelope signal generator	
Preset	0	
State Saved	Saved in instrument state	
Min/Max	Benchtop with VXG	0 / 1V
	M9410A/11A/15A/16A with M3202A/M5301A	–/+1.5V

Vcc Clipping

Determines whether to clip the envelope value using Vcc Max and Vcc Min values.

Remote Command	[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping[:STATe]OFF|ON|0|1 [:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping[:STATe]?

Example	`:PAMP:ET:ETPS:VCC:CLIP OFF` `:PAMP:ET:ETPS:VCC:CLIP?`
Dependencies	Disabled when "Envelope Source" on page 386 is `USER` In M9410A/11A/15A/16A with M3202A/M5301A, when **Envelope Source** is not `USER`, switching Vout Normalization `ON` switches `ON` and grays out Vcc Clipping, otherwise Vcc Clipping is enabled
Couplings	When "Envelope Source" on page 386 is not `USER`, switching Vcc Clipping `ON` enables Vcc Max and Vcc Min, otherwise Vcc Max and Vcc Min are grayed-out
Preset	`OFF`
State Saved	Saved in instrument state

Vcc Max

Sets the maximum value of Vcc when "Envelope Source" on page 386 is not `USER`.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping:MAX <voltage>` `[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping:MAX?`
Example	`:PAMP:ET:ETPS:VCC:CLIP:MAX 1` `:PAMP:ET:ETPS:VCC:CLIP:MAX?`
Dependencies	When "Envelope Source" on page 386 is not `USER`, switching Vcc Clipping `ON` enables Vcc Max and Vcc Min, otherwise Vcc Max and Vcc Min are grayed-out
Preset	3.8 V
State Saved	Saved in instrument state
Min/Max	0.1V /5V

Vcc Min

Sets the minimum value of the Vcc when "Envelope Source" on page 386 is not `USER`.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping:MIN <voltage>` `[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping:MIN?`
Example	`:PAMP:ET:ETPS:VCC:CLIP:MIN 1` `:PAMP:ET:ETPS:VCC:CLIP:MIN?`
Dependencies	When "Envelope Source" on page 386 is not `USER`, switching Vcc Clipping `ON` enables Vcc Max and Vcc Min, otherwise Vcc Max and Vcc Min are grayed-out
Preset	600 mV
State Saved	Saved in instrument state
Min/Max	0V /Vcc Max – 0.1 V

ETPS Input Impedance

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

Specifies the input impedance of the ETPS module:

`I50`	50 Ω
`I1M`	1 MΩ

Remote Command	`[:SENSe]:PAMPlifier:ET:ETPS:IMPedance I50 | I1M` `[:SENSe]:PAMPlifier:ET:ETPS:IMPedance?`
Example	`:PAMP:ET:ETPS:IMP I50` `:PAMP:ET:ETPS:IMP?`
Preset	`I50`
State Saved	Saved in instrument state
Range	50 Ω | 1 MΩ

Vout Normalization

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

When Vout Normalization is `ON`, the PA measurement assumes that the ET voltages in the selected shaping table are normalized according to Vcc Max.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETPS:VOUT:NORMalize[:STATe] OFF | ON | 0 | 1` `[:SENSe]:PAMPlifier:ET:ETPS:VOUT:NORMalize[:STATe]?`
Example	`:PAMP:ET:ETPS:VOUT:NORM OFF` `:PAMP:ET:ETPS:VOUT:NORM?`
Dependencies	Disabled when "Envelope Source" on page 386 is `USER`
Couplings	When **Envelope Source** is not `USER`, switching **Vout Normalization**`ON` switches `ON` and Vcc Clipping is grayed-out, otherwise Vcc Clipping is enabled
Preset	`OFF`
State Saved	Saved in instrument state

Vin Normalization

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

When **Vin Normalization** is `ON`, the PA measurement assumes that the RF voltages in the selected shaping table are normalized according to **PEP Max**.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETPS:VIN:NORMalize[:STATe] OFF | ON | 0 | 1`

	`[:SENSe]:PAMPlifier:ET:ETPS:VIN:NORMalize[:STATe]?`
Example	`:PAMP:ET:ETPS:VIN:NORM OFF` `:PAMP:ET:ETPS:VIN:NORM?`
Dependencies	Disabled when "Envelope Source" on page 386 is `USER` When **Envelope Source** is not `USER`, **Vin Normalization** switches `OFF` and is grayed-out when **Conversion Input Type** changes to **Normalized I/Q Amplitude**. Enabled otherwise
Couplings	When **Envelope Source** is not `USER`, switching **Vin Normalization**`ON` enables **PEP Max**, otherwise **PEP Max** is grayed-out
Preset	`OFF`
State Saved	Saved in instrument state

PEP Max

Only available in M9410A/11A/15A/16A with M3202A/M5301A.

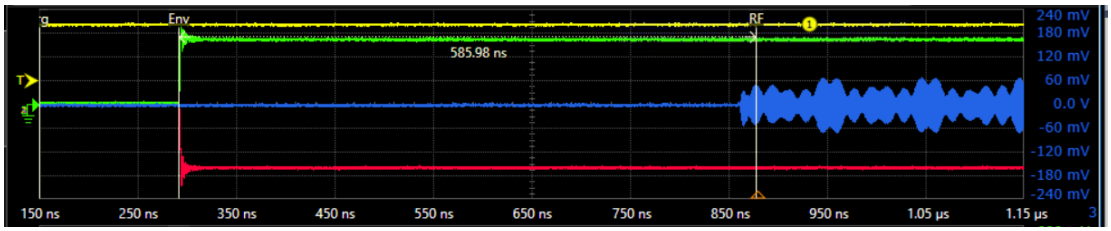
Specifies the power level used for normalizing the RF voltage in the shaping table when **Vin Normalization** is `ON`.

Remote Command	`[:SENSe]:PAMPlifier:ET:ETPS:PEPower <real>` `[:SENSe]:PAMPlifier:ET:ETPS:PEPower?`
Example	`:PAMP:ET:ETPS:PEP 10` `:PAMP:ET:ETPS:PEP?`
Dependencies	When "Envelope Source" on page 386 is not `USER`, switching **Vin Normalization**`ON` enables **PEP Max**, otherwise **PEP Max** is grayed-out
Preset	–10
State Saved	Saved in instrument state
Min/Max	–/+100

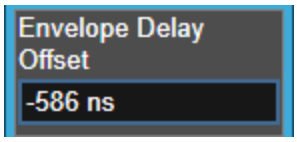
Envelope Delay Offset

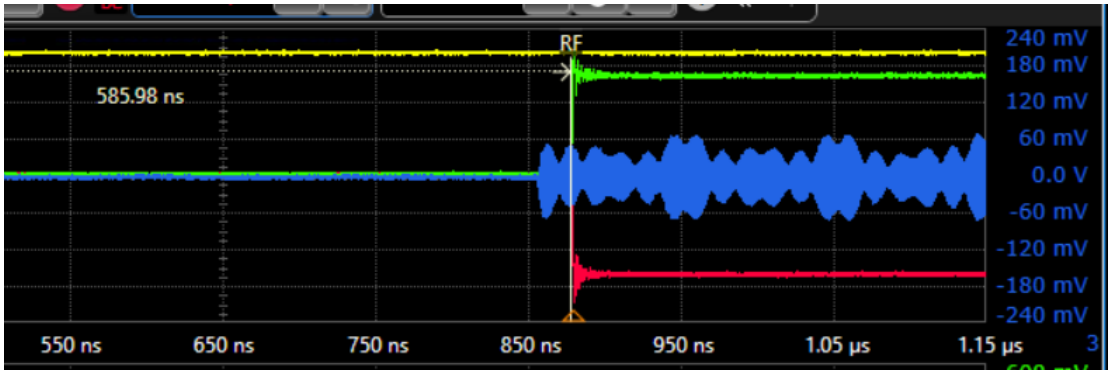
Only available in M9410A/11A/15A/16A with M3202A/M5301A.

Used to pre-align the envelope signal and the RF signal when the envelope delay is 0. The value indicates the time that the envelope lags behind the RF signal. For instance, in the screenshot below, the envelope precedes the RF signal by 585.98ns, that is, the envelope lags behind the RF signal by –585.98ns.



To align the RF signal and the envelope, set –586ns (1ns resolution) to envelope delay offset. The two signals are then aligned.





An oscilloscope must be used to determine the exact envelope delay offset. The offset should be manually updated after the change of the reference waveform.

Remote Command	`[:SENSe]:PAMPlifier:ET:DELay:OFFSet <time>` `[:SENSe]:PAMPlifier:ET:DELay:OFFSet?`
Example	`:PAMP:ET:DEL:OFFS -586ns` `:PAMP:ET:DEL:OFFS?`
Preset	0 s
State Saved	Saved in instrument state
Min/Max	–/+5 us

Envelope Delay

Sets the delay of the envelope signal to the PA input signal.

For Benchtop + VXG, changing this parameter takes effect immediately on the connected VXG.

Remote	`[:SENSe]:PAMPlifier:ET:DELay <time>`

Command	`[:SENSe]:PAMPlifier:ET:DELay?`
Example	`:PAMP:ET:DEL 100ns` `:PAMP:ET:DEL?`
Preset	0 s
State Saved	Saved in instrument state

Min/Max

Instrument	Min	Max
For Benchtop with VXG	–500 ns	500 ns
For M9410A/11A/15A/16A with M3202A/M5301A	–10us	10us

Align ET and RF Signals

This is an immediate action function to initiate an automatic envelope delay alignment. It is only available in M9410A, M9411A, M9415A, M9416A.

The alignment comprises of two parts: coarse and balance alignments. The procedure is described below:

Coarse Alignment:

- Set the envelope delay from Envelope Delay - (Coarse Alignment Step Number - 1) / 2 * Alignment Step to Envelope Delay + (Coarse Alignment Step Number - 1) / 2 * Alignment Step with a step equal to the Alignment Step on the GUI
- Restart the measurement (the EVM and AMAM/AMPM measurements are disabled) after each time the delay is set and get the ACP offset A relative power results, for both the lower and upper offset
- Draw two relative power vs. envelope delay traces for both the lower and upper offset, fitting two curves with the least-square method based on those two traces.
- Pinpoint the pit point on the two fitting curves, respectively

If the two points correspond the same delay, the auto timing alignment stops. And the delay is the optimum delay.

Otherwise, the delay values of the two pit points are used as the boundary of the balance alignment. And the spacing between the two points on the abscissa axis is the Range of the balance alignment. The step of the balance alignment is obtained by calculating Range /(Balance Alignment Step Number - 1).

Balance Alignment:

- For each balance alignment step, restart the measurement (the EVM and AMAM/AMPM measurements are disabled) after each delay is set and get the ACP offset A relative power results, for both the lower and upper offset
- Draw a relative power vs. delay trace with the ordinates being lower offset A relative power – upper offset A relative power, then fit a curve based on the trace
- Pinpoint the point which has the minimum absolute Y value and set the envelope delay with the abscissa value of the point, which is deemed as the optimum envelope delay

Remote Command	`[:SENSe]:PAMPlifier:ET:DELay:ALIGn`
Example	`:PAMP:ET:DEL:ALIG`
Notes	Only available in M9410A, M9411A, M9415A, M9416A
Dependencies	Only enabled when "Envelope Tracking State" on page 384 is ON

Alignment Step

Sets the step of the coarse envelope delay alignment and is only visible in M9410A/11A/15A/16A. The number of steps of the coarse envelope delay is 7. Therefore, the alignment starts from Envelope Delay – 3 * Alignment Step to Envelope Delay + 3 * Alignment Step.

Remote Command	`[:SENSe]:PAMPlifier:ET:DELay:STEP <time>` `[:SENSe]:PAMPlifier:ET:DELay:STEP?`
Example	`:PAMP:ET:DEL:STEP 2ns` `:PAMP:ET:DEL:STEP?`
Preset	1 ns
State Saved	Saved in instrument state
Min	250 ps
Max	1 us

Coarse Alignment Step Number

Identifies the number of steps for the coarse delay alignment.

Remote Command	`[:SENSe]:PAMPlifier:ET:CALignment:NUMBer <integer>` `[:SENSe]:PAMPlifier:ET:CALignment:NUMBer?`
Example	`:PAMP:ET:CAL:NUM 7` `:PAMP:ET:CAL:NUM?`
Dependencies	Only available in M9410A, M9411A, M9415A, M9416A Only odd values are accepted

Preset	7
State Saved	Saved in instrument state
Min	5
Max	21

Balance Alignment Step Number

Identifies the number of steps for the balance delay alignment.

Remote Command	`[:SENSe]:PAMPlifier:ET:BALignment:NUMBer <integer>` `[:SENSe]:PAMPlifier:ET:BALignment:NUMBer?`
Example	`:PAMP:ET:BAL:NUM 7` `:PAMP:ET:BAL:NUM?`
Dependencies	Only available in M9410A, M9411A, M9415A, M9416A
Preset	11
State Saved	Saved in instrument state
Min	5
Max	21

3.1.18 Sweep

Accesses controls to configure and control the acquisition of data, and the X-axis parameters of the instrument.

Depending on the selected mode and measurement, these controls might include: Sweep Time, Continuous/Single, Pause/Resume, X Scale and Number of Points.

3.1.18.1 Sweep/Control

Accesses controls that let you operate the sweep and control functions of the instrument, such as Sweep Time and Continuous/Single.

Sweep/Measure

Lets you toggle between Continuous and Single sweep or measurement operation. The single/continuous state is Meas Global, so the setting affects all measurements.

The front-panel key Single/Cont performs exactly the same function

See "More Information" on page 411

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	Put instrument into **Single** measurement operation:
	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	Put instrument into **Continuous** measurement operation:
	`:INIT:CONT 1`
	`:INIT:CONT ON`

Preset	`ON` Note that `:SYST:PRES` sets `:INIT:CONT` to `ON`, but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is **Single** – A loop with an arrow is **Continuous**
Backwards Compatibility Notes	X-Series A-models had **Single** and **Cont** hardkeys in place of the **SweepSingleCont** softkey. In X-Series A-models, if in single measurement, the **Cont** hardkey (and `INIT:CONT ON`) switched to continuous measurement, but never restarted a measurement and never reset a sweep X-Series B-models have a **Cont/Single** toggle control instead of **Single** and **Cont** hardkeys, but it is still true that, if in single measurement, the **Cont/Single** toggle control never restarts a measurement and never resets a sweep

More Information

Continuous Mode	The instrument takes repetitive sweeps, averages, measurements, etc., when in continuous mode. If in average or Max/Min Hold, and the average/hold count reaches the **Average/Hold Num**, the count stops incrementing, but the instrument keeps sweeping See the **Trace** key description under **Trace Average** for the averaging formula used both before and after the **Average/Hold Num** is reached. The trigger condition must be met prior to each sweep The type of trace processing for multiple sweeps is set under the **Trace** key, with choices of **Trace Average**, **Max Hold**, or **Min Hold**
Single Mode	The instrument takes a single sweep when in **Single** mode, or if in average or Max/Min Hold, or if there is a **Waterfall** window displayed, it takes multiple sweeps until the average/hold count reaches the **Average/Hold Num**, then the count stops incrementing, and the instrument stops sweeping See the **Trace** key description under **Trace Average** for the averaging formula used. The trigger condition must be met prior to the sweep The type of trace processing for multiple sweeps is set under the **Trace** key, with choices of **Trace Average**, **Max Hold**, or **Min Hold**

If the instrument is in **Single** measurement mode, pressing the **Cont/Single** toggle control does not zero the count and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If the instrument is already in **Continuous** sweep:

- `:INIT:CONT 1` has no effect
- `:INIT:CONT 0` places the instrument in Single Sweep but has no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state

See "Restart" on page 412 for details of `:INIT:IMMediate`.

If the instrument is already in **Single** sweep, `:INIT:CONT OFF` has no effect.

If the instrument is already in **Single** sweep, then pressing **Cont/Single** in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing **Cont/Single** does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing **Cont/Single** in the middle of a sweep does not restart the sweep, sending `:INIT:IMM` *does* reset it.

If the instrument is in **Single** sweep, and *not* Averaging/Holding, and you want to take one more sweep, press **Restart**.

If the instrument is in **Single** sweep, *and* Averaging/Holding, and you want to take one more sweep without resetting the Average trace or count, go to **Meas Setup** and increment the average count by 1 by pressing the **Step-Up** key while **Average/Hold Num** is the active function. You can also do this by sending `:CALC:AVER:TCON UP`.

Restart

Restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. If you are Paused, pressing **Restart** performs a Resume.

The front-panel key **Restart** performs exactly the same function.

The **Restart** function is accessed in several ways:

- Pressing the **Restart** key
- Sending `:INIT:IMM`
- Sending `:INIT:REST`

See "More Information" on page 413

Remote	`:INITiate[:IMMediate]`

Command	`:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`
Notes	`:INIT:REST` and `:INIT:IMM` perform exactly the same function
Couplings	Resets average/hold count k. For the first sweep overwrites all active (update = on) traces with new current data. For application modes, it resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `STATus:OPERation` register bits 0 through 8 are cleared , *except* bit 6 (Waiting for Periodic Sync). Initiating a measurement and Waiting for Periodic Sync could be asynchronous The `STATus:QUEStionable` register bit 9 (`INTegrity` sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis Mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **MaxHold** and **MinHold** traces as well

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a **Restart** is executed, the alignment finishes before the restart function is performed.

Even when set for **Single** operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus, when we say that **Restart** "restarts a measurement", depending on the current settings, we may mean that it:

- Restarts the current sweep
- Restarts the current measurement
- Restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- Restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

If there is no Average or Max/Min Hold function (no trace in Trace Average or Hold, or **Average/Hold Num** set to 1), and no **Waterfall** window is being displayed, a single

sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with **Average/Hold Num** >1, and at least one trace set to Trace Average, Max Hold, or Min Hold, or a **Waterfall** window being displayed, multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for **Average/Hold Num**.

Once the full set of sweeps has been taken, the instrument goes to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the **Step-Up** key while **Average/Hold Number** is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

Trace Update

The numeric results are not blanked at any time during the restart cycle.

For slow sweeps (see **Trace Update** section in **Trace/Detector**), the traces are updated real-time during the sweep.

To summarize, the following list shows what happens to the trace data on various events:

Event	Trace Effect
Clear/Write pressed (even if already in Clear/Write)	Set to mintracevalue
Max Hold pressed (even if already in Max Hold)	Set to mintracevalue
Min Hold pressed (even if already in Min Hold)	Set to maxtracevalue
Trace Average pressed (even if already in Trace Average)	Trace data unaffected but start new sweep/avg/hold
Restart pressed	Trace data unaffected but start new sweep/avg/hold
Parameter requiring restart changed (e.g., RBW)	Trace data unaffected but start new sweep/avg/hold

Sweep and Trigger Reset

Resetting the sweep system resets the average/hold count k to 0. It also resets the set point counter to 0. Resetting the trigger system resets the internal auto trig timer to the value set by the **Auto Trig** control.

Averaging

The weighting factor used for averaging is k. This k is also the average/hold count for how many valid sweeps (data acquisitions) have been done. This k is used for

comparisons with N, as those comparisons always needs to be based on valid completed sweeps.

The displayed average/hold, K, shows the count for the sweep (data acquisition) in progress. K = k + 1, with a limit of N. The displayed value K changes from its previous value to 1 as soon as the trigger condition for the first data acquisition (sweep) is met.

Pause/Resume

Pauses a measurement after the current data acquisition is complete.

When paused, the label on the control changes to Resume. Pressing Resume un-pauses the measurement. When paused, pressing Restart performs a Resume.

Remote Command	`:INITiate:PAUSe` `:INITiate:RESume`
Example	`:INIT:PAUS` `:INIT:RES`
Dependencies	Not displayed in Modes that do not support pausing
Annotation	Only on control

Abort (Remote Command Only)

Stops the current measurement. Aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes *before* the abort function is performed, so `:ABORt` does not abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the Restart key Not all measurements support this command

Status Bits/OPC dependencies	The `STATus:OPERation` register bits 0 through 8 are cleared , *except* bit 6 (Waiting for Periodic Sync). Initiating a measurement and Waiting for Periodic Sync could be asynchronous The `STATus:QUEStionable` register bit 9 (`INTegrity` sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the Abort command will cause the `*OPC` query to return true

3.1.18.2 X Scale

Accesses controls that enable you to set the horizontal scale parameters.

Ref Value

Sets the X reference value.

Remote Command	`:DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:RLEVel <real>`
	`:DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:RLEVel?`
	Window numbers are defined in "Views" on page 169

Example	`:DISP:PAMP:WIND:TRAC:X:RLEV 10` `:DISP:PAMP:WIND:TRAC:X:RLEV?`
Couplings	If "Auto Scaling" on page 418 is `ON`, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling automatically changes to `OFF`
Preset	See "Ref Value Parameters" on page 416 below
State Saved	Yes Saved in instrument state
Min/Max	See "Ref Value Parameters" on page 416 below

Ref Value Parameters

Result	Preset	Min	Max	Unit Terminator	Resolution
Raw Main Time	0	–100s	100s	ns,us,ms,s	1ns
AM-AM	–80dBm	–250dBm	50dBm	dBm	0.01
AM-PM	–80dBm	–250dBm	50dBm	dBm	0.01
EVM vs. Power	–100dBm	–250dBm	50dBm	dBm	0.01
DPD Iteration RMS/Delta EVM	1	1	100	N/A	0.01
DPD Iteration ACP Offset A Lower/Upper					

Scale/Div

Sets the horizontal scale.

Remote Command	`:DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:PDIVision <real>`
	`:DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:PDIVision?`
	The window numbers are defined in "Views" on page 169

Example	`:DISP:PAMP:WIND2:TRAC:X:PDIV 500` `:DISP:PAMP:WIND2:TRAC:X:PDIV?`
Couplings	If "Auto Scaling" on page 418 is `ON`, this value is automatically determined by the measurement result. When you set this value manually, Auto Scaling automatically changes to `OFF`
Preset	Auto
State Saved	Yes Saved in instrument state
Min/Max	See "Scale/Div Parameters" on page 417 below

Scale/Div Parameters

Result	Default	Min	Max	Unit Terminator	Resolution
Raw Main Time	1ms	1ns	10s	ns,us,ms,s	1ns
AM-AM	10dB	0.001dB	100dB	dB	0.01
AM-PM	10dB	0.001dB	100dB	dB	0.01
EVM vs. Power	10dB	0	100dB	dB	0.01
DPD Iteration RMS/Delta EVM	0	0	10	N/A	0.01
DPD Iteration ACP Offset A Lower/Upper					

Ref Position

Sets the reference position for the X axis to Left, Center or Right.

Remote Command	`:DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:RPOSition LEFT | CENTer | RIGHt`
	`:DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:RPOSition?`
	The window numbers are defined in "Views" on page 169

Example	`:DISP:PAMP:WIND:TRAC:X:RPOS LEFT` `:DISP:PAMP:WIND:TRAC:X:RPOS?`

Preset	LEFT
State Saved	Saved in instrument state
Range	LEFT|CENTer|RIGHt

Auto Scaling

Toggles the scale coupling function On or Off.

Remote Command	:DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:COUPle 0 | 1 | OFF | ON :DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:COUPle? The window numbers are defined in "Views" on page 169
Example	:DISP:PAMP:WIND:TRAC:X:COUP ON :DISP:PAMP:WIND:TRAC:X:COUP?
Couplings	When "Auto Scaling" on page 418 is ON and the Restart front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results When you set the value of either "Scale/Div" on page 417 or "Ref Value" on page 416 manually, Auto Scaling automatically changes to OFF
Preset	**Window** / **Value** "AM-AM" on page 173, "AM-PM" on page 174 / OFF "Raw Main Time" on page 174, "EVM vs. Power Graph" on page 176, "DPD Iteration EVM" on page 183, "DPD Iteration ACP" on page 184 / ON
State Saved	Saved in instrument state
Range	OFF|ON

3.1.18.3 Recording

Displays the Sample Rate, Sample Points and Sample Time of the saved IQ data file.

Recording and playback of signal data files is a multi-step process that involves controls in several menus:

- Save, Recording (under the Save hardkey or the Save icon in the File panel)
- Recall, Recording (under the Recall hardkey or the Recall icon in the File panel)

- **Sweep**, **Recording** (this tab)
- **Sweep**, "Playback" on page 419
- **Input/Output**, "Data Source" on page 816

NOTE **A complete tutorial for Record/Playback functionality, including how to load and save recording files, can be found in the help for the tab "Data Source" on page 816 under Input/Output.**

This menu includes the following display-only fields:

Sample Rate

Displays the sample rate of the saved IQ data file. If you have not saved an IQ data file, the value is 0.

Sample Points

Displays the total number of sample points in the saved IQ data file. If you have not saved an IQ data file, the value is 0.

Sampling Time

Displays the total sample time of the saved IQ data file. If you have not saved an IQ data file, the value is 0.

Saved Channel(s) [Mode: 5GNR, VMA, WLAN]

Displays the channel index/number of the saved IQ data file. If you have not saved an IQ data file, no value is displayed.

This control is designed for multi-channel I/Q data recording and playback.

3.1.18.4 Playback

Contains parameters for playback of saved recording files recalled to the instrument.

Recording and playback of signal data files is a multi-step process that involves controls in several menus:

- **Save**, **Recording** (under the **Save** hardkey or the **Save** icon in the **File** panel)
- **Recall**, **Recording** (under the **Recall** hardkey or the **Recall** icon in the **File** panel)
- **Sweep**, "Recording" on page 418
- **Sweep**, **Playback** (this tab)
- **Input/Output**, "Data Source" on page 816

NOTE **A complete tutorial for Record/Playback functionality, including how to load and save recording files, can be found in the help for the tab "Data Source" on page 816 under the Input/Output menu.**

This menu includes the following display-only fields:

Sample Points

Displays the total number of sample points in the recalled IQ data file. If you have not recalled an IQ data file, the value is 0.

Sampling Time

Displays the total sample time of the recalled IQ data file. If you have not recalled an IQ data file, the value is 0.

Input Channels [Mode: 5GNR, VMA, WLAN]

Displays the input channel number of the recalled IQ data file. If you have not recalled an IQ data file, the default value of 1 is displayed.

This control is designed for multi-channel I/Q data recording and playback.

Playback Mode

Specifies the mode of IQ data to be played back and analyzed:

- Fixed: Playback Stop value is ignored. Measurement will analyze the first chunk of IQ data start from Playback Start repeatedly
- Iterative: Measurement will analyze the IQ data chunk by chunk between Playback Start and Playback Stop, if the last chunk is not complete it will be ignored and start from the first chunk again

Remote Command	`:CALCulate:<meas>:PLAY:MODE FIXed | ITERative`
	`:CALCulate:<meas>:PLAY:MODE?`
	Where `<meas>` is the mnemonic for the current measurement, for example, `EVM`

Example	For EVM measurement in 5G NR Mode:
	`:CALC:EVM:PLAY:MODE CONT`
	`:CALC:EVM:PLAY:MODE?`

Preset	`FIX`
State Saved	Saved in instrument state
Range	Fixed | Iterative

Playback Start

Once you have loaded an IQ data file using **Recall**, **Recording**, this control enables you to specify the start position of the IQ data playback range to be analyzed. If its value is less than zero, an additional zero is inserted at the beginning of the IQ data.

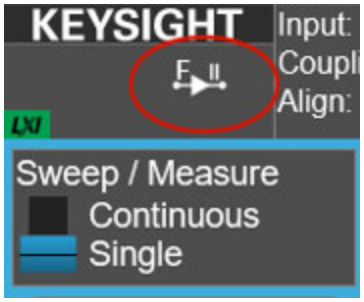
To go to a specific location in the recalled I/Q data, enter the desired **Playback Start** point.

You can use this control to examine the data you recalled from the recording file. How you proceed depends on whether you are in **Continuous** or **Single** mode. To determine which mode you are in, look at the first panel on the left in the **Meas Bar** above the data display.

If the panel looks like this, you are in **Continuous** mode:



If the panel looks like this, you are in **Single** mode:



The **F** indicates that the instrument is using data from a file (if you wish to return to looking at data at the analyzer input, change the **Data Source** control in the **Input/Output**, **Data Source** menu from **File** back to **Input**.)

To examine the data you loaded:

Continuous mode

In this mode, turn the knob or use the **Up/Down** keys on the front panel to move through records in the recording. You will see **Playback Start** change from 0 to successively higher values as you move deeper into the data.

Single mode

In this mode, you can only look at one record. Set the **Playback Start** time to the desired offset from zero, then press **Restart**. A single record will be displayed. Note that until you press **Restart**, the "invalid data" indicator (yellow asterisk) is displayed in each window. After you press **Restart**, the invalid data indicator disappears.

Remote Command	`:CALCulate:<meas>:PLAY:STARt <time>`
	`:CALCulate:<meas>:PLAY:STARt?`
	Where `<meas>` is the mnemonic for the current measurement, for example, `EVM`

Example	For EVM measurement in 5G NR Mode:
	`:CALC:EVM:PLAY:STAR 0.01 s`
	`:CALC:EVM:PLAY:STAR?`

Preset	0
State Saved	Saved in instrument state
Min/Max	–/+Sample Points in IQ file / Sample Rate in IQ file

Playback Stop

Specifies the stop position of the IQ data playback range to be analyzed, when "Playback Mode" is iterative.

Remote Command	`:CALCulate:<meas>:PLAY:STOP <time>`
	`:CALCulate:<meas>:PLAY:STOP?`
	Where `<meas>` is the mnemonic for the current measurement, for example, `EVM`

Example	For EVM measurement in 5G NR Mode:
	`:CALC:EVM:PLAY:STOP 0.01 s`
	`:CALC:EVM:PLAY:STOP?`

Preset	0
State Saved	No
Min	0
Max	Sample Points in IQ file x Sample Rate

Step Forward

Move to next chunk of IQ data when "Playback Mode" on page 420 is iterative.

Remote Command	`:CALCulate:<meas>:PLAY:STEP:FORWard` Where `<meas>` is the mnemonic for the current measurement, for example, `EVM`
Example	For EVM measurement in 5G NR Mode: `:CALC:EVM:PLAY:STEP:FORW`
State Saved	Saved in instrument state

Sample Rate

Displays the sample rate of the recalled IQ data file if the recalled file format contains sampling rate information (`.csv`, `.sdf`, `.txt`). In this case, the *control* is grayed-out.

`BIN` and `BINX` files do not include sampling rate information inside the file, so after recalling one of these files, you must set Sample Rate manually. When you save a file in these formats, you must specify the sample rate, as displayed under Sweep, Recording.

Remote Command	`:CALCulate:<meas>:PLAY:SRATe <freq>`
	`:CALCulate:<meas>:PLAY:SRATe?`
	Where `<meas>` is the mnemonic for the current measurement, for example, `EVM`

Example	For EVM measurement in 5G NR Mode:
	`:CALC:EVM:PLAY:SRAT 122.88MHz`
	`:CALC:EVM:PLAY:SRAT?`

Couplings	Displays only after recalling `.csv`, `.sdf`, or `.txt` files Settable after recalling `.bin` or `.binx` files
Preset	0
State Saved	No
Min	0

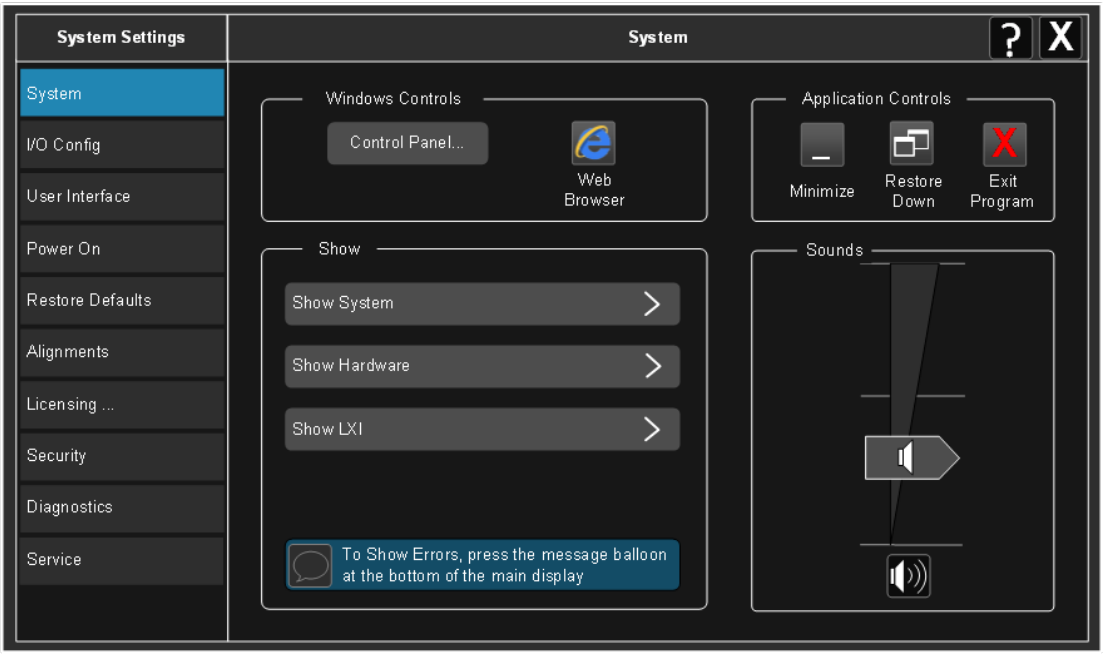
3.1.19 Trace

Not supported in this measurement. The menu is blank.

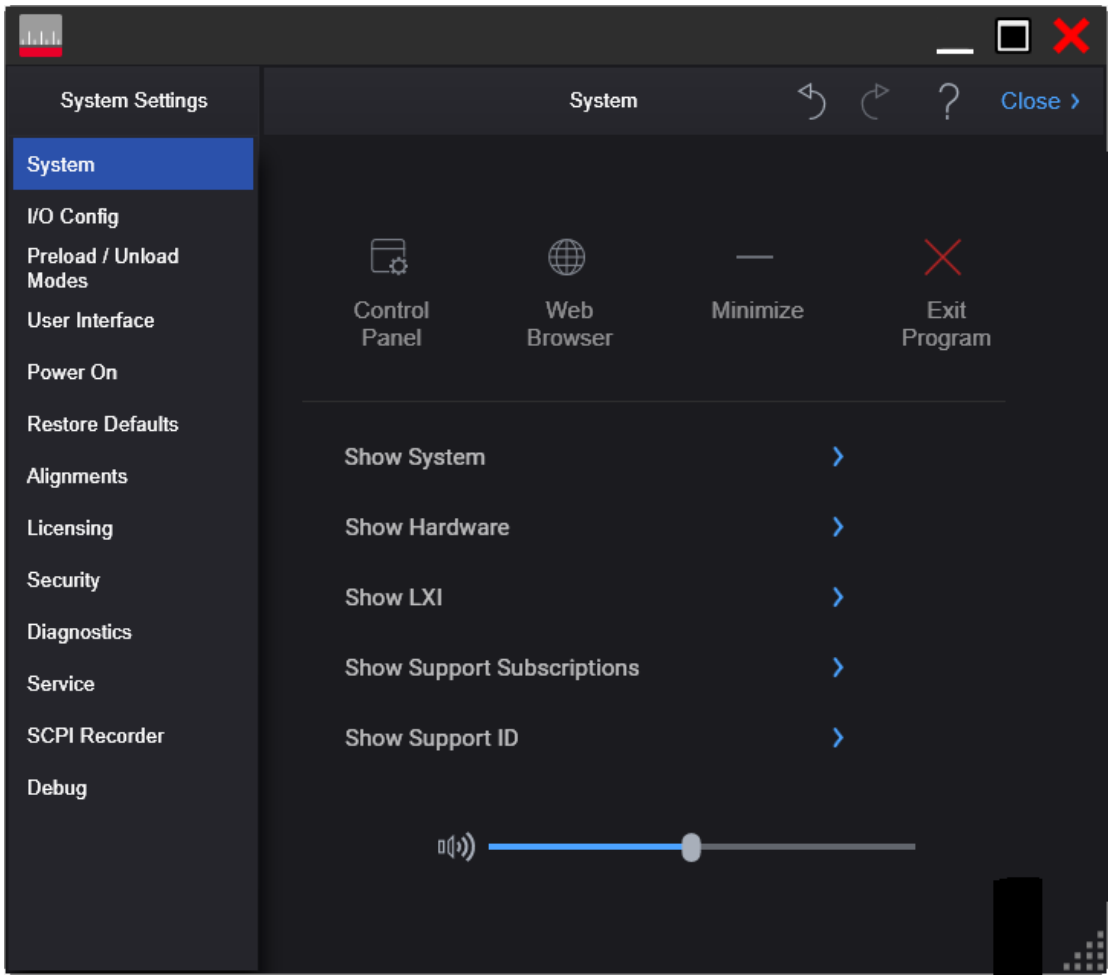
4 System

The System Settings menu, with the “gear” icon, opens the System Settings dialog, which lets you access various configuration menus and dialogs. The line of tabs down the left side let you select various pages for configuring your instrument. The dialog’s appearance depends on the selected User Interface style:

Standard UI



Simplified UI



Notes	No remote command for this key specifically

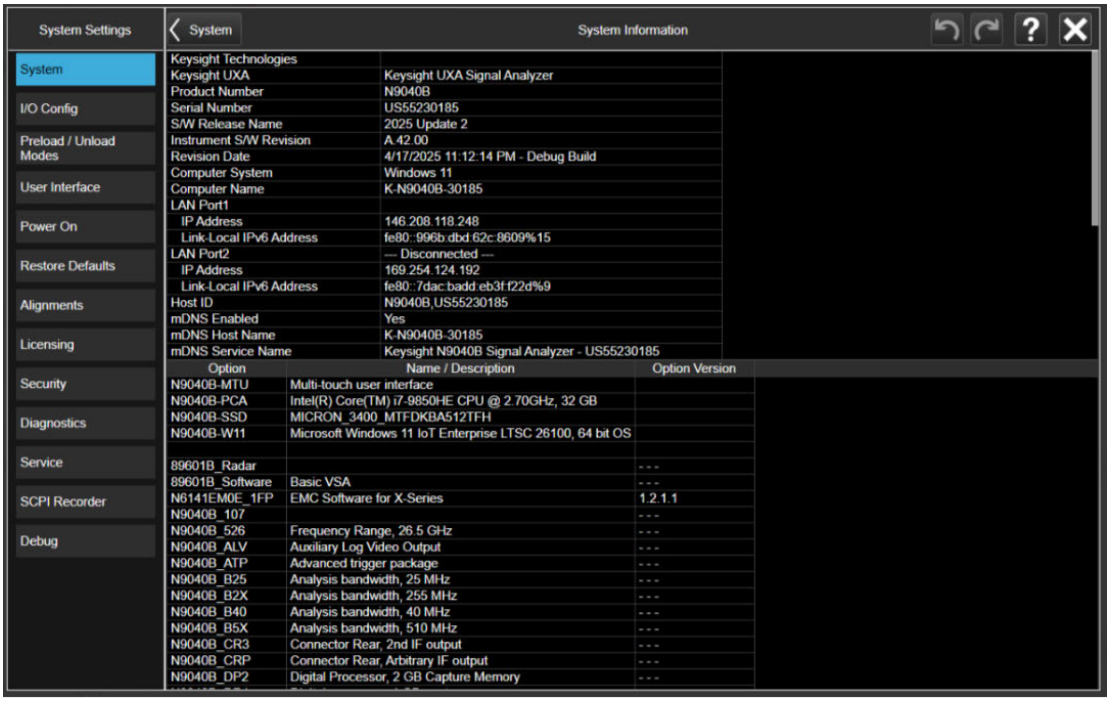
4.1 System

Allows access to several general system functions, including Show screens for viewing system parameters. Several such Show screens are available on this and other System menu pages. They can also be accessed with the SCPI command described here.

Remote Command	`:SYSTem:SHOW OFF | ERRor | SYSTem | HARDware | LXI | HWSTatistics | ALIGnment | SOFTware | CAPPlication` `:SYSTem:SHOW?`
Example	`:SYST:SHOW SYST`
Notes	Displays (or exits) the specified System information screen
Preset	`OFF`
State Saved	No
Range	`OFF| ERRor | SYSTem | HARDware | LXI | HWSTatistics | ALIGNment | SOFTware | CAPPlication`

4.1.1 Show System

This screen is divided into three groups: product descriptive information, options tied to the hardware, and software products. Swipe up and down on this screen to scroll the display.



Example	`:SYST:SHOW SYST`

4.1.1.1 Show System contents (Remote Query Only)

Returns the contents of the Show System screen (the entire contents, not just the currently displayed page).

Remote Command	`:SYSTem:CONFigure[:SYSTem]?`
Example	`:SYST:CONF?`
Notes	The output is an IEEE Block format of the Show System contents. Each line is separated by a new-line character

4.1.1.2 Computer System description (Remote Query Only)

Returns the Computer System description, which consists of the operating system and patch level, as reported by operating system.

Remote Command	`:SYSTem:CSYStem?`
Example	`:SYST:CSYS?`
Notes	Returns the Computer System name and service pack level

4.1.1.3 CPU (Remote Query Only)

Returns CPU information, as shown in the System > Show System window.

Remote Command	:SYSTem:CPU?
Example	`:SYST:CPU?`
Notes	Returns CPU information

4.1.1.4 GPU (Remote Query Only)

Returns GPU information, as displayed in the System > Show System window. If no GPU information is shown or returned, then there is no GPU in this system, and GPU capabilities are not available.

Remote Command	`:SYSTem:GPU?`
Example	`:SYST:GPU?`
Notes	Returns GPU information. Returns “GPU not supported” if no GPU is present

4.1.2 Show Hardware

Displays details of the installed hardware. This information can be used to determine versions of hardware assemblies and field-programmable devices, in the advent of future upgrades or potential repair needs.

The screen is divided into two groups: product descriptive information and hardware information. The hardware information is listed in a table format.

Example `:SYST:SHOW HARD`

4.1.3 Show LXI

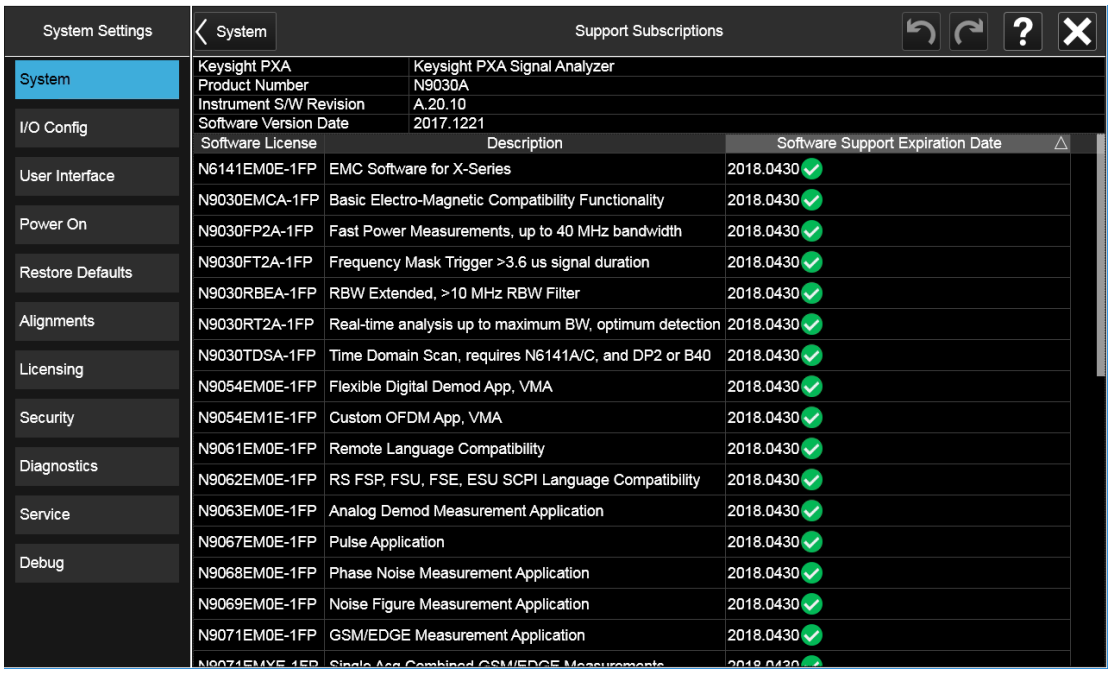
Displays the product number, serial number, firmware revision, computer name, IP address, Host ID, LXI Class, LXI Version, MAC Address, and the Auto-MDIX Capability.

Example `:SYST:SHOW LXI`

4.1.4 Show Support Subscriptions

Displays the software support subscription information for the licenses available on the instrument.

Shows the software license, description, software support expiration date (format is `YYYY.MMDD`), and the software support status. The Software Version Date (format is `YYYY.MMDD`) shown in the header indicates the date required to access the latest software enhancements included in this version of the software. If any license has a Software Support Expiration Date earlier than the Software Version Date, then enhancements may be available that the license does *not* enable.



Example `:SYST:SHOW SSINformation`

4.1.5 Show Support ID

Displays the Support ID for each license available in the instrument. Shows the Software License, Description, software support expiration date, and Support ID for that license.

Each license has a copy icon, which copies just the Support ID for that license to the Windows clipboard. This is useful to avoid typing mistakes when entering this value into another program or web site.

The Copy all to clipboard ... control copies all the data to the Windows clipboard, in comma-separated value (CSV) format.



Example `:SYST:SHOW SID`

4.1.6 Control Panel...

Opens the Windows Control Panel. Control Panel is used to configure certain elements of Windows that are not configured via the Multitouch UI System menus.

NOTE **This feature is *not* available if Option SF1 is installed.**

Control Panel is a separate Windows application, so to return to the Instrument Application, either:

- Exit by tapping on the red X in the upper right-hand corner
- Use Alt+Tab. Press and hold the Alt key and press and release the Tab key until the Instrument logo appears in the window in the center of the screen, then release the Alt key

Notes No remote command for this key

4.1.7 Web Browser

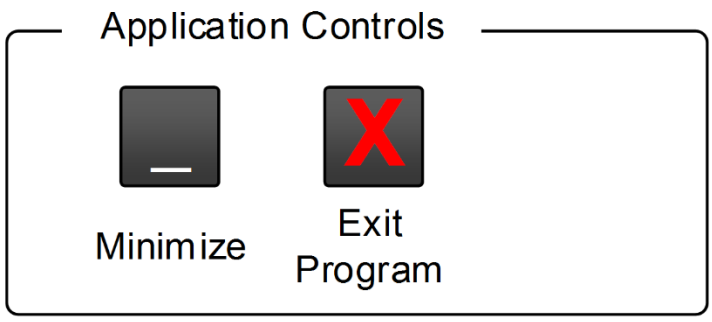
Launches the instrument's default Web Browser. Usually, the default is Microsoft Edge. A mouse and external keyboard are highly desirable for using the browser. To

return focus to the Instrument Application, close the browser (or use Alt-Tab).

NOTE **This feature is *not* available if Option SF1 is installed.**

4.1.8 Application Controls (Minimize, Exit)

Lets you minimize or exit the application.



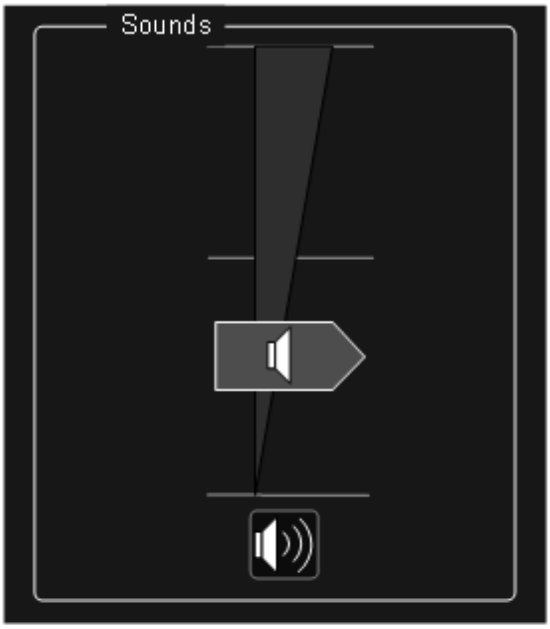
Pressing Exit Program displays a prompt asking if you are sure you want to close the program. If you select OK, the entire analyzer application will shut down, and you will lose any unsaved trace or measurement data.

Notes No equivalent remote command for this key

4.1.9 Sounds

Lets you adjust the speaker volume using the slider, or mute/unmute the speaker, by tapping the Speaker icon.

Moving the slider up and down changes the speaker volume, and *also* unmutes the speaker if muted.





Icon when muted

4.2 I/O Config

Lets you specify and change the I/O configuration for remote control. Controls in this menu allow configuration of the I/O ports used for SCPI remote control over GPIB and LAN.

The SCPI LAN parameters are set using controls in this menu, but configuration of LAN settings themselves is performed using the Windows Control Panel (DHCP, Gateway, Subnet Mask, etc.).

The USB port is also available for remote control, but requires no configuration.

4.2.1 GPIB

Lets you configure the GPIB I/O port.

Dependencies	Not available in UXM In SA6210A, these controls appear only when Option GPB is installed

4.2.1.1 GPIB Address

Select the GPIB remote address.

Remote Command	`:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess <integer>` `:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess?`
Example	`:SYST:COMM:GPIB:ADDR 17`
Notes	If the GPIB port address is changed, all further communication must use the *new* address In SA6210A, if Option GPB is not installed, sending the SCPI command generates the error -241,"Hardware missing; Option not installed"
Preset	Unaffected by **Preset**, but set to 18 by **Restore Defaults** >"Misc" on page 484
State Saved	No
Min	0
Max	30

4.2.1.2 GPIB Controller

Sets the GPIB port into Controller (`ON`) or Device (`OFF`) mode. In the normal state, **GPIB Controller** is disabled (`OFF`), which allows the instrument to be controlled by a remote computer. When **GPIB Controller** is enabled (`ON`), the instrument can run software applications that use the instrument's computer as a GPIB controller for devices connected to the GPIB port.

NOTE When **GPIB Controller** is enabled, the analyzer application itself cannot be controlled over GPIB. In this case, it can be controlled via LAN or USB. The GPIB port cannot be a Controller and Device at the same time. Only one Controller can be active on the GPIB bus at any given time. If the instrument is the Controller, an external PC cannot also be a Controller.

To control the instrument from the software that is performing GPIB Controller operation, you can use an internal TCP/IP connection to the analyzer application. Use the following IP Address to send commands to the analyzer application:

`TCPIP0:localhost:inst0:INSTR`

Remote Command	`:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle] ON | OFF | 0 | 1` `:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle]?`

Example	Set GPIB port to Controller:
	`:SYST:COMM:GPIB:CONT ON`
	Set GPIB port to Device:
	`:SYST:COMM:GPIB:CONT OFF`

Notes	When the instrument becomes the Controller, Bit 0 in the Standard Event Status Register is set. When the instrument relinquishes Controller capability, bit 0 is cleared In SA6210A, if Option GPB is not installed, sending the SCPI command generates the error -241,"Hardware missing; Option not installed"
Preset	Unaffected by Preset, but set to `OFF` (Disabled) by **Restore Defaults** >"Misc" on page 484
State Saved	No
Range	Disabled | Enabled

4.2.2 SCPI LAN

Displays a menu for identifying and changing SCPI over a LAN configuration. There are several ways to send SCPI remote commands to the instrument over LAN.

Having multiple users simultaneously accessing the instrument over the LAN may lead to communication problems. These controls can help to prevent that, by disabling the telnet, socket, and/or SICL capability.

NOTE When multiple instances of the application are running, Telnet port 5023, socket port 5025, SICL server inst0 and HiSLIP server Device 0 will be assigned to the first instance; Telnet port 5123, socket port 5125, SICL server inst1 and HiSLIP server Device 1 will be assigned to the second instance; Telnet port 5223, socket port 5225, SICL server inst2 and HiSLIP server Device 2 will be assigned to the third instance; Telnet port 5323, socket port 5325, SICL server inst3 and HiSLIP server Device 3 will be assigned to the fourth instance.

– "SCPI Telnet" on page 435
– "SCPI Socket" on page 435
– "SICL Server" on page 436
– "HiSLIP Server" on page 437
– "Verbose SCPI On/Off" on page 437
– "SCPI Socket Control Port (Remote Query Only)" on page 439

4.2.2.1 SCPI Telnet

Turns SCPI LAN telnet capability On or Off, allowing you to limit SCPI access over LAN through telnet.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:TELN:ENAB OFF`
Preset	Unaffected by **Preset**, but set to `ON` by **Restore Defaults** >"Misc" on page 484 If not set up or specified, the Secure Instrument Communications configuration setting: is `ON`
State Saved	No
Range	`OFF|ON`

4.2.2.2 SCPI Socket

Turns the capability to establish Socket LAN sessions `ON` or `OFF`, to limit SCPI access over LAN through socket sessions.

Connection String & Copy Button

In "SCPI LAN" on page 434, the full SCPI connection string is displayed to the right of the **SCPI Socket**`ON/OFF` control. Pressing **Copy**, to the right of the string, copies the connection string to the Windows clipboard.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:SOCK:ENAB OFF`
Dependencies	If the Secure Instrument Communications configuration has disabled this connection, local changes are not allowed, and an attempt to do so results in error -221,"Disabled by Secure Instrument Communications configuration"

Preset	Unaffected by **Preset**, but set to ON by **Restore Defaults** >"Misc" on page 484 If not set up or specified, the Secure Instrument Communications configuration setting: is ON
State Saved	No
Range	OFF|ON

4.2.2.3 SICL Server

Turns the **SICL Server** capability ON or OFF, to limit SCPI access over LAN through the SICL server. (SICL IEEE 488.2 protocol.)

Parameter	Description	Setting
Maximum Connections	The maximum number of connections that can be accessed simultaneously	5
Instrument Name	The name (same as the remote SICL address) of your instrument	inst0
Instrument Logical Unit	The unique integer assigned to your instrument when using SICL LAN	8
Emulated GPIB Name	The name (same as the remote SICL address) of the device used when communicating with your instrument	gpib7
Emulated GPIB Logical Unit	The unique integer assigned to your device when it is being controlled using SICL LAN	8
Emulated GPIB Address	The emulated GPIB address assigned to your transmitter tester when it is a SICL server (the same as your GPIB address)	18

Connection String & Copy Button

In "SCPI LAN" on page 434, the full connection string is displayed to the right of the **SICL Server**ON/OFF control. Pressing **Copy**, to the right of the string copies the connection string to the Windows clipboard.

Remote Command	:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle OFF | ON | 0 | 1 :SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?
Example	:SYST:COMM:LAN:SCPI:SICL:ENAB OFF
Dependencies	Not available in UXM If the Secure Instrument Communications configuration has disabled this connection, local changes are not allowed, and an attempt to do so results in error -221,"Disabled by Secure Instrument Communications configuration"
Preset	Unaffected by **Preset**, but set to ON by **Restore Defaults** >"Misc" on page 484 If not set up or specified, the Secure Instrument Communications configuration setting: is ON
State Saved	No
Range	OFF|ON

4.2.2.4 HiSLIP Server

Turns the HiSLIP Server capability ON or OFF, to limit SCPI access over LAN through the HiSLIP server.

HiSLIP stands for High-Speed LAN Instrument Protocol, and is part of the IVI-6.1 specification.

Example of a VISA connection string used to connect to the HiSLIP Server on an X-Series Spectrum Analyzer:

```
TCPIP0::a-n9030a-93016::hislip0::INSTR
```

In the example above, `hislip0` is the HiSLIP device name that VISA users must include in HiSLIP VISA Address strings. Your HiSLIP device name may differ, depending on your VISA settings.

Connection String & Copy Button

In "SCPI LAN" on page 434, the full connection string is displayed to the right of the HiSLIP ServerON/OFF control. Pressing Copy, to the right of the string copies the connection string to the Windows clipboard.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:HISL:ENAB OFF`
Preset	Unaffected by Preset, but set to ON by Restore Defaults >"Misc" on page 484 If not set up or specified, the Secure Instrument Communications configuration setting: is ON
State Saved	No
Range	OFF|ON

4.2.2.5 Verbose SCPI On/Off

When you turn Verbose SCPION, additional information is returned by `:SYSTem:ERRor?`. The additional information consists of the characters that stimulated the error. This can aid you in debugging your test programs, by indicating where in the parsing of a SCPI command the instrument encountered an invalid command or query.

Specifically, with Verbose SCPION, `:SYSTem:ERRor?` is expanded to show the SCPI data received, with the indicator `<Err>` at the point in the stream that the error occurred.

Verbose SCPI has no effect on the Show Errors screen or front-panel Message Line; and only changes the response to `:SYST:ERR?`.

See the example below, where the invalid command `:SENS:BOGUS` is sent:

Normal response to `:SYST:ERR?` (using the Telnet window):

```
SCPI> SENS:BOGUS
SCPI> SYST:ERR?
-113,"Undefined header"
```

After turning on Verbose SCPI:

```
SCPI> SYST:BOGUS
SCPI> SYST:ERR?
-113,"Undefined header;SYST:BOGUS<Err>"
```

Remote Command	`:SYSTem:ERRor:VERBose OFF | ON | 0 | 1` `:SYSTem:ERRor:VERBose?`
Example	`:SYST:ERR:VERB ON`
Preset	Unaffected by **Preset**, but set to `OFF` by **Restore Defaults** >"Misc" on page 484
State Saved	No
Range	`OFF|ON`

4.2.2.6 Device Clear on Disconnect

When using HiSLIP (High Speed LAN Instrument Protocol), Telnet, or Sockets, a communication session with the instrument is opened when you connect, and closed when you disconnect. This differs from other connections such as GPIB, USB and VXI-11 connections, which are never actually closed but stay open as long as the instrument is running.

When a session is closed, a Device Clear function is generated, which affects the entire instrument, not just the current connection. Thus, when using HiSLIP, Telnet, or Sockets, unexpected Device Clears may occur, which can disrupt measurements in ways that GPIB and VXI-11 “sessions” do not.

Device Clear on Disconnect enables these auto-generated Device Clears for Telnet, Socket, and HiSLIP sessions. For backwards compatibility, they are *not* generated unless you explicitly enable them.

There is no change in VXI-11, USB, or GPIB session behavior. These sessions do not close when you disconnect, have never generated Device Clear events, and still do not generate Device Clear events, regardless of the setting of this switch.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle 0 | 1 | ON | OFF` `:SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:EOS:DCLE:ENAB ON`
Preset	Unaffected by **Preset**, but set to `OFF` by **Restore Defaults** >"Misc" on page 484

State Saved	No
Range	OFF|ON

4.2.2.7 SCPI Socket Control Port (Remote Query Only)

Returns the TCP/IP port number of the control socket associated with the SCPI socket session. This query lets you obtain the unique port number to open when a device clear is to be sent to the instrument. Every time a connection is made to the SCPI socket, the instrument creates a peer control socket. The port number for this socket is random. You must use this command to obtain the port number of the control socket. To force a device clear on this socket, open the port and send the string DCL\n to the instrument.

If this query is sent to a non-SCPI Socket interface, then 0 is returned.

Remote Command	:SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTrol?
Example	:SYST:COMM:LAN:SCPI:SOCK:CONT?
Preset	Unaffected by **Preset** or **Restore Defaults** >"Misc" on page 484
State Saved	No
Range	0 to 65534
Min	0
Max	65534
Backwards Compatibility SCPI	:SYSTem:COMMunicate:TCPip:CONTrol?

4.2.2.8 SCPI Instrument Port (Remote Query Only)

Some MIMO applications need to be able to determine the port to use to communicate with the instrument. This query returns the port number to use for communications.

Remote Command	:SYSTem:COMMunicate:LAN:INSTrument:PORT?

4.2.3 Web Password Reset

The embedded web server contains certain capabilities that are password-protected; modifying the LAN configuration of the instrument, and access to web pages that can change the settings of the instrument. This control lets you set the web password as desired, or reset the password to the factory default.

Depending on your instrument type, the default password from the factory may be either:

`measure4u`

or, in newer instruments (for compliance with Microsoft security policies):

`Technology4u!`

Note that passwords are case-sensitive, and that the exclamation point is part of the password.

Selecting **Web Password Reset** displays a form to let you reset the password as desired, or to the factory default via the **Set Default** control. The built-in alpha keyboard appears.

You can cancel this entry by pressing the **Cancel (ESC)** front-panel key (if available).

Dependencies	Not available in UXM

4.2.4 System IDN Response

Lets you specify a response to `*IDN?`, return the instrument to the `FACTory` response if you have changed it, or, if your test software is expecting the `*IDN` response to indicate Agilent Technologies, configure the instrument to respond with Agilent as the manufacturer.

The current `*IDN` response is displayed at the top of the panel, followed by the **System IDN Response** and **User IDN** controls.

4.2.4.1 System IDN Response

To select the factory-set response, select `FACTory`. To specify your own response, select `USER`. You can enter your desired response using "User IDN" on page 442.

If your test software expects the response to indicate Agilent Technologies as the Manufacturer, you can configure this response by selecting `AGILent`.

Remote Command	`:SYSTem:IDN:CONFigure FACTory | AGILent | USER`
	For option details, see "More Information" on page 441
	`:SYSTem:IDN:CONFigure?`

Example	`:SYST:IDN:CONF FACT`
Notes	Affects the response returned by all Modes of the instrument, unless the current Mode has *also* specified a custom response, in which case the current Mode's custom IDN response takes precedence over the System's, but only while that Mode is current Survives shutdown and restart of the software and therefore survives a power cycle
Preset	The `*IDN` response is reset to `FACTory` by **Restore Defaults** >"Misc" on page 484 or **Restore Defaults** >"All" on page 485 and survives subsequent running of the software

More Information

Here are details of the options available for the System *IDN response:

Factory

SCPI example: :SYST:IDN:CONF FACT

Selects the factory default configuration of *IDN?, which indicates the Manufacturer as Keysight Technologies. For example,

"Keysight Technologies,N9040B,MY00012345,A.15.00"

where the fields are Manufacturer, Model Number, Serial Number, Firmware Revision.

NOTE **In products that run multiple instances of the X-Series Application, all instances use the *same* factory System IDN response.**

Agilent

SCPI example: :SYST:IDN:CONF AGIL

Starting with software version x.14.50, the *IDN? response in the Factory configuration indicates the Manufacturer as Keysight Technologies. If your test software is expecting the response to indicate Agilent Technologies, you can configure the response with this menu selection or SCPI command.

For example:

"Agilent Technologies,N9020A,MY00012345,A.05.01"

NOTE **In products that run multiple instances of the X-Series Application, all instances use the *same* Agilent System IDN response.**

User

SCPI example: :SYST:IDN:CONF USER

Selects your customized configuration of *IDN?

Enter your desired response using "User IDN" on page 442.

4.2.4.2 User IDN

Allows you to specify your own response to `*IDN?`. You may enter your desired response with the Alpha Editor or a plugin PC keyboard. Once the value is entered, select `USER` under System IDN Response.

When you select this control, the active function becomes the current User string and is highlighted, so typing replaces it. If instead you wish to edit the existing string, press the left or right arrow to go to the beginning or the end.

If you enter a null string (for example, by clearing the User String while editing and then pressing Done), the instrument automatically reverts to the `FACTory` setting.

NOTE **In products that run multiple instances of the X-Series Application, all instances use the *same* User System IDN response.**

Remote Command	`:SYSTem:IDN <string>` `:SYSTem:IDN?`

Notes	The `<string>` must consist of four fields, each separated by a comma, example:
	`:SYST:IDN "XYZ Corp,Model 12,012345,A.01.01"`
	The four fields are `<manufacturer>`, `<model number>`, `<serial number>`, `<firmware revision>`. The fields are comma-delimited, so text within a field cannot contain a comma
	This affects the response given in all Modes of the instrument, unless the current Mode has *also* specified a custom response, in which case the current Mode's custom IDN response takes precedence over the System's, but only while that Mode is current
	Survives shutdown and restart of the software and therefore survives a power cycle
	Null string as parameter restores the `FACTory` setting, example:
	`:SYST:IDN ""`

Preset	Unaffected by Preset, but set to the original `FACTory` setting by Restore Defaults > "Misc" on page 484

4.2.4.3 SYSTem:PERSona (Remote Commands Only)

The `:SYSTem:PERSona` command set permits setting of individual fields of the `*IDN?` response.

- "SYSTem:PERSona:DEFault" on page 443
- "SYSTem:PERSona:MANufacturer" on page 443
- "SYSTem:PERSona:MANufacturer:DEFault" on page 443
- "SYSTem:PERSona:MODel" on page 443
- "SYSTem:PERSona:MODel:DEFault" on page 444

SYSTem:PERSona:DEFault

Resets the *IDN response to the instrument default.

Remote Command	:SYSTem:PERSona:DEFault :SYSTem:PERSona:DEFault?
Notes	:SYST:PERS:DEF? returns the default value of *IDN? even if the current setting of *IDN? is the non-default value. The query return type is a <string> :SYST:PERS:DEF is equivalent to: :SYSTem:IDN "" :SYSTem:IDN:CONF DEF

SYSTem:PERSona:MANufacturer

Sets the MANufacturer field of the *IDN? response. This is the first field of the *IDN? response.

Remote Command	:SYSTem:PERSona:MANufacturer <string> :SYSTem:PERSona:MANufacturer?
Notes	When setting the MANufacturer field, the current IDN response string is modified to replace the manufacturer field with the string specified by the command. If the resulting IDN response matches one of the predefined responses (:SYST:IDN:CONF FACT | AGIL), then the :SYST:IDN:CONF is set to the corresponding value. If the IDN response with the new manufacturer field is not one of the predefined values, then :SYST:IDN:CONF will be set to USER and :SYST:IDN will be set to the new IDN response string The query returns the current value of the *IDN? Manufacturer field

SYSTem:PERSona:MANufacturer:DEFault

Resets the MANufacturer field of the *IDN? response to the default value.

Remote Command	:SYSTem:PERSona:MANufacturer:DEFault :SYSTem:PERSona:MANufacturer:DEFault?
Notes	The query returns the default MANufacturer field value of *IDN? even if the current setting of *IDN? is the non-default value. The return type is a <string>

SYSTem:PERSona:MODel

Sets the MODel field of the *IDN? response. This is the second field of the *IDN? response.

Remote Command	`:SYSTem:PERSona:MODel <string>` `:SYSTem:PERSona:MODel?`
Notes	When setting the `MODel` field, the current IDN response string is modified to replace the model field with the string specified by the command. If the resulting IDN response matches one of the predefined responses (`:SYST:IDN:CONF FACT | AGIL`), then `:SYST:IDN:CONF` is set to the corresponding value. If the IDN response with the new model field is not one of the predefined values, then `:SYST:IDN:CONF` will be set to `USER` and `:SYST:IDN` will be set to the new IDN response string The query returns the current value of the `*IDN?MODel` field

SYSTem:PERSona:MODel:DEFault

Resets the `MODel` field of the `*IDN?` response to the default value.

Remote Command	`:SYSTem:PERSona:MODel:DEFault` `:SYSTem:PERSona:MODel:DEFault?`
Notes	The query returns the default `MODel` field value of `*IDN?` even if the current setting of `*IDN?` is the non-default value. The return type is a `<string>`

4.2.5 LXI

Accesses various LXI configuration properties.

Dependencies	Not available in UXM

4.2.5.1 LAN Reset

Resets the LAN connection. This sets parameters as follows, and restarts the LAN operation:

DHCP	Enabled
Automatic IP Address	Enabled
ICMP Ping Responder	Enabled
Web Password	`keysight`
Dynamic DNS	Enabled
mDNS and DNS-SD	Enabled
Dynamic Link Local Addressing	Enabled
Auto Negotiation	Enabled

There is no SCPI command for this function.

4.2.5.2 Device Identification (Remote Command Only)

Enabling LXI device identification places the LXI Status Indicator in the Identify state. Disabling LXI device identification places the LXI Status Indicator in the No Fault state. The LXI Status indicator is in the upper left region of the instrument's graphical user interface.

Remote Command	`:LXI:IDENtify[:STATe] OFF | ON | 0 | 1` `:LXI:IDENtify[:STATe]?`
Example	`:LXI:IDEN ON`
Preset	Not part of **Preset**, but reset to `OFF` by **Restore Defaults** > "All" on page 485
State Saved	No
Range	`OFF | ON`

4.2.6 Restore I/O Config Defaults

Causes the group of settings associated with the I/O Config menu to be reset to their default values. This also happens on Restore Misc Defaults, which has a SCPI command.

When Restore I/O Config Defaults is selected, a message appears saying:

```
This will reset all of the I/O Config variables to their default state,
including the GPIB address and SCPI LAN settings

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?
```

The message provides OK and Cancel buttons so you can affirm or cancel the operation.

4.2.7 Query USB Connection (Remote Query Only)

Enables you to determine the speed of the USB connection.

Remote Command	`:SYSTem:COMMunicate:USB:CONNection?`	
Example	`:SYST:COMM:USB:CONN?`	
Notes	`NONE`	Indicates no USB connection has been made
	`LSPeed`	Indicates a USB low speed connection (1.5 Mbps) Note that this is reserved for future use, the T+M488 protocol is not supported on low-speed connections

HSPeed	Indicates that a USB high speed connection (480 Mbps) has been negotiated
FSPeed	Indicates that a USB full speed connection (12 Mbps) has been negotiated

State Saved	No
Range	NONE | LSPeed | HSPeed | FSPeed

4.2.8 USB Connection Status (Remote Query Only)

Lets you determine the current status of the USB connection.

Remote Command	:SYSTem:COMMunicate:USB:STATus?
Example	:SYST:COMM:USB:STAT?
Notes	SUSPended – Indicates that the USB bus is currently in its suspended state. The bus is in the suspended state when: – The bus is not connected to any controller – The controller is currently powered off – The controller has explicitly placed the USB device into the suspended state When in the suspended state, no USB activity, including start of frame packets are received ACTive – Indicates that the USB device is in the active state. When the device is in the active state, it receives periodic frame starts, but is not necessarily receiving or transmitting data
State Saved	No
Range	SUSPended | ACTive

4.2.9 USB Packet Count (Remote Query Only)

Lets you determine the number of packets received and transmitted on the USB bus.

Remote Command	:SYSTem:COMMunicate:USB:PACKets?
Example	:SYST:COMM:USB:PACK?
Notes	Two integers are returned: 1. The number of packets received since application invocation 2. The number of packets transmitted since application invocation If no packets have been received or transmitted, the response is 0,0

	The packet count is initialized to `0,0` when the instrument application is started
State Saved	No

4.2.10 Lock Remote I/O Session (Remote Command only)

An instrument can support multiple remote I/O sessions at the same time. However, you cannot *simultaneously* send remote commands from multiple sessions to the same instrument. The results in such a case are undefined.

Ensure that only *one* session actively controls the instrument at a time. Other sessions must wait until the active session finishes the instrument control.

To help achieve this cooperative instrument sharing, the following remote commands are provided:

- "Lock Remote I/O Request (Remote Query only)" on page 448
- "Unlock Remote I/O Session (Remote Command only)" on page 449
- "Remote I/O Session Lock Name (Remote Query only)" on page 450
- "Remote I/O Session Lock Owner (Remote Query only)" on page 450

Example Procedure for Lock Usage

Step	Action
1	Each session tries to obtain a lock by sending `:SYSTem:LOCK:REQuest?` This query can be sent simultaneously from multiple sessions
2	Only one session will be granted. The granted session receives `1` in response to its query
3	The granted session actively controls the instrument Meanwhile, other sessions must wait, and must periodically send `:SYSTem:LOCK:REQuest?`, requesting the lock
4	When the active session finishes its task, it releases the lock by sending `:SYSTem:LOCK:RELease`
5	Now the lock has become available, so when one of the waiting sessions sends `:SYSTem:LOCK:REQuest?`, it receives `1` in response, granting the lock to that session

By repeating steps 3, 4, and 5 above, multiple sessions can share the same instrument in a cooperative fashion.

NOTE **A session can query its own unique session name by sending `:SYSTem:LOCK:NAME?`. This session name is determined by the instrument.**

A session also can query the name of the currently granted session by sending `:SYSTem:LOCK:OWNer?`.

NOTE Remote I/O interfaces are grouped in two types: single-session interface and multi-session interface. Both types of interfaces can be used for cooperative instrument sharing.

The recommended interface is LAN HiSLIP.

Interface	Single-session	Multi-Session
GPIB	X	
USB-488	X	
LAN VXI-11 (SICL)	X	
LAN Socket		X
LAN HiSLIP		X
LAN Telnet		X

If using a single-session interface, care must be taken to ensure only one client uses the single-session interface.

In particular, LAN VXI-11 (SICL) interface is a single-session interface, even though multiple clients could simultaneously connect to this interface. Such multiple VXI-11 clients share the same session context; the same status registers and the same error queue. Even a SCPI query response can be received by another client. Furthermore, the lock obtained by `:SYSTem:LOCK:REQuest?` is shared among all VXI-11 clients, allowing all of them to actively control the instrument.

If a LAN VXI-11 (SICL) interface must be used by multiple clients for a cooperative instrument sharing, then VISA locking *must* be used, *in addition to* Remote I/O Session Lock.

4.2.10.1 Lock Remote I/O Request (Remote Query only)

You can lock the SCPI control of the instrument to the I/O Interface and Session by sending `:SYSTem:LOCK:REQuest?`. This permits cooperative sharing of the instrument between multiple computers, or multiple sessions from the same computer.

Remote Command	`:SYSTem:LOCK:REQuest?`
Example	`:SYST:LOCK:REQ?`
Notes	Returns 1 if the lock request is granted, or 0 if the request is denied

	Lock requests on an individual interface and session can be nested and each request will increase an internal lock count by 1. For every granted request, send `:SYST:LOCK:REL` to decrement the internal lock count to fully relinquish the lock When the instrument is locked, Bit 0 is set in the Operation Instrument status register Disconnecting the individual interface and session releases the lock if the lock is granted to the interface and session A Device Clear over any interface and session releases the lock, regardless of the interface and session which obtained the lock The following queries are permitted over any interface and session, even if an interface has the instrument locked: – `*IDN?` – `*OPT?` – `*STB?` – `*ESR?` – `:SYSTem:DATE?` – `:SYSTem:TIME?` – `:SYSTem:PON:TIME?` – Queries in the `:STATus` subsystem – Queries in the `:SYSTem:ERRor` subsystem – Queries in the `:SYSTem:LKEY` subsystem – Queries in the `:SYSTem:LOCK` subsystem – Queries in the `:SYSTem:METRics` subsystem – Queries in the `:SYSTem:MODule` subsystem All other commands and queries result in error: -203,"Command protected; Instrument locked by another I/O session"
State Saved	Not part of Save/Recall

4.2.10.2 Unlock Remote I/O Session (Remote Command only)

You can unlock the SCPI control of the current I/O Interface and Session by sending `:SYSTem:LOCK:RELease`. Lock requests on an individual interface and session can be nested, and each request increases an internal lock count by 1. For every granted request, you will need to perform a release. The lock is not relinquished until the internal lock count reaches 0.

Remote Command	`:SYSTem:LOCK:RELease`
Example	`:SYST:LOCK:REL`
Notes	When the instrument is unlocked, Bit 0 is cleared in the Operation Instrument status register

4.2.10.3 Remote I/O Session Lock Name (Remote Query only)

Use this query to obtain the name of the current I/O Interface and Session.

Remote Command	`:SYSTem:LOCK:NAME?`
Example	`:SYST:LOCK:NAME?`
Notes	The information returned is a string of the format: `<I/O Interface>[/<IP address>/<Session ID>]` Where `IP address` and `Session ID` are only provided for interfaces that provide multiple sessions Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list the interface name `Session ID` is an internally generated identifier. It is not guaranteed to be consistent across instrument software versions (the identifier is subject to change when the software of the instrument is updated). The absolute value of `Session ID` is not significant, but the identifier will be consistent for a given software version, and can be relied upon for lock owner logic comparisons

4.2.10.4 Remote I/O Session Lock Owner (Remote Query only)

Use this query to determine which I/O Interface and Session has the SCPI locked.

If no interface and session has the SCPI locked, then the return value is `NONE`.

Remote Command	`:SYSTem:LOCK:OWNer?`
Example	`:SYST:LOCK:OWN?`
Notes	The information returned is a string of the format: `<I/O Interface>[/<IP address>/<Session ID>]` Where `IP address` and `Session ID` are only provided for interfaces that provide multiple sessions Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list the interface name `Session ID` is an internally generated identifier. It is not guaranteed to be consistent across instrument software versions (the identifier is subject to change when the software of the instrument is updated). The absolute value of `Session ID` is not significant, but the identifier will be consistent for a given software version, and can be relied upon for lock owner logic comparisons If no interface and session has the SCPI locked, then the return value is `NONE`

4.2.11 Multiple Network Interface Card Configuration (Remote Commands Only)

Systems that have multiple Network Interface Cards (NICs) require additional configuration information. The following keys can be added to the XApps configuration file:

- `PrimaryNICIpv4` – IP address value is a string with the exact IP V4 format. Required field in IP v4 networks.
- `PrimaryNICIpv6` – IP address value is a string with the exact IP V6 format. Required field in IP v6 networks.

These commands do not apply to instruments that have only one NIC. The commands apply to all modular deployments that have a controller with multiple NICs.

To configure and query these configuration options, the following remote commands are provided:

- "Multiple Network Adapters Enabled (Remote Query Only)" on page 451
- "Config IPV4 Address (Remote Command Only)" on page 452
- "Config IPV6 Address (Remote Command Only)" on page 452
- "List All Physical Network Adapter IP Addresses (Remote Query Only)" on page 452

4.2.11.1 Multiple Network Adapters Enabled (Remote Query Only)

Remote Command	`:SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?`
Example	`:SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?`
Notes	Applies to Instruments that have multiple Network Adapters. When more than one network adapter is present in the system, and they are Enabled (that is, they have a valid IP Address), this query returns: – 1, if more than one NIC enabled – 0, if only one or No NICs are enabled
State Saved	No

4.2.11.2 Config IPV4 Address (Remote Command Only)

Remote Command	`:SYSTem:COMMunicate:LAN:IPV4:CONFig <ipaddress>` `:SYSTem:COMMunicate:LAN:IPV4:CONFig?`
Example	`:SYSTem:COMMunicate:LAN:IPV4:CONFig "192.168.1.146"` `:SYSTem:COMMunicate:LAN:IPV4:CONFig?`
Notes	Applies to instruments that have multiple Network Adapters. When more than one network adapter is present in the system, you must specify in the instrument config file the IP address to use to enable Remoting channel bindings. If this is not provided, Remoting connections are likely to fail on systems where multiple NICs are enabled Sets the valid IPV4 address, passed in as string in the config file The query returns IPV4 address, as a string If config file is missing, "" (empty string) is returned Changing the IPV4 value requires restarting the instrument software, to ensure that servers use the configured IP address
State Saved	No

4.2.11.3 Config IPV6 Address (Remote Command Only)

Remote Command	`:SYSTem:COMMunicate:LAN:IPV6:CONFig <ipaddress>` `:SYSTem:COMMunicate:LAN:IPV6:CONFig?`
Example	`:SYSTem:COMMunicate:LAN:IPV6:CONFig "2001:0db8:85a3:0000:0000:8a2e:0370:7334"` `:SYSTem:COMMunicate:LAN:IPV6:CONFig?`
Notes	Applies to instruments that have multiple Network Adapters. When more than one network adapter is present in the system, you must specify in the instrument config file the IP address to use to enable Remoting channel bindings. If this is not provided, Remoting connections are likely to fail on systems where multiple NICs are enabled Sets the valid IPV6 address, passed in as string in the config file The query returns IPV6 address, as a string If config file is missing, "" (empty string) is returned Changing the IPV6 value requires restarting the instrument software, to ensure servers use the configured IP address
State Saved	No

4.2.11.4 List All Physical Network Adapter IP Addresses (Remote Query Only)

Remote Command	`:SYSTem:COMMunicate:LAN:PHYSical:IPADdress:LIST?`
Example	`:SYSTem:COMMunicate:LAN:PHYSical:IPADdress:LIST?`

	:"192.168.1.146,2001:0db8:85a3:0000:0000:8a2e:0370:7334"
Notes	Returns the IP Addresses of the physical network adapters found in the PC/Instrument
State Saved	No

4.3 Preload / Unload Modes

The X-Series platform supports many Modes. Each Mode that is loaded uses a portion of the total available memory. At some point, this may result in insufficient free memory. This can occur during a measurement, or when loading a new Mode. A limited number of Modes can be loaded without impacting performance.

Preload / Unload Modes allows you to select and enable Modes to be preloaded at startup, and to specify the default Power-On Mode.

The dialog includes the following controls:

- "Power-On Mode" on page 454
- "Table of Modes" on page 455
- "Preload: Select All, Preload: Deselect All" on page 455
- "Move Up, Move Down" on page 455
- "Unload" on page 455

Modes that are not preloaded may be loaded at runtime as needed, resources permitting. However, note that loading more Modes increases memory consumption and may adversely impact performance.

When a memory-full situation occurs, the instrument notifies you with the following message:

```
Out of memory; Insufficient resources. Please save state if needed. You have
following options:

1. Open System Settings > Configure Preload Modes to unload unused Modes

2. Reconfigure preloaded Modes on the above dialog, close and restart the
analyzer SW

3. Close and restart the analyzer SW
```

Option 1 allows you to unload unused Modes and continue running the software, without having to restart it.

The command `:INSTrument:UNLoad <mode>` provides equivalent functionality; see "Unload" on page 455.

4.3.1 Power-On Mode

Displays a list of licensed Modes. Use this control to change the factory default Power-On Mode. The instrument will execute the selected Mode after power up. Selecting the Power-On Mode here automatically enables that Mode for preloading.

4.3.2 Table of Modes

The table of Modes becomes scrollable when the number of Modes exceeds the dialog's displayable size.

Use the check boxes in the Preload column to enable or disable the preloading of the Modes that you want.

Use the check boxes in the Unload column to select the Modes that you want to unload.

The Unload check boxes are grayed-out when the Modes are used by other Modes.

Example:

5G NR & V2X Mode cannot be loaded when either Sequence Analyzer Mode or Power Amplifier Mode are already loaded, because these Modes use 5G NR & V2X Mode. To unload 5G NR & V2X Mode, both Sequence Analyzer Mode and Power Amplifier Mode must be unloaded first.

When the active Mode is unloaded, the screen becomes blank except for the message; "`No Mode is active`". You can then select another desired Mode.

When multiple screens are open, and a Mode is unloaded, inactive screens that have that Mode as their active Modes are closed.

The active screen is never closed.

4.3.3 Preload: Select All, Preload: Deselect All

Toggles the Preload checkbox state for all Applications listed, except for the Power-On Application, which is always selected.

4.3.4 Move Up, Move Down

The default order in which Applications are listed in the table is the order in which they are displayed in the Mode/Measurement/View Selector dialog. To change the order in this list, select the desired Application row from the table, then click Move Up or Move Down to move it to the desired position.

4.3.5 Unload

Unloads the specified Mode.

Remote	`:INSTrument:UNLoad <mode>`

Command	
Example	`:INST:UNL NR5G`

Notes	Error message if the specified Mode is not available,
	`-224,"Illegal parameter value;<mode> is not a valid choice"`
	Error message if the specified Mode is not loaded and therefore cannot be unloaded,
	`-221,"Settings conflict;<mode> is not loaded"`
	Error message if the specified Mode is used by other Modes and therefore cannot be unloaded,
	`-221,"Settings conflict;<mode> is used by <other modes>"`
	Error message if the specified Mode does not support Unload Mode feature and therefore cannot be unloaded,
	`-221,"Settings conflict;Feature not supported for this Mode"`

4.3.6 Loaded Modes (Remote Query Only)

Returns a list of loaded Modes.

Remote Command	`:SYSTem:APPLication:LOADed?`
Example	`:SYST:APPL:LOAD?`
Preset	Not affected by Preset

4.4 User Interface

Configures functions specific to the User Interface, such as the menu panel orientation and the display color theme.

4.4.1 Menu Panel Position

Allows the Menu Panel to be positioned on the `RIGHt` or `LEFT` side of the display.

Remote Command	`:SYSTem:DISPlay:MPPosition RIGHt | LEFT` `:SYSTem:DISPlay:MPPosition?`
Example	`:SYST:DISP:MPP LEFT`
Preset	This is unaffected by **Preset** but is set to `RIGHt` by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.2 Menu Panel Tabs

Allows the **Menu Panel Tabs** to be positioned on the `RIGHt` or `LEFT` side of the menu panel.

Remote Command	`:SYSTem:DISPlay:MPTab RIGHt | LEFT` `:SYSTem:DISPlay:MPTab?`
Example	`:SYST:DISP:MPT LEFT`
Preset	This is unaffected by **Preset** but is set to `RIGHt` by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.3 Annotations Local Settings/All Off

Overrides the annotation settings for all measurements in all modes and turns them all off. This provides the security based "annotation off" function of previous instruments; hence it uses the legacy SCPI command.

When this control is set to **All Off,** the **Screen Annotation, Meas Bar, Trace Annotation,** and **Control Annotation** controls under the **Display, Annotation** menu are grayed-out and forced to `OFF` for all measurements in all modes. When **Local Settings** is selected, you can set the local annotation settings on a measurement-by-measurement basis.

Remote Command	`:DISPlay:WINDow[1]:ANNotation[:ALL] OFF | ON | 0 | 1` `:DISPlay:WINDow[1]:ANNotation[:ALL]?`
Example	`:DISP:WIND:ANN OFF`
Preset	This is unaffected by **Preset** but is set to `ON` by **Restore Defaults** > "User Interface" on page 483, **Restore Defaults** >"Misc" on page 484 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)
Backwards Compatibility Notes	The `WINDow` parameter and optional subopcode is included for backwards compatibility but ignored – all windows are equally affected

4.4.4 Display Theme

Allows you to change the **Display Theme**. This is similar to the Themes selection under Page Setup and Save Screen Image.

The two available themes are:

- `FILLed`: this is the normal theme using filled objects
- `OUTLine`: this theme uses color, but does not use fill for most areas on the display. It is ideal for images that need to be printed on inkjet printers. Although setting **Display Theme** to `OUTLine` does not affect screen image saves or prints, it does show you exactly how screen images will look when using the `OUTLine` theme under **Save Screen Image**, and how prints will look when using the `OUTLine` theme under **Page Setup**.

NOTE **Although the `OUTLine` theme eliminates most of the filled area, some objects remain filled. In particular, the selected marker remains filled with the green marker color, to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display.**

Remote Command	`:DISPlay:THEMe TDColor | TDMonochrome | FCOLor | FMONochrome | FILLed | OUTLine` `:DISPlay:THEMe?`
Example	`:SYST:DISP:THEM OUTL` sets the display style to `OUTLine`
Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models are mapped as follows: - `TDColor` and `TDMonochrome` are both mapped to `FILLed` (exact full color representation of what is on the screen) - `FCOLor` and `FMONochrome` are both mapped to `OUTLine` (uses color for traces and other

	items, but most filled areas are white) There is no Monochrome theme in the B-model instruments, so the monochrome commands for the A-model instruments yield color themes The query of `:DISPlay:THEMe?` always returns `FILLed` or `OUTLine`. It never returns `FCOLor`, `FMONochrome`, `TDColor`, or `TDMonochrome`
Preset	This is unaffected by **Preset** but is set to `FILLed` by **Restore Defaults** > "User Interface" on page 483, **Restore Defaults** >"Misc" on page 484 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.5 Backlight

Turns the display **Backlight** on and off. This setting may interact with settings under the Windows **Power** menu.

When the backlight is `OFF`, pressing ESC, TAB, SPACE, ENTER, UP, DOWN, LEFT, RIGHT, DEL, BKSP, CTRL, or ALT turns the backlight `ON` without affecting the application. Pressing any other key turns backlight `ON`, and could potentially perform the action as well.

Remote Command	`:DISPlay:BACKlight ON | OFF`
	
	`:DISPlay:BACKlight?`

Example	Turn backlight `ON`:
	`:DISP:BACK ON`
	
	Turn backlight `OFF`:
	`:DISP:BACK OFF`

Preset	Pressing any key turns the backlight back `ON`, as does **Restore Defaults** > "User Interface" on page 483, **Restore Defaults** >"Misc" on page 484 or **Restore Defaults** >"All" on page 485
State Saved	Not saved in State

4.4.6 Backlight Intensity

Allows the **Backlight Intensity** to be controlled from the UI settings panel.

Remote Command	`:SYSTem:DISPlay:BACKlight:INTensity <integer>`
	
	`:SYSTem:DISPlay:BACKlight:INTensity?`

Example	`:SYST:DISP:BACK:INT 67`
Preset	100
State Saved	Power On Persistent (survives shutdown and restart)
Range	0-100

4.4.7 Hints

Hints are descriptions that provide additional information for a control. You can set Hints to be enabled or disabled.

Remote Command	`:SYSTem:DISPlay:HINTs[:STATe] OFF | ON | 0 | 1` `:SYSTem:DISPlay:HINTs?`
Example	`:SYST:DISP:HINT OFF`
Preset	This is unaffected by **Preset** but is set to ON by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.8 Control Size

Configures the size of the controls in the user interface. This can be used to make screen dumps from a large screen instrument match those from a smaller screen instrument, to make the controls more readable on a large-screen instrument, or to display more information on a smaller screen instrument.

This control is not available in SA6210A

Remote Command	`:DISPlay:UINTerface:CSIZe SMALl | LARGe` `:DISPlay:UINTerface:CSIZe?`
Example	`:DISP:UINT:CSIZ LARG`
Preset	This is unaffected by **Preset** but is set to SMALl by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.9 Touch On/Off

Turns the touch functionality on and off on the display. If OFF, you can turn it back on using the front panel Touch On/Off key, or by using a mouse to toggle this control.

Preset	Always starts up ON Unaffected by **Preset** but is turned ON by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Not saved in state, not affected by **Preset**, not Power On Persistent (does not survive shutdown and restart)

4.4.10 Simplified Style

Lets you switch the user interface style between the new **Simplified** and older tab-based styles.

This option is only available in SA6210A.

4.4.11 Transparent Dialogs

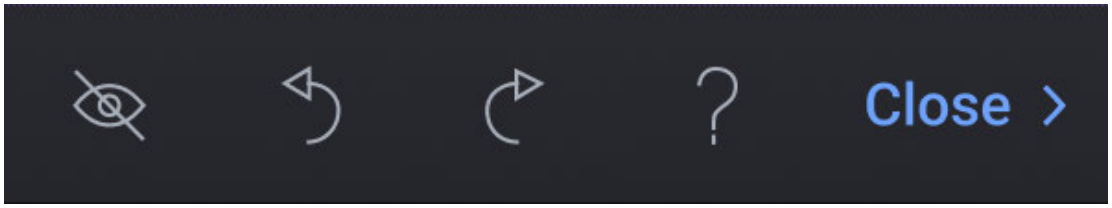
Lets you toggle the transparency of dialog window backgrounds. The effect of transparency is shown below.

Transparency Off	Transparency On
Dialog covers trace view completely	Trace partially visible under dialog



Switching transparency of dialog windows *on* allows you to see an underlying trace while adjusting the dialog window's contents. This option can be found on the upper right corner of the windows when available, to the left of the **Close** button.

Depending on the window and its functionality, the exact placement of the transparency toggle in relation to the button may vary from the example below:



This button has two states. If transparency is on, then the eye icon appears with no line across it. If transparency is off, the the eye icon is crossed out.

4.4.12 Transparent Popups

Use this switch to specify whether popups that cover the trace graph are partially transparent or not.

When the switch is in the right position, popups that appear over the trace have partial transparency, allowing you to see the underlying trace.

When the switch is in the left position, popups appear opaque, as in past software revisions.

Preset	This is unaffected by **Preset**
State Saved	Power On Persistent (survives shutdown and restart)

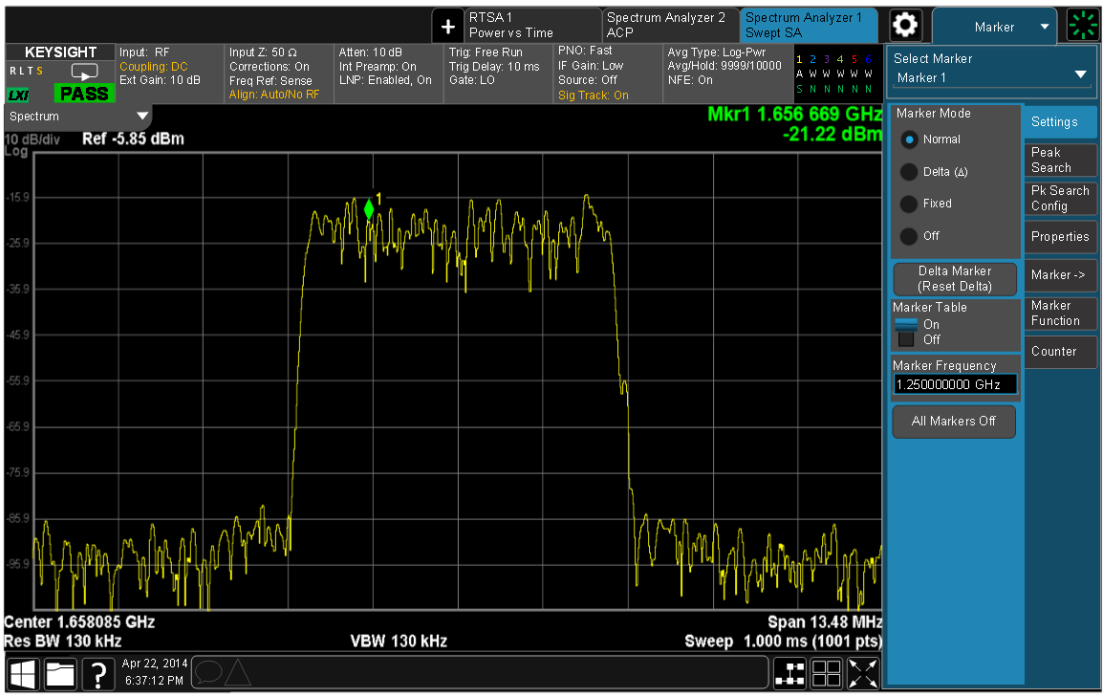
4.4.13 Quick Save Mode

When **Quick Save Mode** is `NORMal` (the default setting), the instrument does an immediate save of a new file of the same type and to the same directory as the previous **Save** action. When **Quick Save Mode** is in the `PROMpt` state, instead of immediately performing a **Save**, the Alpha Keyboard appears with the proposed auto-filename in the entry area. You can then press **Enter** to accept the auto filename, or edit the name then press **Enter**. This allows you to easily save a file with a custom file name.

Remote Command	`:MMEMory:STORe:QSAVe NORMal | PROMpt` `:MMEMory:STORe:QSAVe?`
Example	`:MMEM:STOR:QSAV PROM`
Preset	This is unaffected by **Preset** but is set to `NORMal` by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.14 Screen Tabs Left/Right

This switch, when in the RIGHt position, makes the screen tabs start on the right and build across to the left, thus minimizing the finger travel over to the screen tab when there is only one screen. When tabs are added from right to left, they appear as below:



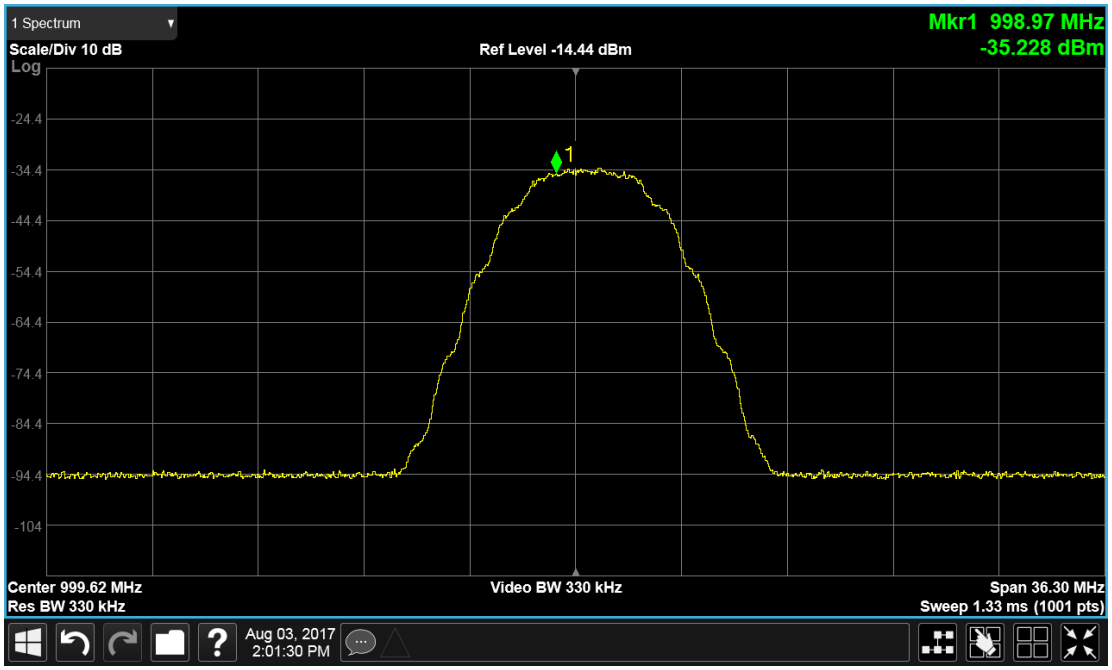
The default is LEFT.

Remote Command	:DISPlay:UINTerface:STAB RIGHt | LEFT :INSTrument:SCReen:STAB?
Example	:DISP:UINT:STAB RIGH
Preset	This is unaffected by **Preset** but is set to LEFT by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.15 Hide Screen Tabs in Full Screen

This switch, when in the ON position, causes the Screen Tabs to be hidden when in Full Screen view, thus maximizing the display area available for results. By also

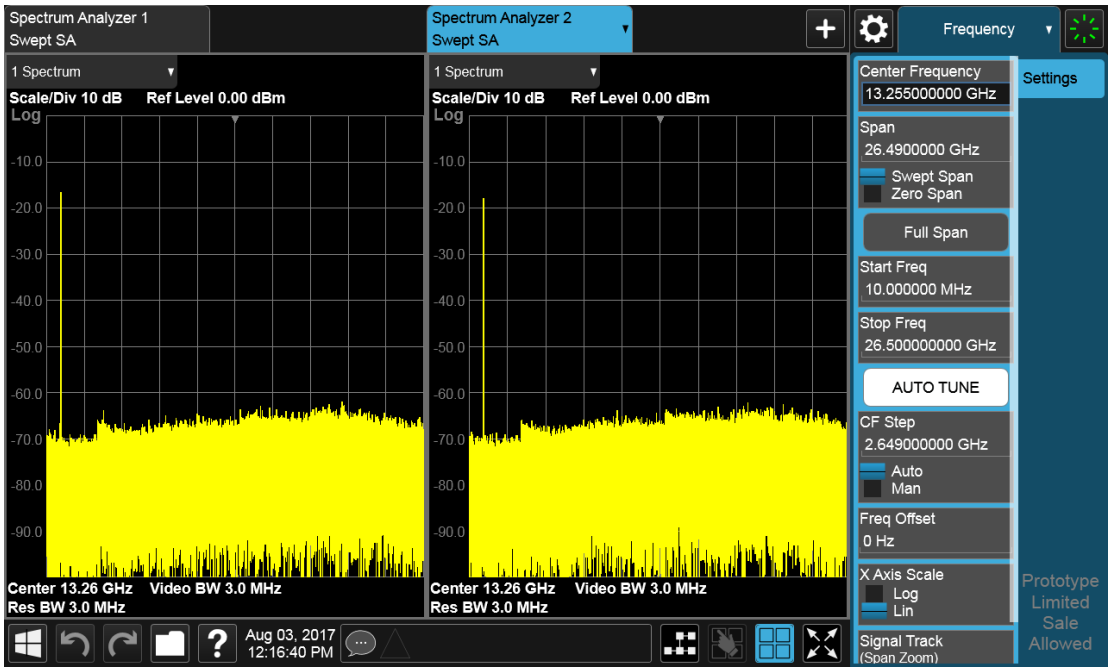
turning off the Meas Bar (in the **Display, Annotation** menu), you can maximize the available area for results, as shown below:



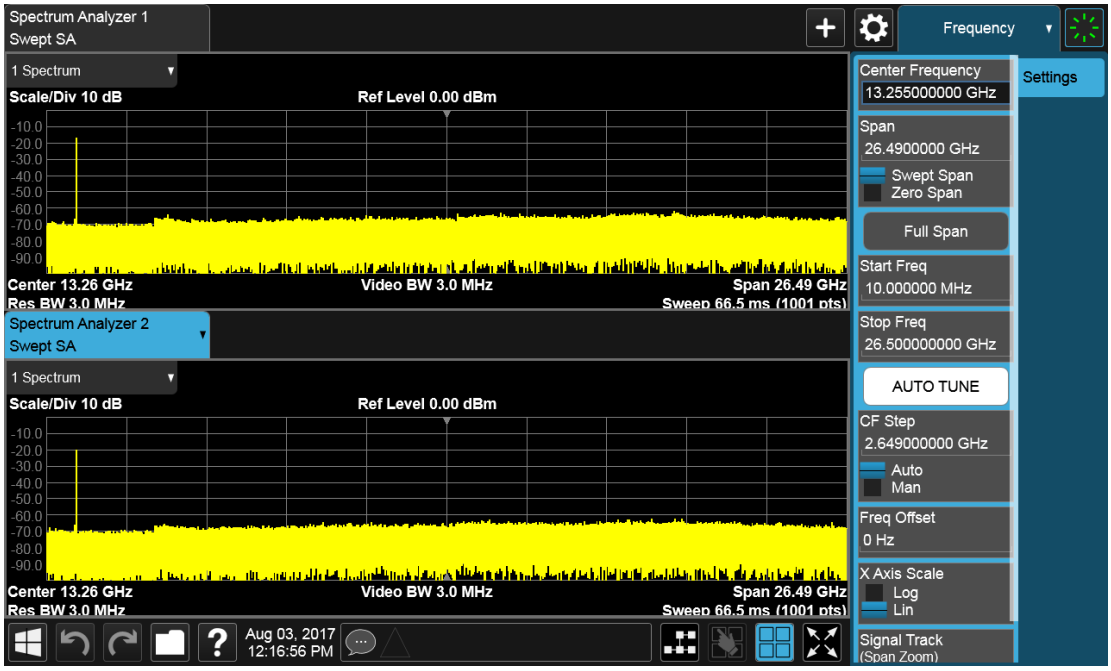
Remote Command	`:DISPlay:UINTerface:HTABs ON | OFF | 1 | 0` `:DISPlay:UINTerface:HTABs?`
Example	`:DISP:UINT:HTAB ON` Hide the tabs in full screen
Preset	This is unaffected by **Preset** but is set to `OFF` by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.16 2-Screen Orientation

When you add a second Screen using the "+" control on the Screen Tabs bar, normally the screen is added to the right of the first screen. However, sometimes it is better to add the new screen below the first screen rather than to the right, as shown below.



New screen added to the right (horizontal orientation)



New screen added below (vertical orientation)

The 2-Screen Orientation switch allows you to choose between these two orientations for 2-Screen configurations. The default is the `HORizontal` configuration, two Screens side-by-side.

Remote Command	`:INSTrument:SCReen:ORIentation VERTical | HORizontal`
Example	`:INST:SCR:ORI VERT` Set the 2 screens to be above/below each other
Preset	`HOR` This is unaffected by **Preset** but is set to `HORizontal` by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485

4.4.17 Clock Format

Allows the **Clock Format** to be switched between 12-Hour Format (`HR12`) and 24-Hour Format (`HR24`).

Remote Command	`:SYSTem:DISPlay:CFORmat HR12 | HR24` `:SYSTem:DISPlay:CFORmat?`
Example	`:SYST:DISP:CFOR HR12`
Preset	`HR12`
State Saved	Power On Persistent (survives shutdown and restart)
Range	12-Hour | 24-Hour

4.4.18 Numeric Entry Auto Open

Configures whether the **Numeric Entry** Panel will appear immediately when an active function control is activated (Auto Open `ON`), or be deferred until you touch it again or begin to enter a value (Auto Open `OFF`). When configured for Auto Open `OFF` (the default), adjusting the value with the front panel Up/Down keys or the RPG hides the **Numeric Entry** Panel.

Remote Command	`:SYSTem:DISPlay:NEPimmediate ON | OFF | 1 | 0` `:SYSTem:DISPlay:NEPimmediate?`
Example	`:SYST:DISP:NEP OFF`
Preset	This is unaffected by **Preset** but is set to `ON` by **Restore Defaults** > "User Interface" on page 483 or **Restore Defaults** >"All" on page 485
State Saved	Power On Persistent (survives shutdown and restart)

4.4.19 Language

Accesses the selection of **Language** displayed on the menus and controls. `ENGLish` is the default.

All Measurement Applications that share common controls will display the localized controls.

The description on the control labels is bounded by the control size. Any given language will have labels in that language that are shorter or longer than the equivalent label in English. Any localized text on the controls that does not fit the label size remains in English. Thus, for any given menu, controls may be displayed in English *and* the selected language.

- Labels that are acronyms, engineering, or technology specific terms may remain in English.
- All Application and Measurement names remain in English.
- All data in exported files remain in English.
- The Diagnostic and Service menus in the System Subsystem remain in English.
- The Windows operating system must remain in English. Changing the **Region and Language** settings in the Windows Control Panel is not supported.

External keyboards in English are supported. Localized external keyboards are not supported. When the language selected is not English, a message is displayed to explain that any external keyboard must remain in English.

Other aspects of the Graphical User Interface remain in English. The Remote User Interface (SCPI) remains in English.

Remote Command	`:SYSTem:DISPlay:LANGuage ENGLish | RUSSian` `:SYSTem:DISPlay:LANGuage?`

Example	`:SYST:DISP:LANG ENGL`
	`:SYST:DISP:LANG RUSS`
	Requires Option AKT

Preset	This is unaffected by **Preset** but is set to `ENGLish` by **Restore Defaults** > "User Interface" on page 483,**Restore Defaults** >"Misc" on page 484 or **Restore Defaults** >"All" on page 485

4.4.20 Restore User Interface Defaults

Causes the group of settings associated with the **User Interface** menu to be reset to their default values. This also happens on **Restore Misc Defaults**.

When **User Interface** is selected, a message appears saying:

```
This will reset all of the User Interface variables to their default state,
including the menu panel location, display theme, and language.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?
```

The message provides OK and Cancel buttons for you to affirm or cancel the operation.

Example	`:SYST:DEF UINT`

4.4.21 User Interface Type (Remote Query Only)

Use this query to determine if the instrument is running the Multi-Touch user interface or Softkey user interface. This is an easy way to distinguish between A-models (Softkey) instruments and Touch UI (Multi-Touch) instruments.

Remote Command	`:DISPlay:UINTerface:TYPE?`
Example	`:DISP:UINT:TYPE?`
Notes	The query returns `MULTITOUCH` for instruments with the Multi-Touch UI or `SOFTKEY` for instruments with the Softkey UI

4.5 Power On

Lets you select how the instrument should power on.

NOTE **In products that run multiple instances of the X-Series Application, the same Power On type is shared between all the instances.**

4.5.1 Power On State

Lets you select whether the instrument powers up in a default state, or some other state. The options are:

- `MODE` and Input/Output Defaults
- `USER` Preset
- `LAST` State

Remote Command	`:SYSTem:PON:TYPE MODE | USER | LAST` `:SYSTem:PON:TYPE?`

Example	`:SYST:PON:TYPE MODE`
	`:SYST:PON:TYPE USER`
	`:SYST:PON:TYPE LAST`

Preset	This is unaffected by **Preset** but is set to `MODE` by **Restore Defaults** >"All" on page 485
State Saved	No
Backwards Compatibility SCPI	`:SYSTem:PON:TYPE PRESet` The `PRESet` parameter is supported for backward compatibility only, and behaves the same as `MODE`

Mode and Input/Output Defaults

When the instrument is powered-on in `MODE` and Input/Output Defaults, it performs "Restore Mode Defaults" on page 615 for all Modes in the instrument, and performs **Restore Input/Output Defaults**.

Persistent parameters (such as Amplitude Correction tables or Limit tables) are not affected at power-on, even though they are normally cleared by **Restore Input/Output Defaults** and/or **Restore Mode Defaults**.

User Preset

Sets **Power On State** to `USER` Preset. When the instrument is powered on in User Preset, it will **User Preset** each mode and switch to the "Power On Application" on page 471. **Power OnUser Preset** does not affect any settings other than those set by a normal **User Preset**.

Backwards Compatibility Note: Power On: **User Preset** causes the instrument to power up in the "Power On Application" on page 471, *not* the last Mode the instrument was in prior to shutdown. Also, **Power On**: **User Preset** will **User Preset** all Modes. This does *not* exactly match legacy behavior.

NOTE **In products that run multiple instances of the X-Series Application, the same User Preset is shared between all the instances.**

NOTE **An instrument can never power up for the first time in `USER` preset.**

Last State

Sets **Power On State** to `LAST`. When the instrument is powered on, it will put all modes in the last state they were in prior to when the instrument was put into Power Standby, and it will start up in the mode it was last in prior to powering off the instrument. The saving of the active mode prior to shutdown happens behind the scenes when a controlled shutdown is requested, either via the front panel **Standby** key, or the remote command `:SYSTem:PDOWn`. The non-active modes are saved as they are deactivated and recalled by Power On: Last State.

Power On: **Last State** only works if you completed a controlled shutdown prior to powering on in `LAST`. If a controlled shutdown is not completed when in **Power On**: **Last State**, the instrument powers up in the last active Mode, but it may not power up in the active Mode's last state. If an invalid Mode state is detected, a **Mode Preset** occurs. To control the shutdown under remote control, use `:SYSTem:PDOWn`.

Backwards Compatibility Note: It is no longer possible to power-up the instrument in the last Mode the instrument was running with that Mode in the preset state. (ESA/PSA `SYST:PRESET:TYPE MODE` with `SYST:PON:PRESET`) You can power-on the instrument in the last Mode the instrument was running in its last state (`:SYST:PON:TYPE LAST`), or you can specify the Mode to power-up in its preset state (`:SYST:PON:MODE <mode>`).

NOTE **In products that run multiple instances of the X-Series Application, each instance has a unique Last State.**

NOTE **An instrument can never power up for the first time in `LAST`.**

If line power to the instrument is interrupted, for example by pulling the line cord plug or by switching off power to a test rack, **Power OnLast State** may not work properly. For proper operation, **Power On Last State** depends on your shutting down the instrument using the **Standby** key or the `:SYSTem:PDOWn` command. This ensures the last state of each Mode is saved and can be recalled during a power-up.

4.5.2 Power On Application

Accesses a menu that lists the available Modes, and lets you select which Mode is to be the **Power On Application**. Whichever application is selected runs at power-on when the Power On Type is set to "`MODE` and Input/Output Defaults".

NOTE **In products that run multiple instances of the X-Series Application, the same Power On Application is shared between all the instances.**

Remote Command	`:SYSTem:PON:MODE <mode>`
	where `<mode>` is an item from the same set that can be sent using the `:INSTrument[:SELect]` command
	`:SYSTem:PON:MODE?`

Example	`:SYST:PON:MODE SA`
Notes	The displayed list of possible Modes (and remote parameters) depends on which Modes are installed in the instrument
Preset	Unaffected by **Preset** but is set by **Restore Defaults** >"All" on page 485 to `SA`, except in the cases noted below:

N8973B, N8974B, N8975B, N8976B	`NFIG`
`VXT models`	`BASIC`
`M9410E/11E/15E/16E`	`BASIC`

State Saved	No

4.5.3 FPGA Configuration

Lets you choose which FPGA image you want loaded into the instrument.

Depending on your hardware configuration, your instrument may contain a Field Programmable Gate Array (FPGA) which handles much of the processing for some of the mathematically intensive features, such as Time Domain Scan (Option TDS) and Enhanced Sweep Speed (Option FS2). The FPGA is not big enough to hold the

functionality for both options, so you must decide which FPGA program you want loaded.

When licenses allow for both FPGA image versions to be available, and you have not explicitly chosen an FPGA image version, then, when the firmware is updated, the Time Domain Scan version will be loaded. In the absence of all licenses, the Enhanced Sweep Speed version will be loaded. Once you have explicitly chosen an FPGA image version, using the FPGA Configuration dialog, any future firmware updates will continue to load the chosen version as long as it is licensed.

Example: loading the Time Domain Scan FPGA image, removing the TDS license, and then updating the firmware will result in the Enhanced Sweep Speed version being loaded.

When multiple capabilities are licensed, the FPGA Configuration presents a dialog that tells you that there is insufficient space to fit all the licensed capabilities, and asks you to choose one of the FPGA programs (images).

If you remove licenses, it is possible to end up with an unlicensed capability loaded in the FPGA while a licensed capability is not loaded. In this case, the dialog does not present the Preference group and shows a message about unlicensed/licensed capabilities. You can dismiss the dialog if the licensed capability is not currently needed, and you do not want to take the time to load the licensed FPGA image. However, this dialog will continue to appear each time the instrument is restarted.

Behavior when the Enhanced Sweep Speed FPGA Image is Loaded

When the Enhanced Sweep Speed version of the FPGA image is loaded, sweep behavior still depends on the licenses:

- Option FS2 gives full FPGA enhanced sweep speed
- Option FS1 gives software implemented enhanced sweep speed
- Neither Option FS1 nor FS2 – no enhanced sweep speed
- Both Options FS1 and FS2 – same as Option FS2, the full FPGA enhanced sweep speed

If EMI Receiver Mode and TDS option are licensed, and the Enhanced Sweep Speed FPGA image is loaded, then you will not have the proper FPGA image loaded to fully support EMI Receiver Mode. In particular, the Frequency Scan measurement cannot use Scan Type “Time Domain Scan” (this is the normally the default Scan Type for instruments with the TDS option). Instead, EMI Receiver Mode behaves as if the TDS option is not licensed.

Behavior when the Time Domain Scan FPGA Image is loaded

When the Time Domain Scan version of the FPGA image is loaded, EMI Receiver Mode works as expected with the TDS option licensed, but the Option FS2 capability

silently reverts to FS1 behavior.

Switching Between Enhanced Sweep Speed and Time Domain Scan FPGA Images

You cannot have both full TDS and FS2 images at the same time, so to switch to the other image, you must go through the process of reloading the FPGA by choosing the desired image with the Selected FPGA control, and pressing "Load FPGA" on page 475, or issuing the “Load FPGA” SCPI command below with the proper parameter.

Incorrect FPGA Configuration

If EMI Receiver Mode, Option TDS, or Option FS2 license is removed while the FPGA image for that license is loaded, the instrument ends up in an incorrect configuration, since the loaded FPGA image version has support for unlicensed functionality that is not accessible and does not support the currently licensed functionality. It will still function, but when the instrument recognizes this situation at startup, it automatically displays the FPGA Configuration dialog. The only selections available will be the licensed ones, but you can choose to dismiss the dialog and continue with the current FPGA image version if you do not want to take the time to load the correct FPGA image. The dialog will continue to be presented at each startup until the correct FPGA image is loaded.

FPGA Updates When Firmware Installs

The FPGA image and X-Series firmware are tightly coupled, so whenever the firmware is updated, the FPGA image is also checked and updated if needed. The rules for choosing between Time Domain Scan and Enhanced Sweep Speed versions of the FPGA image are:

1. Always use Time Domain Scan FPGA image for MXE
2. If neither EMC Mode nor Option TDS nor Option FS2 are licensed, the Enhanced Sweep Speed FPGA image is loaded
3. If EMC Mode and Option TDS are licensed and Option FS2 is not licensed, the Time Domain Scan FPGA image is loaded
4. If EMC Mode and Option TDS are not licensed, and Option FS2 is licensed, the Enhanced Sweep Speed FPGA image is loaded
5. If all are licensed
    a. If "FPGA Load Preference" on page 474 is Time Domain Scan, the Time Domain Scan FPGA image is loaded

b. If **FPGA Load Preference** is **Enhanced Sweep Speed**, the Enhanced Sweep Speed FPGA image is loaded

c. If **FPGA Load Preference** is **Prompt at Startup**:

   a. If the last FPGA Configuration Load was Time Domain Scan, the Time Domain Scan FPGA image is loaded

   b. If the last FPGA Configuration Load was Enhanced Sweep Speed, the Enhanced Sweep Speed FPGA image is loaded

   c. If no FPGA has been explicitly loaded, the Time Domain Scan FPGA image is loaded

4.5.3.1 FPGA Load Preference

Select either image from the radio buttons at the top of the dialog:

Option	SCPI	Description
Time Domain Scan	TDS	Load the Time Domain Scan version of the FPGA image
Enhanced Sweep Speed	FS2	Load the Enhanced Sweep Speed version of the FPGA image
Prompt at Startup	PROMpt	Prompt at each startup, displaying the **FPGA Configuration** dialog. You can choose to continue with the currently loaded FPGA image version, or load a different version

If you select the image that is already loaded, you will not be prompted again. If you select a different one, the Selected FPGA control changes to that one and you must then press "Load FPGA" on page 475 to load the other image.

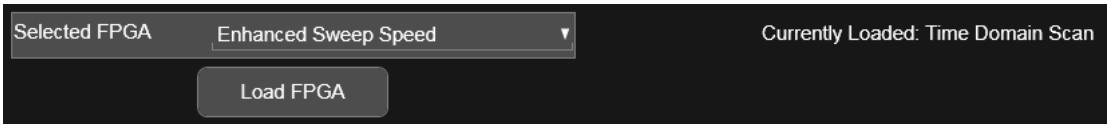
When installing new firmware, the **FPGA Load Preference** setting is used to load the preferred FPGA image version if more than one version is available. Selecting **Prompt at Startup** causes you to be prompted at each startup to select the desired version of the FPGA image.

Remote Command	`:SYSTem:PON:FPGA:PREFerence TDS | FS2 | PROMpt`
Example	`:SYST:PON:FPGA:PREF TDS` `:SYST:PON:FPGA:PREF?`
Notes	This SCPI is always available, but if the hardware does not support multiple FPGA image choices, the returned value is always: NA = Not available for this hardware Also, when not supported, any attempt to change away from NA generates error -224, “Illegal parameter value”
Dependencies	Dialogs and menus available only when EMC Mode, Option TDS and Option FS2 are all licensed

Preset	PROMpt Not affected by **Mode Preset** but set to PROMpt by **Restore Defaults** >"All" on page 485 or **Power On**

4.5.3.2 Load FPGA

Depending on the "FPGA Load Preference" on page 474 selection, there may be a mismatch between the desired FPGA image, and the one that is currently loaded. In that case the **Load FPGA** control at the bottom of the dialog is not grayed-out, and you must press it to actually load the desired FPGA image. The image that is currently loaded is shown on the right:



If you have a mismatch, but do not actually load the other image, the **FPGA Load Preference** is remembered, but the image you had before remains until you return to this dialog and press **Load FPGA**, or until the next time the instrument firmware is updated.

If you press **Load FPGA**, the X-series software exits, the FPGA update program runs, and the instrument reboots. After rebooting, the new image will be loaded in the FPGA.

NOTE **This can take 15 minutes or more.**

CAUTION **If power is lost during the FPGA load process, the FPGA can become corrupted, in which case the only solution is to return it to Keysight for servicing.**

Remote Command	:SYSTem:PON:FPGA:LOAD TDS | FS2
Example	:SYST:PON:FPGA:LOAD TDS For options, see Dependencies row below :SYST:PON:FPGA:LOAD?
Notes	If the specified FPGA image version is the one already loaded, then the command does nothing. If the FPGA image needs to change, the analyzer software exits (terminating the SCPI session), and the FPGA update utility is launched. Once the FPGA has updated, the instrument will reboot This SCPI is always available, but if the hardware does not support multiple FPGA image choices, the value returned is always: NA = Not available for this hardware Also, when not supported, any attempt to change away from NA generates error -224, "Illegal parameter value"
Dependencies	Available only when there are multiple versions of the FPGA image that could be loaded

	Selection limited to licensed features: – TDS selection requires EMC Mode and Option TDS – FS2 requires Option FS2 The UI is blanked when there is only one licensed selection, and that selection is already loaded. Sending the SCPI for an unlicensed selection results in error: -224, "Illegal parameter value; <option> is not licensed"
Preset	None. Not affected by **Mode Preset** nor any "Restore Defaults" on page 482

4.5.4 Restore Power On Defaults

This selection causes the **Power On** settings to be reset to their default values.

When this button is pressed, a message appears saying:

This will reset Power On State and Power On Application to their default state.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides **OK** and **Cancel** buttons for you to confirm or cancel the operation.

Example	`:SYST:DEF PON`

4.5.5 Configure Applications – Desktop application

The **Configure Applications** utility runs from the instrument's desktop. You must close the Instrument Application before running **Configure Applications.**

This utility can be used to:

- select applications (Modes) for preload
- determine how many Modes can fit in memory at one time
- specify the order of the Modes in the Mode menu.

The utility consists of a window with instructions, a set of **Select Application** checkboxes, a "fuel bar" style memory gauge, and keys that help you set up your configuration.

NOTE **In products that run multiple instances of the X-Series Application, the same Configure Applications utility is shared between all the instances.**

For more details, see the following topics:

– "Preloading Applications" on page 477
– "Access to Configure Applications utility" on page 477
– "Virtual memory usage" on page 478

Example

Display the Config Applications screen:

```
:SYST:SHOW CAPP
```

Preloading Applications

During runtime, if a Mode that is not preloaded is selected using the Mode menu or by sending SCPI commands, there will be a pause while the Application is loaded. During this pause, a message that says "`Loading application, please wait ...`" is displayed. Once loaded, the application stays loaded, so the next time you select it during a session, there is no delay.

Preloading lets you "preload" at startup, to eliminate the runtime delay. Preloading an application causes it to be loaded into the instrument's memory when the analyzer program starts up. If you do this, the delay will increase the time it takes to start up the analyzer program, but this may be preferable to having to wait the first time you select an application. Note that, once an application is loaded into memory, it cannot be unloaded without exiting and restarting the analyzer program.

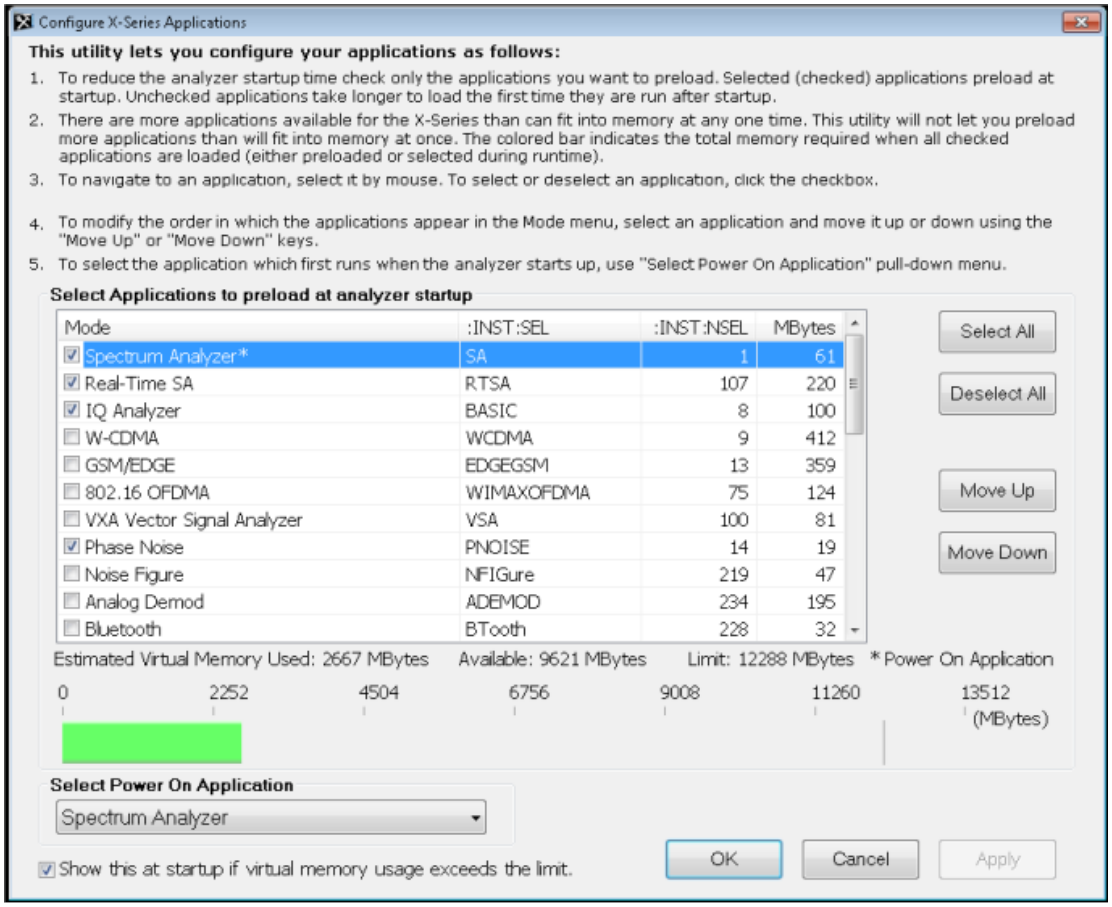
Note that there are more applications available for X-Series than can fit into Windows Virtual Memory. By allowing you to choose which licensed applications to load at startup, the Configure Applications utility allows you to make optimal use of the instrument memory.

Access to Configure Applications utility

A version of the utility runs the first time you power up the instrument after purchasing it from Keysight. The utility automatically configures preloads so that as many licensed applications as possible are preloaded while keeping the total estimated virtual memory usage below the limit. This auto-configuration only takes place at the very first run, and after analyzer software upgrades.

At any time, you can manually start the Configure Applications utility by closing the analyzer application and double-tapping the Configure Applications icon on the desktop.

The utility's main dialog looks like this:



Instructions are provided below and in the utility. Use the utility to find a configuration that works best for you, and then restart the analyzer program.

Select All	Marks all applications in the selection list. This allows you to enable all applications licensed on the instrument for pre-loading, or is a convenience for selecting all applications in one operation and then letting you deselect individual applications
Deselect All	Clears the marks from all applications in the selection list, except the Power On application. The Power On application cannot be eliminated from the pre-load list
Move Up **Move Down**	The application list is the order that applications appear in the Mode Menu. These keys let you shift the selected application up or down in the list, thus moving the selected application earlier or later in the Mode Menu
Select Power On Application	This is the same as the “Power On Application” selection on the Power On page of the System Settings dialog

Virtual memory usage

There are more applications available for X-Series than can fit into memory at any one time, so the **Configure Applications** utility includes a memory tracker that serves

two purposes:

1. It will not let you preload more applications than will fit into memory at once
2. You can determine how many of your favorite applications can reside in memory at one time

The utility provides a graphical representation of the amount of memory (note that the amount of memory shown here is *virtual* memory, which is a limitation imposed by the operating system, not by the amount of physical memory you have in your instrument). You select applications to preload by checking the boxes on the left. Checked applications preload at startup. The colored fuel bar indicates the total memory required when all the checked applications are loaded (either preloaded or selected during runtime).

Here is what the fuel bar colors mean:

- RED: the applications you have selected cannot all fit into the instrument's memory. You must deselect applications until the fuel bar turns yellow
- YELLOW: the applications you have selected can all fit into the instrument's memory, but there is less than 10% of the memory left, probably not enough to load any other applications, either via preload or by selecting a Mode while the instrument is running
- GREEN: The indicator is green when <90% of the memory limit is consumed. This means the applications you have selected can all fit into the instrument's memory with room to spare. You will be able to load one or more other applications without running out of memory

If Sequence Analyzer is selected to be preloaded, all apps that are part of the Sequencer Mode (GSM/EDGE, WCDMA, CDMA2K and 1xEVDO) are preloaded (if licensed).

4.5.6 Configure Applications - Instrument boot-up

When the Instrument Application starts, a dialog box similar to the one you see when you run Configure Applications is displayed, allowing you to choose which licensed applications are to be loaded. This dialog is only displayed if the memory required to pre-load all the licensed applications exceeds the virtual memory available.

4.5.7 Configure Applications - Remote Commands

The following topics provide details on using remote commands to configure the list of applications you want to load into the instrument memory, or query the virtual

memory utilization for your applications.

- "Configuration list (Remote Command Only)" on page 480
- "Configuration Memory Available (Remote Query Only)" on page 480
- "Configuration Memory Total (Remote Query Only)" on page 480
- "Configuration Memory Used (Remote Query Only)" on page 481
- "Configuration Application Memory (Remote Query Only)" on page 481

4.5.7.1 Configuration list (Remote Command Only)

Used to set or query the list of applications to be loaded in-memory.

Remote Command	`:SYSTem:PON:APPLication:LLISt <string of INSTrument:SELect names>` `:SYSTem:PON:APPLication:LLISt?`
Example	`:SYST:PON:APPL:LLIS "SA,BASIC,WCDMA"`
Notes	`<string of INSTrument:SELect names>` contains items that are valid options for the `:INSTrument:SELect` command The order of the `<INSTrument:SELect names>` specifies the order in which the applications are loaded into memory, and the order that they appear in the Mode menu Error message -225 "Out of Memory" is reported when more applications are listed than can reside in virtual memory. When this occurs, the existing applications load list is unchanged
Preset	Not affected by Preset
State Saved	Not saved in instrument state

4.5.7.2 Configuration Memory Available (Remote Query Only)

Returns the amount of Virtual Memory remaining.

Remote Command	`:SYSTem:PON:APPLication:VMEMory[:AVAilable]?`
Example	`:SYST:PON:APPL:VMEM?`
Preset	Not affected by Preset

4.5.7.3 Configuration Memory Total (Remote Query Only)

Returns the limit of Virtual Memory allowed for applications.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:TOTal?`

Example	`:SYST:PON:APPL:VMEM:TOT?`
Preset	Not affected by Preset

4.5.7.4 Configuration Memory Used (Remote Query Only)

Returns the amount of Virtual Memory used by all measurement applications.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:USED?`
Example	`:SYST:PON:APPL:VMEM:USED?`
Preset	Not affected by Preset

4.5.7.5 Configuration Application Memory (Remote Query Only)

Returns the amount of Virtual Memory a particular application consumes.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:USED:NAME? <INSTrument:SELect name>`
Example	`:SYST:PON:APPL:VMEM:USED:NAME? CDMA2K`
Notes	`<INSTrument:SELect name>` is an item from the same set used by the `:INSTrument:SELect` command If the name provided is invalid, 0 (zero) is returned
Preset	Not affected by Preset

4.6 Restore Defaults

Provides initialization of system setting groups, including the option to set the entire instrument back to a factory default state.

NOTE **In products that run multiple instances of the X-Series Application, all instances have the same factory default states for Restore Defaults.**

Remote Command	`:SYSTem:DEFault [ALL] | ALIGn | INPut | MISC | MODes | PON | UINTerface | SCReen`
Example	`:SYST:DEF`
State Saved	No

4.6.1 Input/Output

Input/Output Preset resets the group of settings and data associated with the Input/Output front-panel key to their default values. These settings are not affected by a Mode Preset because they are associated with connections to the instrument, which you will probably not want to reset every time you press Mode Preset.

By using Input/Output Preset and "Restore Mode Defaults" on page 615, a full preset of the current mode will be performed, with the caveat that since Input/Output Preset is a global function, it will affect *all* modes.

This is the same as the Input/Output Preset button in the Preset dropdown and the Input/Output menu.

When Input/Output is selected, a message appears saying:

```
This will reset all of the Input/Output variables to their default state,
including which input is selected, all Amplitude Correction settings and data,
all External Mixing settings, all Frequency Reference settings and all Output
settings

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?
```

The dialog includes OK and Cancel controls, for you to confirm or cancel the operation.

Example	`:SYST:DEF INP`

4.6.2 I/O Config

Causes the group of settings associated with the I/O Config menu to be reset to their default values. This also happens on Restore Misc Defaults, which has a SCPI command, although I/O Config does not.

When I/O Config is selected, a message appears saying:

```
This will reset all of the I/O Config variables to their default state,
including the GPIB address and SCPI LAN settings

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?
```

The dialog includes OK and Cancel controls, for you to affirm or cancel the operation.

4.6.3 User Interface

Causes the group of settings associated with the User Interface menu to be reset to their default values. This also happens on Restore Misc Defaults.

When User Interface is selected, a message appears saying:

```
This will reset all of the User Interface variables to their default state,
including the menu panel location, display theme, and language

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?
```

The dialog includes OK and Cancel controls, for you to affirm or cancel the operation.

Example

```
:SYST:DEF UINT
```

4.6.4 Power On

Causes the Power On settings to be reset to their default values.

The Power On settings are Power On State and Power On Application.

When Power On is selected, a message appears saying:

```
This will reset Power On State and Power On Application to their default state

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?
```

The dialog includes OK and Cancel controls, for you to affirm or cancel the operation.

Example `:SYST:DEF PON`

4.6.5 Alignments

Causes the Alignments system settings to be reset to their default values. This does not affect any Alignment data stored in the system.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

When Alignments is selected, a message appears saying:

```
This will reset all of the settings for the Alignment system to their default values

No alignment data will be erased

This action cannot be undone. Do you want to proceed?
```

The dialog includes OK and Cancel controls, for you to affirm or cancel the operation.

Example `:SYST:DEF ALIG`

4.6.6 Misc

Causes miscellaneous system settings to be reset to their default values.

CAUTION **This function resets the GPIB address to 18.**

When Misc is selected, a message appears saying:

```
This will reset miscellaneous system settings to their default values. This includes settings for I/O Config (GPIB and SCPI LAN), the User Interface, the Save/Recall system, and the Preset type

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?
```

The dialog includes OK and Cancel controls, for you to affirm or cancel the operation.

This Miscellaneous group contains settings that are *not* part of the other Restore Defaults groups. These include:

- All settings on the I/O Config page of the System Settings dialog
- All settings in the following table:

Miscellaneous Setting	Default Value
The SYST:PRES:TYPE	MODE
Auto File Name Number	000
Save Type	State
State Save To	Register 1
Screen Save To	SCREEN000.png
Save/Recall Shortcuts	Deleted
Display Theme	Filled
Backlight	ON
System Annotation	Local Settings
Language	English
DISP:ENABle	ON
Full Screen	Off

Example `:SYST:DEF MISC`

4.6.7 All

Comprehensively resets **All** instrument settings to their factory default values.

Resets all **System Settings** groups, performs "Restore Mode Defaults" on page 615 for all Modes in the instrument, and switches back to the power-on mode. Does not affect the User Preset file, or any user saved files.

When **All** is selected, a message appears:

```
This will reset all of the settings in the instrument to their factory default values, including the state of all Modes and Screens, the GPIB settings, the Alignment settings, and the Power On Mode

It will not affect Alignment data or settings

This action cannot be undone. We recommend canceling this operation and restoring settings individually (I/O Config, User Interface, Alignments, etc.) instead

Do you want to proceed?
```

The dialog includes **OK** and **Cancel** controls, for you to confirm or cancel the operation.

NOTE **If you are using a Keysight USB External Mixer, then you will need to perform Refresh USB Mixer Connection** (SCPI command `:MIX:BAND USB`) **after Restore Defaults > All.**

Example	`:SYST:DEF ALL`
Couplings	**All** causes the currently running measurement to be aborted, and sets all modes to a consistent state, so it is unnecessary to couple any settings

Backwards Compatibility SCPI

Notes	`:SYST:PRES:PERS` is the same as `:SYST:DEF ALL`
Backwards Compatibility SCPI	`:SYSTem:PRESet:PERSistent`
Backwards Compatibility SCPI Example	`:SYST:PRES:PERS`

4.7 Alignments

Accesses the alignment system of the instrument. You can control the automatic alignments, view alignment statistics and manually perform alignments.

The current setting of the alignment system is displayed in the Meas Bar along the top of the display. For conditions that may cause specifications to be impacted, this annotation will be in amber.

4.7.1 Auto Align

Lets you configure the automatic background alignments and the alerts from the automatic alignment system.

Dependencies	Except S9110E and M941xE, Auto Align does not appear in other instruments based on VXT models

4.7.1.1 Auto Align

Configures the method the automatic background alignment will use when it runs.

Automatic background alignments are run periodically between measurement acquisitions. The instrument's software determines when alignments are to be performed to maintain warranted operation. The recommended setting for **Auto Align** is **Normal** (or **Full Specifications** if available).

When the Auto Alignment Method is **Estimation-based**, and correction data is valid, the background alignment will not occur for approximately a month, except for extreme instrument temperature conditions that were not characterized. You can extend the correction data's validity by performing Characterize Basic Hardware once every few weeks, either manually or by using the **Scheduler**.

When the **Auto Alignment Method** is **Classic**, or for instruments that do not support the **Estimation-based** method, the background alignment occurs when instrument temperature changes for certain degrees and once in a day or two.

Auto Align execution *cannot* be aborted with the **Cancel (ESC)** key. To interrupt **Auto Align** execution, select **Auto Align Off**.

Remote Command	`:CALibration:AUTO ON | LIGHt | PARTial | OFF`
	For details of each option, see "Auto Align Options" on page 488
	`:CALibration:AUTO?`

Example	`:CAL:AUTO ON`
Notes	While Auto Align is executing, bit 0 of Status Operation register is set
Dependencies	For S9110E and M941xE, only Light and Off are available

Couplings	Auto Align is set to Off if Restore Align Data is invoked
Preset	This is unaffected by **Preset** but is set to ON by **Restore Defaults** >"Alignments" on page 484 OFF on S9110E and M941xE
State Saved	No
Annotation	In the Meas Bar When **Auto Alignment Method** is **Estimation-based**: – Full Specifications: Auto (white) – Light: Light (white) – Partial: Partial (amber) – Off: Off (amber) When **Auto Alignment Method** is **Classic**, or for instruments that do not support the **Estimation-based** method: – Normal with "All But RF" off: Auto (white) – Normal with "All But RF" on: Auto/No RF (amber) – Light: Light (white) – Partial: Partial (amber) – Off: Off (amber)
Status Bits/OPC dependencies	When **Auto Align** is executing, Bit 0 in the Status Operational register is set An interfering signal at the RF Input may prevent automatic alignment of the RF subsystem. If this occurs, the Error Condition message "Align RF skipped" is reported, the Status Questionable Calibration bit 11 is set, and the alignment proceeds. When a subsequent alignment of the RF subsystem succeeds, either by the next cycle of automatic alignment or from an Align Now, RF, the Error Condition and Status Questionable Calibration bit 11 are cleared
Backwards Compatibility SCPI	`:CALibration:AUTO ALERt` Parameter `ALERt` is for backwards compatibility only, and is mapped to `PARTial`

Auto Align Options

The available options depend on Auto Alignment Method.

Auto Alignment Method: Estimation-based

Full Specifications

The instrument will satisfy the specifications. Basic characterization will expire in a month. Additional characterization might occur.

Light

The instrument will perform well but might not satisfy the specifications. Basic characterization will expire in two months. Additional characterization might occur.

Partial

Auto-align only ResBW filters and IF passband. The instrument will perform well but might not satisfy the specifications. Basic characterization will expire in two months. Additional characterization might occur.

Off

Additional characterization will not occur. Corrections continue to be applied based on the estimation using the previously-measured basic hardware characteristics.

Auto Alignment Method: Classic

These are also the only options for instruments that do not support the **Estimation-based** method.

Normal

SCPI example `:CAL:AUTO ON`

Auto Align, **Normal** turns on the automatic alignment of all measurement systems. This selection maintains the instrument in warranted operation across varying temperature and over time.

If the condition “Align Now All required” is set, transitioning to **Auto Align**, **Normal** performs the required alignments, clears the “Align Now All required” condition, then continues with further alignments as required to maintain the instrument adequately aligned for warranted operation.

When **Auto Align**, **Normal** is selected, the **Auto Align Off** time is set to zero.

When **Auto Align**, **Normal** is selected, the Meas Bar indicates Align: Auto (in white) or Align: Auto/No RF (in amber). The amber color reminds you that you are responsible for maintaining the RF alignment of the instrument.

Alignment processing because of the transition to **Normal** is executed sequentially. Thus, `*OPC?` or `*WAI` following `:CAL:AUTO ON` will return when the alignment processing is complete.

Light

SCPI example `:CAL:AUTO LIGH`

Auto Align, **Light** turns on the automatic alignment of all measurement systems. The **Auto Align**, **Light** selection allows more drift in amplitude accuracy to allow much less frequent measurement interruptions to perform alignments. The temperature changes required to trigger each alignment are increased by a factor of three. Alignments also expire from time as well as temperature. In a stable thermal environment, the alignments occur one-ninth as often as in Normal. With these less

frequent alignments, all accuracy specifications (those expressed with ±x dB tolerances) change by nominally a factor of 1.4.

If the condition “Align Now, All required” is set, transitioning to **Auto Align**, **Light** performs the required alignments, clears the “Align Now, All required” condition, and continues with further alignments as required to maintain the instrument adequately aligned for warranted operation.

Alignment processing because of the transition to **Light** is executed sequentially. Thus, `*OPC?` or `*WAI` following `:CAL:AUTO LIGHT` will return when the alignment processing is complete.

When **Auto Align**, **Light** is selected, the **Auto Align Off** time is set to zero.

When **Auto Align**, **Light** is selected, the Settings Panel indicates Align: Light.

Partial

SCPI example `:CAL:AUTO PART`

Auto Align, **Partial** disables the full automatic alignment and the maintenance of warranted operation for the benefit of improved measurement throughput. Accuracy is retained for the Resolution Bandwidth filters and the IF Passband, which is critical to FFT accuracy, demodulation, and many measurement applications. With Auto Align set to Partial, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The Auto Align, Alert mechanism will notify you when alignments have expired. One solution to expired alignments is to perform the Align All, Now operation. Another is to return the Auto Align selection to Normal.

Auto Align, **Partial** is recommended for measurements where the throughput is so important that a few percent of improvement is more valued than an increase in the accuracy errors of a few tenths of a decibel. One good application of **Auto Align**, **Partial** would be an automated environment where the alignments can be called during overhead time when the device-under-test is exchanged.

When **Auto Align**, **Partial**, is selected the elapsed time counter begins for **Auto Align Off** time.

When **Auto Align**, **Partial** is selected, the Settings Panel indicates Align: Partial in an amber color. The amber color reminds you that you are responsible for maintaining the warranted operation of the instrument.

Off

SCPI example `:CAL:AUTO OFF`

Auto Align, **Off** disables automatic alignment and the maintenance of warranted operation, for the benefit of maximum measurement throughput. With **Auto Align** set to **Off**, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The Auto Align, Alert mechanism will notify you

when alignments have expired. One solution to expired alignments is to perform the Align All, Now operation. Another is to return the Auto Align selection to Normal.

The Auto Align Off setting is rarely the best choice, because Partial gives almost the same improvement in throughput while maintaining the warranted performance for a much longer time. The choice is intended for unusual circumstances, such as the measurement of radar pulses where you might want the revisit time to be as consistent as possible.

When Auto AlignOff is selected, the Auto Align Off time is initialized and the elapsed time counter begins.

When Auto AlignOff is selected, the Settings Panel indicates Align: Off in an amber color. The amber color reminds you that you are responsible for maintaining the warranted operation of the instrument.

4.7.1.2 All but RF

Configures automatic alignment to include or exclude the RF subsystem. (Eliminating the automatic alignment of the RF subsystem prevents the input impedance from changing. The normal input impedance of 50 ohms can change to an open circuit when alignments are being used. Some devices under test do not behave acceptably under such circumstances, for example by showing instability.)

When All but RF is ON, the operator is responsible for performing an Align Now RF when RF-related alignments expire. The Auto Align, Alert mechanism will notify you to perform an Align Now All when the combination of time and temperature variation is exceeded.

When All But RF is ON, the Settings Panel indicates Align: Auto/No RF (in amber). The amber color reminds you that you are responsible for maintaining the RF alignment of the instrument.

Remote Command	`:CALibration:AUTO:MODE ALL | NRF` `:CALibration:AUTO:MODE?`
Example	`:CAL:AUTO:MODE NRF`
Dependencies	`Not available in S9110E and M941xE`
Preset	Unaffected by Preset but set to `ALL` by Restore Defaults >"Alignments" on page 484
State Saved	No

4.7.1.3 Alert

The instrument signals an Alert when conditions exist such that you will need to perform a full alignment (for example, Align Now All or Characterize Basic Hardware). Alert can be configured as one of the following settings:

Setting	Option	See
Time & Temperature	TTEMperature	"Time & Temperature" on page 492
Time & Temperature Light	LIGHt	"Time & Temperature Light" on page 493
24 hours	DAY	"24 hours" on page 493
7 days	WEEK	"7 days" on page 493
None	NONE	"None" on page 493

Note that, when Auto Alignment Method is **Estimation-based**, only **Time & Temperature** and **None** are available.

With **Auto Align** set to **Normal** or **Full Specifications**, the configuration of **Alert** is not relevant, because the instrument's software maintains the instrument in warranted operation.

A confirmation is required when a selection other than `TTEMperature` is chosen. This prevents accidental deactivation of alerts. When setting **Alert** from the front panel to any value but `TTEMperature`, confirmation is required to transition into this setting of Alert. The confirmation dialog is:

```
This will suppress alerts from the Alignment system, which would notify you
when an Alignment is required to maintain warranted operation. Without the
alerts you will be responsible for performing an Align Now All at appropriate
intervals to maintain warranted operation

Do you want to proceed?
```

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

No confirmation is required when **Alert** is configured through a remote command.

For more information see "Time & Temperature" on page 492

Remote Command	`:CALibration:AUTO:ALERt TTEMperature | LIGHt | DAY | WEEK | NONE` `:CALibration:AUTO:ALERt?`
Example	`:CAL:AUTO:ALER TTEM`
Dependencies	Not available in S9110E and M941xE
Preset	Unaffected by **Preset** but set to `TTEMperature` by **Restore Alignment Defaults**
State Saved	No
Status Bits/OPC dependencies	When an alert is generated, the condition message "Align Now All required" appears in the Status Bar, and bit 14 is set in the Status Questionable Calibration register

The settings for **Alert** are detailed below.

Time & Temperature

SCPI Example `CAL:AUTO:ALER TTEM`

The instrument signals an alert when alignments expire due to the combination of the passage of time and changes in temperature. The alert is the Error Condition message “Align Now All required”. If this choice for Alert is selected, the absence of an alert means that the instrument alignment is sufficiently up-to-date to maintain warranted accuracy.

Time & Temperature Light

SCPI Example `CAL:AUTO:ALER LIGH`

This is a light version of Time & Temperature which means for this setting the time/temperature changes required to trigger an alert are increased by a factor of three and the time alerts will occur one-ninth as often as for Time and Temperature.

Not available when Auto Alignment Method is **Estimation-based**. If this command is sent in this case, **Time & Temperature** (`TTEM`) is selected.

24 hours

SCPI Example `CAL:AUTO:ALER DAY`

The instrument signals an alert after a time span of 24 hours since the last successful full alignment (for example, **Align Now All** or completion of a full **Auto Align**). You may want to select this option in an environment where the temperature is stable on a daily basis, at a small risk of accuracy errors in excess of the warranted specifications. The alert is the Error Condition message “Align Now All required”.

Not available when Auto Alignment Method is **Estimation-based**. If this command is sent in this case, **Time & Temperature** (`TTEM`) is selected.

7 days

SCPI Example `CAL:AUTO:ALER WEEK`

The instrument signals an alert after a time span of 168 hours since the last successful full alignment (for example, **Align Now All** or completion of a full **Auto Align**). You may want to select this option in an environment where the temperature is stable on a weekly basis, at a modest risk of accuracy degradations in excess of warranted performance. The alert is the Error Condition message “Align Now All required”.

Not available when Auto Alignment Method is **Estimation-based**. If this command is sent in this case, **Time & Temperature** (`TTEM`) is selected.

None

SCPI Example `CAL:AUTO:ALER NONE`

The instrument does not signal an alert. This is provided for rare occasions where you are making a long measurement that cannot tolerate Auto Align interruptions, and must have the ability to capture a screen image at the end of the measurement without an alert posted to the display. Keysight does not recommend using this selection in any other circumstances, because of the risk of accuracy performance drifting well beyond expected levels without the operator being informed.

4.7.2 Align Now

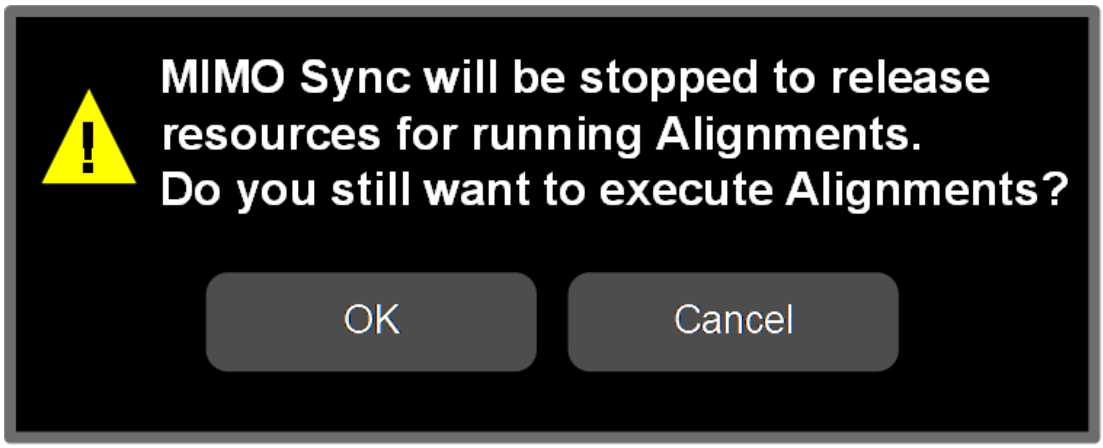
Accesses alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

Executing immediate alignments from SCPI can be problematic due to the length of time required for the alignments to complete. Alignment commands are by their nature sequential, meaning they must complete before any other SCPI commands can be processed. In many cases the alignment itself will take longer than the typical SCPI timeout value. Furthermore, status cannot be easily queried while a sequential command is running.

For this reason, overlapped versions of the Align Now commands are provided. When using these No-Operation-Pending (`NPENDing`) commands, the SCPI thread will not be blocked (will be released immediately), so that you can use `:STATus:OPERation:CONDition?` to query the alignment status bit and use `:STATus:QUEStionable:CALibration:CONDition?` to check the alignment results. As an example, `:CALibration[:ALL]:NPENding` is the overlapped replacement for `:CALibration[:ALL]`.

While the alignment is executing, the coming NOP calibration will be ignored, and `error message "Setting Conflict, Alignment is in process"` will be posted. Also, any other operations to the instrument will be pended and postponed until the alignment is completed. The operations include: Preset, Initiate a new measurement, Device clear and so on. Accordingly, changing parameters will not take effect although the UI is updated immediately. To avoid unexpected timeouts and results, these operations are not recommended during any such alignments.

NOTE **The Alignments are not performed if the MIMO Sync is running, because the MIMO and Alignments require the same hardware resource. If the instrument is in MIMO Sync and you press a button to execute Alignments, a pop-up window appears as below. Click OK to stop MIMO and execute Alignments.**



If the instrument is in MIMO sync, and you send a SCPI command to run Alignments, the align process is not executed, and a warning is generated. To execute Alignments, you must first stop MIMO via SCPI (or manually).

Controls in this Dialog

The selection and order of controls displayed in this dialog depends on the instrument type and options. Select the control of interest from the following list:

- "Align Now All" on page 496
- "Align Now All but RF" on page 498
- "Align Now RF" on page 499
- "Align Now Expired" on page 501
- "Align Now Preselector" on page 502
- "Align Now All but RF Preselector" on page 502
- "Align Now RF Presel Only (20 Hz to 3.6 GHz)" on page 503
- "Align Now External Mixer" on page 504
- "Align Source" on page 505
- "Align Receiver" on page 506
- "Align Fast" on page 506
- "Align LO Leakage" on page 507

- Align Fast Amplitude
- "Align IF Cable" on page 507
- "Align RRH Amplitude" on page 507
- "Align Fast RRH Amplitude" on page 508
- "Align RRH LO Power" on page 508
- "Align LO Clock" on page 508
- "Align Noise Power for IQNC" on page 509
- "Align External Mixer Path" on page 514
- "Align Low Band" on page 515
- "Align High Band" on page 516
- Align External Loopback Phase Linearity of RRH
- Align External Loopback Phase Linearity of RF

4.7.2.1 Align Now All

In PXE, the key label is Align Now All (plus RF Presel 20 Hz – 3.6 GHz)

Immediately executes an alignment of all subsystems. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the Restart key).

If an interfering user signal is present at the RF Input, the alignment is performed on all subsystems except the RF. After completion, the Error Condition message “Align RF skipped” is generated. In addition, the Error Condition message “Align Now, RF required” is generated, and bits 11 and 12 are set in the Status Questionable Calibration register.

The query form of the remote commands (`:CALibration[:ALL]?` or `*CAL?`) invokes the alignment of all subsystems and returns a success or failure value. An interfering user signal is not grounds for failure; if the alignment was able to succeed on all portions but unable to align the RF because of an interfering signal, the resultant will be the success value.

Successful completion of Align Now All will clear the “Align Now All required” Error Condition, and clear bit 14 in the Status Questionable Calibration register. It will also begin the elapsed time counter for Last Align Now All Time, and capture the Last Align Now All Temperature.

If the Align RF subsystem succeeded in aligning (no interfering signal present), the elapsed time counter begins for Last Align Now, RF Time, and the temperature is captured for the Last Align Now, RF Temperature. In addition, the Error Conditions "Align RF skipped" are cleared, the Error Condition "Align Now, RF required" is cleared, and bits 11 and 12 are cleared in the Status Questionable Calibration register

Align Now All can be interrupted, by pressing the Cancel (ESC) front-panel key, or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition message "Align Now All required" is generated, and bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems. However, this mechanism does not apply to the M941xA based instruments or solutions. As the new alignment data is independent for all subsystems. "Align Now All required" is generated only when alignments expire due to the combination of the passage of time and changes in temperature. You can refer to the data sheet for more details.

In many cases, you might find it more convenient to change alignments to Normal, instead of executing Align Now All. When the Auto Align process transitions to Normal, the instrument will immediately start to update only the alignments that have expired, thus efficiently restoring the alignment process.

Remote Command	`:CALibration[:ALL]` `:CALibration[:ALL]?`
Example	`:CAL`
Notes	`:CALibration[:ALL]?` returns 0 if successful, or 1 if failed `:CALibration[:ALL]?` is the same as `*CAL?` While Align Now All is performing the alignment, the Calibrating bit (Bit 0 in the Status Operation register) is set. Completion, or termination, will clear Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion will clear bit 14 in the Status Questionable Calibration register An interfering user signal is not grounds for failure of Align Now All. However, Bits 11 and 12 are set in the Status Questionable Calibration register to indicate Align Now, RF is required An interfering user-supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed
Couplings	Initializes the time for the Last Align Now All Time Records the temperature for the Last Align Now All Temperature If Align RF component succeeded, initializes the time for the Last Align Now, RF Time If Align RF component succeeded, records the temperature for the Last Align Now, RF Temperature
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register

IEEE Command

Remote Command	`*CAL`
Example	`*CAL?`
Notes	Returns 0 if successful, or 1 if failed `:CALibration[:ALL]?` is exactly the same as `*CAL?`, including all conditions, status register bits, and couplings See additional remarks described with `:CALibration[:ALL]?` Overlapped Command

Remote Command	`:CALibration[:ALL]:NPENding`
Example	`:CAL:NPEN`
Notes	`:CALibration[:ALL]:NPENding` is the same as `:CALibration[:ALL]`, including all conditions, status register bits, except this SCPI command *does not block* the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not Typical usage is: 1. `:CALibration:ALL:NPENding` (Start a calibration) 2. `:STATus:OPERation:CONDition?` (Check if the calibration is completed or not, If bit 0 is set, then the system is doing calibration, you should repeat this SCPI query until the bit is cleared) 3. `:STATus:QUEStionable:CALibration:CONDition?` (Check if there are any errors/-failures in previous calibration procedure

4.7.2.2 Align Now All but RF

In PXE, the key label is Align Now All but RF (not including RF Presel)

Immediately executes an alignment of all subsystems except the RF subsystem. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning (similar to pressing the Restart key). This can be used to align portions of the instrument that are not impacted by an interfering user input signal.

This operation might be chosen instead of All if you do not want the device under test to experience a large change in input impedance, such as a temporary open circuit at the instrument input.

The query form of the remote commands (`:CALibration:NRF?`) invokes the alignment and returns a success or failure value.

Successful completion of Align Now All but RF clears the “Align Now All required” Error Condition, and clears Bit 14 in the Status Questionable Calibration register. If “Align Now All required” was in effect prior to executing All but RF, the Error Condition message “Align Now RF required” is generated and Bit 12 in the Status

Questionable Calibration register is set. It will also begin the elapsed time counter for Last Align Now All Time, and capture the Last Align Now All Temperature.

Align Now All but RF can be interrupted, by pressing the Cancel (ESC) front-panel key, or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition message "Align Now All required" is generated, and Bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be used for an individual subsystem, but not a full new set of data for all subsystems.

Remote Command	`:CALibration:NRF` `:CALibration:NRF?`
Example	`:CAL:NRF`
Notes	Returns 0 if successful, or 1 if failed While Align Now All but RF is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, will clear Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion clears Bit 14 in the Status Questionable Calibration register and sets Bit 12 if invoked with "Align Now All required"
Couplings	Initializes the time for the Last Align Now All Time Records the temperature for the Last Align Now All Temperature
Status Bits/OPC dependencies	Bits 12 or 14 may be set in the Status Questionable Calibration register

Overlapped Command

Remote Command	`:CALibration:NRF:NPENding`
Example	`:CAL:NRF:NPEN`
Notes	`:CALibration:NRF:NPENding` is the same as `:CALibration:NRF`, including all conditions, status register bits, except that this SCPI command *does not block* the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not Typical usage is: 1. `:CALibration:NRF:NPENding` (start the All but RF calibration) 2. `:STATus:OPERation:CONDition?` (If bit 0 is set, then the system is doing calibration, you should do re-query until this bit is cleared) 3. `:STATus:QUEStionable:CALibration:CONDition?` (to check if there are any errors/-failures in previous calibration procedure)

4.7.2.3 Align Now RF

In PXE, the key label is Align Now RF Only

Immediately executes an alignment of the RF subsystem. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

This operation might be desirable if the alignments had been set to not include RF alignments, or if previous RF alignments could not complete because of interference which has since been removed.

If an interfering user signal is present at the RF Input, the alignment will terminate and generate the Error Condition message “Align RF skipped”, and Error Condition “Align Now, RF required”. In addition, bits 11 and 12 will be set in the Status Questionable Calibration register.

The query form of the remote commands (`:CALibration:RF?`) invokes the alignment of the RF subsystem and returns a success or failure value. An interfering user signal is grounds for failure.

Successful completion of **Align Now RF** begins the elapsed time counter for Last Align Now, RF Time, and capture the Last Align Now, RF Temperature.

Align Now RF can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition message “Align Now, RF required” is generated, and Bit 12 is set in the Status Questionable Condition register. None of the new alignment data is used.

Remote Command	`:CALibration:RF` `:CALibration:RF?`
Example	`:CAL:RF`
Notes	Returns 0 if successful, or 1 if failed (including interfering user signal) While **Align Now RF** is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion clears the Error Conditions “Align RF skipped” and the Error Conditions “Align RF failed” and “Align Now, RF required”, and clears Bits 3, 11, and 12 in the Status Questionable Calibration register A failure encountered during alignment generates the Error Condition message “Align RF failed” and sets Bit 3 in the Status Questionable Calibration register An interfering user signal will result in Bits 11 and 12 being set in the Status Questionable Calibration register, to indicate Align Now, RF is required An interfering user supplied signal results in the instrument requiring **Align Now RF** with the interfering signal removed
Couplings	Initializes the time for the Last Align Now, RF Time Records the temperature for the Last Align Now, RF Temperature
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register

Overlapped Command

Remote Command	`:CALibration:RF:NPENding`
Example	`:CAL:RF:NPEN`
Notes	`:CALibration:RF:NPENding` is the same as `:CALibration:RF`, including all conditions, status register bits, except that this SCPI command *does not block* the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not Typical usage is: 1. `:CALibration:RF:NPENding` (Start a RF calibration) 2. `:STATus:OPERation:CONDition?` (If Bit 0 is set, then the system is doing calibration, you should do re-query until this bit is cleared) 3. `:STATus:QUEStionable:CALibration:CONDition?` (to check if there are any errors/-failures in previous calibration procedure)

4.7.2.4 Align Now Expired

Alignments can be Expired when **Auto Align** is `PARTial` or `OFF`.

This control runs the alignments that have expired. This differs from performing **Align All, Now.**, which performs an alignment of all subsystems regardless of whether they are needed or not, whereas **Execute Expired Alignments** aligns only the individual subsystems that have become due.

Remote Command	`:CALibration:EXPired` `:CALibration:EXPired?`
Example	`:CAL:EXP?`
Notes	`:CALibration:EXPired?` returns 0 if successful, or 1 if failed While **Align Now Expired** is performing the alignment, the Calibrating bit (Bit 0 in the Status Operation register) is set. Completion, or termination, clears Bit 0 in the Status Operation register This command is sequential; that is, it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by `:ABORt` Successful completion clears bit 14 in the Status Questionable Calibration register An interfering user signal is not grounds for failure of **Align Now Expired**. However, if RF Alignment was required, Bits 11 and 12 are set in the Status Questionable Calibration register to indicate Align Now, RF is required
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register

4.7.2.5 Align Now Preselector

Normally, Preselector Alignment runs during power up, and during the twenty minutes after power up, whenever there is a 1-degree internal temperature change.

This alignment is also run when an "Align Now All" on page 496 is performed. This feature is helpful during the 20-minute warm-up time to correct for preselector drift while alignments are being held off. This feature can also be used in lieu of using the Preselector Center functionality, to improve speed throughput for remote testing with minimal impact to amplitude accuracy specs. The algorithm centers the preselector at the upper and lower operating frequencies of the YTF preselector.

The Align Now Preselector alignment is *not* a substitute for the Characterizer Preselector Advanced Alignment, which creates the default preselector centering curves for the YTF Preselector and is typically run annually.

Remote Command	`:CALibration:PRESelector` `:CALibration:PRESelector?`
Example	`:CAL:PRES`
Notes	Returns 0 if successful, or 1 if failed (including interfering user signal) While Align Now Preselector is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register This command is sequential; that is, it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by `:ABORt` Successful completion clears the Error Conditions “Align Preselector failed” and clears Bit 3 in the Status Questionable Calibration Failure (Extended) register A failure encountered during alignment generates the Error Condition message “Align Preselector failed” and sets Bit 3 in the Status Questionable Calibration Failure (Extended) register
Status Bits/OPC dependencies	Bit 3 may be set in the Status Questionable Calibration Failure (Extended) register

4.7.2.6 Align Now All but RF Preselector

Only available in models with the RF Preselector, such as the N9048B. It is identical to the "Align Now All" on page 496 (plus RF Presel) function, except that the RF Preselector is only partially aligned. Only the System Gain, Mechanical attenuator and Electronic attenuator alignments on the RF Preselector path are aligned. The purpose of these alignments is to improve the RF Preselector path amplitude variation compared to the bypass path.

Remote Command	`:CALibration:NRFPselector` `:CALibration:NRFPselector?`

Example	`:CAL:NRFP`
Dependencies	Only appears in N9048B. Sending the SCPI command or query in other models generates an error
Status Bits/OPC dependencies	Bits 12 or 14 may be set in the Status Questionable Calibration register

4.7.2.7 Align Now RF Presel Only (20 Hz to 3.6 GHz)

Only available in models with the RF Preselector, such as the N9048B. It executes an alignment of the RF Preselector section. The receiver will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning (similar to pressing the Restart key). *Only* the RF Preselector is aligned; no Align Now All function is performed first.

The query (`:CALibration:RFPSelector:ONLY?`) invokes the alignment of the RF Preselector on both Conducted and Radiated Band, and returns a success or failure value. Successful completion clears the “Align 20 Hz to 3.6 GHz required” Error Condition, and clears Bit 1 and Bit 2 in the Status Questionable Calibration Extended Needed register.

The elapsed time counter will begin for Last Align Now, Conducted Time and Last Align Now Radiated Time and the temperature is captured for Last Align Now, Conducted Temperature and Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition “Align 20 Hz to 3.6 GHz required” is set because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The “Align 20 Hz to 3.6 GHz required” Error Condition will appear when this alignment has expired. The user is now responsible to perform the Align Now, 20 Hz to 3.6 GHz in order to keep the receiver in warranted operation. This alignment can only be performed by the user, as it is not part of the Auto Align process.

Remote Command	`:CALibration:RFPSelector:ONLY` `:CALibration:RFPSelector:ONLY?`
Example	`:CAL:RFPS:ONLY`
Notes	Query returns 0 if successful, or 1 if failed When Align 20 Hz to 3.6 GHz is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command. Successful completion clears Bits 1 and 2 in the Status Questionable Calibration Extended Needed register and Bits 0 and 1 in Status Questionable Calibration Extended Failure register A failure encountered during alignment sets the Error Condition “20 Hz to 3.6 GHz Alignment Failure”,

	sets Bits 1 and 2 in the Status Questionable Calibration Extended Needed register, and Bit 9 in Status Questionable Calibration register
Dependencies	Only appears in N9048B. Sending the SCPI command or query in other models generates an error This key is grayed-out if the instrument is displaying an “Align Now All required” message. If you press the key while it is grayed-out, you will see the informational message, “Align Now All required first”
Couplings	Initializes the time for the Last Align Conducted Now, Conducted Time Initializes the time for the Last Align Radiated Now, Radiated Time Records the temperature for the Last Align Conducted Now, Conducted Temperature Records the temperature for the Last Align Radiated Now, Radiated Temperature
Status Bits/OPC dependencies	Bit 8 or 9 may be set in the Status Questionable Calibration register Bit 1 and 2 may be set in the Status Questionable Calibration Extended Needed register Bit 0 and 1 may be set in the Status Questionable Calibration Extended Failure register

4.7.2.8 Align Now External Mixer

Immediately executes an alignment of the External Mixer that is plugged into the USB port. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the Restart key). As this alignment calibrates the LO power to the mixer, this is considered an LO alignment; and failure is classified as an LO alignment failure.

The query (`:CALibration:EMIXer?`) invokes the alignment of the External Mixer and returns a success or failure value.

Remote Command	`:CALibration:EMIXer` `:CALibration:EMIXer?`
Example	`:CAL:EMIX`
Notes	Returns 0 if successful, or 1 if failed While Align Now External Mixer is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command A failure encountered during alignment generate the Error Condition message “Align LO failed” and sets Bit 5 in the Status Questionable Calibration register. Successful completion clears the “Align LO failed” message and Bit 5 in the Status Questionable Calibration register
Dependencies	Does not appear unless Option EXM is present, and is grayed-out unless a USB mixer is plugged in to the USB
Status Bits/OPC dependencies	Bit3 may be set in the Status Questionable Calibration Extended Failure register

4.7.2.9 Align Source

Accesses source alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

The instrument stops any sequence of the source, performs the alignment, then restarts the sequence from the beginning.

NOTE **This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, it is required to perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.**

There is no alert available for the source alignment. Operators are responsible for checking temperature shift since the last Align Now Source to determine whether the source alignment needs to be executed.

Remote Command	`:CALibration:INTernal:SOURce[:ALL]` `:CALibration:INTernal:SOURce[:ALL]?`
Example	`:CAL:INT:SOUR`
Notes	`:CAL:INT:SOUR?` Initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9410A/11A
Couplings	Initializes the time for the Last Align Source Now, All Time Records the temperature for the Last Align Source Now, All Temperature

Overlapped Command

Remote Command	`:CALibration:INTernal:SOURce[:ALL]:NPENding`
Example	`:CAL:INT:SOUR:NPEN`
Notes	`:CALibration:INTernal:SOURce[:ALL]:NPENding` is the same as `:CALibration:INTernal:SOURce[:ALL]`, including all conditions and status register bits, except that this SCPI command *does not block* the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not Typical usage is: 1. `:CALibration:INTernal:SOURce:NPENding` (start an internal source calibration) 2. `:STATus:OPERation:CONDition?` (Check if the calibration is completed or not, If Bit 0 is set, then the system is doing calibration. Repeat this query until the bit is cleared) 3. `:STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?` (Check if Bit 14 is set or not. If this bit is set, that means there are some errors in previous internal source calibration)
Dependencies	Only appears in VXT models M9410A/11A

4.7.2.10 Align Receiver

Accesses receiver alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

NOTE **This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, it is required to perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.**

There is no alert available for the receiver alignment. Operators are responsible for checking temperature shift since the last Align Now, Align Receiver, to determine whether the receiver alignment needs to be executed.

Remote Command	`:CALibration:INTernal:RECeiver[:ALL]` `:CALibration:INTernal:RECeiver[:ALL]?`
Example	`:CAL:INT:REC`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9410A/11A
Couplings	Initializes the time for the Last Align Receiver Now, All Time Records the temperature for the Last Align Receiver Now, All Temperature

4.7.2.11 Align Fast

Accesses fast alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

Align Fast is a subset of Align All, which aligns the subsystems that are most sensitive to temperature and time and includes:

- compensating the DC offset, gain imbalance and quadrature phase imbalance of IQ Modulator and/or Demodulator
- compensating the gain offset of RF path

It is suggested to perform Fast Alignment every 8 hours, or when temperature has changed more than 5°C from the previous Fast Alignment.

Remote Command	`:CALibration:INTernal:FAST[:ALL]` `:CALibration:INTernal:FAST[:ALL]?`
Example	`:CAL:INT:FAST`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9410A/11A /15A/16A and S9110E

4.7.2.12 Align LO Leakage

Accesses LO Leakage alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

This alignment reduce the LO Leakage of the instrument.

Remote Command	`:CALibration:INTernal:LOLeakage` `:CALibration:INTernal:LOLeakage?`
Example	`:CAL:INT:LOL`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9410A/11A /15A/16A and S9110E

4.7.2.13 Align IF Cable

Accesses IF Cable alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

This alignment aligns the IF cabling to the remote heads.

Remote Command	`:CALibration:INTernal:RRHead:IFCable` `:CALibration:INTernal:RRHead:IFCable?`
Example	`:CAL:INT:RRH:IFC`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT based solutions with M1740A/41A/42A/49A/49B RRH
Backwards Compatibility SCPI	`:CALibration:INTernal:IFCable` `:CALibration:INTernal:IFCable?`

4.7.2.14 Align RRH Amplitude

This is an immediate action operation, which runs until complete.

Aligns the amplitude of the Remote Radio Head. This operation could take quite a long time to run.

CAUTION **For M1741A/49A/49B RRH, make sure to connect 50-ohm terminations to Head Tx/Rx 1 and 2 ports.**

Remote Command	`:CALibration:INTernal:RRHead:AMPLitude` `:CALibration:INTernal:RRHead:AMPLitude?`

Example	`:CAL:INT:RRH:AMPL?`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT based solutions with M1741A/42A/49A/49B RRH
Backwards Compatibility SCPI	`:CALibration:INTernal:RRHAmp` `:CALibration:INTernal:RRHAmp?`

4.7.2.15 Align Fast RRH Amplitude

This is an immediate action operation, which runs until complete.

Compare to Align RRH Amplitude, it aligns the amplitude of Remote Radio Head with a wider frequency interval. This operation takes about one minute.

Remote Command	`:CALibration:INTernal:RRHead:AMPLitude:FAST` `:CALibration:INTernal:RRHead:AMPLitude:FAST?`
Example	`:CAL:INT:RRH:AMPL:FAST?`
Notes	The query initiates an alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT based solutions with M1742A RRH

4.7.2.16 Align RRH LO Power

This is an immediate action operation, which runs until complete.

Aligns the LO Power of Remote Radio Head.

Remote Command	`:CALibration:INTernal:RRHead:LOPower` `:CALibration:INTernal:RRHead:LOPower?`
Example	`:CAL:INT:RRH:LOP`
Notes	The query initiates an alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT based solutions with M1741A/49A/49B RRH

4.7.2.17 Align LO Clock

This is an immediate action operation, which runs until complete.

Synchronizes RRH LO Clocks.

Remote Command	`:CALibration:INTernal:RRHead:LOSync` `:CALibration:INTernal:RRHead:LOSync?`
Example	`:CAL:INT:RRH:LOS?`

Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT based solutions with M1741A/42A/49A/49B RRH
Backwards Compatibility SCPI	`:CALibration:INTernal:LOSync` `:CALibration:INTernal:LOSync?`

4.7.2.18 Align Noise Power for IQNC

Accesses Align Noise Power for IQNC processes that are immediate action operations. They perform complete operations and run until they are complete.

The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the Restart key).

Remote Command	`:CALibration:INTernal:NPOWer` `:CALibration:INTernal:NPOWer?`
Example	`:CAL:INT:NPOW`
Notes	The query initializes an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears on instruments based on VXT models M9415A/16A

4.7.2.19 Align VXT Transceiver

In M941xE (M941xA+M9471A) and S9110E, accesses alignment processes in VXT Transceiver (M9410A/11A/15A/16A), which are immediate action operations and perform complete operations, running until they are complete.

The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the Restart key).

There is no alert available for the VXT Transceiver alignment. Operators are responsible for checking temperature shift since the last Align VXT Transceiver to determine whether the VXT Transceiver alignment needs to be executed.

Remote Command	`:CALibration:INTernal:VXT:TRANsceiver` `:CALibration:INTernal:VXT:TRANsceiver?`
Example	`:CAL:INT:VXT:TRAN`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in M9410E/11E/15E/16E and S9110E

4.7.2.20 Align up down converter

In M941xE(M941xA+M9471A) system, accesses alignment processes in up down converter (M9471A), which are immediate action operations and perform complete operations, running until they are complete.

The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the Restart key).

There is no alert available for the up down converter alignment. Operators are responsible for checking temperature shift since the last Align up down converter to determine whether the up down converter alignment needs to be executed.

Remote Command	`:CALibration:UPDown:CONVerter` `:CALibration:UPDown:CONVerter?`
Example	`:CAL:UPD:CONV`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in M9410E/11E/15E/16E

4.7.2.21 Align M9471A up down converter

In S9110E, accesses alignment processes in up down converter (M9471A), which are immediate action operations and perform complete operations, running until they are complete.

The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the Restart key).

There is no alert available for the up down converter alignment. Operators are responsible for checking temperature shift since the last Align M9471A up down converter to determine whether the up down converter alignment needs to be executed.

Remote Command	`:CALibration:UPDown:CONVerter` `:CALibration:UPDown:CONVerter?`
Example	`:CAL:UPD:CONV`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears on S9110E

4.7.2.22 Align Fast Up Down Converter

In M941xE (M941xA+M9471A), accesses alignment processes in up down converter (M9471A), which are immediate action operations and perform complete operations, running until they are complete.

The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the Restart key).

There is no alert available for the up down converter alignment. You are responsible for checking temperature shift since the last Align Fast Up Down Converter, to determine whether the up down converter alignment needs to be executed.

Remote Command	`:CALibration:UPDown:CONVerter:FAST` `:CALibration:UPDown:CONVerter:FAST?`
Example	`:CAL:UPD:CONV:FAST`
Notes	The query initiates an alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in M9410E/11E/15E/16E

4.7.2.23 Align Specified Freq Ranges

VXT models M9410A/11A provide five alignments: Align Now All, Align Source, Align Receiver, Align Fast and Align LO Leakage. M9415A/16A provide six alignments: Align Now All, Align Fast, Align LO Leakage, Align Ext. Mixer Path, Align High Band, Align Low Band. Every time you execute one of these alignments, the system performs a full span alignment. To save time, it is possible to limit the range of alignment frequency settings. Align Specified Freq Ranges allows you to set the start and stop frequency of an alignment.

The example below shows the steps for processing Align Receiver on VXT model M9410A, specifying a frequency range from 1.3 GHz to 1.8 GHz, and 2.5 GHz to 3.9 GHz.

- First row: set the Start and Stop Frequency to 1.3 GHz and 1.8 GHz. Enable the first row
- Second row: set the Start and Stop Frequency to 2.5 GHz and 3.9 GHz. Enable the second row
- Click Align Receiver. A message appears: “Aligning 1 of 7”

The equivalent SCPI command sequence is:

```
:CAL:INT:ASFR ON
:CAL:INT:ASFR:FRAN 1.3 GHz, 1.8 GHz, 2.5 GHz, 3.9 GHz
```

:CAL:INT:REC

Remote Command	:CALibration:INTernal:ASFRanges[:STATe] ON | OFF | 1 | 0 :CALibration:INTernal:ASFRanges?
Example	:CAL:INT:ASFR ON :CAL:INT:ASFR?
Notes	When **Align Specified Freq Ranges** is ON, the table is displayed for setting up the frequency ranges to be aligned
Dependencies	Only available in: – VXT models M9410A/11A/15A/16A – VXT models M9410A/11A/15A/16A with RRH and/or CIU – M9410E/11E/15E/16E – S9110E Only functional for the following alignments: – Align Now All of VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E – Align Source of VXT models M9410A/11A – Align Receiver of VXT models M9410A/11A – Align Fast of VXT models M9410A/11A/15A/16A – Align LO Leakage of VXT models M9410A/11A/15A/16A – Align Ext. Mixer Path of VXT models M9415A/16A – Align High Band of VXT models M9415A/16A – Align Low Band of VXT models M9415A/16A – Align VXT Transceiver of M9410E/11E/15E/16E and S9110E – Align Up Down Converter of M9410E/11E/15E/16E – Align M9471A Up Down Converter of S9110E **Align Specified Freq Ranges** only guarantees the hardware performance within the frequency range
Preset	OFF

Enable Extended Freq Range

Lets you set frequency ranges for VXT models M9410A/11A/15A with Remote Head and/or CIU. When **Enable Extended Freq Range** is not active, the frequency range is limited by VXT models only.

Remote Command	:CALibration:INTernal:ASFRanges:EXTend[:STATe] ON | OFF | 1 | 0 :CALibration:INTernal:ASFRanges:EXTend[:STATe]?
Example	:CAL:INT:ASFR:EXT ON :CAL:INT:ASFR:EXT?
Dependencies	Only available in VXT models M9410A/11A/15A/16A with Remote Head and/or CIU Only available when **Align Specified Freq Ranges** is ON
Preset	OFF

Frequency Range

Lets you set the alignment frequency range.

Remote Command	:CALibration:INTernal:ASFRanges:FRANges <startFreq>,<stopFreq>[,<startFreq>,<stopFreq>][,<startFreq>,<stopFreq>][,<startFreq>,<stopFreq>][,<startFreq>,<stopFreq>]
Example	:CAL:INT:ASFR:FRAN 1.3 GHz,1.8 GHz,2.5 GHz,3.9 GHz :CAL:INT:ASFR:FRAN?
Notes	<startFreq>: Start frequency of an alignment <stopFreq>: Stop frequency of an alignment To process alignment for a single frequency point, set <startFreq> = <stopFreq>
Dependencies	Only appears when "Align VXT Transceiver" on page 509 is ON Error message “Invalid alignment frequency range” is reported if start and stop frequencies are invalid, such as: 1. Stop frequency - Start frequency < 0 2. the count of start and stop frequency is not even 3. the frequency is out of range. See "More Information" on page 513 4. more than 5 pairs of start and stop frequency are listed
Preset	1.0 GHz, 2.0 GHz

More Information

When "Enable Extended Freq Range" on page 512 is not active, the frequency range depends on the VXT models. The table below lists the Start and Stop Frequency Ranges for VXT models M9410A/11A/15A:

Hardware	Options	Min Frequency	Max Frequency
M9410A/11A	F06	330 MHz	6.08 GHz
M9410A/11A	F06 & EP6	330 MHz	6.6 GHz

Hardware	Options	Min Frequency	Max Frequency
M9410A/11A	F06 & LFE & EP6	6.5 kHz	6.6 GHz
M9415A/16A	F06	330 MHz	6.6 GHz
M9415A/16A	F08	330 MHz	8.6 GHz
M9415A/16A	F12	330 MHz	12.9 GHz

When Enable Extended Freq Range is active, the frequency range depends on the extensions connected to VXT models. The table below lists the Start and Stop Frequency Range of VXT models with Remote Radio Heads/CIU:

Connected with Radio Heads/CIU	Min frequency	Max frequency	IF Frequency range
VXT + CIU	5.9 GHz	12 GHz	1.4 GHz ~ 4.6 GHz
VXT + CIU + RRH	24.25 GHz	43.5 GHz	2.5 GHz ~ 4.5 GHz
VXT + M1742A	10 GHz	32 GHz	3.0 GHz ~ 5.5 GHz
VXT + M1749B-F43	22.7 GHz	43.5 GHz	2.5 GHz ~ 4.5 GHz
VXT + M1749B-F49	22.7 GHz	49.8 GHz	2.5 GHz ~ 4.5 GHz
VXT + M9471A + M1749B-F49	22.7 GHz	49.8 GHz	2.5 GHz ~ 4.5 GHz

NOTE **The Min frequency and Max frequency are also the preset frequencies. It is recommended to keep the preset frequency range for VXT models with extensions. An alignment with the full IF Frequency range will be executed ignoring the specific ranges.**

The table below lists the Frequency Range of M941xE(VXT Models with M9471A)

Options	Min Frequency	Max Frequency
Without LFE	330 MHz	26.5 GHz
LFE option in M941xA or M9471A	750 kHz	26.5 GHz

Enable

Enables or disables the selected frequency ranges.

Preset
```
Row 1: ON
Other rows: OFF
```

4.7.2.24 Align External Mixer Path

Immediately executes an alignment of the External Mixer Path inside the VXT models M9415A/16A. External Mixer Path is used when the RF Port is connected to an external Remote Radio Head (RRH). It provides a better performance compared

to the normal path. External Mixer Path Alignment covers frequencies from 2.4 GHz to 3.4 GHz of the external mixer path.

NOTE **This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.**

There is no alert for the External Mixer Path alignment. You are responsible for checking the temperature shift since the last Align Now, External Mixer Path, to determine whether the external mixer path alignment needs to be executed.

Remote Command	`:CALibration:INTernal:EMPath` `:CALibration:INTernal:EMPath?`
Example	`:CAL:INT:EMP`
Notes	The query initiates an alignment and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9415A/16A when Option MXP is installed
Couplings	Initializes the time for the Last Align External Mixer Path Now, All Time Records the temperature for the Last Align External Mixer Path Now, All Temperature

4.7.2.25 Align Low Band

Accesses Low Band alignment processes that are immediate action operations. They perform complete operations and run until they are complete. Low Band Alignment covers frequencies from 380 MHz to 4.3 GHz of the non-external mixer path.

NOTE **This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.**

There is no alert for the Low Band alignment. You are responsible for checking the temperature shift since the last Align Now, Align Low Band, to determine whether the Low Band alignment needs to be executed.

Remote Command	`:CALibration:INTernal:LBANd[:ALL]` `:CALibration:INTernal:LBANd[:ALL]?`
Example	`:CAL:INT:LBAN`
Notes	The query initiates an Alignment, and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9415A/16A
Couplings	Initializes the time for the Last Align Low Band Now, All Time Records the temperature for the Last Align Low Band Now, All Temperature

4.7.2.26 Align High Band

Accesses High Band alignment processes that are immediate action operations. They perform complete operations and run until they are complete. High Band Alignment covers frequencies from 4.3 GHz to 12 GHz of the non-external mixer path.

NOTE **This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.**

There is no alert for the High Band alignment. You are responsible for checking the temperature shift since last Align Now, Align High Band, to determine whether the High Band alignment needs to be executed.

Remote Command	`:CALibration:INTernal:HBANd[:ALL]` `:CALibration:INTernal:HBANd[:ALL]?`
Example	`:CAL:INT:HBAN`
Notes	The query initiates an Alignment, and returns 0 if successful, or 1 if failed
Dependencies	Only appears in VXT models M9415A/16A
Couplings	Initializes the external time for the Last Align High Band Now, All Time Records the temperature for the Last Align High Band Now, All Temperature

4.7.3 Path Delay Calibration

Path Delay Calibration is used to remove the time delay differences between multiple power channels of a module.

Dependencies	Only available in VXT modules M9410A/11A Only for modules with matched Digital board hardware version, which means the modules are in same FPGA version The matched hardware version information is in below table

	Digital board Hardware version	Matched module
M9410A	2,3,4,6,10,11	Yes
M9410A	12, 13	Yes
M9411A	18	Yes
M9411A	20,21	Yes
M9411A	12,13	Yes
M9411A	0,1,2,3,4,6,10,11	Yes

4.7.3.1 Source Path Delay Calibration

Accesses the Source Path Delay Calibration processes, which are immediate-action operations and perform complete operations, running until they are complete.

- Connect the RF In of the primary module to the OUT port (COMMON, PORT 1) of the power splitter (11667B is recommended)
- Before performing Path Delay Calibration of Sources, please confirm that:
  - Each of the RF Out ports is connected to the RF In port of the Primary channel, using a power splitter (11667B is recommended)
  - The cables between the power splitter (11667B is recommended) and the Source output ports are of the same length
- A popup window appears. Press OK to continue the calibration

If the instrument is in MIMO sync, and you send a SCPI command to run Calibration, the calibration process is not executed and instrument a warning is generated ("-221,Setting Conflict; Calibrations are not available while MIMO Sync is On"). To execute Calibration, you must first stop MIMO, manually or via SCPI.

Remote Command	`:CALibration:PDELay:SOURce` `:CALibration:PDELay:SOURce?`
Example	`:CAL:PDEL:SOUR`
Notes	The query initiates an Alignment and returns 0 if successful, or 1 if failed If the calibration process detected a faulty state, an error will be generated: "Misc/System Alignment Failure". Calibration will be aborted. Please see event log for more information: 1. Cables are not connected 2. Power control failure 3. Hardware failure 4. M9300A 10MHz reference open failure
Dependencies	Only appears in VXT models M9410A/11A Only for modules with matched Digital board hardware version, which means the modules are in same FPGA version

4.7.3.2 Path Delay Correction On/Off(Remote Command only)

On/Off the path delay correction to enable the calibration data on the source of the module.

Remote Command	:CALibration:PDELay:CORRection ON | OFF :CALibration:PDELay:CORRection?
Example	:CAL:PDEL:CORR ON
Notes	If the Path Delay Calibration has never been performed and there is no calibration correction data in the controller, an alert is generated
Preset	OFF
Range	ON|OFF

4.7.4 Temperature Drift Correction On/Off (Remote Command Only)

Lets you turn on/off the temperature drift correction at the instrument side.

Remote Command	:CALibration:RRHead:TDCorrection[:STATe] ON | OFF :CALibration:RRHead:TDCorrection[:STATe]?
Example	:CAL:RRH:TDC ON :CAL:RRH:TDC?
Dependencies	Only supported in S9110A-F32
Preset	OFF
Range	ON|OFF

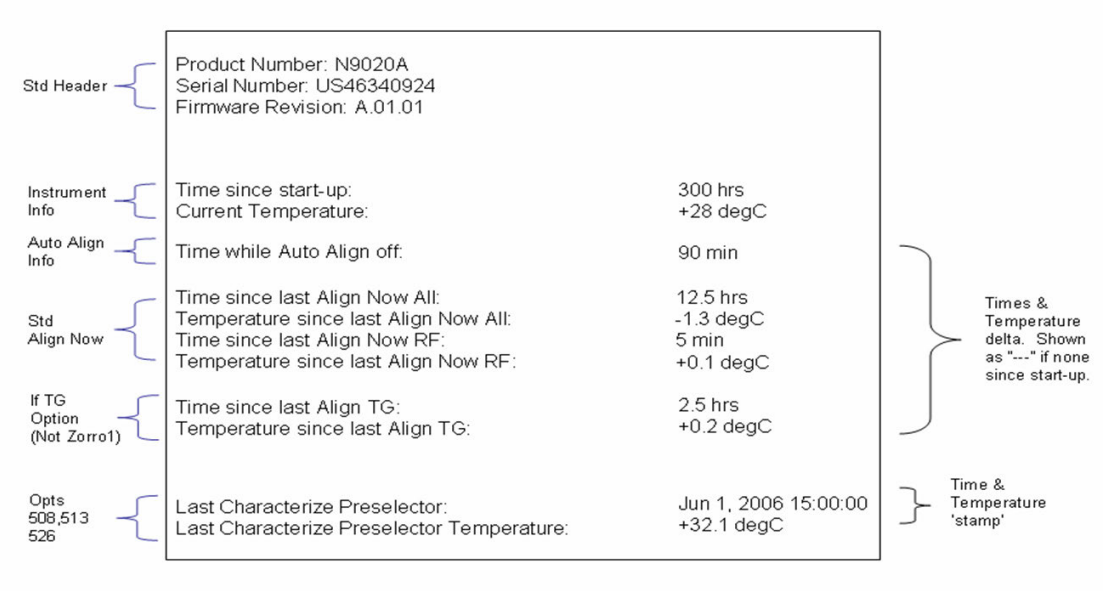
4.7.5 Show Alignment Statistics

Shows alignment information you can use to ensure that the instrument is operating in a specific manner. The Show Alignment Statistics screen is where you can view time and temperature information.

Values displayed are only updated when the Show Alignment Statistics screen is invoked. They are not updated while the Show Alignment Statistics screen is being displayed. The remote commands that access this information obtain current values.

Note that some of these statistics only display if your instrument supports them; for example, Last Source Align Now All Time only shows up in instruments which contain a source which supports auto alignments.

An example of the Show Alignment Statistics screen would be similar to:



"Time while Auto Align off" is not available in VXT models M9410A/11A.

A successful **Align Now, RF** sets the Last Align RF temperature to the current temperature, and resets the Last Align RF time. A successful **Align Now All** or **Align Now All but RF** sets the Last Align Now All temperature to the current temperature, and resets the Last Align Now All time. A successful **Align Now All** also resets the Last Align RF items if the RF portion of the **Align Now** succeeded.

Example	`:SYST:SHOW ALIGN`
Notes	The values displayed on the screen are only updated upon entry to the screen, and not updated while the screen is being displayed

The following data-specific queries are available:

Query Time since Startup

Remote Command	`:SYSTem:PON:TIME?`
Example	`:SYST:PON:TIME?`
Notes	Value is the time since the most recent start-up in seconds
State Saved	No

Query Current Temperature

Remote Command	`:CALibration:TEMPerature:CURRent?`
Example	`:CAL:TEMP:CURR?`
Notes	Value is in degrees Centigrade
State Saved	No

Query Current Temperature at Remote Radio Head

Remote Command	`:CALibration:TEMPerature:CURRent:RRHead?`
Example	`:CAL:TEMP:CURR:RRH?`
Notes	Value is in degrees Centigrade
Dependencies	Only appears when Align RRH Amplitude is available
State Saved	No

Query Current Temperature at Remote Radio Head LO

Remote Command	`:CALibration:TEMPerature:CURRent:RRHead:LO?`
Example	`:CAL:TEMP:CURR:RRH:LO?`
Notes	Value is in degrees Centigrade
Dependencies	Only appears when Align RRH LO Power is available
State Saved	No

Query Time since Last Align Now All

Remote Command	`:CALibration:TIME:LALL?`
Example	`:CAL:TIME:LALL?`
Notes	Value is the elapsed time, in seconds, since the last successful **Align Now All** or **Align Now All but RF** was executed
State Saved	No

Query Temperature of Last Align Now All

Remote Command	`:CALibration:TEMPerature:LALL?`
Example	`:CAL:TEMP:LALL?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now All** or **Align Now All but RF** was executed
State Saved	No

Query Time since Last Align Now Receiver

Remote Command	`:CALibration:TIME:INTernal:RECeiver?`
Example	`:CAL:TIME:INT:REC?`
Notes	Value in hours since the last successful **Align Now Receiver**
Dependencies	Only appears in VXT models M9410A/11A
State Saved	No

Query Temperature of Last Align Now Receiver

Remote Command	`:CALibration:TEMPerature:INTernal:RECeiver?`
Example	`:CAL:TEMP:INT:REC?`
Notes	Value in degrees Centigrade when the last successful **Align Now Receiver** was executed
Dependencies	Only appears in VXT models M9410A/11A
State Saved	No

Query Time since Last Align Now Source

Remote Command	`:CALibration:TIME:INTernal:SOURce?`
Example	`:CAL:TIME:INT:SOUR?`
Notes	Value in hours since the last successful **Align Now Source**
Dependencies	Only appears in VXT models M9410A/11A
State Saved	No

Query Temperature of Last Align Now Source

Remote Command	`:CALibration:TEMPerature:INTernal:SOURce?`
Example	`:CAL:TEMP:INT:SOUR?`
Notes	Value in degrees Centigrade when the last successful **Align Now Source** was executed
Dependencies	Only appears in VXT models M9410A/11A
State Saved	No

Query Time since Last Align Now Fast

Remote Command	`:CALibration:TIME:INTernal:FAST?`
Example	`:CAL:TIME:INT:FAST?`
Notes	Value in hours since the last successful **Align Now Fast**
Dependencies	Only appears in VXT models M9410A/11A/15A/16A
State Saved	No

Query Temperature of Last Align Now Fast

Remote Command	`:CALibration:TEMPerature:INTernal:FAST?`
Example	`:CAL:TEMP:INT:FAST?`
Notes	Value in degrees Centigrade when the last successful **Align Now Fast** was executed
Dependencies	Only appears in VXT models M9410A/11A/15A/16A
State Saved	No

Query Time since Last Align Now LO Leakage

Remote Command	`:CALibration:TIME:INTernal:LOLeakage?`
Example	`:CAL:TIME:INT:LOL?`
Notes	Value in hours since the last successful **Align Now LO Leakage**
Dependencies	Only appears in VXT models M9410A/11A/15A/16A
State Saved	No

Query Temperature of Last Align Now LO Leakage

Remote Command	`:CALibration:TEMPerature:INTernal:LOLeakage?`
Example	`:CAL:TEMP:INT:LOL?`
Notes	Value in degrees Centigrade when the last successful **Align Now LO Leakage** was executed
Dependencies	Only appears in VXT models M9410A/11A/15A/16A
State Saved	No

Query Time since Last Align Fast Amplitude

Remote Command	`:CALibration:TIME:INTernal:AMPLitude:FAST?`
Example	`:CAL:TIME:INT:AMPL:FAST?`
Notes	Value in hours since the last successful **Align Fast Amplitude** Returns `NaN` if Align Fast Amplitude has never been performed on the instrument
Dependencies	Only Appears when Align Fast Amplitude is available
State Saved	No

Query Temperature of Last Align Fast Amplitude

Remote Command	`:CALibration:TEMPerature:INTernal:AMPLitude:FAST?`
Example	`:CAL:TEMP:INT:AMPL:FAST?`
Notes	Value in degrees Centigrade when the last successful **Align Fast Amplitude** was executed Returns 9.91E+37(`NaN`) if Align Fast Amplitude has never been performed on the instrument
Dependencies	Only Appears when Align Fast Amplitude is available
State Saved	No

Query Time since Last Align Now IF Cable

Remote Command	`:CALibration:TIME:INTernal:RRHead:IFCable?`
Example	`:CAL:TIME:INT:RRH:IFC?`
Notes	Value in hours since the last successful **Align Now IF Cable**

Dependencies	Only appears in VXT based solutions with M1740A/41A/42A/49A/49B RRH
State Saved	No
Backwards Compatibility SCPI	`:CALibration:TIME:INTernal:IFCable?`

Query Temperature of Last Align Now IF Cable

Remote Command	`:CALibration:TEMPerature:INTernal:RRHead:IFCable?`
Example	`:CAL:TEMP:INT:RRH:IFC?`
Notes	Value in degrees Centigrade when the last successful **Align Now IF Cable** was executed
Dependencies	Only appears in VXT based solutions with M1740A/41A/42A/49A/49B RRH
State Saved	No
Backwards Compatibility SCPI	`:CALibration:TEMPerature:INTernal:IFCable?`

Query Time since Last Align LO Clock

Remote Command	`:CALibration:TIME:INTernal:RRHead:LOSync?`
Example	`:CAL:TIME:INT:RRH:LOS?`
Notes	Value in hours since the last successful Align LO Clock
Dependencies	Only appears in VXT based solutions with M1741A/42A/49A/49B RRH
State Saved	No
Backwards Compatibility SCPI	`:CALibration:TIME:INTernal:LOSync?`

Query Temperature of Last Align LO Clock

Remote Command	`:CALibration:TEMPerature:INTernal:RRHead:LOSync?`
Example	`:CAL:TEMP:INT:RRH:LOS?`
Notes	Value in degrees Centigrade when the last successful Align LO Clock was executed
Dependencies	Only appears in VXT based solutions with M1741A/42A/49A/49B RRH
State Saved	No
Backwards Compatibility SCPI	`:CALibration:TEMPerature:INTernal:LOSync?`

Query Time since Last Noise Power for IQNC

Remote Command	`:CALibration:TIME:INTernal:NPOWer?`
Example	`:CAL:TIME:INT:NPOW?`

Notes	Value in hours since the last successful **Align Noise Power for IQNC**
Dependencies	Only Appears when Align Noise Power for IQNC is available
State Saved	No

Query Temperature of Last Align Noise Power for IQNC

Remote Command	`:CALibration:TEMPerature:INTernal:NPOWer?`
Example	`:CAL:TEMP:INT:NPOW?`
Notes	Value in degrees Centigrade when the last successful **Align Noise Power for IQNC** was executed
Dependencies	Only Appears when Align Noise Power for IQNC is available
State Saved	No

Query Time since Last Align RRH Amplitude

Remote Command	`:CALibration:TIME:INTernal:RRHead:AMPLitude?`
Example	`:CAL:TIME:INT:RRH:AMPL?`
Notes	Value in hours since the last successful Align RRH Amplitude
Dependencies	Only appears in VXT based solutions with M1741A/42A/49A/49B RRH
State Saved	No
Backwards Compatibility SCPI	`:CALibration:TIME:INTernal:RRHAmp?`

Query Temperature of Last Align RRH Amplitude

Remote Command	`:CALibration:TEMPerature:INTernal:RRHead:AMPLitude?`
Example	`:CAL:TEMP:INT:RRH:AMPL?`
Notes	Value in degrees Centigrade when the last successful Align RRH Amplitude was executed
Dependencies	Only appears in VXT based solutions with M1741A/42A/49A/49B RRH
State Saved	No
Backwards Compatibility SCPI	`:CALibration:TEMPerature:INTernal:RRHAmp?`

Query Time since Last Align Fast RRH Amplitude

Remote Command	`:CALibration:TIME:INTernal:RRHead:AMPLitude:FAST?`
Example	`:CAL:TIME:INT:RRH:AMPL:FAST?`
Notes	Value in hours since the last successful Align Fast RRH Amplitude
Dependencies	Only appears in VXT based solutions with M1742A RRH
State Saved	No

Query Temperature of Last Align Fast RRH Amplitude

Remote Command	`:CALibration:TEMPerature:INTernal:RRHead:AMPLitude:FAST?`
Example	`:CAL:TEMP:INT:RRH:AMPL:FAST?`
Notes	Value in degrees Centigrade when the last successful Align Fast RRH Amplitude was executed
Dependencies	Only appears in VXT based solutions with M1742A RRH
State Saved	No

Query Time since Last Align RRH LO Power

Remote Command	`:CALibration:TIME:INTernal:RRHead:LOPower?`
Example	`:CAL:TIME:INT:RRH:LOP?`
Notes	Value in hours since the last successful Align RRH LO Power
Dependencies	Only appears in VXT based solutions with M1741A/49A/49B RRH
State Saved	No

Query Temperature of Last Align RRH LO Power

Remote Command	`:CALibration:TEMPerature:INTernal:RRHead:LOPower?`
Example	`:CAL:TEMP:INT:RRH:LOP?`
Notes	Value in degrees Centigrade when the last successful Align RRH LO Power was executed
Dependencies	Only appears in VXT based solutions with M1741A/49A/49B RRH
State Saved	No

Query Time since Last Align Now RF

Remote Command	`:CALibration:TIME:LRF?`
Example	`:CAL:TIME:LRF?`
Notes	Value is the elapsed time, in seconds, since the last successful **Align Now, RF** was executed, either individually or as a component of **Align Now All**
State Saved	No

Query Temperature of Last Align Now RF

Remote Command	`:CALibration:TEMPerature:LRF?`
Example	`:CAL:TEMP:LRF?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now RF** was executed, either individually or as a component of **Align Now All**
State Saved	No

Query Time since Last Align IF

Remote Command	`:CALibration:TIME:LIF?`
Example	`:CAL:TIME:LIF?`
Notes	Value is the elapsed time, in seconds, since the last successful **Align IF** was executed
State Saved	No

Query Temperature of Last Align IF

Remote Command	`:CALibration:TEMPerature:LIF?`
Example	`:CAL:TEMP:LIF?`
Notes	Value is in degrees Centigrade at which the last successful **Align IF** was executed
State Saved	No

Query Time since Last Characterize Preselector

Remote Command	`:CALibration:TIME:LPReselector?`
Example	`:CAL:TIME:LPR?`
Notes	Value is the date and time the last successful **Characterize Preselector** was executed. The date is separated from the time by a space character Returns "" if no **Characterize Preselector** has ever been performed on the instrument
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Query Temperature of Last Characterize Preselector

Remote Command	`:CALibration:TEMPerature:LPReselector?`
Example	`:CAL:TEMP:LPR?`
Notes	Value is in degrees Centigrade at which the last successful **Characterize Preselector** was executed
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Query Time since Auto Align Off

Remote Command	`:CALibration:AUTO:TIME:OFF?`

Example	`:CAL:AUTO:TIME:OFF?`
Notes	Value is the elapsed time, in seconds, since **Auto Align** has been set to **Off** or **Off with Alert**. The value is 0 if **Auto Align** is `ALL` or `NORF`
State Saved	No

Query Time since Last Align Now 20 Hz - 30 MHz

Remote Command	`:CALibration:TIME:RFPSelector:LCONducted?`
Example	`:CAL:TIME:RFPS:LCON?`
Notes	Values are the date and time the last successful **Align Now, 20 Hz – 30 MHz** was executed. The date is separated from the time by a semi-colon character
State Saved	No

Query Temperature of Last Align Now 20 Hz - 30 MHz

Remote Command	`:CALibration:TEMPerature:RFPSelector:LCONducted?`
Example	`:CAL:TEMP:RFPS:LCON?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now, 20 Hz – 30 MHz** was executed
State Saved	No

Query Time since Last Align Now 30 MHz - 3.6 GHz

Remote Command	`:CALibration:TIME:RFPSelector:LRADiated?`
Example	`:CAL:TIME:RFPS:LRAD?`
Notes	Value is the date and time the last successful **Align Now, 30 MHz – 3.6 GHz** was executed. The date is separated from the time by a semi-colon character
State Saved	No

Query Temperature of Last Align Now 30 MHz - 3.6 MHz

Remote Command	`:CALibration:TEMPerature:RFPSelector:LRADiated?`
Example	`:CAL:TEMP:RFPS:LRAD?`
Notes	Value is in degrees Centigrade at which the last successful **Align Now, 30 MHz – 3.6 GHz** was executed
State Saved	No

Query Next Scheduled Alignment Time

Remote Command	`:CALibration:RFPSelector:SCHeduler:TIME:NEXT?` Returns data using the following format: YYYY/MM/DD; HH:MM:SS
Example	`:CAL:RFPS:SCH:TIME:NEXT?`

Notes	The next run time will be updated based on the start date/time and recurrence set by the user
	"date" is representation of the date the task will run in the form:
	`YYYY/MM/DD`
	where:
	– YYYY is the four-digit representation of year. (for example, 2009)
	– MM is the two-digit representation of month. (for example, 01 to 12)
	– DD is the two-digit representation of the day. (for example, 01 to 28, 29, 30 or 31 depending on the month and year)
	"time" is a representation of the time of day the task will run in the form:
	`HH:MM:SS`
	where:
	– HH is the two-digit representation of the hour in 24-hour format
	– MM is the two-digit representation of minute
	– SS is the two-digit representation of seconds

State Saved	No

Query Time since Last Align Now External Mixer Path

Remote Command	`:CALibration:TIME:INTernal:EMPath?`
Example	`:CAL:TIME:INT:EMP?`
Notes	Value in hours since the last successful **Align Now External Mixer Path**
Dependencies	Only appears option MXP is installed
State Saved	No

Query Temperature of Last Align Now External Mixer Path

Remote Command	`:CALibration:TEMPerature:INTernal:EMPath?`
Example	`:CAL:TEMP:INT:EMP?`
Notes	Value in degrees Centigrade when the last successful **Align Now External Mixer Path** was executed
Dependencies	Only appears option MXP is installed
State Saved	No

Query Time since Last Align Now Low Band

Remote Command	`:CALibration:TIME:INTernal:LBANd?`
Example	`:CAL:TIME:INT:LBAN?`
Notes	Value in hours since the last successful **Align Now Low Band**
Dependencies	Only appears in VXT models M9415A/16A
State Saved	No

Query Temperature of Last Align Now Low Band

Remote Command	`:CALibration:TEMPerature:INTernal:LBANd?`
Example	`:CAL:TEMP:INT:LBAN?`
Notes	Value in degrees Centigrade when the last successful **Align Now Low Band** was executed
Dependencies	Only appears in VXT models M9415A/16A
State Saved	No

Query Time since Last Align Now High Band

Remote Command	`:CALibration:TIME:INTernal:HBAN?`
Example	`:CAL:TIME:INT:HBAN?`
Notes	Value in hours since the last successful **Align Now High Band**
Dependencies	Only appears in VXT models M9415A/16A
State Saved	No

Query Temperature of Last Align Now High Band

Remote Command	`:CALibration:TEMPerature:INTernal:HBANd?`
Example	`:CAL:TEMP:INT:HBAN?`
Notes	Value in degrees Centigrade when the last successful **Align Now High Band** was executed
Dependencies	Only appears in VXT models M9415A/16A
State Saved	No

Query Time since Last Align VXT Transceiver

Remote Command	`:CALibration:TIME:INTernal:VXT:TRANsceiver?`
Example	`:CAL:TIME:INT:VXT:TRAN?`
Notes	Value in hours since the last successful **Align VXT Transceiver** Returns `NaN` if Align VXT Transceiver has never been performed on the instrument
Dependencies	Only appears in M9410E/11E/15E/16E
State Saved	No

Query Temperature of Last Align VXT Transceiver

Remote Command	`:CALibration:TEMPerature:INTernal:VXT:TRANsceiver?`
Example	`:CAL:TEMP:INT:VXT:TRAN?`
Notes	Value in degrees Centigrade when the last successful **Align VXT Transceiver** was executed Returns 9.91E+37(`NaN`) if Align VXT Transceiver has never been performed on the instrument
Dependencies	Only appears in M9410E/11E/15E/16E
State Saved	No

Query Time since Last Align Up Down Converter

Remote Command	`:CALibration:TIME:UPDown:CONVerter?`
Example	`:CAL:TIME:UPD:CONV?`
Notes	Value in hours since the last successful **Align Up Down Converter** Returns `NaN` if Align Up Down Converter has never been performed on the instrument
Dependencies	Only appears in M9410E/11E/15E/16E
State Saved	No

Query Temperature of Last Align Up Down Converter

Remote Command	`:CALibration:TEMPerature:UPDown:CONVerter?`
Example	`:CAL:TEMP:UPD:CONV?`
Notes	Value in degrees Centigrade when the last successful **Align Up Down Converter** was executed Returns 9.91E+37(`NaN`) if Align Up Down Converter has never been performed on the instrument
Dependencies	Only appears in VXT models M9410A/11A and M9410E/11E
State Saved	No

Query Time since Last Align Fast Up Down Converter

Remote Command	`:CALibration:TIME:UPDown:CONVerter:FAST?`
Example	`:CAL:TIME:UPD:CONV:FAST?`
Notes	Value in hours since the last successful **Align Fast Up Down Converter** Returns `NaN` if Align Fast Up Down Converter has never been performed on the instrument
Dependencies	Only appears in M9410E/11E/15E/16E
State Saved	No

Query Temperature of Last Align Fast Up Down Converter

Remote Command	`:CALibration:TEMPerature:UPDown:CONVerter:FAST?`
Example	`:CAL:TEMP:UPD:CONV:FAST?`

Notes	Value in degrees Centigrade when the last successful **Align Fast Up Down Converter** was executed Returns 9.91E+37(`NaN`) if Align Fast Up Down Converter has never been performed on the instrument
Dependencies	Only appears in M9410E/11E/15E/16E
State Saved	No

Query Time since Last Path Delay Calibration

Remote Command	`:CALibration:TIME:PDELay:SOURce?`
Example	`:CAL:TIME:PDEL:SOUR?`
Notes	The value is the elapsed time in hours since the last successful **Path Delay Calibration** has been performed Returns `NaN` if the **Path Delay Calibration** has never been performed
State Saved	No

Query Temperature of Last Path Delay Calibration

Remote Command	`:CALibration:TEMPerature:PDELay:SOURce?`
Example	`:CAL:TEMP:PDEL:SOUR?`
Notes	The value is in degrees Centigrade at which the last successful **Path Delay Calibration** has been performed Returns 9.91E+37(`NaN`) if the **Path Delay Calibration** has never been performed
State Saved	No

4.7.6 Timebase DAC

Lets you change the setting of the **Timebase DAC** from a factory calibrated setting to your own desired setting.

The display shows the current **Timebase DAC** setting at the top, and gives you a choice of `CALibrated` or `USER` setting. There is also a field for you to enter your desired setting.

Dependencies	Does not appear in VXT and M941xE

4.7.6.1 Timebase DAC

Allows control of the internal 10 MHz reference oscillator timebase. This may be used to adjust for minor frequency alignment between your signal's reference and

the internal frequency reference. This adjustment has no effect if the instrument is operating with an External Frequency Reference.

If the value of the Timebase DAC changes (by switching to `CALibrated` from `USER` with User Value set to a different value, or in `USER` with a new value entered) an alignment may be necessary. The alignment system will take appropriate action; which will either invoke an alignment or cause an Alert.

The `CALibrated` setting sets the Timebase DAC to the value established during factory or field calibration. In this case the value displayed at the top of the screen is the calibrated value.

The `USER` setting sets the Timebase DAC to the value set on the User Value control. In this case the value displayed at the top of the screen is the user value.

Remote Command	`:CALibration:FREQuency:REFerence:MODE CALibrated | USER` `:CALibration:FREQuency:REFerence:MODE?`
Example	`:CAL:FREQ:REF:MODE CAL`
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due
Dependencies	Not available in UXM
Preset	Unaffected by Preset, but set to `CALibrated` by Restore Defaults >"Alignments" on page 484
State Saved	No

4.7.6.2 User Value

Lets you set the Timebase DAC to a value other than the value established during the factory or field calibration. The current value of the DAC is displayed at the top of the screen. This will be the Calibrated value if Timebase DAC is set to `CALibrated`.

Remote Command	`:CALibration:FREQuency:REFerence:FINE <integer>` `:CALibration:FREQuency:REFerence:FINE?`
Example	`:CAL:FREQ:REF:FINE 8191`
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due
Couplings	Setting `:CAL:FREQ:REF:FINE` sets `:CAL:FREQ:REF:MODE USER`
Preset	Unaffected by Preset, but set to the factory setting by Restore Defaults >"Alignments" on page 484
State Saved	No
Min	0
Max	16383
Backwards Compatibility	`:CALibration:FREQuency:REFerence:COARse` ESA hardware contained two DAC controls for the Timebase. In X-Series the command `:CALibra-`

SCPI	`tion:FREQuency:REFerence:FINE` is the method for adjusting the timebase. The `COARse` option is provided as an alias to `FINE` Backwards Compatibility Command
Remote Command	`:CALibration:FREQuency:REFerence:COARse <integer>` `:CALibration:FREQuency:REFerence:COARse?`
Example	`:CAL:FREQ:REF:COAR 8191`
Notes	This is an alias for `:CAL:FREQ:REF:FINE`. Any change to `COARse` is reflected in `FINE` and *vice-versa*. See `:CAL:FREQ:REF:FINE` for description of functionality
Couplings	Setting `:CAL:FREQ:REF:COAR` sets `:CAL:FREQ:REF:MODE USER`

4.7.7 Advanced

Accesses alignment processes that are immediate action operations that perform operations that run until complete. Advanced alignments are performed on an irregular basis, or require additional operator interaction.

Dependencies	Not available in UXM

4.7.7.1 Characterize Preselector

The Preselector tuning curve drifts over temperature and time. Recognize that the Amplitude, Presel Center function adjusts the preselector for accurate amplitude measurements at an individual frequency. Characterize Preselector improves the amplitude accuracy by ensuring the Preselector is approximately centered at all frequencies without the use of the Amplitude, Presel Center function. Characterize Preselector can be useful in situations where absolute amplitude accuracy is not of utmost importance, and the throughput savings or convenience of not performing a Presel Center is desired. Presel Center is required prior to any measurement for best (and warranted) amplitude accuracy.

Keysight recommends that the Characterize Preselector operation be performed yearly as part of any calibration, but performing this operation every three months can be worthwhile.

Characterize Preselector immediately executes a characterization of the Preselector, which is a YIG-tuned filter (YTF). The instrument stops any measurement currently underway, performs the characterization, then restarts the measurement from the beginning (similar to pressing the Restart key).

The query (`:CALibration:YTF?`) invokes the alignment of the YTF subsystem, and returns a success or failure value.

A failure encountered during alignment generates the Error Condition message "Characterize Preselector failure" and sets Bit 3 in the `STATus:QUEStionable:CALibration:EXTended:FAILure` status register. Successful completion of **Characterize Preselector** clears this Condition. It also begins the elapsed time counter for Last Characterize Preselector Time, and captures the Last Characterize Preselector Temperature.

The last Characterize Preselector Time and Temperature survives across the power cycle, as this operation is performed infrequently.

NOTE **The Characterize Preselector function can be interrupted, by pressing the Cancel (ESC) front-panel key, or remotely with Device Clear followed by the `:ABORt SCPI` command. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an uncharacterized preselector. You should re-execute this function and allow it to finish before making any further preselected measurements.**

Remote Command	`:CALibration:YTF` `:CALibration:YTF?`
Example	`:CAL:YTF`
Notes	`:CALibration:YTF?` returns 0 if successful, or 1 if failed (including interfering user signal) While **Advanced**, **Characterize Preselector** is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion clears Bit 9 in the Status Questionable Calibration register A failure encountered during alignment generates the Error Condition message "Characterize Preselector failed" and sets Bit 9 in the Status Questionable Calibration register For Options that support frequencies > 3.6 GHz only
Dependencies	This control does not appear in models that do not contain preselectors. In these models the SCPI command is accepted without error, but no action is taken
Couplings	Initializes the time for the Last Characterize Preselector Time Records the temperature for the Last Characterize Preselector Temperature

Overlapped Command

Remote Command	`:CALibration:YTF:NPENding`
Example	`:CAL:YTF:NPEN`
Notes	`:CALibration:YTF:NPENding` is the same as `:CALibration:YTF`, including all conditions, status register bits, except that this SCPI command *does not block* the SCPI session, so you should use status register bits to query if the calibration is successfully completed or not

Typical usage is:

1. `:CALibration:YTF:NPENding` (Start a YTF calibration)
2. `:STATus:OPERation:CONDition?` (Check if the calibration is completed or not, If Bit 0 is set, then the system is doing calibration, and you should repeat this query until the bit is cleared)
3. `:STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?` (Check whether Bit 2 is set. If this bit is set, that means there are some errors in previous internal source calibration)

4.7.7.2 Characterize Reference Clock

Calibrates the Reference Input Phase with the External Reference Output. This feature is only available when either option DP2 or B40 is present. It requires connecting the 10 MHz OUT to the EXT REF IN port with a BNC cable before running the characterization.

See "Front panel guided calibration sequence" on page 536

Remote Command	`:CALibration:REFerence:CLOCk?`

Example	`:CAL:REF:CLOC:INIT?`
	connect cable
	`:CAL:REF:CLOC?`
	disconnect cable
	`:CAL:REF:CLOC:END?`

Notes	`:CALibration:REFerence:CLOCk?` returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Initializes the time for the Last Characterize Reference Clock Time Records the temperature for the Last Characterize Reference Clock Temperature. Expected to be run after `:CAL:REF:CLOC:INIT`, and before `:CAL:REF:CLOC:END`

Remote Command	`:CALibration:REFerence:CLOCk:INITialize?`
Example	`:CAL:REF:CLOC:INIT?`
Notes	Returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Expected to be run before sending `:CAL:REF:CLOC?`. This will stop the current measurement when it has completed (does not abort the current data acquisition), and prepare the instrument for the expected cabling

Remote Command	`:CALibration:REFerence:CLOCk:END?`
Example	`:CAL:REF:CLOC:END?`

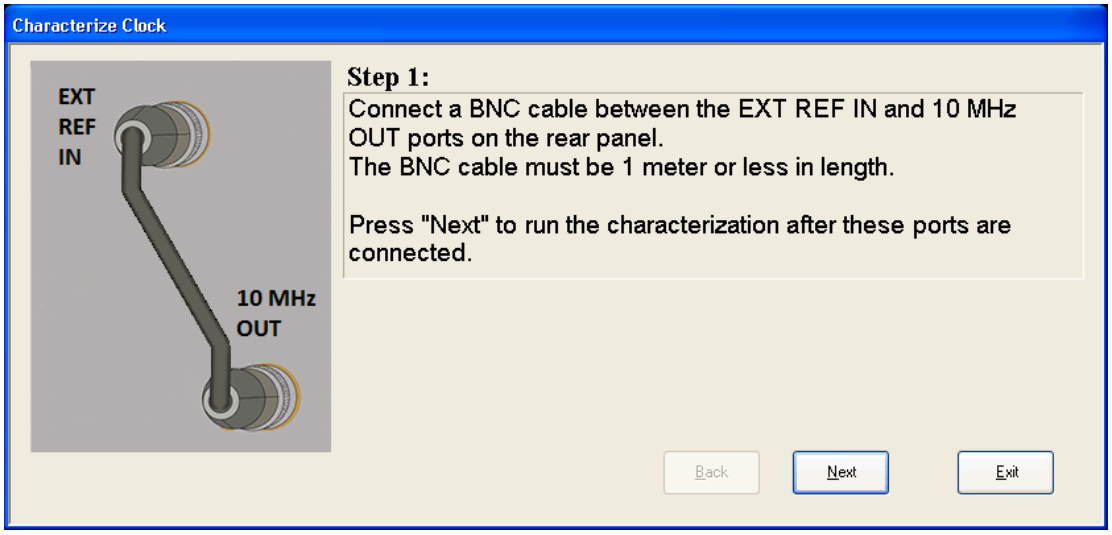
Notes	Returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Expected to be run after sending `:CAL:REF:CLOC?`, and after removing the cable used in that Characterize Reference Clock step. This will resume any queued measurements, and concludes the reference clock characterization

Remote Command	`:CALibration:TIME:REFerence:CLOCk?`
Example	`:CAL:TIME:REFerence:CLOCk?`
Notes	Value is the date and time the last successful Characterize Reference Clock was executed. The date is separated from the time by a space character. Returns “” if Characterize Reference Clock has never been performed on the instrument
Dependencies	Option DP2 or B40
State Saved	No

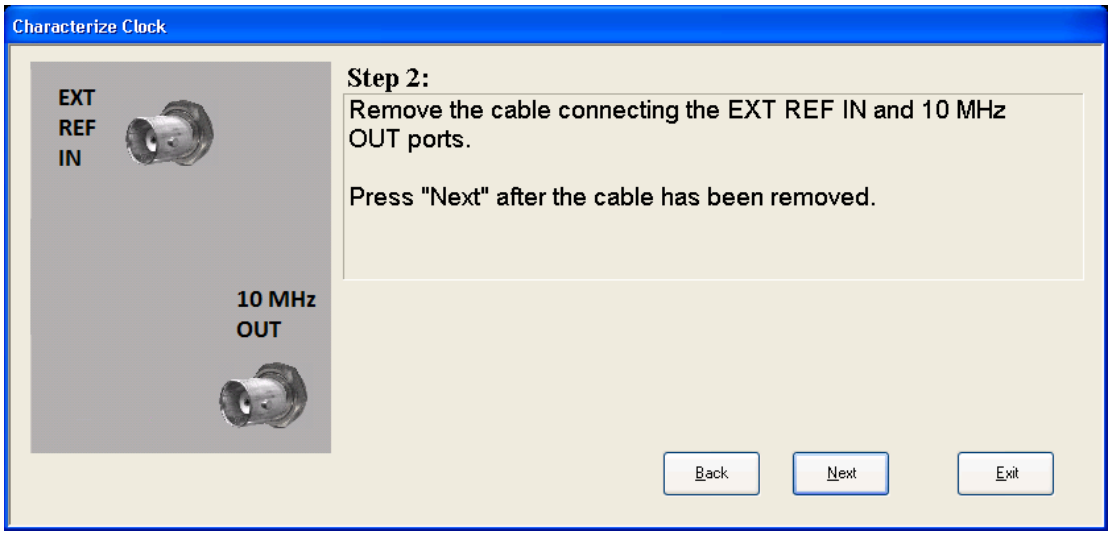
Front panel guided calibration sequence

When selecting Characterize Reference Clock via the front panel, the following form is displayed.

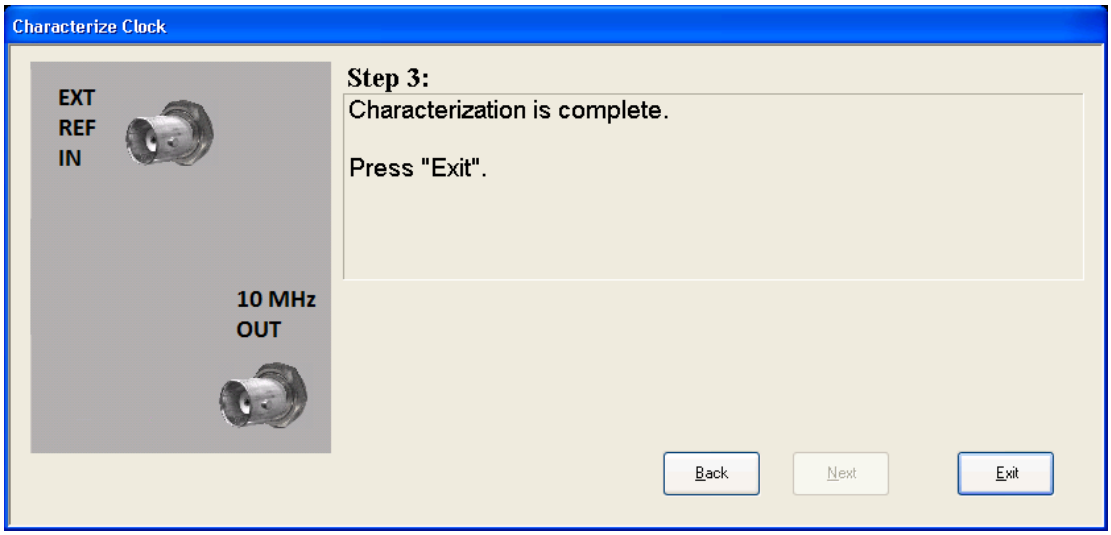
Step 1 of the guided calibration sequence:



Step 2 of the guided calibration sequence:



Step 3 of the guided calibration sequence:



4.7.7.3 Characterize Noise Floor

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. To do this, press Characterize Noise Floor. When you press this control, the instrument stops any measurement currently underway, and a dialog appears with an OK and Cancel button that says:

```
This action will take several minutes to perform. Please disconnect all cables
from the RF input and press Enter to proceed. Press ESC to cancel
```

When you press Enter or OK, the characterization proceeds. After the characterization, the instrument restarts the measurement from the beginning

(similar to pressing the **Restart** key). The characterization takes many minutes to run.

The noise floor model used by Noise Floor Extensions includes an estimation of the temperature behavior of the noise floor, but this is only an estimation. The noise floor changes little with the age of the components. However, even small changes in the estimated level of the noise floor can make large changes in the effective noise floor, because the effective noise floor is the error in the estimation of the noise floor. Keysight recommends that the **Characterize Noise Floor** operation be performed when the instrument is operating at an ambient temperature that is significantly different than the ambient temperature at which this alignment was last run. In addition, Keysight recommends that the **Characterize Noise Floor** operation be performed after the first 500 hours of operation, and once every calendar year.

The noise floor model from the last operation of **Characterize Noise Floor** survives across the power cycle.

NOTE **The Characterize Noise Floor function can be interrupted, by pressing the Cancel (ESC) front-panel key, or remotely with Device Clear followed by the `:ABORt SCPI` command. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an uncharacterized noise floor. You should re-execute this function and allow it to finish before making any further measurements with NFE. Until you do, the instrument will display a "Characterize Noise Floor required" message and set bit 12 in the Status Questionable Calibration register (`STATus:QUEStionable:CALibration:EXTended:NEEDed`).**

Remote Command	`:CALibration:NFLoor` `:CALibration:NFLoor?`
Example	`:CAL:NFL`
Notes	`:CALibration:NFLoor?` returns 0 if successful, or 1 if failed (including interfering user signal) This command is sequential; it must complete before further commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command
Dependencies	This control does not appear in models that do not contain NF2. In these models the command is accepted without error, but no action is taken
Couplings	Successful completion of **Characterize Noise Floor** begin the elapsed time counter or the Last Characterize Noise Floor Time

Remote Command	`:CALibration:TIME:NFLoor?`
Example	`:CAL:TIME:NFL?`
Notes	Value is the date and time the last successful **Characterize Noise Floor** was executed. The date is separated from the time by a space character Returns "" if no **Characterize Noise Floor** has ever been performed on the instrument

Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Remote Command	`:CALibration:TEMPerature:NFLoor?`
Example	`:CAL:TEMP:NFL?`
Notes	Value is the temperature of the last successful **Characterize Noise Floor** was executed Returns "" if no **Characterize Noise Floor** has ever been performed on the instrument
Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Remote Command	`:CALibration:TIME:ELAPsed:NFLoor?`
Example	`:CAL:TIME:ELAP:NFL?`
Notes	Value is the elapsed time the instrument was powered-on since the last successful **Characterize Noise Floor** was executed Returns "" if no **Characterize Noise Floor** has ever been performed on the instrument
Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

4.7.7.4 Characterize Noise Floor for IQ Measurement

Available in N9042B and N9032B instruments only.

The calibrated noise floor used by IQ-based measurements should be refreshed periodically. To do this, select the **IF Path**, select the **Frequency Range** from the table in this dialog, then press **Characterize Noise Floor for IQ Measurement**. The instrument stops any measurement currently underway, and a dialog appears with an **OK** and **Cancel** button that states:

```
The NF2 license requires characterization of the analyzer's noise floor.

Characterizing the analyzer's noise floor for IQ measurement is an alignment
that can take 30 minutes to several hours to complete depending on the IF Path
and frequency range you selected. If all IF Path and all frequency ranges are
selected, it will take about 18 hours. This alignment is only needed once every
calendear year.

Ensure the instrument has been warmed up for at least an hour before running
this alignment.

Please disconnect all cables from the RF input(s) and press Enter to proceed.
Press ESC to cancel.
```

When you press **Enter** or **OK**, the characterization proceeds. After the characterization, the instrument restarts the measurement from the beginning

(similar to pressing the **Restart** key). The characterization takes about 30 minutes if 1 or 2 frequency ranges are selected for one **IF Path**. If *all* frequency ranges and **IF Paths** are selected, it will take about 18 hours.

The noise floor model used by IQ based measurements includes an estimation of the temperature behavior of the noise floor, but this is *only* an estimation. The noise floor changes little with the age of the components. However, even small changes in the estimated level of the noise floor can make large changes in the effective noise floor, because the effective noise floor is the error in the estimation of the noise floor. Keysight recommends that the **Characterize Noise Floor for IQ Measurement** operation be performed whenever the instrument is operating at an ambient temperature that is significantly different than the ambient temperature at which this alignment was last run. In addition, Keysight recommends that **Characterize Noise Floor for IQ Measurement** be performed after the first 500 hours of operation, and once every calendar year.

The noise floor model from the last operation of **Characterize Noise Floor for IQ Measurement** survives a power cycle.

NOTE **The Characterize Noise Floor for IQ Measurement function can be interrupted, by pressing the Cancel (ESC) front-panel key (if available), or remotely with Device Clear followed by `:ABORt`. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an *uncharacterized* noise floor. You should re-execute this function and allow it to finish before making any further measurements that use the calibrated noise floor.**

To perform this alignment, you must first select IF Path and Frequency Range Table. If multiple frequency ranges are selected, it will take several hours to complete this alignment. To save time, it is recommended that you only perform this alignment *only* for **IF Path** and **Frequency Ranges** that are used in your measurement.

The command below runs alignments for *all* IF Paths and frequency ranges.

Remote Command	`:CALibration:NFLoor:IQ:ALL` `:CALibration:NFLoor:IQ:ALL?`
Example	`:CAL:NFL:IQ:ALL`
Notes	The query returns 0 if successful, or 1 if failed (including interfering user signal) This command is sequential; it must complete before further commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command
Dependencies	Only available in N9032B and N9042B

The command below runs alignments *only* for all IF Path 2 GHz, for all frequency ranges.

Remote Command	`:CALibration:NFLoor:IQ:B2G`

	`:CALibration:NFLoor:IQ:B2G?`
Example	`:CAL:NFL:IQ:B2G`
Notes	The query returns 0 if successful, or 1 if failed (including interfering user signal) This command is sequential; it must complete before further commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command
Dependencies	Only available in N9032B and N9042B

4.7.7.5 Calibration Temperature History

The following queries let you retrieve various statistics regarding the Calibration Temperature history.

Minimum Temperature Within Last Number of Seconds

Lets you query the minimum temperature within the last number of seconds. If no data exists for the requested time, the returned value is 9.91e+37.

Remote Command	`:CALibration:TEMPerature:MINimum? <seconds>`
Example	`:CAL:TEMP:MIN? 60`

Maximum Temperature Within Last Number of Seconds

Lets you query the maximum temperature within the last number of seconds. If no data exists for the requested time, the returned value is 9.91e+37.

Remote Command	`:CALibration:TEMPerature:MAXimum? <seconds>`
Example	`:CAL:TEMP:MAX? 60`

Temperature Seconds Ago

Lets you query temperature X seconds ago. If no data exists for the requested time, the returned value is 9.91e+37.

Remote Command	`:CALibration:TEMPerature:AGO? <seconds>`
Example	`:CAL:TEMP:AGO? 75`

Oldest Temperature Value

Lets you query the oldest recorded temperature value.

Remote	`:CALibration:TEMPerature:OLDest[:TEMPerature]?`

Command	
Example	`:CAL:TEMP:OLD?`

Oldest Temperature Time

Lets you query how long ago the oldest temperature value was recorded.

Remote Command	`:CALibration:TEMPerature:OLDest:SEConds?`
Example	`:CAL:TEMP:OLD:SEC?`

4.7.7.6 TDS Alignment

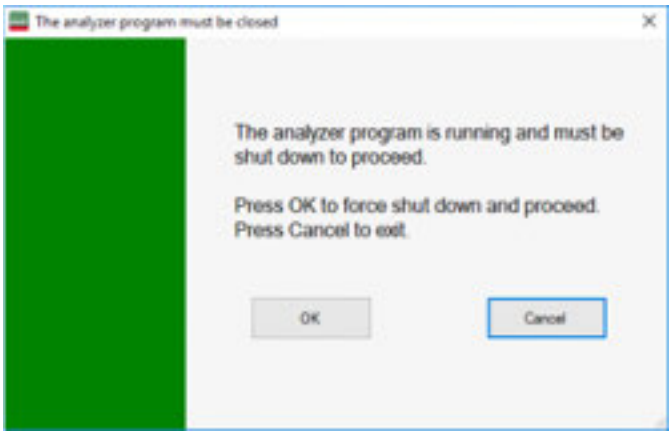
The TDS alignment includes `AlignNowAll` and `RFPresel` alignment. Immediately executes an alignment of the TDS subsystem. The instrument stops any measurement currently underway, performs the alignment, and then restarts the measurement from the beginning (similar to pressing the Restart key).

Align TDS can be interrupted by pressing the Cancel (ESC) front-panel key or from remote with Device Clear followed by `:ABORt`. When this occurs, no new TDS alignment data will be employed.

Remote Command	`:CALibration:TDS` `:CALibration:TDS?`
Example	`:CAL:TDS`
Notes	This command is sequential; it must complete before further commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command

4.7.7.7 Backup or Restore Align Data...

Opens the utility for backing-up or restoring alignment data. Since this utility cannot be run while the instrument software is running, a prompt tells you to shut down the instrument first:



Press **OK** and the instrument will shut down and open the backup utility.

Alignment data for the instrument resides on the hard drive in a database. Keysight uses high quality hard drives; however, it is highly recommended the alignment data be backed-up to storage outside of the instrument. Additionally, for customers who use multiple CPU Assemblies or multiple disk drives, the alignment that pertains to the instrument must be transferred to the resident hard drive after a CPU or hard drive is replaced. This utility facilitates backing-up and restoring the alignment data.

NOTE **This utility allows you to navigate to any location of the Windows file system. If you are backing up alignment data to storage outside of the instrument, then it is assumed that you will use a USB memory device, or Mapped Network Drive.**

Processor Assembly types PC6 and PC7 contain a removable SD memory card. When one of these CPUs is installed, the Backup and Restore Alignment Data wizard defaults to the SD card as the backup location. At every power-on, the software will check to determine if the calibration data on the SD memory card (the backup) is newer than the data in use on the disk. In such situations, before the application is loaded, you are given the opportunity to restore the data from the backup. If you respond **Yes**, the Backup and Restore Alignment Data wizard (see "Alignment Data Wizard (without Flash)" on page 544) will be invoked to perform the restore.

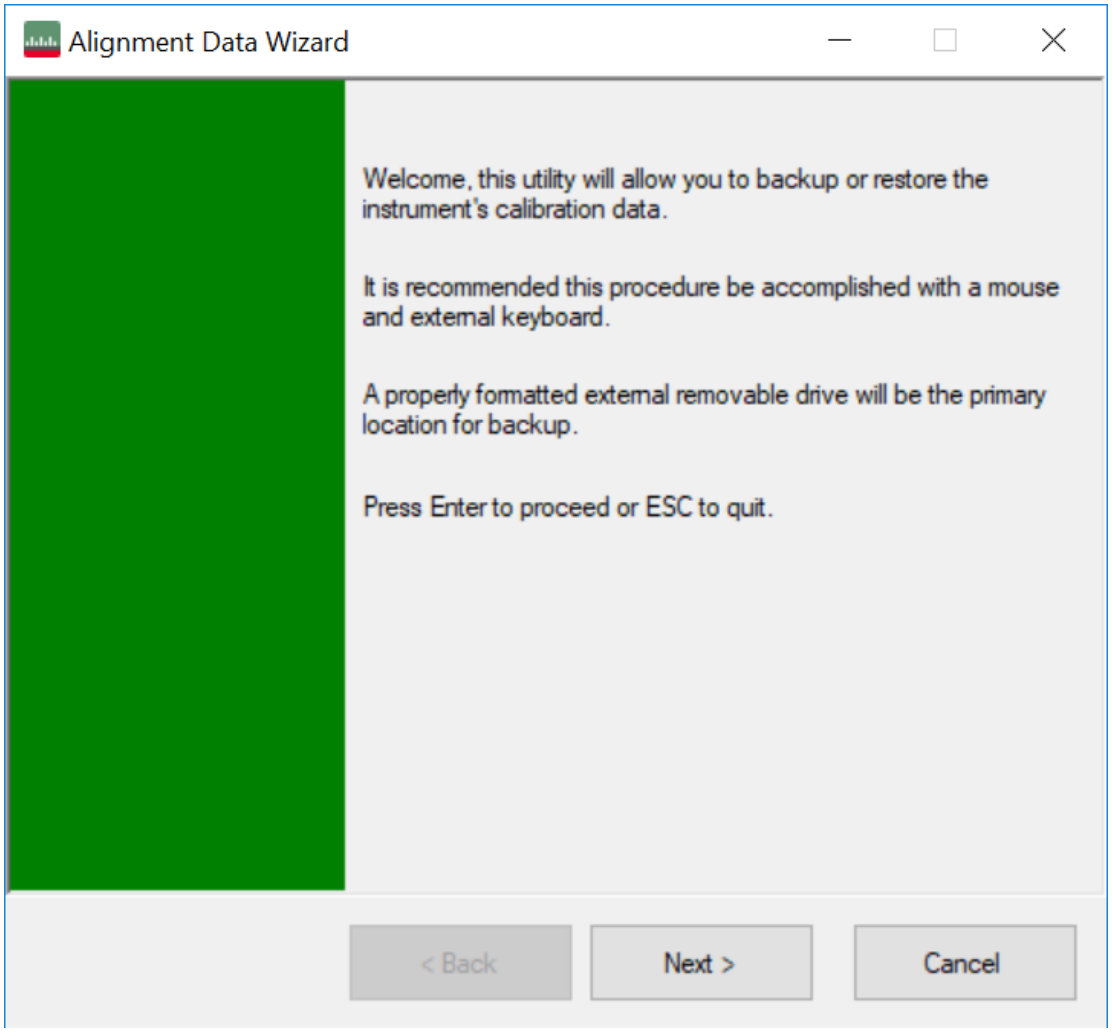
Processor Assembly types PC6S and PC7S contain an internal flash EEPROM, as well as a removable SD card. When one of these CPUs is installed, the Backup and Restore Alignment Data wizard defaults to the internal flash as the backup location. As with the PC6 and PC7, at every power-on, the software compares the timestamp of the backup on the flash and the timestamp of the alignment data in use on the disk. If the backup on the flash has newer data, you are given the opportunity to restore the data from the backup before the application is loaded. If you respond **Yes**, the Backup and Restore Alignment Data wizard (see "Alignment Data Wizard (with Flash)" on page 554) will be invoked and will prompt you to restore that backup.

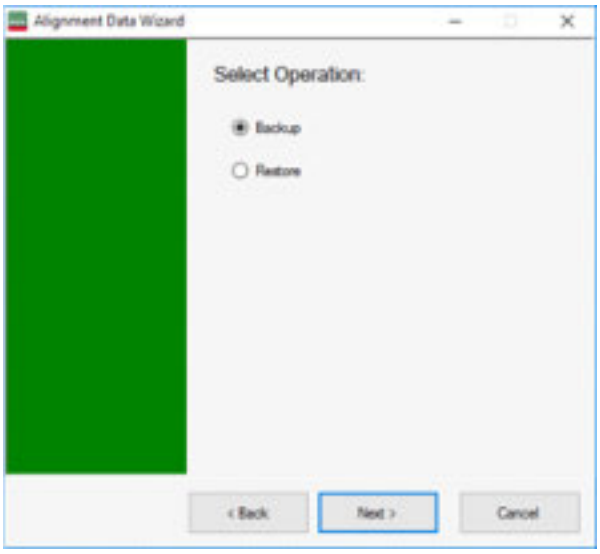
For purposes of these instructions, “alignment data” and “calibration data” are used interchangeably.

Dependencies	Not available in UXM
Remote Command	`:CALibration:DATA:DEFault`
Example	`:CAL:DATA:DEF`
Notes	Restores the alignment data files to their default state
Couplings	Sets **Auto Align** to `OFF`. Sets Bit 14 in the Status Questionable Calibration register. The Error Condition message “Align Now All required” is generated

Alignment Data Wizard (without Flash)

Guides you through the operation of backing-up or restoring the alignment data.

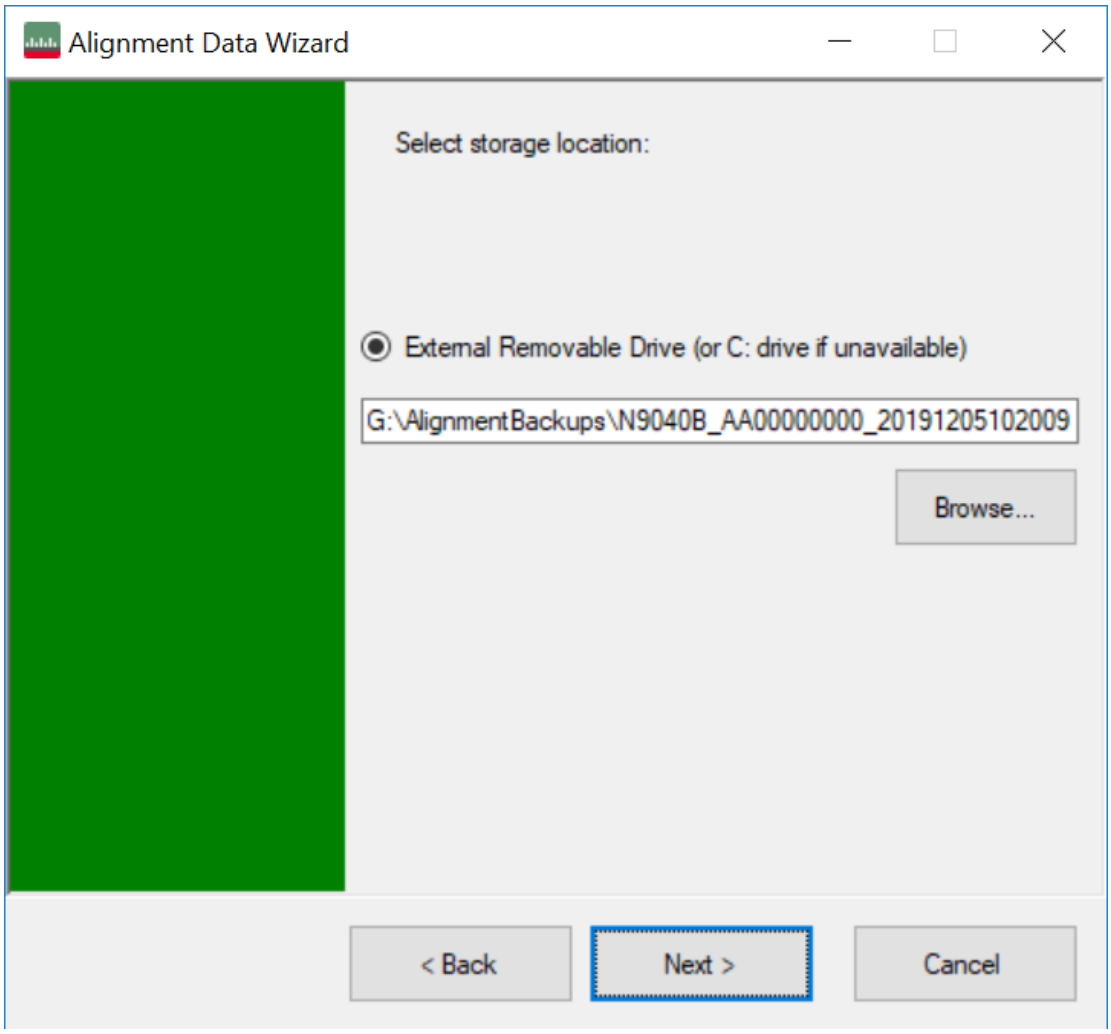




The default backup location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition.

The default file name is `<model number>_<serial number>_<date in YYYYMMDDHHMMSS>.bkz`.

The default file extension for legacy backup files was `.bak`. The Backup and Restore operations support both the `.bak` (legacy format) and `.bkz` formats.

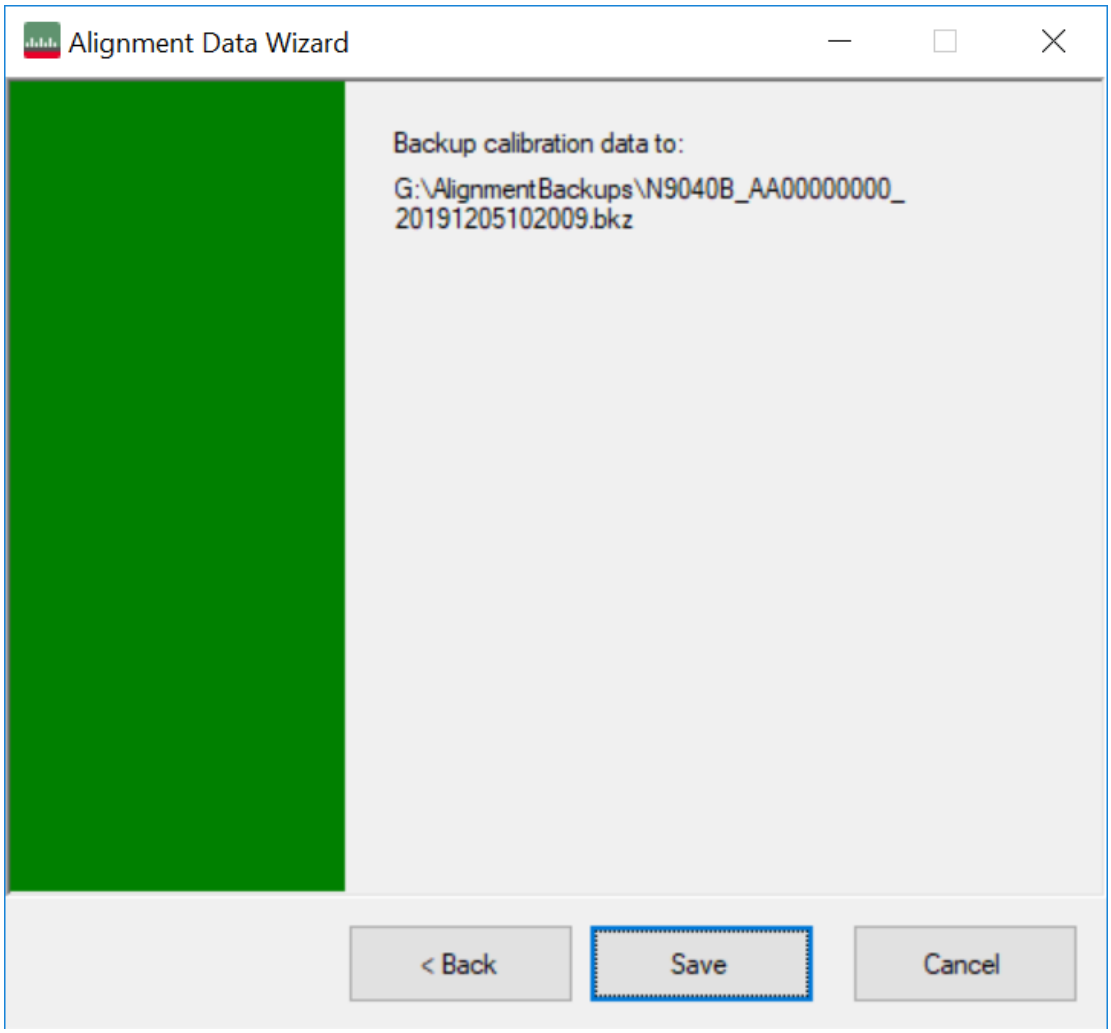


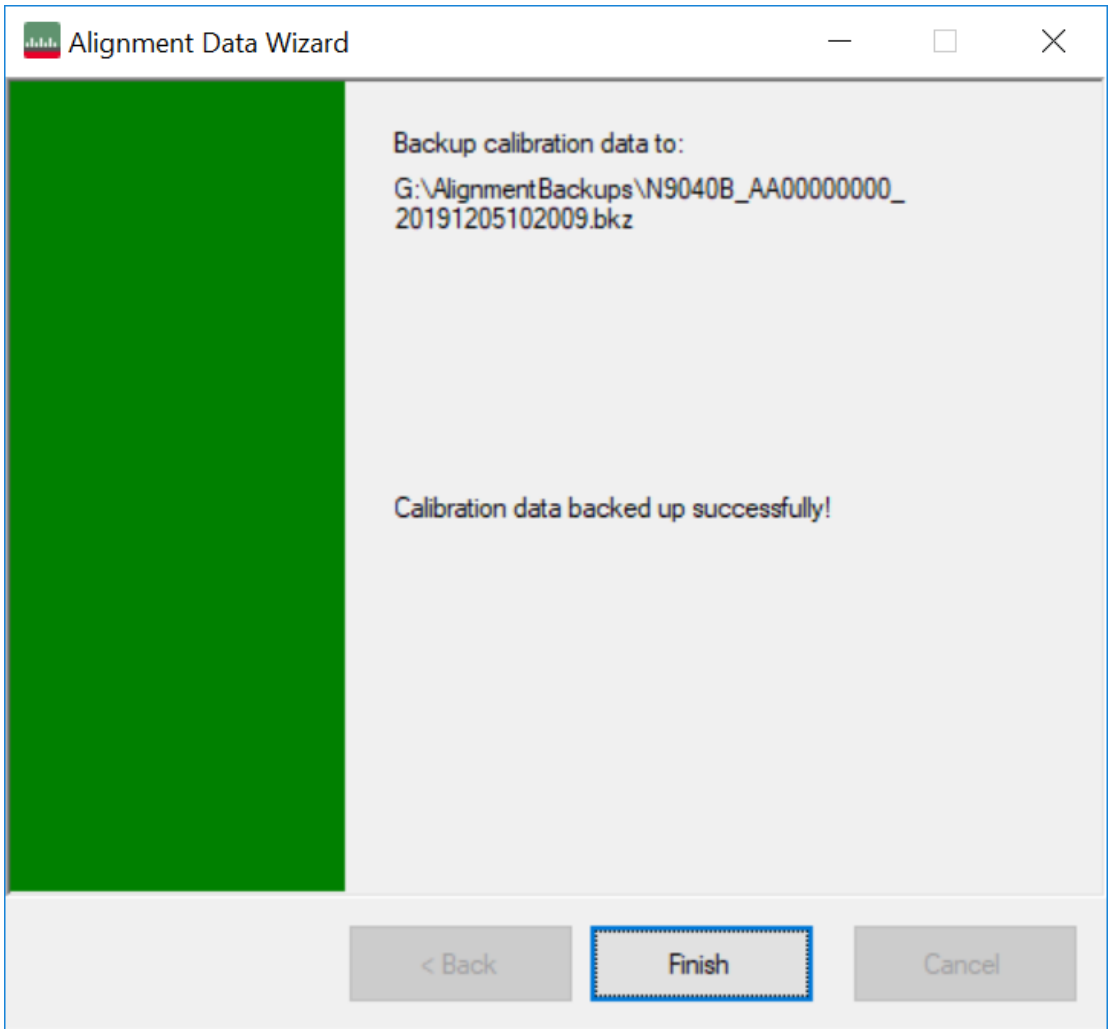
If a USB drive is present, it will be selected by default. The path defaults to the `AlignmentBackups` folder, and a filename is automatically created, in the form: `<model>_<serial number>_<date><time>.bkz`

If you wish to enter a customer filename, you can do so with an external keyboard, or by opening the onscreen Alpha keyboard, by pressing the **Keyboard** hardkey on the front panel (if available):



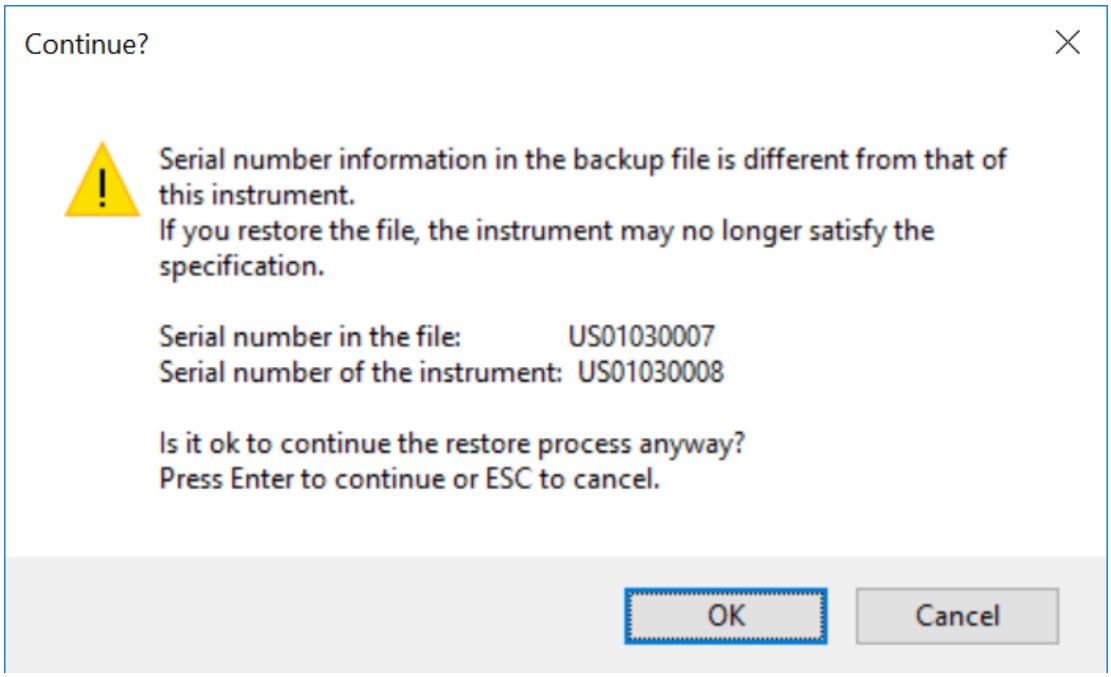
When the **Next >** button is pressed, you will be prompted to create a new folder if the chosen path does not yet exist.


Alignment Data Wizard
Backup calibration data to:
G:\AlignmentBackups\N9040B_AA00000000_
20191205102009.bkz
< Back
Save
Cancel

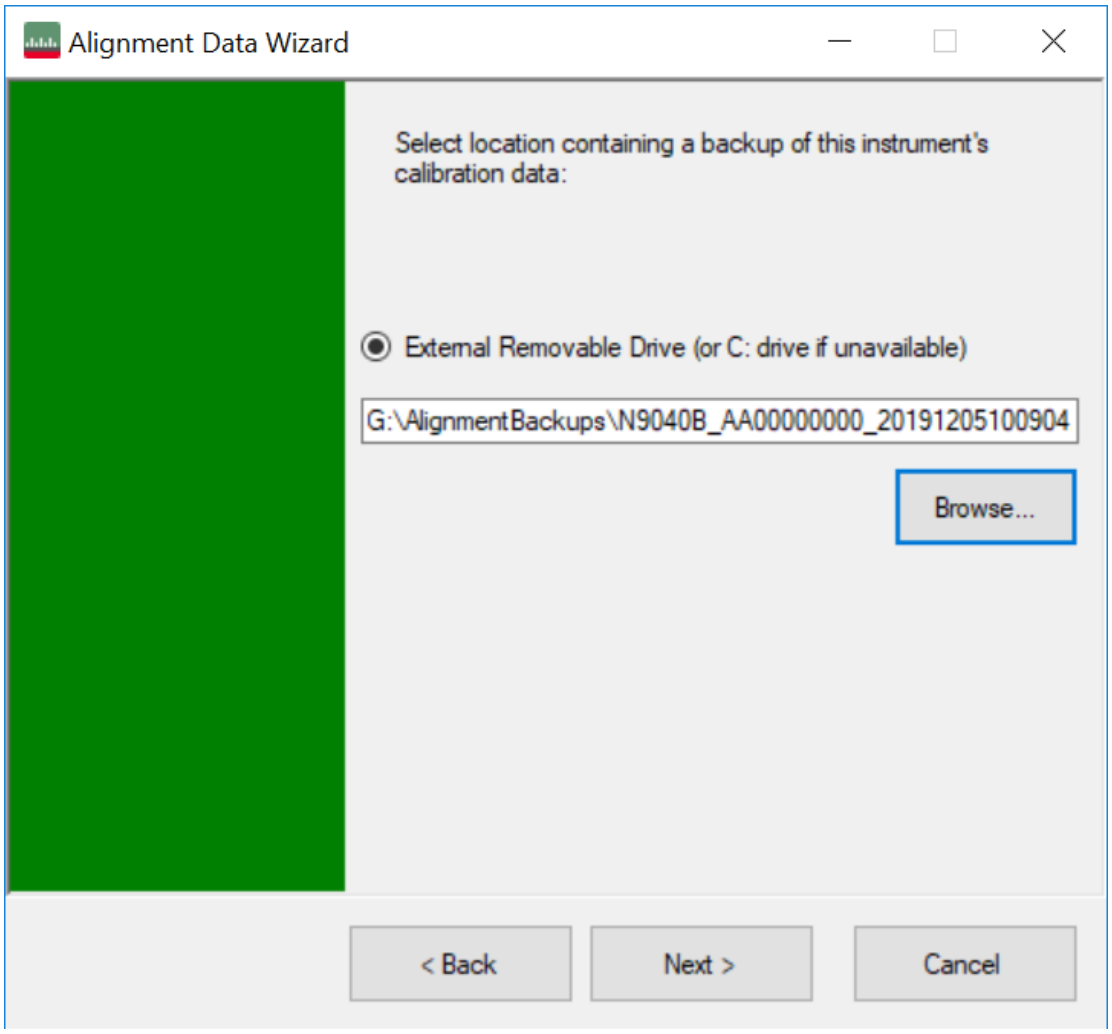


The restore operation checks the validity of the restore file using the database's built-in file validation. If the restore file is corrupt, the existing alignment data will remain in use.

If the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):

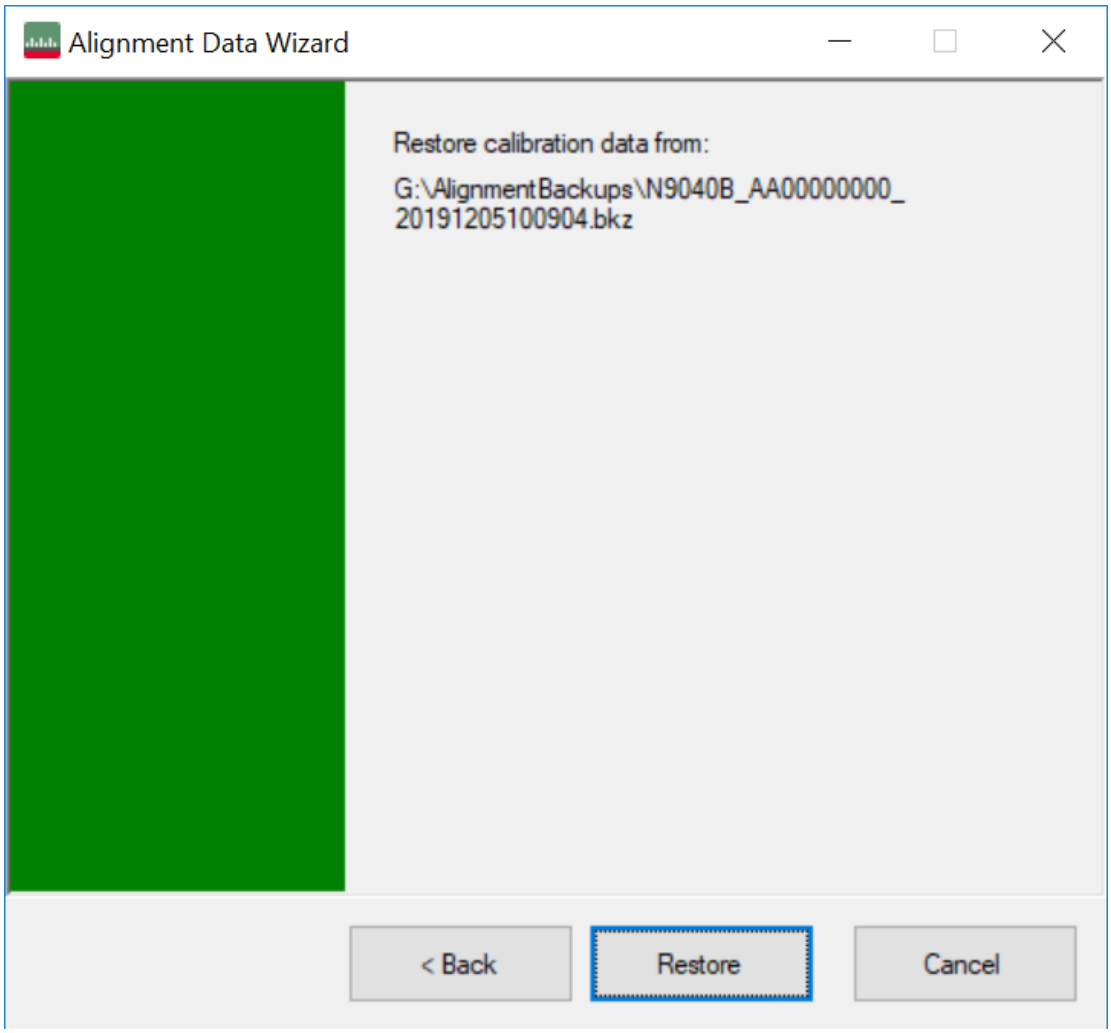


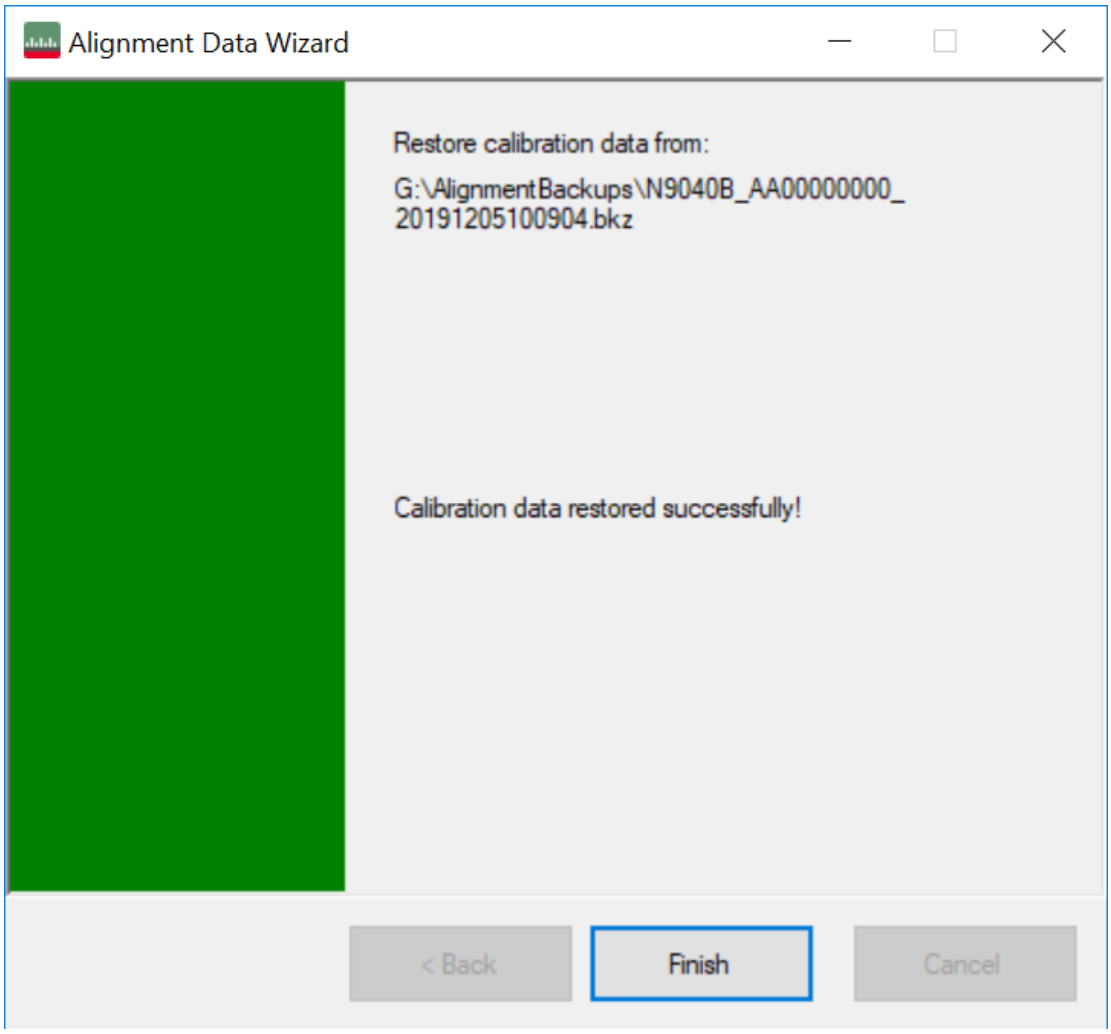
The default restore location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition. The default restore file will be the most recent file that matches the default backup file name format: `<model number>_<serial number>_<date>.bkz`



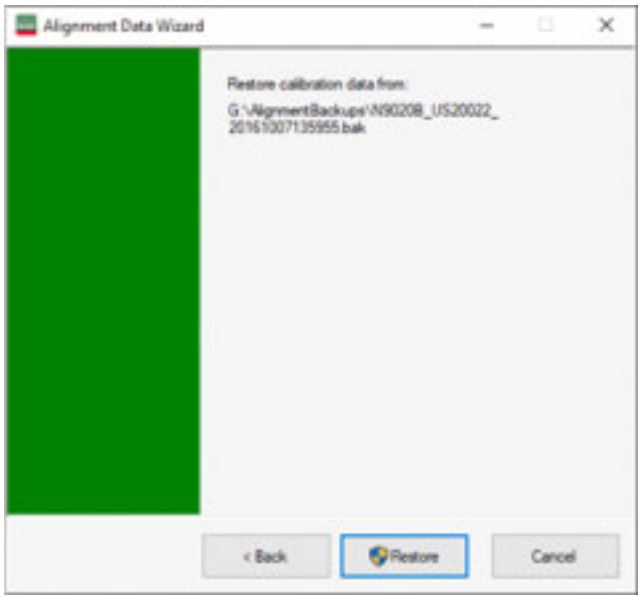
Changing the drive letter also modifies the path displayed in the box below. When this step is first loaded, the drive drop-down menu is populated with connected drives, which provide you with read access.

The path defaults to the `AlignBackups` folder. The most recent backup (`*.bkz` or `*.bak`) file in the folder will also be selected by default.


Alignment Data Wizard
Restore calibration data from:
G:\AlignmentBackups\N9040B_AA00000000_
20191205100904.bkz
< Back
Restore
Cancel



When restoring data in the legacy `.bak` format, Administrator privileges are required. You will be prompted when you attempt a restore (indicated by the UAC Shield on the **Restore** button below).



Perform Backup (without Flash) (Remote Command Only)

Invokes an alignment data backup operation to the provided location.

NOTE Keysight recommends that the specified location should be external to the instrument (USB or Mapped Network Drive).

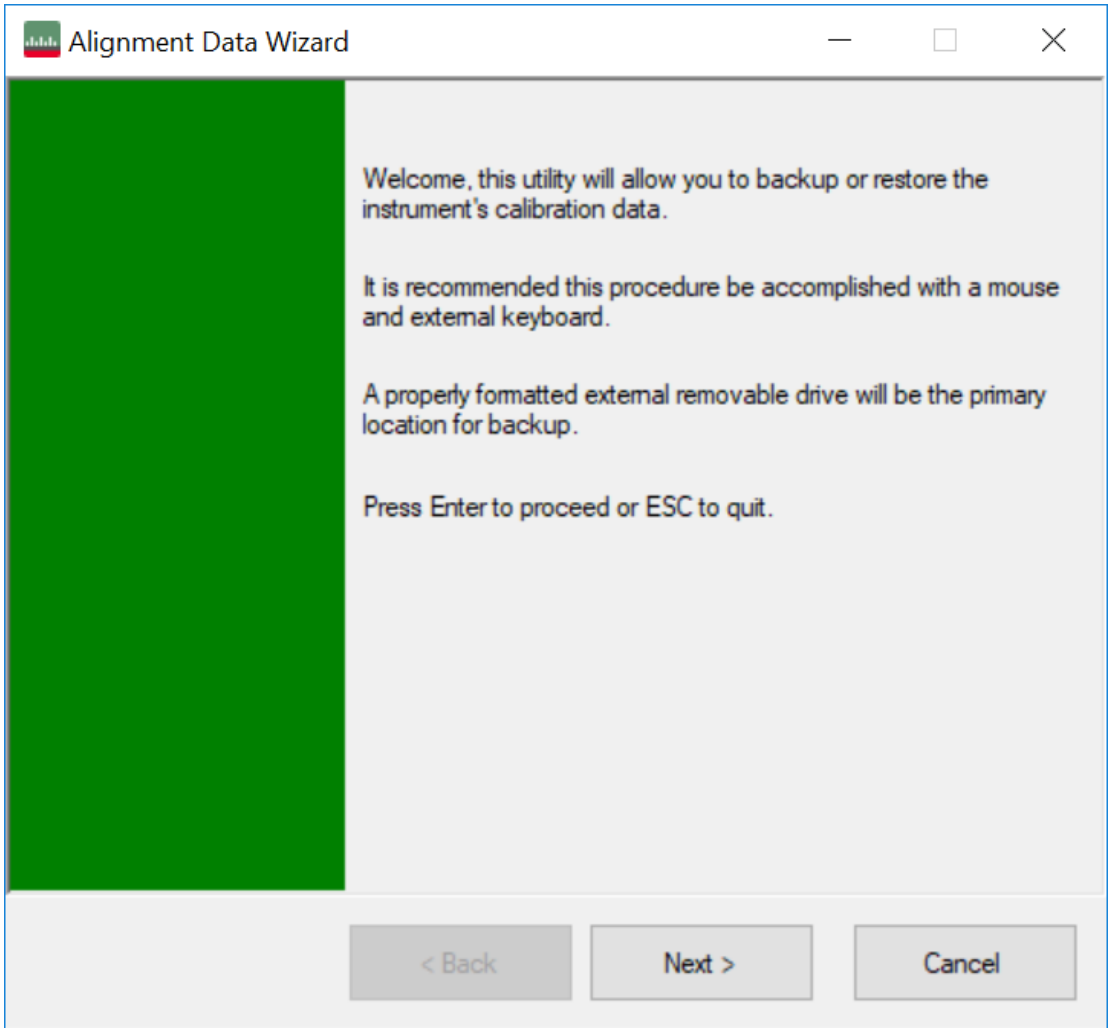
Remote Command	`:CALibration:DATA:BACKup <filename>`
Example	`:CAL:DATA:BACK "F:\AlignDataBackup_N9020A_US00000001_2008140100.bkz"`

Perform Restore (without Flash) (Remote Command Only)

Invokes an alignment data restore operation from the provided filename.

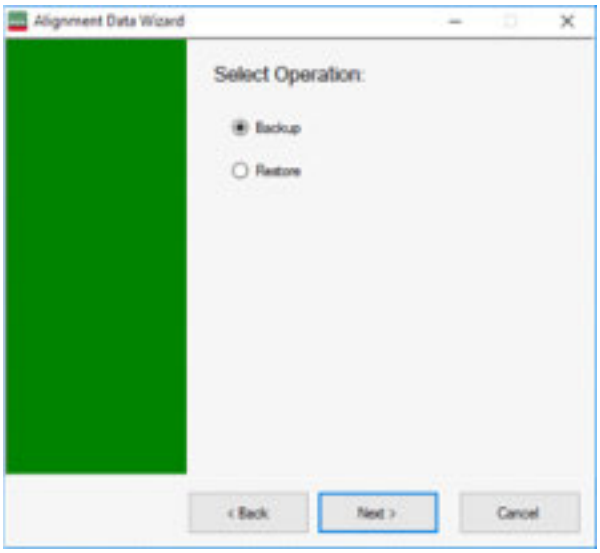
Remote Command	`:CALibration:DATA:RESTore <filename>`
Example	`:CAL:DATA:REST "F:\ AlignDataBackup_N9020A_US00000001_2008140100.bkz"`

Alignment Data Wizard (with Flash)



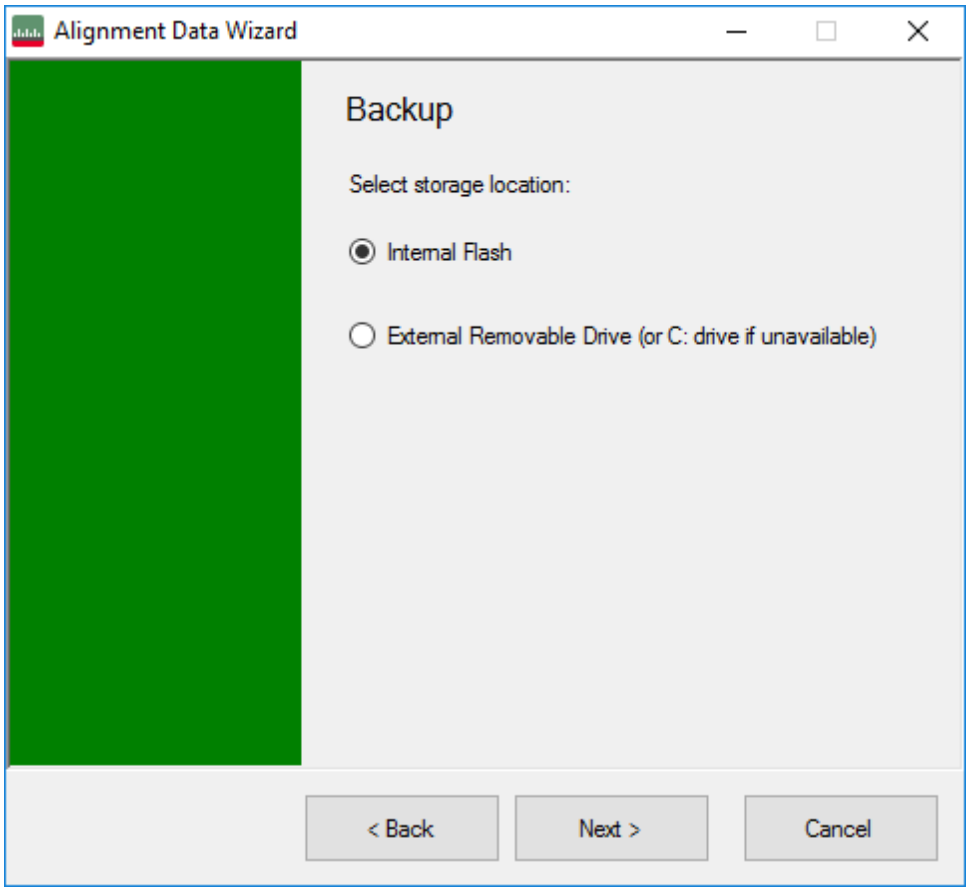
If your instrument has Processor Assembly type PC6S or PC7S (see "Control Panel..." on page 430) the instrument has an internal flash EEPROM that can store a backup of the alignment data. In this case, the interface to the Alignment Data Wizard is enhanced to accommodate this internal storage. This section details the use of this internal flash. For details on using external storage, see the previous section.

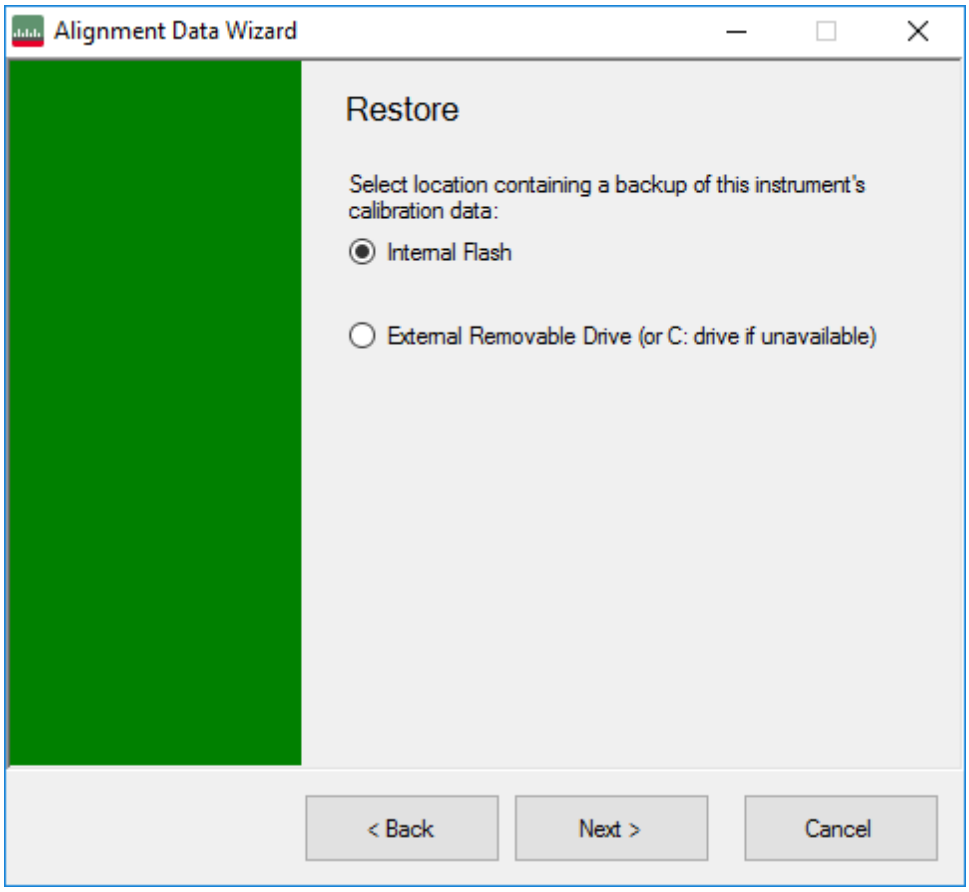
The Alignment Data Wizard guides you through the operations of backing up or restoring alignment data.



Having selected **Backup** or **Restore**, you then select the source or destination for the alignment data. As shown below, you can select either:

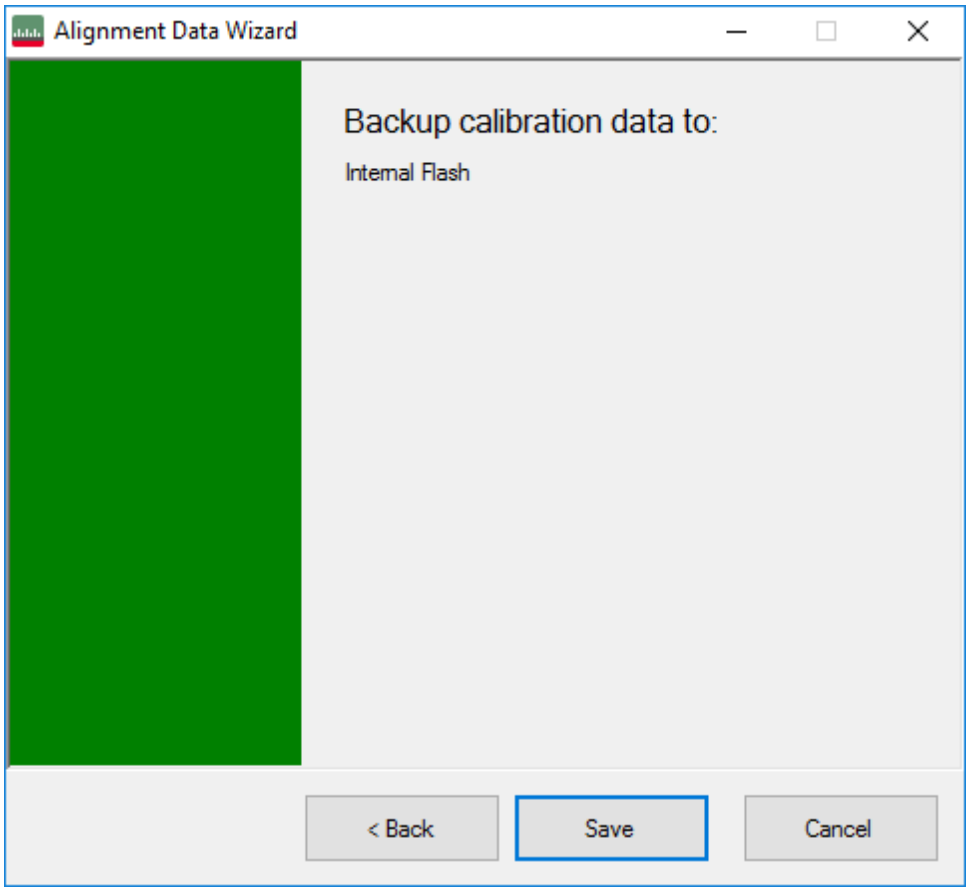
- Internal flash EEPROM, or,
- External Removable Drive (which includes the SD card described in Auto Alignment Method)

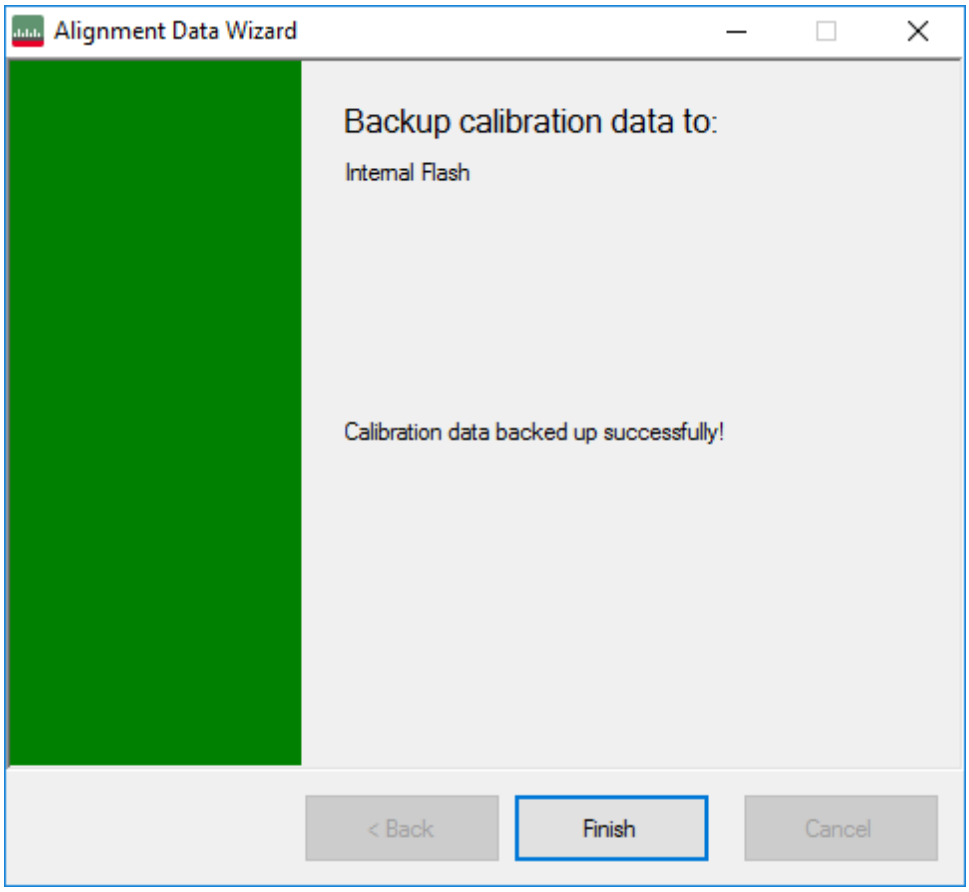

Alignment Data Wizard
Backup
Select storage location:
Internal Flash
External Removable Drive (or C: drive if unavailable)
< Back
Next >
Cancel



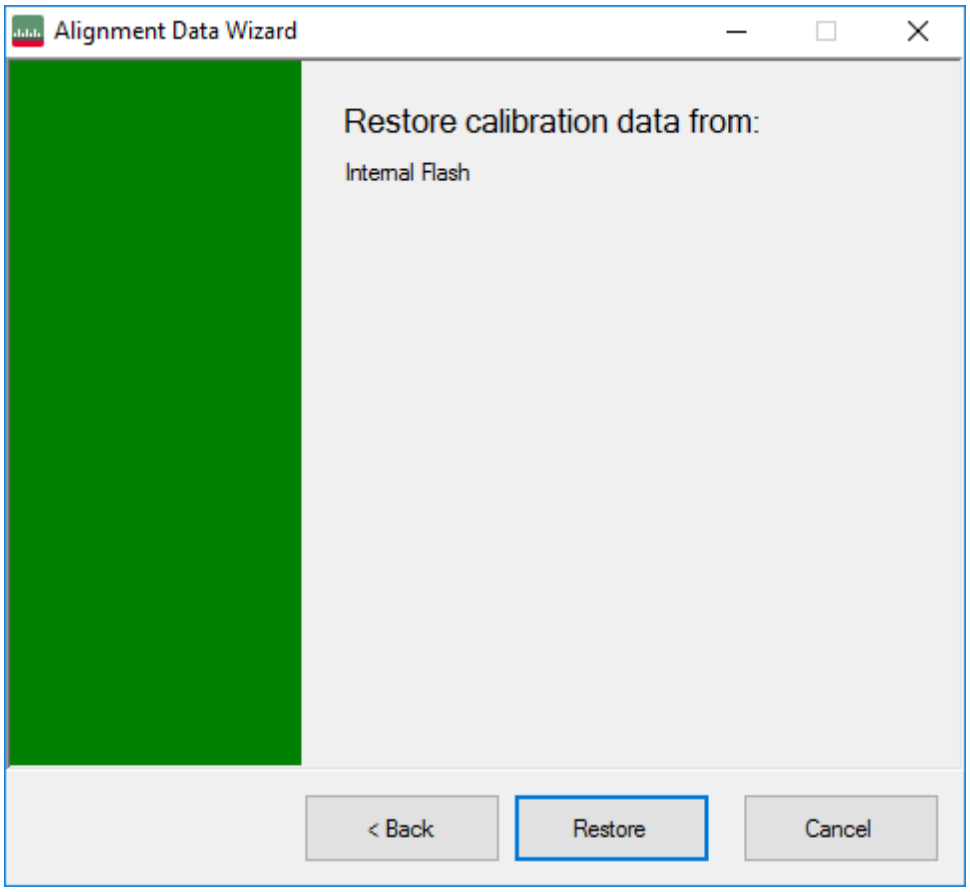
The final page of the wizard asks you to confirm the choices made in the previous pages. When the operation is complete, an indication is displayed on the same page, as below.

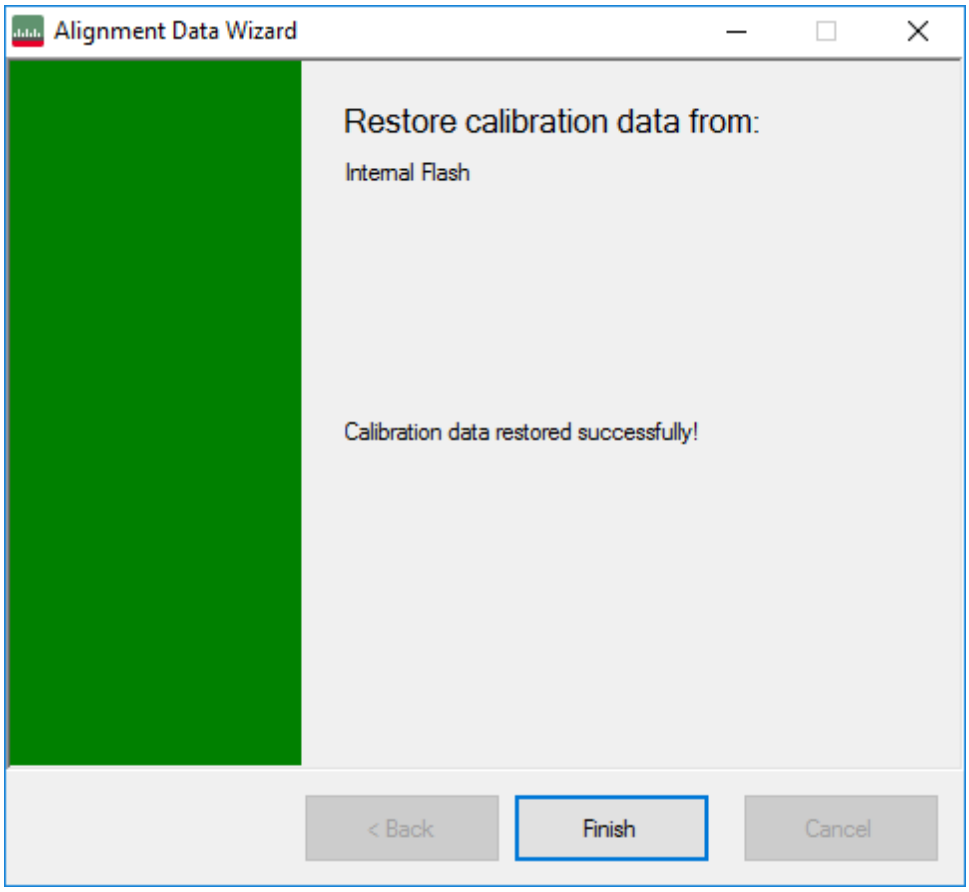
Backup


Alignment Data Wizard
Backup calibration data to:
Internal Flash
< Back
Save
Cancel

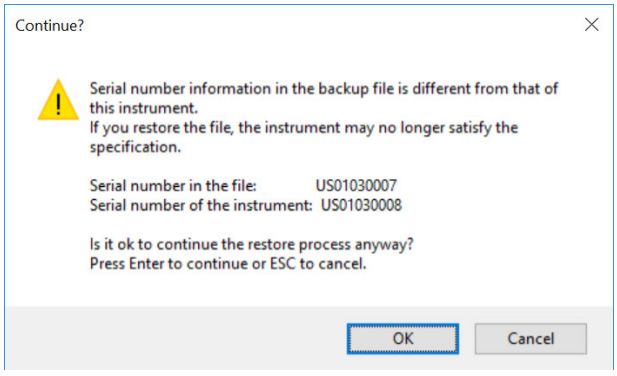

Alignment Data Wizard
Backup calibration data to:
Internal Flash
Calibration data backed up successfully!
< Back
Finish
Cancel

Restore

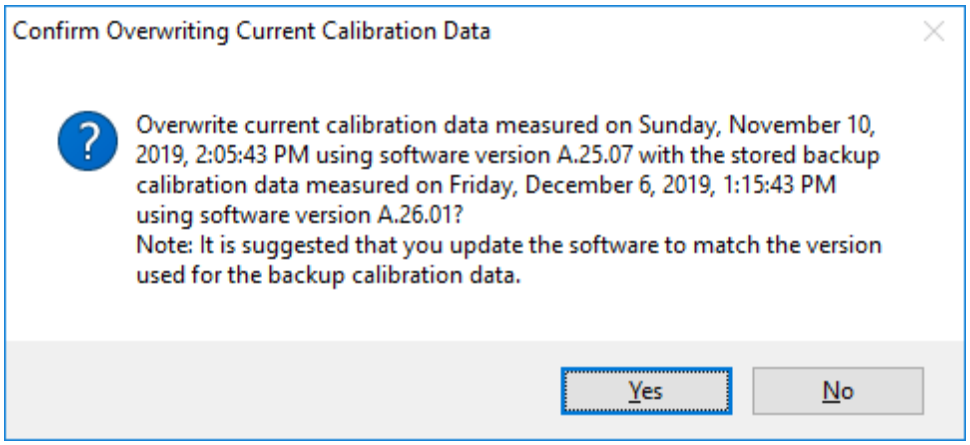

Alignment Data Wizard
Restore calibration data from:
Internal Flash
< Back
Restore
Cancel



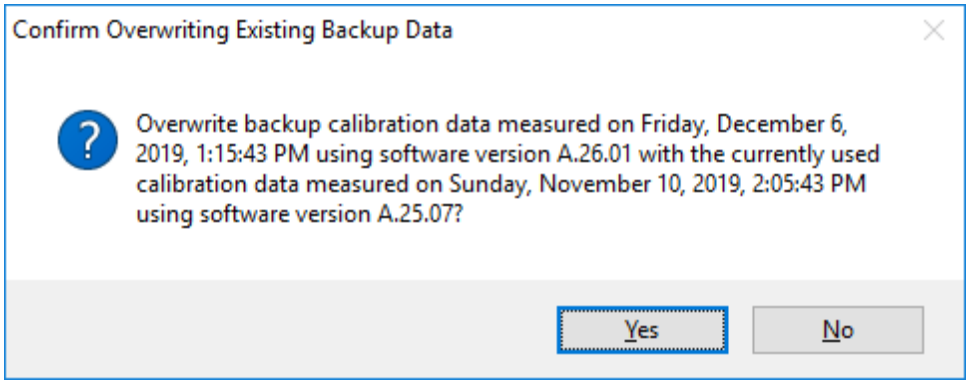
When restoring alignment data, if the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):



Immediately before the actual restoration, a final confirmation message is displayed detailing what is being restored and the current database that will be overwritten on the disk (the dates and versions are examples):



When backing up alignment data to the flash, if there is already an existing backup on the flash, a final confirmation message is displayed detailing what is being backed up and what will be overwritten on the flash (again, the dates and versions are examples):



Perform Backup (with Flash) (Remote Command Only)

Invokes an alignment data backup operation to the internal flash EEPROM.

Remote Command	`:CALibration:DATA:INTernal:BACKup`
Example	`:CAL:DATA:INT:BACK`

Perform Restore (With Flash) (Remote Command Only)

Invokes an alignment data restore operation from the internal flash EEPROM.

Remote Command	`:CALibration:DATA:INTernal:RESTore`
Example	`:CAL:DATA:INT:REST`

Restore Alignment Defaults

Causes the Alignment system settings to be reset to their default values. This does not affect any Alignment data stored in the system.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

When Alignments is selected, a message appears saying:

```
This will reset all of the settings for the Alignment system to their default values

No alignment data will be erased

This action cannot be undone. Do you want to proceed?
```

The dialog includes OK and Cancel controls, for you to affirm or cancel the operation.

Align Now All must be executed if the value of the Timebase DAC results in a change.

Example	`:SYST:DEF ALIG`
Notes	Alignment processing that results as the transition to Auto Align Normal will be executed sequentially; thus `*OPC?` or `*WAI` will wait until the alignment processing is complete

The parameters affected are:

Parameter	Setting
Timebase DAC	Calibrated
Timebase DAC setting	Calibrated value
Auto Align State	Normal (if the instrument is not operating with default alignment data, Off otherwise)
Auto Align All but RF	Off
Auto Align Alert	Time & Temperature

4.7.7.8 RF Preselector

This menu and all its submenus are only available in models with the RF Preselector, such as N9038B, or N9048B.

Dependencies	Only available in RF Preselector models

Align Now, 20 Hz to 30 MHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the **Restart** key, if available).

The query `:CALibration:RFPSelector:CONDucted?` invokes the alignment of the RF Preselector on Conducted Band and returns a success or failure value. Successful completion clears the "Align 20 Hz to 30 MHz required" Error Condition, and clears bit 1 in the Status Questionable Calibration Extended Needed register. The elapsed time counter will begin for Last Align Now, Conducted Time, and the temperature is captured for the Last Align Now, Conducted Temperature. The alignment can be interrupted by pressing the **Cancel (ESC)** front-panel key (if available), or remotely with Device Clear followed by the `:ABORt` command. When this occurs, the Error Condition "Align 20 Hz to 30 MHz required" is set because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The "Align 20 Hz to 30 MHz required" Error Condition will appear when this alignment has expired. Users are then responsible for performing the Align Now, 20 Hz to 30 MHz to keep the receiver in warranted operation. This alignment can only be performed by users, as it is not part of the **Auto Align** process.

Remote Command	`:CALibration:RFPSelector:CONDucted` `:CALibration:RFPSelector:CONDucted?`
Example	`:CAL:RFPS:COND`
Notes	The query returns 0 if successful, or 1 if failed When Align 20 Hz to 30 MHz is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register This command is sequential; it must be complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command. Successful completion will clear bit 1 in the Status Questionable Calibration Extended Needed register and bit 0 in Status Questionable Calibration Extended Failure register A failure encountered during alignment will set the Error Condition "20 Hz to 30 MHz Alignment Failure" and set both bit 1 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register
Dependencies	Does not appear in non-RF Preselector models; setting or querying the SCPI generates an error
Couplings	Initializes the time for the Last Align Conducted Now, Conducted Time Records the temperature for the Last Align Conducted Now, Conducted Temperature
State Saved	No
Status Bits/OPC dependencies	Bit 8 or 9 may be set in the Status Questionable Calibration register Bit 1 may be set in the Status Questionable Calibration Extended Needed register Bit 0 may be set in the Status Questionable Calibration Extended Failure register

Align Now, 30 MHz to 3.6 GHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the Restart key, if available).

The query (`:CALibration:RFPSelector:RADiated?`) invokes the alignment of the RF Preselector on Radiated Band and returns a success or failure value. Successful completion clears the "Align 30 MHz to 3.6 GHz required" Error Condition and clears bit 2 in the Status Questionable Calibration Extended Needed register. The elapsed time counter begins for Last Align Now, Radiated Time, and the temperature is captured for the Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the Cancel (ESC) front-panel key (if available), or remotely with Device Clear followed by `:ABORt`. When this occurs, the Error Condition "Align 30 MHz to 3.6 GHz required" is set, because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The "Align 30 MHz to 3.6 GHz required" Error Condition appears when this alignment has expired. You must now perform Align Now, 30 MHz to 3.6 GHz to keep the receiver in warrantied operation.

Remote Command	`:CALibration:RFPSelector:RADiated` `:CALibration:RFPSelector:RADiated?`
Example	`:CAL:RFPS:RAD`
Notes	The query returns 0 if successful, or 1 if failed When Align 30 MHz to 3.6 GHz is performed, alignment, bit 0 in the Status Operation register is set. Completion, or termination, clears bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by `:ABORt`. Successful completion clears bit 2 in the Status Questionable Calibration Extended Needed register and bit 1 in Status Questionable Calibration Extended Failure register A failure encountered during alignment sets the Error Condition "30 MHz to 3.6 GHz Alignment Failure" and sets both bit 2 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register
Dependencies	Does not appear in non-RF Preselector models; setting or querying the SCPI generates an error
Couplings	Initializes the time for the Last Align Radiated Now, Radiated Time Records the temperature for the Last Align Radiated Now, Radiated Temperature
State Saved	No
Status Bits/OPC dependencies	May set Bit 8 or 9 in the Status Questionable Calibration register May set Bit 2 in the Status Questionable Calibration Extended Needed register May set Bit 1 in the Status Questionable Calibration Extended Failure register

Align Now, 20 Hz to 3.6 GHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the **Restart** key, if available).

The query (`:CALibration:RFPSelector:FULL?`) invokes the alignment of the RF Preselector on both Conducted and Radiated Band and return a success or failure value. Successful completion clears the "Align 20 Hz to 3.6 GHz required" Error Condition, and clears bit 1 and bit 2 in the Status Questionable Calibration Extended Needed register. The elapsed time counter begins for Last Align Now, Conducted Time and Last Align Now Radiated Time and the temperature is captured for Last Align Now, Conducted Temperature and Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the **Cancel (ESC)** front-panel key (if available), or remotely with Device Clear, followed by `:ABORt`. When this occurs, the Error Condition "Align 20 Hz to 3.6 GHz required" is set, because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The "Align 20 Hz to 3.6 GHz required" Error Condition appears when this alignment has expired. You must now perform **Align Now, 20 Hz to 3.6 GHz** to keep the receiver in warrantied operation.

Remote Command	`:CALibration:RFPSelector:FULL` `:CALibration:RFPSelector:FULL?`
Example	`:CAL:RFPS:FULL`
Notes	The query returns 0 if successful, or 1 if failed When **Align Now 20 Hz to 3.6 GHz** is performed, alignment, bit 0 in the Status Operation register is set. Completion, or termination, clears bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear, followed by `:ABORt`. Successful completion clears bit 1, bit 2 in the Status Questionable Calibration Extended Needed register and bit 0, bit 1 in Status Questionable Calibration Extended Failure register A failure encountered during alignment sets the Error Condition "20 Hz to 3.6 GHz Alignment Failure" and sets bit1, bit 2 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register
Dependencies	Does not appear in non-RF Preselector models; setting or querying the SCPI generates an error
Couplings	Initializes the time for the Last Align Conducted Now, Conducted Time Initializes the time for the Last Align Radiated Now, Radiated Time Records the temperature for the Last Align Conducted Now, Conducted Temperature Records the temperature for the Last Align Radiated Now, Radiated Temperature
State Saved	No

Status Bits/OPC dependencies	May set Bit 8 or 9 in the Status Questionable Calibration register May set Bit 1 and 2 in the Status Questionable Calibration Extended Needed register May set Bit 0 and 1 in the Status Questionable Calibration Extended Failure register

Alert

Enables or disables the display of RF Preselector alignment required message on the status line. The instrument powers up with Alert ON.

Remote Command	:CALibration:RFPSelector:ALERt ON | OFF | 0 | 1 :CALibration:RFPSelector:ALERt?
Example	:CAL:RFPS:ALER OFF
Notes	Error Condition is generated when alert is ON and any of the RF Preselector alignments has expired
Preset	Unaffected by Preset, but set to ON by Restore Defaults >"Alignments" on page 484
State Saved	No
Range	OFF|ON

4.7.7.9 Scheduler

Characterize Basic Hardware can be performed either manually, or automatically using the Scheduler.

This control enables or disables the Scheduler.

There are several parameters that specify when the instrument may perform Characterize Basic Hardware, as described in this section. The instrument performs the characterization when needed during the specified periods. Characterization takes approximately 1 to 2 hours to complete. The instrument does not perform the characterization if it is not needed.

Remote Command	:CALibration:BASic:SCHeduler:STATe OFF | ON | 0 | 1 :CALibration:BASic:SCHeduler:STATe?
Example	CAL:BAS:SCH:STAT ON CAL:BAS:SCH:STAT?
Notes	On: Scheduler is enabled Off: Scheduler is disabled
Dependencies	Available only in models: SA6320A, SA6210A
Preset	Unaffected by Preset, but set to Off by Restore Alignment Defaults
State Saved	Save in instrument state
Range	On | Off

Schedule Setup

Lets you schedule a task to run automatically at the background based on the recurrence and time set in the scheduler. Make sure that the instrument's local time is accurate, because the Scheduler relies on this information to execute the task.

This dialog contains the following controls:

- "Task" on page 568
- "Date/Time" on page 569
- "Hour" on page 569
- "Minute" on page 569
- "Recurrence" on page 570
- "Number of Weeks" on page 570
- "Day" on page 570

Task

There are 3 tasks that can be selected for the scheduler to run.

- Task 1 is the 20 Hz to 30 MHz alignment
- Task 2 is the 30 MHz to 3.6 GHz alignment
- Task 3 is the 20 Hz to 3.6 GHz alignment

Remote Command	`:CALibration:RFPSelector:SCHeduler:TASK T1 | T2 | T3` `:CALibration:RFPSelector:SCHeduler:TASK?`
Example	`:CAL:RFPS:SCH:TASK T1`
Notes	Changing the task does not reset the Scheduler time, and the alignment is based on the current scheduled configuration to occur
Preset	Unaffected by **Preset** but set to `T3` by **Restore Defaults** >"Alignments" on page 484
State Saved	No
Range	Task 1 | Task 2 | Task 3

Date/Time

Lets you configure the scheduler to run a task starting from this date and time. The date and time rely on the instrument's local time to execute a scheduled task. The date format is "YYYY/MM/DD", and the time is 24-hour clock.

Remote Command	`:CALibration:RFPSelector:SCHeduler:TIME:STARt "date","time"`
	`:CALibration:RFPSelector:SCHeduler:TIME:STARt?`
	This query returns data using the format "YYYY/MM/DD; HH:MM:SS"

Example	`:CAL:RFPS:SCH:TIME:STAR "2009/8/20","12:00:00"`
Notes	`"date"` is the date the task will run, in the form `YYYY/MM/DD` where: – `YYYY` is the four-digit representation of year (for example, 2009) – `MM` is the two-digit representation of month (for example, 01 to 12) – `DD` is the two-digit representation of the day (for example, 01 to 28, 29, 30 or 31 depending on the month and year) `"time"` is the time of day the task will run, in the form `HH:MM:SS` where: – `HH` is the two-digit representation of the hour in 24-hour format – `MM` is the two-digit representation of minute – `SS` is the two-digit representation of seconds
Preset	Unaffected by **Preset** but set to Current date and 00:00:00 by **Restore Defaults** >"Alignments" on page 484
State Saved	No

Hour

Lets you configure the hour for the scheduled task. The command to configure the date and time parameters of the scheduler is the same; but they each have their own front panel-control.

Notes	See "Date/Time" on page 569
Preset	Unaffected by **Preset** but set to Current hour and 00 by **Restore Defaults** >"Alignments" on page 484
State Saved	No

Minute

Lets you configure the minute for the scheduled task. The command to configure the date and time parameters of the scheduler is the same; but they each have their own

front panel-control.

Notes	See "Date/Time" on page 569
Preset	Unaffected by **Preset** but set to Current minute and 00 by **Restore Defaults** >"Alignments" on page 484
State Saved	No

Recurrence

Lets you configure the scheduler to run the task recurrently on a scheduled date and time. You can schedule it to run daily, weekly, or alternate weeks.

Remote Command	`:CALibration:RFPSelector:SCHeduler:RECurrence DAY | WEEK | OFF` `:CALibration:RFPSelector:SCHeduler:RECurrence?`
Example	`:CAL:RFPS:SCH:REC DAY`
Preset	Unaffected by **Preset** but set to `OFF` by **Restore Defaults** >"Alignments" on page 484
State Saved	No
Range	`DAY | WEEK | OFF`

Number of Weeks

Lets you set the number of weeks that the scheduler will wait to trigger a task.

Remote Command	`:CALibration:RFPSelector:SCHeduler:RECurrence:WEEK <integer>` `:CALibration:RFPSelector:SCHeduler:RECurrence:WEEK?`
Example	`:CAL:RFPS:SCH:REC:WEEK 2`
Notes	New scheduled date to run the alignment task is updated when this parameter is changed
State Saved	No
Range	1-52
Min	1
Max	52

Day

Lets you set the Day of the Week the scheduler will run a scheduled task.

Remote Command	`:CALibration:RFPSelector:SCHeduler:RECurrence:DAY SUN | MON | TUE | WED | THU | FRI | SAT` `:CALibration:RFPSelector:SCHeduler:RECurrence:DAY?`
Example	`:CAL:RFPS:SCH:REC:DAY SUN`
State Saved	No
Range	Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday

4.8 Licensing

Accesses capabilities for configuring the licenses in your instrument.

4.8.1 License Manager

Opens the License Explorer for Fixed and Transportable licenses.

NOTE **This feature is not available if Option SF1 is installed.**

For help on licensing, select **Help** in the menu bar at the top of the License Explorer window.

There are also several remote commands available for licensing. See:

- "Install License (Remote Command Only)" on page 579
- "Remove License (Remote Command Only)" on page 579
- "List Licenses (Remote Query Only)" on page 580
- "Validate License (Remote Query Only)" on page 581
- "Host ID Query (Remote Query Only)" on page 581
- "List Borrowed Licenses (Remote Query Only)" on page 576
- "Return a Borrowed License (Remote Command Only)" on page 577

Notes No equivalent remote command for this control

4.8.2 System Software Version Date

The date of the newest features introduced in this release of the firmware. This is *not* necessarily the same as the build date of the firmware, because the version date only changes when new features are added. For example, if A.18.06 has only defect fixes and no new features compared to A.18.05, then both A.18.05 and A.18.06 would have the same software version date.

For any feature to be enabled, the SW Support Expiration Date of the enabling license must be greater than or equal to the software version date when that feature was first introduced. See the Keysight web site for features related to a specific software application and their required support date.

The SCPI response is 3 integer values: `<year>,<month>,<day>`.

Remote Command	`:SYSTem:SOFTware:VERSion:DATE?`
Example	`:SYST:SOFT:VERS:DATE?`

4.8.3 Software Support Expiration Date

This date is encoded in each software license's Version field in the `YYYY.MMDD` format. It specifies the end date of the support contract associated with this license. When a support contract is renewed, a new license is issued with an updated Version corresponding to the new contract's end date. The functionality available for a license is determined by the features available before the expiration date. For example, if feature X is introduced in a release with System Software Version Date of `2017.0831`, then a license with a Software Support Expiration Date of `2017.0831` or greater would enable feature X, but `2017.0830` or earlier would not enable feature X.

The SCPI response is 3 integer values: `<year>,<month>,<day>`.

Remote Command	`:SYSTem:LKEY:SOFTware:SUPPort:EXPiration:DATE? <feature>`
Example	`:SYST:LKEY:SOFT:SUPP:EXP:DATE? "N9084EM0E-1FP"`
Dependencies	When `<feature>` is not a valid license, one of the following errors will be issued: – -224,"IllegalParameterValue;License is not installed" – -224,"IllegalParameterValue;Unknown license feature" – -224,"IllegalParameterValue;Support contract not offered for this license"

4.8.4 Network Licenses

Network Licenses are available over the customer's network from a server the customer configures. The server has a count for each license and will only allow instruments to "check-out" a license up to that count. Once the count is reached for a specific license, further check-outs fail until one of the licenses is checked back in to the server. What this means is that it is possible for an instrument to have different features available to it based on what licenses are still available on the server when it tries to get licenses.

Setting up network licenses is done via the Keysight Floating License Manager (available on external Keysight web) and it has an Installation Guide that can be downloaded from that web page.

4.8.4.1 Application Licenses

Application Licenses (like N9077EM0E-1NP) are automatically checked out when entering the Mode that uses them, and they are automatically checked-in when leaving that Mode. Because the server may have already checked out the last license for the application to another instrument, there is now the possibility that a mode switch will fail because a required license could not be checked out from the server. If the server has a limited number of licenses compared to the number of users desiring to use that license, this may mean that switching from Mode A to Mode B then back to Mode A may fail when returning to Mode A because another instrument checked out the last available license while the user was in Mode B. Also, for Modes with multiple licenses for different features (like Multi-Standard Radio), the features available may also change when switching out of the Mode and back into it.

So, when using network licenses, it is necessary to check `:SYST:ERR?` after every Mode switch, to verify that it successfully switched. If the Mode's required licenses were not successfully checked out, the instrument posts the error:

-310,"System error; feature not licensed"

There is also a potential performance issue when using network licenses, because the instrument must communicate with the server on each license check-out and check-in. This operation is usually fast (a few milliseconds), but it depends on the network communication lag between the instrument and server. For remote servers on slow or congested networks, this could be significantly slower than that.

4.8.4.2 Instrument Software Options

Instrument software licenses are those that are reported via `*OPT?` the same as HW options. For example, N9040RT1B-1NP is an instrument software option, and is reported via `*OPT?` as `RT1`. Note that the license is composed of the model number (in this case `N9040B`) combined with the option code (`RT1`).

When instrument software options are available from a network server, the instrument automatically checks them out at start-up, and only checks them in when shutting down.

4.8.4.3 License Checked Out Query (Remote Query Only)

Shows whether the specified license is checked out from a server. Since network served licenses may not always be available when there are limited licenses available compared to the desired number of users, the features available on an instrument can vary. Use this query to see whether the feature is currently checked-out to the instrument. The return value is boolean (0 or 1), returning 1 if the feature

exists and is checked out from a server. Note that querying a license that is local to the instrument (-xFP or -xTP) also returns 0, even though the license exists and is valid, because it does not require a check-out. Also, querying a license that does not exist returns 0.

Remote Command	`:SYSTem:LKEY:COUT? <feature>`
Example	`:SYST:LKEY:COUT? "N9080EM0E"` Returns 1
Notes	`<"OptionInfo">` contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one Return Value: 0 if not checked out, 1 if checked out

4.8.4.4 List Licenses Checked Out (Remote Query Only)

Lists the licenses checked out from a server. Since network served licenses may not always be available when there are limited licenses available compared to the desired number of users, the features available on an instrument can vary. Use this query to see which features are currently checked-out to the instrument.

Remote Command	`:SYSTem:LKEY:COUT:LIST?`

Example	`:SYST:LKEY:COUT:LIST?`
	`:#284`
	`:N9073EM0E,2018.0831`
	`:N9077EM0E,2018.0831`
	`:N9080EM0E,2018.0831`
	`:N9081EM0E,2018.0831`

4.8.4.5 Borrowed Network Licenses

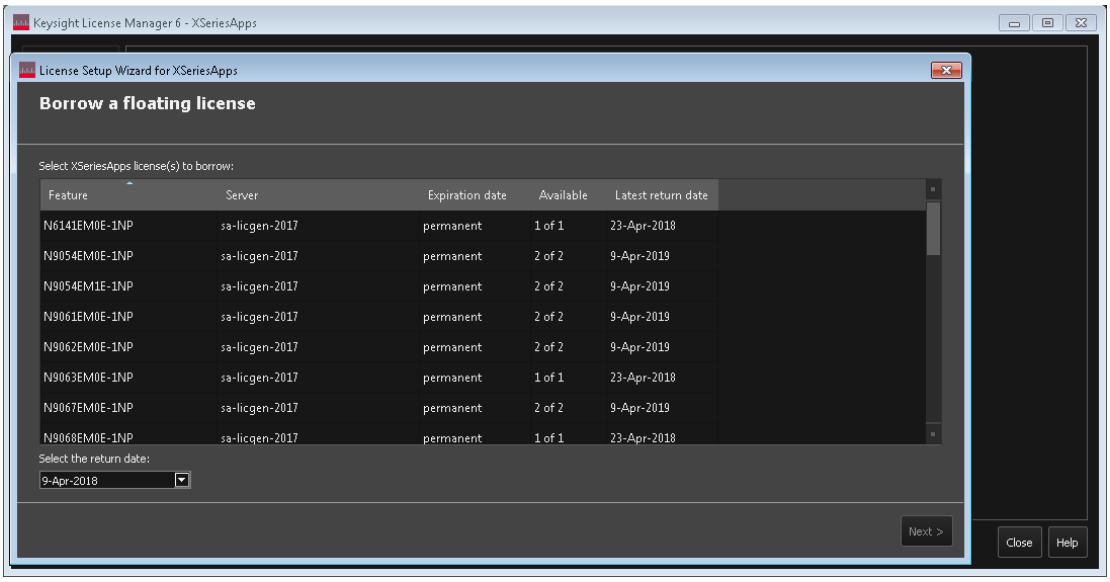
Network licenses can be borrowed from the network license server for a time. The maximum amount of time a license can be borrowed is specified in the license installed on the server and is set at the time the license is generated by Keysight. As part of the borrow operation, you specify how long to borrow the license. This borrow period is in hours and can be any time up to the maximum allowed by the license. Once borrowed, the license appears as a local license and can be used even when not connected to the network, and the instrument software treats them the same as other time-based licenses that are installed on the instrument. This means the licenses are validated when the instrument is started and then are used without the overhead of checking them out and back in when switching Modes. At the time of the borrow, a time is specified for how long the license will be borrowed. When that time expires, the license is automatically returned to the network license server

even if the instrument is not connected to the network. If you are done with the license before it automatically returns to the network server, the license can be explicitly returned earlier.

4.8.4.6 Borrow a License

Licenses are borrowed by using the Keysight License Manager 6 application. This can be launched from the System Licensing screen.

Graphic



The corresponding remote command is:

Remote Command	`:SYSTem:LKEY:BORRow "<feature>[,<version>]",<return date>` `:SYSTem:LKEY:BORRow? "<feature>[,<version>]"`

Example	`:SYST:LKEY:BORR "N9080EM0E","20-Aug-2018"`
	`:SYST:LKEY:BORR? "N9080EM0E"`
	`:"20-Aug-2018"`

Notes	If `<version>` is not specified, the highest available version will be borrowed The `<return date>` is the day when the borrow will automatically be returned to the server
Dependencies	For the command, when `<feature>` is not a valid license, or when a license is not currently available for borrowing, one of the following errors is issued: – -224,"IllegalParameterValue;License is not installed" – -224,"IllegalParameterValue;Unknown license feature"

- -224,“IllegalParameterValue;License not available for borrowing”

Additionally, the return date is evaluated. If it is not a valid date, the following error is issued:

- -224,“IllegalParameterValue;Invalid return date”
- -200,"Execution error; No Available Borrow Licenses For Feature: <feature>"

The return date may be clipped to the maximum borrow allowed by the license. When this happens, the following warning is issued:

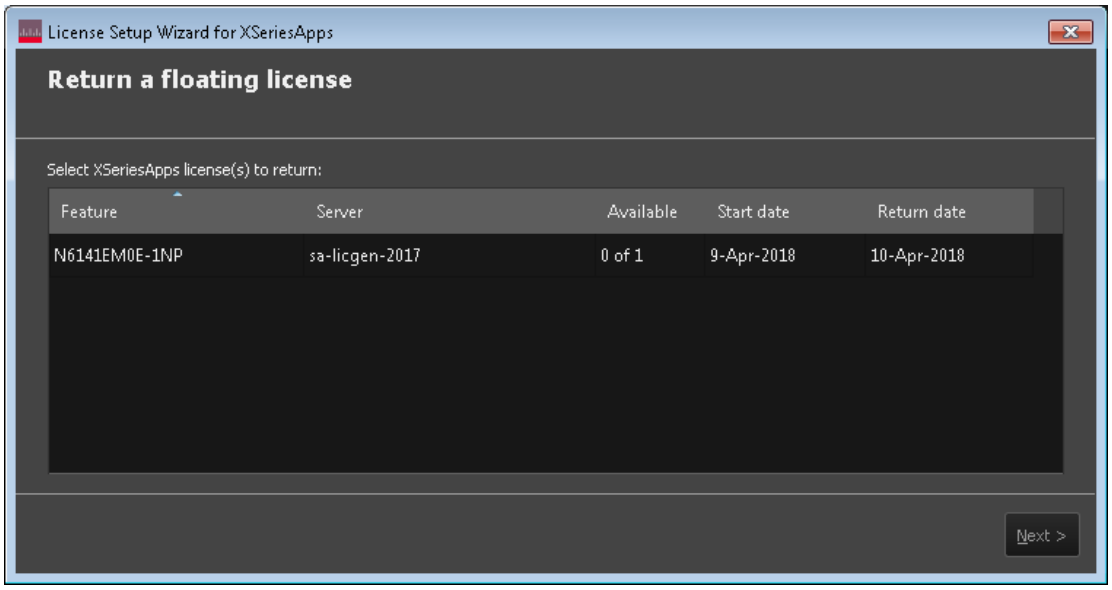
- -221,”Return date clipped to maximum of <max date>”

For the query, the return is the borrow return date (as a string in `dd-mmm-yyyy` format) if the license is borrowed. In all other cases, (not borrowed, not installed, etc.) the return is an empty string

4.8.4.7 Listing Borrowed Licenses and Return a Borrowed License

The Keysight License Manager 6 can also be used to see the currently borrowed licenses or return a license before the automatic return time.

Graphic



List Borrowed Licenses (Remote Query Only)

Remote Command	`:SYSTem:LKEY:BORRow:LIST?`
Example	`:SYST:LKEY:BORR:LIST?`

```
:#266
:N9073EM0E,2018.0831,20-Aug-2018
:N9077EM0E,2018.0831,20-Aug-2018
```

Return a Borrowed License (Remote Command Only)

Remote Command	`:SYSTem:LKEY:BORRow:RETurn "<feature>"`
Example	`:SYST:LKEY:BORR:RET "N9080EM0E"`
Dependencies	When `<feature>` is not a valid license or when a license is not borrowed, one of the following errors is issued: – -224,"IllegalParameterValue;License is not installed" – -224,"IllegalParameterValue;Unknown license feature" – -224,"IllegalParameterValue;License not borrowed"

4.8.4.8 Enabling Network Checkouts While Borrowed

The default for borrowed license use is that you will be explicitly borrowing all desired network licenses, and that all other available network licenses should be ignored. This allows you to intentionally limit the functionality available to the instrument to what is explicitly borrowed.

For example, the RT1/RT2 options that enable the RTSA Mode are automatically checked out when the instrument is started, because the hardware must be configured for them at startup time. If you do not intend to use RTSA, then by borrowing only the licenses you want to use and disabling other network checkouts, the RT1/RT2 licenses will not be checked out at startup. This leave more RTSA licenses available for others to use. Note that the instrument must be restarted after the borrowing has been done to ensure the release of any network licenses already acquired.

If your intent in borrowing is to ensure access to a particular feature or application, but you still want to opportunistically use other features or applications, the default behavior can be changed to enable network license checkouts even when licenses have been borrowed.

Remote Command	`:SYSTem:LKEY:BORRow:NETWork:COUT:ENABle`
Example	`:SYST:LKEY:BORR:NETW:COUT:ENAB 0` `:SYST:LKEY:BORR:NETW:COUT:ENAB?`
Dependencies	Only visible when licensing is configured to use a network server. SCPI is always available
Preset	Unaffected by **Preset** but set to 0 by **Restore Defaults** >"Misc" on page 484 or **Restore Defaults** >"All" on page 485

State Saved	Power On Persistent (survives shutdown and restart)

4.8.5 USB Portable Licenses

The USB Portable license is implemented with a physical dongle that is a USB device, like a USB thumb drive. It has a Host ID fixed in the dongle HW. It does not contain any writable data and so is acceptable to high security A/D customers. Transporting licenses from one instrument to another just requires moving the dongle and license files to the desired instrument. The license files can be installed on many instruments, but they will only be valid the one instrument that has the dongle. The use of USB portable licenses requires that the Keysight Floating License Manager is installed on the instrument. The licenses can then be added to the instrument's server.

USB Portable licenses are checked out and in like Network licenses. Because the licenses are local, there will be no network latency involved in the check-out/check-in, but there can still be a slight performance degradation compared to Fixed and Transportable licenses. If the instrument allows multiple concurrent instances of the X-Series software (as is the case for modular products), there may also be availability issues if all licenses are already checked out to other X-Series instances. Plugging/un-plugging the dongle is equivalent to transporting a license to/from the instrument, however, the software must be restarted whenever the dongle is plugged in.

4.8.6 Configuring Network and USB Portable Licenses

The Keysight Floating License Manager must be used to configure the Network or USB Portable licenses before the licenses can be used. Currently, an instrument can only be configured for Network or USB Portable licenses or both.

- To set up USB Portable licenses, in the Keysight Floating License Manager select "Start a floating license server with a license file" and add files containing the USB Portable licenses desired
- To set up Network licenses, in the Keysight Floating License Manager select "Connect to a floating license server" and enter the network server's name preceded by the "@" character (example: "@myserver")
- To set up both Network and USB Portable license, first configure the USB Portable license, then configure the Network licenses, but append ";@localhost" to the server name (example: "@myserver;@localhost"). Whenever the configuration is changed, the X-Series software must be restarted

4.8.7 Floating License Manager

Opens the License Explorer for Network and USB Portable licenses.

NOTE **This feature is not available if Option SF1 is installed.**

For help with licensing, select **Help** in the menu bar at the top of the License Explorer window.

4.8.8 Install License (Remote Command Only)

Used to add a license to the instrument.

An example of such a command would be as below. The parameter is a unique 120-character code for each license.

```
SYST:LKEY “N9073A-
1FP”,”027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909C551DE0A91”
```

Another example using one of the optional clauses.

```
SYST:LKEY "N9063EM0E-
1FP,2019.0330","02220210867E187713C9AFD4C90EA0DE2B674615DD0255798EE5B237A146A0D4E411E0ABFE04D3CAFDFA","ISSUED=30-Mar-2018"
```

NOTE **This command does not work for Transportable, Network or USB Portable licenses.**

Remote Command	`:SYSTem:LKEY <"OptionInfo">, <"LicenseInfo">,<"Optional1">,<"Optional2">,<"Optional3">,<"Optional4">,<"Optional5">`
Notes	`<”OptionInfo”>` contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, since the system knows which version is supported for each feature `<”LicenseInfo”>` contains the signature, the expiration date, and serial number for transport if transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the serial number, the system regards it as non-transportable. As a result, this supports reverse compatibility `<”Optional#”>` are optional parameters that may be needed to match the information in the original license

4.8.9 Remove License (Remote Command Only)

Removes a particular license.

An example of such a command would be as below. The parameter is a unique 120-character code for each license.

```
SYST:LKEY:DEL “N9073A-
1FP”,”027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909C551DE0A91”
```

NOTE **This command does not work for Transportable, Network or USB Portable licenses.**

Remote Command	`:SYSTem:LKEY:DELete <"OptionInfo">,<"LicenseInfo">`
Notes	`<”OptionInfo”>` contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, if more than one version is installed `<”LicenseInfo”>` contains the signature, the expiration date, and whether be transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the transportability, the system regards it as non-transportable. As a result, this supports reverse compatibility

4.8.10 List Licenses (Remote Query Only)

Returns a list of installed licenses.

Remote Command	`:SYSTem:LKEY:LIST?`

Notes	Return Value:
	An `<arbitrary block data>` of all the installed instrument licenses
	The format of each license is as follows
	`<Feature>,<Version>,<Signature>,<Expiration Date>,<Serial Number for Transport>,…`
	Return Value Example:
	`#3136`
	`N9073A-1FP,1.000,B043920A51CA`
	`N9060A-2FP,1.000,4D1D1164BE64`
	`N9020A-508,1.000,389BC042F920`
	`N9073A-1F1,1.000,5D71E9BA814C,13-aug-2005`
	`<arbitrary block data>` is:
	`#NMMM<data>`
	Where:
	`N` is the number of digits that describes the number of `MMM` characters. For example, if the data was 55 bytes, N would be 2

	MMM would be the ASCII representation of the number of bytes. In the previous example, N would be 55 <data> ASCII contents of the data Additional fields may appear depending on the type of license (Fixed, Transportable, Network, USB Portable)

4.8.11 Validate License (Remote Query Only)

Lets you query whether a particular license is currently valid.

Remote Command	:SYSTem:LKEY? <"OptionInfo">
Example	:SYST:LKEY? "N9073A-1FP"
Notes	<"OptionInfo"> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one Return Value: <"LicenseInfo"> if the license is valid, null otherwise <"LicenseInfo"> contains the signature, the expiration date, and serial number if transportable Return Value Example: "B043920A51CA"

4.8.12 Host ID Query (Remote Query Only)

Returns the Host ID as a string.

Remote Command	:SYSTem:HID?

4.9 Security

Accesses capabilities for operating the instrument in a security-controlled environment.

The Security page of the System menu has two controls: USB Read/Write and Restore Security Defaults.

Dependencies	Not available in UXM

4.9.1 USB Write Protect

The Windows operating system can be configured to disable write access to the USB ports for users who are in a secure environment where transferring data from the instrument is prohibited. The USB Write Protect control is a convenient way for you to disable write access to USB.

NOTE **This control is only available to users with Administrator privileges.**

Remote Command	`:SYSTem:SECurity:USB:WPRotect[:ENABle] ON | OFF | 0 | 1` `:SYSTem:SECurity:USB:WPRotect[:ENABle]?`

Example	Set USB ports to Read-only:
	`:SYST:SEC:USB:WPR ON`
	Set USB ports to Read-Write:
	`:SYST:SEC:USB:WPR OFF`

Notes	When the USB ports are in Read-only mode, then no data can be stored to USB, including the internal USB memory used for a back-up location for the calibration data
Dependencies	Grayed-out unless the current user has Administrator privileges
Preset	Unaffected by Preset or any "Restore Defaults" on page 482. A Keysight Recovery sets the USB to write protect `OFF`
State Saved	No
Range	Read-Write | Read only

4.9.2 Restore Security Defaults

Sets USB Read/Write to Enable.

NOTE **This control is only available to users with Administrator privileges.**

4.10 Diagnostics

Displays a slider that allows you to view Hardware Statistics.

Dependencies	Not available in UXM

4.10.1 Show Hardware Statistics

Provides a display of various hardware statistics. The statistics include the following:

- Mechanical relay cycles (on models with mechanical relays)
- High and Low temperature extremes
- Elapsed time that the instrument has been powered-on (odometer)

Modular instruments display only time and temperature information.

Example	`:SYST:SHOW HWST`
Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed

4.10.2 Pathwave Calibration Advisor...

This is a separate application that helps maintain your instrument at peak performance. You can set the cal interval, configure cal due reminders, check the cal status, view cal certificates and test reports, and contact Keysight for a cal service.

The embedded help documentation can be accessed in the instrument at: C:\Program Files\Keysight\Calibration Advisor\PCA.chm, or via the **?** button at the top right of the PathWave Calibration Advisor window.

4.10.3 Query the Mechanical Relay Cycle Counts (Remote Query Only)

Returns the count of mechanical relay cycles.

This query only returns cycle counts. To receive mechanical relay names as well, use :SYSTem:MRELay:COUNt:NAME? query instead.

Remote Command	`:SYSTem:MRELay:COUNt?`
Example	`:SYST:MREL:COUN?`
Notes	Query Only

	The return value is a comma-separated list of the individual counts for each mechanical relay The position of the relays in the list is: "<Cal Signal>,<AC/DC>,<2dB #1 Atten>,<2dB #2 Atten>,<6dB Atten>,<10dB Atten>,<20dB Atten>,<30dB Atten>,<Fixed Atten>,<Low Noise Path Switch>,<Presel Bypass>,<N9038A Input2>,<N9038A Bypass>,<40dB Atten>,<N9041B VW Atten>,<N9041B VW 6dB Atten>,<N9041B VW 14dB Atten>,<N9041B RF Input Switch>" Items in the list not pertaining to your hardware configuration return as -999 for those items
Dependencies	*Not* supported by E6607C *Not* supported by SA6210A. Use :SYSTem:MRELay:COUNt:NAME? instead

4.10.4 Query the Mechanical Relay Names and Cycle Counts (Remote Query Only)

Returns the names and cycle counts of mechanical relays.

Instruments are equipped with different types of mechanical relays based on models and options.

This query returns information for mechanical relays found on your instrument.

Remote Command	:SYSTem:MRELay:COUNt:NAME?
Example	:SYST:MREL:COUN:NAME?
Notes	Query Only The return value is an IEEE 488.2 Binary Block format (IEEE 488.2-1992 Section 7.7.6 Arbitrary Block Program Data, definite length) The block contains a string in the following representation Each mechanical relay's name and cycle count are represented as a name/value entry When multiple mechanical relays are found, their name/value entries are reported, too All the entries are enclosed by square brackets [ ] \{ "mechanical_relays": [\{ "name": "<name of mechanical relay 1>", "value": <double> \}, \{ "name": "<name of mechanical relay 2>", "value": <double> \},

```
    ...repeat as needed...
  ]
\}
```

Models that do not have mechanical relays to report return an empty entry in the square brackets:

```
\{
  "mechanical_relays": [
  ]
\}
```

In future S/W Revisions, additional information might be added in each entry as in the example below

Make sure your remote program can continue to parse the query result without being affected by such additional information

```
\{
  "mechanical_relays": [
    \{
      "name": "<name of mechanical relay 1>",
      "value": <double>,
      “additional_info_a”: “<additional string>”,
      “additional_info_b”: <additional double>
    \},
    \{
      "name": "<name of mechanical relay 2>",
      "value": <double>,
      “additional_info_a”: “<additional string>”,
      “additional_info_b”: <additional double>
    \},
    ...repeat as needed...
  ]
\}
```

4.10.5 Query the Operating Temperature Extremes (Remote Query Only)

Returns the low operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

Remote Command	`:SYSTem:TEMPerature:LEXTreme?`

Example	`:SYST:TEMP:LEXT?`
Notes	Value is in degrees Celsius, at which the lowest operating temperature has been recorded since 1st power-up
State Saved	No

Returns the high operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

Remote Command	`:SYSTem:TEMPerature:HEXTreme?`
Example	`:SYST:TEMP:HEXT?`
Notes	Value is in degrees Celsius at which the highest operating temperature has been recorded since 1st power-up
State Saved	No

4.10.6 Query the Elapsed Time since 1st power on (Remote Query Only)

Returns the elapsed on-time in minutes since 1st power-on.

Remote Command	`:SYSTem:PON:ETIMe?`
Example	`:SYST:PON:ETIM?`
Notes	Query Only

4.11 Service

Accesses capabilities performed in the factory or under instructions from repair procedures. This key is only visible when the logged-in user is “advanceduser” or “saservice”. The first access to the Service menu after invoking the instrument application will require an authentication Service Code.

Dependencies	Not available in UXM

4.12 Wake on LAN

Lets you remotely turn on an instrument that has been in power-off state, by sending a special LAN packet, called Magic Packet. Wake-On-LAN is also called WOL or Remote Wake up. It is part of the Advanced Configuration and Power Interface (ACPI).

This feature is available only when *all* the following conditions are satisfied.

1	Product Model	Must be one of: N904x, N903x, N902x, N901x, N900x, SA6210A
2	CPU Option	Must be one of: PC8, PC9, PCA, PCB, CP2, or PCE
3	BIOS/UEFI and Windows Operating System Configuration	See "BIOS/UEFI and Windows Operating System Configuration" on page 588
4	Network Configuration	See "Network Configuration" on page 588

4.12.1 BIOS/UEFI and Windows Operating System Configuration

The procedure varies according to CPU type:

- For PC8/PC9 CPUs, see "BIOS/UEFI and Windows Operating System Configuration Procedure for PC8 and PC9 CPUs" on page 589
- For PCA/PCB CPUs, see "LAN Port, BIOS/UEFI, and Windows Operating System Configuration Procedure for PCA and PCB CPUs" on page 592
- For CP2 CPU, see "LAN Port, BIOS/UEFI, and Windows Operating System Configuration Procedure for CP2 CPU" on page 597

4.12.2 Network Configuration

Configure the LAN so that the external PC that sends the Magic Packet and the instrument that receives the Magic Packet share all the following:

- Gateway
- Subnet Mask
- DNS Server

4.12.3 Procedures to Configure Wake-On-LAN

The following sections explain how to configure:

1. LAN Port connection (PCA/PCB/CP2/PCE CPUs only)
2. BIOS/UEFI settings
3. Windows Operating System settings

The procedure varies depending on the CPU type. Follow the procedure that matches the instrument's CPU option. For easier operation, we recommend connecting a keyboard and mouse to the instrument.

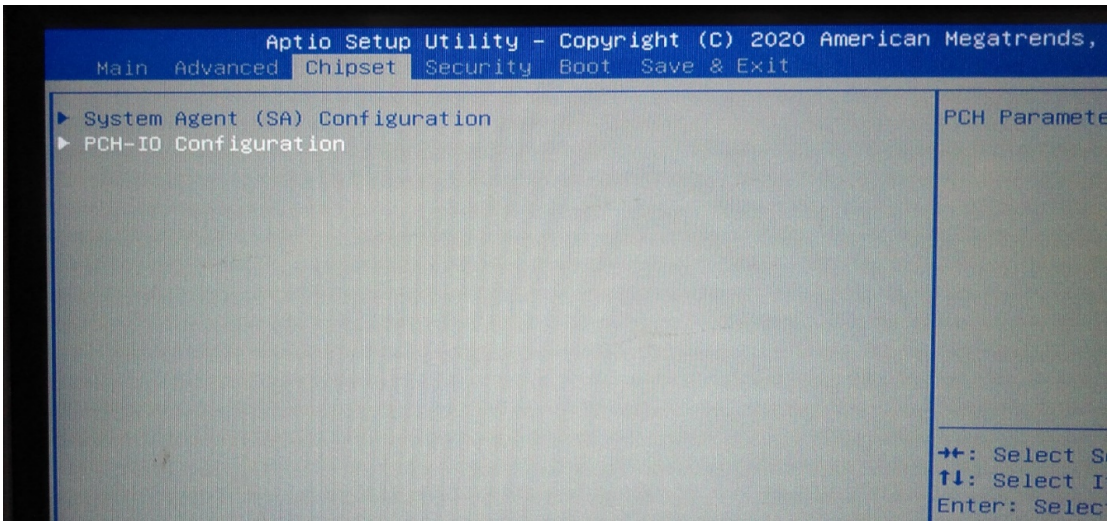
4.12.3.1 BIOS/UEFI and Windows Operating System Configuration Procedure for PC8 and PC9 CPUs

This section includes:

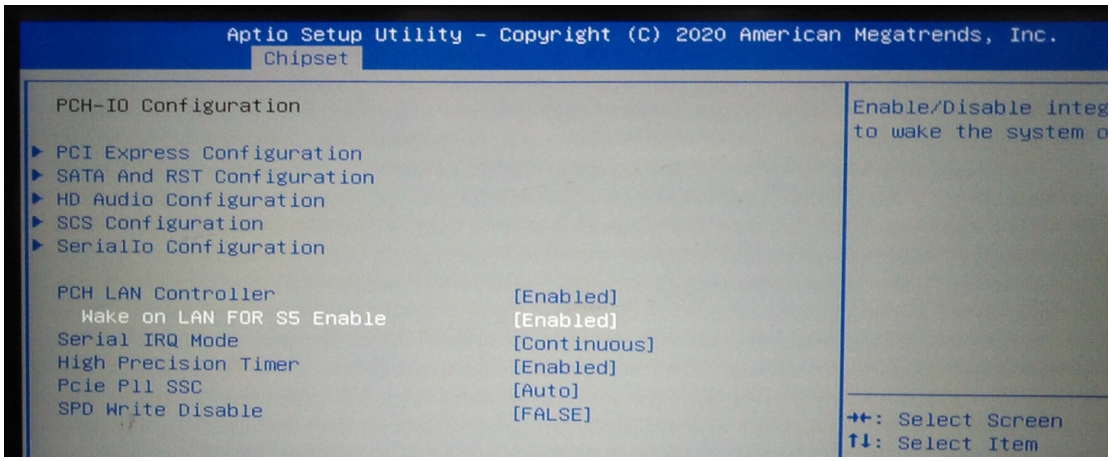
– "BIOS/UEFI Procedure" on page 589
– "Windows Operating System Procedure" on page 590

BIOS/UEFI Procedure

1 Restart the instrument
2 During the restart, press **Delete** to enter the **BIOS/UEFI Setup** menu
3 Select the **Chipset** tab
4 Select **PCH-IO Configuration**
5 Press **Enter**



6 Select **Wake on LAN FOR S5 Enable**
7 If it is not enabled, enable it

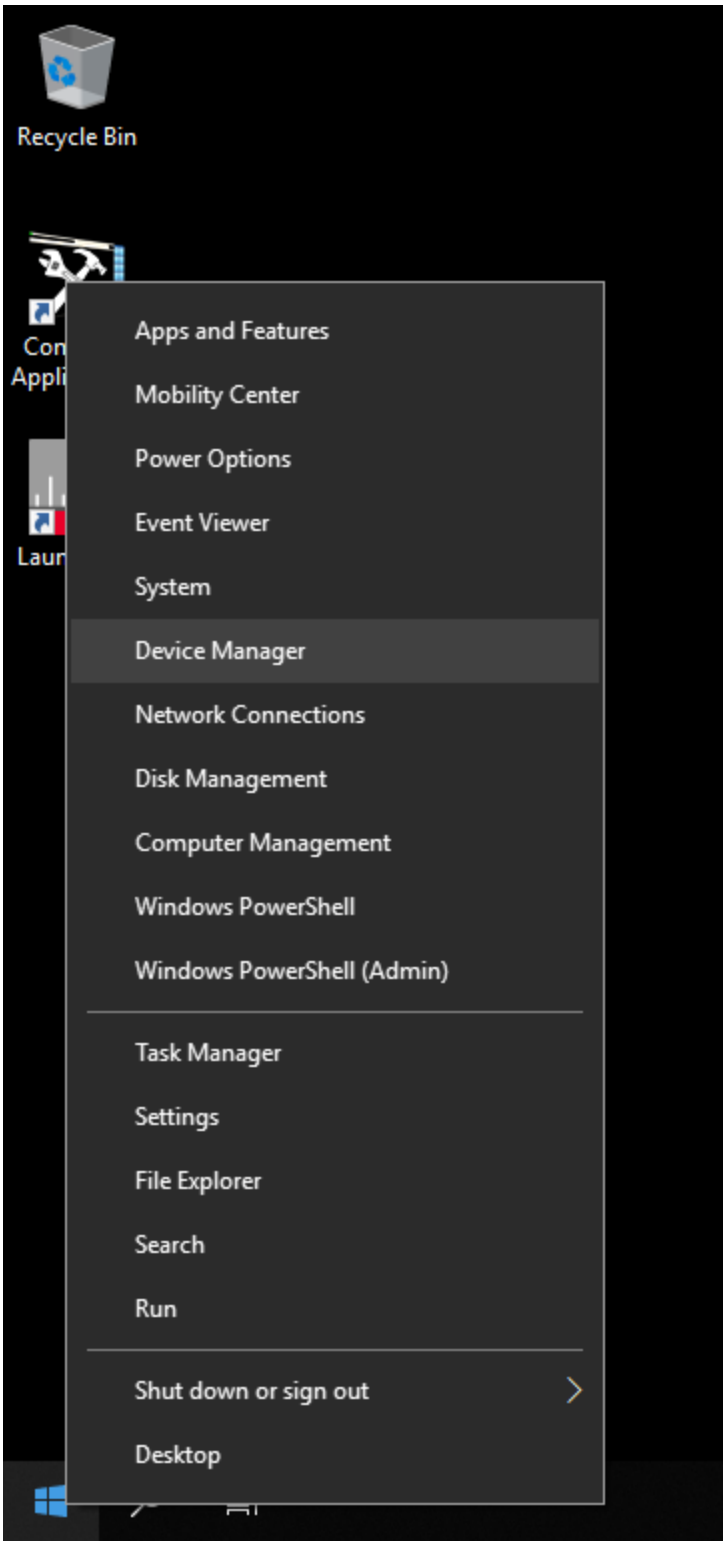


8 Press **F10** to save and exit the **BIOS/UEFI** screen

Windows Operating System Procedure

1 Log in to the instrument as Administrator

2 Right-click **Start** and select **Device Manager**


Recycle Bin
Apps and Features
Mobility Center
Power Options
Event Viewer
System
Device Manager
Network Connections
Disk Management
Computer Management
Windows PowerShell
Windows PowerShell (Admin)
Task Manager
Settings
File Explorer
Search
Run
Shut down or sign out
Desktop

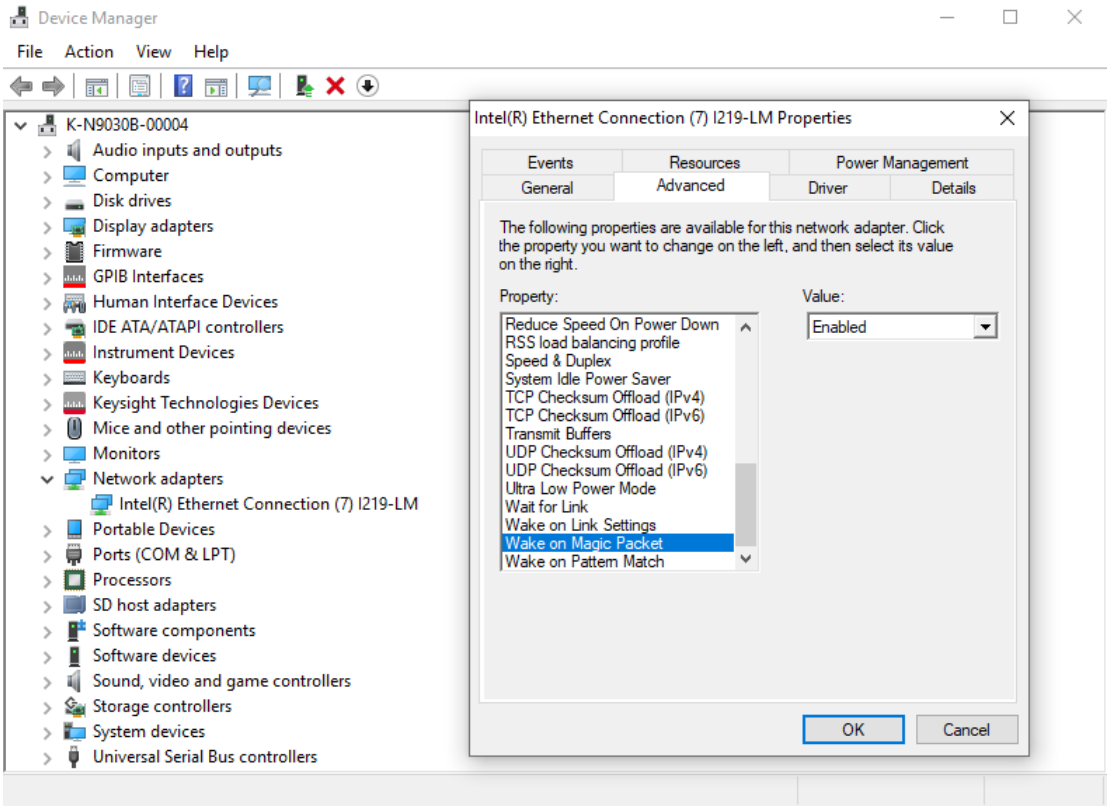
3 Navigate to **Network adapters" à "Intel(R) Ethernet Connection...**

4 Right-click, then select **Properties**

5 Select the **Advanced** tab

6 In the Property list, select **Wake on Magic Packet**

7 If the Value is not enabled, select **Enabled** and click **OK**



4.12.3.2 LAN Port, BIOS/UEFI, and Windows Operating System Configuration Procedure for PCA and PCB CPUs

Note that PCA and PCB have two LAN ports, but only "LAN 1G" port supports **Wake On LAN**.

This section includes:

– "LAN Port Connection" on page 593
– "BIOS/UEFI Procedure" on page 593
– "Windows Operating System Procedure" on page 595

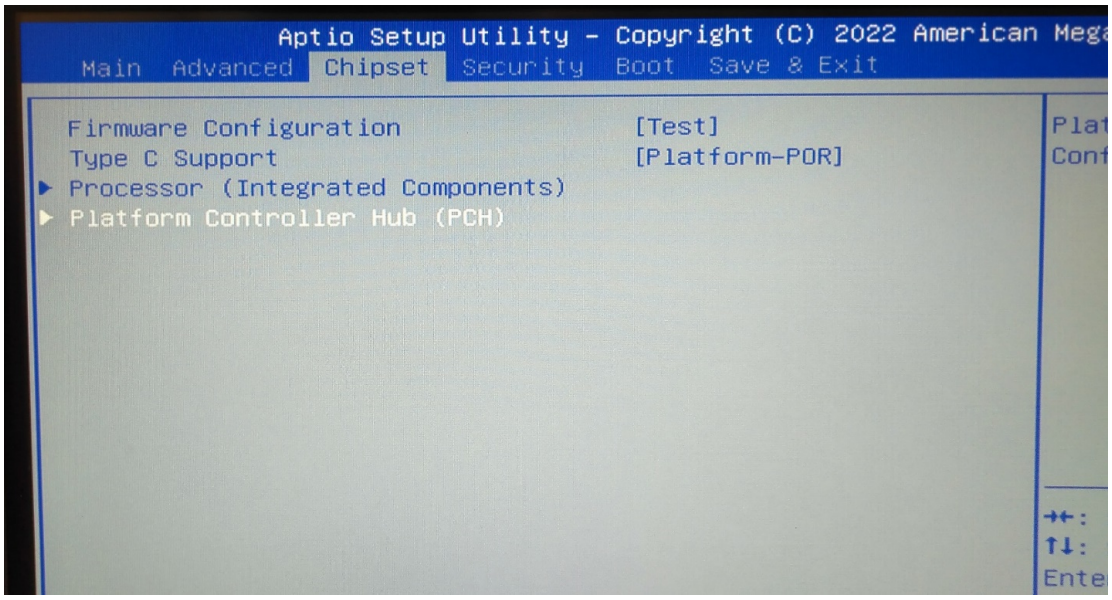
LAN Port Connection

PCA and PCB-equipped instruments have two LAN ports: LAN 1G and LAN 10G, but only the LAN 1G port supports Wake On LAN. Connect the LAN cable to the LAN 1G port.



BIOS/UEFI Procedure

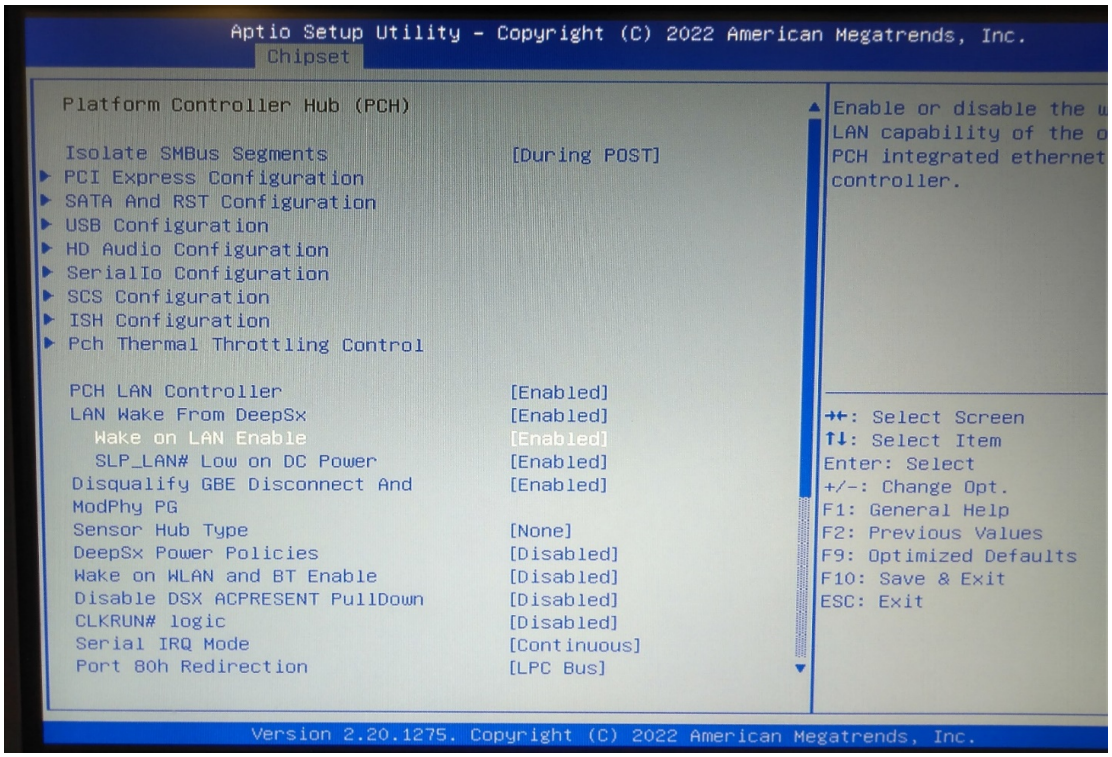
1 Restart the instrument
2 During the restart, press Delete to enter the BIOS/UEFI Setup menu
3 Select the Chipset tab
4 Select Platform Controller Hub (PCH)
5 Press Enter



6 Select **Wake on LAN Enable**

If it is not enabled, enable it

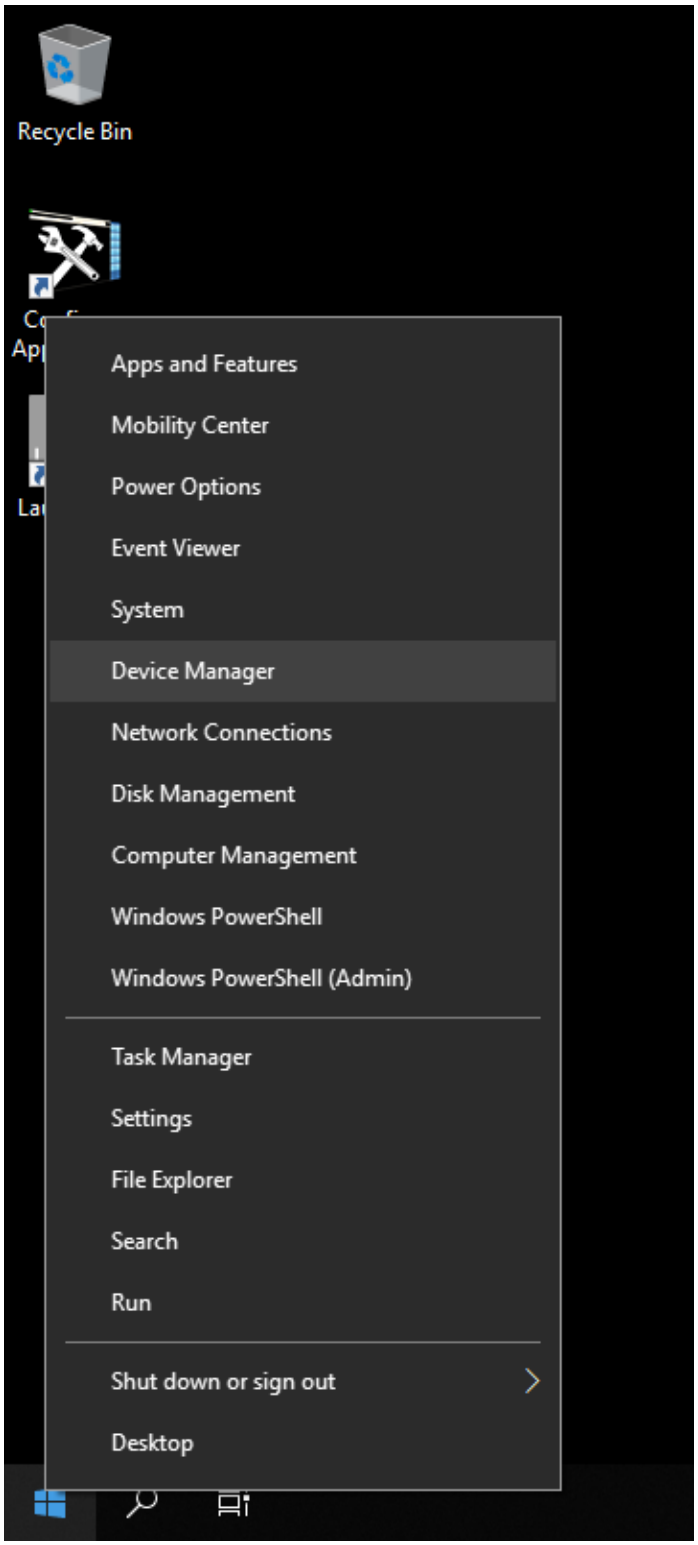
7 Press **F10** to save and exit **BIOS/UEFI Setup**



Windows Operating System Procedure

1 Log in to the instrument as Administrator

2 Right-click on the **Start** button and select **Device Manager**


Recycle Bin
Apps and Features
Mobility Center
Power Options
Event Viewer
System
Device Manager
Network Connections
Disk Management
Computer Management
Windows PowerShell
Windows PowerShell (Admin)
Task Manager
Settings
File Explorer
Search
Run
Shut down or sign out
Desktop

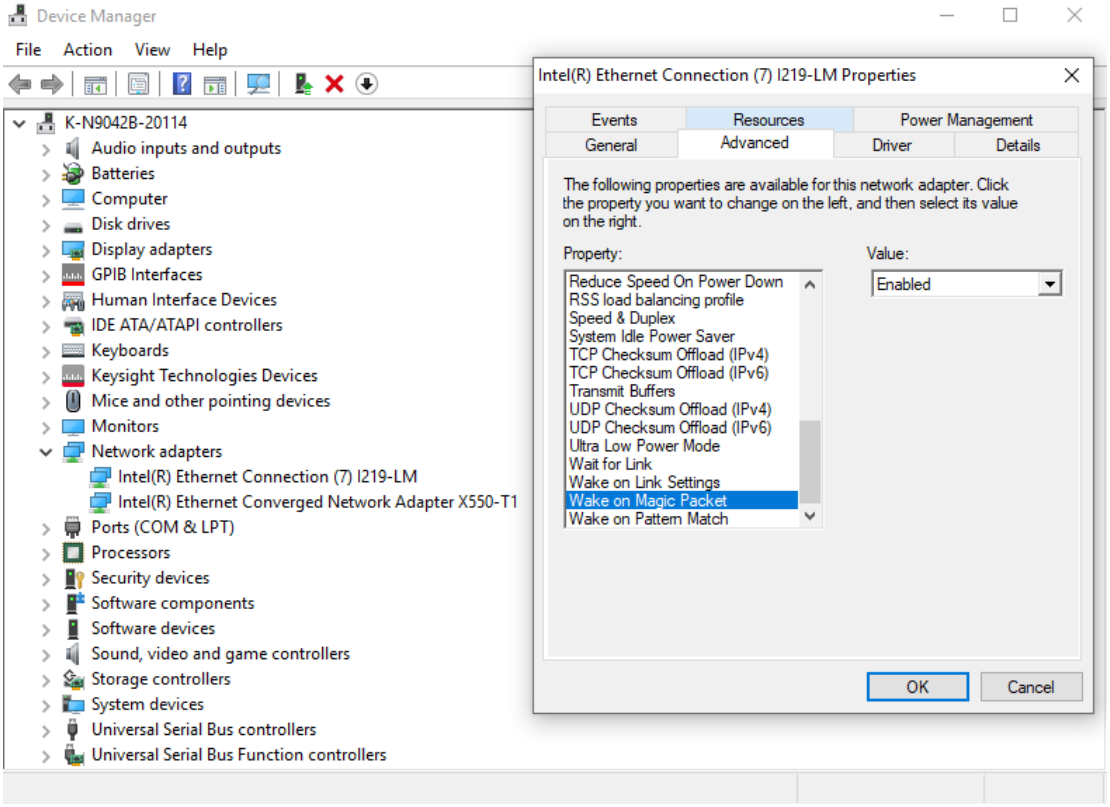
3 Navigate to **Network adapters** > **Intel(R) Ethernet Connection...**

4 Right-click and select **Properties**

5 Select the **Advanced** tab

6 In the Property list, select **Wake on Magic Packet**

7 If the Value is not enabled, select **Enabled** and click **OK**



4.12.3.3 LAN Port, BIOS/UEFI, and Windows Operating System Configuration Procedure for CP2 CPU

This section includes:

– "LAN Port Connection" on page 593

– "BIOS/UEFI Procedure" on page 593

– "Windows Operating System Procedure" on page 595

LAN Port Connection

In SA6210A, when Option GBE is installed, two more 10 Gbps ports are added (on the right in the image below) and four ports become available in total. **Wake on LAN** is only supported on 1 Gbps LAN ports (the two in the middle). See "Wake on LAN" on page 588

BIOS/UEFI Procedure

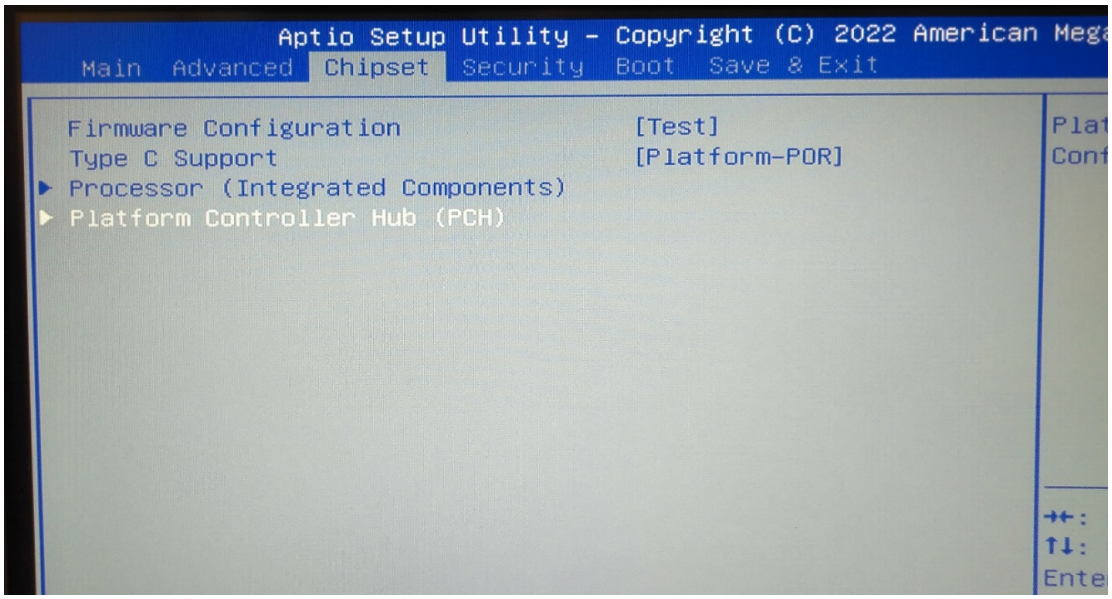
1 Restart the instrument

2 During the restart, press **Delete** to enter the **BIOS/UEFI Setup** menu

3 Select the **Chipset** tab

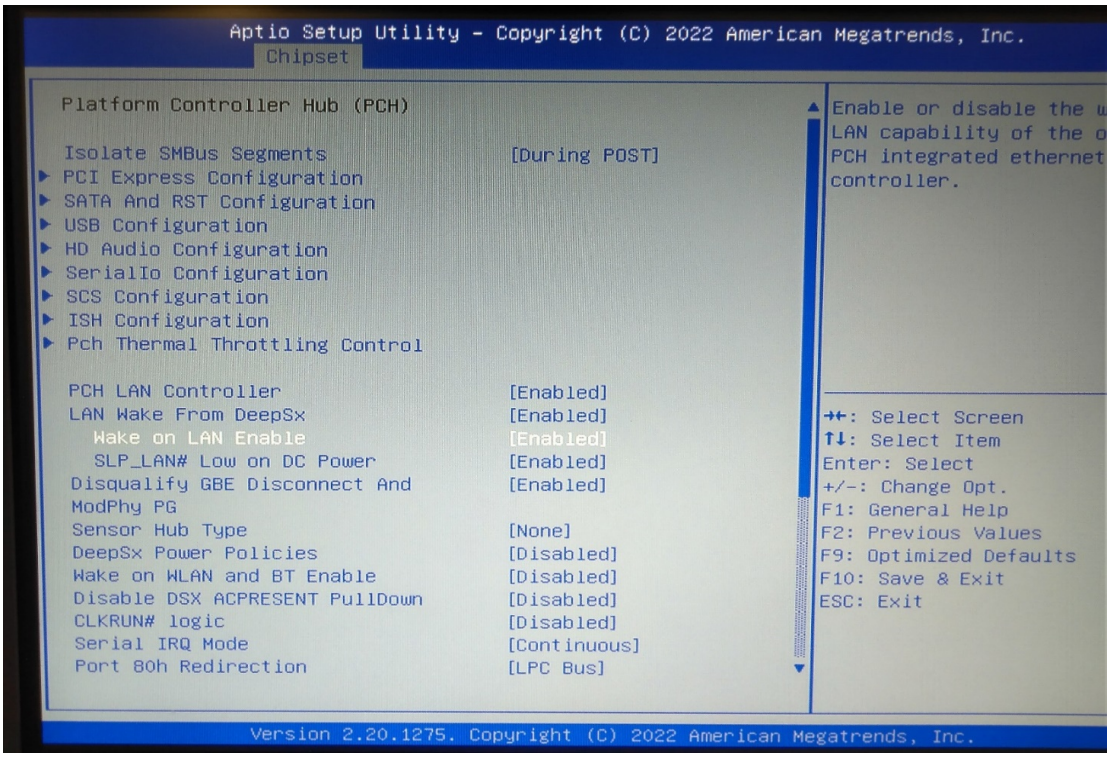
4 Select **Platform Controller Hub (PCH)**

5 Press **Enter**



6 Select **Wake on LAN Enable**
If it is not enabled, enable it

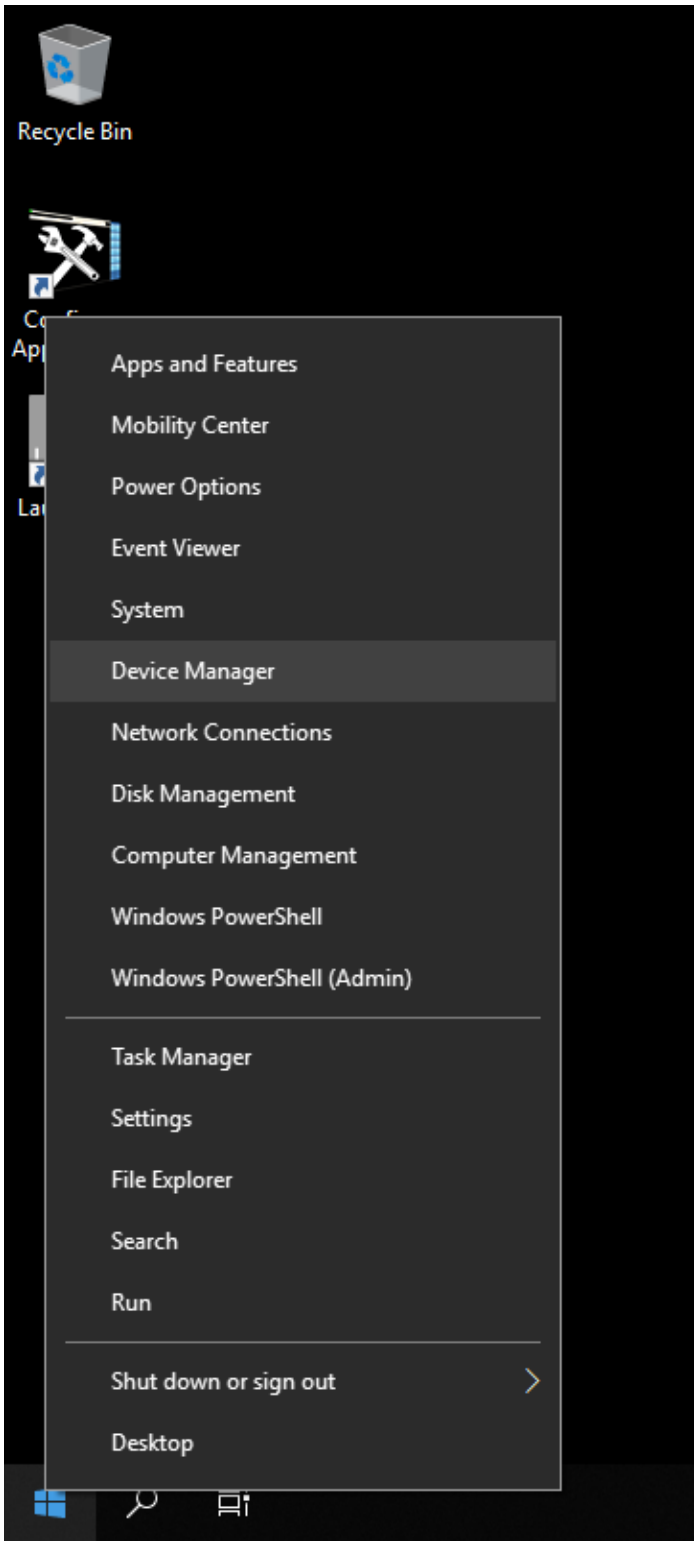
7 Press **F10** to save and exit **BIOS/UEFI Setup**



Windows Operating System Procedure

1 Log in to the instrument as Administrator

2 Right-click on the **Start** button and select **Device Manager**


Recycle Bin
Apps and Features
Mobility Center
Power Options
Event Viewer
System
Device Manager
Network Connections
Disk Management
Computer Management
Windows PowerShell
Windows PowerShell (Admin)
Task Manager
Settings
File Explorer
Search
Run
Shut down or sign out
Desktop

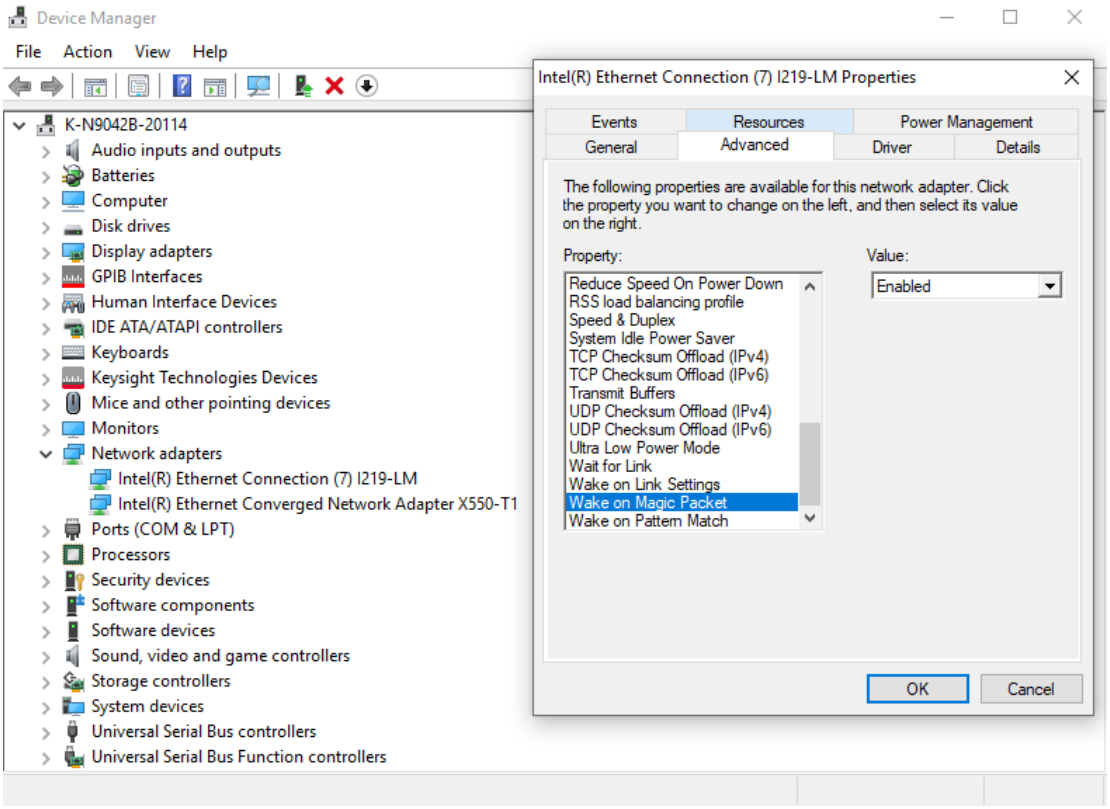
3 Navigate to **Network adapters** > **Intel(R) Ethernet Connection...**

4 Right-click and select **Properties**

5 Select the **Advanced** tab

6 In the Property list, select **Wake on Magic Packet**

7 If the Value is not enabled, select **Enabled** and click **OK**



4.13 System Remote Commands (Remote Commands Only)

These commands have no front-panel key equivalent.

- "List installed Options (Remote Query Only)" on page 602
- "Lock the Front-panel keys (Remote Command Only)" on page 603
- "Lock Workstation (Remote Command Only)" on page 603
- "List SCPI Commands (Remote Query Only)" on page 605
- "Front Panel activity history (Remote Query only)" on page 605
- "SCPI activity history (Remote Query only)" on page 606
- "Instrument start time (Remote Query only)" on page 606
- "SCPI Version Query (Remote Query Only)" on page 607
- "Date (Remote Command Only)" on page 607
- "Time (Remote Command Only)" on page 607
- "Input Overload Enable (Remote Command Only)" on page 608
- "Power Up (Remote Query Only)" on page 608

4.13.1 List installed Options (Remote Query Only)

Lists the installed options that pertain to the instrument (signal analyzer).

Remote Command	`:SYSTem:OPTions?`
Example	`:SYST:OPT?`
Notes	The return string is a comma-separated list of the installed options. For example: `"503,P03,PFR"` `:SYSTem:OPTions?` and `*OPT?` are the same
State Saved	No

4.13.2 Lock the Front-panel keys (Remote Command Only)

Disables the instrument keyboard to prevent local input when the instrument is controlled remotely. Annunciation showing a “K” for KLOCk (keyboard lock) alerts the local user that the keyboard is locked. KLOCk is similar to the GPIB Local Lockout function; namely that no front-panel keys are active except for the Power Standby key. (The instrument is allowed to be turned-off if KLOCk is ON.) The KLOCk command is used in remote control situations where Local Lockout cannot be used.

Although primary intent of KLOCk is to lock-out the front panel, it will lock-out externally connected keyboards through USB. KLOCk has no effect on externally connected pointing devices (mice).

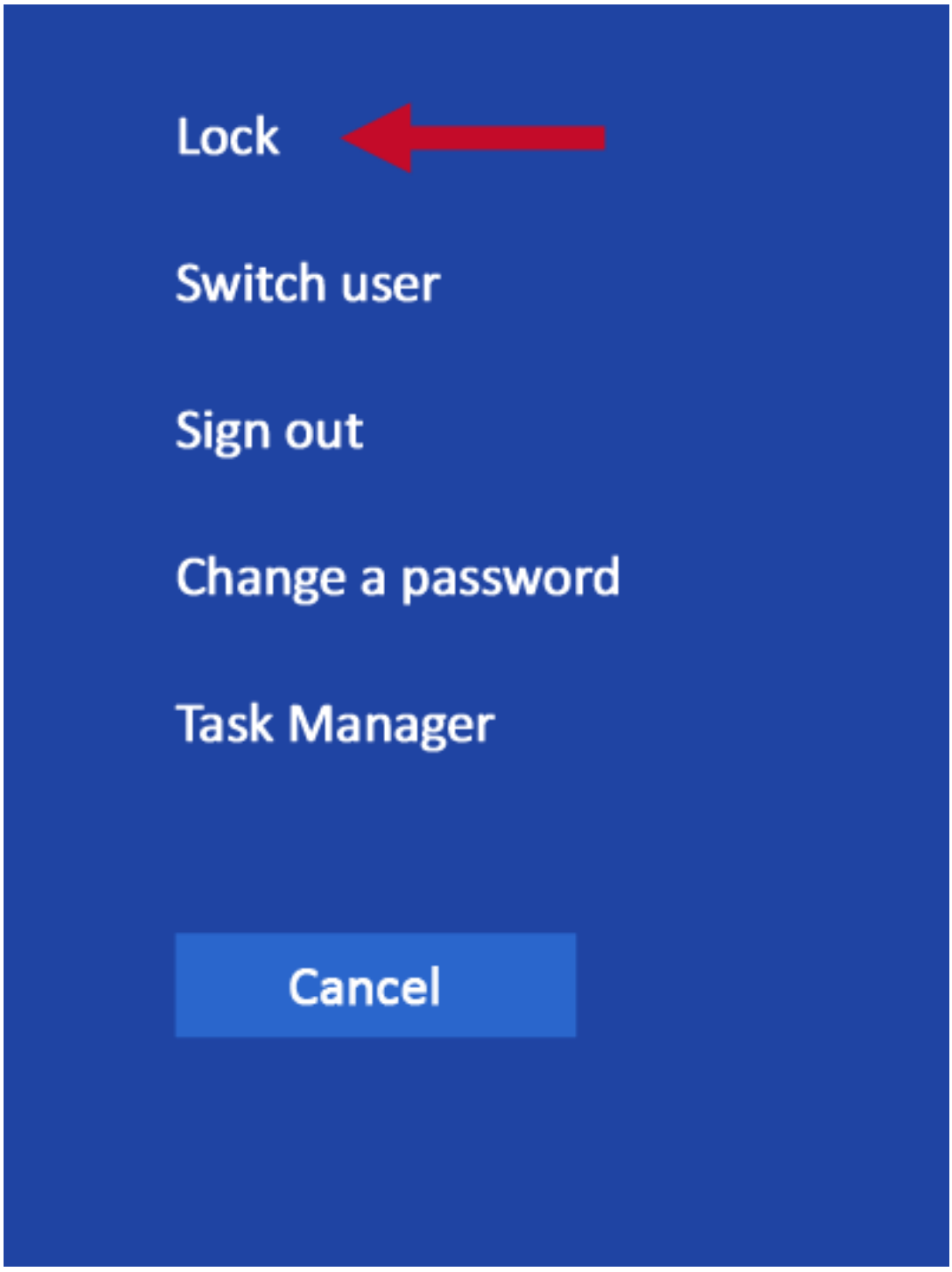
The front panel ‘Local’ key (Cancel/Esc) has no effect if KLOCk is ON.

See also "Local Button" on page 104.

Remote Command	:SYSTem:KLOCk OFF | ON | 0 | 1 :SYSTem:KLOCk?
Example	:SYST:KLOC ON
Notes	Keyboard lock remains in effect until turned-off, or until the instrument is power-cycled
Preset	Initialized to OFF at startup, unaffected by Preset
State Saved	No

4.13.3 Lock Workstation (Remote Command Only)

Performs the same functionality as the Win+L function or the “Lock” function on the CTL-ALT-DEL screen in Windows.



As soon as you do this, the computer is locked. The initial login screen appears; no-one can access the computer at that point unless they have an account and know the account's password.

Failure to initiate adds an error to the Windows event log for SA;

`"LockWorkStation - Failed to initiate function"`

See also "Local Button" on page 104.

Remote Command	`:SYSTem:LWSTation`
Example	`:SYST:LWST`
Notes	The lock remains in effect until a user logs in
State Saved	No

4.13.4 List SCPI Commands (Remote Query Only)

Outputs a list of the valid SCPI commands for the currently selected Mode.

Remote Command	`:SYSTem:HELP:HEADers?`
Example	`:SYST:HELP:HEAD?`
Notes	The output is an IEEE Block format, with each command separated with the New-Line character (`0x0A`)

4.13.5 Front Panel activity history (Remote Query only)

Instrument front panel usage can be monitored using `:SYSTem:METRics:FPANel?`. The monitoring occurs for front panel hardkey or softkey operation (including mouse or touch operation on instruments with Multi-Touch User Interface). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

To prevent the front panel from being placed into Remote the monitoring must occur via an I/O protocol such as LAN Socket, or the remote program performing the monitoring must explicitly place the instrument into Local after the query has been performed.

Remote Command	`:SYSTem:METRics:FPANel?`
Example	`:SYST:METR:FPAN?`
Notes	The return value is a string with the format **"**`YYYY-MM-DD<space>HH:MM:SS`**"**, in instrument local time If no front panel activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with the query `:SYSTem:METRics:STIMe?`

4.13.6 SCPI activity history (Remote Query only)

Instrument remote operation usage via SCPI can be monitored using `:SYSTem:METRics:SCPI?`. The monitoring occurs for SCPI control from any I/O channel (GPIB, USB, or LAN). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

Remote Command	`:SYSTem:METRics:SCPI?`
Example	`:SYST:METR:SCPI?`
Notes	The return value is a string with the format `"YYYY-MM-DD<space>HH:MM:SS"`, in instrument local time The following commands are excluded from the history accounting: – `*IDN?` – `*OPT?` – `:SYSTem:DATE?` – `:SYSTem:TIME?` – `:SYSTem:PON:TIME?` – Queries in the `:SYSTem:ERRor` subsystem – Queries in the `:SYSTem:LKEY` subsystem – Queries in the `:SYSTem:METRics` subsystem – Queries in the `:SYSTem:MODule` subsystem If no SCPI activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with `:SYSTem:METRics:STIMe?`

4.13.7 Instrument start time (Remote Query only)

To determine if instrument activity has occurred, `:SYSTem:METRics:STIMe?` can be used to determine the instrument application start time.

Remote Command	`:SYSTem:METRics:STIMe?`
Example	`:SYST:METR:STIM?`
Notes	The return value is a string with the format `"YYYY-MM-DD<space>HH:MM:SS"`, in instrument local time

4.13.8 SCPI Version Query (Remote Query Only)

Returns the SCPI version number with which the instrument complies. The SCPI industry standard changes regularly. This command indicates the version used when the instrument SCPI commands were defined.

Remote Command	`:SYSTem:VERSion?`
Example	`:SYST:VERS?`

4.13.9 Date (Remote Command Only)

The recommended access to the Date, Time, and Time zone of the instrument is through the Windows native control (Control Panel, or accessing the Task Bar). You may also access this information remotely, as shown here and in "Time (Remote Command Only)" on page 607.

Sets or queries the date in the instrument.

Remote Command	`:SYSTem:DATE "<year>,<month>,<day>"` `:SYSTem:DATE?`
Example	`:SYST:DATE "2006,05,26"`
Notes	`<year>` is the four-digit representation of year (for example, 2006) `<month>` is the two-digit representation of year (01 to 12) `<day>` is the two-digit representation of day (01 to 28, 29, 30, or 31, depending on the month and year) Unless the current account has Power User or Administrator privileges, sending this command generates an error, and no action is taken

4.13.10 Time (Remote Command Only)

Sets or queries the time in the instrument.

Remote Command	`:SYSTem:TIME "<hour>,<minute>,<second>"` `:SYSTem:TIME?`
Example	`:SYST:TIME "13,05,26"`
Notes	`<hour>` is the two-digit representation of the hour in 24-hour format `<minute>` is the two-digit representation of minute `<second>` is the two-digit representation of second Unless the current account has Power User or Administrator privileges, sending this command generates an error, and no action is taken

4.13.11 Input Overload Enable (Remote Command Only)

Input Overload errors are reported using the Input Overload status bit (bit 12 in the Measurement Integrity Status Register). Input Overloads (for example, ADC Overload errors) can come and go with great frequency, generating many error events (for example, for signals just on the verge of overload), and so are not put into the SCPI error queue by default. Normally the status bit is the only way for detecting these errors remotely.

Use this command to enable or disable Input Overload reporting to the SCPI queue. By default, reporting is disabled. Send `:SYSTem:ERRor:OVERload ON`. to enable, or `:SYSTem:ERRor:OVERload OFF` to disable. In either case, Input Overloads *always* set the status bit.

NOTE **For versions of firmware before A.10.01, Input Overload was only a Warning and so was never available in the SCPI queue, although it did set the status bit. For A.10.01 and later, Input Overload is an error, which can be enabled to the SCPI queue using this command.**

Remote Command	`:SYSTem:ERRor:OVERload[:STATe] 0 | 1 | OFF | ON`
Example	Enable overload errors: `:SYST:ERR:OVER 1`
Preset	Set to `OFF` by **Restore Misc Defaults** (no Overload errors go to SCPI)
State Saved	Saved in instrument state

4.13.12 Power Up (Remote Query Only)

Returns a list of errors encountered during the application boot-up, such as: mismatch FW-FPGA, missing Calibration data, missing hardware, and construction errors.

Remote Command	`:SYSTem:ERRor:PUP?`
Notes	If no error occurs, the return value is: “No Power Up Errors” Return Value: `<List of error strings>` in <IEEE488 Block> format Return Value Example: “Power up errors, see details in Windows Event Log” "Unmatched FPGA Version(s), See details in Windows Event Log”

5 Preset

The Preset functions are available in two ways; either by pressing the **Mode Preset** or **User Preset** front panel keys, or from the **Preset** dropdown menu that appears when you press the green **Preset** icon in the upper right corner of the display.



Types of Preset

The table below shows all possible presets, their corresponding SCPI commands and front-panel access methods.

Instrument settings are tiered in scope from those local to the current measurement to those global to all measurements and modes. There are presets tailored to each scope. The table identifies the scope of each preset type.

NOTE **To get a Mode back to a fully predefined state, you should execute "Restore Mode Defaults" on page 615 and "Input/Output Preset" on page 616, but since Input/Output Preset is a global function, it affects *all* Modes.**

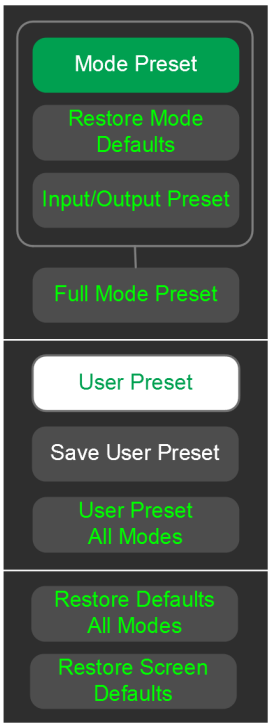
Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
Auto All (Auto Couple)	`:COUPle ALL`	Local to the current measurement, only affects Auto/Man variables	Meas Setup menu
Meas Preset	`:CONFigure:<meas>`	Local to the current measurement. Does not preset the RF Source	Meas Setup menu
"Mode Preset" on page 613	`:SYSTem:PRESet`	Local to the current mode, global to all measurements in the mode, affects most but not all parameters in the mode, does not affect Input/Output or System variables. Presets the RF Source	**Mode Preset** (green key) and Preset Dropdown
"Restore Mode Defaults" on page 615	`:INSTrument:DEFault`	Local to the current mode, global to all measurements in the mode, affects all parameters in the mode but does not affect Input/Output or System variables, does not preset the RF Source	Preset Dropdown
"Restore Defaults	`:SYSTem:DEFault MODes`	Affects all parameters in ALL modes	Preset Dropdown

Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
All Mode" on page 622		but does not affect Input/Output or System variables. Presets the RF Source	
"Restore Screen Defaults" on page 625	:SYSTem:DEFault SCReen	Deletes all Screens but one, restores that screen to its default mode and performs a Mode Preset for that mode. Does not affect Input/Output or System variables. Presets the RF Source	Preset Dropdown
"User Preset" on page 618	:SYSTem:PRESet:USER	Local to the current mode, global to all measurements in the mode, affects all parameters in the mode as well as the Input/Output variables. Does not affect System variables	**User Preset** key and Preset Dropdown
"User Preset All Modes" on page 621	:SYSTem:PRESet:USER:ALL	Same as User Preset but affects all Modes in the current Screen	Preset Dropdown
"User Preset Screens" on page 623		Affects the entire Screen Configuration; global to all Modes and Screens	Preset Dropdown
*RST	*RST	Same as Mode Preset - and in addition always sets Single/Cont to Single	Not available from front panel
"Input/Output Preset" on page 616	:SYSTem:DEFault INPut	Affects all Input/Output variables. Does not preset the RF Source	**Input/Output** menu, Preset dropdown, and **System** menu, **Restore Defaults**
"Full Mode Preset" on page 617	:SYSTem:PRESet:FULL	Same as doing Mode Preset, Restore Mode Defaults and Input/Output Preset. Essentially a factory preset of the current Mode. Presets the RF Source	Preset Dropdown
Restore User Interface Defaults	:SYSTem:DEFault UINTerface	Affects all variables in the "User Interface" group. Does not preset the RF Source	**System** menu, **Restore Defaults** and User Interface tabs
Restore Power On Defaults	:SYSTem:DEFault PON	Affects all variables in the "Power On" group. Presets the RF Source	**System** menu: **Restore Defaults** and Power On tabs
Restore Alignment Defaults	:SYSTem:DEFault ALIGn	Affects all variables in the "Alignments" group. Presets the RF	System menu, **Restore Defaults**

Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
		Source	and **Alignments** tabs
Restore Miscellaneous Defaults	`:SYSTem:DEFault MISC`	Affects various variables not reset by other commands. Presets the RF Source	**System** menu, **Restore Defaults**
Restore All Defaults	`:SYSTem:DEFault [ALL]` `:SYSTem:PRESet:PERSistent`	Affects all variables. Presets the RF Source	**System** menu, **Restore Defaults**

5.1 Preset Dropdown

The Preset dropdown contains the following controls. In the image below, click a control for details of that control.



5.2 Mode Preset

Returns the current Mode to a known state. **Mode Preset** only presets the current Screen, it does not affect any other Screens.

Mode Preset also presets the RF Source. In this sense it is equivalent to pressing **Source Preset** on the **Input/Output, RF Source** menu panel.

Mode Preset can be executed from the **Preset** dropdown, or by pressing the **Mode Preset** front panel key.



Mode Preset does the following for the currently active Mode:

- Aborts the currently running measurement
- Switches to the default measurement and brings up the default menu for that measurement
- Sets most parameters for the Mode and all of its Measurements to a preset state
- Clears the input and output buffers
- Sets Status Byte to 0

Mode Preset does not cause a Mode switch, nor affect any **Input/Output** or **System** settings (those set in the **System Settings** dialog).

Furthermore, there are some Mode settings that are unaffected by **Mode Preset** (for example, Noise Floor Extension, Limit Line data, reference marker numbers, etc.) These are only reset by "Restore Mode Defaults" on page 615, and in each parameter's definition table there is a note that indicates whether it is reset by **Mode Preset** or by **Restore Mode Defaults**.

See Types of Preset for more information.

Remote Command	`:SYSTem:PRESet`
Example	`:SYST:PRES`
Notes	`*RST` is preferred over `:SYST:PRES` for remote operation. `*RST` does a **Mode Preset**, as done by `:SYST:PRES`, and it sets the measurement mode to **Single** rather than **Continuous** for optimal remote-control throughput
Status Bits/OPC dependencies	Clears all pending `OPC` bits. The Status Byte is set to 0

Backwards Compatibility Notes	In X-Series, the legacy “Factory Preset” has been replaced with Mode Preset, which only presets the currently active mode, not the entire instrument. In X-Series, the way to preset the entire instrument is by using **System**, **Restore System Defaults All**, which behaves essentially the same way as restore System Defaults did in ESA and PSA There is also no “Preset Type” as there was in PSA. There is a green **Mode Preset** front-panel key that does a **Mode Preset** and a white-with-green-letters **User Preset** front-panel key that does a **User Preset**. The old `:PRESet:TYPE` command is ignored (without generating an error), and `:SYST:PRES` without a parameter does a **Mode Preset**, which should cover most backwards code compatibility issues The settings and correction data under the **Input/Output** front-panel key (examples: Input Z Corr, Ext Amp Gain, etc.) are no longer part of any Mode, so they are not preset by **Mode Preset**. They are preset using **Restore Input/Output Defaults**, **Restore System Defaults All**. Note that because **User Preset** does a Recall State, and all of these settings are saved in State, they *are* recalled when using **User Preset**

5.3 Restore Mode Defaults

Most settings within a mode are affected by "Mode Preset" on page 613, but there are some Mode settings that are unaffected by **Mode Preset** (for example, Noise Floor Extension, Limit Line data, reference marker numbers, etc.) **Restore Mode Defaults** resets all of these additional settings as well as all the **Mode Preset** settings, except **RF Source**.

In each parameter's definition table, there is a note that indicates whether it is reset by **Mode Preset** or by **Restore Mode Defaults**.

Note that a Recall State affects *all* of a Mode's settings; both the **Mode Preset** settings and those additionally affected by **Restore Mode Defaults**.

Restore Mode Defaults can be executed from the **Preset** dropdown.

When **Restore Mode Defaults** is selected, a message appears saying

"This will reset all of the current Mode's variables to their default state. This action cannot be undone. Do you want to proceed?"

Use the **OK** and **Cancel** buttons to confirm or cancel the operation.

Remote Command	`:INSTrument:DEFault`
Example	`:INST:DEF`
Notes	Clears all pending `OPC` bits. The Status Byte is set to 0
Couplings	Causes the currently running measurement to be aborted and causes the default measurement to be active. Sets the Mode to a consistent state, with all default couplings set

5.4 Input/Output Preset

Resets the group of settings and data associated with the **Input/Output** front-panel key to their default values. These settings are not affected by "Mode Preset" on page 613, because they are generally associated with connections to the instrument, which generally should not be modified when **Mode Preset** is executed.

All the variables set under the **Input/Output** front panel key are reset by **Input/Output Preset**, including Amplitude Corrections and Data (described in the **Corrections** section), except for **RF Source** settings, which are unaffected.

By using **Input/Output Preset** and **Restore Mode Defaults**, a full preset of the current Mode can be performed, with the caveat that since **Input/Output Preset** is a global function, it will affect all Modes.

Input/Output Preset can be executed from the **Input/Output** menu, from the **Preset** dropdown, or from the **Restore Defaults** menu under the **System** key.

When **Input/Output Preset** is selected, a message appears saying:

“This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings

It will not affect Alignment data or settings

It will not affect RF Source settings

This action cannot be undone. Do you want to proceed?”

Use the **OK** and **Cancel** buttons to confirm or cancel the operation.

Example — Preset all Input/Output variables to their factory defaults:

```
:SYST:DEF INP
```

5.5 Full Mode Preset

Same as Mode Preset, Restore Mode Defaults and Input/Output Preset. This is essentially a factory preset of the current Mode.

When Full Mode Preset is selected, a message appears saying:

“This will reset all of the current Mode’s variables and all of the Input/Output variables to their default state, including Input and Output selection and settings, Amplitude Correction, Frequency Reference and RF Source settings

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?”

Use the OK and Cancel buttons to confirm or cancel the operation.

Remote Command	`:SYSTem:PRESet:FULL`
Example	`:SYST:PRES:FULL`
Status Bits/OPC dependencies	Clears all pending `OPC` bits. The Status Byte is set to 0

5.6 User Preset

Recalls a state previously saved using the **Save User Preset** function. You can save a **User Preset** state for each Mode, allowing you to define your own favorite state for each Mode and recall it at the touch of a single button.

User Preset can be executed by pressing the **User Preset** front panel key or from the **Preset** dropdown.



Because **User Preset** is actually a Recall State, rather than a predefined preset, it works a little differently than **Mode Preset**, in that it affects all of the variables that normally only reset on **Restore Mode Defaults**, and it affects the Input/Output variables, because both of these are included in State files.

A default **User Preset** file is provided for each Mode, which simply matches the current Mode's state after **Restore Mode Defaults** and **Input/Output Preset** has been performed.

NOTE **In products that run multiple instances of the X-Series Application, all instances use the same location to save User Preset state. So, saving User Preset of one instance will overwrite the saved User Preset of another instance.**

Remote Command	`:SYSTem:PRESet:USER`

Example	Save the User Preset:
	`:SYST:PRES:USER:SAVE`
	Recall the User Preset:
	`:SYST:PRES:USER`

Notes	`:SYST:PRES:USER:SAVE` is used to save the current state as the user preset state If loading a **User Preset** file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the mode may have changed from when the **User Preset** file was saved
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0
Backwards Compatibility Notes	**User Preset** actually loads a state, and in legacy analyzers, it was possible to load a state without affecting the trace data, limit lines or correction data. Similarly, it was possible to **User Preset** without affecting the trace data, limit lines or correction data In X-Series, "state" always includes all this data; so, whenever state is loaded, or **User Preset** is executed, all traces, limit lines and corrections are affected

In ESA and PSA, **User Preset** affected the entire instrument's state. In X-Series, **User Preset** only recalls the state for the active Mode. There is a User Preset file for each Mode. **User Preset** can never cause a Mode switch as it did in legacy analyzers. If you want to recall all Modes to their user preset file state, perform **User Preset** after switching into each Mode

User Preset recalls Mode state, which can now include data-like traces; whereas in ESA and PSA, **User Preset** did not affect data

For more details of each menu item, see:

- "Save" on page 620
- "User Preset All Modes" on page 621

5.7 Save

Saves the state of the currently active mode in a unique location for recall by "User Preset" on page 618. Each Mode has one such location, so for each Mode one **User Preset** can be defined.

Save can be executed from the **Preset** dropdown.

All the Mode variables are saved, including those reset by "Mode Preset" on page 613, and those only reset by "Restore Mode Defaults" on page 615, as well as all **Input/Output** variables, so when you subsequently press **User Preset**, the instrument returns to the exact same setup that existed when you pressed **Save User Preset**. Thus, **User Preset** has a larger scope than **Mode Preset**.

Remote Command	`:SYSTem:PRESet:USER:SAVE`
Example	`:SYST:PRES:USER:SAVE`
Notes	`:SYST:PRES:SAVE` creates the same file as if you executed `*SAV` or `:MMEM: STOR:STAT`, except **Save User Preset** does not allow you to specify the filename or the location of the file

5.8 User Preset All Modes

Recalls all the User Preset files for each Mode, switches to the power-on Mode, and activates the saved measurement from the power-on mode User Preset file.

User Preset All Modes can be executed from the Preset dropdown.

See the "User Preset" on page 618 description for more about User Preset.

Remote Command	`:SYSTem:PRESet:USER:ALL`
Example	`:SYST:PRES:USER:SAVE` `:SYST:PRES:USER:ALL`
Notes	`:SYST:PRES:USER:SAV` is used to save the current state as the user preset state
Status Bits/OPC dependencies	Clears all pending `OPC` bits. The Status Byte is set to 0

5.9 Restore Defaults All Mode

Resets all of the Modes in the current Screen back to their default state, just as "Restore Mode Defaults" on page 615 does, switches the current Screen to the power-on Mode, and causes the default measurement for the power-on Mode to be active in the current Screen. Only the current Screen is affected.

Restore Defaults All Modes can be executed from the Preset dropdown.

When Restore Defaults All Modes is selected, a message appears saying:

“This will reset all of the variables for all of the Modes in the current Screen to their default state. This action cannot be undone. Do you want to proceed?”

The message provides an OK and Cancel button.

Example	`:SYST:DEF MOD`
Couplings	Causes the currently running measurement to be aborted, a Mode switch to the power-on Mode, and activates the default measurement for the power-on Mode

5.10 User Preset Screens

Recalls a screen configuration previously saved using "Save" on page 624. The complete configuration of all your Screens is loaded, including the state of each Screen.

Because **User Preset Screens** performs a Recall State as part of its function, it affects all of the variables that normally only reset by "Restore Mode Defaults" on page 615, and it affects the **Input/Output** variables, because both of these are included in State files.

Note that recalling a screen configuration in this manner will wipe out your current screen configuration and all states of all Screens.

Notes	"Save" on page 624 is used to save the current screen configuration as the “user preset all screens” configuration If loading a User Preset All Screens file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the mode may have changed from when the User Preset All Screens file was saved
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0

5.11 Save

Saves the current Screen Configuration in a unique location for recall by **User Preset Screens**.

Save can be executed from the **Preset** dropdown.

Besides the screen configuration, all Mode variables of all Screens are saved, including those reset by "Mode Preset" on page 613, those only reset by "Restore Mode Defaults" on page 615, and all **Input/Output** variables, so when you subsequently press "User Preset Screens" on page 623, the instrument returns to the exact Screen setup that existed when you pressed **Save User Preset All Screens**.

Notes

Save User Preset All Screens creates the same file as if you executed **Screen Config + State**, except **Save User Preset All Screens** does not allow you to specify the filename or the location of the file

5.12 Restore Screen Defaults

Resets the Screen configuration to the factory default; deleting all screens, all screen names, all screen states, and setting Multi-Screen to Off. A single screen will remain, set to the power-on Mode in a preset state with the default screen name.

Restore Screen Defaults can be executed from the Preset dropdown.

When Restore Screen Defaults is selected, a message appears saying:

“This function will delete all defined screens and their settings. This action cannot be undone

Do you want to proceed?”

The message provides an OK and Cancel button.

Example

```
:SYST:DEF SCReen
```

5.13 Preset Type (Remote Command Only)

Supported for backwards-compatibility only. It is a no-op, and does not change the behavior of any preset operation.

Example	`:SYST:PRES:TYPE FACT`
Preset	Unaffected by **Preset** but set to `MODE` by **Restore System Defaults > All**
State Saved	No
Backwards Compatibility SCPI	`:SYSTem:PRESet:TYPE FACTory|MODE|USER` `:SYSTem:PRESet:TYPE?`

5.14 Restart Instrument (Shutdown)

Shuts down the instrument, then reboots it.

Remote Command	`:SYSTem:PUP`
Example	`:SYST:PUP`

5.15 Restart Application (Application Shutdown)

Restarts the analyzer application without rebooting the instrument. Before you send this command, make sure you have saved any trace or measurement data that you want to preserve.

Remote Command	`:SYSTem:PUP:PROCess`
Example	`:SYST:PUP:PROC` You must wait after this command for the instrument application to restart
Notes	You cannot use `*WAI` or `*OPC?` to synchronize operation after a restart This command stops and restarts the instrument application, so the SCPI operation is terminated and restarted. A remote program wait a fixed amount of time to resume sending commands to the instrument. The actual wait time depends on which applications are pre-loaded

5.16 System Log Off (Remote Command Only)

Provides a means to terminate all open Windows applications and log off the current user. This is equivalent to executing the Windows command `shutdown -l -f -t0`.

Remote Command	`:SYSTem:LOFF`
Example	`:SYST:LOFF`
Notes	Initiates an immediate log-off of the current user. This exits the instrument application; thus, any unsaved measurement result will be lost. You cannot use `*WAI` or `*OPC?` to synchronize this operation In addition to the instrument application, all other Windows programs will be terminated without the opportunity to save any work in progress. The instrument will then require human interaction to perform a log-in, to restart instrument operation

5.17 Power Standby (Instrument Shutdown)

Pressing the power switch powers down the instrument. The instrument displays a warning that shutting down will cause the application to lose unsaved data, then waits for you to respond before shutting down.

The command below shuts down the instrument in the same way, but you can choose between the normal way (`NORMal`) or the forced way (`FORCe`). In the `NORMal` mode, the system waits until you respond to the warning. In the `FORCe` mode, the system shuts down after waiting 20 seconds, and all data is lost.

If the analyzer is not properly shutdown prior to removal of line power, the system will validate the Journaling File System and the Power On Last State (if the instrument is in Power On Last State) during the following power-on. If a problem is detected, a message appears indicating that the system 'recovered' from an inappropriate shutdown. This is only an issue if Power On Type is Last State. If the Last State is not valid, the instrument powers up in the last active Mode, but executes Mode Preset.

Remote Command	`:SYSTem:PDOWn [NORMal | FORCe]`
Example	Execute a normal shutdown: `:SYST:PDOW`
Notes	If no parameter is sent, `NORMal` is assumed

6 Input/Output

Accesses menus that let you control the Input/Output parameters of the instrument. In general, these are functions associated with external connections to the instrument, either to the inputs or the outputs.

Input/output connections tend to be based on situation-specific hardware set up. For that reason, input/output settings do *not*, in general, change when you perform a Mode Preset. You can revert to the default values in one of three ways:

- Use **Restore Input/Output Defaults**, in the **Input/Output** menu
- Use **System->Restore System Defaults->Input/Output Settings**
- Use **System -> Restore System Defaults->All**

The settings survive a Preset and a Power cycle.

A few Input/Output settings *do* respond to Mode Preset. For example, if the Calibrator is on, **Preset** turns it off, and if DC coupling is in effect, **Preset** switches it to AC. These exceptions are noted in the SCPI tables for the excepted functions.

Input/Output features are common across multiple Modes and Measurements. In general, they do not change when you change Mode or Measurement, although some controls appear only in certain measurements.

6.1 RF Source

Lets you control and configure the internal RF Source. This tab only appears in models that support a built-in independent RF Source, which include E7760B, and modular products such as EXM and VXT.

External Source Control and built-in Tracking Sources are controlled using the Source tab in Meas Setup.

Dependencies	Only appears in models that support a built-in independent RF Source, such as E7760B, EXM and VXT

6.1.1 RF Output

Sets the source RF power output state.

Remote Command	`:OUTPut[:EXTernal][:STATe] ON | OFF | 1 | 0` `:OUTPut[:EXTernal][:STATe]?`
Example	`:OUTP OFF` `:OUTP?`
Notes	This setting is for the independent mode and has no effect on the "List Sequencer" on page 645. If Sequencer is ON, the List Sequencer controls the source output, and this key is grayed-out When Sequencer is OFF, makes source leave List Sequencer and this setting is blanked out, taking effect immediately
Dependencies	For E7760B, RF Output cannot be set to ON if the RF Output port is set to NONE. If you attempt to set RF Output to ON in this situation, the error message -221, "Settings conflict; Source Output is not available while Output Port is None" is displayed `:OUTPut:EXTernal[:STATe]` is supported only when Option ESC is installed. Otherwise, only `:OUTPut[:STATe]` is supported
Preset	OFF
Range	ON|OFF

6.1.2 RF Output Port

Specifies the RF Output Port used by the internal source.

Switching from the RF Output port to one of the RFIO ports changes the transmitter performance of the instrument.

The NONE selection is available to allow setting a half-duplex port to an Input, if it was previously assigned as an Output. Set the Output to NONE first, then any port can be assigned as an Input.

When using VXT M9410A/11A/15A/16A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu appear as:

Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half-duplex ports, the choices for these ports will appear as below:

Head and Port	Choice in dropdown	SCPI parameter
Head 1, port RF Tx/Rx 1	Head 1 RFHD 1	RRH1RFHD1
Head 1, port RF Tx/Rx 2	Head 1 RFHD 2	RRH1RFHD2
Head 2, port RF Tx/Rx 1	Head 2 RFHD 1	RRH2RFHD1
Head 2, port RF Tx/Rx 2	Head 2 RFHD 2	RRH2RFHD2

When using the E7770A Common Interface Unit, outputs may come from the DUT IF OUT ports on the rear of the CIU or the half-duplex ports on the front of the CIU labeled DUT IF In/Out. You would select GUI parameter IF Out n or SCPI parameter IFOutn for the DUT IF OUT ports or GUI parameter IFHD n or SCPI parameter IFHDn for the DUT IF In/Out ports. See "RF Input Port" on page 748 “Parameters for VXT M9410A/11A/15A/16A and EXM when used with Radio Heads/CIU” for more details.

Remote Command	`[:SENSe]:FEED:RF:PORT:OUTPut RFOut | RFIO1 | RFIO2 | RFIO3 | RFIO4 | RFHD | RFFD | A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | GEN | TR | RRHhRFHDp | IFOutn | IFHDn | NONE`
	For details of each option, see "Port Options" on page 634
	`[:SENSe]:FEED:RF:PORT:OUTPut?`

Example	Set output to RF Output:
	`:FEED:RF:PORT:OUTP RFO`
	Set output to Radio Head 1, RF Tx/Rx Port 2:
	`:FEED:RF:PORT:OUTP RRH1RFHD2`

Dependencies	Only appears in models that support multiple output ports. If the SCPI command is sent with unsupported parameters in any other model, an error is generated, -221, “Settings conflict; option not installed” RFHD and RFFD are only available on VXT. Option HDX is required to enable RFHD port. Option FDX is required to enable RFFD port For E7760B: Ports IFIO1 and IFIO2 are available if Option RF2 is installed. Ports A1, A2, A3, B1, B2, B3 are available if Option RF3 is installed. Attempting to select a port for which the option is not present generates the error, -241, “Hardware missing; Output not available” A port cannot be selected as an Output while it is occupied as an Input. If the SCPI command is sent while the port is occupied, an error is generated, -221, “Settings conflict; Output Port is not available while occupied by Input” Additionally, the mmWave ports are divided into two banks: the A Bank and the B Bank. A port cannot be selected as an Output if any port on the *same* bank is occupied as an Input. If the SCPI command is sent for this situation, an error is generated, -221 “Settings conflict; Output Port is not available while

	port bank is occupied by Input" Lastly, if RF3 is present, and RF4 is absent, a mmWave port cannot be selected as an Output if the Input Port is occupied by wwWave Transceiver with a different frequency range. If the SCPI command is sent for this situation an error is generated, -221 "Settings conflict; Output Port is not available while occupied by Input of incompatible frequency" Ports GEN and TR are only available.in modular analyzers, and only when the M9470A module is installed, such as in M8920A. Option HDX is required to enable the T/R port When any output is selected in a measurement that does not support it, the "No result; Meas invalid with this output" error condition occurs, and the measurement returns invalid data when queried
Preset	Unaffected by **Mode Preset**, but set to default by **Source Preset** or **Restore System Defaults -> All**
State Saved	Saved in State
Backwards Compatibility SCPI	`:FEED:RF:PORT:OUTPut IFIO1` `IFIO1` is treated as `IFO1` and sets the IF output to be the port labeled **DUT IF Out** on the CIU rear panel. This is for compatibility with earlier implementations on EXM and VXT when using the E7770A Common Interface Unit

Port Options

Value	Notes
RF Output `RFOut`	On EXM with hardware M9430A, if RF Output is selected as RF Output Port, use the settings in the **Half Duplex Config** menu to determine which port (`RFIO3` or `RFIO4`) will be used On EXM with hardware M9431A, this setting is not supported. If the SCPI command is sent with this setting, an error is generated, -221, "Settings conflict; option not installed"
`RFHD`	RFHD port is exclusive for RF Input and RF Output. If HD Port is chosen as RF Input port, pressing this key, or sending SCPI to set it, generates error message: "-221, Settings conflict; RFHD is being used as RF Input Port" Option HDX is required to enable RFHD port
`RFFD`	Option FDX is required to enable RFFD port
`GEN`	Selects the Gen port on M8920A/20B
T/R `TR`	Selects the T/R port on M8920A/20B
`RRHhRFHDp`	Used to select a port on a Radio Head (such as the Keysight M1740A mmWave Transceiver) as an output `RRHhRFHDp` corresponds to **Head h**, port **RF Tx/Rx p**. For example, `RRH1RFHD2` = the port labeled **RF Tx/Rx 2** on **Head 1**

6.1.3 Half Duplex Output Port

Specifies whether `RFIO3` or `RFIO4` is the Half Duplex Output port.

Remote Command	`[:SENSe]:HDUPlex:PORT:OUTPut RFIO3 | RFIO4`

Example	`:HDUPlex:PORT:OUTPut RFIO3` `:HDUPlex:PORT:OUTPut?`
Dependencies	Only appears in EXM If `RFIO3` is selected as "Half Duplex Input Port", then "Half Duplex Output Port" will be set to `RFIO4` automatically If `RFIO4` is selected as "Half Duplex Input Port", then "Half Duplex Output Port" will be set to `RFIO3` automatically
Preset	`RFIO4`
State Saved	Saved in State

6.1.4 RF Power

Lets you control the amplitude of the Source output. Same as "RF Power" on page 637 in Amplitude Setup.

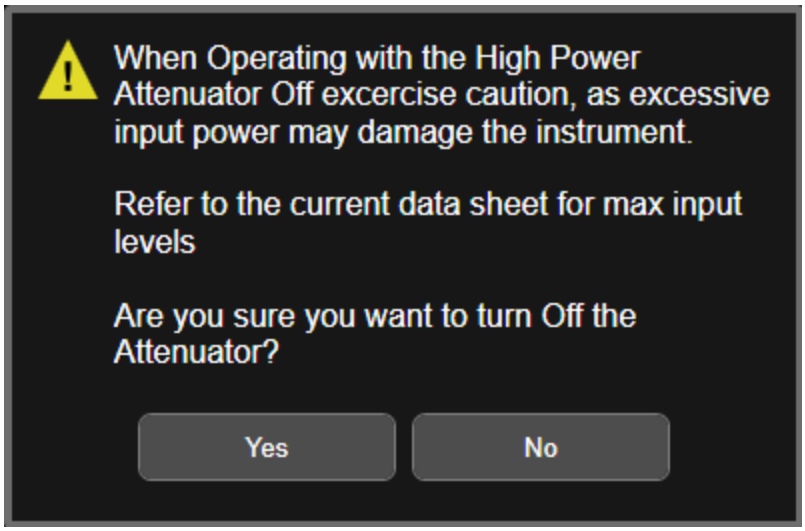
Example	`:SOUR:POW -100 dBm`

6.1.5 T/R Port High Power Attenuator

Controls whether additional attenuation is added at the T/R Port. The T/R port has two input paths, one that provides a 16 dB attenuator, and the other that bypasses this attenuator.

- When `ON`, the path includes the 16 dB attenuator, so the max input level for this path is +47 dBm (50 W)
- When `OFF`, the 16 dB attenuator is bypassed, so the max input level for this path is +33 dBm (2 W)

If the attenuator is turned off, the following warning message is displayed and confirmation that the attenuator is to be turned off is required;



Whenever the attenuator is bypassed (OFF), a warning appears in the status bar: “Input caution; T/R unprotected"

In the case of an input overload at the T/R input, (>2 W with Attenuator off, or >50 W with attenuator on), or an over-temperature at the T/R input, the input is disconnected, and a dialog is displayed, stating:

“CAUTION! Excessive power has been detected at the T/R Port. The input has been disconnected. Remove the high signal power and press OK”

Or:

“CAUTION! Over temperature has been detected at the T/R Port. The input has been disconnected. Remove the signal, allow to cool & press OK”

Until you press OK, the input remains disconnected, and no measurement can be made.

Remote Command	`[:SENSe]:FEED:RF:PORT:TR:HPOWer:ATTenuator[:STATe] ON | OFF` `[:SENSe]:FEED:RF:PORT:TR:HPOWer:ATTenuator[:STATe]?`
Example	`:FEED:RF:PORT:TR:HPOW:ATT ON` `:FEED:RF:PORT:TR:HPOW:ATT?`
Dependencies	Only appears in modular analyzers, and only when the M9470A module is installed, such as in M8920A. Option HDX is required to enable the T/R port
Preset	ON
State Saved	Saved in instrument state

6.1.6 Amplitude Setup

Lets you access the Amplitude Setup panel.

Notes	This menu under this control is for independent mode, and has no effect on "List Sequencer" on page 645. If "Sequencer" on page 645 is ON, the List Sequencer controls the source output, and this control is grayed-out on the front panel, to indicate out-of-scope. When you set "Sequencer" on page 645 to OFF, makes source leave List Sequencer and this control is blanked out

6.1.6.1 RF Power

Lets you adjust the power level of the source using the numeric keypad, step keys, or RPG. Pressing any digit, 0 through 9 on the numeric keypad displays the unit terminator.

Please refer to the "RF Power Range" on page 638 table below for the valid ranges.

Remote Command	`:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <ampl>` `:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?`
Example	`:SOUR:POW -100 dBm`
Notes	Amplitude corrections can be specified for use with the source. In the event of amplitude corrections being applied, the valid ranges for the RF power do not change dependent on the current amplitude correction setting. If the combination of RF power + amplitude correction is higher or lower than the source output range, the Source Unleveled bit is set, and the “Source Unleveled” indicator will appear on status panel to indicate that the source cannot maintain the output power that has been requested When signal generator is unable to maintain the requested output level, the “Source Unleveled” indicator will appear on status panel. When the source output setting is restored to the normal range, the “Source Unleveled” is removed from status panel Internal source has list sequence mode, which comprises of several steps which contain separate output power, frequency and waveform etc. When the source list sequence playing is complete, the last step keeps playing, and user can use this command to change the list sequence last step’s output power For EXT, The multiport adapter RFIO TX ports and GPS ports cannot ensure power accuracy when power setting is lower than -130dBm, this power setting value is defined by the sum of RF Power setting and related amplitude correction value. But user settable value could be lower than this limit. When application detected there exists power setting lower than -130dBm on MPA RFIO TX ports, then popup warning message . When application detected there exists power setting lower than -130dBm on MPA GPS ports, then popup warning message . This is only warning message, and check is performed when RF is ON
Dependencies	The RF power is dependent on the RF output port and frequency, such that the current frequency and selected output port determine the valid range of power values
Couplings	For if AWGN State is ON and ARB State is ON, this setting is adjusted to the value to maintain the AWGN power relationship defined by Power Control Mode and other noise settings
Preset	–100 dBm
Min	The range of values depends on the current frequency and selected RF output port. See "RF Power Range" on page 638 below for the valid ranges
Max	The range of values depends on the current frequency and selected RF output port. Refer to "RF Power Range" on page 638 below for the valid ranges

RF Power Range

RF Output Port	Frequency Range	Min Output Power	Max Output Power
High Power RF Out	10 MHz ≤ f ≤ 6 GHz	–150 dBm	20 dBm
RFIO 1 & RFIO 2	10 MHz ≤ f ≤ 6 GHz	–150 dBm	0 dBm

Note: This is the UI power range, which is larger than the actual specification.

VXT model M9420A

RF Output Port	Frequency Range	Min Output Power	Max Output Power without Option “1EA”	Max Output Power with Option “1EA”
RF Output	60 MHz ≤ f ≤ 6 GHz	–150 dBm	10 dBm	25 dBm
RFHD	60 MHz ≤ f ≤ 6 GHz	–150 dBm	10 dBm	15 dBm
RFFD	60 MHz ≤ f ≤ 6 GHz	–150 dBm	0 dBm	0 dBm

Note 1: This is the UI power range, which is larger than the actual specification.

Note 2: Max output power with Option 1EA can be set to 25 dBm, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when output power set higher than 20 dBm.

VXT models M9410A/11A

Ports	Option LFE	Frequency Range	Min Output Power	Max Output Power without option “1EA”	Max Output Power with “1EA”
RF Output	With Option LFE	1 MHz ≤ f ≤ 60 MHz	–150 dBm	5 dBm	5 dBm
		60 MHz ≤ f ≤ 380MHz	–150 dBm	5 dBm	25 dBm
	Without Option LFE	380 MHz ≤ f ≤ 6 GHz	–150 dBm	5 dBm	25 dBm
RFHD		1 MHz ≤ f ≤ 6 GHz	–150 dBm	5 dBm	5 dBm

Note 1: Min Output Power is the UI power range, which is smaller than the actual specification.

Note 2: Max output power with Option 1EA can be set to 25 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set higher than 20 dBm.

Note 3: Option LFE provides Low Frequency Extension, which covers frequency from 1 MHz to 380 MHz.

VXT models M9415A/16A

RF Output Port	Frequency Range	Min Output Power	Max Output Power without Option "1EA"	Max Output Power with Option "1EA"
RF Output	380 MHz ≤ f ≤ 12.3 GHz	–150 dBm	5 dBm	25 dBm
RFHD	380 MHz ≤ f ≤ 12.3 GHz	–150 dBm	5 dBm	18 dBm

Note 1: For RF output port, the Max output power with Option 1EA can be set to 25 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set higher than 20 dBm.

Note 2: For RFHD port, the Max output power with Option 1EA can be set to 18 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set higher than 10 dBm.

M9410E/11E/15E/16E

Ports	Option LFE	Frequency Range	Min Output Power	Max Output Power
RF Output	With Option LFE	1 MHz ≤ f ≤ 380 MHz	-150 dBm	13 dBm
		380 MHz ≤ f ≤ 25.9 GHz	-150 dBm	25 dBm
	Without Option LFE	380 MHz ≤ f ≤ 25.9 GHz	-150 dBm	25 dBm
RFHD		1 MHz ≤ f ≤ 25.9 GHz	-150 dBm	5 dBm

VXT Models with Remote Radio Heads/CIU

Solution	Port	Option	Frequency Range	Min Output Power	Max Output Power
S9100A	Head h	--	22.7 GHz to	-150 dBm	10 dBm

Solution	Port	Option	Frequency Range	Min Output Power	Max Output Power
	RFHD p		43.5 GHz		
	RF Out	RH1 007	0.33 GHz to 6 GHz	-150 dBm	20 dBm
		022	0.33 GHz to 6 GHz	-150 dBm	Primary: 17 dBm Blocker: 2 dBm
	DUT IF OUT n	--	6 GHz to 12 GHz	-150 dBm	10 dBm
S9101A	Head h RFHD p	--	22.7 GHz to 43.5 GHz	-150 dBm	10 dBm
	RF Out	TR1 TR2	0.33 GHz to 6 GHz	-150 dBm	20 dBm
		BK1	0.33 GHz to 6 GHz	-150 dBm	Primary: 17 dBm Blocker: 2 dBm
	RFIO HD	--	0.33 GHz to 6 GHz	-150 dBm	5 dBm
S9110A	Head h RFHD p	F32	10 GHz to 32 GHz	-150 dBm	15 dBm
	RF Out	--	0.33 GHz to 6 GHz	-150 dBm	20 dBm
	RFIO HD	--	0.33 GHz to 6 GHz	-150 dBm	5 dBm
	Head h RFHD p	F43	22.7 GHz to 43.5 GHz	-150 dBm	10 dBm
	Head h RFHD p	F49	22.7 GHz to 49.2 GHz	-150 dBm	10 dBm
S9115A	RF Out	--	0.33 GHz to 13.0 GHz	-150 dBm	27 dBm
	RFIO HD	--	0.33 GHz to 13.0 GHz	-150 dBm	27 dBm
	Head h RFHD p	F43	22.7 GHz to 43.5 GHz	-150 dBm	10 dBm
	Head h RFHD p	F49	22.7 GHz to 49.2 GHz	-150 dBm	10 dBm
S9110E	RF Out	LFE	750 kHz to 380 MHz 380 MHz to	-150 dBm -150 dBm	13 dBm 25 dBm

Solution	Port	Option	Frequency Range	Min Output Power	Max Output Power
			26.5 GHz		
	RF Out	without LFE	330 MHz to 26.5 GHz	-150 dBm	25 dBm
	Head h RFHD p	F49	22.7 GHz to 49.2 GHz	-150 dBm	10 dBm

Note: When using older hardware versions, the maximum output power of S9110A-F32 can be 10 dBm at Port Head h RFHD 1 and 8 dBm at Port Head h RFHD 2

M8920A/20B

RF Output Port	Frequency Range	Min Output Power	Max Output Power
Gen	100 kHz ≤ f ≤ 6 GHz	–150 dBm	Without option 1EA: 3 dBm With option 1EA: 15 dBm
T/R	100 kHz ≤ f ≤ 6 GHz	–150 dBm	T/R port high power attenuator On: -15 dBm T/R port high power attenuator Off: 5 dBm

Note: This is the UI power range, which is larger than the actual specification.

6.1.6.2 Set Reference Power

Turns the power reference state to ON, sets the reference power value to the current RF output power, maintains this power at the RF output, and sets the displayed power to 0.00 dB. All subsequent RF power values entered under Source, Amplitude, RF Power are interpreted as being relative to this reference power.

When you use a power reference, the signal generator outputs an RF power that is set relative to the reference power by the value entered under Source, Amplitude, RF Power as follows:

Output power = reference power – entered power

Where:

- reference power equals the original RF Power entered under Source>Amplitude>RF Power and set as the reference power
- entered power equals a new value entered under Source>Amplitude>Amptd Offset

In addition, the displayed power value is the same as a new value entered under Source, Amplitude, RF Power.

NOTE

If Power Ref is ON with a reference value set, entering a value under **Source**, **Amplitude**, **RF Power** and pressing **Set Reference Power** adds that value to the existing Power Ref value.

If you wish to change the reference power value to a new value entered under **Source**, **Amplitude**, **RF Power**, first set Power Ref to OFF, then press **Set Reference Power**.

Dependencies	Unavailable, and grayed-out, when "List Sequencer" on page 645 is ON

6.1.6.3 Power Ref

Lets you toggle the state of the power reference. When you use a power reference, the signal generator outputs an RF power that is set relative to the reference power by the value entered under Source>Amplitude>RF Power as follows:

Output power = reference power + entered power

Where:

- reference power equals the original RF Power entered under Source>Amplitude>RF Power and set as the reference power
- entered power equals a new value entered under Source>Amplitude>Amptd Offset

For more information on Reference Frequency, see "Set Reference Power" on page 641.

Remote Command	`:SOURce:POWer:REFerence <ampl>` `:SOURce:POWer:REFerence?`
Example	`:SOUR:POW:REF 0.00 dBm`
Dependencies	Unavailable and grayed-out when "List Sequencer" on page 645 is ON
Couplings	Coupled to "Set Reference Power" on page 641, such that pressing Set Reference Power updates the reference power with the current output power
Preset	0.00 dBm
Min	–125.00 dBm
Max	10.00 dBm

Auto Function

Remote Command	`:SOURce:POWer:REFerence:STATe OFF | ON | 0 | 1` `:SOURce:POWer:REFerence:STATe?`

Example	`:SOUR:POW:REF:STATe ON`
Preset	`OFF`

6.1.6.4 Power Unit

Modifies the units for RF Power and Power Ref. The change is immediate and does not force a restart.

Remote Command	`:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT DBM | W | V | DBUV` `:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT?`
Example	Set the RF Power units to volts: `:SOUR:POW:UNIT V`
Couplings	RF Power and Power Ref units are modified by Power Unit
Preset	dBm
State Saved	Saved in Instrument State

6.1.6.5 Amptd Offset

Lets you specify the RF output power offset value.

When the amplitude offset is set to zero (0) and you set a new offset value (positive or negative), the displayed amplitude value changes as follows, and the RF output power does not change:

Displayed value = output power + offset value

Where:

- output power equals the original RF Power entered under Source, Amplitude, RF Power
- offset value equals the value entered under Source, Amplitude, Amptd Offset

When the amplitude offset is set to a value other than zero (0) and you enter a new RF power value under Source, Amplitude, RF Power, the displayed power will be the same as the value entered, and the RF output power will be equal to the value entered minus the offset value as follows:

Output power = entered power – offset power

Displayed Power = output power + offset power

Displayed power = entered power

Where:

- entered power equals the amplitude entered under **Source, Amplitude, RF Power**
- offset power equals the value previously entered and set under **Source, Amplitude, Amptd Offset**

Remote Command	`:SOURce:POWer[:LEVel][:IMMediate]:OFFSet <rel_ampl>` `:SOURce:POWer[:LEVel][:IMMediate]:OFFSet?`
Example	`:SOUR:POW:OFFS 0.00 dB`
Notes	The amplitude Offset unit follows the units set in **Power Unit**
Dependencies	Unavailable, and grayed-out, when List Sequencer is `ON`
Preset	0.00 dB
Min/Max	–/+200.00 dB

6.1.6.6 Amplitude Increment

Changes the step size for the RF Power function. Once an increment size has been selected and the RF Amplitude function is active, the step keys (and the `UP|DOWN` parameters for RF Power from remote commands) change the RF Power by the set value. This feature exists in EXG and MXG.

Remote Command	`:SOURce:POWer:STEP[:INCRement] <ampl>` `:SOURce:POWer:STEP[:INCRement]?`
Example	`:SOUR:POW:STEP 1`
Notes	The Amplitude Increment unit follows the units set in **Power Unit**
Couplings	Coupled to the Step size of the RF Power function
Preset	1 dB
Min	0.1 dB
Max	10 dB

6.1.7 Frequency

Lets you set the selected calibrator's frequency.

Remote Command	`:SYSTem:CALibration:TUNE:FREQuency <freq>` `:SYSTem:CALibration:TUNE:FREQuency?`
Example	Set source frequency to 150 MHz: `:SYST:CAL:TUNE:FREQ 150000000`
Preset	Unaffected by **Mode Preset**. Set to 1 GHz or 100 MHz in SA6210A by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Min/Max	Depends on the selected calibrator

For SA6210A, Mix: 10 MHz, Max: 55 GHz

6.1.8 List Sequencer

Accesses sub-menus for configuring the List Sequencer.

List sequences allow you to enter frequencies and amplitudes at unequal intervals in nonlinear ascending, descending or random order. Each step within the list can also include its own waveform file for playback, step duration, trigger event and trigger output.

The complexities involved in configuring the List Sequencer do not lend themselves to manual configuration; hence the manual configuration for this feature is limited. For easier configuration of the List Sequencer, it is recommended that you use either SCPI, or load a tab-delimited file containing the setup parameters in a tabular form. The details of the SCPI for configuring the List Sequencer can be found in "Step Configuration (Remote Command Only)" on page 661.

Once the List Sequencer has been configured using the front panel, SCPI, or by loading a tab-delimited file, the sequence must be initiated using the front panel Initiate Sequence key, or the corresponding SCPI command.

Dependencies	Not available in E7760B

6.1.8.1 Sequencer

Sets the state of "List Sequencer" on page 645

- When List Sequencer is ON, the source outputs the sequence defined by the sequencer
- When List Sequencer is OFF, the source outputs a single waveform segment or sequence (independent mode) at a single frequency and amplitude

Remote Command	`:SOURce:LIST[:STATe] ON | OFF | 1 | 0` `:SOURce:LIST[:STATe]?`
Example	`:SOUR:LIST OFF`
Notes	When the sequencer is ON, the List Sequencer controls the output of the source
Dependencies	Not available in E7760B
Couplings	When in Sequence Analyzer Mode, and the List Sequencer state is OFF, Include Source is forced to NO, and the Include Source key is grayed-out When in Sequence Analyzer Mode, and the List Sequencer state is ON, Include Source is available to set, and an ARB memory related operation such as load or delete will be rejected
Preset	OFF
Range	ON | OFF

6.1.8.2 Initiate Sequence

Arms the sequence for single execution. Once the sequence is armed, the source begins the sequence as soon as the trigger is received. If trigger is set to **Free Run**, the sequence starts immediately.

Remote Command	`:SOURce:LIST:TRIGger[:IMMediate]`
Example	`:SOUR:LIST:TRIG`
Notes	When in Sequence Analyzer Mode, and **Include Source** is `ON`, the Initiate List Sequencer operation is rejected, and the key is grayed-outIf the file needed by the sequencer is not already in ARB memory, the sequence cannot be initiated, and an error is generated There is a blocking SCPI query that can be used to check whether source list sequence was initiated successfully (see "Remote Software Trigger (Remote command Only)" on page 669)
Dependencies	In Sequence Analyzer Mode, if **Meas Setup, Include Source** is set to `YES`, **Source, List Sequencer, Initiate Sequence** is disabled Not available in E7760B

6.1.8.3 Repetition

Accesses a sub-menu to select the repetition type for the List Sequencer globally. It cannot be changed between different sequence steps.

In **Single**, the Source list plays one time after initiation. In **Continuous**, the Source list plays continuously after initiation.

This setting is available on EXM.

Remote Command	`:SOURce:LIST:REPetition:TYPE SINGle | CONTinuous`
Example	`:SOUR:LIST:REP:TYPE SING` `:SOUR:LIST:REP:TYPE?`
Dependencies	Available on EXM Not available in E7760B
Preset	`SINGle`
Range	`SINGle | CONTinuous`

6.1.8.4 Trig Out Type

Accesses a sub-menu to select the output trigger type for the List Sequencer globally. It cannot be changed between different sequence steps. It sets the output trigger type for the whole source sequence.

Remote Command	`:SOURce:LIST:TRIGger:OUTPut:TYPE STEP | MARKer`

	:SOURce:LIST:TRIGger:OUTPut:TYPE?
Notes	STEP = Start of Step MARKer = Data Marker
Dependencies	Available in EXM Not available in E7760B
Preset	STEP
Backwards Compatibility SCPI	:SOURce:LIST:TRIGgerout:TYPe BEGinningofstep|DATamarker

6.1.8.5 Select Data Marker

When "Trig Out Type" on page 646 is set to Data MARKer, specifies which marker to route.

Remote Command	:SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer M1 | … | M4 :SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer?
Backwards Compatibility SCPI	:SOURce:LIST:TRIGgerout:TYPe:Marker

6.1.8.6 Manual Trigger Now

Provides a software trigger event to the List Sequencer. During execution of a sequence, if the sequencer is halted on any step that has been configured with a “Manual” step trigger, then this keypress causes the sequencer to continue and execute the step.

Notes	No remote command, front panel only

6.1.8.7 List Sequencer Setup

Accesses the List Sequencer setup menus.

Number of Steps

Lets you specify the number of steps within the list sequence.

Remote Command	:SOURce:LIST:NUMBer:STEPs <integer> :SOURce:LIST:NUMBer:STEPs?
Example	:SOUR:LIST:NUMB:STEP 1
Notes	Increasing the number of steps creates additional steps at the end of the list, with all the settings within the steps set to their default values

	Decreasing the number of steps removes steps from the end of the list. The settings within the removed steps are not reset. This means that increasing the number of steps again would allow you to retrieve these steps
Dependencies	The Step Count parameter is increased or decreased when you insert or delete a point from within the GUI interface to the sequencer Not available in E7760B
Preset	1
Min	1
Max	1000

Go To Step

Lets you select the step number you wish to view or edit.

Preset	1
Min	1
Max	Step Count

Insert Step Before

Inserts a new step, with default values, before the currently selected step. Inserting a step automatically increases the Step Count parameter by 1. If a sequence has already reached the upper limit of 1000 steps, then this operation is rejected, and error -221, “Setting Conflict; Cannot insert more steps, maximum number of steps reached” is displayed.

Notes	If the list already contains the maximum limit (1000 steps), pressing this control has no effect

Delete Step

Deletes the current step. Deleting a step automatically decreases the Step Count parameter by 1. If the sequence only has one step left, then this operation is rejected, and error -221, “Setting conflict; Cannot delete current step, minimum number of steps reached” is displayed.

Notes	If the list already contains the minimum limit of 1 step, pressing this control has no effect

Clear List

Clears the list. Clearing the list sets the number of steps to the default value (1) and sets the parameters for the only step to their default values.

Step Trigger

Lets you select the trigger input for the current step.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:INPut:TRIGger IMMediate | INTernal | EXTernal2 | KEY | BUS | EXTernal4`
	For details of options, see "More Information" on page 649
	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:INPut:TRIGger?`

Example	`:SOUR:LIST:STEP2:SET:INP:TRIG BUS` `:SOUR:LIST:STEP2:SET:INP:TRIG?`
Notes	SCPI is supported after A.09.40
Dependencies	Not available in E7760B
Preset	`IMMediate`
Range	`IMMediate|INTernal|EXTernal2|KEY|BUS|EXTernal4`

More Information

Parameter	SCPI	Notes
Free Run	`IMM`	Sets the trigger input for the current step to Free Run
Internal	`INT`	Sets the trigger input for the current step to Internal
Manual (Trigger Key)	`KEY`	Sets the trigger input for the current step to Manual (Trigger Key). Any step in the sequence set to Manual will cause the sequence execution to stop until the manual trigger key is pressed. Sending the Bus Trigger SCPI command will have no effect. At any point in the sequence where the List Sequencer is paused waiting for a software trigger, a pop-up dialog is displayed until the trigger event occurs
Bus	`BUS`	Sets the trigger input for the current step to Bus. Any step in the sequence set to Bus will cause the sequence execution to stop until the Bus Trigger command is sent. Pressing the manual trigger key has no effect. At any point in the sequence where the List Sequencer is paused waiting for a software trigger, a pop-up dialog is displayed until the trigger event occurs
External 2	`EXT2`	Sets the trigger input for the current step to External 2 Note: When on EXM, trigger 2 is a bi-directional trigger port. So, when trigger 2 has been configured as OUTPUT type, choosing External 2 as the input trigger for the current step will generate error

Transition Time

Lets you specify the transition time for the current step.

The following table lists recommended values for appropriate settling times to allow for changes within the source.

Value Changed	Recommended Transition Time
Frequency	500 µs
Amplitude	100 µs to within 0.1 dB
	20 µs to within 1.0 dB

If the Transition Time value is shorter than the time necessary for the hardware to settle and a List Sequence is initiated, a warning is generated.If the Transition Time value is longer than the Step Duration, an error is generated when initiating a source list sequence. For source list sequence, transition time is included in the step duration length. If the Transition Time value is longer than the Step Duration Time, the real step duration length is extended to equal the transition time and cause a timing shift.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:TRANsition:TIME <time>` `:SOURce:LIST:STEP[1]|2|…|1000:SETup:TRANsition:TIME?`
Example	`:SOUR:LIST:STEP2:SET:TRAN:TIME 1ms` `:SOUR:LIST:STEP2:SET:TRAN:TIME?`
Notes	SCPI is supported after A.09.40
Dependencies	Not available in E7760B
Preset	1.0 ms
Min	0.0 ms
Max	4.0 ks

Band

Lets you select the radio band for use in the current step.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:RADio:BAND <band>` where `<band>` is one of: `NONE | PGSM | EGSM | RGSM | DCS1800 | PCS1900 | GSM450 | GSM480 | GSM700 | GSM850 | TGSM810 | USCELL | USPCS | JAPAN | KOREAN | NMT | IMT2K | UPPER | SECOND | PAMR400 | PAMR800 | IMTEXT | PCS1DOT9G | AWS | US2DOT5G | PUBLIC | LOWER | BANDI | BANDII | BANDIII | BANDIV | BANDV | BANDVI | BANDVII | BANDVIII | BANDIX | BANDX | BANDXI | BANDXII | BANDXIII | BANDXIV | BANDXIX | BAND1 | BAND2 | BAND3 | BAND4 | BAND5 | BAND6 | BAND7 | BAND8 | BAND9 | BAND10 | BAND11 | BAND12 | BAND13 | BAND14 | BAND17 | BAND18 | BAND19 | BAND20 | BAND21 | BAND24 | BAND25 | BAND26 | BAND27 | BAND28 | BAND29 | BAND30 | BAND31 | BAND65 | BAND66 | BAND67 | BAND68 | BAND71 | BAND252 | BAND255 | BAND33 | BAND34 | BAND35 | BAND36 | BAND37 | BAND38 | BAND39 | BAND40 | BAND41 | BAND42 | BAND43 | BAND44 | BAND45 | BAND46 | BANDA | BANDB | BANDC | BANDD | BANDE | BANDF | N1 | N2 | N3 | N5 | N7 | N8 | N12 | N20 | N25 | N28 | N34 | N38 | N39 | N40 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N80 | N81 | N82 | N83 | N84 | N86 | N257 | N258 | N260 | N261` `:SOURce:LIST:STEP[1]|2|…|1000:SETup:RADio:BAND?`

Example	`:SOUR:LIST:STEP2:SET:RAD:BAND PGSM` `:SOUR:LIST:STEP2:SET:RAD:BAND?`
Notes	SCPI is supported after A.09.40
Dependencies	Not available in E7760B

Here are the Radio Standards for each Band, and a SCPI example for each (Step 2 is assumed):

Band	Standard	SCPI Example
None	None	`:SOUR:LIST:STEP2:SET:RAD:BAND NONE`
P-GSM	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND PGSM`
E-GSM	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND EGSM`
R-GSM	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND RGSM`
DCS 1800	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND DCS1800`
PCS 1900	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND PCS1900`
GSM 450	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND GSM450`
GSM 480	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND GSM480`
GSM 700	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND GSM700`
GSM 850	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND GSM850`
T-GSM 810	GSM/EDGE	`:SOUR:LIST:STEP2:SET:RAD:BAND T-GSM810`
US Cell	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND USCELL`
US PCS	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND PCS`
Japan Cell	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND JAPAN`
Korean PCS	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND KOREAN`
NMT 450	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND NMT`
IMT 2000	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND IMT2K`
Upper 700	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND UPPER`
Secondary 800	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND SECOND`
400 Euro PAMR	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND PAMR400`
800 PAMR	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND PAMR800`
2.5 GHz IMT EXT	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND IMTEXT`
US PCS 1.9 GHz	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND PCS1DOT9G`
AWS	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND AWS`
US 2.5 GHz	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND US2DOT5G`
700 Public Safety	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND PUBLIC`
C2K Lower 700	CDMA 2000	`:SOUR:LIST:STEP2:SET:RAD:BAND LOWER`
Band I	W-CDMA	`:SOUR:LIST:STEP2:SET:RAD:BAND BANDI`
Band II	W-CDMA	`:SOUR:LIST:STEP2:SET:RAD:BAND BANDII`

Band	Standard	SCPI Example
Band III	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDIII
Band IV	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDIV
Band V	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDV
Band VI	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDVI
Band VII	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDVII
Band VIII	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDVIII
Band IX	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDIX
Band X	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDX
Band XI	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXI
Band XII	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXII
Band XIII	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXIII
Band XIV	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXIV
Band XIX	W-CDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDXIX
Band 1	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND1
Band 2	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND2
Band 3	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND3
Band 4	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND4
Band 5	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND5
Band 6	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND6
Band 7	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND7
Band 8	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND8
Band 9	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND9
Band 10	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND10
Band 11	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND11
Band 12	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND12
Band 13	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND13
Band 14	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND14
Band 17	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND17
Band 18	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND18
Band 19	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND19
Band 20	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND20
Band 21	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND21
Band 24	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND24
Band 25	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND25
Band 26	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND26
Band 27	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND27

Band	Standard	SCPI Example
Band 28	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND28
Band 29	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND29
Band 30	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND30
Band 31	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND31
Band 65	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND65
Band 66	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND66
Band 67	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND67
Band 68	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND68
Band 71	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND71
Band 252	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND252
Band 255	LTE FDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND255
Band 33	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND33
Band 34	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND34
Band 35	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND35
Band 36	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND36
Band 37	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND37
Band 38	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND38
Band 39	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND39
Band 40	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND40
Band 41	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND41
Band 42	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND42
Band 43	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND43
Band 44	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND44
Band 45	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND45
Band 46	LTE TDD	:SOUR:LIST:STEP2:SET:RAD:BAND BAND46
Band A	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDA
Band B	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDB
Band C	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDC
Band D	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDD
Band E	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDE
Band F	TD-SCDMA	:SOUR:LIST:STEP2:SET:RAD:BAND BANDF
N 1	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N1
N 2	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N2
N 3	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N3
N 5	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N5
N 7	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N7

Band	Standard	SCPI Example
N 8	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N8
N 12	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N12
N 20	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N20
N 25	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N25
N 28	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N28
N 34	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N34
N 38	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N38
N 39	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N39
N 40	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N40
N 41	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N41
N 50	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N50
N 51	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N51
N 66	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N66
N 70	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N70
N 71	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N71
N 74	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N74
N 75	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N75
N 76	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N76
N 77	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N77
N 78	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N78
N 79	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N79
N 80	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N80
N 81	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N81
N 82	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N82
N 83	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N83
N 84	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N84
N 86	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N86
N 257	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N257
N 258	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N258
N 260	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N260
N 261	5G NR	:SOUR:LIST:STEP2:SET:RAD:BAND N261

Device

Lets you specify the radio band link direction for the steps within the list sequence. The link is used in conjunction with the channel band and channel number to determine the output frequency.

Setting	Option	Description
Uplink	UP	The source calculates the uplink frequency according to an uplink formula together with selected channel band and channel number
Downlink	DOWN	The source calculates the downlink frequency according to a downlink formula together with selected channel band and channel number

Remote Command	:SOURce:LIST:STEP[1]|2|…|1000:SETup:RADio:BAND:LINK DOWN | UP :SOURce:LIST:STEP[1]|2|…|1000:SETup:RADio:BAND:LINK?
Example	:SOUR:LIST:STEP2:SET:RAD:BAND:LINK UP :SOUR:LIST:STEP2:SET:RAD:BAND:LINK?
Notes	SCPI is supported after A.09.40
Dependencies	Not available in E7760B
Preset	DOWN
Range	DOWN | UP

Freq/Chan

Lets you select the frequency or channel value for the current step. If the Band selection for the current row is NONE, you enter a frequency. Otherwise, enter a channel, which causes the frequency to be automatically selected, based on the Band selection.

Entering a Frequency

If the Band selection for the current row is NONE, enter a Frequency. This field in the table allows you to select the frequency value for the current step.

Remote Command	:SOURce:LIST:STEP[1]|2|…|1000:SETup:CNFRequency <double> :SOURce:LIST:STEP[1]|2|…|1000:SETup:CNFRequency?
Example	:SOUR:LIST:STEP2:SET:CNFR 1GHz :SOUR:LIST:STEP2:SET:CNFR?
Notes	SCPI is supported after A.09.40 Used to set up channel number or frequency setting, according to the current Radio Band setting. If Radio Band is NONE, then the value is frequency. If Radio Band is not NONE, then the value is channel number
Dependencies	Not available in E7760B
Couplings	The frequency value is coupled to the channel band and number for the step, such that updates to the radio band and channel number will update the frequency value to the corresponding absolute frequency. The reverse is also true, changing the frequency value causes the value of the channel number to be updated

Preset	1.00 GHz
Min	10.00 MHz
Max	Hardware Dependent:

Option 503	3.6 GHz
Option 504	3.9 GHz
Option 506	6.00 GHz
Option F06	6.08 GHz
Option F06 & EP6	6.60 GHz

Entering a Channel

If the Band selection for the current row is not NONE, enter a Channel Number. This field in the table allows you to select the channel value for the current step. The frequency is selected automatically, based on the Band.

Example	`:SOUR:LIST:STEP2:SET:CNFR 124` `:SOUR:LIST:STEP2:SET:CNFR?`
Notes	SCPI is supported after A.09.40 Used to set up channel number or frequency settings, according to current Radio Band setting. If Radio Band is NONE, then the value is a frequency. If Radio Band is not NONE, then the value is a channel number
Dependencies	Not available in E7760B
Couplings	The channel number is coupled to the step frequency value. When the step frequency value is changed, the channel number increases or decreases to match the new step frequency. If the step frequency is not at an exact match for a channel number, the nearest channel number is displayed, along with a greater-than or less-than sign, to indicate the frequency is above or below the channel number
Preset	1
Min/Max	0/10838 (See "Channel" on page 670 for valid ranges)

Power

Lets you specify the power value for the current step.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:AMPLitude <double>` `:SOURce:LIST:STEP[1]|2|…|1000:SETup:AMPLitude?`
Example	`:SOUR:LIST:STEP2:SET:AMPL -50dBm` `:SOUR:LIST:STEP2:SET:AMPL?`
Dependencies	The RF power is dependent on the RF output port and frequency, such that the current frequency and selected output port determine the valid range of power values

	Not available in E7760B
Preset	–100 dBm
Min/Max	The range of values depends on the current frequency and selected RF output port See "RF Power" on page 637 and the RF Power Range table for valid ranges

Waveform

Lets you select the waveform to be played back during the current step. Options are: CW, a Waveform file, Continue the previous step's waveform, or Off.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:WAVeform <string>`
	where `<string>` is one of (including the quote marks):
	`"CW"`, `"waveform name"`, `"Cont"`, `"Off"`
	For full details of options, see "More Information" on page 657
	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:WAVeform?`

Example	`:SOUR:LIST:STEP2:SET:WAV "CW"` `:SOUR:LIST:STEP2:SET:WAV?`
Notes	SCPI is supported after A.09.40
Dependencies	Not available in E7760B For VXT models M9410A/11A/16A, if **Waveform** is not **Continue Previous**, there is always a time gap between the current step and the previous step
Preset	`CW`
Range	`"CW", "waveform name", "Cont", "Off"`

More Information

Parameter	SCPI	Notes
CW	`"CW"`	Sets the current step to output a CW tone
Selected Waveform	`"waveform name"`	Inserts a waveform from the Select Waveform dialog as the waveform for playback during the current step If the selected waveform contains header (which contains ARB play parameters), source list sequence will automatically apply header settings of the selected waveform in that step
Continue Previous	`"Cont"`	Sets the current step to continue with playback of the waveform from the previous step. When continuing the previous waveform, the ARB playback will not pause while the source retunes to the new frequency or amplitude that may be defined for the new step
Off	`"Off"`	Disable RF output of the current step

Waveform File

Pressing the slide-aside field of this column (>) opens the "Select Waveform" on page 713 screen, which lets you select a waveform in ARB memory to playback during the current step. When you select a waveform, and press **OK**, it returns to the List Sequencer Setup screen with that file name in the table.

Step Duration

Lets you select the duration of play for the current step.

The duration can be set to be either the number of times for the ARB file associated with the sequence to play, or a specific time value, or continuous. If the step is set to play a CW tone, the step duration cannot be set to a play count.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TYPE TIME | COUNt | CONTinuous | CABort`
	See "Option Details" on page 658
	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TYPE?`

Example	`:SOUR:LIST:STEP2:SET:DUR:TYPE TIME` `:SOUR:LIST:STEP2:SET:DUR:TYPE?`
Dependencies	Not available in E7760B If in VXT models M9410A/11A/16A, **Step Duration** is `TIME` or Play `COUNt`, only **Free Run** is available for the next step. Otherwise, an error message is generated: “Parameter error; only Free Run is available as step trigger on step<n>”
Range	`TIME|COUNt|CONTinuous|CABort`

Option Details

Parameter	SCPI	Notes
Time	`TIME`	Sets the duration of the current step to be a time value for the length of time the step will play When `TIME` is selected, the Time may be set using the second field under **Step Duration** and/or by the "Duration Time" on page 659 command
Count	`COUNt`	Sets the duration of the current step to be an integer value for the number of times (play count) the ARB file is selected for playback during this step. For example, a 5 second ARB will be set to play 5 times during the step When `COUNt` is selected, the Count may be set using the second field under **Step Duration** and/or by the "Play Count" on page 660 command
Continuous	`CONTinuous`	Sets the current step to be played continuously until the next step starts. The waveform will always play completely before transitioning to the next step

Parameter	SCPI	Notes
Continuous Abort	`CABort`	Sets the current step to be played continuously or until the trigger event of the next step is detected. When a trigger event is received, the waveform play will be aborted after the interval specified by the Duration Time parameter and it will then transition to the next step When Continuous Abort is selected, the Duration Time may be set using the second field under Step Duration and/or by the "Duration Time" on page 659 command

Duration Time

Lets you specify the length of time the current step will play when "Step Duration" on page 658 is Time.

When "Step Duration" on page 658 is Continuous Abort, this parameter specifies the maximum duration that the waveform will continue to play after a step trigger is received before the transition to the next waveform will occur. Duration is limited to a maximum of 20 seconds.

If the Transition Time value is longer than the Step Duration Time, an error is generated when initiating a source list sequence. For source list sequence, transition time is included in the step duration length (not occupy additional time). If the Transition Time value is longer than the Step Duration Time, the real step duration length is extended to equal the transition time and cause a timing shift.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TCOunt <double>` `:SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TCOunt?`
Example	`:SOUR:LIST:STEP2:SET:DUR:TCO 1s` `:SOUR:LIST:STEP2:SET:DUR:TCO?`
Notes	When Repetition is **Single**, the last step continues playing after the sequence is completed. In this extended playing time, `:STAT:OPER:COND?` returns 0 for the Source Sweeping Status Bit (bit 9) SCPI is supported after A.09.40 If current **Duration Type** is **Continuous**, then error -221, "Settings conflict; Cannot accept time or count input when step duration type is Continuous on step #" is displayed
Dependencies	Not available in E7760B
Preset	VXT models M9410A/11A/16A: 2.0 ms All others: 1.00 ms
Min	For VXT models M9410A/11A/16A, the minimum duration time for first step is 1.2 ms. If the Waveform is “waveform name”, the minimum duration time is 1.2 ms All others: 100 µs
Max	1800 s

Play Count

Lets you specify the number of times the current ARB waveform file will play during a step when "Step Duration" on page 658 is Count.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TCOunt <double>` `:SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TCOunt?`
Example	`:SOUR:LIST:STEP2:SET:DUR:TCO 10` `:SOUR:LIST:STEP2:SET:DUR:TCO?`
Notes	SCPI is supported after A.09.40 This command is reused by **Play Count** and **Duration Time** if **Duration Type** is set to **Play Count** or **Duration Time** If **Duration Type** is **Continuous**, then error -221, "Settings conflict; Cannot accept time or count input when step duration type is Continuous on step #" is displayed If **Play Count** is set for the last step, the last step of ARB keeps playing as if set to **Continuous** after play count setting is reached
Dependencies	Not available in E7760B
Preset	1
Min	1
Max	65536

Trig Out

Lets you specify the trigger output for the current step. The trigger output signal is sent at the start of the step.

When this is `ON`, a trigger event occurs on both Internal and External2 paths. Selecting `OFF` turns off trigger output.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup:OUTPut:TRIGger ON | OFF | 1 | 0` `:SOURce:LIST:STEP[1]|2|…|1000:SETup:OUTPut:TRIGger?`
Example	`:SOUR:LIST:STEP2:SET:OUTP:TRIG ON` `:SOUR:LIST:STEP2:SET:OUTP:TRIG?`
Notes	SCPI is supported after A.09.40
Dependencies	Not available in E7760B
Preset	`OFF`
Range	`ON|OFF`

Step Configuration (Remote Command Only)

Used to configure the List Sequencer, as detailed in the table below. The command is defined such that you send one command per step, with the step number being specified as a subopcode of the SCPI command. Each command includes all the parameter settings for the step. As a step is set up, the values entered are run through several levels of validation.

Remote Command	`:SOURce:LIST:STEP[1]|2|…|1000:SETup <step_trigger>, <trans_time>, <band>, <link_type>, <freq_chan>, <power>, <waveform>, <duration>, <time_count>, <trig_state>`
	For details of each option, see "Step Configuration Parameters" on page 661 below
	`:SOURce:LIST:STEP[1]|2|…|1000:SETup?`

Example	`:SOUR:LIST:STEP1:SET INT, 1ms, PGSM, DOWN, 10, -25 dBm, "GSM_Test1.bin", TIME, 10ms, OFF`
Dependencies	The range of subopcode values is 1 to 1000, and the value you enter is determined by the number of steps you have configured. For details see "Number of Steps" on page 647 If you attempt to remotely set or query a subopcode that is out of range, an error is generated

Step Configuration Parameters

There are 10 parameters for each step, which must be in the following order in the command:

1	Step Trigger `<step_trigger>`	Data Type: enum Specifies the input trigger for the step. For further details, see "Step Trigger" on page 649
2	Transition Time `<trans_time>`	Data Type: enum Specifies the transition time for the step, in seconds. For further details, see "Transition Time" on page 649
3	Radio Band `<band>`	Data Type: enum Specifies the radio band for the step, as any one of: `NONE | PGSM | EGSM | RGSM | DCS1800 | PCS1900 | TGSM810 | GSM450 | GSM480 | GSM700 | GSM850 | BANDI | BANDII | BANDIII | BANDIV | BANDV | BANDVI | BANDVII | BANDVIII | BANDIX | BANDX | BANDXI | BANDXII | BANDXIII | BANDXIV | BANDXIX | USCELL | USPCS | JAPAN | KOREAN | NMT | IMT2K | UPPER | SECOND | PAMR400 | PAMR800 | IMTEXT | PCS1DOT9G | AWS | US2DOT5G | PUBLIC | LOWER | NONE | BAND1 | BAND2 | BAND3 | BAND4 | BAND5 | BAND6 | BAND7 | BAND8 | BAND10 | BAND11 | BAND12 | BAND13 | BAND14 | BAND17 | BAND18 | BAND19 | BAND20 | BAND21 | BAND24 | BAND25 | BAND26 | BAND33 | BAND34 | BAND35 | BAND36 | BAND37 | BAND38 | BAND39 | BAND40 | BAND41 | BAND42 | BAND43 | BANDA | BANDB | BANDC | BANDD | BANDE | BANDF | N1 | N2 | N3 | N5 | N7 | N8 | N12 | N20 | N25 | N28 | N34 | N38 | N39 | N40 | N41 | N50 | N51`

		`| N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N80 | N81 | N82 | N83 | N84 | N86 | N257 | N258 | N260 | N261` For further details, see "Band" on page 650
4	Radio Band Link `<link_type>`	Data Type: enum Specifies the radio band link direction for the step, as either of: `DOWN|UP` For further details, see "Device" on page 654 The old **Device** BTS|MS is obsolete, but is still supported, acting as an alias for the **Link** parameter
5	Frequency/Channel Number `<freq_chan>`	Data Type: freq/chan num Specifies the frequency in Hz or the channel number for the step. The channel number and frequency are combined as one parameter that represents the frequency or channel number depending on the radio band setting. If the radio band is set to `NONE`, this value is interpreted as a frequency value in Hz. If the radio band is set to a valid band, this value is interpreted as a channel number For further details, see "Freq/Chan" on page 655
6	Power `<power>`	Data Type: ampl Specifies the output power for the step in dBm. For details of the valid ranges see "Power" on page 656
7	Waveform `<waveform>`	Data Type: string Specifies the waveform for playback during the step. The step can output either a new ARB waveform, continue playback of the previous waveform, or output a CW tone. The options for specifying these are: `<filename>` — Plays the specified waveform from the start. The filename value is the name of the file within ARB playback memory, it does not include the windows path to the file on the HDD. If you enter a filename for a waveform that does not reside within ARB playback memory, an error is generated `CONT` — Continues playback of the ARB file from the previous step `CW` — Outputs a CW tone `OFF` — Disables RF output For further details, see "Waveform" on page 657 and "Waveform File" on page 658
8	Step Duration `<duration>`	Data Type: enum Specifies the duration of the step, as one of: `TIME|COUNt|CONTinuous` The duration can be specified to be either time, or play count of the ARB file associated with the step, or continuous. If Waveform is set to `CW`, this value cannot be set to Play Count and an error will be generated. If `CONTinuous` is selected, the following Time or Count value is ignored. For further details, see "Step Duration" on page 658

9	Time or Count `<time_count>`	Data Type: time/int Specifies time duration in seconds, or play count of the ARB file associated with the step For further details, see "Play Count" on page 660
10	Output Trigger `<trig_state>`	Data Type: boolean Specifies the output trigger state for the step, as one of: `ON|OFF|1|0` For further details, see "Trig Out" on page 660

Step Configuration of Step Trigger parameter list (Remote Command Only)

Configures the “Step Trigger” parameter array of the whole List Sequencer at one time. The number of arrays is the same as the step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:INPut:TRIGger <enum>, <enum>, <enum>, …` `:SOURce:LIST:SETup:INPut:TRIGger?`
Example	`:SOUR:LIST:SET:INP:TRIG IMM,INT,EXT2` `:SOUR:LIST:SET:INP:TRIG?`
Notes	The command is to set up the parameter array for the whole list sequence Step Trigger <**enum**> - specifies the input trigger for the step. For details of the valid types of step trigger see "Step Trigger" on page 649 If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then error -221 "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls in number of steps will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Step Configuration of Transition Time parameter list (Remote Command Only)

Configures the “Transition Time” parameter array of the whole List Sequencer at once. The array size is the same as step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:TRANsition:TIME <time>, <time>, <time>, …` `:SOURce:LIST:SETup:TRANsition:TIME?`
Example	`:SOUR:LIST:SET:TRAN:TIME 1ms,1ms,1ms` `:SOUR:LIST:SET:TRAN:TIME?`

Notes	The command sets up the parameter array for a complete list sequence Transition Time <time> - specifies the transition time for the step in seconds. For details of the valid ranges for the transition time see "Transition Time" on page 649 If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then the error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls in number of steps will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Step Configuration of Radio Band parameter list (Remote Command Only)

Configures the Radio Band parameter array of the whole List Sequencer at once. The size of the array is the same as the step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:RADio:BAND <enum>, <enum>, <enum>, …` `:SOURce:LIST:SETup:RADio:BAND?`
Example	`:SOUR:LIST:SET:RAD:BAND PGSM, EGSM, RGSM` `:SOUR:LIST:SET:RAD:BAND?`
Notes	The command sets up the parameter array of whole list sequence Radio Band <enum> - specifies the radio band for the step. For available options, see "Band" on page 650 If the input parameter number exceeds the step number defined by "Number of Steps" on page 647, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within the number of steps will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Step Configuration of Radio Band Link parameter list (Remote Command Only)

Configures the Radio Band Link parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:RADio:BAND:LINK <enum>, <enum>, <enum>, …` `:SOURce:LIST:SETup:RADio:BAND:LINK?`
Example	`:SOUR:LIST:SET:RAD:BAND:LINK DOWN,UP,UP` `:SOUR:LIST:SET:RAD:BAND:LINK?`

Notes	The command sets up the parameter array of whole list sequence Radio Band Link <enum> - specifies the radio band link direction for the step. Options are: DOWN|UP If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within the number of steps will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Step Configuration of Frequency/Channel Number parameter list (Remote Command Only)

Configures the Frequency or Channel Number parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	:SOURce:LIST:SETup:CNFRequency <double>, <double>, <double>, … :SOURce:LIST:SETup:CNFRequency?
Example	:SOUR:LIST:SET:CNFR 1GHz,100MHz,100MHz :SOUR:LIST:SET:CNFR? :SOUR:LIST:SET:CNFR 124,124,124 :SOUR:LIST:SET:CNFR?
Notes	The command sets up the parameter array for an entire list sequence Frequency/Channel Number <freq>/<chan num> - specifies the frequency in Hz or the channel number for the step. The channel number and frequency are combined as one parameter that represents the frequency or channel number depending on the radio band setting. If the radio band is set to NONE, this value is interpreted as a frequency value in Hz. If the radio band is set to a valid band, this value is interpreted as a channel number This command is used to setup/query channel number or frequency setting, according to current Radio Band setting of that step. If Radio Band is NONE, then it is frequency. If Radio Band is not NONE, then it is channel number If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then generate error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number", and only those parameters whose index number falls in legal step number will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Step Configuration of Power parameter list (Remote Command Only)

Configures the Power parameter array of the whole List Sequencer at one time. The number of arrays is the same as step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:AMPLitude <ampl>, <ampl>, <ampl>, …` `:SOURce:LIST:SETup:AMPLitude?`
Example	`:SOUR:LIST:SET:AMPL -50dBm,-40dBm,-30dBm` `:SOUR:LIST:SET:AMPL?`
Notes	The command sets up the parameter array of whole list sequence Power <ampl> - specifies the output power for the step in dBm. For details of the valid ranges, see "Power" on page 656 If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within legal step number will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Step Configuration of Waveform parameter list (Remote Command Only)

Configures the Waveform parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:WAVeform <string>, <string>, <string>, …` `:SOURce:LIST:SETup:WAVeform?`
Example	`:SOUR:LIST:SET:WAV "CW","Off","CONT"` `:SOUR:LIST:SET:WAV?`
Notes	Sets up or queries the parameter array of whole list sequence Waveform `<string>` - specifies the waveform for playback during the step. The step can output either a new ARB waveform, continue playback of the previous waveform, or output a CW tone. The options for specifying these are:

`<filename>`	Plays the specified waveform from the start. The filename value is the name of the file within ARB playback memory, it does not include the windows path to the file on the HDD. If you enter a filename for a waveform that does not reside within ARB playback memory, an error is generated
`CONT`	Continues playback of the ARB file from the previous step

	CW	Outputs a CW tone
	OFF	Disables the RF output
	If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within number of steps will be updated	
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647	
Range	"filename" | "CW" | "Off" | "CONT"	

Step Configuration of Step Duration parameter list (Remote Command Only)

Configures the Step Duration parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	:SOURce:LIST:SETup:DURation:TYPE <enum>, <enum>, <enum>, … :SOURce:LIST:SETup:DURation:TYPE?
Example	:SOUR:LIST:SET:DUR:TYPE COUN,TIME,CONT :SOUR:LIST:SET:DUR:TYPE?
Notes	Sets up or queries the parameter array of whole list sequence Step Duration <enum> - specifies the duration of the step. The duration can be specified to be either time, or play count of the ARB file associated with the step, or continuous. If Waveform is set to “CW”, this value cannot be set to Play Count and an error will be generated. If continuous is selected, the following Time or Count value is ignored. For further details of this setting, see "Step Duration" on page 658 Options are: TIME | COUNt | CONTinuous If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within number of steps will be updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Step Configuration of Duration Time or Play Count parameter list (Remote Command Only)

Configures the Duration Time or Play Count parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in

"Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:TOCount <time/int>, <time/int>, <time/int>, …` `:SOURce:LIST:SETup:TOCount?`

Example	`:SOUR:LIST:SET:TOC 1s,2s,3s`
	`:SOUR:LIST:SET:TOC?`
	`:SOUR:LIST:SET:TOC 5,6,7`
	`:SOUR:LIST:SET:TOC?`

Notes	Sets up or queries the parameter array of whole list sequence Time or Count `<time/int>` - specifies time duration in seconds or play count of the ARB file associated with the step If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then an error is generated, and only those parameters whose index number falls within number of steps will be updated If current "Step Duration" on page 658 is **Continuous**, then error -221, "Settings conflict; Cannot accept time or count input when step duration type is Continuous on step #" is generated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Step Configuration of Output Trigger parameter list (Remote Command Only)

Configures the **Output Trigger** parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in "Number of Steps" on page 647. As a step is set up, the value entered runs through several levels of validation.

Remote Command	`:SOURce:LIST:SETup:OUTPut:TRIGger <bool>, <bool>, <bool>, …` `:SOURce:LIST:SETup:OUTPut:TRIGger?`
Example	`:SOUR:LIST:SET:OUTP:TRIG ON,OFF,ON` `:SOUR:LIST:SET:OUTP:TRIG?`
Notes	Sets up or queries the parameter array of whole list sequence Output Trigger `<bool>` - specifies the output trigger for the step. Options are: `ON|OFF|1|0` If input parameter number exceeds the step number defined by "Number of Steps" on page 647, then error -221,"Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within legal step number are updated
Dependencies	The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 647

Clear List (Remote Command Only)

The SCPI equivalent of the Clear List UI feature described in "Clear List" on page 648.

Remote Command	`:SOURce:LIST:SETup:CLEar`
Example	`:SOUR:LIST:SETup:CLE`
Dependencies	Not available in E7760B

6.1.8.8 Remote Software Trigger (Remote command Only)

During execution of a list sequence, the sequence halts and waits at any step that has Step Trigger set to “Bus”. Sending this command triggers the step and continues the sequence.

Remote Command	`:SOURce:LIST:TRIGger:INITiate[:IMMediate]`
Example	`:SOUR:LIST:TRIG:INIT`
Dependencies	Not available in E7760B

6.1.8.9 Query List Sequence Initiation Armed Status (Remote Query Only)

This is a blocking SCPI query to determine whether a source list sequence has been initiated successfully.

Remote Command	`:SOURce:LIST:INITiation:ARMed?`
Example	`:SOUR:LIST:INIT:ARMed?`
Notes	Returns “1” if list sequence has been initiated successfully, or “0” if not. If the response is “0”, use `:SYST:ERR?` to query the actual error Like `*OPC?`, this command can be blocked until event/status “IsSourceSweeping” occurs, and then returns. Doing so can help a script query the armed status only once during the time interval of the initiation. As an ancillary to the existing `:SOUR:LIST:TRIGger[:IMMediate]`, send this query after `:SOUR:LIST:TRIG`. Otherwise, this query will return “1” immediately The return data is in the following format: Integer There is an alias: `:SOURce:LIST:TRIGger:INITiation:ARMed?`
Dependencies	Not available in E7760B

6.1.9 Frequency Setup

Lets you access the Frequency Setup sub-menu panel.

Notes	The menu under this control is for independent mode and has no effect on the "List Sequencer" on page 645. If "Sequencer" on page 645 is ON, the List Sequencer controls the source output and this key is grayed-out, to indicate out-of-scope. When "Sequencer" on page 645 is OFF, source leaves List Sequencer and this button is blanked out

6.1.9.1 Frequency

Lets you control the frequency of the Source. Same as "Frequency" on page 834 under "Frequency Setup" on page 669.

Example	`:SOUR:FREQ 1.00 GHz`

6.1.9.2 Channel

The frequency of the source can be specified by a channel number of a given frequency band. This control allows you to specify the current channel number. For the appropriate range of channel numbers for a given frequency band, see the following tables: "GSM/EDGE Channel Number Ranges" on page 670, "W-CDMA Channel Number Ranges" on page 671, "LTE FDD Channel Number Ranges" on page 673, and "LTE TDD Channel Number Ranges" on page 674.

Channel is not available on E7760B.

Remote Command	`:SOURce:FREQuency:CHANnels:NUMBer <int>` `:SOURce:FREQuency:CHANnels:NUMBer?`
Example	`:SOUR:LIST:STEP2:SET:RAD:NUMB 1`
Notes	Grayed-out when the "Radio Standard/Radio Band" on page 675 is set to NONE
Couplings	The channel number is coupled to the frequency value when "Radio Standard/Radio Band" on page 675 is not set to NONE When the frequency value is changed, the channel number increases or decreases to match the new frequency. If the frequency is not at an exact match for a channel number, the nearest channel number is displayed, with > or < indicating whether the frequency is above or below the channel number
Preset	1
Min/Max	See "GSM/EDGE Channel Number Ranges" on page 670, "W-CDMA Channel Number Ranges" on page 671, "LTE FDD Channel Number Ranges" on page 673, and "LTE TDD Channel Number Ranges" on page 674

GSM/EDGE Channel Number Ranges

Band	Link (Device)	Range	Frequency (MHz)
P-GSM	Uplink (MS)	1 £ n £ 124	890.0 + 0.2*n
	Downlink (BS)	1 £ n £ 124	935.0 + 0.2*n
E-GSM	Uplink (MS)	0 £ n £ 124	890.0 + 0.2*n

Band	Link (Device)	Range	Frequency (MHz)
		975 £ n £ 1023	890.0 + 0.2*(n-1024)
	Downlink (BS)	0 £ n £ 124	935.0 + 0.2*n
		975 £ n £ 1023	935.0 + 0.2*(n-1024)
DCS 1800	Uplink (MS)	512 £ n £ 885	1710.200 + 0.20*(n-512)
	Downlink (BS)	512 £ n £ 885	1805.200 + 0.20*(n-512)
PCS 1900	Uplink (MS)	512 £ n £ 810	1850.200 + 0.2*(n-512)
	Downlink (BS)	512 £ n £ 810	1930.200 + 0.2*(n-512)
R-GSM	Uplink (MS)	0 £ n £ 124	890.0 + 0.2*n
		955 £ n £ 1023	890.0 + 0.2*(n-1024)
	Downlink (BS)	0 £ n £ 124	935.0 + 0.2*n
		955 £ n £ 1023	935.0 + 0.2*(n-1024)
GSM 450	Uplink (MS)	256 £ n £ 293	450.6 + 0.2*(n-259)
	Downlink (BS)	256 £ n £ 293	460.6 + 0.2*(n-259)
GSM 480	Uplink (MS)	306 £ n £ 340	479.000 + 0.20*(n-306)
	Downlink (BS)	306 £ n £ 340	489.000 + 0.20*(n-306)
GSM 850	Uplink (MS)	128 £ n £ 251	824.200 + 0.20*(n-128)
	Downlink (BS)	128 £ n £ 251	869.200 + 0.20*(n-128)
GSM 700	Uplink (MS)	438 £ n £ 516	777.200 + 0.20*(n-438)
	Downlink (BS)	438 £ n £ 516	747.200 + 0.20*(n-438)
T-GSM810	Uplink (MS)	350 £ n £ 425	806.0 + 0.20*(n-350)
	Downlink (BS)	350 £ n £ 425	851.0 + 0.20*(n-350)

W-CDMA Channel Number Ranges

Band	Link (Device)	Range	Frequency (MHz)
Band I	Downlink	10562 £ n £ 10838	n÷5
	Uplink	9612 £ n £ 9888	n÷5
Band II	Downlink	412 £n £687	n÷5 + 1850.1
		9662 £n £9938	n÷5
	Uplink	12 £n £287	n÷5 + 1850.1
		350 £n £425	n÷5
Band III	Downlink	1162 ≤n £1513	n÷5 + 1575
	Uplink	937 ≤n £1288	n÷5 + 1525
Band IV	Downlink	537 ≤n ≤1738	n÷5 + 1805
		1887 ≤n ≤2087	n÷5 + 1735.1
	Uplink	1312 ≤n ≤1513	n÷5 + 1450
		1662 ≤n ≤1862	n÷5 + 1380.1

Band	Link (Device)	Range	Frequency (MHz)
Band V	Downlink	1007 ≤n ≤1087	n÷5 + 670.1
		4357 ≤n ≤4458	n÷5
	Uplink	782 ≤n ≤862	n÷5 + 670.1
		4132 ≤n ≤4233	n÷5
Band VI	Downlink	1037 ≤n ≤1062	n÷5 + 670.1
		4387 ≤n ≤4413	n÷5
	Uplink	812 ≤n ≤837	n÷5 + 670.1
		4162 ≤n ≤4188	n÷5
Band VII	Downlink	2237 ≤n ≤2563	n÷5 + 2175
		2587 ≤n ≤2912	n÷5 + 2105.1
	Uplink	2012 ≤n ≤2338	n÷5 + 2100
		2362 ≤n ≤2687	n÷5 + 2030.1
Band VIII	Downlink	2937 ≤n ≤3088	n÷5 + 340
	Uplink	2712 ≤n ≤2863	n÷5 + 340
Band IX	Downlink	9237 ≤n ≤9387	n÷5
	Uplink	8762 ≤n ≤8912	n÷5
Band X	Downlink	3112 ≤n ≤3388	n÷5 + 1490
		3412 ≤n ≤3687	n÷5 + 1430.1
	Uplink	2887 ≤n ≤3163	n÷5 + 1135
		3187 ≤n ≤3462	n÷5 + 1075.1
Band XI	Downlink	3712 ≤n ≤3812	n÷5 + 736
	Uplink	3487 ≤n ≤3587	n÷5 + 733
Band XII	Downlink	3837 ≤n ≤3903	n÷5 – 37
		3927 ≤n ≤3992	n÷5 – 54.9
	Uplink	3612 ≤n ≤3678	n÷5 – 22
		3702 ≤n ≤3767	n÷5 – 39.9
Band XIII	Downlink	4017 ≤n ≤4043	n÷5 – 55
		4067 ≤n ≤4092	n÷5 – 64.9
	Uplink	3792 ≤n ≤3818	n÷5 + 21
		3702 ≤n ≤3767	n÷5 – 39.9
Band XIV	Downlink	4117 ≤n ≤4143	n÷5 – 63
		4167 ≤n ≤4192	n÷5 – 72.9
	Uplink	3892 ≤n ≤3918	n÷5 + 12
		3942 ≤n ≤3967	n÷5 + 2.1
Band XIX	Downlink	712 £ n £ 763	n÷5 + 735
		787 £ n £ 837	n÷5 + 720.1

Band	Link (Device)	Range	Frequency (MHz)
	Uplink	312 £ n £ 363	n÷5 + 770
		387 £ n £ 437	n÷5 + 755.1

LTE FDD Channel Number Ranges

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where F_{DL_low} and $N_{Offs\text{-}DL}$ are given in table 5.4.4-1 and N_{DL} is the downlink EARFCN.

$F_{DL} = F_{DL_low} + 0.1(N_{DL} - N_{Offs\text{-}DL})$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where F_{UL_low} and $N_{Offs\text{-}UL}$ are given in table 5.4.4-1 and N_{UL} is the uplink EARFCN.

$F_{UL} = F_{UL_low} + 0.1(N_{UL} - N_{Offs\text{-}UL})$

Band	Downlink			Uplink		
	F_{DL_low} (MHz)	$N_{Offs\text{-}DL}$	Range of N_{DL}	F_{UL_low} (MHz)	$N_{Offs\text{-}UL}$	Range of N_{UL}
1	2110	0	0 – 599	1920	18000	18000 – 18599
2	1930	600	600 – 1199	1850	18600	18600 – 19199
3	1805	1200	1200 – 1949	1710	19200	19200 – 19949
4	2110	1950	1950 – 2399	1710	19950	19950 – 20399
5	869	2400	2400 – 2649	824	20400	20400 – 20649
6	875	2650	2650 – 2749	830	20650	20650 – 20749
7	2620	2750	2750 – 3449	2500	20750	20750 – 20449
8	925	3450	3450 – 3799	880	21450	21450 – 21799
9	1844.9	3800	3800 – 4149	1749.9	21800	21800 – 22149
10	2110	4150	4150 – 4749	1710	22150	22150 – 22749
11	1475.9	4750	4750 – 4949	1427.9	22750	22750 – 22949
12	729	5010	5010 – 5179	699	23010	23010 – 23179
13	746	5180	5180 – 5279	777	23180	23180 – 23279
14	758	5280	5280 – 5379	788	23280	23280 – 23379
...						
17	734	5730	5730 – 5849	704	23730	23730 – 23849
18	860	5850	5850 – 5999	815	23850	23850 – 23999
19	875	6000	6000 – 6149	830	24000	24000 – 24149
20	791	6150	6150 – 6449	832	24150	24150 – 24449

Band	Downlink			Uplink		
	21	1495.9	6450	6450 – 6599	1447.9	24450 4 4 5 0 – 2 4 5 9 9
...						
24	1525	7700	7700 - 8039	1626.5	25700	25700 – 26039
25	1930	8040	8040 - 8689	1850	26040	26040 - 26689
26	859	8690	8690 - 9039	814	26690	26690 - 27039
...						

Note: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.

LTE TDD Channel Number Ranges

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where F_{DL_low} and $N_{Offs\text{-}DL}$ are given in table 5.4.4-1 and N_{DL} is the downlink EARFCN.

$F_{DL} = F_{DL_low} + 0.1(N_{DL} – N_{Offs\text{-}DL})$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where F_{UL_low} and $N_{Offs\text{-}UL}$ are given in table 5.4.4-1 and N_{UL} is the uplink EARFCN.

$F_{UL} = F_{UL_low} + 0.1(N_{UL} – N_{Offs\text{-}UL})$

Band	Downlink			Uplink		
	F_{DL_low} (MHz)	$N_{Offs\text{-}DL}$	Range of N_{DL}	F_{UL_low} (MHz)	$N_{Offs\text{-}UL}$	Range of N_{UL}

Band	Downlink			Uplink		
	33	1900	36000	36000 – 36199	1900	36000 6 0 0 0 – 3 6 1 9 9
34	2010	36200	36200 –36349	2010	36200	36200 – 36349
35	1850	36350	36350 –36949	1850	36350	36350 – 36949
36	1930	36950	36950 –37549	1930	36950	36950 – 37549
37	1910	37550	37550 –37749	1910	37550	37550 – 37749
38	2570	37750	37750 –38249	2570	37750	37750 – 38249
39	1880	38250	38250 –38649	1880	38250	38250 – 38649
40	2300	38650	38650 –39649	2300	38650	38650 – 39649
41	2496	39650	39650 - 41589	2496	39650	39650 - 41589
42	3400	41590	41590 – 43589	3400	41590	41590 – 43589
43	3600	43590	43590 – 45589	3600	43590	43590 – 45589

Note: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.

6.1.9.3 Radio Setup

Lets you select the radio standard and associated radio band. You can also set the Radio Band Link to Uplink or Downlink.

Radio Standard/Radio Band

Lets you select the radio standard and associated radio band. The first column in the dialog lets you set the Radio Standard; for each standard, and the second column in the dialog changes to show you the available bands.

Once you have selected the radio standard, you can then set an active channel band. The radio standard and the active channel band allow you to use the "Channel" on page 670 control to set Channel numbers, thus setting "Frequency" on page 834 automatically.

Remote Command	`:SOURce:FREQuency:CHANnels:BAND <band>` where `<band>` is one of: `NONE | PGSM | EGSM | RGSM | DCS1800 | PCS1900 | GSM450 | GSM480 | GSM700 | GSM850 | TGSM810 | USCELL | USPCS | JAPAN | KOREAN | NMT | IMT2K | UPPER | SECOND | PAMR400 | PAMR800 | IMTEXT | PCS1DOT9G | AWS | US2DOT5G | PUBLIC | LOWER | BANDI | BANDII | BANDIII | BANDIV | BANDV | BANDVI | BANDVII | BANDVIII | BANDIX | BANDX | BANDXI | BANDXII | BANDXIII | BANDXIV | BANDXIX | BAND1 | BAND2 | BAND3 | BAND4 | BAND5 | BAND6 | BAND7 | BAND8 | BAND9 | BAND10 | BAND11 | BAND12 | BAND13 | BAND14 | BAND17 | BAND18 | BAND19 | BAND20 | BAND21 | BAND24 | BAND25 | BAND26 | BAND27 | BAND28 | BAND29 | BAND30 | BAND31 | BAND65 | BAND66 | BAND67 | BAND68 | BAND71 | BAND252 | BAND255 | BAND33 | BAND34 | BAND35 | BAND36 | BAND37 | BAND38 | BAND39 | BAND40 | BAND41 | BAND42 | BAND43 | BAND44 | BAND45 | BAND46 | BANDA | BANDB | BANDC | BANDD | BANDE | BANDF | N1 | N2 | N3 | N5 | N7 | N8 | N12 | N20 | N25 | N28 | N34 | N38 | N39 | N40 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N80 | N81 | N82 | N83 | N84 | N86 | N257 | N258 | N260 | N261` `:SOURce:FREQuency:CHANnels:BAND?`
Example	`:SOUR:LIST:STEP2:SET:RAD:BAND PGSM`
Notes	Setting this to `NONE` grays-out "Channel" on page 670 under **Frequency Setup**

Here are the members of each group in Radio Standard and a SCPI example for each:

None – no Radio Standard

None	`:SOUR:FREQ:CHAN:BAND NONE`

GSM

Sets GSM/EDGE as the radio standard for use and accesses the GSM/EDGE specific channel band sub-menus.

P-GSM	`:SOUR:FREQ:CHAN:BAND PGSM`
E-GSM	`:SOUR:FREQ:CHAN:BAND EGSM`
R-GSM	`:SOUR:FREQ:CHAN:BAND RGSM`
DCS 1800	`:SOUR:FREQ:CHAN:BAND DCS1800`
PCS 1900	`:SOUR:FREQ:CHAN:BAND PCS1900`
GSM 450	`:SOUR:FREQ:CHAN:BAND GSM450`
GSM 480	`:SOUR:FREQ:CHAN:BAND GSM480`
GSM 700	`:SOUR:FREQ:CHAN:BAND GSM700`
GSM 850	`:SOUR:FREQ:CHAN:BAND GSM850`
T-GSM 810	`:SOUR:FREQ:CHAN:BAND T-GSM810`

W-CDMA

Sets WCDMA as the radio standard for use and accesses the W-CDMA specific channel band sub-menus.

Band I	`:SOUR:FREQ:CHAN:BAND BANDI`
Band II	`:SOUR:FREQ:CHAN:BAND BANDII`
Band III	`:SOUR:FREQ:CHAN:BAND BANDIII`
Band IV	`:SOUR:FREQ:CHAN:BAND BANDIV`
Band V	`:SOUR:FREQ:CHAN:BAND BANDV`
Band VI	`:SOUR:FREQ:CHAN:BAND BANDVI`
Band VII	`:SOUR:FREQ:CHAN:BAND BANDVII`
Band VIII	`:SOUR:FREQ:CHAN:BAND BANDVIII`
Band IX	`:SOUR:FREQ:CHAN:BAND BANDIX`
Band X	`:SOUR:FREQ:CHAN:BAND BANDX`
Band XI	`:SOUR:FREQ:CHAN:BAND BANDXI`
Band XII	`:SOUR:FREQ:CHAN:BAND BANDXII`
Band XIII	`:SOUR:FREQ:CHAN:BAND BANDXIII`
Band XIV	`:SOUR:FREQ:CHAN:BAND BANDXIV`
Band XIX	`:SOUR:FREQ:CHAN:BAND BANDXIX`

LTE

Sets LTE FDD as the radio standard for use and accesses the LTE FDD specific channel band sub-menus.

Band 1	`:SOUR:FREQ:CHAN:BAND BAND1`
Band 2	`:SOUR:FREQ:CHAN:BAND BAND2`
Band 3	`:SOUR:FREQ:CHAN:BAND BAND3`
Band 4	`:SOUR:FREQ:CHAN:BAND BAND4`
Band 5	`:SOUR:FREQ:CHAN:BAND BAND5`
Band 6	`:SOUR:FREQ:CHAN:BAND BAND6`
Band 7	`:SOUR:FREQ:CHAN:BAND BAND7`
Band 8	`:SOUR:FREQ:CHAN:BAND BAND8`
Band 9	`:SOUR:FREQ:CHAN:BAND BAND9`
Band 10	`:SOUR:FREQ:CHAN:BAND BAND10`
Band 11	`:SOUR:FREQ:CHAN:BAND BAND11`
Band 12	`:SOUR:FREQ:CHAN:BAND BAND12`
Band 13	`:SOUR:FREQ:CHAN:BAND BAND13`
Band 14	`:SOUR:FREQ:CHAN:BAND BAND14`
Band 17	`:SOUR:FREQ:CHAN:BAND BAND17`

Band 18	`:SOUR:FREQ:CHAN:BAND BAND18`
Band 19	`:SOUR:FREQ:CHAN:BAND BAND19`
Band 20	`:SOUR:FREQ:CHAN:BAND BAND20`
Band 21	`:SOUR:FREQ:CHAN:BAND BAND21`
Band 24	`:SOUR:FREQ:CHAN:BAND BAND24`
Band 25	`:SOUR:FREQ:CHAN:BAND BAND25`
Band 26	`:SOUR:FREQ:CHAN:BAND BAND26`
Band 27	`:SOUR:FREQ:CHAN:BAND BAND27`
Band 28	`:SOUR:FREQ:CHAN:BAND BAND28`
Band 29	`:SOUR:FREQ:CHAN:BAND BAND29`
Band 30	`:SOUR:FREQ:CHAN:BAND BAND30`
Band 31	`:SOUR:FREQ:CHAN:BAND BAND31`
Band 65	`:SOUR:FREQ:CHAN:BAND BAND65`
Band 66	`:SOUR:FREQ:CHAN:BAND BAND66`
Band 67	`:SOUR:FREQ:CHAN:BAND BAND67`
Band 68	`:SOUR:FREQ:CHAN:BAND BAND68`
Band 71	`:SOUR:FREQ:CHAN:BAND BAND71`
Band 252	`:SOUR:FREQ:CHAN:BAND BAND252`
Band 255	`:SOUR:FREQ:CHAN:BAND BAND255`

LTE TDD

Sets LTE TDD as the radio standard for use and accesses the LTE TDD specific channel band sub-menus.

Band 33	`:SOUR:FREQ:CHAN:BAND BAND33`
Band 34	`:SOUR:FREQ:CHAN:BAND BAND34`
Band 35	`:SOUR:FREQ:CHAN:BAND BAND35`
Band 36	`:SOUR:FREQ:CHAN:BAND BAND36`
Band 37	`:SOUR:FREQ:CHAN:BAND BAND37`
Band 38	`:SOUR:FREQ:CHAN:BAND BAND38`
Band 39	`:SOUR:FREQ:CHAN:BAND BAND39`
Band 40	`:SOUR:FREQ:CHAN:BAND BAND40`
Band 41	`:SOUR:FREQ:CHAN:BAND BAND41`
Band 42	`:SOUR:FREQ:CHAN:BAND BAND42`
Band 43	`:SOUR:FREQ:CHAN:BAND BAND43`
Band 44	`:SOUR:FREQ:CHAN:BAND BAND44`
Band 45	`:SOUR:FREQ:CHAN:BAND BAND45`
Band 46	`:SOUR:FREQ:CHAN:BAND BAND46`

5GNR

Sets 5G NR as the radio standard for use and accesses the 5G NR specific channel band sub-menus.

N 1	`:SOUR:FREQ:CHAN:BAND N1`
N 2	`:SOUR:FREQ:CHAN:BAND N2`
N 3	`:SOUR:FREQ:CHAN:BAND N3`
N 5	`:SOUR:FREQ:CHAN:BAND N5`
N 7	`:SOUR:FREQ:CHAN:BAND N7`
N 8	`:SOUR:FREQ:CHAN:BAND N8`
N 12	`:SOUR:FREQ:CHAN:BAND N12`
N 20	`:SOUR:FREQ:CHAN:BAND N20`
N 25	`:SOUR:FREQ:CHAN:BAND N25`
N 28	`:SOUR:FREQ:CHAN:BAND N28`
N 34	`:SOUR:FREQ:CHAN:BAND N34`
N 38	`:SOUR:FREQ:CHAN:BAND N38`
N 39	`:SOUR:FREQ:CHAN:BAND N39`
N 40	`:SOUR:FREQ:CHAN:BAND N40`
N 41	`:SOUR:FREQ:CHAN:BAND N41`
N 50	`:SOUR:FREQ:CHAN:BAND N50`
N 51	`:SOUR:FREQ:CHAN:BAND N51`
N 66	`:SOUR:FREQ:CHAN:BAND N66`
N 70	`:SOUR:FREQ:CHAN:BAND N70`
N 71	`:SOUR:FREQ:CHAN:BAND N71`
N 74	`:SOUR:FREQ:CHAN:BAND N74`
N 75	`:SOUR:FREQ:CHAN:BAND N75`
N 76	`:SOUR:FREQ:CHAN:BAND N76`
N 77	`:SOUR:FREQ:CHAN:BAND N77`
N 78	`:SOUR:FREQ:CHAN:BAND N78`
N 79	`:SOUR:FREQ:CHAN:BAND N79`
N 80	`:SOUR:FREQ:CHAN:BAND N80`
N 81	`:SOUR:FREQ:CHAN:BAND N81`
N 82	`:SOUR:FREQ:CHAN:BAND N82`
N 83	`:SOUR:FREQ:CHAN:BAND N83`
N 84	`:SOUR:FREQ:CHAN:BAND N84`
N 86	`:SOUR:FREQ:CHAN:BAND N86`
N 257	`:SOUR:FREQ:CHAN:BAND N257`
N 258	`:SOUR:FREQ:CHAN:BAND N258`
N 260	`:SOUR:FREQ:CHAN:BAND N260`
N 261	`:SOUR:FREQ:CHAN:BAND N261`

Radio Band Link

Lets you specify the channel band type as either uplink or downlink link direction. This value is used in conjunction with the channel band and channel number to determine the absolute frequency output by the source.

- When set to Uplink (UP), the source calculates the uplink frequency using an uplink formula together with the selected channel band and channel number
- When set to Downlink (DOWN) the source calculates the downlink frequency using a downlink formula together with the selected channel band and channel number

Remote Command	:SOURce:RADio:BAND:LINK DOWN | UP :SOURce:RADio:BAND:LINK?
Example	:SOUR:RAD:BAND:LINK UP
Preset	DOWN
Range	DOWN | UP
Backwards Compatibility SCPI	:SOURce:RADio:DEVice BTS|MS :SOURce:RADio:DEVice?
Backwards Compatibility Notes	DOWN = BTS UP = MS

6.1.9.4 Set Reference Frequency

Lets you set the frequency reference. Pressing this control turns the frequency reference state to ON, sets the reference frequency value to the current frequency, maintains this frequency at the RF output, and sets the displayed frequency to 0.00 Hz. All subsequent frequencies entered under Source>Frequency>Frequency are interpreted as being relative to this reference frequency.

When you use a frequency reference, the signal generator outputs a frequency that is set relative to the reference frequency by the value entered under Source, Frequency, Frequency as follows:

Output frequency = reference frequency - entered frequency

Where:

- reference frequency equals the original RF frequency entered under Source>Frequency>Frequency and set as the reference frequency
- entered frequency equals a new value entered under Source, Frequency, Frequency

In addition, the displayed frequency value will be the same as the value entered under Source>Frequency>Frequency.

NOTE

If Freq Reference is ON with a reference value set, entering a value under **Source**, **Frequency**, **Frequency** and pressing **Set Frequency Reference** adds that value to the existing Freq Reference value.

If you wish to change the reference frequency value to the new value entered under **Source**, **Frequency**, **Frequency**, first set Freq Reference OFF then press **Set Frequency Reference**.

Remote Command	`:SOURce:FREQuency:REFerence:SET`
Example	`:SOUR:FREQ:REF:SET`
Dependencies	Unavailable, and grayed-out, when List Sequencer is ON

6.1.9.5 Freq Reference

Lets you toggle the state of the frequency reference. When the frequency reference state is ON, an annunciator is displayed on the main source view to indicate this state to the user.

When you use a frequency reference, the signal generator outputs a frequency that is set relative to the reference frequency by the value entered under Source, Frequency, Frequency as follows:

Output frequency = reference frequency + entered frequency

Where:

- reference frequency equals the original RF frequency entered under Source, Frequency, Frequency and set as the reference frequency
- entered frequency equals a new value entered under Source, Frequency, Frequency

For more information on Reference Frequency, see "Set Reference Frequency" on page 680.

Remote Command	`:SOURce:FREQuency:REFerence <freq>` `:SOURce:FREQuency:REFerence?`
Example	`:SOUR:FREQ:REF 0.00 Hz`
Dependencies	Unavailable, and grayed-out, when List Sequencer is ON
Couplings	The frequency reference state is coupled to the frequency reference set immediate action. When the reference set immediate action key is pressed, or the SCPI command issued, it turns the frequency reference state ON
Preset	0.00 Hz

Min	0.00 Hz
Max	Hardware Dependent: Option 503 3.6 GHz Option 504 3.8 GHz Option 506 6.00 GHz For E7760B: Dependent on port selected

Auto Function

Remote Command	`:SOURce:FREQuency:REFerence:STATe OFF | ON | 0 | 1` `:SOURce:FREQuency:REFerence:STATe?`
Example	`:SOUR:FREQ:REF:STATe ON`
Preset	`OFF`

6.1.9.6 Freq Offset

Specifies any frequency offset that is to be applied to the currently selected Cal Group. This can be used when using an external mixer.

Remote Command	`:SYSTem:CALibration:FREQuency:OFFSet <freq>` `:SYSTem:CALibration:FREQuency:OFFSet?`
Example	`:SYST:CAL:FREQ:OFFS 1e9`
Dependencies	The query applies to the currently selected Cal Group
Preset	All 0 Hz
State Saved	Saved in instrument state
Min	0 Hz
Max	100.0 GHz

6.1.9.7 Freq Increment

Changes the step size for the RF Output Frequency function. Once an increment size has been selected and the RF Output Frequency function is active, the step keys (and the `UP|DOWN` parameters for RF Frequency from remote commands) change the RF Output Frequency by the increment set value.

This feature exists in EXG and MXG.

Remote Command	`:SOURce:FREQuency:STEP[:INCRement] <freq>` `:SOURce:FREQuency:STEP[:INCRement]?`

Example	`:SOUR:FREQ:STEP 1.0 kHz`
Couplings	Coupled to the Step size of the RF Frequency function
Preset	Hardware Dependent. 10% of the span preset value
Min	1 Hz
Max	Hardware Dependent:

Option 503	3.6 GHz
Option 504	3.8 GHz
Option 506	6.00 GHz

For E7760B: Dependent on port selected

For EXM, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, reports error message "Settings conflict; Frequency is outside available range"

6.1.9.8 Rx/Tx Coupling

Allows coupling between the frequency of the Internal Source, RF Output Frequency, and the instrument Center Frequency. For all settings except `NONE`, this parameter couples the **Center (Frequency)** of the instrument to the RF Output Frequency of the source. Valid setting changes result in the Analyzer CF and RF Output Frequency parameters being set to the same value, plus the "Rx/Tx Offset" on page 684.

NOTE:

RF Output Frequency is calculated by Frequency, Freq Reference and Freq Offset

The four states for coupling are:

`SFANalyzer` Source follows Analyzer

Coupling is in one direction only. Changes to **Center** Frequency will result in RF Output Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to RF Output Frequency will not change **Center** Frequency and will change Rx/Tx Frequency Coupling to None

`AFSource` Analyzer follows Source

Coupling is in one direction only. Changes to RF Output Frequency will result in **Center** Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to **Center** Frequency will not change the RF Output Frequency and will change Rx/Tx Frequency Coupling to None

`BOTH` Analyzer/Source Coupled

When switching to Analyzer/Source Coupled, RF Output Frequency is synchronized to **Center** frequency at first, then coupling is bi-directional. Changes to **Center** Frequency will result in RF Output Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to RF Output Frequency will result in **Center** Frequency being set to the same value, with any Rx/Tx Frequency Offset applied

`NONE` None

RF Output Frequency and **Center** Frequency are independently controlled

Remote Command	`:SOURce:FREQuency:COUPling NONE | BOTH | SFANalyzer | AFSource` `:SOURce:FREQuency:COUPling?`
Example	`:SOUR:FREQ:COUP BOTH`
Dependencies	Only appears in Radio Test, Group Delay and VMA Mode
Couplings	When set to `NONE`, Shared LO Mode changes to Exclusive LO
Preset	`NONE` Input/Output Preset
State Saved	Yes

6.1.9.9 Rx/Tx Offset

Lets you offset the RF Output Frequency of the source from the **Center** Frequency of the instrument. See "Rx/Tx Coupling" on page 683 for coupling behavior.

Remote Command	`:SOURce:FREQuency:COUPling:OFFSet <freq>` `:SOURce:FREQuency:COUPling:OFFSet?`
Example	`:SOUR:FREQ:COUP:OFF 100 kHz`
Dependencies	Grayed-out when "Rx/Tx Coupling" on page 683 is set to `NONE`. If the grayed-out control is selected, the following message appears: "The parameter cannot be changed when Rx/Tx Coupling is Off" Only appears in Radio Test Mode
Preset	0 Hz (Input/Output Preset)
Min	–6 GHz
Max	Hardware Dependent:

Option 503	3.6 GHz
Option 504	3.8 GHz
Option 506	6.00 GHz

For E7760B: Dependent on port selected

For E6640A, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, UI reports an error message: "Settings conflict; Frequency is outside available range"

6.1.10 Modulation

Lets you toggle the state of modulation.

Remote Command	:OUTPut:MODulation[:STATe] ON | OFF | 1 | 0 :OUTPut:MODulation[:STATe]?
Example	:OUTP:MOD OFF
Notes	This setting is for independent mode and has no effect on the "List Sequencer" on page 645. If Sequencer is ON, the List Sequencer controls the source output, and this key is grayed-out When Sequencer is OFF, source leaves List Sequencer, and this setting is blanked out, taking effect immediately When Modulation is ON, the "MOD" annunciator is displayed in the system settings panel. When Modulation is OFF, the "MOD" annunciator is cleared If Sequencer is ON, the "MOD" annunciator will be replaced by "SEQ" in the system settings panel, indicating that the output is controlled by List Sequencer
Preset	OFF
Range	ON|OFF

6.1.11 Modulation Setup

Allows access to the menus for setting up available modulation types.

Not available in E7760B.

AM/FM/PM are not available for VXT models M9415A/16A and M9415E/16E .

6.1.11.1 AM

Enables or disables amplitude modulation.

Turning AMON when another modulation format is already on results in the previous modulation format being turned off, and generates an error.

Remote Command	:SOURce:AM:STATe ON | OFF | 1 | 0 :SOURce:AM:STATe?
Example	:SOUR:AM:STAT OFF
Dependencies	Not available in E7760B
Preset	OFF
Range	ON|OFF

6.1.11.2 AM Mod Depth

Lets you set the amplitude modulation depth in percent.

Remote Command	:SOURce:AM[:DEPTh][:LINear] <real> :SOURce:AM[:DEPTh][:LINear]?

Example	`:SOUR:AM 0.1`
Dependencies	Not available in E7760B
Preset	0.1 %
Min	0.1 %
Max	95.0 %

6.1.11.3 AM Rate

Lets you set the internal amplitude modulation rate.

Remote Command	`:SOURce:AM:INTernal:FREQuency <freq>` `:SOURce:AM:INTernal:FREQuency?`
Example	`:SOUR:AM:INT:FREQ 40.0 Hz`
Dependencies	Not available in E7760B
Preset	400.0 Hz
Min	10 Hz
Max	40 kHz

6.1.11.4 AM Rate Increment

Changes the step size for "AM Rate" on page 686. Once an increment size has been selected and **AM Rate** is active, the step keys (and the `UP|DOWN` parameters for **AM Rate** from remote commands) change **AM Rate** by the increment value.

Remote Command	`:SOURce:AM:INTernal:FREQuency:STEP[:INCRement] <freq>` `:SOURce:AM:INTernal:FREQuency:STEP[:INCRement]?`
Example	`:SOUR:AM:INT:FREQ:STEP 100 Hz` `:SOUR:AM:INT:FREQ:STEP?`
Couplings	Coupled to the increment size of **AM Rate**
Preset	10 Hz
State Saved	Yes
Min	1 Hz
Max	40 kHz

6.1.11.5 FM

Enables or disables frequency modulation.

Turning FMON when another modulation format is already on results in the previous modulation format being turned off and the generation of an error.

Remote Command	:SOURce:FM:STATe ON | OFF | 1 | 0 :SOURce:FM:STATe?
Example	:SOUR:FM:STAT OFF
Dependencies	Not available in E7760B
Preset	OFF
Range	ON|OFF

6.1.11.6 FM Deviation

Lets you set the frequency modulation deviation.

Remote Command	:SOURce:FM[:DEViation] <freq> :SOURce:FM[:DEViation]?
Example	:SOUR:FM 1.00 kHz
Dependencies	Not available in E7760B
Preset	1.00 Hz
Min	1.00 Hz
Max	100.00 kHz

6.1.11.7 FM Rate

Lets you set the internal frequency modulation rate.

Remote Command	:SOURce:FM:INTernal:FREQuency <freq> :SOURce:FM:INTernal:FREQuency?
Example	:SOUR:FM:INT:FREQ 40.0 Hz
Dependencies	Not available in E7760B
Preset	400.0 Hz
Min	10 Hz
Max	40 kHz

6.1.11.8 FM Rate Increment

Changes the step size for "FM Rate" on page 687. Once an increment size has been selected and FM Rate is active, the step keys (and the UP | DOWN parameters for FM Rate from remote commands) change FM Rate by the increment value.

Remote Command	`:SOURce:FM:INTernal:FREQuency:STEP[:INCRement] <freq>` `:SOURce:FM:INTernal:FREQuency:STEP[:INCRement]?`
Example	`:SOUR:FM:INT:FREQ:STEP 100 Hz` `:SOUR:FM:INT:FREQ:STEP?`
Couplings	Coupled to the increment size of FM Rate
Preset	10 Hz
State Saved	Yes
Min	1 Hz
Max	40 kHz

6.1.11.9 PM

Enables or disables phase modulation.

Turning PMON when another modulation format is already on results in the previous modulation format being turned OFF and the generation of an error.

Remote Command	`:SOURce:PM:STATe ON | OFF | 1 | 0` `:SOURce:PM:STATe?`
Example	`:SOUR:PM:STAT OFF`
Dependencies	Not available in E7760B
Preset	OFF
Range	ON|OFF

6.1.11.10 PM Deviation

Lets you set the phase modulation deviation in radian.

Remote Command	`:SOURce:PM[:DEViation] <real>` `:SOURce:PM[:DEViation]?`
Example	`:SOUR:PM 1.00`
Dependencies	Not available in E7760B
Preset	0.1 rad
Min	0.1 rad
Max	

Instrument Type	Value
M9410A/11A	10.0 rad
All Others	20.0 rad

6.1.11.11 PM Rate

Lets you set the internal phase modulation rate.

Remote Command	`:SOURce:PM:INTernal:FREQuency <freq>` `:SOURce:PM:INTernal:FREQuency?`
Example	`:SOUR:PM:INT:FREQ 40.0 Hz`
Dependencies	Not available in E7760B
Preset	400.0 Hz
Min	10 Hz
Max	40 kHz

6.1.11.12 PM Rate Increment

Changes the step size for "PM Rate" on page 689. Once an increment size has been selected and PM Rate is active, the step keys (and the `UP|DOWN` parameters for PM Rate from remote commands) change PM Rate by the increment value.

Remote Command	`:SOURce:PM:INTernal:FREQuency:STEP[:INCRement] <freq>` `:SOURce:PM:INTernal:FREQuency:STEP[:INCRement]?`
Example	`:SOUR:PM:INT:FREQ:STEP 100 Hz` `:SOUR:PM:INT:FREQ:STEP?`
Couplings	Coupled to the increment size of PM Rate
Preset	10 Hz
State Saved	Yes
Min	1 Hz
Max	40 kHz

6.1.11.13 ARB Setup

Accesses menus for setting up the Arbitrary Waveform Generator.

Basic Control

Lets you set up the basic ARB parameters and select a waveform to play.

ARB State

Lets you toggle the state of the ARB function. When the ARB is ON, a “MOD” annunciator is displayed in the system settings panel. When the ARB is OFF, the MOD annunciator is cleared

Remote Command	`:SOURce:RADio:ARB[:STATe] ON | OFF | 1 | 0` `:SOURce:RADio:ARB[:STATe]?`
Example	`:SOUR:RAD:ARB OFF` `:SOUR:RAD:ARB?`
Notes	If ARB is ON and Stream In are OFF, and you then load or delete another file to ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished If both ARB and Stream In are ON, and you then select another waveform, current streaming in action will be stopped, and then start streaming in the new waveform
Dependencies	This setting is for the independent mode, and has no effect on "List Sequencer" on page 645. If Sequencer is ON, this will make the source enter List Sequencer mode, and even if ARB state is ON, the ARB file will not be played. When Sequencer is OFF, source leaves List Sequencer and this setting takes effect immediately The ARB can only be turned on when there is a waveform file selected for playback. On the GUI, If no waveform is selected, this key is grayed out. If you send the SCPI command to turn the ARB on with no waveform selected for playback, the ARB state remains OFF and an error is generated -If you try to recall a certain set of states in which the selected waveform is not in ARB memory and the ARB state is ON, errors are reported
Preset	OFF
Range	ON|OFF

Sample Rate

Lets you set the ARB waveform playback sample rate.

See "More Information" on page 691

Remote Command	`:SOURce:RADio:ARB:SCLock:RATE <freq>` `:SOURce:RADio:ARB:SCLock:RATE?`
Example	`:SOUR:RAD:ARB:SCL:RATE 48.00 MHz`
Notes	If there is a sample rate specified in the header of the waveform file, changing that sample rate is not recommended, as it may cause problems with burst timing For E7760B, the Sample Rate is fixed. If this control is attempted to be set the error -221, “Settings conflict; Sample Rate is fixed” is generated
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The sample rate is one of the values stored within the header file. If

	the newly selected waveform file has an associated header file, the sample rate is updated with the value from the header file. The sample rate will remain unchanged if the newly selected waveform does not have an associated header file

Preset

E7760B	2.64 GHz
Option B40	50 MHz
Option B85	100 MHz
Option B1X	200 MHz
Option B3X	375 MHz
Option B6X	750 MHz
Option B4X	500 MHz
Option B8X	1.0 GHz
Option B12	1.5 GHz

Min

E7760B: 2.64 GHz

All Others: 1.00 kHz

Max

Hardware Dependent:

E7760B		2.64 GHz
VXT model M9420A	Option B40	50 MHz
	Option B85	100 MHz
	Option B1X	200 MHz
VXT models M9410A/11A and M9410E/11E	Option B40	50 MHz
	Option B3X	375 MHz
	Option B6X	750 MHz
	Option B12	1.5 GHz
VXT models M9415A/16A and M9415E/16E	Option B4X	500 MHz
	Option B8X	1.0 GHz
	Option B12	1.5 GHz

For VXT models M9410A/11A/15A/16A, M9410E/11E/15E/16E and E6680A/81A, the sample rate is only limited by the option, but the IF BW is limited by center frequency in addition to options. See "More Information" on page 691. Performance is guaranteed only when the bandwidth of the selected waveform is smaller than the Max IF BW

More Information

Although the range of Sample Rate only depends on the installed option, the Maximum IF BW depends on options as well as the Center Frequency.

VXT models M9410A/11A, E6680A and E6681A

Option Limitation:

Option	Maximum IF BW
B40	40 MHz
B3X	300 MHz
B6X	600 MHz
B12	1200 MHz

Center Frequency Limitation:

Center Frequency	Maximum IF BW
6.5 kHz ~ 9 kHz (Option LFE)	(CF – 6.5 kHz) * 2
9 kHz ~ 100 kHz (Option LFE)	5 kHz
100 kHz ~ 1 MHz (Option LFE)	50 kHz
1 MHz ~ 10 MHz (Option LFE)	500 kHz
10 MHz ~ 20 MHz (Option LFE)	5 MHz
20 MHz ~ 60 MHz (Option LFE)	10 MHz
60 MHz ~ 80 MHz (Option LFE)	20 MHz
80 MHz ~ 380 MHz (Option LFE)	40 MHz
330 MHz ~ 380 MHz (without Option LFE)	(CF – 330 MHz) * 2
380 MHz ~ 550 MHz	100 MHz
550 MHz ~ 1310 MHz	200 MHz
1310 MHz ~ 2000 MHz (without Option EP6)	600 MHz
2000 MHz ~ 5480 MHz (without Option EP6)	1200 MHz
5480 MHz ~ 6080 MHz (without Option EP6)	(6080 MHz – CF) * 2
1310 MHz ~ 1900 MHz (Option EP6)	600 MHz
1900 MHz ~ 6000 MHz (Option EP6)	1200 MHz
6000 MHz ~ 6600 MHz (Option EP6)	(6600 MHz – CF) * 2

VXT models M9415A/16A

Option Limitation:

Option	Maximum IF BW
B4X	400 MHz
B8X	800 MHz
B12	1200 MHz

Center Frequency Limitation:

Center Frequency	Maximum IF BW
330 MHz ~ 380 MHz	(CF – 330 MHz) * 2
380 MHz ~ 550 MHz	100 MHz
550 MHz ~ 1310 MHz	200 MHz
1310 MHz ~ 2000 MHz	600 MHz
2000 MHz ~ 12300 MHz	1200 MHz
12300 MHz ~ 12900 MHz	(12900 MHz – CF) * 2

M9410E/11E

Option Limitation:

Option	Maximum IF BW
B40	40 MHz
B3X	300 MHz
B6X	600 MHz
B12	1200 MHz

Center Frequency Limitation:

Center Frequency	Maximum IF BW
1 MHz ~ 10 MHz (Option LFE)	500 kHz
10 MHz ~ 20 MHz (Option LFE)	5 MHz
20 MHz ~ 60 MHz (Option LFE)	10 MHz
60 MHz ~ 80 MHz (Option LFE)	20 MHz
80 MHz ~ 380 MHz (Option LFE)	40 MHz
330 MHz ~ 380 MHz (without Option LFE)	(CF – 330 MHz) * 2
380 MHz ~ 550 MHz	100 MHz
550 MHz ~ 1310 MHz	200 MHz
1310 MHz ~ 2000 MHz (without Option EP6)	600 MHz
2000 MHz ~ 25.9 GHz (without Option EP6)	1200 MHz
1310 MHz ~ 1900 MHz (Option EP6)	600 MHz
1900 MHz ~ 25.9 GHz (Option EP6)	1200 MHz
25.9 GHz ~ 26.5 GHz	Min(Max BW by option, 2*(26.5 GHz-Center Freq))

M9415E/16E

Option Limitation:

Option	Maximum IF BW
B4X	400 MHz
B8X	800 MHz
B12	1200 MHz

Center Frequency Limitation:

Center Frequency	Maximum IF BW
1 MHz ~ 10 MHz (Option LFE)	500 kHz
10 MHz ~ 20 MHz (Option LFE)	5 MHz
20 MHz ~ 60 MHz (Option LFE)	10 MHz
60 MHz ~ 80 MHz (Option LFE)	20 MHz
80 MHz ~ 380 MHz (Option LFE)	40 MHz
330 MHz ~ 380 MHz (without Option LFE)	(CF – 330 MHz) * 2
380 MHz ~ 550 MHz	100 MHz
550 MHz ~ 1310 MHz	200 MHz
1310 MHz ~ 2000 MHz	600 MHz
2000 MHz ~ 25.9 GHz	1200 MHz
25.9 GHz ~ 26.5 GHz	Min(Max BW by option, 2*(26.5 GHz-Center Freq))

Run-Time Scaling

Lets you adjust the run-time scaling value. The run-time scaling value is applied in real-time while the waveform is playing.

Remote Command	`:SOURce:RADio:ARB:RSCaling <real>` `:SOURce:RADio:ARB:RSCaling?`
Example	`:SOUR:RAD:ARB:RSC 100.00`
Notes	Cannot be set in EXM and VXT. Grayed-out in menu, and the value is fixed at 70.00%
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The run-time scaling is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the run-time scaling is updated with the value from the header file. The run-time scaling will remain unchanged if the newly selected waveform does not have an associated header file
Preset	70.00 %
Min	1.00 %
Max	100.00 %

Baseband Freq Offs

Lets you adjust the value by which the baseband frequency is offset relative to the carrier.

Remote Command	`:SOURce:RADio:ARB:BASeband:FREQuency:OFFSet <freq>` `:SOURce:RADio:ARB:BASeband:FREQuency:OFFSet?`
Example	`:SOUR:RAD:ARB:BAS:FREQ:OFFS 0.00 Hz`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The baseband frequency offset is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the baseband frequency offset is updated with the value from the header file. The baseband frequency offset will remain unchanged if the newly selected waveform does not have an associated header file For VXT models M9410A/11A/15A/16A (and associated with M9470A/71A), the settable range can be found in "Parameters for VXT models" on page 695. However, the signal could be filtered when the offset exceeds current max IF BW Not available in E7760B When BaseBand Freq Offset Mode is `Auto` mode, Baseband Freq Offset cannot be changed. Operation to set Markers Polarity with SCPI generates an error "-220 Setting conflict; Baseband Freq Offset cannot be changed when BaseBand Freq Offset Mode is Auto mode"
Preset	0.00 Hz
Min/Max	–/+50.00 MHz

Parameters for VXT models

Models	Option	Minimum	Maximum
VXT models M9410A/11A, M9410E/11E and M8920B	Option B40	-20 MHz	20 MHz
	Option B3X	-150 MHz	150 MHz
	Option B6X	-300 MHz	300 MHz
	Option B12	-600 MHz	600 MHz
VXT models M9415A/16A and M9415E/16E	Option B4X	-200 MHz	200 MHz
	Option B8X	-400 MHz	400 MHz
	Option B12	-600 MHz	600 MHz

Baseband Power

Lets you quickly control the power of the modulator prior to up-conversion to the RF carrier.

Remote Command	`:SOURce:RADio:ARB:BASeband:POWer <ampl>` `:SOURce:RADio:ARB:BASeband:POWer?`

Example	`:SOUR:RAD:ARB:BAS:POW -10 dB`
Notes	The Source Power level equals RF Power plus Baseband Power. For example, if the RF Power is set to -10 dBm and the Baseband Power is set to -4 dB, the actual Source Power level is -14 dBm Can be used to change the output level very quickly compared to the RF Power
Dependencies	Only appears in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Preset	0 dB
Min	–50 dB
Max	20 dB

Mkr 1-4 Polarity

Lets you set the polarity of markers 1 through 4 respectively.

Remote Command	`:SOURce:RADio:ARB:MPOLarity:MARKer1|…|4 POSitive | NEGative` `:SOURce:RADio:ARB:MPOLarity:MARKer1|…|4?`
Example	`:SOUR:RAD:ARB:MPOL:MARK1 NEG`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The marker polarity is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the marker polarity is updated with the value from the header file. The marker polarity will remain unchanged if the newly selected waveform does not have an associated header file Not available in E7760B
Couplings	When Streaming In is ON, markers are not available. Operation to set Markers Polarity with SCPI generates an error "-220 Setting conflict; Markers are unavailable when Streaming In is ON"
Preset	`POSitive`
Range	`POSitive|NEGative`

Clear Marker (Remote Command Only)

Let you clear a single marker point or a range of marker points on a waveform segment for the selected marker (1-4).

Remote Command	`:SOURce:RADio:ARB:MARKer:CLEar <file_name>, <marker>, <first_point>, <last_point>`
Example	`:SOUR:RAD:ARB:MARK:CLE "Test_data",1,1,30`
Dependencies	Available in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Range	<marker>: 1-4 <first_point>: 1-number of waveform points <last_point>: <first_point>-number of waveform points

For Setup SCPI

For the Setup SCPI command, the parameters are:

`<filename>` - String Type

Specifies the name of the waveform file in volatile waveform memory.

`<marker>` - Integer Type

Selects the marker number, an integer value from one to four.

`<first_point>` - Integer Type

Defines the first point in a range of points. The number must be greater than or equal to one, and less than or equal to the total number of waveform points.

`<last_point>` - Integer Type

Defines the last point in a range of points. The number must be greater than or equal to the first point, and less than or equal to the total number of waveform points.

To clear a single marker point, use the same marker point for the first and the last point variables.

Error Checks for Setup SCPI command:

If you specify a filename does not exist in volatile waveform memory, an error is generated.

If you specify marker less than 1 or larger than 4, an error is generated.

If you specify the first point less than 1, an error is generated.

If you specify the last point less than 1, an error is generated.

If you specify first point larger than last point, an error is generated.

If you specify last point larger than number of waveform points, an error is generated.

Pulse/RF Blank

Lets you select which marker is used for **Pulse/RF Blank** . This function blanks the RF when the marker signal goes low. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points.

Marker points should be set before using this function. Enabling this function without setting maker points may create a continuous low or high signal, dependent on the marker polarity. This causes either no RF output, or a continuous RF output.

Remote Command	`:SOURce:RADio:ARB:MDEStination:PULSe NONE | M1 | M2 | M3 | M4`
	For option details, see "More Information" on page 698
	`:SOURce:RADio:ARB:MDEStination:PULSe?`

Example	`:SOUR:RAD:ARB:MDES:PULS NONE`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The **Pulse/RF Blank** setting is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the **Pulse/RF Blank** setting is updated with the value from the header file. The **Pulse/RF Blank** setting remains unchanged if the newly selected waveform does not have an associated header file When **Streaming In** is ON, markers are not available. An attempt to set Markers Polarity generates error "-220 Setting conflict; Markers are unavailable when Streaming In is ON"
Range	`NONE | M1 | M2 | M3 | M4`

More Information

Parameter	SCPI	Notes
None	`NONE`	Sets no marker to be used for **Pulse/RF Blank** function, essentially turning the RF blanking function off
Marker 1	`M1`	Sets marker 1 to be used for **Pulse/RF Blank**
Marker 2	`M2`	Sets marker 2 to be used for **Pulse/RF Blank**
Marker 3	`M3`	Sets marker 3 to be used for **Pulse/RF Blank**
Marker 4	`M4`	Sets marker 4 to be used for **Pulse/RF Blank**

ALC Hold

Lets you specify which marker is routed for use within **ALC Hold**. This function holds the ALC circuitry at the average value of the sample points set by the marker.

ALC Hold operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For positive polarity, this is during the marker points. For a negative polarity, this is when there are no maker points.

Remote Command	`:SOURce:RADio:ARB:MDEStination:ALCHold NONE | M1 | M2 | M3 | M4`
	For option details, see "Option Details" on page 699
	`:SOURce:RADio:ARB:MDEStination:ALCHold?`

Example	`:SOUR:RAD:ARB:MDES:ALCH NONE`
Dependencies	When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. **ALC Hold** is one of the values stored within the header file. If the newly selected waveform file has an associated header file, **ALC Hold** is updated with the value from the header file. **ALC Hold** remains unchanged if the newly selected waveform does not have an associated header file Not available in E7760B, VXT models M9410A/11A/15A/16A, M9410E/11E/15E/16E
Range	`NONE | M1 | M2 | M3 | M4`

Option Details

Parameter	SCPI	Notes
None	NONE	Use no marker for **ALC Hold**, essentially turning **ALC Hold** off
Marker 1	M1	Use marker 1 for **ALC Hold**
Marker 2	M2	Use marker 2 for **ALC Hold**
Marker 3	M3	Use marker 3 for **ALC Hold**
Marker 4	M4	Use marker 4 for **ALC Hold**

Trigger Type

Determines the behavior of the waveform when it plays.

Remote Command	`:SOURce:RADio:ARB:TRIGger:TYPE CONTinuous | SINGle | SADVance` `:SOURce:RADio:ARB:TRIGger:TYPE?`
Example	`:SOUR:RAD:ARB:TRIG:TYPE CONT` `:SOUR:RAD:ARB:TRIG:TYPE?`
Couplings	When **Streaming In** is ON, only **Continuous** and **SingleTrigger Type** are available. An attempt to set **Trigger Type** to an unavailable type generates error "-220 Setting conflict; <Trigger Type> is unavailable when Streaming In is ON"
Preset	`CONTinuous`
Range	Continuous | Single | Seg Adv

Continuous trigger

Sets the active trigger type to **Continuous**. If **Continuous** is already selected as the active trigger type, pressing this control allows access to the **Continuous trigger** type setup menu. In **Continuous** trigger mode, the waveform repeats continuously.

Remote Command	`:SOURce:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE] FREE | TRIGger | RESet`
	See "Option Details" on page 700
	`:SOURce:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE]?`

Example	`:SOUR:RAD:ARB:TRIG:TYPE:CONT FREE`
Couplings	When **Streaming In** is ON, only **Free Run** and **Trigger + Run Continuous** are available. An attempt to set **Continuous Trigger** type to an unavailable value generates error "-220 Setting conflict; <Trigger Type> is unavailable when Streaming In is ON"
Preset	`FREE`
Range	Free Run | Trigger + Run | Reset + Run

Option Details

Parameter	SCPI	Notes
Free Run	`FREE`	Sets the waveform generator to play a waveform sequence or segment continuously, without waiting for a trigger. In this mode, the waveform generator does not respond to triggers
Trigger + Run	`TRIGger`	Sets the waveform generator to play a waveform sequence or segment continuously when the first trigger is received, and to ignore any subsequent triggers
Reset + Run	`RESet`	Sets the waveform generator to play a waveform sequence or segment continuously when the first trigger is received. Subsequent triggers reset the waveform sequence or segment to the start, and then play it continuously

Single trigger

Sets the active trigger type to **Single**. If **Single** is already selected as the active trigger type, pressing this control allows access to the single trigger type setup menu. In **Single** trigger mode, the waveform plays once.

Remote Command	`:SOURce:RADio:ARB:RETRigger ON | OFF | IMMediate`
	See "Option Details" on page 700
	`:SOURce:RADio:ARB:RETRigger?`

Example	`:SOUR:RAD:ARB:RETR OFF`
Notes	`ON`: Buffered Trigger `OFF`: No Retrigger `IMMediate`: Restart on Trigger This is defined as an enumerated SCPI command, with `ON|OFF` being considered as enumerated types rather than Boolean. This means the query returns `OFF` instead of 0, and `ON` instead of 1
Couplings	When **Streaming In** is ON, only **No Retrigger** and **Single** Trigger are available. An attempt to set **Single Trigger** to an unavailable value generates error "-220 Setting conflict; < Trigger Type> is unavailable when Streaming In is ON"
Preset	`ON`

Option Details

Parameter	SCPI	Notes
No Retrigger	`OFF`	Sets the waveform generator to play a waveform sequence or segment once when a trigger is received. Any triggers then received during playback are ignored
Buffered Trigger	`ON`	Sets the waveform generator to play a waveform sequence or segment once when a trigger is received. If a trigger is received during playback, the waveform generator plays the sequence or segment to the end, then plays the sequence or segment once more
Restart on Trigger	`IMMediate`	Sets the waveform generator to play a waveform sequence or segment once when a trigger is received. If a trigger is received during playback, the waveform generator

Parameter	SCPI	Notes
		resets and plays the sequence or segment from the start

Segment Advance trigger

Sets the active trigger type to **Segment Advance**. If **Segment Advance** is already selected as the active trigger type, pressing this control allows access to the segment advance trigger type setup menu.

Segment Advance triggering allows you to control the playback of waveform segments within a waveform sequence. When a trigger is received the ARB advances to the next waveform segment within the waveform sequence. This type of triggering ignores the repetition count for the waveform segment within the waveform sequence. For example, if a waveform segment has a repetition count of 10 and you select single segment advance triggering mode, the waveform segment will only play once.

Segment Advance triggering can also be used for waveform segments only. In this situation, the same waveform segment is played again when a trigger is received.

Remote Command	`:SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE] SINGle | CONTinuous`
	See "Option Details" on page 701
	`:SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]?`

Example	`:SOUR:RAD:ARB:TRIG:TYPE:SADV SING`
Dependencies	Not available in E7760B
Preset	`CONTinuous`
Range	`SINGle|CONTinuous`

Option Details

Parameter	SCPI	Notes
Single	`SINGle`	Once a trigger is received a segment is played once. If a trigger is received during playback of a segment, the segment plays to completion and the next segment is played once
Continuous	`CONTinuous`	Once a trigger is received a segment is played continuously. When subsequent triggers are received, the currently playing segment plays to completion and then the next segment is played continuously
Trigger Initiate	Front panel only	If "Trigger Source" on page 702 is set to `KEY`, initiates an immediate trigger event

Trigger Source

Determines how the source receives the trigger that starts the waveform playing. Grayed-out if "Trigger Type" on page 699 is **Free Run**, since free run triggers immediately with no trigger source required.

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce] KEY | BUS | EXTernal1 | EXTernal2 | PXI`
	See "Option Details" on page 702
	`:SOURce:RADio:ARB:TRIGger[:SOURce]?`

Example	`:SOUR:RAD:ARB:TRIG KEY`
Notes	For E7760B, the available selections are `KEY|BUS`
Dependencies	Grayed-out if **Trigger Type** is **Continuous**, **Free Run**
Preset	`EXTernal2` For E7760B: `BUS`
Range	`Key | Bus | External1 | External 2 | PXI`

Option Details

Parameter	SCPI	Notes
Key	`KEY`	The waveform is triggered when you press the front panel **Trigger** key
Bus	`BUS`	Enables triggering over GPIB, LAN, or USB using: `:SOURce:RADio:ARB:TRIGger:INITiate`
External 1	`EXTernal1`	Enables triggering a waveform by an externally-applied signal
External 2	`EXTernal2`	Enables triggering a waveform by an externally-applied signal Note: in EXM, trigger 2 is a bi-directional trigger port, so when trigger 2 has been configured as OUTPUT type, selecting External 2 as the input trigger for the current step generates an error Note 2: in VXT model M9420A, triggers on an externally connected trigger source marked **Trigger 1** on the front panel
PXI	`PXI`	Enables triggering a waveform by a PXI backplane Line applied signal

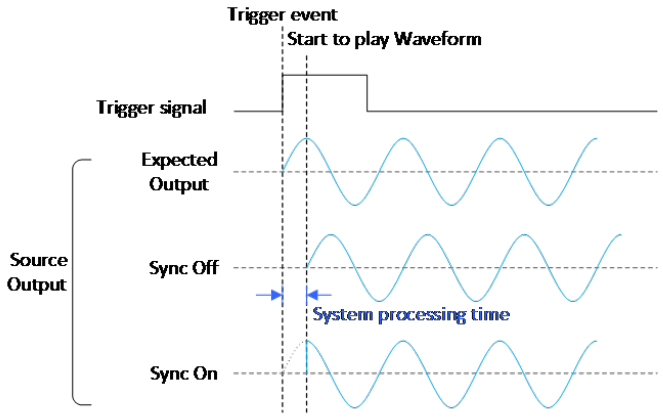
Bus Trigger Command (Remote Command Only)

Used to initiate an immediate trigger event if "Trigger Source" on page 702 is set to `BUS`.

Remote Command	`:SOURce:RADio:ARB:TRIGger:INITiate`
Example	`:SOUR:RAD:ARB:TRIG:INIT`

Sync to Trigger Source

There is a time interval (system processing time) between the trigger event and the beginning of playing waveform. Turn on this control to compensate for the system latency at the cost of cutting off the beginning of the ARB. The figure below shows the turn-on and turn-off behavior of the control.



Remote Command	`:SOURce:RADio:ARB:TRIGger:SYNC[:STATe] ON | OFF | 1 | 0` `:SOURce:RADio:ARB:TRIGger:SYNC[:STATe]?`
Example	`:SOUR:RAD:ARB:TRIG:SYNC ON` `:SOUR:RAD:ARB:TRIG:SYNC?`
Notes	Compensates for the instrument internal latency. The negative trigger delay compensates for the external latency (that is, heads and cables). See "External Trigger Delay" on page 704 and "PXI Trigger Delay" on page 706 The first PerARB trigger is cut off if **Sync to Trigger Source** is `ON`
Dependencies	Only available when "Trigger Source" on page 702 is `EXTernal1`, `EXTernal2`, or `PXI`
Preset	`OFF`
Range	`ON|OFF`

External Trigger Delay

Lets you toggle the state and value of external trigger delay. The value you enter sets a delay time between when an external trigger is received and when it is applied to the waveform. Only active if "Trigger Source" on page 702 is `EXTernal1` or `EXTernal2`.

Negative trigger delay is only supported by VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E (see "More Information" on page 704).

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay <time>` `:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay?`
Example	`:SOUR:RAD:ARB:TRIG:EXT:DEL 100ns` `:SOUR:RAD:ARB:TRIG:EXT:DEL?`
Notes	External trigger delay time set by users will be rounded to the nearest integer multiple of the resolution
Dependencies	Unavailable and grayed-out when **Trigger Source** is not set to `EXTernal1` or `EXTernal2` Not available in E7760B
Preset	1 ms
Min	VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E: -10 s All others: 0 s

Max

Instrument/Condition	Value	Derivation
VXT models M9410A/11A/15A/16A	11.45324612 s	2.666667ns *(2^32-1)
M9410E/11E/15E/16E	11.45324612 s	2.666667ns *(2^32-1)
Continuous – Trigger + Run	11.45324612 s	2.666667ns *(2^32-1)
Other trigger conditions	17.17986918 s	4 ns *(2^32-1)
All others	8.589934588 s	4ns * (2^31 – 1) = 8589934588 ns

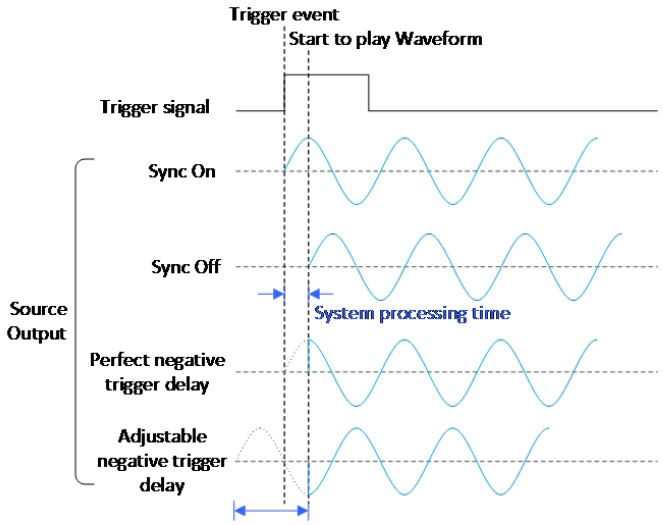
Auto Function

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe OFF | ON | 0 | 1` `:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe?`
Example	`:SOUR:RAD:ARB:TRIG:EXT:DEL:STAT ON` `:SOUR:RAD:ARB:TRIG:EXT:DEL:STAT?`
Preset	`OFF`

More Information

There is a time interval (system processing time) between the trigger event and the beginning of playing waveform. The figure below shows you the behavior. The

negative trigger delay allows you to specify the beginning of a waveform.



Note: the first PerArb trigger signal will be missed when the trigger delay is negative.

External Trigger Polarity

Sets the polarity of the external trigger. When `POSitive` is selected, trigger event happens on a rising edge of the external trigger in signal. When `NEGative` is selected, trigger event happens on a falling edge of the external trigger in signal.

Active only if "Trigger Source" on page 702 is `EXTernal1` or `EXTernal2`.

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe POSitive | NEGative` `:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?`
Example	`:SOUR:RAD:ARB:TRIG:EXT:SLOP POS` `:SOUR:RAD:ARB:TRIG:EXT:SLOP?`
Dependencies	Unavailable and grayed-out when "Trigger Source" on page 702 is not `EXTernal1` or `EXTernal2` Not available in E7760B

Preset	POSitive
Range	POSitive|NEGative

Select PXI Line

Controls which PXI_TRIG[0..7] backplane line is used for the trigger source.

Only appears in modular analyzer products.

Remote Command	:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE <line> :SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE?
Example	:SOUR:RAD:ARB:TRIG:PXI:LINE 2
Dependencies	Unavailable and grayed-out when "Trigger Source" on page 702 is not set to PXI Not available in E7760B
Preset	0
State Saved	Saved in instrument state
Range	[0,7]

PXI Trigger Delay

Lets you toggle the state and value of PXI trigger delay. The value you enter sets a delay time between when an PXI trigger is received and when it is applied to the waveform.

Only active if "Trigger Source" on page 702 is PXI.

Remote Command	:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay <time> :SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay?
Example	:SOUR:RAD:ARB:TRIG:PXI:DEL 100ns :SOUR:RAD:ARB:TRIG:PXI:DEL?
Notes	PXI trigger delay time set by users will be rounded to the nearest integer multiple of the resolution
Dependencies	Unavailable and grayed-out when "Trigger Source" on page 702 is not PXI Not available in E7760B
Preset	1 ms
Min	VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E: -10 s
Max	

Instrument/Condition	Value	Derivation
VXT models M9410A/11A/15A/16A	11.45324612 s	2.666667ns * (2^32-1)
M9410E/11E/15E/16E	11.45324612 s	2.666667ns * (2^32-1)

Instrument/Condition	Value	Derivation
Continuous – Trigger + Run" trigger	11.45324612 s	2.666667ns * (2^32-1)
Other trigger conditions	17.17986918 s	4 ns *(2^32-1)
All Others	8.589934588 s	4ns * (2^31 – 1)

Auto Function

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay:STATe OFF | ON | 0 | 1` `:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay:STATe?`
Example	`:SOUR:RAD:ARB:TRIG:PXI:DEL:STAT ON` `:SOUR:RAD:ARB:TRIG:PXI:DEL:STAT?`
Preset	`OFF`

PXI Trigger Polarity

Sets the polarity of the PXI trigger:

- When `POSitive` is selected, trigger event happens on a rising edge of the PXI trigger in signal
- When `NEGative` is selected, trigger event happens on a falling edge of the PXI trigger in signal

Active only if "Trigger Source" on page 702 is `PXI`.

Remote Command	`:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe POSitive | NEGative` `:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe?`
Example	`:SOUR:RAD:ARB:TRIG:PXI:SLOP POS` `:SOUR:RAD:ARB:TRIG:PXI:SLOP?`
Dependencies	Unavailable and grayed-out when "Trigger Source" on page 702 is `PXI` Not available in E7760B
Preset	`POSitive`
Range	`POSitive|NEGative`

I/Q Adjustments

Enables or disables the I/Q adjustments.

Remote Command	`:SOURce:RADio:ARB:IQADjustment:[STATe] OFF | ON | 0 | 1` `:SOURce:RADio:ARB:IQADjustment:[STATe]?`

Example	`:SOUR:RAD:ARB:IQAD ON` `:SOUR:RAD:ARB:IQAD?`
Dependencies	Not available in E7760B
Preset	`OFF`

I/Q Gain

Lets you adjust the ratio of I to Q while preserving the composite, vector magnitude. Adding Gain (+x dB) to the signal increases the I component and decreases the Q component proportionally. Reducing Gain (-x dB) decreases the I component and increases the Q component proportionally.

Remote Command	`:SOURce:RADio:ARB:IQADjustment:GAIN <value><unit>` `:SOURce:RADio:ARB:IQADjustment:GAIN?`
Example	`:SOUR:RAD:ARB:IQAD:GAIN 0.5` `:SOUR:RAD:ARB:IQAD:GAIN?`
Notes	Effective only if the I/Q adjustment function is `ON`
Dependencies	Unavailable and grayed-out when the ARB state is `OFF` Not available in E7760B
Preset	+0.00000000E+000
Min/Max	–/+1 dB

I/Q Delay

Lets you change the absolute phase of both I and Q with respect to triggers and markers. A positive value delays I and Q. This value affects both the external I/Q out signals and the baseband signal modulated on the RF output. This adjustment does not affect external I/Q inputs.

Remote Command	`:SOURce:RADio:ARB:IQADjustment:DELay <value><unit>` `:SOURce:RADio:ARB:IQADjustment:DELay?`
Example	`:SOUR:RAD:ARB:IQAD:DEL 10ps` `:SOUR:RAD:ARB:IQAD:DEL?`
Notes	User-set IQ delay time values are rounded to the nearest integer multiple of the resolution
Dependencies	Unavailable and grayed-out when the ARB state is off Not available in E7760B
Preset	+0.00000000E+000

Min/Max

Instrument Type	Min	Max
M9410A/11A/15A/16A	–80ns	80ns
All Others	–250ns	250ns

RMS

Lets you directly specify current RMS value used to playback currently selected waveform.

For EXM, note that an incorrect RMS value may cause inaccurate power output that is sensitive to RMS value.

This setting is also updated by RMS in waveform header or updated when invoking RMS calculation operation.

This setting can be saved to the header of currently selected waveform by "Save Header" on page 729.

Remote Command	`:SOURce:RADio:ARB:RMS <float>` `:SOURce:RADio:ARB:RMS?`
Example	`:SOUR:RAD:ARB:HEAD:RMS 0.7` `:SOUR:RAD:ARB:HEAD:RMS?`
Notes	The valid range for this setting is 0 to 1.414 (linear). Values outside the range are clipped to the closest boundary This value does not affect Source List Sequencer, which always uses the RMS value included in each ARB header. If this setting is to take effect in List Sequencer, use "Save Header" on page 729 to save the current RMS value to the header, then play the ARB in Source List Sequencer
Dependencies	When a new waveform is selected for playback this setting is updated by the RMS value included in the associated waveform header file. If the selected waveform has no associated header file or the header file does not include the RMS value then the instrument will try to calculate the value automatically based on the RMS Calculation Mode setting Pressing **Calculate** also updates this setting
Preset	0
Range	0 ~ 1.414

RMS Calculation Mode

Lets you specify the mode to calculate the current RMS.

Remote Command	`:SOURce:RADio:ARB:RMS:CALCulation:MODE AUTO | M1 | M2 | M3 | M4` See "Option Details" on page 710

	`:SOURce:RADio:ARB:RMS:CALCulation:MODE?`
Example	`:SOUR:RAD:ARB:RMS:CALC:MODE AUTO`
Notes	If no waveform is selected, or selected waveform is waveform sequence, the key is grayed-out
Preset	`AUTO`
Range	`AUTO | M1 | M2 | M3 | M4`

Option Details

Parameter	SCPI	Notes
Auto	`AUTO`	In Auto, RMS is calculated based on the whole sample range of the currently selected waveform
Marker 1	`M1`	Marker 1 designates the sample range for RMS calculation
Marker 2	`M2`	Marker 2 designates the sample range for RMS calculation
Marker 3	`M3`	Marker 3 designates the sample range for RMS calculation
Marker 4	`M4`	Marker 4 designates the sample range for RMS calculation

Calculate

Lets you calculate current RMS based on mode selected. Updates the setting in the "RMS" on page 709 control.

Remote Command	`:SOURce:RADio:ARB:RMS:CALCulate`
Example	`:SOUR:RAD:ARB:RMS:CALC`
Notes	If no waveform is selected, invoking this operation generates error "-221 Setting conflict; No waveform is selected for RMS operation" Grayed-out if no waveform is selected, or selected waveform is waveform sequence If selected waveform does not contain marker data, but "RMS Calculation Mode" on page 709 is set to marker, invoking a calculation operation generates error "-221 Setting conflict; There is no marker for currently selected waveform, auto RMS calculation mode is used instead", and "RMS Calculation Mode" on page 709 is coupled to **Auto** mode automatically RMS calculation is not suitable for waveform sequence. If selected waveform is waveform sequence file, invoking this operation generates error "-221 Setting conflict; RMS calculation does not apply to waveform sequence" You can still edit current RMS as play parameter, and save current RMS to waveform sequence header for later use

Use Header RMS

Lets you quickly set RMS to value in ARB header. Updates the setting in the "RMS" on page 709 control.

Notes	Grayed-out if no waveform is selected If no waveform is selected, invoking this operation generates error "-221 Setting conflict; No waveform is selected for RMS operation"

Real-Time 5G NR Compensation

Phase compensation is a new concept introduced into 5G NR baseband signal generation in TS38.211 as below, to address a typical 5G scenario that Tx and Rx frequencies may not be the same. In that case, without properly compensating the phase, receiver would not be able to correctly demodulate the received signal.

Modulation and up-conversion to the carrier frequency f_0 of the complex-valued OFDM baseband signal for antenna port p, subcarrier spacing configuration μ, and OFDM symbol l in a subframe assumed to start at t = 0 is given by the following equation for all channels and signals except PRACH:

$$Re\left\{s_l^{(p,\mu)}(t)\cdot e^{j2\pi f_0\left(t-t_{start,l}^{\mu}-N_{CP,l}^{\mu}T_C\right)}\right\}$$

From the 3GPP specification equation above, it can be observed that phase compensation is performed for a specific transmission frequency f_0. So that means, even if a same signal configuration needs to be transmitted at multiple frequencies, we'll have to generate a different waveform for each frequency point. As a result, the number of test waveforms will increase significantly along with the frequency number. This would be a big challenge for test engineers, considering the complexity of 5G NR signal configurations - they have to maintain a large waveform library and identify each waveform carefully with its "frequency tag".

Real-Time 5G NR Phase Compensation allows you to play the same 5G NR waveform while performing phase compensation along with transmission frequency change automatically. This control allows you to turn on or off the real-time phase compensation for 5G NR waveform.

Remote Command	`:SOURce:RADio:ARB:NR5G:PHASe[:STATe] ON | OFF | 1 | 0` `:SOURce:RADio:ARB:NR5G:PHASe[:STATe]?`
Example	`:SOUR:RAD:ARB:NR5G:PHAS ON` `:SOUR:RAD:ARB:NR5G:PHAS?`
Dependencies	Only appears when Option RPC is present If the waveform is not for 5G NR, there may be an error message, and the output signal may be incorrect To ensure that you do *not* compensate for phase twice, once at waveform generation and again during

	playback, turn *off* this control if you had turned on phase compensation while generating the waveform
Preset	OFF
Range	ON|OFF

SCS

Sets the SCS for real-time 5G NR phase compensation.

Remote Command	:SOURce:RADio:ARB:NR5G:PHASe:SCS SCS15K | SCS30K | SCS60K | SCS60KECP | SCS120K | SCS240K | SCS480K :SOURce:RADio:ARB:NR5G:PHASe:SCS?
Example	:SOUR:RAD:ARB:NR5G:PHAS:SCS SCS15K :SOUR:RAD:ARB:NR5G:PHAS:SCS?
Preset	SCS30K

Range

μ	CP	Value
0		15 kHz
1		30 kHz
2	Normal	60 kHz
	Extended	60 kHz
3		120 kHz
4		240 kHz
5		480 kHz

Filter

Sets the state of filter usage following real-time 5G NR phase compensation.

Remote Command	:SOURce:RADio:ARB:NR5G:PHASe:FILTer[:STATe] ON | OFF | 1 | 0 :SOURce:RADio:ARB:NR5G:PHASe:FILTer[:STATe]?
Example	:SOUR:RAD:ARB:NR5G:PHAS:FILT ON :SOUR:RAD:ARB:NR5G:PHAS:FILT?
Preset	OFF
Range	ON|OFF

Filter Bandwidth

Sets **Filter Bandwidth** if **Filter** is used.

By searching the <FilterBandwidth> node in the *.scp file, you can get the correct filter bandwidth value for phase compensation.

Remote Command	:SOURce:RADio:ARB:NR5G:PHASe:FILTer:BANDwidth <freq> :SOURce:RADio:ARB:NR5G:PHASe:FILTer:BANDwidth?
Example	:SOUR:RAD:ARB:NR5G:PHAS:FILT:BAND 99MHz :SOUR:RAD:ARB:NR5G:PHAS:FILT:BAND?
Preset	100 MHz
Min	10 Hz
Max	1200 MHz

Select Waveform

Lets you select a waveform segment or sequence to be played by the ARB player. Presents you with a list of waveform segments files and waveform sequence files. The list of waveform segment files and waveform sequence files contains the names of all the waveform segments and waveform sequence files currently loaded into ARB playback memory.

Waveform sequences are not available in E7760B.

Waveforms formatted as *.mat, *.csv and *.txt are supported by models with a built-in source, such as VXT and EXM.

NOTE **To load a file from the hard drive into ARB memory, go to the Recall, Waveform dialog**

NOTE **Selecting a waveform file does not result in automatic adjustments to burst timing; that adjustment occurs only when a waveform is loaded to ARB memory.**

Remote Command	:SOURce:RADio:ARB:WAVeform <string> :SOURce:RADio:ARB:WAVeform?
Example	:SOUR:RAD:ARB:WAV "test_waveform.bin"
Notes	If the intended waveform is not in the memory yet, then issuing this command invokes ARB loading operation first, which involves a delay of unpredictable length, so this command should be followed by *OPC?, which holds off subsequent commands until the loading operation is complete <string> - specifies the name of the waveform segment or waveform sequence to be played by the ARB Sequence Analyzer Mode only: – If Include Source is Yes, and you attempt to play a waveform sequence, but not all the required waveform segments are in the ARB playback memory, the application rejects the loading operation, and an error is generated

- If Include Source is No, and you attempt to play a waveform sequence, but not all the required waveform segments are contained in the ARB playback memory, the application attempts to load the required segments from either the default directory or the current directory. If the ARB memory does not have enough space for all the waveform segments to be loaded, an error is generated and none of the waveform segments is loaded

If ARB is **ON**, and you attempt to play a waveform sequence but not all the waveform segments within the sequence could be found to be loaded into ARB memory, an error is generated. The selected waveform keeps the previous value and ARB state remains On

If you specify a waveform segment via SCPI but the waveform segment is not present within ARB playback memory, and cannot be found for auto loading within the current directory or the default directory, an error is generatedand the file selection remains unchanged

If you select a waveform for playback and the waveform requires a license that is not installed on the instrument, an error is generated

If ARB is **ON** and you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished

Segments in ARB Memory

Shows you which files are loaded into the ARB memory and lets you select a file for playback.

Recall Waveform

This is the same as **Recall From File** in the dialog **Recall**, "Waveform" on page 955.

Delete Segment From ARB Mem

This is the same as **Delete Segment From ARB Mem** in the **Recall**, "Waveform" on page 955.

Delete All From ARB Memory

This is the same as **Delete All From ARB Memory** in the **Recall**, "Waveform" on page 955.

Query ARB Memory File List (Remote Query Only)

Queries the test set for the list of waveform segments in the ARB memory.

NOTE **Returns a string for waveform segment names in ARB memory. If you require a string list of waveform segments in the ARB memory, use "Query ARB Memory Full File List (Remote Query Only)" on page 715**

Remote Command	`:SOURce:RADio:ARB:CATalog?`
Example	`:SOUR:RAD:ARB:CAT?`
Notes	The return data is in the following format:

`<integer>`	Memory used, in kB
`<integer>`	Memory free, in kB
`<string> …`	Comma-separated list of waveform segments within ARB memory

Query ARB Memory Full File List (Remote Query Only)

Queries the test set for the string list of waveform segments in the ARB memory. Returns a string list for waveform segment names in the ARB memory.

Remote Command	`:SOURce:RADio:ARB:FCATalog?`
Example	`:SOUR:RAD:ARB:FCAT?`
Notes	The return data is in the following format:

`<integer>`	Memory used, in kB
`<integer>`	Memory free, in kB
`<integer>`	File count in ARB memory
`<string>,<string>, … <string>`	Comma-separated string list of waveform segments within ARB memory

EXT returns: 27499,2069653,3,"c2k.wfm","gsm.wfm","wcdma.wfm"

Waveform Sequences

Not available in E7760B.

Lets you build new sequences or edit existing sequences. The Sequences table displayed in this dialog shows you the sequences in the current directory. You may build a new sequence or select one of the sequences in the table and tap **Edit Selected Sequence**. The default current directory is `C:\NVARB`. Tapping any element of this path lets you select an alternate route. Tapping the **Computer** arrow lets you select a different drive. Tapping the **Back** arrow navigates to the previously selected directory.

Build New Sequence

Lets you build a new sequence of waveform segments. When you build a sequence you are building the “current sequence”, and the next time you press “Build New Sequence” the sequence you have been building will still be there, allowing you to add or remove segments from it.

Segment

Shows the segment number assigned to this row.

Waveform

Shows the file name for the waveform inserted into this row. Use "Insert Waveform" on page 717 to insert a waveform.

Repetitions

Lets you specify the number of times the currently selected waveform is played within the sequence.

Preset	1
Min	1
Max	65535

Marker 1 – Marker 4

Lets you enable or disable Marker 1, 2, 3, or 4 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Preset	Enabled
Range	Enabled | Disabled

Sync Seq File

Enables or disables the saving of secondary modules’ waveform sequence files based on the current primary module segment’s waveform settings.

Remote Command	`:SOURce:RADio:ARB:SEQuence:SYNC ON | OFF`

	`:SOURce:RADio:ARB:SEQuence:SYNC?`
Example	`:SOUR:RAD:ARB:SEQ:SYNC OFF`
Notes	Available only on primary modules If this setting is `ON`, when Sync Config is not `NONE`, the responding secondary module's waveform sequence file will be saved accordingly when save sequence... on the primary module, and the primary sequence file name should end with `xxx0.seq`, so the secondary module will be named according to the "Naming Rule" on page 717 Waveform names in sequence files should also follow the **Naming Rule**
Dependencies	Not available in E7760B
Preset	`OFF`
Range	`ON|OFF`

Naming Rule

If Sync Config is not 2x2 +2x2 or 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the primary source should end in 0; the waveform files for the controlled sources should end in 1, 2, or 3 (reflecting the order of the TRXs). For example, for DL 11AC80 3X3 MIMO, sequence file names for TRX1,TRX2 and TRX3 should be xxx0.xx, xxx1.xx and xxx2.xx

If Sync Config is 2x2+2x2, the waveform files to be used should follow this naming convention: the waveform file for the primary source of first 2x2 should end in 0_0; the waveform files for the secondary source of first 2x2 should end in 0_1; the waveform files for the primary source of second 2x2 should end in 1_0; the waveform files for the secondary source of second 2x2 should end in 1_1. For example, for DL 11AC80 2x2 + 2x2 MIMO, waveform file names for TRX1,TRX2,TRX3 and TRX4 should be xxx0_0.xx, xxx0_1.xx, xxx1_0.xx and xxx1_1.xx

If Sync Config is 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the first source should end in 0_0; the waveform files for the second source should end in 1_0. For example, for DL 11AC80 1x1 + 1x1 MIMO, waveform file names for TRX1 and TRX2 should be xxx0_0.xx and xxx1_0.xx

Insert Waveform

Lets you select a waveform segment to be added to the sequence.

NOTE **To load a file from the hard drive into ARB memory, go to the Recall, Waveform dialog**

Segments in ARB Memory

Shows you which files are loaded into the ARB memory and lets you select a file for inclusion in the sequence.

Delete Segment From ARB Mem

This is the same as **Delete Segment From ARB Mem** in the **Recall**, **Waveform** dialog.

Delete All From ARB Memory

This is the same as **Delete All From ARB Memory** in the **Recall**, **Waveform** dialog.

Delete Segment

Lets you delete the selected segment from the waveform sequence.

Save Sequence

Lets you save the newly built Waveform Sequence to the disk drive.

Sequence files have the extension `.seq`. The default filename is `WfmSequence_0000.seq`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory. Use “File Name” and “File Type’ to specify your waveform sequence. The newly built sequence will be stored in the current directory.

Build New Sequence (Remote Command Only)

This is the SCPI equivalent of the waveform sequence creation features described in "Build New Sequence" on page 716.

Writes a waveform sequence file to the hard disk. You must specify the waveform sequence file path and filename which will be saved on the hard disk, and the waveform segment file path and name which will be nested into the waveform sequence file. You can utilize mass storage unit specifier (MSUS) “NVWFM” or use a real full path representation. See the example below. MSUS “NVWFM” is mapped to `D:\NVARB` directory on test set hard disk.

Any number of segments, up to a segment count limit of 64, can be used to create a sequence. Repeated segments are included in the count limit.

Each waveform segment name string length upper limit is 128 chars. Do not attempt to insert a waveform with a name string that exceeds 128 chars.

The internal source does not support nesting one waveform sequence file into another waveform sequence file.

Remote Command	`:SOURce:RADio:ARB:SEQuence[:MWAVeform] <filename>, <waveform1>, <reps>, NONE | M1 | M2 | M3 | M4 | M1M2 | M1M3 | M1M4 | M2M3 | M2M4 | M3M4 | M1M2M3 | M1M2M4 | M1M3M4 | M2M3M4 | M1M2M3M4 | ALL, \{<waveform2>, <reps>, NONE | M1 | M2 | M3 | M4 | M1M2 | M1M3 | M1M4 | M2M3 | M2M4 | M3M4 | M1M2M3 | M1M2M4 | M1M3M4 | M2M3M4 | M1M2M3M4 | ALL,\} …` For additional description of each item, see "For Setup SCPI" on page 719 below `:SOURce:RADio:ARB:SEQuence[:MWAVeform]? <filename>` For additional description of each item, see "For Query SCPI" on page 720 below

Example	For setup:
	`:SOUR:RAD:ARB:SEQ "NVWFM:testSeq1.seq", "NVWFM:wfmSegment1.wfm",10, M2M3M4, "NVWFM:wfmSegment2.wfm", 20, M1M3`
	Or
	`:SOUR:RAD:ARB:SEQ "D:\NVARB\testSeq1.seq", "D:\NVARB\wfmSegment1.wfm",10, M2M3M4, "D:\NVARB\wfmSegment2.wfm", 20, M1M3`
	For query, must specify which waveform sequence file to query
	`:SOUR:RAD:ARB:SEQ? "NVWFM:testSeq1.seq"`
	Or
	`:SOUR:RAD:ARB:SEQ? "D:\NVARB\testSeq1.seq"`

For Setup SCPI

For the Setup SCPI command, the parameters are:

`<filename>` - String Type

This variable specifies the path and name for the waveform sequence file. The path supports MSUS (NVWFM) or a real full path representation. See example.

`<waveform1>` - String Type

This variable specifies the path and name of the first existing waveform segment. The path supports MSUS (NVWFM) or a real full path representation. See example.

The segment file must reside within ARB playback memory before it can be played by the ARB player.

`<reps>` - Integer Type

This variable specifies the number of times a segment or sequence plays before moving on to the next segment or sequence.

`<marker>` - Enum Type

NONE – This choice disables all four markers for the waveform. Disabling markers means that the waveform sequence ignores the segments or sequence marker settings.

M1, M2, M3, M4 – these choices, either individually or a combination of them, enable the markers for the waveform segment or sequence. Markers not specified are ignored for that segment or sequence.

ALL – This choice enables all four markers in the waveform segment or sequence.

<waveform2> - String type

This variable specifies the name of a second existing waveform segment. The path supports MSUS (NVWFM) and real full path representation both. See example.

The segment file must reside within ARB playback memory before it can be played by the ARB player.

<reps> same as above, for the 2nd waveform segment.

<marker> same as above, for the 2nd waveform segment.

You can insert several waveform segments into a waveform sequence file. Just repeat inserting waveform segments as described above.

Error Checks for Setup SCPI command:

If you do not specify a filename, or you use an unsupported MSUS (that is, not NVWFM), or have an error in the waveform sequence file path, an error is generated.

If the specified waveform sequence file name suffix is not ".seq", error is generated.

If you use an unsupported MSUS (that is, not NVWFM), or have an error in the waveform segment file path, an error is generated.

If the first specified waveform file cannot be found, an error is generated.

If you nest one waveform sequence file into another waveform sequence file, an error is generated.

If the specified repetition value is larger than 65535 or smaller than 1, an error is generated.

If the specified marker type is unrecognized, an error is generated.

For Query SCPI

For the Query the parameters are:

<filename> - String type

This variable specifies the path and name of the waveform sequence file being queried. The path supports MSUS (NVWFM) or a real full path representation. See example.

The return value is a `<string>`, which includes each waveform segment file name, repetitions, and marker type. For example:

```
>:SOUR:RAD:ARB:SEQ? “NVWFM:testSeq1.seq”,
<“wfmSegment1. wfm, 10, ALL, wfmSegment2.wfm, 20, M1M3”,
```

Error Checks for Query SCPI command:

If you do not specify a filename, an error is generated.

If the waveform sequence file name is empty, an error is generated.

If the specified waveform sequence file cannot be found, an error is generated.

Edit Selected Sequence

This dialog lets you edit an existing sequence of waveform segments. A table of the segments in the currently selected sequence displays, allowing you to insert waveform segments or edit the characteristics of each segment.

Segment

This field in the table shows the segment number assigned to this row.

Waveform

This field in the table shows the file name for the waveform inserted into this row. Use "Insert Waveform" on page 717 to insert a waveform.

Repetitions

Lets you specify the number of times the currently selected waveform is played within the sequence.

Preset	1
Min	1

Marker 1 – Marker 4

Lets you enable or disable Marker 1, 2, 3, or 4 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

Notes	No remote command, front panel only
Preset	Enabled
Range	Enabled | Disabled

Sync Seq File

Change this setting to enable/disable the function of saving secondary modules' waveform sequence files based on the current primary segment's waveform settings.

Remote Command	See "Sync Seq File" on page 716
Notes	Available only on primary modules If this setting is `ON`, when Sync Config is not `NONE`, the responding secondary module's waveform sequence file will be saved accordingly when save sequence... on the primary module, and the primary sequence file name should end with `xxx0.seq`, so the secondary module will be named according to the "Naming Rule" on page 722 Waveform names in sequence files should also follow the Naming Rule
Dependencies	Not available in E7760B
Preset	`OFF`
Range	`ON|OFF`

Naming Rule

If Sync Config is not 2x2 +2x2 or 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the primary source should end in 0; the waveform files for the controlled sources should end in 1, 2, or 3 (reflecting the order of the TRXs). For example, for DL 11AC80 3X3 MIMO, sequence file names for TRX1,TRX2 and TRX3 should be xxx0.xx, xxx1.xx and xxx2.xx

If Sync Config is 2x2+2x2, the waveform files to be used should follow this naming convention: the waveform file for the primary source of first 2x2 should end in 0_0; the waveform files for the secondary source of first 2x2 should end in 0_1; the waveform files for the primary source of second 2x2 should end in 1_0; the waveform files for the secondary source of second 2x2 should end in 1_1. For example, for DL

11AC80 2x2 + 2x2 MIMO, waveform file names for TRX1,TRX2,TRX3 and TRX4 should be xxx0_0.xx, xxx0_1.xx, xxx1_0.xx and xxx1_1.xx

If Sync Config is 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the first source should end in 0_0; the waveform files for the second source should end in 1_0. For example, for DL 11AC80 1x1 + 1x1 MIMO, waveform file names for TRX1 and TRX2 should be xxx0_0.xx and xxx1_0.xx

Insert Waveform

This dialog selects a waveform segment to be added to the sequence.

NOTE **To load a file from the hard drive into ARB memory, go to the Recall, Waveform dialog**

Segments in ARB Memory

This table shows you which files are loaded into the ARB memory and lets you select a file for inclusion in the sequence.

Delete Segment From ARB Mem

Deletes a segment from ARB memory. This is the same as **Delete Segment From ARB Mem** in the **Recall**, **Waveform** dialog.

Delete All From ARB Memory

Removes all segments from ARB memory. This is the same as **Delete All From ARB Memory** in the **Recall**, **Waveform** dialog.

Delete Segment

Lets you delete the current segment from the waveform sequence.

Notes No remote command, front panel only

Waveform Utilities

Not available in E7760B.

Only appears if there is at least one Multi-pack license installed in the instrument.

On modular instruments, such as EXM , multi-pack license operations are only allowed on the default module, that is, “TRX1” module for EXM.

For EXM, if access multi-pack license sub-menu from modules other than “TRX1”, an advisory message like “Please go to “TRX1” to operate multi-pack license” will display.

Add Waveform

Use this dialog to select and add waveforms. Pressing OK in this dialog adds the currently highlighted waveform to the next available slot and returns you to the "Waveform Utilities" on page 723 dialog.

Remote Command	`:SYSTem:LKEY:WAVeform:ADD <string>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:ADD <string>`

Example	`:SYST:LKEY:WAV:ADD "mywaveform.wfm"`
	or
	`:SYST:LIC:WAV:ADD "mywaveform.wfm"`

Notes	The second form, `:SYSTem:LICense[:FPACk]:WAVeform:ADD`, is provided for consistency with Keysight signal sources. You can use either form Since adding a waveform segment to a Multi-Pack license causes the license slot to enter the trial period of only 48 hours, pressing this key causes a confirmation dialog to be displayed to ensure you do want to add the waveform segment to the Multi-Pack If you attempt to license a waveform that is already licensed using another slot an error is generated For EXM, if current module is not “TRX1” module, the key is grayed-out, and error message is generated “-221 Setting conflict; Not allowed on current module. Go to “TRX1” to operate multi-pack license” when invoking SCPI
Dependencies	Only available if the currently selected file is a secure waveform requiring a license, and there is at least one slot available within at least one multi-pack license. Unavailable if the waveform highlighted is a secure waveform, but is already licensed

Replace Selected Waveform

Lets you replace the waveform in the currently selected slot with the waveform currently selected in the Multi-Pack License Waveform Add view. Pressing OK in this dialog replaces the waveform in the currently selected slot with that currently highlighted, and returns you to the "Waveform Utilities" on page 723 dialog.

Remote Command	`:SYSTem:LKEY:WAVeform:REPLace <int>, <string>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:REPLace <int>, <string>`

Example	`:SYST:LKEY:WAV:REPL 1, "myotherwaveform.wfm"`

	or `:SYST:LIC:WAV:REPL 1, "myotherwaveform.wfm"`
Notes	The second command form, `:SYSTem:LICense[:FPACk]:WAVeform:REPLace` is provided for consistency with Keysight signal sources. You can use either form If you attempt to license a waveform that is already licensed using another slot an error is generated Waveform slot number <int> is positive. If you attempt to input a slot number less than or equals 0, an error is generated For EXM, if current module is not "TRX1" module, the key is grayed-out, and error message is generated "-221 Setting conflict; Not allowed on current module. Go to "TRX1" to operate multi-pack license" when invoking SCPI

Clear Waveform from Slot

Lets you clear the waveform from the selected slot.

Remote Command	`:SYSTem:LKEY:WAVeform:CLEar <int>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:CLEar <int>`

Example	`:SYST:LKEY:WAV:CLE 1`
	or
	`:SYST:LIC:WAV:CLE 1`

Notes	The second form: `:SYSTem:LICense[:FPACk]:WAVeform:CLEar` is provided for consistency with the style of Keysight signal sources. You can use either form Waveform slot number `<int>` is positive. If you attempt to input a slot number less than or equal to 0, an error is generated For EXM, if current module is not "TRX1" module, the key is grayed-out, and error message is generated "-221 Setting conflict; Not allowed on current module. Go to "TRX1" to operate multi-pack license" when invoking SCPI
Dependencies	Only available if the currently selected slot is in the trial state

Lock Waveform in Slot

If the selected slot is in the trial state or the lock required state, the waveform that occupies the slot is locked and permanently licensed.

Remote Command	`:SYSTem:LKEY:WAVeform:LOCK <int>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:LOCK <int>`

Example	`:SYST:LKEY:WAV:LOCK 1`
	or
	`:SYST:LIC:WAV:LOCK 1`

Notes	The command form `:SYSTem:LICense[:FPACk]:WAVeform:LOCK` is provided for consistency with Keysight signal sources. You can use either form Waveform slot number `<int>` is positive. If you attempt to input a slot number less than or equal to 0, an error is generated For EXM, if current module is not “TRX1” module, the key is grayed-out, and error message is generated “-221 Setting conflict; Not allowed on current module. Go to “TRX1” to operate multi-pack license” when invoking SCPI
Dependencies	Only available if the currently selected slot is in the trial state, or the lock required state

Slot Status Query (Remote Command Only)

Returns the status of the specified slot.

Remote Command	`:SYSTem:LKEY:WAVeform:STATus? <int>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:STATus? <int>`

Example	`:SYST:LKEY:WAV:STAT? 1`
	<"Locked"
	or
	`:SYST:LIC:WAV:STAT? 1`
	<"Locked"

Notes	The command form `:SYSTem:LICense[:FPACk]:WAVeform:STATus` is provided for consistency with Keysight signal sources. You can use either form Waveform slot number `<int>` is positive. If you attempt to input a slot number less than or equal to 0, an error is generated Result type is string. If input slot number exceeds total available slot numbers, “Nonexistent” is returned
Range	"Locked" | "Available" | “Trail” | “LockRequired” | “Nonexistent”

Slots Free Query (Remote Query Only)

Returns the number of license slots free.

Remote Command	`:SYSTem:LKEY:WAVeform:FREE?`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:FREE?`

Example	`:SYST:LKEY:WAV:FREE?`
	or
	`:SYST:LIC:WAV:FREE?`

Notes	The second form: `:SYSTem:LICense[:FPACk]:WAVeform:FREE` is provided for consistency with the style of Keysight signal sources. You can use either one

Slots Used Query (Remote Query Only)

Returns the number of license slots used.

Remote Command	`:SYSTem:LKEY:WAVeform:USED?`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:USED?`

Example	`:SYST:LKEY:WAV:USED?`
	or
	`:SYST:LIC:WAV:USED?`

Notes	The second form: SCPI `:SYSTem:LICense[:FPACk]:WAVeform:USED` is provided for consistency with the style of Keysight signal sources. You can use either form

Slot Waveform Name Query (Remote Command Only)

Returns the waveform name of the specified slot.

Remote Command	`:SYSTem:LKEY:WAVeform:NAME? <int>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:NAME? <int>`

Example	`:SYST:LKEY:WAV:NAME? 1`
	`<"CDMA2K_22.wfm"`
	or
	`:SYST:LIC:WAV:NAME? 1`
	`<"CDMA2K_22.wfm"`

Notes	Waveform slot number `<int>` is positive. If you attempt to input a slot number less than or equal to 0, an error is generated Result type is string. If input slot number exceeds total available slot numbers, “Nonexistent” is returned If no waveform stored in the specified slot, then empty string is returned

Slot Waveform Unique ID Query (Remote Command Only)

Returns the waveform unique ID of the specified slot.

Remote Command	`:SYSTem:LKEY:WAVeform:UID? <int>`
	or
	`:SYSTem:LICense[:FPACk]:WAVeform:UID? <int>`

Example	`:SYST:LKEY:WAV:UID? 2` `<"1346752140"`

	or
	`:SYST:LIC:WAV:UID? 2`
	`<"1346752140"`

Notes	Waveform slot number `<int>` is positive. If you attempt to input a slot number less than or equal to 0, an error is generated Result type is string. If input slot number exceeds total available slot numbers, “Nonexistent” is returned Only Signal Studio waveform has a unique ID, which is a positive number. User-generated waveforms have no unique ID. If no waveform is stored in the specified slot, returns “0”

Locked Waveform Name List Query (Remote Query Only)

Returns the waveform name list of locked.

Remote Command	`:SOURce:RADio:ARB:MPLicensed:NAME:LOCKed?`
Example	`:SOUR:RAD:ARB:MPL:NAME:LOCKed?` `< "CDMA2K_27.wfm","GSM_MCS1.WFM","c2kWfm.wfm"`

Locked Waveform Unique ID List Query (Remote Query Only)

Returns the waveform unique id list of locked.

Remote Command	`:SOURce:RADio:ARB:MPLicensed:UID:LOCKed?`
Example	`:SOUR:RAD:ARB:MPL:UID:LOCKed?` `< "2996927136","3812603511","3710986266"`
Notes	Each Signal Studio waveform has a unique id recorded in header. If the unique ids are same, that means they are the same waveform. For this reason, in addition to the locked waveform name list query , there is also a locked waveform unique id list query

Multi-Pack License multi-module control state (Remote Command Only)

When `ON`, multi-pack license operations (such as adding/locking/replacinwaveform etc.) from TRXs other than TRX1 are allowed. If `OFF`, only TRX1 is allowed to operate multi-pack license, while other TRXs are only able to show the related multi-pack license information.

Remote Command	`:SERVice[:PRODuction]:SOURce:MCONtrol:MPLicense[:STATe] ON | OFF | 1 | 0` `:SERVice[:PRODuction]:SOURce:MCONtrol:MPLicense[:STATe]?`
Example	`:SERV:SOUR:MCON:MPL OFF`

Notes	Only effective in modular-based OBTs, such as EXM
Preset	`OFF`
Range	`ON|OFF`

Header Utilities

If there is currently a waveform selected for playback, this table shows you the header information for the file. You can clear the header information out or edit it and save it.

Dependencies	Only available if there is currently a waveform selected for playback. Grayed-out if no waveform is selected

Clear Header

Lets you clear the header information from the file header associated with the currently selected waveform.

Remote Command	`:SOURce:RADio:ARB:HEADer:CLEar`
Example	`:SOUR:RAD:ARB:HEAD:CLE`
Notes	Attempting to clear the header details via SCPI when no waveform was selected for playback generates an error

Save Header

Lets you save new file header information details to the file.

Remote Command	`:SOURce:RADio:ARB:HEADer:SAVE`
Example	`:SOUR:RAD:ARB:HEAD:SAVE`
Notes	Attempting to save the header details via SCPI when no waveform was selected for playback generates an error

Query Waveform Unique ID (Remote Query Only)

Each Signal Studio waveform contains a unique waveform ID, which is recorded in the header. This command allows you to query the unique waveform ID from the header.

Remote Command	`:MMEMory:HEADer:ID? "<file name>"`

Example	Query the waveform already loaded into the ARB memory:
	`:MMEM:HEAD:ID? "test.wfm"`
	Query the waveform on the hard disk by absolute path:
	`:MMEM:HEAD:ID? "D:\NVARB\test.wfm"`
	Query the waveform on the hard disk by MSUS:
	`:MMEM:HEAD:ID? "NVWFM:test.wfm"`

Notes	The queried waveform file can be in ARB memory, or on hard disk. If you want to query ARB in ARB memory, then give out the file name directly. If want to query ARB on the hard disk, then absolute file path or MSUS should be given along with the file name. The valid MSUS is `NVWFM`, which is mapped to `D:\NVARB` on the hard disk If the file cannot be found in ARB memory or on hard disk, an error is generated and value -1 is returned

Query Selected Waveform Header info (Remote Query Only)

Returns a listing of the current selected ARB header info. If no ARB is selected, then empty string is returned.

Remote Command	`:SOURce:RADio:ARB:HEADer:INFormation?`
Example	`:SOUR:RAD:ARB:HEAD:INF?`
Notes	After each colon of field title string, related header info string is appended The field title string in “Range” part cannot change, for Sequence Studio needs to accurately match those string character to know which header info field it is Below are the abbreviation descriptions:

DESC	Description
SR	Sample Rate
RTS	Run Time Scaling
RMS	Root Mean Square
M1P	Marker 1 Polarity
M2P	Marker 2 Polarity
M3P	Marker 3 Polarity
M4P	Marker 4 Polarity
ALCHR	ALC Hold Routing
RFBR	RF Blank Routing
FOFF	Frequency Offset
AWGNST	AWGN State
AWGNCN	AWGN C/N Ratio

	AWGNCBW	AWGN Carrier Bandwidth
	AWGNNBW	AWGN Noise Bandwidth
	AWGNCRMS	AWGN Carrier RMS
	ORP	DAC Over Range Protection
	UID	Unique ID
	LICSTS	License Status
Range	"DESC:", "SR:", "RTS:", "RMS:", "M1P:", "M2P:", "M3P:", "M4P:", "ALCHR:", "RFBR:", "FOFF:", "AWGNST:", "AWGNCN:", "AWGNCBW:", "AWGNNBW:", "AWGNCRMS:", "ORP:", "UID:", "LICSTS"	

6.1.12 Trigger Initiate

Initiates an immediate trigger event if the trigger source (under ARB Setup) is set to KEY.

Dependencies	Grayed-out unless Trigger Source is set to KEY and an ARB waveform is configured

6.1.13 Source Sync

Accesses a menu for setting up Source Synchronization for multiple models.

Only appears in modular products such as VXT, and only when the instrument is configured for MIMO analysis.

6.1.13.1 Sync Config

Lets you config MIMO type for source.

Grayed-out when Primary and Secondary modules are in Sync State.

Remote Command	:SOURce:SYNC:CONFig NONE | TWO | THRee | FOUR | SIX | EIGHt | DONE | DTWO | DTHR | DFOU See "Option Details" on page 732 :SOURce:SYNC:CONFig?	
Example	:SOUR:SYNC:CONF TWO	
Dependencies	EXM	2x2 and 1x1+1x1 MIMO are supported when license E6640A-M22 is enabled
		2x2 and 3x3 MIMO are supported when license E6640A-M33 is enabled
		2x2, 3x3, 4x4 and 2x2+2x2 MIMO are supported when license E6640A-M44 is enabled

	VXT models M9410A/11A	No-Across chassis MIMO is supported when license M941xA-MMO is enabled
		Across chassis MIMO is supported when license M941xA-MTS is enabled
	VXT models M9415A/16A	No-Across chassis MIMO is supported when license M941xA-MMO is enabled

Range	`NONE|TWO|THRee|FOUR|SIX|EIGHt|DONE|DTWO|DTHR|DFOU`

Option Details

Parameter	SCPI	Notes
None	`NONE`	Sets MIMO Config type as None
2x2	`TWO`	Sets 2x2 as MIMO Config Type. 2 models are configured to Sync
3x3	`THRee`	Sets 3x3 as MIMO Config Type. 3 models are configured to Sync
4x4	`FOUR`	Sets 4x4 as MIMO Config Type. 4 models are configured to Sync
6x6	`SIX`	Sets 6x6 as MIMO Config Type. 6 models are configured to Sync
8x8	`EIGHt`	Sets 8x8 as MIMO Config Type. 8 models are configured to Sync
1x1+1x1	`DONE`	Sets 1x1+1x1 as MIMO Config Type. 2 models are configured to Sync with different center frequency. Use Segment 2 Setup to config the second model
2x2+2x2	`DTWO`	Sets 2x2+2x2 as MIMO Config Type. 2 groups of 2x2 MIMO. First group consists of Primary and TRX1. Second group consists of TRX2 and TRX3. Segment 2 Setup allows you to config the second group
3x3+3x3	`DTHR`	Sets 3x3+3x3 as MIMO Config Type. 2 groups of 3x3 MIMO. First group consists of Primary, TRX1 and TRX2. Second group consists of TRX3, TRX4 and TRX5. Segment 2 Setup allows you to config the second group
4x4+4x4	`DFOU`	Sets 4x4+4x4 as MIMO Config Type. 2 groups of 4x4 MIMO. First group consists of Primary, TRX1, TRX2 and TRX3. Second group consists of TRX4, TRX5, TRX6 and TRX7. Segment 2 Setup allows you to config the second group

6.1.13.2 Sync Type

Grayed-out when models are in Sync State.

Remote Command	`:SOURce:SYNC:TYPE PRIMary | SECondary | OFF`
	For details of parameter options, see "Options" on page 733
	`:SOURce:SYNC:TYPE?`

Example	`:SOUR:SYNC:TYPE PRIM`
Preset	`OFF`
Range	`PRIMary|SECondary|OFF`

Options

Parameter	Notes
OFF	This model is not listed in the Secondary module List
SECondary	Use :SOURce:SYNC:CONNected:NAME? to obtain the Primary's name in Sync State
PRIMary	Sync Setup is only available for Primary

6.1.13.3 Sync Settings

Grayed-out when Primary and Secondary are in Sync State.

Dependencies	Grayed-out when Sync Type is set to OFF or Secondary

Secondary Module List

Lists the parameters of Secondary modules. The Selected checkbox in each row allows you to select the Secondary module when the Sync Type is set to Primary:

- When Sync Config is set to NxN, use this control to enable N-1 Secondary modules
- When Sync Config is set to NxN+NxN, use this control to enable 2N-1 Secondary modules

See "More Information" on page 733

Remote Command	:SOURce:SYNC:REMote:SECondary<integer> ON | OFF | 1 | 0 :SOURce:SYNC:REMote:SEC<integer>?
Example	:SOUR:SYNC:REM:SEC1 ON :SOUR:SYNC:REM:SEC2 OFF
Notes	<integer> Secondary module number in Available Models
Preset	OFF

More Information

Parameter	SCPI Example	Notes
Available Secondary modules	:SOUR:SYNC:REM:SEC:List?	All the available Secondary models are listed
IP Address	:SOUR:SYNC:REM:SEC1:ADDR?	Refer to Remote Chassis to add the IP Address for remote chassis

Parameter	SCPI Example	Notes
		"Local Host" indicates that the Primary and Secondary modules share the same chassis
Slot Number	:SOUR:SYNC:REM:SEC2:SLOT?	Indicates the slot number of available models
Socket Port	:SOUR:SYNC:REM:SEC2:SPOR?	Indicates the socket port of available models
Secondary module Order		Shows you the models to be Secondary devices Use Selected to choose from available Secondary models

Sync Settings

Lets you apply the source settings of the Primary module to its Secondary modules.

Remote Command	:SOURce:SYNC:SETTings:ENABle ON | OFF | 1 | 0 :SOURce:SYNC:SETTings:ENABle?
Example	:SOUR:SYNC:SETT:ENAB ON :SOUR:SYNC:SETT:ENAB?
Notes	When **Sync Settings** is ON, the source settings of **Primary** are applied to **Secondary** modules. The supported settings are: **Amplitude**, **Frequency**, **Trigger Source**, **Trigger Type**, **RF Output**, and waveform-related information When Sync Segment 2 is switched ON, this toggle is set ON simultaneously
Dependencies	Waveform files naming convention: For NxN MIMO: – xxx0.wfm for Primary – xxx[n].wfm for TRX[n] For example, in 3x3 MIMO: – xxx0.wfm for Primary – xxx1.wfm for TRX1 – xxx2.wfm for TRX2 For NxN+NxN MIMO, in the first group: – xxx0_0.wfm for Primary – xxx0_n.wfm for TRX[n] in the second group: – xxx1_n.wfm for TRX[n+N] For example, in 3x3+3x3 MIMO:

	– xxx0_0 for Primary – xxx0_1.wfm for TRX1 – xxx0_2.wfm for TRX2 – xxx1_0.wfm for TRX3 – xxx1_1.wfm for TRX4 xxx1_2.wfm for TRX5
Preset	OFF
Range	ON|OFF

Sync Segment 2

Lets you configure the models in the second group of NxN+NxN MIMO.

Remote Command	:SOURce:SYNC:SETTings:SEGMent2:ENABle ON | OFF | 1 | 0 :SOURce:SYNC:SETTings:SEGMent2:ENABle?
Example	:SOUR:SYNC:SETT:SEGM2:ENAB ON :SOUR:SYNC:SETT:SEGM2:ENAB?
Notes	Only **Frequency** in settings is supported
Dependencies	When this setting is ON, **Sync Settings** will be turned on accordingly
Preset	OFF
Range	ON|OFF

Segment 2 Frequency

When **Sync Segment 2** is ON, lets you set the frequency of models in the second group of NxN+NxN MIMO.

Remote Command	:SOURce:SYNC:SETTings:SEGMent2:FREQuency <freq> :SOURce:SYNC:SETTings:SEGMent2:FREQuency?
Example	:SOUR:SYNC:SETT:SEGM2:FREQ 1.00 GHz :SOUR:SYNC:SETT:SEGM2:FREQ?
Preset	1.00 GHz
Min	VXT models M9410A/11A/15A/16A: 380 MHz
Max	Hardware Dependent VXT models M9410A/11A/15A/16A: – Option F06 = 6.0 GHz

IP Address

Sets up the controller's IP address for Remote Secondary models.

Remote Command	`:SOURce:SYNC:REMote:ADDRess <string>`
Example	`:SOUR:SYNC:REM:ADDR "192.168.1.2"`
Notes	`<string>` - IP Address

SCPI Socket Port

Sets up the controller's SCPI socket port for Remote Secondary models.

Remote Command	`:SOURce:SYNC:REMote:IPPort <integer>`
Example	`:SOUR:SYNC:REM:IPP 5025`
Notes	`<integer>` - Port

Add Secondary Module

Lets you connect to the remote chassis specified by IP Address and Socket Port.

Remote Command	`:SOURce:SYNC:REMote:ADDRess:ADD`
Example	`:SOUR:SYNC:REM:ADDR:ADD`

Notes	Example of how to add a remote chassis:
	`:SOUR:SYNC:REM:ADDR "192.168.1.2"`
	`:SOUR:SYNC:REM:IPP 5025`
	`:SOUR:SYNC:REM:ADDR:ADD`
	Once a remote chassis is connected, the "Secondary Module List" on page 733 shows you the available Secondary modules

Delete Secondary Module

Lets you delete a selected remote chassis IP Address from the "Secondary Module List" on page 733 .

Remote Command	`:SOURce:SYNC:REMote:ADDRess:DELete`
Example	`:SOUR:SYNC:REM:ADDR:DEL`
Notes	Example of how to delete a remote chassis: `:SOUR:SYNC:REM:ADDR "192.168.1.2"`

	:SOUR:SYNC:REM:ADDR:DEL

Sync Runtime Settings (Remote Command Only)

Lets you Sync runtime settings to the Secondary modules without restarting Sync.

Remote Command	:SOURce:SYNC:RTSetting:STATe ON | OFF | 1 | 0 :SOURce:SYNC:RTSetting:STATe?
Example	:SOUR:SYNC:RTS:STAT ON :SOUR:SYNC:RTS:STAT?
Notes	When OFF, Sync is interrupted when changing frequency or power settings on the Primary module. After applying the new settings to the Secondary modules, Sync will restart When ON, setting changes on the Primary module are applied to the Secondary modules immediately without interrupting Sync status. This is the default behavior. The supported settings are Amplitude and Frequency
Preset	ON
Range	ON|OFF

6.1.13.4 Sync Start

Lets you start synchronizing Primary and Secondary modules to play Arb synchronously.

When the Sync connection is built successfully, Primary and Secondary modules are in the Sync State.

Sync Start and Sync Config are grayed-out when Primary and Secondary modules are in Sync State.

Remote Command	:SOURce:SYNC:STARt
Example	:SOUR:SYNC:STAR
Notes	If you change the source settings during Sync State, an error message appears in the status bar: "Settings conflict; Sync connection is already established" and the change will not be applied until Sync Stop

6.1.13.5 Sync Stop

Stops the synchronization.

When Sync Stops, Sync Config menu and Sync Start will be available.

Remote Command	:SOURce:SYNC:STOP
Example	:SOUR:SYNC:STOP

6.1.13.6 Sync Connected (Remote Query Only)

Lets you query the state of synchronization.

Remote Command	`:SOURce:SYNC:CONNected?`
Example	`:SOUR:SYNC:CONN?` Returns: 1 when synchronization is established, 0 when synchronization is stopped

6.1.14 Source Preset

Lets you preset the source settings to their default values.

Remote Command	`:SOURce:PRESet`
Example	`:SOUR:PRES`

6.2 Input

The controls on this tab let you select and configure the instrument's inputs.

6.2.1 Select Input

Lets you choose which signal input you want to analyze:

- "RF Input" on page 741
- "External Mixer" on page 741
- "I/Q" on page 745

See also:

- "External Mixer Setup" on page 768
- "I/Q Setup" on page 788

Remote Command	`[:SENSe]:FEED RF | AIQ | EMIXer` `[:SENSe]:FEED?`

Example	Select the RF Input:
	`:FEED RF`
	Select External Mixing:
	`:FEED EMIX`
	Select BBIQ:
	`:FEED AIQ`

Dependencies	I/Q only appears when Option BBA present Ext Mix only appears when Option EXM present
Couplings	Connecting a U7227A USB Preamplifier to one of the instrument's USB ports causes the Input to automatically switch to the RF Input. If the RF Calibrator is on, it is turned off. Subsequently disconnecting the USB Preamp from USB does not change the Input selection, nor restore the previous selection `[:SENSe]:FEED RF` turns the calibrator `OFF`
Preset	Unaffected by Preset or power cycle. Survives **Mode Preset** and Mode changes Set to `RF` by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state
Annotation	Displayed in the Meas Bar as "Input:" followed by: RF or Ext Mix or I/Q depending on which input is selected

	REF appears when Cal Source is other than None or when RF Calibrator is other than Off

Backwards Compatibility SCPI	`[:SENSe]:FEED AREFerence`
	In the PSA the calibrator was one of the inputs and selected using the AREF parameter to the same :FEED command that switched the inputs. In the X-Series, it is controlled in a separate menu and overrides the input selection. For code compatibility, `[:SENSe]:FEED AREFerence` is provided, and is aliased to `[SENSe]:FEED:AREF REF50`, which causes the input to be switched to the 50 MHz calibrator. `[:SENSe]:FEED RF` switches the input back to the RF port and turns the calibrator `OFF`, thus providing full compatibility with the PSA calibrator function
	Note that after sending this, `[:SENSe]:FEED?` does *not* return "AREF" but instead the currently selected input:
	`[:SENSe]:FEED IQ|IONLy|QONLy`
	`[:SENSe]:FEED?`
	The parameters `IQ | IONLy | QONLy` are supported for backwards compatibility with E4406A
	`[:SENSe]:FEED IQ` aliases to `[:SENSe]:FEED: IQ:TYPE IQ`
	`[:SENSe]:FEED IONLy` aliases to `[:SENSe]:FEED:IQ:TYPE IONLy`
	`[:SENSe]:FEED QONLy` aliases to `[:SENSe]:FEED:IQ:TYPE QONLy`
	`[:SENSe]:FEED?` always returns `AIQ`, whatever type of legacy parameter `IQ | IONLy | QONLy` has been used

Backwards Compatibility Notes	Most of the settings in the X-Series Input/Output system, including External Gain, Amplitude Corrections settings and data, etc., are shared by all modes and are not changed by a mode switch. Furthermore, most variables under the **Input/Output** menu are not affected by Mode Preset. Both of these behaviors represent a departure from legacy behavior In X-Series. Input/Output settings are reset by using **Restore Input/Output Defaults**. They can also be reset to their default values by **System**->**Restore System Defaults**-> **In/Out Config**, or by **System** ->**Restore System Defaults** -> **All** (and corresponding SCPI) While this matches most use cases better, it does create some code compatibility issues. For example, Amplitude Corrections are no longer turned off by Mode Preset, but instead by **Restore Input/Output Defaults** Although Input/Output settings are not part of each Mode's State, they are saved in Save State files, so that all of the instrument settings can be recalled with **Recall**, **State**, as in legacy instruments
Notes	In legacy analyzers, you chose between the Internal mixer or an External Mixer. In X-Series, the External Mixer is one of the choices for the Input and is selected using the `FEED` command (`:SENSe:FEED EXTMixer`) For compatibility, the `:INPut:MIXer EXTernal|INTernal` legacy command is mapped as follows: 1. When `:INPut:MIXer EXTernal` is received, `:SENSe:FEED EMIXer` is executed 2. When `:INPut:MIXer INTernal` is received, `:SENSe:FEED RF` is executed 3. When `:INPut:MIXer?` is received, the response is `INT` if any input other than the external mixer is selected, and `EXT` if the external mixer is selected
Preset	`INT`

Backwards Compatibility SCPI	`:INPut:MIXer EXTernal|INTernal` `:INPut:MIXer?`
Backwards Compatibility SCPI Example	`:INP:MIX INT` `:INP:MIX?`

Backwards Compatibility Notes	PSA supports the following SCPI Command:
	`:INPut:MIXer:TYPE PRESelected | UNPReselect`
	`:INPut:MIXer:TYPE?`
	PXA does not support the `:INPut:MIXer:TYPE` command

RF Input

Selects the front-panel RF input port to be the instrument signal input. If RF is already selected, pressing this key accesses the RF input setup functions.

External Mixer

Lets you select an External Mixer through which to apply signal input to the instrument. When selected, the LO/IF port becomes the input to the instrument.

External Mixing requires option EXM. The External Mixer key will not appear unless option EXM is installed. The presence of the LO/IF connector alone does not indicate that you have Option EXM licensed. To verify that option EXM is installed, press System, Show, System.

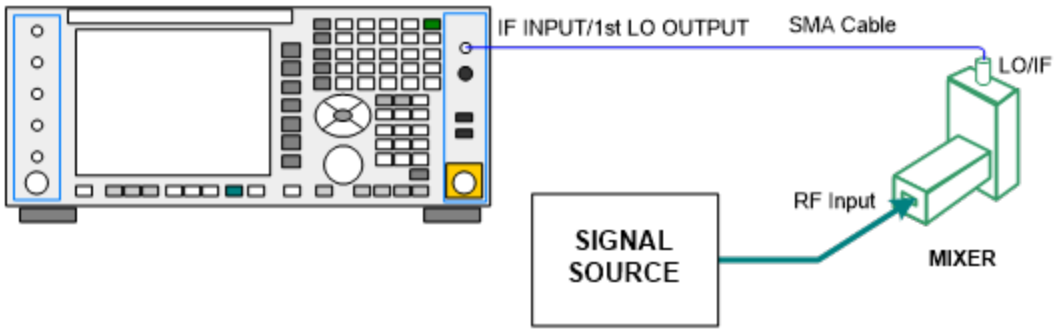
When External Mixer is selected, the Center Freq key controls the setting of the Center Freq in external mixing, which is separate from the settings of Center Freq for the RF Input or BBIQ. Each input retains its unique settings for Center Freq. A unique SCPI command is provided solely for the external mixing Center Freq (see the Center Freq key description), which only affects the External Mixer CF, although sending the generic Center Freq command while External Mixer is selected also controls the External Mixer CF.

Unless option EXM is present, the External Mixer key is blanked, and all SCPI commands associated with menus accessed by this key return an error.

Manual FFT mode is available with external mixing, but not with Signal ID.

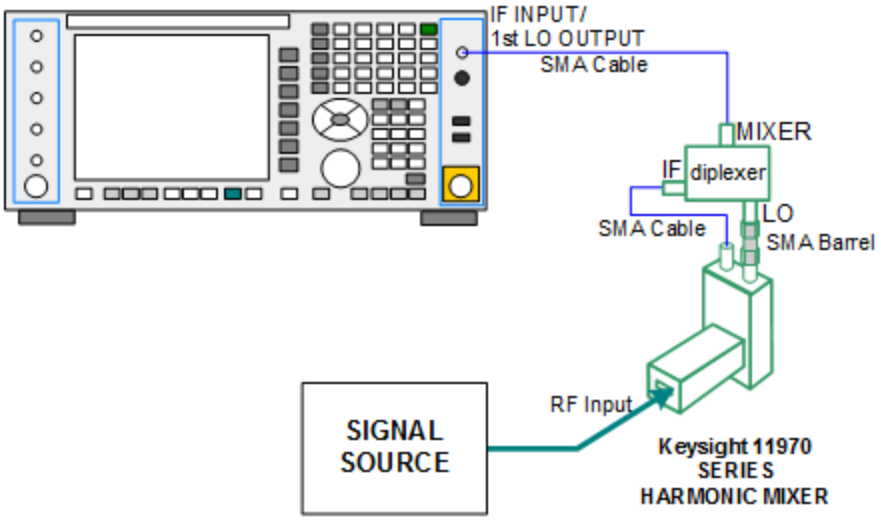
All settings under this key, and all Frequency settings, are remembered when you go out of External Mixer, so that when External Mixer is chosen again, all the external mixer functions will retain their previous settings, with the exception of Signal ID which is set to OFF (Signal ID is also set to Off unless External Mixer is the selected Input). Note that this differs from ESA and PSA, in which all external mixer settings including Center Frequency are lost when you turn off External Mixing or Preset the instrument.

X-series instruments have a combined LO Out/IF In connection, whereas earlier instruments used separate ports for the LO Out and the IF in. Internal diplexers in the instrument and the mixer simplify the connection for users – only a single SMA cable is required.



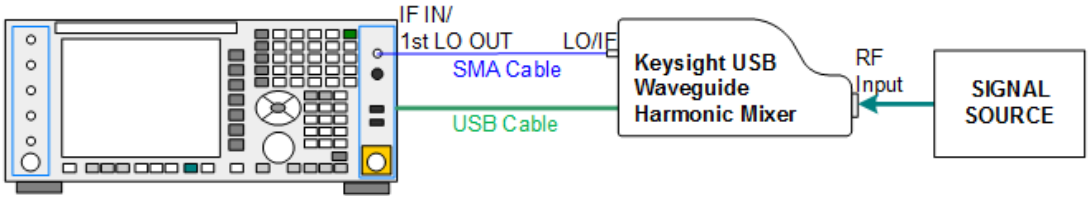
Legacy HP/Agilent and some third-party mixers have separate LO In and IF out connections. This requires you to use an external diplexer to connect these mixers. A diplexer can easily be purchased for this purpose (for example, Diplexer Model # DPL.26 or # DPL.313B from OML Inc., Morgan Hill, California, USA).

The connection diagram for such a legacy mixer is:



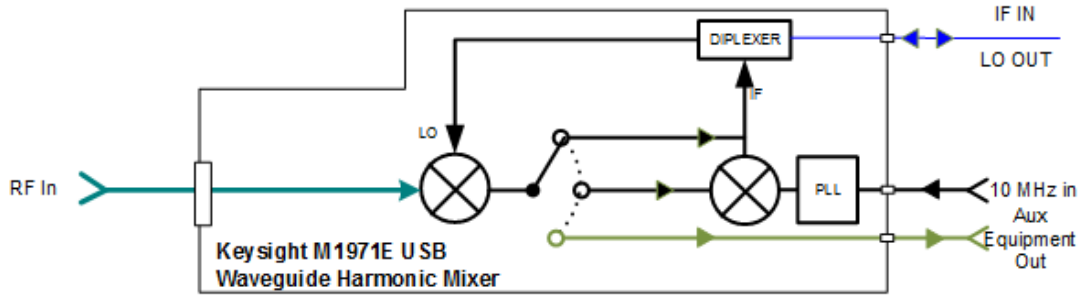
In addition, External Mixing in the X-Series supports the new Keysight M1970 series of Harmonic Mixers, which provide a USB connection for download of calibration data and additional control.

The connection diagram for one of the Keysight USB mixers is:

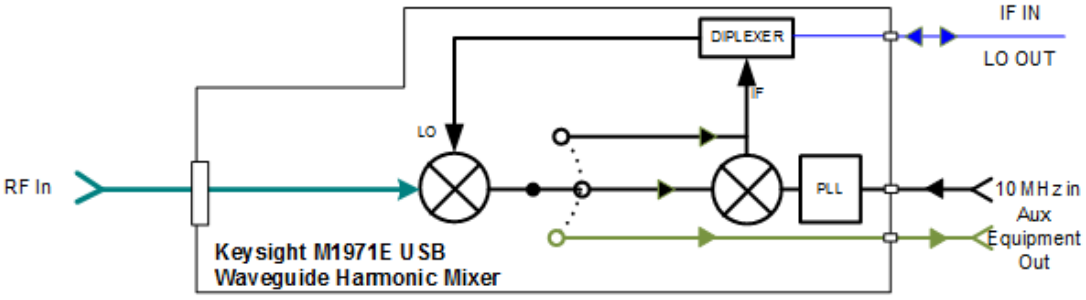


Also available in the M197x series are the M1971 series USB Mixers, which provide additional inputs and outputs for special functionality as described below. These mixers have multiple signal paths which allow them to function in three different states:

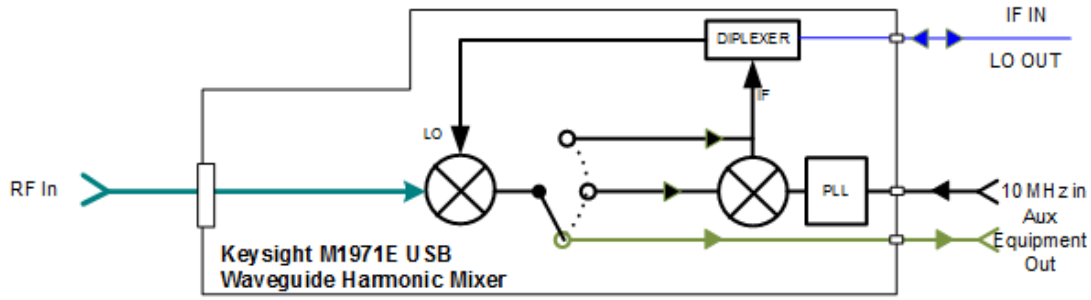
- Normal, in which the mixer functions as a classic external mixer with a single conversion:



- Dual Conversion, which gives you a wider image-free range. In Dual Conversion, the first conversion is to a higher IF frequency and you provide a 10 MHz signal to which an internal PLL is locked, to effect a second downconversion:



- Aux Equipment, wherein the first mixer output drives an output connector on the mixer and the instrument is out of the circuit:



External Mixing is only supported in certain Modes and Measurements in the X-Series, as shown in the table below. When External Mixer is selected in a measurement that does not support it, the "No result; Meas invalid with Ext Mixing" error condition occurs:

Mode	Measurements	Sig ID (Image Suppress only)
Spectrum Analyzer	Swept SA	Y*
	TOI	Y
	Harmonics	N
	Spurious Emissions	Y
	Channel Power	Y
	Occupied BW	Y
	ACP	Y
	Spectrum Emissions Mask	Y
	CCDF	N
	Burst Power	N
	List Sweep	N
Phase Noise	Monitor Spectrum	Y
	Log Plot	Y
	Spot Frequency	N
	Waveform	N
I/Q Analyzer	Complex Spectrum	N
	Waveform	N
Vector Signal Analyzer	Vector Analysis	N
	Analog Demod	N
	Digital Demod	N
Analog Demod	AM	N
	FM	N
	PM	N
	FM Stereo	N

* the Swept SA measurement also supports Image Shift

I/Q

Selects the front-panel I/Q input ports to be the instrument signal input. If I/Q is already selected, pressing this key accesses the I/Q setup menu.

The Baseband I/Q functionality is a hardware option. It is option BBA. If the option is not installed, none of the I/Q functionality is enabled.

The Baseband I/Q has four input ports and one output port. The input ports are I, I-bar, Q, and Q-bar. The I and I-bar together compose the I channel, and the Q and Q-bar together compose the Q channel. Each channel has two modes of operation, Single-Ended (also called "unbalanced") and Differential Input (also called "balanced"). When in Single-Ended operation, only the main port (I or Q) is used, and the complementary port (I-bar or Q-bar) is ignored. When in Differential Input mode, both main and complementary ports are used.

The input settings (range, attenuation, skew, impedance, external gain) apply to the channels, not the individual ports.

The system supports a variety of 1 MΩ input passive probes as well as the Keysight 113x Series active differential probes using the Infinimax probe interface.

The Keysight 113x Series active probes can be used for both single ended and differential measurements. In either case a single connection is made for each channel (on either the I or Q input). The input is automatically configured to 50 Ω single ended and the probe power is supplied through the Infinimax interface. The probe can be configured for a variety of input coupling and low frequency rejection modes. In addition, a wide range of offset voltages and probe attenuation accessories are supported at the probe interface. The active probe has the advantage that it does not significantly load the circuit under test, even with unity gain probing.

With passive 1 MΩ probes, the probe will introduce a capacitive load on the circuit, unless higher attenuation is used at the probe interface. Higher attenuation reduces the signal level and degrades the signal-to-noise-ratio of the measurement. Passive probes are available with a variety of attenuation values for a moderate cost. Most Keysight passive probes can be automatically identified by the system, setting the input impedance setting required as well as the nominal attenuation. For single-ended measurements a single probe is used for each channel. Other passive probes can be used, with the attenuation and impedance settings configured manually.

For full differential measurements, the system supports probes on each of the four inputs. The attenuation of the probes should be the same for good common mode rejection and channel match.

Both active and passive probes in single ended and differential configurations can be calibrated. This calibration uses the Cal Out BNC connection and a probe

connection accessory. The calibration achieves excellent absolute gain flatness in a probed measurement. It matches both the gain and frequency response of the I and Q channels as well as any delay skew, resulting in high accuracy in derived measurements such as Error Vector Magnitude (EVM).

When a probe is connected a status message will be displayed. The message will indicate if calibration data is available or not. Calibration data is saved for each type of probe (including "none") for each port and will be reapplied whenever that type of probe is re-connected to the same port. For probes with EEPROM identification, the calibration data will be stored based on the unique probe identifier and will reapply data for that particular probe if it is available. The data will not follow a probe from one port to another. For probes without EEPROM identification, the instrument cannot distinguish between different probes of the same type, and it will use the data from the last calibration for that probe type on that port.

When in differential mode, both the main and complementary probes are expected to be of the same type.

In some situations, the I and Q channels should be configured identically. In other situations, it is convenient to control them independently. Some menus have a "Q Same as I" setting that will cause the Q channel configuration to mirror the I channel configuration, avoiding the overhead of double data entry when the channels should be the same.

The output port is for calibrating the I/Q input ports, although it can also be manually controlled.

There are two types of calibrations available: cable calibration and probe calibration. The cable calibration will guide the user through connecting each input port in turn. All ports must be calibrated together. The probe calibration is done for a specific channel (I or Q). If in Single-Ended mode, only the main port is calibrated. When in Differential Input mode, the user is guided through calibrating both main and complementary ports.

The front panel I/Q port LEDs indicate the current state of that port. On (green) indicates it is active, and off (dark) indicates it is not in use. For example, the Cal Out port LED is on if and only if there is signal coming out of that port.

The input is a context, and some parameters have separate values for each context. The SCPI for these parameters has an optional "[:RF|IQ]" node. If the specific context is omitted, the command acts on the current input context's value. Here are the parameters that are input context sensitive:

- Center Frequency
- Trigger Source

It is important to distinguish between the I and Q input ports and the displayed I and Q data values. The I and Q input ports feed into a digital receiver that does digital

tuning and filtering. The I and Q data seen by the user (either on the display or through SCPI) corresponds to the real ("I") and the imaginary ("Q") output from the digital receiver. When the input path is I+jQ or I Only and the center frequency is 0 Hz the I input ends up in as the real output from the receiver and appears as "I" data. Likewise, when the input path is I+jQ and the center frequency is 0 Hz, the Q input ends up as the imaginary output from the receiver and appears as "Q" data. However, when the input path is Q Only, the Q input is sent to the receiver as Q+j0, so the receiver output has the Q input coming out on the real output, and so in Q Only, the signal from the Q input port appears as the "I" data. Another situation where the I and Q data do not necessarily correspond directly to the I and Q inputs is when the center frequency is non-zero. The digital processing involved in the tuning is a complex operation. This will result in I Only data appearing as both "I" and "Q" data, the same as that signal would appear if seen through the RF input port.

BBIQ is only supported in certain Modes and Measurements in the X-Series. When I/Q is selected in a measurement that does not support it, the “No Result; Meas invalid with I/Q inputs” message appears. This is error 135

Baseband I/Q Remote Language Compatibility

For the Agilent E4406A VSA Series Transmitter Tester, Option B7C provided baseband I/Q inputs. Code compatibility has been provided to allow many of the commands for Option B7C to function properly with X-Series. X-Series has hardware differences and additional capabilities (for example, E4406A does not have independent settings of I & Q, nor does it provide for probe calibrations), which make 100% compatibility impossible.

The following commands are supported:

```
:CALibration:IQ:FLATness
```

```
:INPut:IMPedance:IQ U50 | B50 | U1M | B1M
```

```
:INPut:IMPedance:REFerence <integer>
```

`[:SENSe]:FEED RF|IQ|IONLy|QONLy|AREFerence|IFALign` supports all parameters except `IFALign`. The `FEED?` query returns only `RF|AIQ|AREF`.

The following commands are not supported:

```
:CALibration:GIQ
```

```
:CALibration:IQ:CMR
```

```
:INPut:IQ:ALIGn OFF | ON | 0 | 1
```

The Rohde & Schwarz FSQ-B71 also provides baseband I/Q inputs. A certain amount of code compatibility is provided in X-Series, but hardware differences make this a somewhat limited set.

Supported:

The "<1|2>" is supported as "[1]".

```
INPut<1|2>:IQ:BALanced[:STATe] ON | OFF
INPut<1|2>:IQ:TYPE I | Q | IQ
INPut<1|2>:IQ:IMPedance LOW | HIGH
```

Not Supported:

```
DIAGnostic<1|2>:SERVice:IQ:CALibration:DC 0 | 0.1 | 0.178 | 0.316 | 0.562 | 1.0
DIAGnostic<1|2>:SERVice:IQ:CALibration:DESTination IHIGh | ILOW | QHIGh | QLOW
DIAGnostic<1|2>:SERVice:IQ:CALibration:PULSe: PRATe 10 kHz | … | 4 MHz
DIAGnostic<1|2>:SERVice:IQ:INPut IQ | GND | CALDc | CALPulse
INPut<1|2>:SELect AIQ | RF
TRACe<1|2>:IQ:DATA:FORMat COMPatible | IQBLock | IQPair>
TRACe<1|2>:IQ:DATA:MEMory? <offset samples>,<# of samples>
TRACe<1|2>:IQ:DATA?
TRACe<1|2>:IQ:SET <filter type>,<rbw>,<sample rate>,<trigger source>,<trigger
slope>, <pretrigger samples>, <# of samples>
TRACe<1|2>:IQ:SRATe 10.0kHz to 81.6MHz
TRACe<1|2>:IQ[:STATe] ON | OFF
```

The Rohde & Schwarz FMU has the following SCPI, which is *not* supported (these commands start/abort the probe calibration procedure, which is manually interactive from the front panel):

```
CALibration:ABORt
CALibration:PROBe[:STARt]
```

6.2.2 RF Input Port

Specifies the RF input port used. For instruments including multiple RF Input port listed below, only appears on units with multiple RF inputs, and lets you switch between the inputs.

Instruments that include multiple RF Input ports include:

- N9041B, N9042B
- N9000B (CXA)
- N9048B (PXE)
- VXT, M941xE and EXM
- M8920A/20B

- E7760B
- SA6210A

For the 5GNR Modulation Analysis measurement in SA6210A Opt 002 Two Ports, only appears when Port Config is Single and lets you switch between the inputs. Otherwise, the setting is hidden.

NOTE **Switching input ports may change the receiver performance of the instrument.**

See "Instruments with 2 Inputs" on page 750

Remote Command	`[:SENSe]:FEED[:RF]:PORT[:INPut] <port>`
	For instrument-specific definitions of `<port>`, see:
	"Parameters for EXT, EXF and EXM Wireless Test Sets" on page 751
	"Parameters for VXT M9410A/11A/15A16A, M9410E/11E/15E/16E and M9420A Vector Transceivers" on page 751
	"Parameters for VXT M9410A/11A/15A/16A and EXM when used with Radio Heads/CIU" on page 752
	"Parameters for E7760B Wideband Transceiver" on page 755
	"Parameters for M8920A/20B Radio Test Set" on page 757
	"Parameters for UXM Wireless Test Set" on page 757
	"Parameters for N9040B, 41B, 42B/N9030B, 32B/N9020B, 21B/N9010B/N9000B/N9038B/N9048B/N8973B, 74B, 75B, 76B" on page 757
	"Parameters for SA6210A" on page 758
	`[:SENSe]:FEED[:RF]:PORT[:INPut]?`

Example	Use the port labeled RF Input when the selected input is RF:
	`:FEED:RF:PORT RFIN`
	Use the port labeled RF Input 2 when the selected input is RF:
	`:FEED:RF:PORT RFIN2`

Notes	The control label is Input Port in SA6210A For other models, the label is RF Input Port
Dependencies	Only appears when RF Input is selected as the Input Only appears when RF is selected in Select Input on the legacy models that support multiple inputs. If the SCPI command is sent with unsupported parameters in any other model, an error is generated, -221, “Settings conflict; option not installed” When any input is selected in a measurement that does not support it, the "No result; Meas invalid with this input" error condition occurs, and the measurement returns invalid data when queried
Couplings	When switching between inputs, you may find the new input has a different frequency range than the current input. This means the frequency at the new input may be limited, depending on where you were tuned When you switch from an input whose maximum frequency is greater than the input to which you are switching:

	1. If the current Stop Freq is below the Max Freq for the new input, then neither Stop Freq or Start Freq needs to change 2. But if the current Stop Freq is above the Max Freq for the new input, Stop Freq must change; so, it is set to the Max Freq for the new input 3. If the Stop Freq is forced to change then, if possible, the Span is preserved with the new Stop Freq; however, the Start Freq can't go below zero Example: Input 2 has a Max Freq of 110 GHz and Input 1 has a Max Freq of 52 GHz Case 1: Input 2 is selected and Start Freq=40 GHz, Stop Freq=60 GHz. Change to Input 1. Stop Freq changes to 52 GHz so, to preserve Span, Start Freq is set to 32 GHz Case 2: Input 2 is selected and Start Freq=40 GHz, Stop Freq=110 GHz. Change to Input 1. Stop Freq changes to 52 GHz. Span was 70 GHz, but new Span maximum is 52 GHz so Start Freq is set to 0 Hz Case 3: Input 2 is selected and Start Freq=10 GHz, Stop Freq=20 GHz. Change to Input 1. No change is necessary, Start Freq and Stop Freq don't change
Preset	Unaffected by Mode Preset, but set to `RFIN` on **Restore Input/Output Defaults** or **Restore System Defaults -> All**, unless noted in the platform-specific sections below
State Saved	Saved in instrument state
Annotation	Annotation in the Meas Bar reads as follows: When input is RF In: Input: RF When input is RF In 2: Input: RF2

Backwards Compatibility SCPI	`:INPut<1|2>:TYPE INPUT1 | INPUT2`
	`:INPut<1|2>:TYPE?`
	Included for R&S ESU compatibility. In MXE, the INPUT1 parameter is aliased to RFIN and the INPUT2 parameter is aliased to RFIN2

Instruments with 2 Inputs

In models with two inputs, the second input usually has a different maximum frequency than the first input. For your convenience, the actual "Max Freq" value is allowed to go slightly higher than the nominal Max Freq for the second input, just as is the case with the first input.

Model	Nominal Input 2 Max Freq	Absolute Input 2 Max Freq	Transition rule for switching from Input 1 to Input 2
N9038A	1 GHz	1.000025 GHz	If Stop Freq is above 1.000025 GHz, it is set to 1.000025 GHz, otherwise it does not change If Start Freq is above 1.000024990 Hz, Start Freq is set to 1.000024990 Hz and Span to 10 Hz, otherwise nothing changes
N9000A with option C75	1.5 GHz	1.58 GHz	If Stop Freq is above 1.58 GHz, it is set to 1.58 GHz, otherwise it does not change If Start Freq is above 1.579999990 GHz, Start Freq is set to

Model	Nominal Input 2 Max Freq	Absolute Input 2 Max Freq	Transition rule for switching from Input 1 to Input 2
			1.579999990 GHz and Span to 10 Hz, otherwise nothing changes

Parameters for EXT, EXF and EXM Wireless Test Sets

<port>	Input
RFIO1	RFIO 1
RFIO2	RFIO 2
RFIO3	RF3 I|O
RFIO4	RF4 I|O

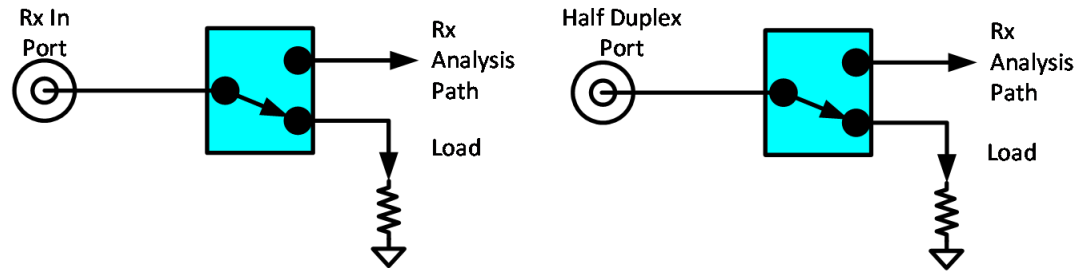
See also "Parameters for VXT M9410A/11A/15A/16A and EXM when used with Radio Heads/CIU" on page 752

Example	Set the RF input to RFIO 1: `:FEED:RF:PORT RFIO1`
Dependencies	In EXF, or in EXM with hardware M9430A, if RF Input is selected as RF Input Port, you need to choose the settings in the Half Duplex Config menu to determine which port (RFIO3 or RFIO4) will be used In EXM with hardware M9431A, this setting is not supported. If the SCPI command is sent with this setting, an error is generated, -221, "Settings conflict; option not installed"
Preset	RFIO1
Annotation	Annotation in the Meas Bar reads as follows: – When input is RFIO1: Input: RFIO1 – When input is RFIO2: Input: RFIO2 – When input is RFIO3: Input: RFIO3 – When input is RFIO4: Input: RFIO4

Parameters for VXT M9410A/11A/15A16A, M9410E/11E/15E/16E and M9420A Vector Transceivers

<port>	Input
RFIN	RF Input
RFFD	RFIO FD
RFHD	RFIO HD, Half Duplex

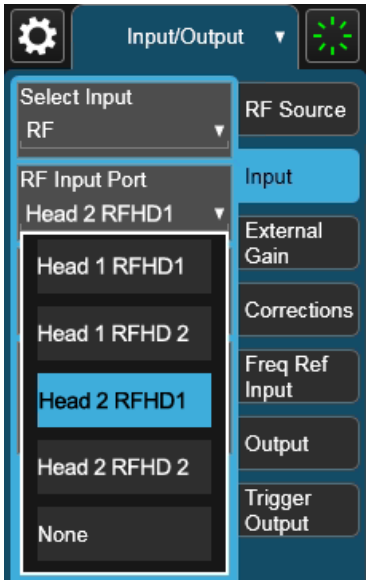
Example	`:FEED:RF:PORT RFIN`
	`:FEED:RF:PORT RFFD`
	`:FEED:RF:PORT RFHD`

	`:FEED:RF:PORT NONE`
Notes	`RFIN` sets the RF input to be the RF Input port, labeled RF Input `RFFD` sets the RF input to be the full duplex port, labeled RFIO FD. Note that Option "FDX" is required to enable this port `RFHD` sets the RF input to be the half duplex port, labeled Half Duplex (M9410A/11A/15A/16A) or RFIO HD (M9420A) M9410E/11E/15E/16E also has HD port, which is the HD port on M9471A module `NONE` sets the RF In port and Half Duplex port (if HD Port is not set to RF Output) to connect to 50Ω load, as shown below:  When using Source only, set RF Input to `NONE` to provide better isolation. When the input port is set to `NONE`, an error appears in the status area: 
Dependencies	Option HDX is required to enable the Half Duplex (RFIO HD) port You cannot set this port to be the input if it is already set to be the output. Attempting to do so generates error message: "-221, Settings conflict; RF Input cannot be set to RFIO HD when RF Output is RFIO HD" `NONE` is not available in VXT model M9420A
Preset	`RFIN`
Annotation	Annotation in the Meas Bar reads as follows: When input is RF Input: Input: RF When input is RFIO FD: Input: RFFD When input is RFIO HD or Half Duplex: Input: RFHD When input is None: Input: NONE

Parameters for VXT M9410A/11A/15A/16A and EXM when used with Radio Heads/CIU

<port>	Input
`RRH`*h*`RFHD`*p*	Head *h*, RF Tx/Rx *p*, for example `RRH1RFHD2` = Head 1, RF Tx/Rx 2
`IFIN`*n*	DUT IF IN for Channel *n*, for example `IFIN1` = DUT IF IN for Channel 1
`IFHD`*n*	DUT IF In/Out for Channel *n*, for example `IFHD1` = DUT IF In/Out for Channel 1

When using a Remote Radio Head (RRH), such as the Keysight M1740A mmWave Transceiver for 5G, with the VXT or EXM, the choices in the dropdown are dependent on which heads are installed. For example, in the case where two M1740As are present, each with two ports, the dropdown will look like this:

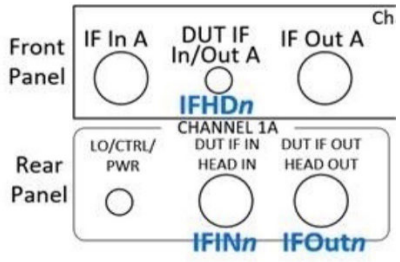


Note the inclusion of the None choice, which allows the input port to become unassigned, and thus allows any Output port to be assigned without concern about an Input port conflict. When the input port is unassigned, an error appears in the status area:



The user interface parameter RFHD p corresponds to the port labeled RF Tx/Rx p; for example, RFHD 2 means the port labeled RF Tx/Rx 2 on the M1740A.

When using a E7770A Common Interface Unit, you may make connections to the half-duplex port on the front of the CIU labeled DUT IF In/Out, and/or to ports on the rear of the CIU labeled DUT IF IN and DUT IF OUT. For example, if your DUT has an IF Output you will usually connect it to one of the DUT IF IN ports on the rear panel of the CIU. The user interface parameter IFIN n corresponds to the DUT IF IN port for Channel n on the CIU, so you would choose IFIN 1 in the dropdown to connect to the DUT IF IN port for Channel 1, and the corresponding SCPI parameter would be IFIN1. See the figure below:

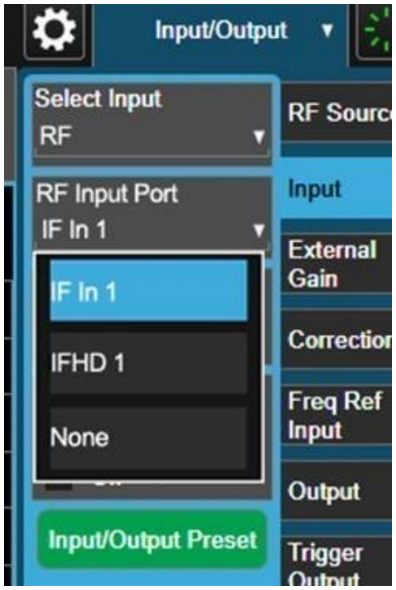


The following table lists the GUI parameter for each input or output on the CIU, and the SCPI parameter for the RF Input Port command (`[:SENSe]:FEED[:RF]:PORT[:INPut]`) and the RF Output Port command (`[:SENSe]:FEED:RF:PORT:OUTPut`):

Port	Port name on CIU	Name displayed in GUI	SCPI parameter for RF Input Port and Output Port commands
IF input port	DUT IF IN	IF In n	`IFINn`, for example `IFIN1`
IF output port	DUT IF OUT	IF Out n	`IFOutn`, for example `IFO1`
IF port, half duplex	DUT IF In/Out	IFHD n	`IFHDn`, for example, `IFHD1`

NOTE **The value of n for each port, in the multiple-port use case, may vary according to your system configuration. For the value of n for your use case, consult the Startup Guide for your particular system (for example S9100A).**

An example of the GUI for the CIU ports appears below:



Example	Set the RF input to be the port labeled RF Tx/Rx 2 on Head 1:
	`:FEED:RF:PORT RRH1RFHD2`
	Set the RF input to be the Channel 1 port labeled DUT IF IN on the CIU:
	`:FEED:RF:PORT IFIN1`

Notes	Parameter `RRHhRFHDp` corresponds to **Head h**, port **RF Tx/Rx p**; for example, `RRH1RFHD2` = the port labeled **RF Tx/Rx 2** on **Head 1** For the CIU, the parameter `IFINc` corresponds to the **DUT IF IN** for channel c. For example, IFIN1 would connect to the **DUT IF IN** port for Channel 1
Dependencies	The Radio Head and CIU parameters only appear when a Remote Radio Head or CIU is connected to the instrument. If these parameters are sent at any other time, an error is generated, "-221, Settings conflict; option not installed"
Preset	`RRH1RFHD1`
Annotation	Annotation in the Meas Bar reads as follows: Input:Hd *h* RFHD *p* For example, in the case above, with RFHD 2 on Head 1 selected: Input:Hd 1 RFHD 1 When using the CIU: – When input is IFIN1: Input: IFIN 1 – When input is IFIN2: Input: IFIN 2 – When input is IFIN3: Input: IFIN 3 – When input is IFIN4: Input: IFIN 4

Backwards Compatibility SCPI	`:FEED:RF:PORT A1`
	A1 is treated as RRH1RFHD1 and sets the RF input to be the port labeled RF Tx/Rx 1 on Head 1
	`:FEED:RF:PORT B1`
	B1 is treated as RRH1RFHD2 and sets the RF input to be the port labeled RF Tx/Rx 2 on Head 1
	`:FEED:RF:PORT IFIO2`
	IFIO2 is treated as IFIN1, and sets the IF input to be the port labeled "DUT IF In/Out" on the CIU rear panel

Parameters for E7760B Wideband Transceiver

<port>	Input
A*n*	Bank A, Channel *n*, for example `A1`
B*n*	Bank B, Channel *n*, for example `B1`
IFIO*n*	IF In/Out for Channel *n*, for example `IFIO1`

Example	Set the RF input to `A1`: `:FEED:RF:PORT A1`

	Set the RF input to `B3`:
	`:FEED:RF:PORT B3`
	Set the RF input to `IFIO1`:
	`:FEED:RF:PORT IFIO1`

Dependencies	Ports `A1`, `A2`, `A3`, `B1`, `B2`, and `B3` are available if Option RF3 is installed. Ports `IFIO1` and `IFIO2` are available if option RF2 is installed Note that for E7760B: – Attempting to select a port for which the option is not present will generate the error, -241, "Hardware missing; Input not available" – A port cannot be selected as an Input while it is occupied as an Output. Sending such a command while the port is occupied generates error: -221, "Settings conflict; Input Port is not available while occupied by Output" – The mmWave ports are divided into two banks; the A Bank and the B Bank. A port cannot be selected as an Input if any port on the same bank is occupied as an Output. Sending a command for this situation generates error: -221 "Settings conflict; Input Port is not available while port bank is occupied by Output" If RF3 is present and RF4 is absent, a mmWave port cannot be selected as an Input if the Output Port is occupied by wwWave Transceiver with a different frequency range. Sending a command for this situation generates error: -221 "Settings conflict; Input Port is not available while occupied by Output of incompatible frequency"
Preset	E7760B with Option RF2: `IFIO1` E7760B without Option RF2: the first port with mmWave Transceiver attached. If no mmWave Transceiver attached: `NONE`
Annotation	Annotation in the Meas Bar reads as follows: – When input is A1: Input: A1 – When input is A2: Input: A2 – When input is A3: Input: A3 – When input is B1: Input: B2 – When input is B2: Input: B2 – When input is B3: Input: B3 – When input is IFIO1: Input: IFIO1 – When input is IFIO2: Input: IFIO2

Parameters for M8920A/20B Radio Test Set

<port>	Input
ANT	Ant
TR	T/R

Example
Set the RF input to be the Antenna port on M9470A, labeled **Ant**:
```
:FEED:RF:PORT ANT
```
Set the RF input to be the T/R port on M9470A and M8920A/20B, labeled **T/R**. Note that Option HDX is required to enable the T/R port:
```
:FEED:RF:PORT TR
```

Dependencies
ANT and TR are only available in modular analyzers, and only when the M9470A module is installed, such as in M8920A. Option HDX is required to enable the T/R port

Preset
ANT

Annotation
Annotation in the Meas Bar reads as follows:

- When input is Ant: Input: Ant
- When input is T/R: Input: T/R

Parameters for UXM Wireless Test Set

<port>	Input
RFIN	RF Input
RFIO1	RFIO 1
RFIO2	RFIO 2

Example
Set the RF input to RFIO 2:
```
:FEED:RF:PORT RFIO2
```

Preset
RFIN

Parameters for N9040B, 41B, 42B/N9030B, 32B/N9020B, 21B/N9010B/N9000B/N9038B/N9048B/N8973B, 74B, 75B, 76B

<port>	Input
RFIN	RF Input
RFIN2	RF Input 2
ERFIN	External RF

Example
Set the RF input to be RF Input:
```
:FEED:RF:PORT RFIN
```
Set the RF input to be RF Input 2 if that port exists:
```
:FEED:RF:PORT RFIN2
```

	Set the RF input to be External RF if the V3050A unit is connected: `:FEED:RF:PORT ERFIN`
Dependencies	If the command is sent with RFIN2 or ERFIN and that port does not exist, an error is generated, -221, "Settings conflict; option not installed" ERFIN requires option "EXW"
Couplings	Connecting a V3050A changes the Preset to ERFIN and automatically switches the input to ERFIN. Disconnecting the V3050A changes the Preset back to RFIN and automatically switches the input to RFIN
Preset	`RFIN`
Annotation	Annotation in the Meas Bar reads as follows: – When input is RFIN: Input: RF – When input is RFIN2: Input: RF2 – When input is ERFIN: Input: Ext RF

Example	`:FEED:PORT RFIN`
Notes	`RF|RF2|RF3|RF4` are aliased to `RFIN|RFIN2|RFIN3|RFIN4`
Dependencies	`ERFIN` requires option EXW
Couplings	Connecting a Keysight Frequency Extender, as aV3050A or a Saturn, changes the Preset to `ERFIN` and automatically switches the input to `ERFIN`. Disconnecting the Keysight Frequency Extender, as aV3050A or a Saturn, changes the Preset back to `RF` and automatically switches the input to `RF`
Preset	`ERFIN` when a Keysight Frequency Extender, as a V3050A or a Saturn, is connected, otherwise `RF`
Annotation	Annotation in the Meas Bar reads as follows: – When input is RF: Input: RF – When input is ERFIN : Input: Ext RF

Parameters for SA6210A

<port>	Input Port Selection
`RFIN`	RF Input
`RFIN2`	RF Input 2

Example	`:FEED:PORT RFIN`
Notes	RFIN2 requires Option 002 `RF|RF2|RF3|RF4` are aliased to `RFIN|RFIN2|RFIN3|RFIN4`
Preset	`RFIN`
Annotation	Annotation in the Meas Bar reads as follows: – When input is RF: Input: RF

6.2.3 SA Frequency Extender Firmware Update (Front Panel Only)

When a Frequency Extender device (for example, V3050A) is connected and selected, if a firmware update is available for that device, this control will be visible. Because the measurement will be stopped for the duration of the firmware update, and because the update cannot be un-done, a confirmation dialog will be presented before proceeding with the firmware update. The update can take some time, so while in process, a modal dialog will be shown indicating that the update is in process and warning not to disconnect the device or turn off power. Typically, the update will take about a minute, but time can vary with the model of the Frequency Extender. When complete, the modal dialog will be dismissed, and a pop-up message will be shown for a few seconds indicating the success or failure of the update.

See "Error Messages" on page 759

Notes	Measurement is stopped while the update is in process
Dependencies	Not available unless an External RF device is connected, External RF is the selected RF Input Port, and there is a firmware update available for the device

Error Messages

Update Already in Process Error

If a firmware update is already in process, the following message is displayed:

```
Another external device FW update is already in process. Only one update is allowed at a time
```

If received, wait until the current FW update is complete and then try again if still needed.

Unknown Assembly Error

When updating the firmware, the target hardware assembly needs to be identified. If for some reason the assembly cannot be identified, the firmware will not be able to initiate the update, and this error message will be displayed:

```
Error updating FW for external device model <model number>' serial number <serial number>
```

```
Could not find HW assembly, cannot perform FW update
```

The `<model number>` and `<serial number>` contain the actual numbers for the device.

This is a failure that warrants investigation, so you should contact Keysight Customer Support for service.

Error During Firmware Update Process

If there is an execution problem during the FW update, the specific error message(s) is written to the SA Event Log and this error message is displayed:

```
Error updating FW for external device model <model number>' serial number
<serial number>
```

```
Error during FW update. See windows event log for more details
```

The `<model number>` and `<serial number>` contain the actual numbers for the device.

6.2.4 SA Frequency Extender Cable Correction

An SA Frequency Extender, such as V3050A, is attached to the instrument with several cables. Keysight provides several cables for purchase with the frequency extender. Typically, these are 1-, 2-, or 3-meter cables for the RF and IF connections. Keysight has characterized these cables and can correct for their loss. This control allows you to specify which cable is being used.

If you are using another type of cable, the instrument *cannot* automatically correct for it, so this function must be set to `OFF`. In this case, you can use RCal to characterize the corrections.

Remote Command	`:INPut:FEXTender:CABLe:CORRection OFF | V3050A1M | V3050A2M | V3050A3M`
Example	`:INP:FEXT:CABL:CORR V3050A1M`
Notes	The RF Input Port selections that support an SA Frequency Extender (such as V3050A) are: N9042B: External RF No other instruments support an SA Frequency Extender
Dependencies	An SA Frequency Extender must be attached, and the frequency extender's port must be the selected input for this control to be visible – If the instrument does not support frequency extenders, the SCPI command returns error -241, "Hardware missing; option not available" – If the instrument does support frequency extenders, but a frequency extender is not attached, the SCPI command returns error -241, "Hardware missing; Cable selection only available when supporting frequency extender attached" When a frequency extender is attached, the control is not visible unless the frequency extender's port is the selected RF input, but the command will still be available. Setting the cable selection when the frequency extender's port is not active has no effect until the port is selected
Preset	Unaffected by **Mode Preset** but set to preset value by **Restore Input/Output Defaults** or **Restore System Defaults -> All**
State Saved	Saved in instrument state

6.2.5 Half Duplex Input Port

Specify whether `RFIO3` or `RFIO4` is the Half Duplex Input port.

Remote Command	`[:SENSe]:HDUPlex:PORT:INPut RFIO3 | RFIO4`
Example	`:HDUPlex:PORT:INPut RFIO3` `:HDUPlex:PORT:INPut?`
Dependencies	Only appears in EXM If `RFIO3` is selected as "Half Duplex Output Port", then "Half Duplex Input Port" will be set to `RFIO4` automatically. If `RFIO4` is selected as "Half Duplex Output Port", then "Half Duplex Input Port" will be set to `RFIO3` automatically
Preset	`RFIO3`
State Saved	Saved in State

6.2.6 Port Information (Remote Command Only)

Provides information about an instrument port. The return information consists of two comma-separated fields:

- Field 1: the connection status (0 or 1)
- Field 2: a string of port information

The return information is device-dependent.

Remote Command	`[:SENSe]:FEED[:RF]:PORT:INFormation? RFIN | RFIN2 | RFFD | RFHD | A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | ANT | TR`
Example	`:FEED:PORT:INF? A1` Example = `1,"US56160060"` where `1` is the connection status and `"US56160060"` is the port information
Notes	For E7760B: The connection status (first field in the return value) indicates: – 0 – the port is either not licensed for use or is not connected to a mmWave Transceiver – 1 – the port is licensed; and for the case of mmWave ports, the port is connected to a mmWave Transceiver The port information (second field in the return value) contains: – "" (empty string) – no applicable information – Serial Number – the serial number of the connected mmWave Transceiver If you send an incompatible parameter, the return values are: 0,""
Dependencies	Only valid for E7760B

6.2.7 RF Preselector

In models that support the RF Preselector, such as PXE (N9048B), lets you turn the preselector on or off.

NOTE **When using the RF Preselector, if your measurement starts below 3.6 GHz and finishes above 3.6 GHz, the preselector bypass switch will have to switch in and out for every measurement. When this is the case, you will hear a clicking sound from the instrument and a warning message will be displayed: "Settings Alert: Mechanical switch cycling". You are advised to *avoid* such setups as much as possible, to minimize switch wear. Pressing Mode Preset resets Stop Freq to 3.6 GHz, to exit this state, or you can manually set Stop Freq to be below 3.6 GHz.**

Remote Command	`[:SENSe]:POWer[:RF]:RFPSelector[:STATe] 1 | 0 | ON | OFF` `[:SENSe]:POWer[:RF]:RFPSelector[:STATe]?`
Example	`:POW:RFPS 1` `:INP:PRES:STAT ON`

Notes	Set full compliance measurement:
	`[:SENSe]:POWer[:RF]:RFPSelector[:STATe] 1 | ON`
	Set pre-compliance measurement:
	`[:SENSe]:POWer[:RF]:RFPSelector[:STATe] 0 | OFF`

Dependencies	Only appears when RF Input is selected as the Input Only appears in MXE and PXE The RF Preselector is not available in all measurements. The key is grayed out in measurements that do not support it, unless you are in a Mode in which no measurements support it, in which case the key does not appear at all. If the preselector is unavailable, it is forced to Off. Attempting to turn it on or off in measurements that do not support it generates the error message: -221, Settings conflict; Feature not supported for this measurement The RF Preselector is not available when FFT Sweep Type is manually selected. Attempting to turn it on or off when this is the case generates an error message: -221, Settings conflict; RF Presel unavailable when Sweep Type=Manual FFT Only appears in Modes that support the RF Preselector, in other Modes, sending the SCPI command or query generates an error In Frequency Scan measurement, this key is grayed-out when final measurement is running. Warning message "Function not available while measurement is running" appears if the grayed-out key is pressed
Preset	`ON`
Annotation	When RF Preselector=On, "RF PRESEL" is displayed on the Settings Panel
Backwards Compatibility SCPI	`:INPut<1|2>:PRESelection[:STATe] ON|OFF` `:INPut<1|2>:PRESelection[:STATe]?`

Included for R&S ESU compatibility

6.2.8 Notch Filter

In some models that support the RF Preselector, such as PXE, there is also a notch filter to suppress signals in the frequency band from 2.4 GHz to 2.5 GHz. This control allows you to turn the notch filter on or off.

Remote Command	`[:SENSe]:POWer[:RF]:RFPSelector:NFILter[:STATe] OFF | ON | 0 | 1` `[:SENSe]:POWer[:RF]:RFPSelector:NFILter[:STATe]?`
Example	`:POW:RFPS:NFIL 1` `:POW:RFPS:NFIL?`
Dependencies	Only appears when RF Input is selected as the Input Only appears in models that support the notch filter, such as PXE. Attempting to turn it on or off via SCPI in models that do not support it generates error message: -241 Hardware missing; Not available for this model number Only appears in measurements that support the Notch Filter, such as EMI Receiver measurements. Attempting to turn it on or off via SCPI in measurements that do not support it generates error message: -221, Settings conflict; Feature not supported for this measurement In Frequency Scan measurement, this control is grayed-out when final measurement is running, aligned with the RF Preselector key. The warning message "Function not available while measurement is running" appears if the grayed-out control is pressed
Preset	`OFF`
State Saved	Saved in instrument state
Range	`OFF|ON`
Annotation	Due to limited space in the Measurement Bar, Notch Filter annotation is shown as part of the RF Presel state – `RF Presel: On, NF`, when both RF Presel and Notch Filter are turned on – `RF Presel: On`, when RF Presel = on and Notch Filter= off – `RF Presel: Off`, when RF Presel = off
Backwards Compatibility SCPI	`:INPut<1|2>:PRESelection:FILTer:NOTCh[:STATe] ON|OFF` `:INPut<1|2>:PRESelection:FILTer:NOTCh[:STATe]?`

6.2.9 RF Calibrator

Lets you choose a calibrator signal to look at or turns the calibrator off.

Remote Command	`[:SENSe]:FEED:AREFerence REF50 | REF4800 | OFF` `[:SENSe]:FEED:AREFerence?`

Example	Select the 50 MHz amplitude reference as the signal input:
	`:FEED:AREF REF50`
	Select the 4.8 GHz amplitude reference as the signal input:
	`:FEED:AREF REF4800`
	Turn the calibrator "off" (switches back to the selected input - RF or I/Q):
	`:FEED:AREF OFF`

Dependencies	Only appears when RF Input is selected as the Input Selecting an input (RF, Ext Mix or I/Q) turns the Calibrator `OFF`. This is true whether the input is selected using the menu panel or `[:SENSe]:FEED` The 4.8 GHz internal reference is only available in some models and frequency range options. If the 4.8 GHz reference is not present, the **4.8 GHz** choice does not show, and if the REF4800 parameter is sent, the instrument generates an error In **Measuring Receiver (MMR)** Mode, **RF Calibrator** is turned off and disabled in RF Power and TRFL measurements, to prevent impedance mismatch at the input of the instrument. Trying to turn on **RF Calibrator** in these measurements generates an error Not available in SA6210A
Couplings	When one of the calibrator signals is selected, the instrument routes that signal (an internal amplitude reference) to the instrument, and changes the main input selection to RF so the calibrator signal can be seen. When you turn the calibrator off it does not switch back to the previously selected input
Preset	`OFF`
State Saved	Saved in instrument state
Annunciation	An advisory message is sent, indicating that the input is set to internal

Backwards Compatibility SCPI

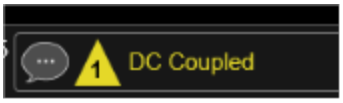
Notes	For ESA backwards compatibility In the ESA the calibrator was a separate output which you connected to the input and switched on with this command In X-Series, the `ON` parameter is aliased to `[:SENSe]:FEED:AREF REF50` and the `OFF` parameter is aliased to `[:SENSe]:FEED:AREF OFF` When `:CALibration:SOURce:STATe?` is received, 1 is returned if any of the references is selected, or 0 if the Calibrator is `OFF`
Preset	`OFF`
Backwards Compatibility SCPI	`:CALibration:SOURce:STATe OFF|ON|0|1` `:CALibration:SOURce:STATe?`

6.2.10 RF Coupling

Specifies alternating current (`AC`) or direct current (`DC`) coupling at the instrument RF input port. Selecting `AC` coupling switches in a blocking capacitor that blocks any DC voltage present at the instrument input. This decreases the input frequency

range of the instrument, but prevents damage to the input circuitry of the instrument if there is a DC voltage present at the RF input.

NOTE **When operating in DC coupled mode, ensure protection of the instrument input circuitry by limiting the DC part of the input level to within 200 mV of 0 Vdc. In AC or DC coupling, limit the input RF power to +30 dBm (1 Watt).**

Remote Command	`:INPut:COUPling AC | DC` `:INPut:COUPling?`
Example	`:INP:COUP DC`
Dependencies	Only appears when RF Input is selected as the Input Does not appear in models that are always AC coupled. When the SCPI command to set DC coupling is sent to these models, it generates the error "Illegal parameter value; This model is always AC coupled" In these models, `:INP:COUP?` always returns AC Does not appear in models that are always DC coupled. When the SCPI command to set AC coupling is sent to these models, it generates the error "Illegal parameter value; This instrument is always DC coupled" In these models, `:INP:COUP?` always returns DC
Preset	AC on models that support AC coupling On models that are always DC coupled, such as millimeter wave models (frequency ranges 30 GHz and above), the preset is DC
State Saved	Saved in instrument state
Annunciation	When the RF Input is selected, and AC coupling is selected, annunciators appear in the Meas Bar to that effect:  appears in the settings panel (the row of annunciators across the top of the display) to that effect, as shown below: When the RF Input is selected, and DC coupling is in effect, the annunciator changes as shown below:  Note the amber color, which indicates that you should exercise caution when applying a signal to any DC coupled input (see note above this table for the specific cautions) On models that support both AC and DC coupling: when DC coupling is selected, a warning condition message appears in the status line "DC coupled" as shown below:  On models that support both AC and DC coupling: when AC coupling is selected, and any part of the displayed frequency range is below 10 MHz, a warning condition message appears in the status line: "AC: Accy unspec'd below 10 MHz"

In AC coupling mode, you can view signals below the corner frequency of the DC block, but below a certain frequency the amplitude accuracy is not specified.

The lowest frequency for which specifications apply is:

X-Series Model	Lowest Freq for meeting specs when AC coupled	Lowest Freq for meeting specs when DC coupled
CXA-503/507	100 kHz	n/a
CXA-C75 Input 2	1 MHz	n/a
CXA-513/526	10 MHz	9 kHz
CXA-m	10 MHz	9 kHz
EXA	10 MHz	9 kHz
MXA	10 MHz	20 Hz
PXA	10 MHz	3 Hz
UXA	10 MHz	3 Hz
XA5	n/a	2 Hz
XA6	n/a	2 Hz

Some amplitude specifications apply only when coupling is set to DC. Refer to the appropriate amplitude specifications and characteristics for your instrument.

6.2.11 Input Z Correction

Sets the input impedance for unit conversions. This affects the results when the y-axis unit is voltage or current units (dBmV, dBµV, dBµA, V, A), but not when it is power units (dBm, W). The impedance you select is for computational purposes only, since the actual impedance is set by internal hardware to 50 ohms. Setting the computational input impedance to 75 ohms is useful when using a 75 ohm to 50-ohm adapter to measure a 75-ohm device on an instrument with a 50-ohm input impedance.

There are a variety of ways to make 50-to-75-ohm transitions, such as impedance transformers or minimum loss pads. The choice of the solution that is best for your measurement situation requires balancing the amount of loss that you can tolerate with the amount of measurement frequency range that you need. If you are using one of these pads/adaptors with the Input Z Corr function, you might also want to use the Ext Gain key. This function is used to set a correction value to compensate for the gain (loss) through your pad. This correction factor is applied to the displayed measurement values.

A user defined impedance value from 50 to 100,000,000 ohms is also supported.

Remote Command	`[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] 50 | 75` `[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?`
Example	Set the input impedance correction to 75 ohms: `:CORR:IMP 75` Set the input impedance correction to 1 MΩ:

	`:CORR:IMP 1 MOHM`
Couplings	For CXA Option C75, when RF Input 2 is selected, the Input Z Correction automatically changes to 75 ohms. You may then change it to whatever is desired. When the main RF Input is selected, the Input Z Correction automatically changes to 50 ohms. You may then change it to whatever is desired
Preset	Unaffected by Preset, but set to 50 ohms by **Restore Input/Output Defaults** or **Restore System Defaults->All** Some instruments/options may have 75 ohms available
State Saved	Saved in instrument state

6.2.12 All Screens Use Same Input

If `ON`, then all Screens share the same Input settings. This is the default state.

If `OFF`, then certain settings are allowed to be local to each Screen, meaning one Screen can have them set one way and another can have them set another way.

The Input settings that become local to each Screen when **All Screens Use Same Input** is `OFF` are:

Input Tab:

- Selected Input (RF, Ext Mix, BBIQ)
- RF Input Port (only appears in instruments with multiple RF ports, such as N9041B, MXE, and CXA)
- RF Coupling (AC/DC)
- Input Z Correction

External Gain Tab:

- External Preamp
- MS
- BTS

Corrections Tab:

- For each Correction, whether it is on or off

Note that if **All Screens Use Same Input** is `OFF` and you press the **+** control to create a new Screen, the new Screen contains a copy of the old Screen's state, including all its Input/Output variables.

Remote Command	`:INSTrument:COUPle:SCReen:INPut ON | OFF | 1 | 0` `:INSTrument:COUPle:SCReen:INPut?`

Example	`:INST:COUP:SCR:INP OFF`
Preset	ON Not affected by **Input/Output Preset**, but set to ON by **Restore Input/Output Defaults**

6.2.13 External Mixer Setup

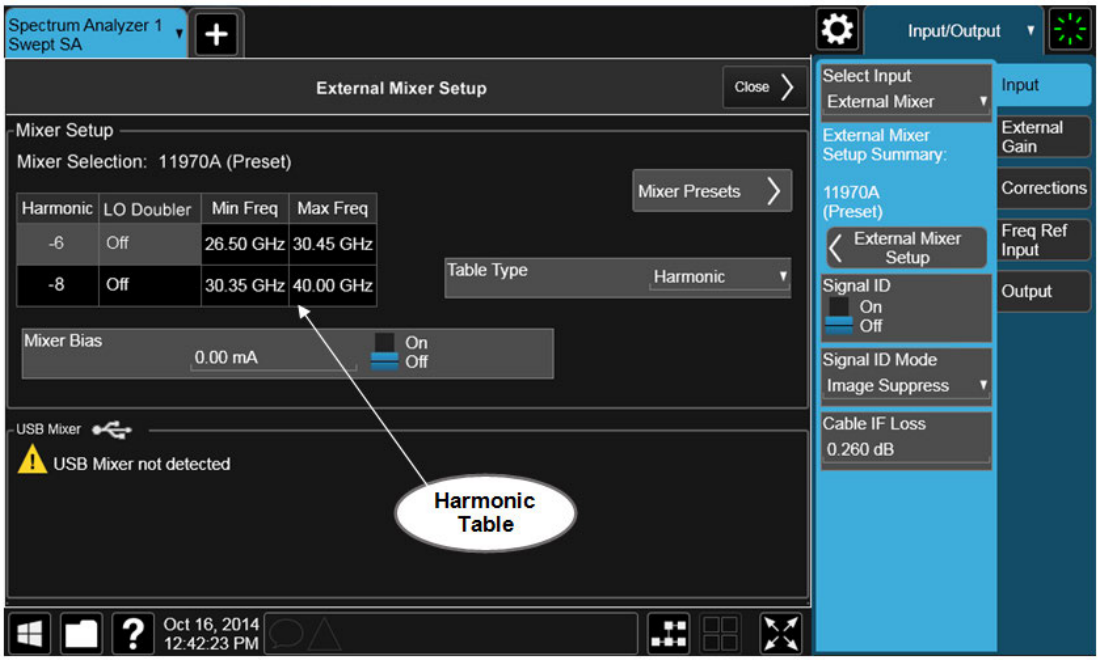
Lets you select the mixer type, and lets you configure your mixer (if necessary). The first page of the dialog shows you the current settings for the selected mixer. These settings may depend on which IF path is currently in use, whether a + or – harmonic is currently selected, etc.

To apply any amplitude correction factors needed to correct mixer flatness, you enter values into one of the Correction tables (under **Input/Output**, **Corrections**). The correction conversion loss values can be extracted from data supplied with the mixer or from manual measurements you make to determine the conversion loss. Note that the correction applied by the Correction tables is global to the instrument; therefore, you should make sure to turn off the External Mixer corrections when you are not using the External Mixer input.

NOTE **Keysight USB Mixers automatically supply their flatness data to the instrument, and the correction is applied internally. No correction needs be entered, and the correction does not appear in the user-accessible Corrections tables. You are free to enter additional corrections into the Correction tables under Input/Output, Corrections.**

Notes	The setup summary on the menu panel appears just above this control, showing the current external mixer setup
Dependencies	Only appears when External Mixer is selected as the Input
State Saved	All settings in the External Mixer Setup dialog are part of the Input/Output system, and hence are saved whenever State is saved

The **External Mixer Setup** screen looks like this:



The current Mixer selection (the current or most recently connected USB Mixer, or the most recent Mixer Preset, or **Custom** if you have modified the setup) reads out at the top of this screen as **Mixer Selection**.

The Harmonic Table currently being used reads out below the Mixer Selection. It shows each range being used for the current mixer. Note that a band may be made up of up to 3 ranges. Each range represents a choice of mixer harmonic and doubler state. When you select a Mixer Preset, it sets the instrument Start and Stop frequency to the values shown in the Harmonic Table; Start Freq is set to the Min Freq for the bottom range, and Stop Freq is set to the Max Freq for the top range. In many cases you can exceed these nominal values; the absolute maximum and minimum frequency for each preset are shown in the tables that accompany the control descriptions for the Mixer Presets.

NOTE **If the current measurement has a limited Span available to it and cannot achieve the Span shown in the table (Span = Stop Freq - Start Freq), the instrument uses the maximum Span the measurement allows, and sets Center Frequency to the midpoint of the Start and Stop Freq values in the Harmonic Table.**

You may edit some of the Harmonic and LO Doubler fields in the Harmonic Table, as shown by the gray backgrounds of these fields. When you edit the Harmonic Table, the Mixer Selection changes to **Custom**. To change it back you must go back into the Mixer Presets menu and select a Preset.

When you edit the Harmonic Table, the nominal Min Freq and Max Freq that are available will usually be different than the Preset you were using; and the absolute frequency limits will change as well. This may result in a change to your Start and/or

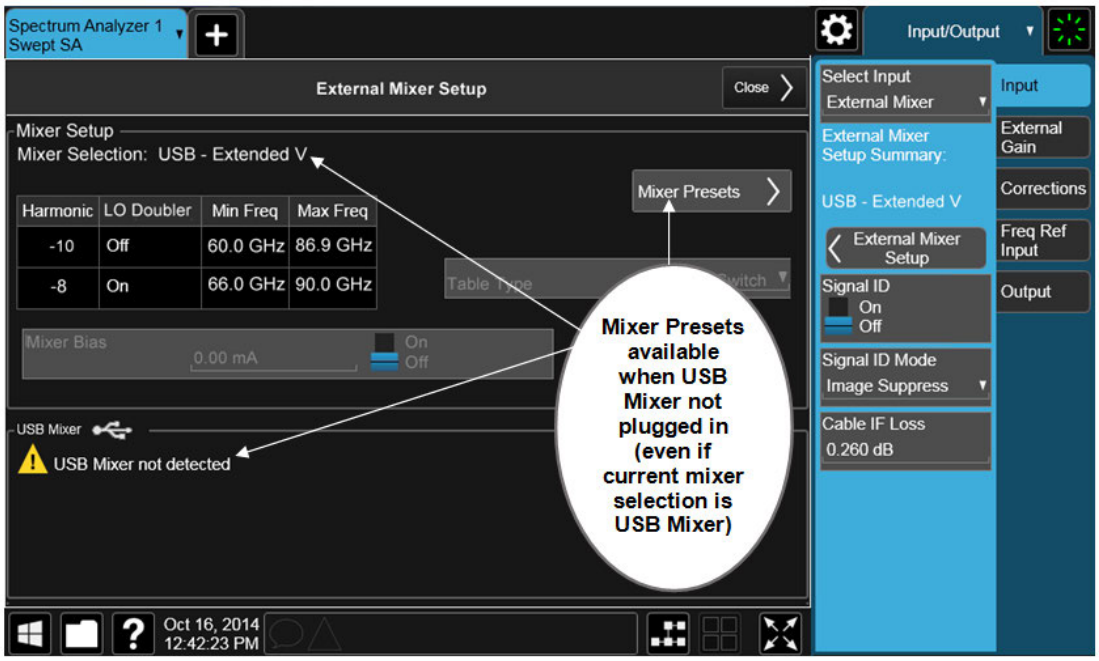
Stop Freq, if the current values fall outside the new range, requiring you to retune your Center Freq to get your signal back in the center.

The instrument supports the Keysight M1970 Series Harmonic Mixers with USB connection. While in External Mixing, if one of these mixers is plugged in to a USB port, it is automatically detected and displayed in the “USB Mixer” area of the setup screen, including its model number and serial number.

The instrument assumes that if you plug a mixer into the USB you want to use that mixer, so:

1. If a USB mixer is connected to the USB port, the Mixer Presets button is grayed-out, as none of the presets make sense with a USB Mixer connected. Note that once the instrument has acquired the USB Mixer, the mixer selection will remain if it is subsequently unplugged from the USB, allowing you to plug it back in with no change to your settings. However, once you unplug it, the Mixer Presets control ceases to be grayed-out, allowing you to preset to a different mixer
2. When Restore Input/Output Defaults is performed, if a Keysight USB Mixer is plugged into the instrument’s USB port, the Mixer Selection remains unchanged
3. When recalling an instrument state, if a Keysight USB Mixer is plugged into the instrument’s USB port, and the Mixer Selection in the recalled state is for a USB Mixer that does not match the mixer currently plugged in, you will have to unplug your mixer and then plug it back in to get the instrument to recognize your mixer

As long as the selection in Ext Mixer Setup shows one of the USB mixers, the Mixer Bias control is grayed-out and the Harmonic Table is no longer editable, as shown by the fact that the fields in the Harmonic Table are now black and the Table Type control is grayed-out.



Only one USB Mixer is supported at a time. To switch to a different USB Mixer, disconnect the one that is no longer being used prior to connecting a new one.

The **Mixer Selection** displayed and menu panel readback for the Keysight M1970 series mixers is:

Mixer Model	Mixer Selection display on Setup Screen	Readback
Keysight M1970E: Option 001: 60 to 90 GHz Waveguide Harmonic Mixer	**USB - M1970E-001 E-Band**	USB Mixer E-Band
Keysight M1971E: Option 001: 60 to 90 GHz Waveguide Harmonic Mixer	**USB - M1971E-001 E-Band**	USB Mixer E-Band
Keysight M1971E: Option 003: 55 to 90 GHz Waveguide Harmonic Mixer	**USB - M1971E-003 Extended E-Band**	USB Mixer Extended E
Keysight M1971V: Option 001: 50 to 75 GHz Waveguide Harmonic Mixer	**USB - M1971E-001 V-Band**	USB Mixer V-Band
Keysight M1971W: Option 001:75 to 110 GHz Waveguide Harmonic Mixer	**USB - M1971E-001 W-Band**	USB Mixer W-Band
Keysight M1970V Option 001: 50 to 75 GHz	**USB - M1970V-001 V-Band**	USB Mixer V-Band

Mixer Model	Mixer Selection display on Setup Screen	Readback
Waveguide Harmonic Mixer Keysight M1970V Option 002: 50 to 80 GHz Waveguide Harmonic Mixer	USB - M1970V-002 Extended V-Band	USB Mixer Extended V
Waveguide Harmonic Mixer Keysight M1970W Option 001: 75 to 110 GHz Waveguide Harmonic Mixer	USB - M1970W-001 W-Band	USB Mixer W-Band

The Keysight USB mixer essentially acts as a “remote front end” and is fully calibrated over the specified frequency range, without requiring any user interaction. This is particularly useful at high mm-wave frequencies, where cable loss is typically quite large, and it is desirable to bring the front end right up to the device under test, rather than bringing the mm-wave signal to the instrument using a lossy and uncalibrated cable or waveguide connection.

Connecting the mixer to the USB port on the instrument switches you to External Mixing, aborts the current measurement, and initiates an alignment of the mixer. A popup message, “USB Mixer connected” appears on the display. When a USB mixer and the LO/IF cable are connected the alignment is performed. When the alignment begins, an “Aligning” popup replaces the previous message on the display. When the alignment completes, the current measurement restarts.

6.2.13.1 Mixer Presets

Presets the mixer setup for the particular type of mixer that you are using.

These presets are divided into four groups:

- One for legacy HP/Agilent/Keysight mixers (11970)
- Three for general purpose mixers:
- presets that use a single harmonic and no doubling
- presets that use a single harmonic but double the LO
- presets that use multiple harmonics

Note that the IF/LO port provides a 3.8-14 GHz LO in two bands: 3.8-8.7 (LO fundamental), and 8.6-14 GHz (doubled LO).

In most cases, once you have executed the preset, you will not need to adjust any further settings.

Remote `[:SENSe]:MIXer:BAND A | Q | U | V | W | NA | ND | NE | NF | NG | NJ | NK | NQ`

Command	| NU | NV | NW | NY | NEXT | DD | DF | DG | DJ | DK | DQ | DV | DW | DY | DEXT | MA | ME | MU | MCOAX | USB | VDIWR6PT5M4 [:SENSe]:MIXer:BAND?
Example	:MIX:BAND A :MIX:BAND?
Notes	A|Q|U|V|W select HP/Agilent/Keysight 11970 mixer presets NA|ND|NE|NF|NG|NJ|NK|NQ|NU|NV|NW|NY|NEXT select single harmonic, non-doubled LO presets DD|DF|DG|DJ|DK|DQ|DV|DW|DY|DEXT select single harmonic, doubled LO presets MA|ME|MU|MCOAX select multiple harmonic presets VDIWR6PT5M4 selects presets for the VDI WR6.5CCD-M4 external mixer (a Compact Down-Converter in the Keysight N9029ACST Series) VDIWR6PT5M4 requires Model N9042B with the EXW option. To use this selection, you must connect cables from the external mixer to the High LO Out and High IF In ports (not the Ext Mixer port) of the N9042B All these presets are detailed in their respective control descriptions The query returns the most recent preset, *unless* the harmonic table has been edited after the preset was executed. If the harmonic table has been edited, returns CUSTOM The command USB refreshes the USB mixer connection and automatically detects the mixer band. The query returns the following if a Keysight USB Mixer is plugged into the instrument's USB port:

USBE	Keysight E-Band USB Mixer
USBV	Keysight V-Band USB Mixer
USBVEXT	Keysight Extended V-Band USB Mixer
USBW	Keysight W-Band USB Mixer

Note that the parameters CUSTOM, USBV, USBVEXT, and USBW are query responses only, and cannot be sent *to* the instrument

The following cross-reference matches the mixer band designators used by Keysight to the EIA waveguide designations:

EIA	Keysight	Freq Range
WR-28	A	26.5 - 40 GHz
WR-22	Q	33 - 50 GHz
WR-19	U	40 - 60 GHz
WR-15	V	50 - 75 GHz
WR-12	E	60 - 90 GHz
WR-10	W	75 - 110 GHz
WR-8	F	90 - 140 GHz
WR-6	D	110 - 170 GHz

EIA	Keysight	Freq Range
WR-5	G	140 - 220 GHz
WR-3	J	220 - 325 GHz

Preset

When **Restore Input/Output Defaults** is performed, an "A" mixer preset is also issued (11970A band), unless a Keysight USB Mixer is plugged into the instrument's USB port, in which case the Mixer Selection remains unchanged

When using Keysight USB Mixers, if **Restore All Defaults** (`:SYSTem:DEFault`) has been performed, either remove and reinsert the USB cable or press the **Refresh USB Mixer Connection** control

VDI CCD (N9029)

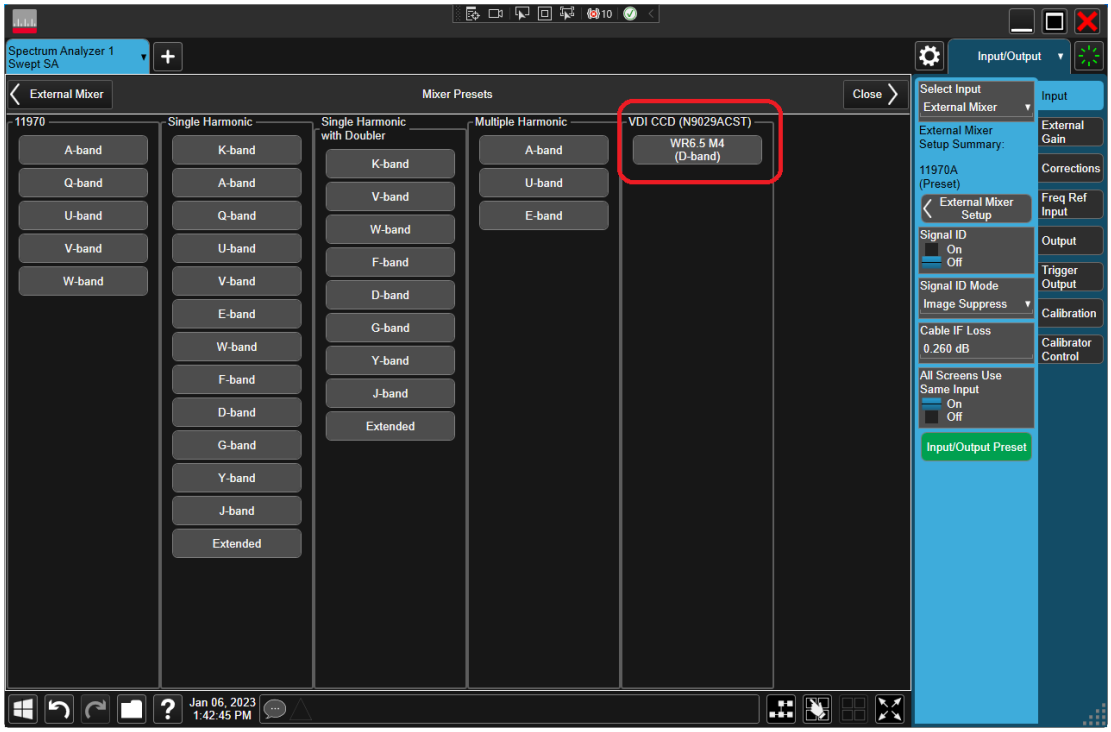
These presets select a setup that uses a single harmonic and no LO doubling.

This setup is used with an external mixer in the series VDI CCD (N9029ACST). The currently supported example is the D-band mixer VDI WR6.5CCD-M4.

Mixer	Readout on setup dialog and menu panel	Harm #	RF start	RF stop	RF center
WR6.5 M4 (D-band)	VDI WR6.5CCD-M4	-4	110	170	140

This mixer setup is enabled only for model N9042B with the EXW option You must connect cables from this external mixer to the High LO Out and High IF In ports (not the Ext Mixer port) of the N9042B, as illustrated below:





11970

Lets you preset for a model in the HP/Agilent/Keysight 11970 series.

Because X-Series has an LO range of 3.8 - 14 GHz, and older analyzers had an LO range of 3.0 - 6.8 GHz, the harmonic numbers used in X-Series may differ from those used on older analyzers for the same mixers. Additionally, some of the 11970 mixers cannot be operated over their full range with X-Series without switching harmonics. Consequently, you will find that some of the bands (A-Band, for example) are broken into two ranges for use with X-Series.

Below are the 11970A presets. The 11970U and the 11970W use a single harmonic. The other three switch harmonics mid-band. Both harmonic ranges are shown in the table. None of these mixers use LO doubling.

The 11970 K-band mixer and the 11974 preselected mixer series are not supported.

Preset	Readout on setup dialog and menu panel	Range	Harm #	RF start	RF stop	RF center
A-band	11970A	1	-6	26.5	30.45	28.475
		2	-8	30.35	40	35.175
Q-band	11970Q	1	-8	33	40.8	36.9
		2	-10	39.8	50	44.9

Preset	Readout on setup dialog and menu panel	Range	Harm #	RF start	RF stop	RF center
U-band	11970U	..	-10	40	60	50
V-band	11970V	1	-12	50	66	58
		2	-14	53	75	64
W-band	11970W	..	-18	75	110	92.5

Single Harmonic

These presets select a setup that uses a single harmonic and no doubling for the LO.

Mixer	Readout on setup dialog and menu panel	Harm #	RF start	RF stop	RF center
K-band	K-band Single Harmonic, no doubler	-4	18	26.5	22.25
A-band	A-band Single Harmonic, no doubler	-6	26.5	40	33.25
D-band	D-band Single Harmonic, no doubler	-20	110	170	140
E-band	E-band Single Harmonic, no doubler	-12	60	90	75
F-band	F-band Single Harmonic, no doubler	-18	90	140	115
Q-band	Q-band Single Harmonic, no doubler	-6	33	50	41.5
U-band	U-band Single Harmonic, no doubler	-8	40	60	50
V-band	V-band Single Harmonic, no doubler	-10	50	75	62.5
W-band	W-band Single Harmonic, no doubler	-14	75	110	92.5
G-band	G-band Single Harmonic, no doubler	-26	140	220	180
Y-band	Y-band Single Harmonic, no doubler	-30	170	260	215
J -band	J-band Single Harmonic, no doubler	-38	220	325	272.5
Extended	Extended Single Harmonic, no doubler	-40	155	345	250

Single Harmonic with doubler

These presets select a setup that uses a single harmonic and doubling for the LO.

Mixer	Readout on setup dialog and menu panel	Harm #	RF start	RF stop	RF center
D-band	D-band Single Harmonic w/doubler	-14	110	170	140
F-band	F-band Single Harmonic w/doubler	-10	90	140	115
G-band	G-band Single Harmonic w/doubler	-16	140	220	180
J-band	J-band Single Harmonic w/doubler	-24	220	325	272.5
K-band	K-band Single Harmonic w/doubler	-2	18	26.5	22.25
Q-band	Q-band Single Harmonic w/doubler	-4	33	50	41.5
V-band	V-band Single Harmonic w/doubler	-6	50	75	62.5
W-band	W-band Single Harmonic w/doubler	-8	75	110	92.5

Mixer	Readout on setup dialog and menu panel	Harm #	RF start	RF stop	RF center
Y-band	Y-band Single Harmonic w/doubler	-20	170	260	215
Extended	Extended Single Harmonic w/doubler	-28	245	390	317.5

Multiple Harmonics

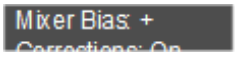
These presets select a setup that uses multiple harmonics and may or may not use doubling for the LO.

Mixer	Readout on setup dialog and menu panel	Range	Harm #	Dblr?	RF start	RF stop	RF Center
A-band	A-band Multiple Harmonic	1	-4	N	26.5	34.1	30.3
		2	-4	Y	33.1	40	36.55
E-band	E-band Multiple Harmonic	1	-6	Y	60	83	71.5
		2	-8	Y	65	90	77.5
U-band	U-band Multiple Harmonic	1	-6	N	40	51.5	45.75
		2	-6	Y	49.5	60	54.75
Coaxial	Coaxial Multiple Harmonic	1	-4	N	26.5	34	30.25
		2	-4	Y	32.5	55	43.75
		3	-6	Y	50	70	60

6.2.13.2 Mixer Bias

Adjusts an internal bias source for use with external mixers. The bias signal is present on the center conductor of the IF input connector on the front panel. The shunt current range is from -10 mA to 10 mA, and it can be set whether Mixer Bias state is On or Off, but it will only be applied if it is On.

The bias remains as set if you switch to another input (for example, the RF Input).

Remote Command	`[:SENSe]:MIXer:BIAS <real>` `[:SENSe]:MIXer:BIAS?`
Example	`:MIX:BIAS 0` `:MIX:BIAS?`
Preset	Unaffected by Preset, but set to `OFF` (0) by **Restore Input/Output Defaults**
State Saved	Saved in instrument state
Min/Max	–/+10 mA
Annunciation	When the bias is turned on this (together with the bias polarity) is indicated in the Meas Bar with a plus or minus sign:  otherwise, it reads “Off”

Auto Function

Remote Command	`[:SENSe]:MIXer:BIAS:STATe OFF | ON | 0 | 1` `[:SENSe]:MIXer:BIAS:STATe?`
Example	`:MIX:BIAS:STAT 0` `:MIX:BIAS:STAT?`
Preset	`OFF`

6.2.13.3 Table Type

Determines the Custom Mixer configuration type. You can choose: Single Row, Harmonic Switching, or Doubler Switching. For details, see "Available Types" on page 778.

The Harmonic Table can be configured as:

- A single row (meaning only one harmonic number is used and the LO Doubler is either on or off)
- Two rows where the harmonic number switches between the first row and the second
- Two rows where the LO Doubler state switches between the first row and the second

Available Types

Table Type	Behavior
Single Row	The External Mixer always stays in the same Harmonic Number, and the LO Doubler is either on or off and does not change state during a sweep. You may change the Harmonic Number, and you may change the state of the Doubler
Harmonic Switching	The External Mixer switches the Harmonic Number in the middle of the sweep. The LO Doubler may be on or off, but it is the same for both Harmonic Numbers. You can set the initial Harmonic Number, and when it switches it decrements by two when the harmonic is negative and increments by two when the harmonic is positive For example, if you set the initial number to -6, when it switches it will go to -8. If you set the harmonic number to 8, when it switches it will go to 10
Doubler Switching	The External Mixer switches the doubler from Off to On in the middle of the sweep. You can set the Harmonic Number, but it stays the same for the Doubler Off state as for the Doubler On state. The LO Doubler control is grayed-out in this table type

Editable Fields

Table Type	Fields you can edit
Single Row	Harmonic and LO Doubler cells
Harmonic Switching	Harmonic and LO Doubler cells (only the first row)
Doubler Switching	Harmonics cell (only the first row)

Note that you cannot add or delete rows from the table; you can only modify the rows that are already there.

Remote Command	`[:SENSe]:MIXer:TTYPe SINGle | HARMonic | DOUBler` `[:SENSe]:MIXer:TTYPE?`
Example	`:MIX:TTYP SING`
Couplings	When you change the Table Type, the Mixer Selection changes to **Custom**
Preset	Depends on the current Mixer Preset. Unaffected by **Mode Preset**, but **Restore Input/Output Defaults** presets the Mixer to 11970A, for which the Table Type is Harmonic Switching
State Saved	Saved in instrument state

6.2.13.4 Select VDI CCD Correction

Selects the appropriate VDI CCD Correction data by mixer Serial Number.

Remote Command	`[:SENSe]:VCORrection:SELect NONE | <serialNumber>` `[:SENSe]:VCORrection:SELect?`
Example	`:VCOR:SEL NONE` `:VCOR:SEL 123123`
Dependencies	Requires EXW (External Mixing Wide Bandwidth) and Ampcor (Amplitude Correction) licenses
Couplings	When the External Mixer Model or VDI CCD Corrections data changes, this field checks whether VDI CCD corrections are stored for the currently-selected External Mixer Model, and automatically selects the first serial number found, or `NONE` if no matching corrections are found When setting this parameter via SCPI, if no match is found for the given serial number, the parameter is set to `NONE.` If the correction should be automatically selected, this can be done by setting the value via SCPI to **Any** (see "External Mixer Setup" on page 768)
State Saved	Saved in instrument state

6.2.13.5 Delete All VDI CCD Corrections

Erases all stored VDI CCD corrections.

Remote Command	`[:SENSe]:VCORrection:DELete`
Example	`:VCOR:DEL`
Dependencies	Requires EXW (External Mixing Wide Bandwidth) and Ampcor (Amplitude Correction) licenses
Couplings	When the VDI CCD corrections are deleted from memory, "Select VDI CCD Correction" on page 779 is set to NONE

6.2.13.6 Harmonic

Lets you enter the **Harmonic** value with its associated sign (mixing mode). Only the first row of the table is editable. When you edit a value or change "Table Type" on page 778, the Mixer Selection changes to **Custom**.

In **Custom** mode, the maximum start and stop frequencies are strictly set by the LO range and the harmonic number you have chosen. The undoubled LO range is approximately 3.8 - 8.7 GHz , and (for LOs that support doubling) the doubled range is approximately 8.0 – 14.0 GHz. That range times the harmonic you have selected determines the tuning range. If your frequency is currently outside that range when you edit the Harmonic Table, the frequency will be changed to fall at the edge of the range. To change it back, go to the **Mixer Presets** menu and select a Preset.

The harmonic number is a signed integer, where the sign distinguishes between positive and negative mixing products. Desired mixing products occur at an IF frequency that equals the difference between the RF frequency ($f_{RF)}$ and the LO frequency (Nf_{LO}). When this difference is positive, we can say $f_{IF} = f_{RF} - Nf_{LO}$. When this difference is negative, we can say $f_{IF} = Nf_{LO} - f_{RF}$. Thus, a negative harmonic means the instrument will be tuned such that the harmonic of the LO is higher than the indicated frequency by the frequency of the first IF. A positive harmonic means the instrument will be tuned such that the harmonic of the LO is lower than the indicated frequency by the frequency of the first IF.

Remote Command	`[:SENSe]:MIXer:HARMonic <integer>` `[:SENSe]:MIXer:HARMonic?`
Example	`:MIX:HARM -28` `:MIX:HARM?`
Notes	The query returns the harmonic value of the first row of the harmonic table
Couplings	When you set a value for **Harmonic** via SCPI, the Mixer Selection changes to **Custom**
Preset	Unaffected by **Mode Preset**, but **Restore Input/Output Defaults** turns editing off, the Harmonic Table returns to normal, and the Mixer is preset to 11970A, which has -6 in the first row of its Harmonic Table
State Saved	Saved in instrument state
Min/Max	–/+400

6.2.13.7 LO Doubler

Lets you specify whether the Doubler is on or off. Only the first row of the table is editable, and the LO Doubler field is only editable in Single Row and Harmonic Switching table types. When you edit a value or change the Table Type, the Mixer Selection changes to **Custom**.

The LO Doubler setting controls the choice of the LO doubler state for LO's that support doubled operation. In Single Row mode it is either on or off for the one row in the table. In Harmonic Switching mode it is on for both rows, or off for both rows. In Doubler switching it is off for row 1 and on for row 2, so it is not editable.

In LOs that support doubling, the fundamental band is approximately 3.8 – 8.7 GHz, and the doubled band is approximately 8.0 – 14 GHz. The higher LO frequency can result in a lower mixer harmonic and reduced mixer conversion loss.

Remote Command	`[:SENSe]:MIXer:LODoubler ON | OFF | 0 | 1` `[:SENSe]:MIXer:LODoubler?`
Example	`:MIX:LOD 0` `:MIX:LOD?`
Notes	The query returns the doubler value of the first row of the harmonic table
Dependencies	Grayed-out and set to `OFF` when "Table Type" on page 778 is set to Doubler Switching Grayout message: "-221 Settings conflict; Function unavailable while Table Type=Doubler Switching"
Couplings	When you set a value via SCPI, the Mixer Selection changes to **Custom**
Preset	Unaffected by **Mode Preset**, but **Restore Input/Output Defaults** turns off editing, the Harmonic Table returns to normal, and the Mixer is preset to 11970A, which has the doubler Off in the first row of its Harmonic Table
State Saved	Saved in instrument state

6.2.13.8 Refresh USB Mixer Connection

Re-reads the USB devices and refreshes connection to Keysight USB mixers. This operation is the same as physically removing and reinserting the mixer's USB connection.

Example	`:MIX:BAND USB`
Notes	When using Keysight USB Mixers, if **Restore All Defaults** (`:SYSTem:DEFault`) has been performed, either remove and reinsert the USB cable or press **Refresh USB Mixer Connection**

6.2.14 Mixer Path

Determines which path you wish to use when using M1971 series USB mixers:

- NORMal, in which they function as a classic external mixer with a single conversion
- DUAL Conversion, in which the first conversion is to a higher IF frequency (nominally 1.5 GHz) and you provide a 10 MHz signal to which an internal PLL is locked, to effect a second downconversion. The higher IF frequency used in Dual Conversion increases the image frequency offset, giving you a wider image-free conversion range. This reduces aliasing effects and improves the image suppress functionality for wideband signals
- AUX Equipment, wherein the first mixer output drives an output connector on the mixer and the instrument is out of the circuit. When you connect an M1971 Mixer to USB, the instrument will pull the IF and RF flatness data from the USB mixer and write this data to a user-accessible file in CSV format for your use when Aux Equipment is selected

Remote Command	`[:SENSe]:MIXer:MPATh NORMal | DUAL | AUX` `[:SENSe]:MIXer:MPATh?`
Example	`:MIX:MPAT NORM`
Dependencies	Only appears when an M1971 series Mixer is connected to the USB port of the instrument When AUX Equipment is selected, Sig Id is turned off to avoid shifting the LO. It is *not* turned back on when a different path is selected When AUX Equipment is the selection, there is no valid result, so the instrument displays a “No Result; Meas invalid with Aux Equip” error condition message (error 135) DUAL Conversion is grayed-out unless in the Swept SA measurement. If grayed-out and the command is sent, generates error:”-221, Settings Conflict; Dual Conversion mixer path is only available in Swept SA" If in DUAL Conversion and you exit Swept SA, reverts to NORMal setting. If you subsequently return to Swept SA, does *not* automatically return to DUAL Conversion When DUAL Conversion is selected, if no signal is sensed at the 10 MHz input port, an error condition is generated, “Ref missing or out of range; M1971” (error 521). This also lights the Error LED on the mixer itself
Couplings	When AUX path is selected, the instrument switches to Zero Span
Preset	NORMal
State Saved	Saved in instrument state
Annotation	In the Meas Bar, if an M1971 series Mixer is connected to the USB port of the instrument, the field Mixer Path appears and says: – Normal for Normal – 2xConv for Dual Conversion – Aux for Aux Equipment

6.2.15 User IF Freq

Specifies the desired IF frequency when using the Aux Equipment path. This setting determines the LO frequency that the instrument will drive into the mixer to correspond to the specified center frequency. Note that the Aux Equipment path always uses “Negative Mixing”, that is, the LO frequency is always higher than the RF frequency.

Remote Command	`[:SENSe]:MIXer:UIFFreq <real>` `[:SENSe]:MIXer:UIFFreq?`
Example	`:MIX:UIFF 300 MHz`
Dependencies	Only appears if an M1971 mixer is connected to USB and the Mixer Path is Aux Equipment
Preset	1.2 GHz
State Saved	Saved in Input/Output state
Min	0 GHz
Max	4 GHz

6.2.16 Signal ID On/Off

Toggles the Signal ID (signal identification) function On or Off. This function lets you identify multiple responses of a single input signal that are generated when using un-preselected external mixers. The use of mixers without pre-selecting filters offers the advantage of improved receiver sensitivity because of the absence of the filter insertion loss, but results in multiple responses due to images and undesired harmonic mixing products.

While in Signal ID, basic spectrum analyzer functions work normally (for example, you can change Span normally), but some functions are disabled (for example, some traces are unavailable).

There are two forms of Signal ID, Image Suppress and Image Shift. Choose the one most appropriate for your application. For Image Shift, an LO-shifted and an unshifted trace are taken in Trace 1 and Trace 2 and displayed together. Any peaks that are not the same in both traces are images. For Image Suppress, image cancellation is performed in the background using two hidden traces, and the result displayed in Trace 1, which shows only the valid signals.

When Signal ID is `ON`, this is indicated in the Meas Bar as Signal ID: On. The annotation is displayed in amber to alert you, because it can cause unexpected behavior if you are not aware that it is on.

Remote Command	`[:SENSe]:SIDentify[:STATe] OFF | ON | 0 | 1` `[:SENSe]:SIDentify[:STATe]?`

Example	`:SID 0` `:SID?`
Notes	Signal ID uses data from two successive sweeps. Therefore, if the instrument is in single sweep mode, two sweep triggers are used to generate the data needed for signal identification For the Log Plot measurement in the Phase Noise Mode, Signal ID works only in the segment of LO sweeping where the offsets are greater than the Rejection Offset setting. When turning it on, you may notice a discontinuity in the Phase Noise trace at the Rejection Offset setting frequency by a few dB due to the under response inherent to Signal ID
Dependencies	Only appears when External Mixer is selected as the Input Not available in some measurements. If Signal ID does not appear or is grayed-out while in your measurement, then it is not available Because Signal ID uses data from two successive sweeps, several trace and sweep functions are grayed-out in Signal ID. See the documentation for your measurement for details on which trace functions are grayed-out Not available with Signal Track, in which case Signal ID is grayed-out Turned off when External Mixer is turned off. Signal ID cannot be turned on when using internal mixing Rules for auto coupling of the Sweep and FFT controls are changed with Signal ID`ON`. For both the dynamic range case and the speed case, swept is chosen whenever any form of Signal ID is on. If Manual FFT is selected, Signal ID is grayed-out If Signal ID is selected in a measurement that does not support it, a warning message is generated
Couplings	The Auto Rules for detector selection select Normal for all active traces when Signal ID is turned `ON`
Preset	Unaffected by Preset, but set to `OFF` by Restore Input/Output Defaults
Annunciation	When Signal ID is on this is indicated in the Meas Bar as Signal ID: On. The annotation is displayed in amber color to alert you to the fact that Signal ID is on, as it can cause unexpected behavior if you are not aware that it is on

6.2.17 Signal ID Mode

Determines the Signal ID mode to use, either Image Suppress or Image Shift.

Image Suppress

Mathematically removes all image and multiple responses of signals present at the mixer input. Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by 2 * IF / N. For each point in each trace, the smaller amplitude from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals, others are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

NOTE When changing from Image Shift to Image Suppress mode, Trace 2 is blanked, as it was used for Image Shift and contains data that you will probably not want to see in Image Suppress

Image Shift

Like the Image Suppress mode, Image Shift is a two-sweep sequence. The data from the first sweep is placed in Trace 1 and the data from the second (LO frequency shifted by 2 * IF / N) sweep is placed in Trace 2. On alternate sweeps, the alternate trace (trace 2) is placed in front of trace 1. This way, you can see a signal at the same place on alternate sweeps, showing in yellow (trace1) and blue (trace2). Signal responses of Trace 1 and Trace 2 that have the same horizontal position are considered to be in the current band and therefore can be analyzed with the amplitude and frequency measurement systems of the SA. All other responses are invalid and should be ignored.

NOTE This function takes control of and uses Trace 1 and Trace 2. Any data in these traces prior to activating Image Shift will be lost.

Remote Command	`[:SENSe]:SIDentify:MODE ISUPpress | ISHift` `[:SENSe]:SIDentify:MODE?`

Example	`:SID:MODE ISUP`
	`:SID:MODE ISH`
	`:SID:MODE?`

Dependencies	Only appears when External Mixer is selected as the Input
Preset	Unaffected by Preset, but set to `ISUPpress` by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.2.18 Cable IF Loss

The loss at the IF in the IF/LO cable can be compensated for with this function, by entering the loss in dB for your cable.

The cable loss will depend on the IF frequency. The IF frequency varies depending on which IF path your measurement is using. For best accuracy, characterize your cable's loss for the IF frequency or frequencies you will be using.

IF Frequencies

10 MHz path	322.5 MHz
25 MHz path	322.5 MHz
40 MHz path	250 MHz
140 MHz path	300 MHz

Remote Command	`[:SENSe]:MIXer:CIFLoss <rel_ampl>` `[:SENSe]:MIXer:CIFLoss?`
Example	`:MIX:CIFL 0.23 DB` `:MIX:CIFL?`
Dependencies	Only appears when External Mixer is selected as the Input
Preset	0.26 dB
State Saved	Saved in instrument state
Min/Max	–/+100

6.2.19 I/Q Path

Selects which I/Q input channels are active. The LED next to each I/Q input port will be on when that port is active.

The analysis bandwidth for each channel is the same as that of the instrument. For example, the base N9020A has a bandwidth of 10 MHz. With I/Q input the I and Q channels would each have an analysis bandwidth of 10 MHz, giving 20 MHz of bandwidth when the I/Q Path is I+jQ. With option B25, the available bandwidth becomes 25 MHz, giving 25 MHz each to I and Q and 50 MHz to I+jQ.

I/Q voltage to power conversion processing is dependent on the I/Q Path selected:

- With I+jQ input, we know that the input signal may not be symmetrical about 0 Hz, because it has a complex component. Therefore, above 0 Hz only the positive frequency information is displayed, and below 0 Hz only the negative frequency information is displayed
- With all other Input Path selections, the input signal has no complex component and therefore is always symmetrical about 0 Hz. In this case, by convention, the power conversion shows the combined voltage for both the positive and negative frequencies. The information displayed below 0 Hz is the mirror of the information displayed above 0 Hz. This results in a power reading 6.02 dB higher (for both) than would be seen with only the positive frequency voltage. Note also that, in this case the real signal may have complex modulation embedded in it, but that must be recovered by further signal processing

Remote Command	`[:SENSe]:FEED:IQ:TYPE IQ | IONLy | QONLy`
	For option details, see "More Information" on page 787
	`[:SENSe]:FEED:IQ:TYPE?`

Example	Set the input to be both the I and Q channels, combined as I + j * Q:
	`:FEED:IQ:TYPE IQ`
	Set the input to be only the I channel:
	`:FEED:IQ:TYPE IONL`
	Set the input to be only the Q channel:
	`:FEED:IQ:TYPE QONL`
	Turn on both I and Q channels and treat I as channel 1 and Q as channel 2:
	`:FEED:IQ:TYPE IND`

Dependencies	Only appears when I/Q is the selected input
Preset	`IQ`
State Saved	Yes Unaffected by Preset, but set to the default value by **Restore Input/Output Defaults** or **Restore System Defaults->All**

Backwards Compatibility SCPI

Notes	For R&S FSQ-B71 compatibility
Preset	`IQ`
Backwards Compatibility SCPI	`:INPut[1]:IQ:TYPE IQ|I|Q` `:INPut[1]:IQ:TYPE?`

More Information

I+jQ

Sets the signal input to be both the I and Q channels. The I and Q channel data will be combined as I + j * Q.

I Only

Sets the signal input to be only the I channel. The Q channel will be ignored. The data collected is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant.

Q Only

Sets the signal input to be only the Q channel. The I channel will be ignored. The Q channel will be sent to the digital receiver block as Q+j0. The receiver's output is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant.

Note that since the receiver's real output is displayed as the "I" data, when the center frequency is 0, the Q Only input appears as the "I" data.

6.2.20 Reference Z

Sets the value of the impedance to be used in converting voltage to power for the I and Q channels. This does not change the hardware's path impedance (see "Input Z" on page 789).

Remote Command	`:INPut:IMPedance:REFerence <integer>` `:INPut:IMPedance:REFerence?`
Example	Set the I/Q reference impedance to 50 Ω: `:INP:IMP:REF 50`
Dependencies	Only appears when I/Q is the selected input
Preset	50 Ω
State Saved	Yes Unaffected by a Preset, but set to the default value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Min/Max	1 Ω / 1 MΩ

6.2.21 I/Q Setup

Lets you set up and calibrate various parameters for the I/Q inputs.

Dependencies	Only appears when I/Q is the selected input

6.2.21.1 I Setup

Accesses the channel setup parameters for the I channel.

Differential

Selects differential input on or off for the I channel. For differential input (also called balanced input), the instrument uses both main and complementary ports. When differential input is off (also called single-ended or unbalanced input), the instrument uses only the main port.

Remote Command	`:INPut:IQ[:I]:DIFFerential OFF | ON | 0 | 1` `:INPut:IQ[:I]:DIFFerential?`
Example	Put the I channel in Differential mode: `:INP:IQ:DIFF ON`

	Put the I channel in Single Ended mode: `:INP:IQ:DIFF OFF`
Notes	When I Differential Input = On, the instrument checks for attenuation mismatches between the I and I-bar ports. If the difference in attenuation values exceeds 0.5 dB, a Settings Alert error condition, error 159 is set When I Differential Input = **On**, and **IQ Path** is **I+jQ**, the Q Differential input must also be **On**. Similarly, when I Differential Input = **Off**, and **IQ Path** is **I+jQ**, the Q Differential input must also be **Off**. If the states of the two inputs do not match, an error condition message is generated, 159, Settings Alert; I/Q mismatch: Differential
Couplings	Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Instrument will use only the main port, and the key will show that the Instrument's Differential Input mode is **Off** (indicating that the complementary port is not in use) When **Q Same as I** is **On**, the value set for I will also be copied to Q
Preset	`OFF` (Single Ended) Unaffected by **Mode Preset**, but set to the default value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Yes
Annotation	The LED on the I-bar port indicates the Differential Input setting

Backwards Compatibility Command

Notes	For R&S FSQ-B71 compatibility, with no independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards compatibility command, Q Same as I should be `ON`
Preset	`OFF`
Backwards Compatibility SCPI	`:INPut[1]:IQ:BALanced[:STATe] OFF|ON|0|1` `:INPut[1]:IQ:BALanced[:STATe]?`

Input Z

Selects the input impedance for the I channel. The impedance applies to both the I and I-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

Remote Command	`:INPut[1]:IQ[:I]:IMPedance LOW | HIGH` `:INPut[1]:IQ[:I]:IMPedance?`
Example	Set the I channel input impedance to 1 MΩ: `:INP:IQ:IMP HIGH`

	Set the I channel input impedance to 50 Ω: `:INP:IQ:IMP LOW`
Notes	`LOW` = 50 Ω, `HIGH` = 1 MΩ When **IQ Path** is **I+jQ**, the I **Input Z** setting must be the same as the Q **Input Z** setting. If the settings of the two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Input Z
Couplings	Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled, and the value is set to match the probe When no probe is sensed on Q and **Q Same as I** is **On**, the value set for I will also be copied to Q
Preset	`LOW` Unaffected by **Mode Preset**, but set to the default value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Yes
Annotation	"I:<I Input Z>" (examples, "I:50Ω" or "I:1MΩ") in the Measurement Bar. The annotation shows both the I and Q Input Z values

Skew

Sets the skew factor for the I channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling.

Remote Command	`[:SENSe]:CORRection:IQ[:I]:SKEW <seconds>` `[:SENSe]:CORRection:IQ[:I]:SKEW?`
Example	Delay the data for the I channel by 10 ns: `:CORR:IQ:SKEW 10 ns`
Preset	0
State Saved	Yes Unaffected by **Mode Preset**, but set to the default value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Range	0 s to 100 ns
Min	0 s
Max	+100 ns

Combined Differential/Input Z (Remote Command Only)

For backwards compatibility only. It combines the Differential Input and Input Z selections into a single command.

Notes	Provided for E4406A code compatibility

	The enum values translate as follows: U50 — Differential Input = Off, Input Z = 50 Ω B50 — Differential Input = On, Input Z = 50 Ω U1M — Differential Input = Off, Input Z = 1 MΩ B1M — Differential Input = On, Input Z = 1 MΩ Combines the Input Z (50 Ω or 1 M Ω) parameter with the Differential Input (**Off** = "Unbalanced", **On** = "Balanced") parameter into a single enumeration This backwards-compatibility command was for an instrument without independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards-compatibility command, **Q Same as I** should be set to ON Note also the subtle difference between this command and the backwards-compatibility command for Input Z. The Input Z SCPI has "IQ" before "IMP", while this command has that order reversed
Couplings	Does not have an independent parameter, but instead is tied to the Differential Input and Input Z parameters. The coupling for those parameters apply to this command too
Preset	U50
Backwards Compatibility SCPI	:INPut:IMPedance:IQ U50|B50|U1M|B1M :INPut:IMPedance:IQ?
Backwards Compatibility SCPI Example	:INPut:IMPedance:IQ U50 This is equivalent to the following two SCPI commands: :INP:IQ:DIFF OFF :INP:IQ:IMP 50

6.2.21.2 I Probe

Access the probe setup parameters for the I channel.

Dependencies	Only appears when I/Q is the selected input

The set of I/Q probe setup parameters will change based on the type of probe that is sensed. All probe types have the Attenuation parameter, and all probe types can be calibrated. The remaining parameters are only available for some probe types and will not be shown when not available. The probe type is determined by and reported for only for the I and Q ports, never the I-bar or Q-bar ports. The menu title will be "<ch>: <probe id>", where "<ch>" is either "I" or "Q" and "<probe id>" is the type of probe. For example, for the I Probe setup with a Keysight 1130A probe connected to the I port, the title will be "I: 1130A".

Probe calibration data is stored for each probe type for each channel. When no probe is sensed, the probe type "Unknown" is used, and this is also treated like a probe type with its own calibration data. When a probe is changed, the calibration

data for that probe type for that port is restored. An advisory message will be displayed showing the new probe type and the calibration status. The calibration data is stored permanently (survives a power cycle) and is not affected by a Preset or any of the Restore commands. When the probe has EEPROM identification (most newer Keysight probes have this), the calibration data is stored by probe serial number and port, so if you have two probes of the same type, the correct calibration data will be used for each. For probes that do not have EEPROM identification, the calibration data is stored by probe type and port, and the instrument cannot distinguish between different probes of the same type. In all cases (with or without EEPROM identification), the calibration data is port specific, so it will not follow a specific probe from port to port if the probe is moved.

The **Unknown** probe type is used whenever no probe is sensed. When no calibration data exists for **Unknown**, the latest cable calibration data is used.

Attenuation

Attenuation (**Atten**) can be set for each Port.

When there is a Keysight Saturn Extender connected, the setting of **Atten** changes to **Freq Extender Atten** on the Port connected with Keysight Saturn Extender [model number].

See **Amplitude**, "Attenuation" on page 190.

Offset

Some active probes have DC offset capability. When one of these probes is connected, this control will be visible. The signal is adjusted for the DC offset before entering the instrument's port. This allows for removal of a DC offset before reaching the instrument's input port voltage limits. For example, a signal that varies 1 V peak-to-peak with a DC offset equal to the instrument's max input voltage would exceed the input limits of the instrument for half its cycle. Removing the DC offset allows the instrument to correctly process the entire signal.

Remote Command	`:INPut:OFFSet:I <voltage>` `:INPut:OFFSet:I?`
Example	Remove a DC offset of -0.5 V from the I channel input: `:INP:OFFS:I -0.5`
Notes	Only some probe types support **Offset**. For those that do, each probe type has its own **Offset** setting. As probes are changed, the **Offset** value will reflect the new probe's setting. Changing **Offset** affects only the current probe type's setting and leaves all others unchanged
Preset	0 V
State Saved	Saved with probe calibration data. Survives power cycle and is not affected by Preset or Restore
Min/Max	–/+18 V

Coupling

Determines the Coupling to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:COUPling AC | DC` `:SYSTem:CALibration:ROW[1]|2|…|100:COUPling?`
Example	`:SYST:CAL:ROW3:COUP AC`
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`AC`
State Saved	Saved in instrument state
Range	`AC|DC`

Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type, and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

Remote Command	`:CALibration:IQ:PROBe:I:CLEar`
Example	Clear the calibration data for the I channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification): `:CAL:IQ:PROBe:I:CLE`

6.2.21.3 Calibrate

Determines whether the Cal row should be included when Calibrate Selected is executed.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:CALibrate:STATe ON | OFF | 1 | 0` `:SYSTem:CALibration:ROW[1]|2|…|100:CALibrate:STATe?`
Example	`:SYST:CAL:ROW2:CAL:STAT ON`

	:SYST:CAL:ROW2:CAL:STAT?
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	All OFF
State Saved	Saved in instrument state
Range	ON|OFF

I/Q Isolation Calibration

I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. This calibration is performed with nothing connected to any of the front panel I/Q ports. This is the first step in both the I/Q Cable Calibration and the I/Q Probe Calibration. This dialog appears if the Calibration is being run for the first time. It can also be accessed by pressing Back from the I Input Cal, the Q Input Cal, or the I/Q Cable Cal. Pressing Next from this dialog runs the calibration.

Remote Command	:CALibration:IQ:ISOLation
Example	:CAL:IQ:ISOL
Notes	All front panel I/Q ports must be unconnected
State Saved	No

I/Q Isolation Calibration Time (Remote Query Only)

Returns the last date and time that the I/Q Isolation Calibration was performed.

Remote Command	:CALibration:IQ:ISOLation:TIME?
Example	:CAL:IQ:ISOL:TIME?
Notes	Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0
Annunciation	Guided Calibration, Isolation Calibration, Last Calibration

I Port

The I port calibration is performed with the probe body attached to the front panel's I port, and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:PROBe:I`
Example	`:CAL:IQ:PROB:I`
Notes	The I port must be connected to the Cal Out port before issuing the command The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands
State Saved	No

I Port Probe Calibration Time (Remote Query Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port.

Remote Command	`:CALibration:IQ:PROBe:I|:TIME?`
Example	`:CAL:IQ:PROB:I:TIME?`
Notes	Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected

I-bar Port

The I-bar port calibration is performed with the probe body attached to the front panel's I-bar port and the probe tip connected via an adapter to the Cal Out port. The I-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:PROBe:IBar`
Example	`:CAL:IQ:PROB:IB`
Notes	The I-bar port must be connected to the Cal Out port before issuing the command The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands
State Saved	No

I-bar Port Probe Calibration Time (Remote Query Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port.

Remote Command	`:CALibration:IQ:PROBe:IBAR:TIME?`

Example	`:CAL:IQ:PROB:IBAR:TIME?`
Notes	Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected
Annunciation	Guided Calibration, Probe Calibration, Last Calibration

6.2.21.4 Q Setup

Access the channel setup parameters for the Q channel.

Dependencies	Only appears when I/Q is the selected input

Q Same as I

Many, but not all, usages require the I and Q channels have an identical setup. To simplify channel setup, **Q Same as I** causes the Q channel parameters to be mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time **Q Same as I** is turned **Off**, the I and Q channel setups will be identical. This does not apply to Probe settings or to parameters that are determined by the probe.

Remote Command	`:INPut:IQ:MIRRored OFF | ON | 0 | 1` `:INPut:IQ:MIRRored?`
Example	Turn off the mirroring of parameters from I to Q: `:INP:IQ:MIRR OFF`
Couplings	Only displayed for the Q channel. When **On**, the I channel values for some parameters are mirrored (copied) to the Q channel. However, when a parameter is determined by the type of probe and a probe is sensed, the probe setting is always used and the I channel setting is ignored. The following parameters are mirrored: – Differential Input (when not determined by probe) – Input Z (when not determined by probe)
Preset	Unaffected by Preset, but set to the default value (Q Same as I set to ON) by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state
Range	`OFF | ON`

Differential

Selects differential input on or off for the Q channel. For differential input (also called balanced input), the instrument uses both the Q and Q-bar ports. When differential

input is **Off** (also called single-ended or unbalanced input), the instrument uses only the Q port.

Remote Command	`:INPut:IQ:Q:DIFFerential OFF | ON | 0 | 1` `:INPut:IQ:Q:DIFFerential?`

Example	Put the Q channel in Differential mode:
	`:INP:IQ:Q:DIFF ON`
	Put the Q channel in Single Ended mode:
	`:INP:IQ:Q:DIFF OFF`

Notes	When Differential Input = `ON`, the instrument checks for attenuation mismatches between the Q and Q-bar ports. If the difference in attenuation values exceeds 0.5 dB a Settings Alert error condition, error 159 will be set When Q Differential Input = `ON`, and **IQ Path** is **I+jQ**, the I Differential input must also be `ON`. Similarly, when Q Differential Input = `OFF`, and **IQ Path** is **I+jQ**, the I Differential input must also be `OFF`. If the states of the two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Differential
Couplings	Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Instrument will use only the main port, and the key will show that the Instrument's Differential Input mode is **Off** (indicating that the complementary port not in use) When a differential probe is not sensed and **Q Same as I** is **On**, the value set for I will be copied to Q. This key is disabled when **Q Same as I** is **On**
Preset	`OFF`
State Saved	Yes Unaffected by a Preset, but set to the default value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Range	`OFF | ON`
Annotation	The LED on the Q-bar port indicates the Differential Input setting

Input Z

Selects the input impedance for the Q channel. The impedance applies to both the Q and Q-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

Remote Command	`:INPut[1]:IQ:Q:IMPedance LOW | HIGH` `:INPut[1]:IQ:Q:IMPedance?`
Example	Set the Q channel input impedance to 1 MΩ: `:INP:IQ:Q:IMP HIGH`

	Set the Q channel input impedance to 50 Ω: `:INP:IQ:Q:IMP LOW`
Notes	`LOW` = 50 Ω, `HIGH` = 1 MΩ When **IQ Path** is **I+jQ**, the I **Input Z** setting must be the same as the Q **Input Z** setting. If the settings of the two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Input Z
Couplings	Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled, and the value is set to match the probe When no probe is sensed and **Q Same as I** is **On**, the value set for I will also be copied to Q. This key is disabled when **Q Same as I** is **On**
Preset	`LOW`
State Saved	Yes Unaffected by a Preset, but set to the default value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Range	50 Ω | 1 MΩ
Annotation	"Q:<Q Input Z>" (examples, "Q:50Ω" or "Q:1MΩ") in the Measurement Bar. The annotation shows both the I and Q Input Z values

Skew

Sets the skew factor for the Q channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling and probes.

Remote Command	`[:SENSe]:CORRection:IQ:Q:SKEW <seconds>` `[:SENSe]:CORRection:IQ:Q:SKEW?`
Example	Delay the data for the Q channel by 10 ns `:CORR:IQ:Q:SKEW 10 ns`
Preset	0
State Saved	Yes Unaffected by a Preset, but set to the default value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Min/Max	0 s/ 100 ns

6.2.21.5 Q Probe

Accesses the probe setup parameters for the Q channel. See "Combined Differential/Input Z (Remote Command Only)" on page 790.

Dependencies	Only appears when I/Q is the selected input

Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value, and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

Remote Command	`[:SENSe]:CORRection:IQ:I:ATTenuation:RATio <real>` `[:SENSe]:CORRection:IQ:I:ATTenuation:RATio?`
Example	Set the attenuation for the current I probe to 100.00:1: `:CORR:IQ:I:ATT:RAT 100`
Notes	Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged When the **IQ Path** is **I+jQ**, the Q probe attenuation setting must match the I Probe attenuation setting within 1 dB. If this is not the case, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Attenuation
Preset	1
State Saved	Saved with probe calibration data. Survives a power cycle and is not affected by Preset or Restore
Min/Max	0.001/10000

This is an alternate form of the SCPI command that allows input as a power instead of a ratio.

Remote Command	`[:SENSe]:CORRection:IQ:I:ATTenuation <rel_ampl>` `[:SENSe]:CORRection:IQ:I:ATTenuation?`
Example	Set the attenuation for the current I probe type to 100.00:1: `:CORR:IQ:I:ATT 20 dB`
Min/Max	–60 dB /+80 dB

Offset

Some active probes have DC offset capability. When one of these probes is connected this control will be visible. The signal is adjusted for the DC offset before entering the instrument's port. This allows for removal of a DC offset before reaching the instrument's input port voltage limits. For example, a signal that varies 1 V peak-to-peak with a DC offset equal to the instrument's max input voltage would exceed the input limits of the instrument for half its cycle. Removing the DC offset allows the instrument to correctly process the entire signal.

Remote	`:INPut:OFFSet:Q <voltage>`

Command	`:INPut:OFFSet:Q?`
Example	Remove a DC offset of -0.5 V from the Q channel input: `:INP:OFFS:Q -0.5`
Notes	Only some probe types support **Offset**. For those that do, each probe type has its own **Offset** setting. As probes are changed, the **Offset** value will reflect the new probe's setting. Changing **Offset** affects only the current probe type's setting and leaves all others unchanged
Preset	0 V
State Saved	Saved with probe calibration data. Survives power cycle and is not affected by Preset or Restore
Min/Max	–/+18 V

Coupling

Some probe types allow coupling to reject low frequencies. This filters out the DC component of a signal that is composed of a DC bias plus some AC signal. This control is visible only for probe types that have this capability.

Remote Command	`:INPut:COUPling:I DC | LFR1 | LFR2` `:INPut:COUPling:I?`

Example	Turn off low frequency rejection on the I channel, allowing signals down to DC:
	`:INP:COUP:I DC`
	Turn on low frequency rejection on the I channel for frequencies lower than 1.7 Hz:
	`:INP:COUP:I LFR1`
	Turn on low frequency rejection on the I channel for frequencies lower than 0.14 Hz:
	`:INP:COUP:I LFR2`

Notes	Only some probe types support **Coupling**. For those that do, each probe type has its own **Coupling** setting. As probes are changed, the **Coupling** value will reflect the new probe's setting. Changing **Coupling** affects only the current probe type's setting and leaves all others unchanged
Preset	DC
State Saved	Saved with probe calibration data. Survives a power cycle and is not affected by a Preset or Restore
Range	DC | AC 1.7 Hz LFR1 | AC 0.14 Hz LFR2

Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type, and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is **On**, both the data for the probe attached to the main port

and the data for the probe attached to the complementary port are cleared. When Differential Input is Off, only data for the probe attached to the main port is cleared.

Remote Command	`:CALibration:IQ:PROBe:Q:CLEar`
Example	Clear the calibration data for the Q channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification): `:CAL:IQ:PROBe:I:CLE`

6.2.21.6 Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When the Differential control is switched to Differential, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When the Differential control is switched to Single Ended, only the probe attached to the main port is calibrated.

Calibrating the Baseband I/Q ports requires several steps and manual connections. The Guided Calibration will interactively step you through the required steps, displaying diagrams to help with the connections. The steps will vary depending on the setup.

In the Guided Calibration windows, the date and time of the last calibration are displayed. If any of the items listed are displayed in yellow, this indicates that the calibration for that item is inconsistent with the latest calibration, and you should complete the entire calibration process before you exit the calibration. For passive probes with Differential On, any calibration that is more than a day older than the most recent calibration will be displayed with the color amber.

The I/Q probe calibration creates correction data for one of the front panel I/Q channels. When the probe has EEPROM identification, the data is unique to that specific probe. When the probe does not have EEPROM identification, the data will be used for all probes of the same type. The data is also unique to the channel, so calibration data for the I channel will not be used for the Q channel and *vice versa*.

The guided calibration (front panel only) will show connection diagrams and guide you through the I/Q Isolation Calibration and through calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If a user presses "Exit" to exit the calibration process, the data for the port already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the probe. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both softkeys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. You will need to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

For Active probes or when Differential is Off, only the main port is calibrated, otherwise both the main and complementary ports are calibrated.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the `CAL:IQ:PROB:I|IB|Q|QB` command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on, and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

Q Port

The Q port calibration is performed with the probe body attached to the front panel's Q port and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:PROBe:Q`
Example	`:CAL:IQ:PROB:Q`
Notes	The Q port must be connected to the Cal Out port before issuing the command The calibration data is saved as soon as the port is calibrated and survives power cycles. It is not reset by any preset or restore data commands
State Saved	No

Q Port Probe Calibration Time (Remote Query Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port.

Remote Command	`:CALibration:IQ:PROBe:Q:TIME?`
Example	`:CAL:IQ:PROB:Q:TIME?`
Notes	Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been

	performed, all values are 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected
Annunciation	Guided Calibration, Probe Calibration, Last Calibration

Q-bar Port

The Q-bar port calibration is performed with the probe body attached to the front panel's Q-bar port and the probe tip connected via an adapter to the Cal Out port. The Q-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:PROBe:QBar`
Example	`:CAL:IQ:PROB:QB`
Notes	The Q-bar port must be connected to the Cal Out port before issuing the command The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands
State Saved	No

Q-bar Probe Calibration Time (Remote Query Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port.

Remote Command	`:CALibration:IQ:PROBe:QBAR:TIME?`
Example	`:CAL:IQ:PROB:QBAR:TIME?`
Notes	Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected
Annunciation	Guided Calibration, Probe Calibration, Last Calibration

6.2.22 I/Q Cable Calibrate

The I/Q cable calibration creates correction data for each of the front panel I/Q ports. This calibration data is used whenever no probe specific calibration data is available. It is important that all ports are calibrated using the same short BNC cable so that the data is comparable from port to port.

The guided calibration (front panel only) will show connection diagrams and guide you through the isolation calibration and calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is

saved and will be used. If you press "Exit" to exit the calibration process, the data for the ports already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the I/Q ports. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both keys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. You will have to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the `CAL:IQ:FLAT:I|IB|Q|QB` command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the Next button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the Next button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on, and the others will be off. When the screen progresses to the next step (Next button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

The last calibration date and time for each port will be displayed. Any calibrations that are more than a day older than the most recent calibration will be displayed with the color amber.

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. See "I/Q Isolation Calibration" on page 794

Dependencies	Only appears when I/Q is the selected input

6.2.22.1 I Port

The I port calibration is performed with the front panel's I port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:FLATness:I`
Example	`:CAL:IQ:FLAT:I`
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports

	should be calibrated sequentially during the procedure The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands The I port must be connected to the Cal Out port before issuing the command
State Saved	No

6.2.22.2 I-bar Port

The I-bar port calibration is performed with the front panel's I-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:FLATness:IBAR`
Example	`:CAL:IQ:FLAT:IBAR`
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands The I-bar port must be connected to the Cal Out port before issuing the command
State Saved	No

6.2.22.3 Q Port

The Q port calibration is performed with the front panel's Q port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:FLATness:Q`
Example	`:CAL:IQ:FLAT:Q`
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands The Q port must be connected to the Cal Out port before issuing the command
State Saved	No

6.2.22.4 Q-bar Port

The Q-bar port calibration is performed with the front panel's Q-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

Remote Command	`:CALibration:IQ:FLATness:QBAR`
Example	`:CAL:IQ:FLAT:QBAR`
Notes	The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands The Q-bar port must be connected to the Cal Out port before issuing the command
State Saved	No

6.2.22.5 I/Q Cable Calibration Time (Remote Query Only)

Returns the last date and time that the I/Q Cable Calibration was performed for a specific port.

Remote Command	`:CALibration:IQ:FLATness:I|IBAR|Q|QBAR:TIME?`
Example	`:CAL:IQ:FLAT:I:TIME?`
Notes	Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0
Annunciation	Guided Calibration, Cable Calibration, Last Calibration

6.2.23 Audio Input Channel

Determines which Audio Input to be used for audio measurements.

Remote Command	`[:SENSe]:FEED:AFINput:PORT CH1 | CH2` `[:SENSe]:FEED:AFINput:PORT?`
Example	`:FEED:AFIN CH1`
Dependencies	Only appears in Radio Test Mode Only appears in modular products, and only if an M9260A Audio Analyzer module is installed
Preset	Unaffected by Mode Preset, but set to Channel 1 by **Input/Output Preset**

6.2.24 Audio Calibrator

Lets you turn on the internal calibrator in the X-Series Audio board.

Remote Command	`[:SENSe]:FEED:AFALign OFF | REF10` `[:SENSe]:FEED:AFALign?`
Example	`:FEED:AFAL REF10`
Dependencies	Only appears in Measuring Receiver Mode's Audio Measurements when Option 107 is present
Preset	`OFF`

6.2.25 Audio Coupling

Lets you set AC or DC coupling for the currently selected audio input.

Remote Command	`[:SENSe]:AFINput[1]|2:COUPling AC | DC` `[:SENSe]:AFINput[1]|2:COUPling?`
Example	`:AFIN:COUP AC`
Dependencies	Only appears in Measuring Receiver Mode and Radio Test Mode In Measuring Receiver Mode, only appear in Audio Measurements, and only if Option 107 is present In Radio Test Mode, only appears in modular products, and only if an M9260A Audio Analyzer module is installed
Preset	`AC`

6.2.26 Audio Input Ground

Lets you float or ground the low side of the currently selected audio input channel. When you choose `FLOat`, the low side of the input is disconnected from ground.

Remote Command	`[:SENSe]:AFINput[1]|2:LOW FLOat | GROund` `[:SENSe]:AFINput[1]|2:LOW?`
Example	`:AFIN2:LOW FLO`
Dependencies	Only appears in Radio Test Mode Only appears in modular products, and only if an M9260A Audio Analyzer module is installed
Preset	Unaffected by Mode Preset, but set to `GROund` by **Input/Output Preset**

6.2.27 Audio In Impedance

Lets you set the Impedance of the currently selected audio input channel.

The value you enter is rounded up to the nearest allowed value.

Remote Command	`[:SENSe]:AFINput[1]|2:IMPedance 50 | 600 | 1000000` `[:SENSe]:AFINput[1]|2:IMPedance?`
Example	`:AFIN:IMP 50`
Dependencies	Only appears in Radio Test Mode Only appears in modular products, and only if an M9260A Audio Analyzer module is installed
Preset	Unaffected by Mode Preset, but set to 600 by Input/Output Preset

6.2.28 Input/Output Preset

Resets the group of settings and data associated with the Input/Output front-panel key to their default values. These settings are not affected by Mode Preset because they are generally associated with connections to the instrument, which you generally would not want to reset every time you press Mode Preset.

This is the same as the control in the Preset dropdown, and also the same as Input/Output button in the Restore Defaults menu under System.

All the variables set under the Input/Output front panel key are reset by Input/Output Preset, including Amplitude Corrections and Data (described in the Corrections section), with the exception of RF Source settings, which are unaffected.

By using Input/Output Preset and Restore Mode Defaults, a full preset of the current mode will be performed, with the caveat that since Input/Output Preset is a global function it will affect *all* Modes.

When Input/Output Preset is selected, a message appears saying:

“This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings.

It will not affect Alignment data or settings.

It will not affect RF Source settings.

This action cannot be undone. Do you want to proceed?”

Use the OK or Cancel buttons to affirm or cancel the operation.

Example	`:SYST:DEF INP` presets all Input/Output variables to their factory default values

6.3 External Gain

Contains controls that let you compensate for gain or loss in the measurement system outside the instrument. The External Gain is subtracted from the amplitude readout (or the loss is added to the amplitude readout). So, the displayed signal level represents the signal level at the output of the device-under-test, which can be the input of an external device that provides gain or loss.

Entering an External Gain value does not affect the Reference Level, therefore the trace position on screen changes, as do all of the values represented by the trace data. Thus, the values of exported trace data, queried trace data, marker amplitudes, trace data used in calculations such as N dB points, trace math, peak threshold, etc., are all affected by External Gain. Changing the External Gain, even on a trace that is not updating, immediately changes all of the above, without new data needing to be taken.

NOTE **Changing the External Gain causes the instrument to immediately stop the current sweep and prepare to begin a new sweep. The data will not change until the trace data updates because the offset is applied to the data as it is taken. If a trace is exported with a nonzero External Gain, the exported data will contain the trace data with the offset applied.**

In Spectrum Analyzer Mode, a Preamp is the common external device providing gain or loss. In a measurement application mode like GSM or W-CDMA, the gain or loss could be from a BTS (Base Transceiver Station) or an MS (Mobile Station). So, in the Spectrum Analyzer mode MS and BTS would be grayed out, and the only choice would be Ext Preamp. Similarly, in some of the digital communications applications, Ext Preamp will be grayed out, and you would have a choice of MS or BTS.

The Ext Preamp, MS, and BS controls may be grayed-out depending on which measurement is currently selected. If any of the grayed-out controls are pressed, or the equivalent SCPI command is sent, an advisory message is generated.

6.3.1 External Preamp

This function is similar to the reference level offset function. Both affect the displayed signal level. Ref Lvl Offset is a mathematical offset only, no instrument configuration is affected. Ext Preamp gain is used when determining the auto-coupled value of the Attenuator. The External Gain value and the Maximum Mixer Level settings are both part of the automatic setting equation for the RF attenuation setting. (10 dB of Attenuation is added for every 10 dB of External Gain.)

Note that the Ref Lvl Offset and Maximum Mixer Level are described in the Amplitude section. They are reset by Mode Preset. The External Preamp Gain is

reset by the "Restore Input/Output Defaults" or "Restore System Defaults->All functions.

The Swept SA Measurement in SA Mode only supports the “Ext Preamp” function under External Gain. The other External Gain functions are grayed-out, and generate a settings conflict, if the SCPI for them is sent.

See "More Information" on page 810

Remote Command	`[:SENSe]:CORRection:SA<port>:GAIN <rel_ampl>`
	`[:SENSe]:CORRection:SA<port>:GAIN?`
	where `<port>` is one of:
	– `[:RF]|:RF2` for SA6210A Opt 002
	Other than above, replace `<port>` with `[:RF]`

Example	Set the Ext Gain value to 10 dB:
	`:CORR:SA:GAIN 10`
	Set the Ext Gain value to –10 dB (that is, an attenuation of 10 dB):
	`:CORR:SA:GAIN -10`

Notes	Does not auto return This command is new in X-Series
Dependencies	The reference level limits are determined in part by the External Gain/Atten, Max Mixer Level, and RF Atten Grayed out in Modes that do not support External Gain
Preset	Unaffected by Preset, but set to 0 dB by **Restore Input/Output Defaults** or **Restore System Defaults->All** 0.00 dB, Gain
State Saved	Saved in instrument state
Min/Max	–/+120 dB
Annotation	Displayed in the Meas Bar as "Ext Gain <value>". When the gain is zero, no annotation is shown
Backwards Compatibility SCPI	`[:SENSe]:CORRection:OFFSet[:MAGNitude]` The legacy **Ext Preamp Gain** key is now called **Ext Gain,** and the sub-menu has choices of Ext Preamp | MS | BTS for backwards compatibility The MS and BTS choices are unavailable in the Swept SA measurement, and the Ext Preamp is unavailable in the cell comms measurements

More Information

The U7227A USB Preamplifier is an accessory for the X-Series Signal Analyzer that provides gain externally, and whose gain settings are automatically loaded into the instrument over USB whenever it is connected to one of the instrument’s USB ports.

While the USB Preamplifier is plugged into one of the instrument's USB ports, the instrument will consider it to be in the signal path of the RF Input and will apply the calibration data from the USB Preamp to measurements taken at the RF Input (on 2 input boxes, it will be considered to be in the signal path of RF Input 1; it is not supported for RF Input 2).

The USB Preamplifier contains its own cal data. This includes a noise trace suitable for use with NFE, for those models which support NFE. The act of connecting the Preamp to USB will cause the cal data to be downloaded from the preamp. When this happens, an informational message is provided saying "Cal data loaded from USB Preamp". The instrument will then automatically apply the calibration factors loaded from the Preamp in any measurement that supports the USB Preamp.

The External Preamp Gain setting may still be used, even though it is not required for the USB Preamp (since the USB Preamp supplies its own gain data to the instrument which is applied automatically). Connecting the USB Preamp does not change the External Preamp Gain setting, however unless you have another gain or attenuation element in the signal path, the appropriate setting for External Preamp Gain is 0 dB.

Overload detection and reporting will apply when the USB preamplifier is connected to USB. The USB Preamplifier has its own overload detector which reports overloads to the instrument over USB. This generates an error condition, "Input Overload; USB Preamp."

If, while the USB Preamp is connected to USB, a measurement is selected that does not support the USB preamplifier, the "No result; Meas invalid with Preamp" error condition is generated.

6.3.2 External Gain - MS

Sets an external gain/attenuation value for MS (Mobile Station) tests.

Remote Command	`[:SENSe]:CORRection:MS<port>:GAIN <rel_ampl>`
	`[:SENSe]:CORRection:MS<port>:GAIN?`
	where `<port>` is one of:
	– `[:RF]|:RF2` for SA6210A Opt 002
	Other than above, replace `<port>` with `[:RF]`

Example	Set the Ext Gain value to 10 dB:
	`:CORR:MS:GAIN 10`
	Set the Ext Gain value to -10 dB (that is, a loss of 10 dB):
	`:CORR:MS:GAIN -10`

Notes	Does not auto return
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten

	Grayed-out in modes that do not support MS
Preset	Unaffected by Preset, but set to 0 dB by **Restore Input/Output Defaults** or **Restore System Defaults->All** 0.00 dB, Gain
State Saved	Saved in instrument state
Min/Max	–/+100 dB
	Backwards Compatibility SCPI

Example	Set the Ext Gain value to –10 dB, and subsequently querying `:LOSS` will give 10 dB:
	`:CORR:MS:LOSS 10`
	Set the Ext Gain value to 10 dB. Subsequently querying `:LOSS` will return –10 dB:
	`:CORR:MS:LOSS -10`

Notes	A positive value of `<rel_ampl>` in the above command means a loss and a negative value indicates a gain If `:LOSS` is set, `:GAIN` is set to the negative value of the parameter sent If `:LOSS` is queried, it returns the negative of `:GAIN`
Preset	Unaffected by Preset, but set to 0 dB by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Min/Max	–/+100 dB
Backwards Compatibility SCPI	`[:SENSe]:CORRection:MS[:RF]:LOSS <rel_ampl>` `[:SENSe]:CORRection:MS[:RF]:LOSS?`

6.3.3 External Gain - BTS

Sets an external attenuation value for BTS (Base Transceiver Station) tests.

Remote Command	`[:SENSe]:CORRection:BTS<port>:GAIN <rel_ampl>`
	`[:SENSe]:CORRection:BTS<port>:GAIN?`
	where `<port>` is one of:
	– `[:RF]|:RF2` for SA6210A Opt 002
	Other than above, replace `<port>` with `[:RF]`

Example	Set the Ext Gain value to 10 dB:
	`:CORR:BTS:GAIN 10`
	Set the Ext Gain value to –10 dB (that is, a loss of 10 dB):
	`:CORR:BTS:GAIN -10`

Notes	Does not auto return
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten

	Grayed-out in modes that do not support BTS
Preset	Unaffected by Preset, but set to 0 dB by **Restore Input/Output Defaults** or **Restore System Defaults->All** 0.00 dB, Gain
State Saved	Saved in instrument state
Min/Max	–/+100 dB
	Backwards Compatibility SCPI

Example	Set the Ext Gain value to –10 dB, and subsequently querying `:LOSS` will give 10 dB:
	`:CORR:BTS:LOSS 10`
	Set the Ext Gain value to 10 dB. Subsequently querying `:LOSS` will return –10 dB:
	`:CORR:BTS:LOSS -10`

Notes	A positive value of `<rel_ampl>` in the above command means a loss and a negative value indicates a gain If `:LOSS` is set, `:GAIN` is set to the negative value of the parameter sent If `:LOSS` is queried, it returns the negative of `:GAIN`
Preset	Unaffected by Preset, but set to 0 dB by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Min/Max	–/+100 dB
Backwards Compatibility SCPI	`[:SENSe]:CORRection:BTS[:RF]:LOSS <rel_ampl>` `[:SENSe]:CORRection:BTS[:RF]:LOSS?`

6.3.4 I Ext Gain

Affects the I channel input. However, when Q Gain in I+jQ is set to Same as I Gain, this value is applied to both I and Q channel inputs.

Remote Command	`[:SENSe]:CORRection:IQ:I:GAIN <rel_ampl>` `[:SENSe]:CORRection:IQ:I:GAIN?`

Example	Set the I Ext Gain to 10 dB:
	`:CORR:IQ:I:GAIN 10`
	Set the I Ext Gain to –10 dB (that is, a loss of 10 dB):
	`:CORR:IQ:I:GAIN -10`

Dependencies	Not available unless option BBA is installed Grayed-out when I/Q Path is Q Only
Preset	0 dB Unaffected by Preset, but set to 0 dB by **Restore Input/Output Defaults** or **Restore System Defaults->All**

State Saved	Yes
Min/Max	–/+100 dB
Annotation	Ext Gain: <I Ext Gain> dB No annotation is shown when Input is not I/Q. Also not shown when I Ext Gain is 0.00 dB. I Ext Gain is not shown for Input Path Q Only. When the Input Path is Independent I and Q and I Ext Gain is not the same as Q Ext Gain, both are shown. "Ext Gain: <I Ext Gain> dB, <Q Ext Gain> dB"

6.3.5 Q Ext Gain

Affects the Q channel input.

Remote Command	`[:SENSe]:CORRection:IQ:Q:GAIN <rel_ampl>` `[:SENSe]:CORRection:IQ:Q:GAIN?`

Example	Set the Q Ext Gain to 10 dB:
	`:CORR:IQ:Q:GAIN 10`
	Set the Q Ext Gain to –10 dB (that is, a loss of 10 dB):
	`:CORR:IQ:Q:GAIN -10`

Dependencies	Not available unless option BBA is installed Grayed-out when Q gain in I+jQ is set to Same as I Gain
Preset	0 dB Unaffected by Preset, but set to 0 dB by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state
Min/Max	–/+100 dB
Annotation	Ext Gain: <Q Ext Gain> dB No annotation is shown when Input is not I/Q. Also not shown when Q Ext Gain is 0.00 dB. Q Ext Gain is not shown for Input Path I Only or I+jQ. When Input Path is Independent I and Q and when I and Q Ext Gain are both non-zero but are the same the annotation will be "Ext Gain: <Ext Gain> dB" and when I Ext Gain is not the same as Q Ext Gain, both are shown. "Ext Gain: <I Ext Gain> dB, <Q Ext Gain> dB"

6.3.6 Q Gain in I+jQ

When Same as I Gain (`ON`) is selected, I Ext Gain value is applied to both I and Q channel input if **Input Path** is **I+jQ**.

When Independent (`OFF`) is selected, I and Q Ext Gain values are applied to I and Q channel input independently.

Remote Command	`[:SENSe]:CORRection:IQ:Q:GAIN:COUPle ON | OFF | 0 | 1` `[:SENSe]:CORRection:IQ:Q:GAIN:COUPle?`

Example	`:CORR:IQ:Q:GAIN:COUP ON` `:CORR:IQ:Q:GAIN:COUP?`
Preset	ON
State Saved	Yes
Range	Same as I Gain | Independent

6.4 Data Source

Contains controls that let you select the source of the data being fed to the instrument analysis engine.

The ability to Save and Record files of I/Q data is an important feature of some X-Series applications, and the Data Source controls allow you to switch back and forth from actual data at the instrument input and recorded data from a File.

In addition, some measurements allow you to retain a single measurement record in a Capture Buffer, and some measurements allow you to retain a specified length data record internally in a Recorded data area.

So, for measurements that support it, the controls on this tab allow you to select data from the instrument inputs, a recalled recording File, the Capture Buffer, or the Recorded data area. For measurements that do not support these features, the Data Source tab does not appear, and if `:FEED:DATA SCPI` is sent, an Undefined Header error is generated.

The available choices depend on which measurement you are running. All measurements support Input; Capture Buffer and File are only available in certain measurements, as shown in the table below. The choice of the internal Recorded data area is only available in Pulse Mode.

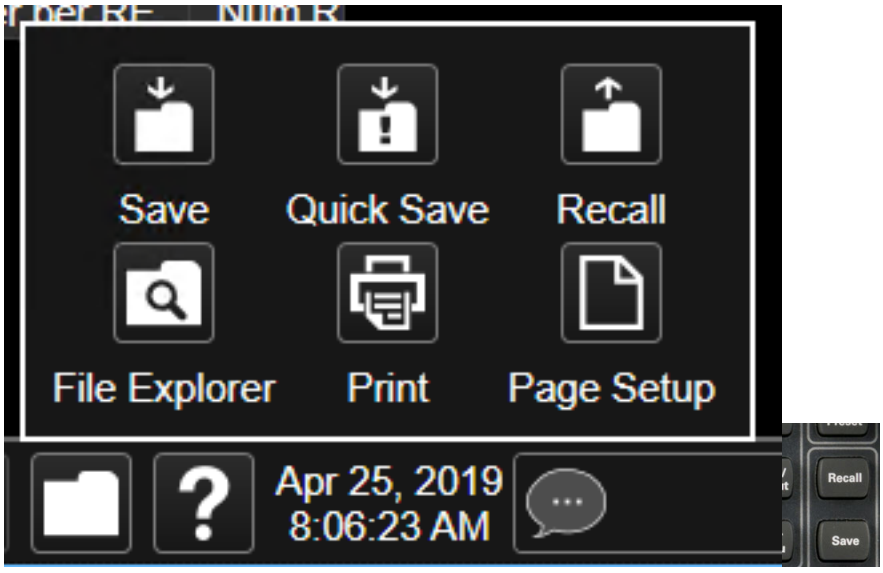
Measurement	Capture Buffer	File
WCDMA Code Domain	x	
WCDMA Mod Accuracy	x	
VMA Digital Demod		x
VMA Custom OFDM		x
5G NR Modulation Analysis		x
FDD LTE-A Modulation Analysis		x
TDD LTE-A Modulation Analysis		x
WLAN Modulation Analysis	x	x
WLAN Spectral Flatness		x
WLAN MIMO Modulation Analysis		x
Analog Demod AM		x
Analog Demod PM		x
Analog Demod FM		x
Analog Demod FM Stereo		x
Bluetooth Transmit Analysis	x	x
IoT & SRComms LoRa CSS Demod		x

How to Record and Playback I/Q Data

In several Demod measurements (and certain other measurements), it is possible to record I/Q data to files on your hard drive or network, and then recall these files for subsequent playback. These are the measurements shown in the table above with an “x” in the File column.

The Recording and Playback of signal data files is a multi-step process which involves controls in several menus (listed below).

Menus involved in Record/Playback:



- Save, Recording (under the Save hardkey or the Save icon in the File panel)
- Recall, Recording (under the Recall hardkey or the Recall icon in the File panel)
- Sweep, Recording tab
- Sweep, Playback tab
- Input/Output, Data Source tab (this tab)

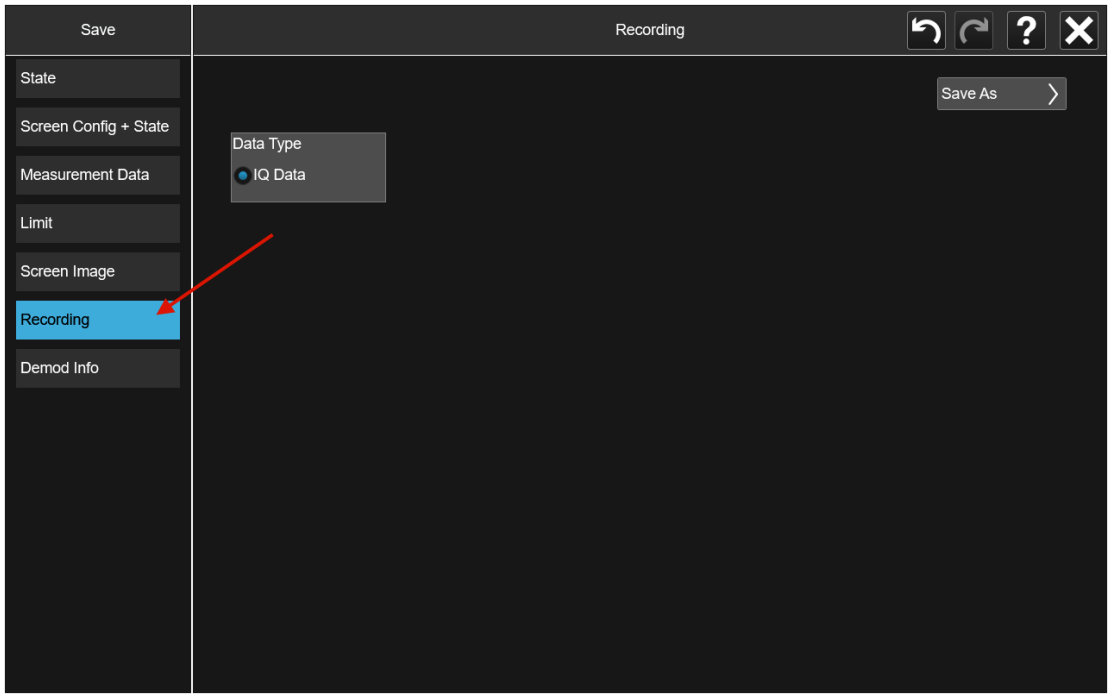
Saving a Recording

When you save a recording, a certain number of measurement records are saved to a Recording file. The amount of data that is saved varies depending on the measurement and measurement settings. The following example uses VMA Digital Demod to illustrate the process.

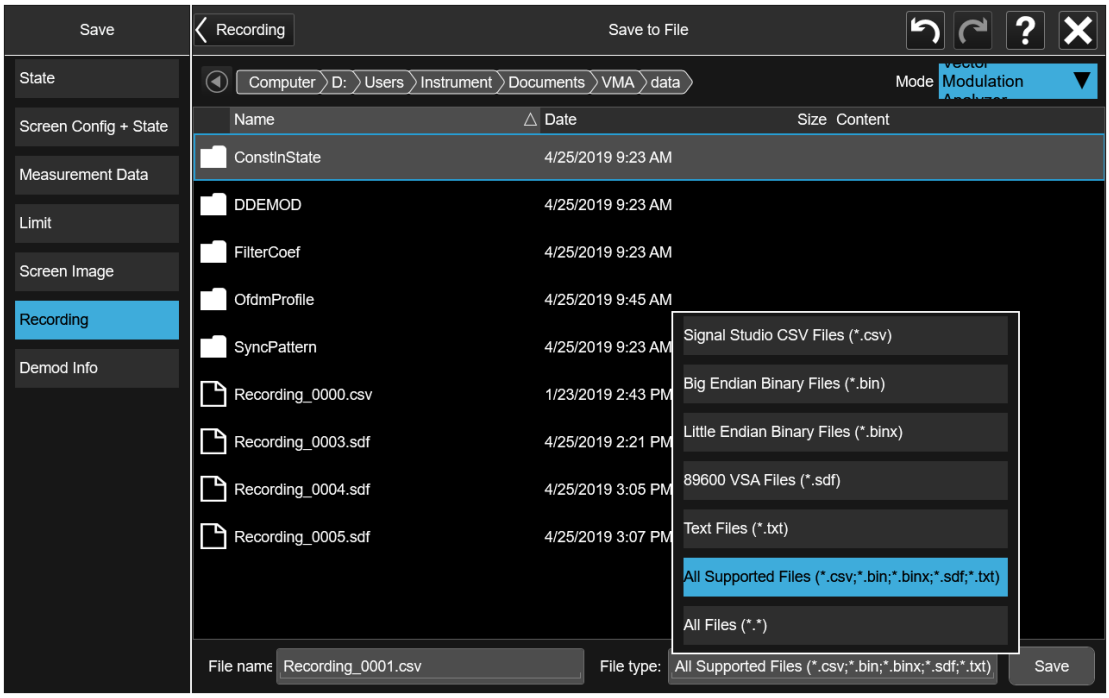
If you press the **Recording** tab in the **Sweep** menu, you will see a certain number of parameters displayed on the menu panel. Before you save a Recording, these parameters are all 0, as shown below:



To save the data for the current measurement, press the **Save** hardkey (or the **Save** icon in the **File** panel) and press the **Recording** tab on the left side of the **Save** panel:

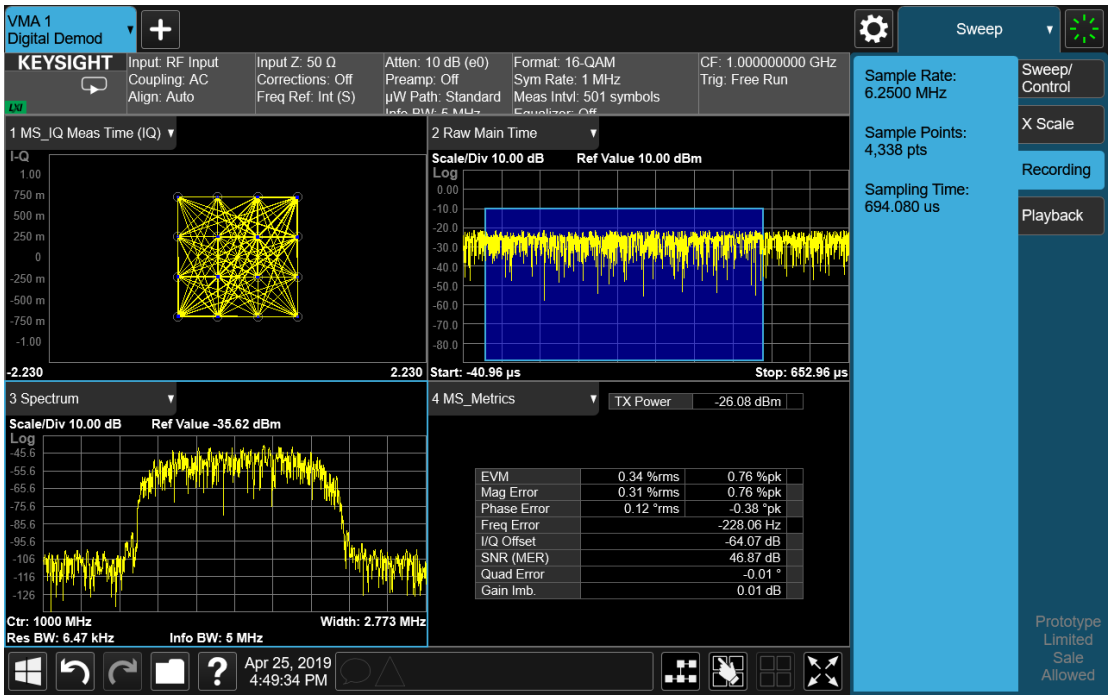


Then press **Save As** and choose the file type you would like to use for the Save (`CSV`, `SDF`, `TXT`, `BIN`, `BINX`). You can find details of the file formats in **Save > Recording**.



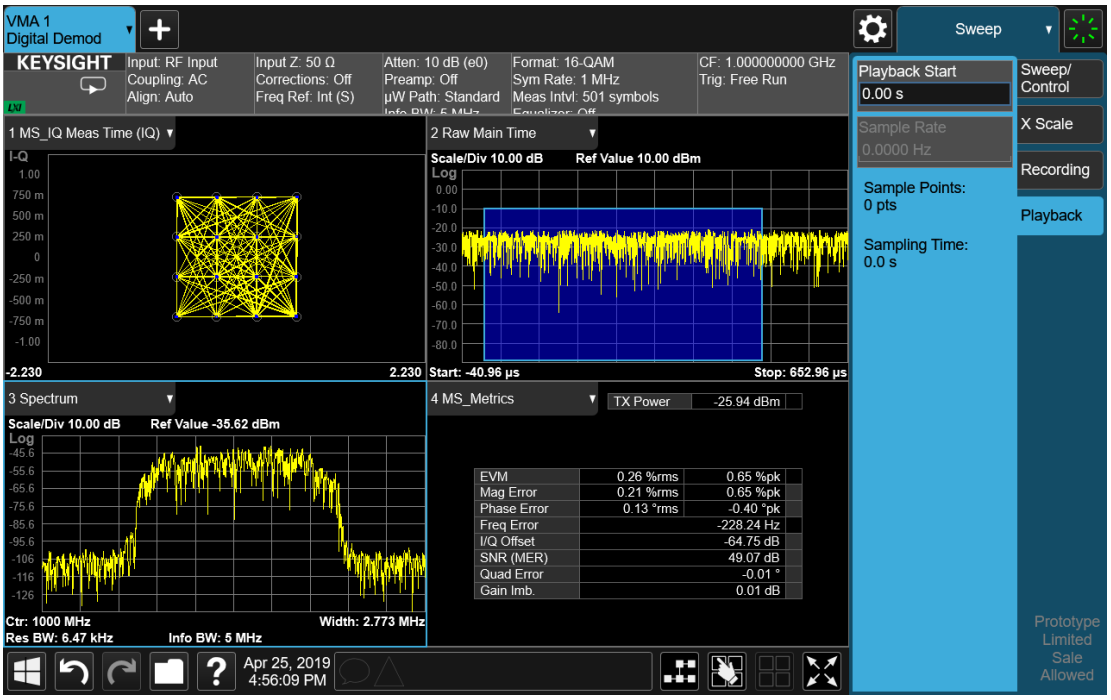
Then press **Save** to save the raw I/Q data of the current measurement.

After the Save, you will see that the data on the Recording panel has changed to describe the data in the file you just saved. You should note this data in case you need to refer to it when you recall the file, particularly as not all file formats include the Sample Rate that was used to save the data. In particular, `BIN` and `BINX` files do not include sampling rate information inside the file, so after recalling one of these file types, you will need to set the Sample Rate manually in the **Sweep**, **Playback** menu.



Step 2: Recalling a Recording

If you press the **Playback** tab in the **Sweep** menu, you will see a certain number of parameters displayed on the menu panel. Before you recall a Recording, these parameters are all 0, as shown below:



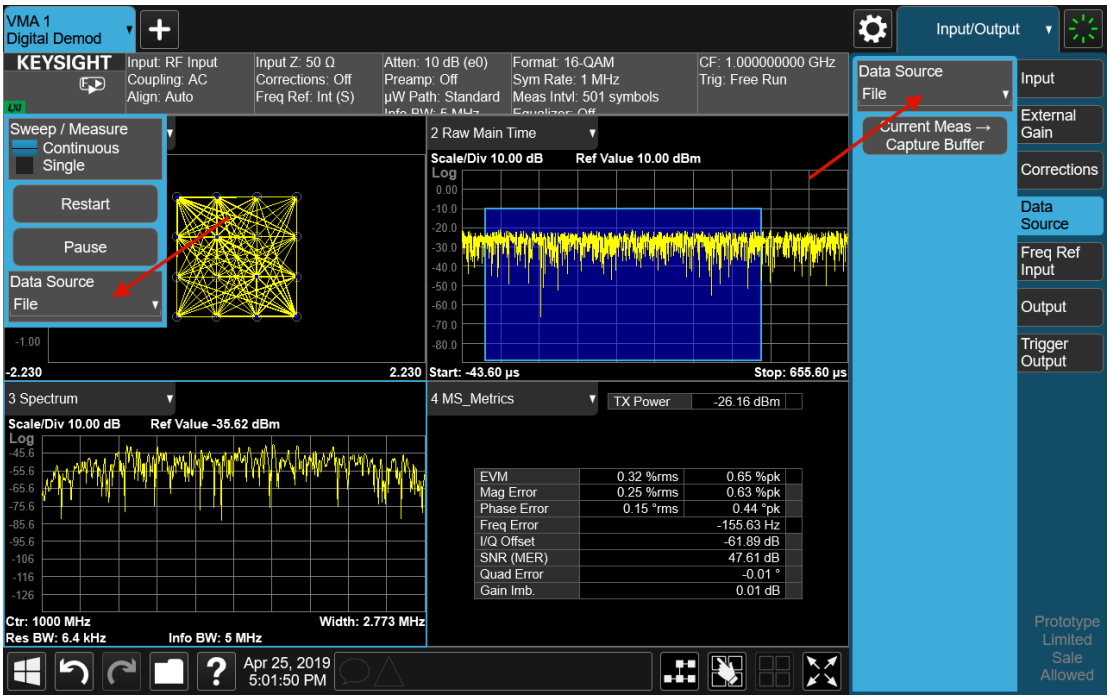
To recall a Recording, press the **Recall** hardkey (or the **Recall** icon in the **File** panel) and press the **Recording** tab on the left side of the **Recall** panel. Then press **Recall From** and choose the file you would like to recall. This will read the raw I/Q data from the specified file and feed it to the current measurement.

After the Recall, you will see that the data on the Recording panel has changed to describe the data in the file you just recalled:

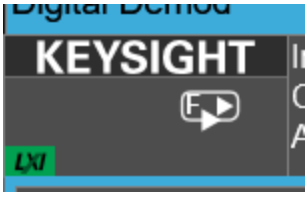


Note that the Sample Rate key is grayed out if the file type you loaded contains Sample Rate information. `BIN` and `BINX` files do not include sampling rate information inside the file, so after recalling one of these file types, you will need to set the Sample Rate. You should have noted the Sample Rate that was displayed on the Sweep, Recording menu panel after you saved the file.

After the recall is performed, you will also see that the Data Source control has switched to File. You can see this on the Data Source menu panel, and also on the dropdown from the Measurement Bar on the far-left side of the instrument:

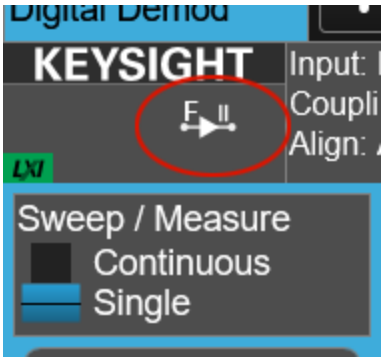


You can also see that the control indicator on the measurement bar has an “F” in it and the playback symbol (right facing triangle) displayed:



This indicates that the instrument is in **Continuous Playback** mode and is using data from a File.

If you select **Single** in the control dropdown, the indicator will change to show that it is in **Single Pause** mode as below:



You can now examine data in the recorded file which you loaded. How you do this depends on whether you are in **Continuous Playback** mode or **Single Pause** mode.

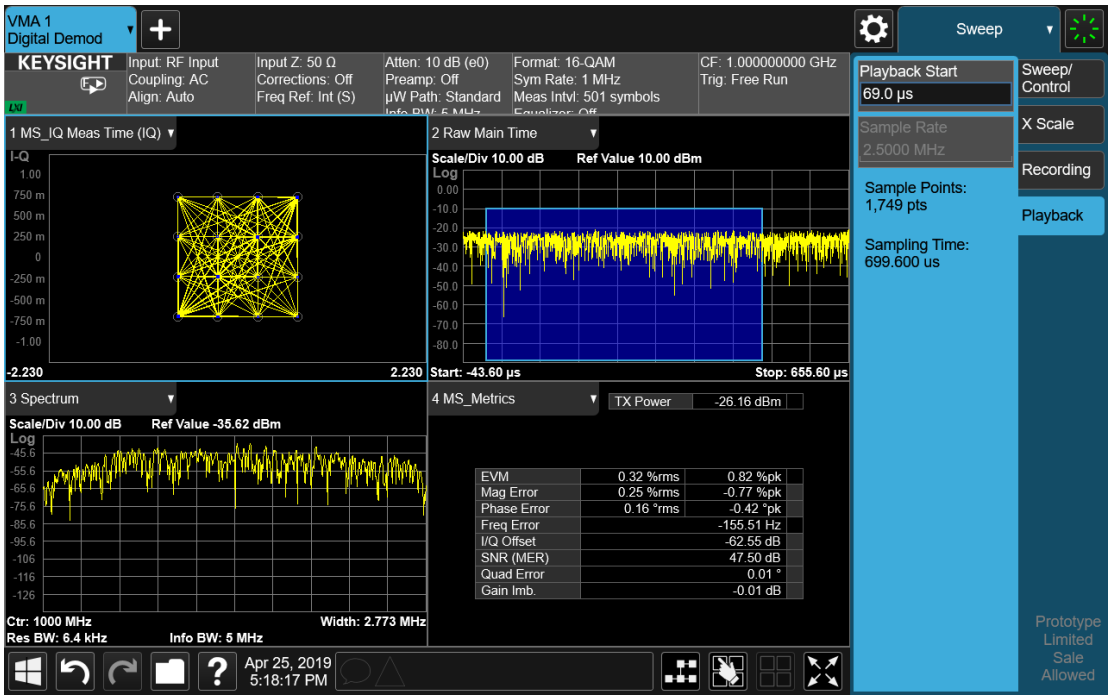
If you wish to return to looking at data at the instrument input, simply change the **Data Source** control from **File** back to **Input**.

Looking at your Recorded data

To examine the data you loaded, go to the **Playback** menu panel under **Sweep**. How you proceed from here depends on whether you are in **Continuous Playback** mode or **Single Pause** mode.

Continuous Playback mode

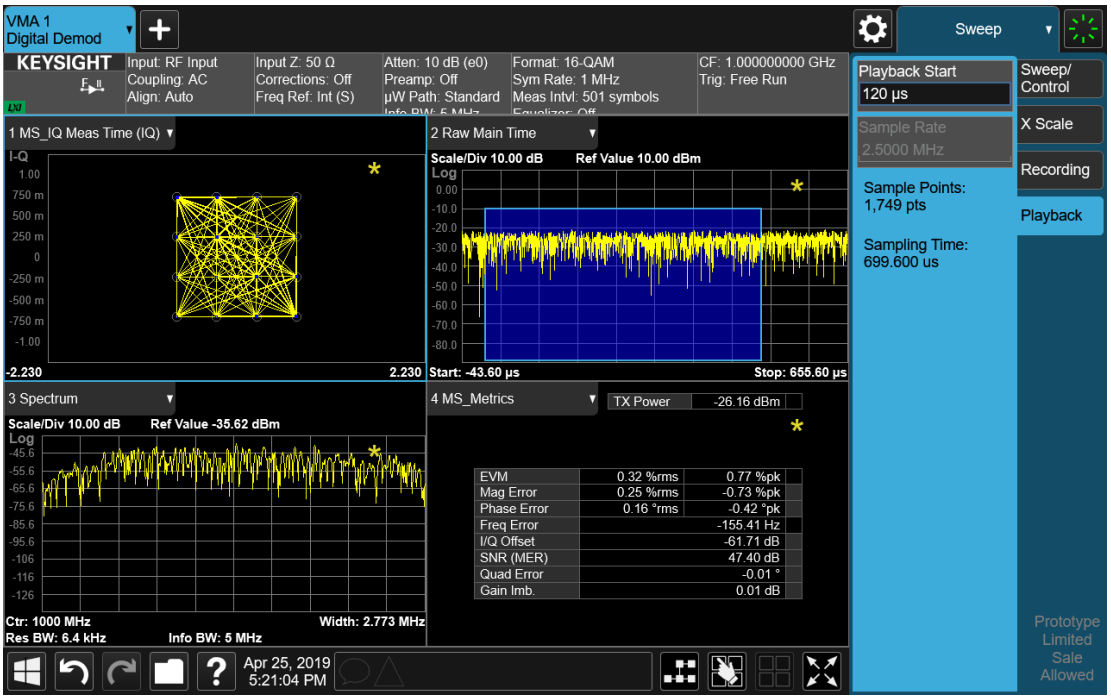
In this mode, turn the knob clockwise or use the **Up** key on the front panel to move through successive records in the recording. You will see the Playback Start control change from 0 to successively higher values as you move through the records.



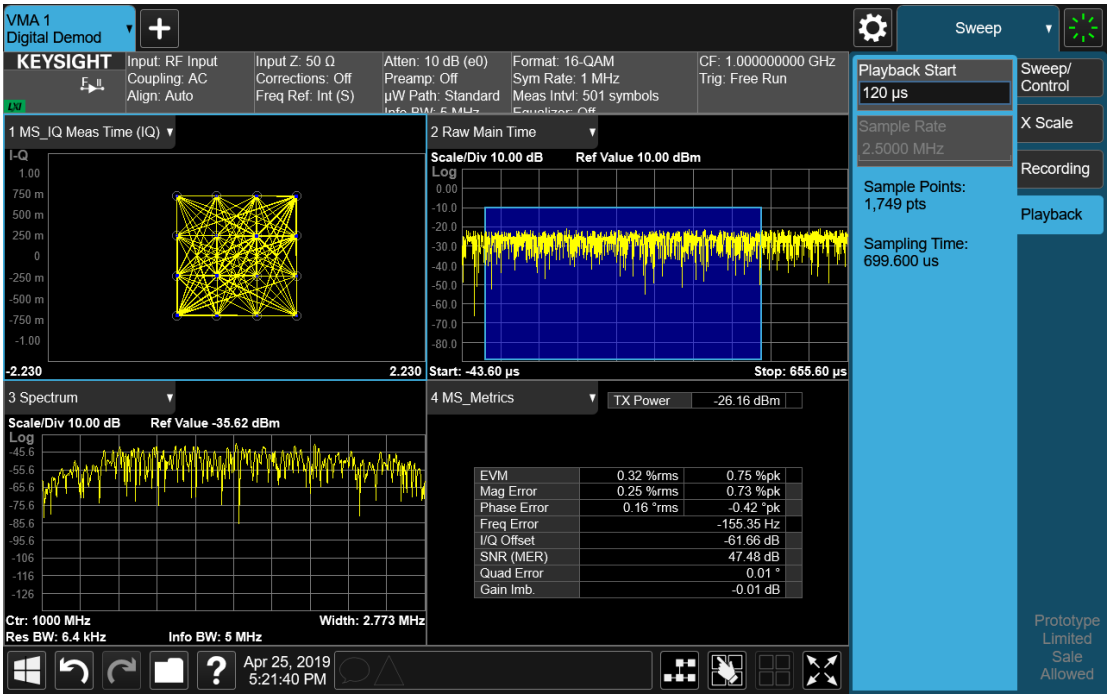
Single Pause mode

In this mode, you can only look at one record. Set the Playback Start time to the desired offset from zero and press **Restart**. A single record will be displayed.

Note that until you press **Restart**, the “invalid data” indicator (yellow asterisk) will be displayed in each window as below:



Once you press **Restart**, the invalid data indicator will disappear, as below:



6.4.1 Data Source

Lets you select the input to the analysis engine. The following options are available:

Input	`INPut`	A hardware input signal (the default). This causes the measurement to take its input data from the hardware input (for example RF, I/Q, or EXTMixer) currently selected on the Input tab under Input/Output
Capture Buffer	`STORed`	Data stored in a storage buffer from a single earlier acquisition. Selecting "Capture Buffer" allows you to use data that has been previously stored using the "Current Meas -> Capture Buffer" control. You can make a measurement and then, if you want to make a different measurement using the exact same data, store the raw data using the "Current Meas -> Capture Buffer" control and select “Capture Buffer” as the Data Source, then switch to the other measurement. You must have previously done a "Current Meas -> Capture Buffer" before the Capture Buffer choice is available for use
Recorded	`RECorded`	Data recorded to memory from a set of earlier acquisitions. Selecting “Recorded” lets you use the record buffer, previously filled by using the “Recording” tab in the Sweep menu, as the input (only available in the Pulse measurement)
File	`FILE`	Data recorded on a storage device from a set of earlier acquisitions. If you load a Recording using Recording under the Recall key, “File” is automatically selected, which lets you use the recorded data as though it were coming from the Input

See "Data Source" on page 816 for a table of available choices on a per-measurement basis.

Remote Command	`[:SENSe]:FEED:DATA INPut | STORed | RECorded | FILE` `[:SENSe]:FEED:DATA?`

Example	Cause the measurement to look at the input selection:
	`:FEED:DATA INP`
	Cause stored measurement data to be used with a different measurement that supports this:
	`:FEED:DATA STOR`

Dependencies	If you switch to a measurement that does not support the currently selected Data Source, the instrument switches Data Source to "Input". Attempting to select an unavailable Data Source via SCPI generates an error The Data Source setting is independent for each mode. Not all Data Sources are available in all modes
Preset	Unaffected by Preset, but set to `INPut` by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`[:SENSe]:FEED:SOURce INPut|STORed` `[:SENSe]:FEED:SOURce?`

6.4.2 Current Meas -> Capture Buffer

Stores the raw data of one measurement in the internal memory of the instrument where it can then be used by a different measurement by pressing Stored Data. When raw data is stored, then the data source selection switch automatically changes to Stored Data. Stored raw data cannot be directly accessed. There is no save/recall function to save the raw data in an external media. If you want to get the stored raw data, you must first perform a measurement using the stored raw data. Now you can access the used raw data, which is the same as stored raw data, using the `:FETch` or `:READ` commands.

Remote Command	`[:SENSe]:FEED:DATA:STORe`
Example	`:FEED:DATA:STOR` stores recorded data
Notes	Command only; no query
Dependencies	Grayed-out in the SA measurement
Backwards Compatibility SCPI	`[:SENSe]:FEED:SOURce:STORe`

6.5 Correction

Accesses the Corrections menu, which lets you select, turn on and off, and configure and edit Corrections. You can also select, turn on and off and configure Complex Corrections and Corrections Groups.

Corrections arrays provide Amplitude Corrections, and can be entered by the user, sent over SCPI, or loaded from a file. They allow you to correct the response of the instrument for various use cases. X-Series supports eight separate Corrections arrays, each of which can contain up to 2000 points. They can be turned on and off individually and any or all can be on at the same time. Corrections Groups let you load several (Amplitude) Corrections at a time into a Correction Group.

Complex Correction arrays provide both Amplitude and Phase Corrections, and can be loaded from a file. Currently the file type supported has the extension .s2p. Complex Corrections operate in much the same manner as Corrections - the X-series supports eight separate Complex Corrections arrays, each of which can contain up to 30000 points, and each Complex Correction can be turned on and off individually and any or all can be on at the same time. Some Modes, such as Spectrum Analyzer Mode, only support only the Amplitude (Magnitude) element of Complex Corrections. Other Modes, such as IQ Analyzer Mode and VMA, support both the Amplitude and Phase elements of Complex Corrections. If a Complex Correction is turned on in a Measurement that does not support Phase, only the Magnitude information will be used for the Correction.

Trace data is in absolute units and corrections data is in relative units. You can edit the Corrections arrays in the Corrections editor using the “Edit Correction” dialog (you cannot edit the Complex Corrections arrays; they can only be loaded from a file).

In zero span measurements (such as Zero Span in the Swept SA measurement), where the frequency is always the center frequency of the instrument, we apply the (interpolated) correction for the center frequency to all points in the trace. In the event where there are two correction amplitudes at the center frequency, we apply the first one in the table.

Note that the corrections are applied as the data is taken; therefore, a trace in View (Update Off) will not be affected by changes made to the corrections after the trace is put in View.

The Corrections tab only appears in Modes and Measurements that support Corrections and/or Complex Corrections. In other Modes, sending SCPI for Corrections and/or Complex Corrections will generate a Settings Conflict message

Corrections and Complex Corrections arrays are not affected by a Preset, because they are in the Input/Output system. They also survive shutdown and restarting of the instrument application, which means they will survive a power cycle. Corrections

and Complex Corrections arrays are reset (deleted) by Restore Input/Output Defaults. The following commands delete the correction registers:

- User Preset the current mode `:SYST:PRES:USER`
- User Preset all modes `:SYST:PRES:USER ALL`
- Full mode preset `:SYST:PRES:FULL`
- Restore power on default `:SYST:DEF PON`
- Restore all defaults `:SYST:DEF`; `:SYST:DEF ALL`
- Preset Input/Output variables `:SYST:DEF INP`
- Delete all corrections `:CORR:CSET:ALL:DEL`

The instrument Save State and Save Screen Config + State includes the data in the correction registers. If a measurement setup is saved and then recalled at a later time, the correction data will be recalled as well. This feature is useful for recreating the full instrument condition, but the user has to be careful that the recalled correction data is the desired data. For example, if the state is recalled on a different instrument different correction data might be needed. Or if the system is recalibrated, the correction data in the save state would then be stale. Applications that use measured data for corrections will generally need to reload the correction data from file whenever a state is recalled; this ensures that the correction data is current and applies to hardware in use.

In the EXM and EXF, on the RF Input/Output panel, there are two full-duplex RF ports (RFIO1 and RFIO2), RF Input and RF Output. When RF Input is selected, it will correspond to one input port from two half-duplex RF ports (RFIO3 and RFIO4), and when RF Output is selected, it will correspond to one output port from two half-duplex RF ports (RFIO3 and RFIO4). So, there are 8 sets of corrections in all that can be applied to the RF ports. Ports cannot share the same set of corrections, but a single port can have multiple corrections applied to it. The correction data is applied to incoming signals as well as transmitted signals and is in the form of a list of spot frequencies and amplitude correction levels.

Annotation	In EMI Mode, you can choose to display the correction details in the graph area by turning on Display, Annotation, Correction Annotation

6.5.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

Notes	The selected correction is remembered even when not in the correction menu
Preset	Set to Correction 1 by Restore Input/Output Defaults

6.5.2 Correction On/Off

Turning the Selected Correction from OFF to ON allows the values in it to be applied to the data. This state transition also automatically turns on "Apply Corrections" (sets it to ON), otherwise the correction would not take effect.

A new sweep is initiated if an amplitude correction is switched on or off. Note that changing, sending or loading corrections data does *not* directly initiate a sweep, however in general these operations will turn corrections on, which *does* initiate a sweep.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET[1]|2|…|16[:STATe]?`
Example	`:SENS:CORR:CSET1 ON`
Dependencies	Changing this from OFF to ON automatically turns on "Apply Corrections" Note that if any Correction is turned on that has a transducer unit set (other than “None”), the Y-Axis Unit of the instrument is forced to that Transducer Unit. All other Y-Axis Unit choices are grayed-out This command generates an “Option not available” error unless you have the proper option installed in your instrument
Preset	Not affected by Preset. Set to OFF by Restore Input/Output Defaults
State Saved	Saved in instrument state
Annotation	If *any* Correction is turned on, Corr in the Meas Bar displays in amber to indicate Corrections are in use
Backwards Compatibility Notes	Unlike legacy instruments, Preset does not turn Corrections off (Restore Input/Output Defaults does)

6.5.3 Correction Port

Maps one of the sets of corrections to a particular I/O port. This control allows any Input port (including External Mixing, BBIQ, the RF2 input, etc.) to be mapped to a specific Correction, so that the Correction is only applied when that Port is being used by the current Screen. You can also map any internal source Output port to a specific Correction.

When Current Input (CINPut) is selected for Correction Port, it chooses the current input port of the current Screen for the selected Correction. In other words, the Correction applies to whichever input is selected. If the input changes, the correction applies to the new input.

When using the VXT M9410A/11A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu appear as:

Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half duplex ports, the choices for these ports appear as below:

Head and Port	Choice in dropdown	SCPI parameter
Head 1, port RF Tx/Rx 1	Head 1 RFHD 1	RRH1RFHD1
Head 1, port RF Tx/Rx 2	Head 1 RFHD 2	RRH1RFHD2
Head 2, port RF Tx/Rx 1	Head 2 RFHD 1	RRH2RFHD1
Head 2, port RF Tx/Rx 2	Head 2 RFHD 2	RRH2RFHD2

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:RF:PORT CINPut | RFIN | RFIN2 | AIQ | EMIXer | RFIO1 | RFIO2 | RFIO3 | RFIO4 | RFOut | RFHD | RFFD | ANT | GEN | TR | A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | RRHnRFHDp | ERFIN`
	See "Parameter Options" on page 831
	`[:SENSe]:CORRection:CSET[1]|2|…|16:RF:PORT?`

Example	Set Correction Port for Correction 1 to apply to the currently selected input:
	`:CORR:CSET:RF:PORT CINP`
	Set Correction Port for Correction 4 to apply to Radio Head 1, RF Tx/Rx Port 2:
	`:CORR:CSET4:RF:PORT RRH1RFHD2`

Notes	The `RF` node in this command is retained for backwards compatibility, even though the scope of the Correction Port command goes beyond the RF ports and includes BBIQ and External Mixing
Dependencies	`RFIN2|AIQ|EMIXer` are only available on C/E/M/P/UXA analyzers with the appropriate options loaded `RFOut` is only available on modular products such as VXT `ANT`, `GEN` and `TR` are only available in VXT and only when the M9470A module is installed, such as in the M8920A. Option “HDX” is required to enable the TR port `RFHD` and `RFFD` are only available on VXT. Option HDX is required to enable RFHD port and option FDX is required to enable RFFD port `RFIO3` and `RFIO4` are only available on EXM with hardware M9431A `RFIN` and `RFOut` are not available on EXM with hardware M9431A `ERFIN` requires option “EXW”
Preset	Unaffected by Preset. Set as below by **Restore Input/Output Defaults**: For VXT: `RFIN` For EXM, EXF: `RFIO1` For all other models: `CINPut` (the currently selected input)
State Saved	Saved in State

Parameter Options

Note that the presence of these ports is highly hardware dependent.

Correction Port	SCPI	Note
Current Input	CINPut	The correction will be applied to whichever input is currently selected in the Input menu
RF Input	RFIN	Main RF Port Not available on EXM with hardware M9431A
RF Input 2	RFIN2	Second RF Port, labeled **RF Input 2** Only available on certain instruments. Not available on modular instruments
BBIQ input	AIQ	Requires option BBA Not available on modular instruments
External Mixer	EMIXer	Requires option EXM Not available on modular instruments
Antenna	ANT	Antenna input port on M9470A, labeled **Ant**
Generator	GEN	Generator output port on M9470A, labeled **Gen**
T/R	TR	T/R port on M9470A, labeled **T/R**
RF Full Duplex	RFFD	On modular instruments, labeled **RFFD**. Option “FDX” is required to enable RFFD port
RF Half Duplex	RFHD	On modular instruments, labeled **RFHD**. Option “HDX” is required to enable RFHD port
A1	A1	On E7760B
A2	A2	On E7760B
A3	A3	On E7760B
B1	B1	On E7760B
B2	B2	On E7760B
B3	B3	On E7760B
IFIO1	IFIO1	On E7760B
IFIO2	IFIO2	On E7760B
RF Output	RFOut	Appears on some modular instruments Not available on EXM with hardware M9431A
RFIO1	RFIO1	Appears on some modular instruments
RFIO2	RFIO2	Appears on some modular instruments
RFIO3	RFIO3	Only available in EXM with hardware M9431A
RFIO4	RFIO4	Only available in EXM with hardware M9431A
GPS out	GPS	Appears on some modular instruments
GNSS out	GNSS	Appears on some modular instruments

6.5.4 Correction Direction

Selects whether corrections will be applied when the device associated with the specified correction is being used as an input, an output or in both directions. The choices are:

INPut	Correct the port only when the port is used as an Input
OUTPut	Correct the port only when the port is used as an Output
BOTH	Correct the port when the port is used as either an Input or an Output (or both)

A port that is only an Output is always corrected as an output if the Correction is On. A port that is only an Input is always corrected as an Input if the Correction is On. For a port that can be either an Input or an Output (or both), the Correction is determined by the Correction Direction setting. The default is BOTH, which means that by default a port that can be either an Input or an Output (or both) is corrected in both directions if the Correction is On.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:DIRection INPut | OUTPut | BOTH` `[:SENSe]:CORRection:CSET[1]|2|…|16:DIRection?`
Example	`:CORR:CSET2:DIR INP`
Dependencies	The Correction Direction control only appears when Correction Port selects a port that can either function as an input or an output (or both simultaneously), such as RFIO HD, RFFD or T/R. If the SCPI command is sent to any other port, it is accepted but ignored
Preset	Not affected by a Preset. Set to BOTH by Restore Input/Output Defaults
State Saved	Saved in State

Backwards Compatibility SCPI	The following SCPI results in the selection of BOTH (included for compatibility with early Multitouch implementations):
	`[:SENSe]:CORRection:CSET[1]|2|…|8:DIRection BIDirectiona`
	included for compatibility with A-models modular products:
	`[:SENSe]:CORRection:CSET[1]|2|…|8:RF:PORT:RFFD SOURce|ANALyzer|BOTH`
	`[:SENSe]:CORRection:CSET[1]|2|…|8:RF:PORT:RFIO1 SOURce|ANALyzer|BOTH`
	`[:SENSe]:CORRection:CSET[1]|2|…|8:RF:PORT:RFIO2 SOURce|ANALyzer|BOTH`
	`[:SENSe]:CORRection:CSET[1]|2|…|8:RF:PORT:RFIO3 SOURce|ANALyzer|BOTH`
	`[:SENSe]:CORRection:CSET[1]|2|…|8:RF:PORT:RFIO4 SOURce|ANALyzer|BOTH`

6.5.5 Edit Correction

Invokes the integrated editing facility for this correction set.When entering the menu, the editor window turns on, the selected correction is turned On, Apply Corrections is set to On, the amplitude scale is set to Log, and the Amplitude Correction (“Ampcor”) trace is displayed. The actual, interpolated correction trace is shown in green for the selected correction. Note that since the actual interpolated correction is shown, the correction trace may have some curvature to it. This trace represents only the correction currently being edited, rather than the total, accumulated amplitude correction for all amplitude corrections which are currently on, although the total, accumulated correction for all corrections which are turned on is still applied to the data traces.

Because corrections data is always in dB, but the Y-axis of the instrument is in absolute units, it is necessary to establish a reference line for display of the Corrections data. The reference line is halfway up the display and represents 0 dB of correction. It is labeled “0 dB CORREC”. It is drawn in blue. Corrections data is always in dB. Whatever dB value appears in the correction table represents the correction to be applied to that trace at that frequency. So, if a table entry shows 30 dB that means we ADD 30 dB to each trace to correct it before displaying it. By definition all points are connected. If a gap is desired for corrections data, enter 0 dB.

Note that a well-designed Corrections array should start at 0 dB and end at 0 dB. This is because whatever the high-end point is will be extended to the top frequency of the instrument, and whatever the low-end point is will be extended down to 0 Hz. So, for a Corrections array to have no effect outside its range, you should start and end the array at 0 dB.

NOTE **The table editor only operates properly if the instrument is sweeping, because its updates are tied to the sweep system. Thus, you should not try to use the editor in single sweep, and its response will be sluggish during compute-intensive operations like narrow-span FFT sweeps.**

When exiting the edit menu (by using the Return key or by pressing an instrument front-panel key), the editor window turns off and the Ampcor trace is no longer displayed; however, Apply Corrections remains On, any correction that was on while in the editor remains on, and the amplitude scale returns to its previous setting.

Corrections arrays are not affected by a Preset, because they are in the Input/Output system. They also survive shutdown and restarting of the instrument application, which means they will survive a power cycle.

When editing a correction, the editor remembers which correction and which element in the correction array you were editing, and returns you to that correction and that element when you return to the editor after leaving it.

6.5.5.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

Notes	The selected correction is remembered even when not in the correction menu
Preset	Set to Correction 1 by Restore Input/Output Defaults

6.5.5.2 Frequency

Lets you set the RF Output Frequency. You can adjust the frequency of the source using the numeric keypad, step keys, or RPG. Pressing any digit (0 through 9) on the

numeric keypad displays the unit terminator.

Remote Command	`:SOURce:FREQuency[:CW] <freq>` `:SOURce:FREQuency[:CW]?`
Example	`:SOUR:FREQ 1.00 GHz`
Notes	Internal source has list sequence mode, which comprises of several steps that contain separate output power, frequency and waveform etc. When the source list sequence playing is complete, the last step keeps playing, and you can use this command to change the list sequence last step's output frequency
Couplings	The frequency value is coupled to the current channel band and number, such that updates to the band and number will update the frequency value to the corresponding absolute frequency

Preset

E7760B	Depends on port selected
EXM, with license F1A or 5WC	2.412 GHz
VXT Models with Radio Heads/CIU	See "VXT Models with Remote Radio Heads/CIU" on page 836
M941xE(VXT Models with M9471A)	See "M941xE(VXT Models with M9471A)" on page 837
All other models	1.00 GHz

Min

E7760B	Depends on port selected
VXT model M9420A	60 MHz
VXT models M9410A/11A/15A/16A	380 MHz
VXT model M9411A with Option LFE	1 MHz
VXT Models with Radio Heads/CIU	See "VXT Models with Remote Radio Heads/CIU" on page 836
M941xE(VXT Models with M9471A)	See "M941xE(VXT Models with M9471A)" on page 837
All other models	10.00 MHz

Max

Hardware Dependent:

Option 503	3.6 GHz
Option 504	3.8 GHz
Option 506	6.00 GHz
Option F06	6.00 GHz

Parameters for "VXT models M9415A/16A" on page 836

Parameters for "VXT Models with Remote Radio Heads/CIU" on page 836

Parameters for "M941xE(VXT Models with M9471A)" on page 837

For E7760B: Depends on port selected

For EXM, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, reports error message "Settings conflict; Frequency is outside available range"

VXT models M9410A/11A

RF Output Port	Preset	Min Without Option "LFE"	Min With Option "LFE"	Max
RF Output	1 GHz	380 MHz	1 MHz	6 GHz
RFHD	1 GHz	380 MHz	1 MHz	6 GHz

VXT models M9415A/16A

Freq Option	Preset	Min	Max
F06	1 GHz	380 MHz	6.0 GHz
F08	1 GHz	380 MHz	8.0 GHz
F12	1 GHz	380 MHz	12.3 GHz

E7760B

RF Output Port	Preset	Min	Max
IFIO	16 GHz	2 GHz	18 GHz
M1650A	58.32 GHz	55 GHz	69 GHz
M1720A	28 GHz	25 GHz	29 GHz

VXT Models with Remote Radio Heads/CIU

Products with Radio Heads/CIU	Port	Preset	Min frequency	Max frequency
VXT + CIU + M1740A RRH	RF Out	1 GHz	0.33 GHz	6 GHz
	DUT IF OUT n	6 GHz	5.9 GHz	12 GHz
	Head h RFHD p	28 GHz	22.7 GHz	43.5 GHz
VXT + M1742A RRH	RF Out	1 GHz	0.33 GHz	6 GHz
	Head h RFHD p	28 GHz	10 GHz	32 GHz
VXT + M1749B RRH-F43	RF Out	1 GHz	0.33 GHz	6 GHz
	Head h RFHD p	28 GHz	22.7 GHz	43.5 GHz

Products with Radio Heads/CIU	Port	Preset	Min frequency	Max frequency
VXT + M1749B RRH-F49	RF Out	1 GHz	0.33 GHz	6 GHz
	Head h RFHD p	28 GHz	22.7 GHz	49.2 GHz
VXT + M9471A + M1749B RRH-F49	RF Out	1 GHz	750 kHz (with LFE) 0.33 GHz (without LFE)	26.5 GHz
	Head h RFHD p	28 GHz	22.7 GHz	49.2 GHz

M941xE(VXT Models with M9471A)

Products with M9471A	Preset	Minimum settable frequency	Minimum frequency with Spec	Maximum settable frequency
M941xE without LFE option	1 GHz	330 MHz	380MHz	26.5GHz
M941xE with LFE option (LFE option in M9411A or M9471A)	1 GHz	750 kHz	1MHz	26.5GHz

NOTE The minimum spec frequency is 380 MHz, minimum settable center frequency is 330 MHz.

With Option LFE in M9411A or in M9471A, the minimum settable frequency is 750 kHz, but Spec to customer only ensure down to 1 MHz.

6.5.5.3 Amplitude

Touching an amplitude value makes the touched row the current row and lets you edit the amplitude.

Min	-1000 dB
Max	1000 dB

6.5.5.4 Go to Row

Sets the selected row in the Cal table for the currently selected Cal Group.

Notes	You can only go to a row that has already been added

Preset	1
State Saved	Saved in instrument state
Min	1
Max	32

6.5.5.5 Insert Row Below

Adds a new row to the currently selected Cal Group, under the currently selected row in the table or after the sub opcode used in the SCPI command. The default values for each of the settings in the row is used.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:INSert`
Example	`:SYST:CAL:ROW2:INSert`
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.5.5.6 Delete Row

Deletes the settings from the selected row of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:DELete`
Example	`:SYST:CAL:ROW2:DEL`
Notes	Disabled if the Cal Group contains no Cal rows
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.5.5.7 Scale X Axis

Matches the X-Axis to the selected Correction, as well as possible. Sets the Start and Stop Frequency to contain the minimum and maximum Frequency of the selected Correction. The range between Start Frequency and Stop Frequency is 12.5% above the range between the minimum and maximum Frequency, so that span exceeds this range by one graticule division on either side. If in zero-span, or there is no data in the Ampcor table, or the frequency range represented by the table is zero, no action is taken. Standard clipping rules apply if the value in the table is outside the allowable range for the X-Axis.

Dependencies	If either the first or last point in the array is outside the frequency range of the current input, an error message is generated: "-221. Settings conflict; Start or Stop Freq out of range for current input settings"

6.5.5.8 Delete Correction

Deletes the correction values for this set. When this key is pressed, a prompt appears on the screen saying "Please press Enter or OK key to delete correction. Press ESC or Cancel to close this dialog." The deletion is only performed if you press OK or Enter.

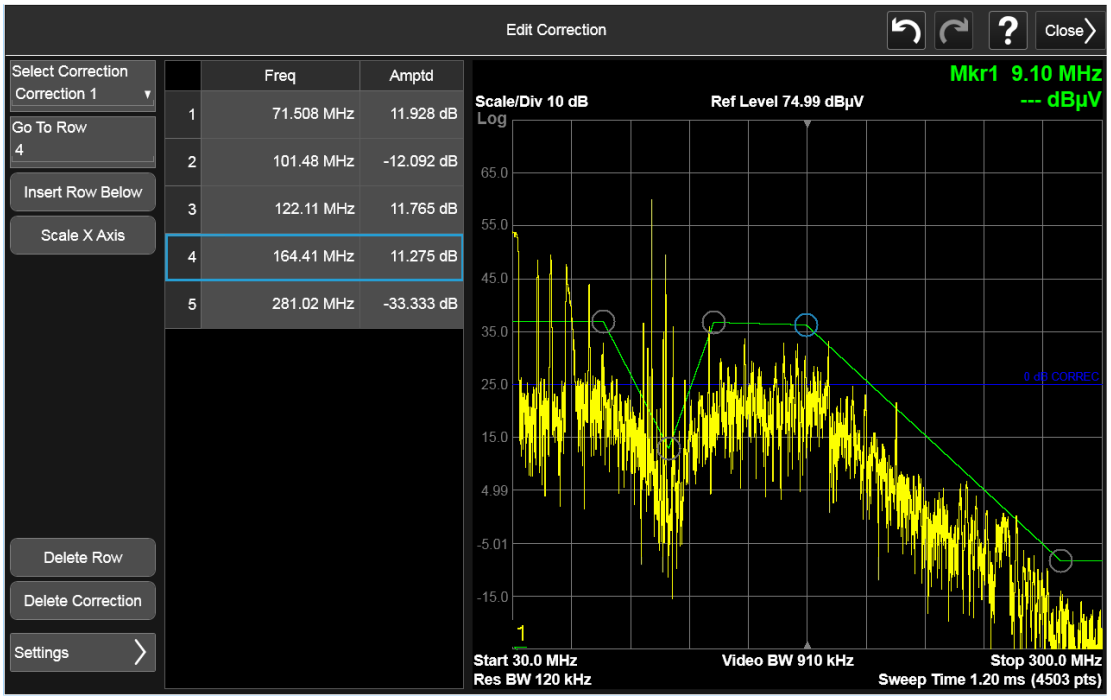
Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:DELete`

Example	`:CORR:CSET:DEL`
	`:CORR:CSET1:DEL`
	`:CORR:CSET4:DEL`

Notes	Pressing this key when no corrections are present is accepted without error

6.5.5.9 Correction Graph

The Correction Graph embedded in the Edit Correction dialog lets you edit the Amplitude Correction visually. Each node in the Correction is represented by a gray circle. The current node has a blue outline in the table and a blue circle in the graph. Touch any circle and drag it where you want it to go.



6.5.6 Edit Correction Settings

Opens another menu page that lets you set certain properties of the selected correction, such as Interpolation, Transducer Unit, Description and Comment.

6.5.6.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

Notes	The selected correction is remembered even when not in the correction menu
Preset	Set to Correction 1 by **Restore Input/Output Defaults**

6.5.6.2 Freq Interpolation

Controls how the correction values per-bucket are calculated. We interpolate between frequencies in either the logarithmic or linear scale.

This setting is handled and stored individually per correction set.

VXT models M9410A/11A/15A/16A only support **Linear** Interpolation. For more details, see "Interpolation" on page 840.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:X:SPACing LINear | LOGarithmic` `[:SENSe]:CORRection:CSET[1]|2|…|16:X:SPACing?`
Example	`:CORR:CSET:X:SPAC LIN`
Preset	Unaffected by Preset. Set to **Linear** by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

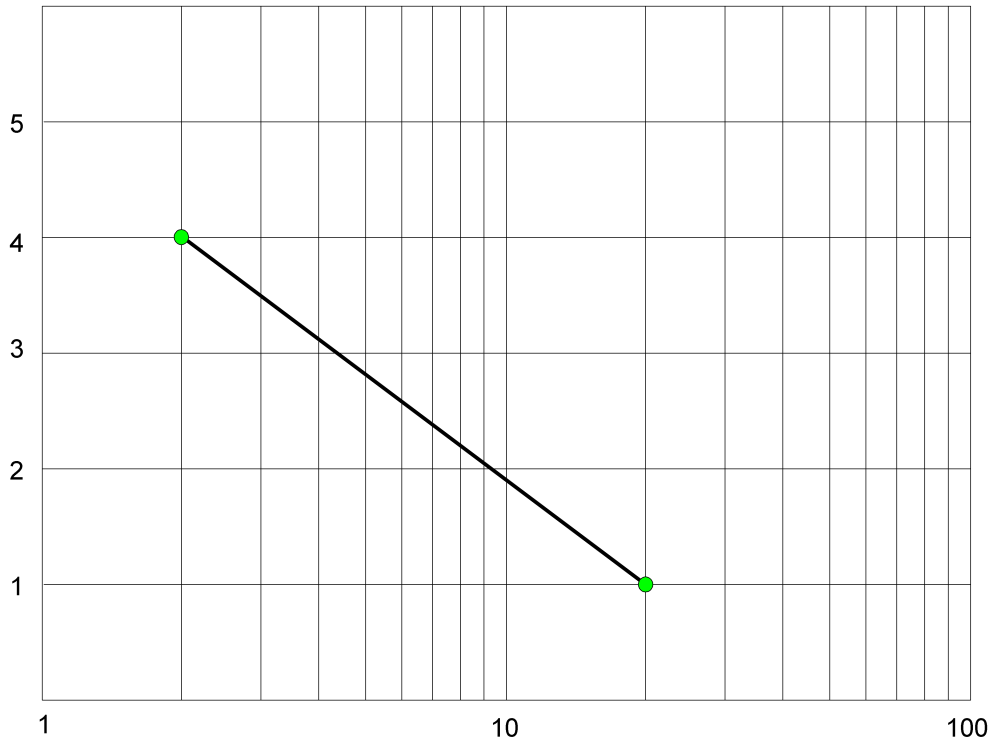
Interpolation

For each bucket processed by the application, all the correction factors at the frequency of interest (center frequency of each bucket) are summed and added to the amplitude. All trace operations and post processing treat this post-summation value as the true signal to use.

To effect this correction, the goal, for any particular start and stop frequency, is to build a correction trace, whose number of points matches the current Sweep Points setting of the instrument, which will be used to apply corrections on a bucket-by-bucket basis to the data traces.

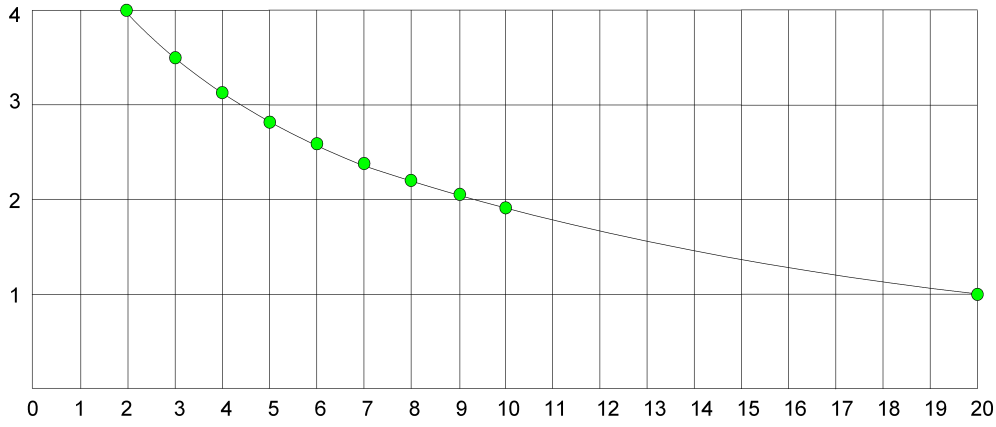
For amplitudes that lie between two user specified frequency points, we interpolate to determine the amplitude value. You may select either linear or logarithmic interpolation between the frequencies.

If we interpolate on a log scale, we assume that the line between the two points is a straight line on the log scale. For example, let's say the two points are (2,4) and (20,1). A straight line between them on a log scale looks like:



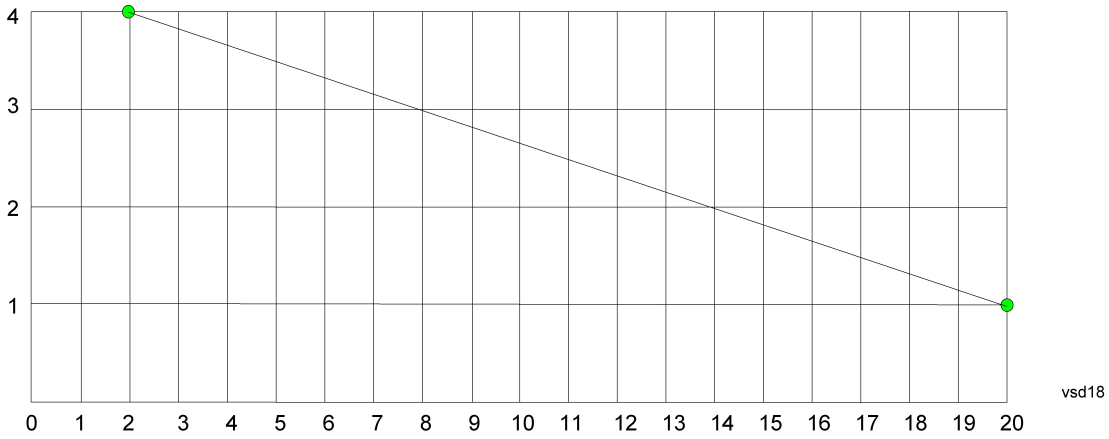
vsd17

On a linear scale (like that of the spectrum analyzer), this translates to:



vsd19

If we interpolate on a linear scale, we assume that the two points are connected by a straight line on the linear scale, as below:



The correction to be used for each bucket is taken from the interpolated correction curve at the center of the bucket.

6.5.6.3 Transducer Unit

For devices (like antennas) that make measurements of field strength or flux density, the correction array should contain within its values the appropriate conversion factors such that, when the data on the instrument is presented in dBµV, the display is calibrated in the appropriate units. The "Transducer Unit" used for the conversion is contained within the corrections array database. It may be specifiedor loaded in from an external file or SCPI.

When an array with a Transducer Unit other than "None" is turned on, the Y Axis Unit of the instrument is forced to that unit, and all other Y Axis Unit choices are grayed out.

Transducer Unit only appears in certain Modes; it does not appear in all Modes that support Corrections.

See "Examples" on page 843

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:ANTenna[:UNIT] GAUSs | PTESla | UVM | UAM | UA | NOConversion` `[:SENSe]:CORRection:CSET[1]|2|…|16:ANTenna[:UNIT]?`
Example	`:CORR:CSET:ANT GAUS`
Dependencies	Only one **Transducer Unit** can be on at any given time. Note that this means that if a correction file with a **Transducer Unit** is loaded into a particular Correction, all other Corrections are set to that same **Transducer Unit** When **Normalize** is On (in the **Trace**, **Normalize** menu), **Transducer Unit** is grayed-out and forced to None
Preset	Unaffected by Preset. Set to NOC by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

Examples

The units that may be specified and what appears in the file and on the screen are shown below:

Transducer Unit	SCPI Example	In the Correction file	On the screen (also Y Axis Unit forced to)
dBµV/m	`:CORR:CSET:ANT UVM`	Antenna Unit=µV/m	dBµV/m
dBµA/m	`:CORR:CSET:ANT UAM`	Antenna Unit=µA/m	dBµA/m
dBµA	`:CORR:CSET:ANT UA`	Antenna Unit=µA	dBµA
dBpT	`:CORR:CSET:ANT PTES`	Antenna Unit=pTesla	dBpT
dBG	`:CORR:CSET:ANT GAUS`	Antenna Unit=Gauss	dBG
None	`:CORR:CSET:ANT NOC`	Antenna Unit= (or no line at all)	none (not forced)

6.5.6.4 Description

Provides a description for the currently selected Cal Group from which the operator can easily identify the Cal Group.

Remote Command	`:SYSTem:CALibration:DESCription "Description"` `:SYSTem:CALibration:DESCription?`
Example	`:SYST:CAL:DESC "Description"`
Notes	Also shown on the **Calibration** menu panel, but limited to the first 18 characters
Dependencies	The SCPI command is applied to the currently selected Cal Group
State Saved	Saved in instrument state

6.5.6.5 Comment

Sets an ASCII comment field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to appear in a screen capture.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:COMMent "text"` `[:SENSe]:CORRection:CSET[1]|2|…|16:COMMent?`

Example	`:CORR:CSET1:COMM "this is a comment"`
Notes	60 chars max; may not fit on display if max chars used
Preset	Unaffected by Preset. Set to empty by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.7 Complex Corrections

This dialog is used to set up and display information about the **Complex Corrections** set. It also lets you view and edit certain information such as the Description and Comment for the selected Complex Correction.

Complex Corrections (loaded from `.s2p` files) support both magnitude and phase corrections, whereas standard corrections (loaded from standard Ampcor `.csv` files) support only magnitude corrections.

When loading an `.s2p` file, the component representing S21 is the one that is used to generate the complex correction. If no S21 component is present, a Mass Storage error is reported.

NOTE **Data types RI, MA, and DB are supported.**

The phase components of the S2P file are taken to be in degrees, not in radians. You must provide the phase correction in degrees.

Unlike Correction files, S2P files describe device characteristics, rather than the correction required to compensate for those characteristics; so, when an S2P file is loaded, both the magnitude and phase are negated to turn it into a correction.

Complex Corrections and standard corrections can be turned on at the same time. For example, you could turn on Correction 2, Correction 4, and Complex Correction 1 and 2, all at the same time. The magnitude part of all the corrections would add, and the phase part of the complex corrections would add.

You can have up to 64 **Complex Corrections** loaded simultaneously. Each Complex Correction can hold up to 30,000 points.

You can load a standard correction into **Complex Corrections**, but it will only provide a magnitude correction, not a phase correction.

NOTE **A standard correction (from a CSV file) can be loaded into a Complex Correction, but when it is loaded the Phase correction is set to 0 for all points.**

Some measurements, like Swept SA, have no phase component to the measurement, but nonetheless support Complex Corrections. For such measurements, only the Magnitude part of the Complex Correction is applied.

6.5.7.1 Go To Row (Select Correction)

Specifies the selected complex correction. The selected correction will be identified by the blue outlined row in the dialog.

The "selected complex correction" is an important concept when sending SCPI commands to the Complex Corrections system, because in each case the SCPI command is directed to the currently selected Complex Correction and that will be the Correction which is modified by the SCPI command.

Remote Command	`[:SENSe]:CCORrection:CSET:SELect <integer>` `[:SENSe]:CCORrection:CSET:SELect?`
Example	`:CCOR:CSET:SEL 3` `:CCOR:CSET:SEL?`
Notes	The selected correction is remembered even when not in the correction menu
Preset	Set to Correction 1 by Restore Input/Output Defaults
Min	1
Max	64

6.5.7.2 Delete Row

Deletes the currently-selected point, whether or not that point is being edited, and selects the Navigate functionality. The point following the currently-selected point (or the point preceding if there is none) will be selected.

6.5.7.3 Delete All

Deletes all the Cals in the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:DELete:ALL`
Example	`:SYST:CAL:DEL:ALL`
Notes	Disabled if the Cal Group contains no Cal rows
Dependencies	The SCPI command is applied to the currently selected Cal Group

6.5.7.4 Correction On

Checking or unchecking this box turns the Selected Complex Correction `ON` or `OFF`. Turning it `ON` causes the values in it to be applied to the data. This state transition also automatically turns on Apply Corrections (sets it to `ON`), otherwise the correction would not take effect.

A new sweep/acquisition is initiated if a complex correction is switched on or off. Note that changing, sending or loading corrections data does *not* directly initiate a sweep, however in general these operations will turn corrections on, which *does* initiate a sweep.

Remote Command	`[:SENSe]:CCORrection:CSET[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CCORrection:CSET[:STATe]?`

Example	Select correction 3:
	`:CCOR:CSET:SEL 3`
	Turn correction 3 on:
	`:CCOR:CSET ON`

Dependencies	Changing this from `OFF` to `ON` automatically turns on **Apply Corrections** Grayed-out if **Complex Corrections** is not supported by the current measurement. A warning or SCPI error is generated if you try to turn it on under these circumstances: "Feature not supported for this measurement"
Preset	Not affected by Preset. Set to `OFF` by **Restore Input/Output Defaults**
State Saved	Saved in instrument state
Annotation	If *any* Complex Correction is turned on, CC in the Meas Bar displays in amber to indicate Complex Corrections are in use

6.5.7.5 Correction Port

Maps one of the sets of corrections to a particular I/O port. This control allows any Input port (including External Mixing, BBIQ, the RF2 input, etc.) to be mapped to a specific Correction, so that the Correction is only applied when that Port is being used by the current Screen. You can also map any internal source Output port to a specific Correction.

When Current Input (CINPut) is selected for **Correction Port**, it chooses the current input port of the current Screen for the selected Correction. In other words, the Correction applies to whichever input is selected. If the input changes, the correction applies to the new input.

When using the VXT M9410A/11A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu will appear as

Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half duplex ports, the choices for these ports will appear as below:

Head and Port	Choice in dropdown	SCPI parameter
Head 1, port RF Tx/Rx 1	Head 1 RFHD 1	RRH1RFHD1
Head 1, port RF Tx/Rx 2	Head 1 RFHD 2	RRH1RFHD2

Head and Port	Choice in dropdown	SCPI parameter
Head 2, port RF Tx/Rx 1	Head 2 RFHD 1	RRH2RFHD1
Head 2, port RF Tx/Rx 2	Head 2 RFHD 2	RRH2RFHD2

See also the parameters, notes and examples table under "Correction Port" on page 830.

Remote Command	`[:SENSe]:CCORrection:CSET:PORT CINPut | RFIN | RFIN2 | AIQ | EMIXer | RFOut | RFIO1 | RFIO2 | RFIO3 | RFIO4 | RFHD | RFFD | ANT | GEN | TR | A1 | A2 | A3 | B1 | B2 | B3 | IFIO1 | IFIO2 | RRHnRFHD | ERFIN` `[:SENSe]:CCORrection:CSET:PORT?`

Example	Select correction 2:
	`:CCOR:CSET:SEL 2`
	Set correction 2 to RFIN:
	`:CCOR:CSET:PORT RFIN`
	Set Correction 2 to Radio Head 1, RF Tx/Rx Port 2:
	`:CCOR:CSET:PORT RRH1RFHD2`

Dependencies	`RFIN2|AIQ|EMIXer` are only available on C/E/M/P/UXA analyzers with the appropriate options loaded `RFOut` is only available on modular products such as VXT `ANT`, `GEN` and `TR` are only available in VXT and only when the M9470A module is installed, such as in the M8920A. Option "HDX" is required to enable the TR port `RFHD` and `RFFD` are only available on VXT. Option HDX is required to enable RFHD port and Option FDX is required to enable RFFD port `RFIO3` and `RFIO4` are only available on EXM with hardware M9431A `RFIN` and `RFOut` are not available on EXM with hardware M9431A `ERFIN` requires option "EXW"
Preset	Not affected by Preset. Set to `CINPut` by **Restore Input/Output Defaults**
State Saved	Saved in State

6.5.7.6 Direction

Selects whether corrections will be applied when the device associated with the specified correction is being used as an input, an output or in both directions. The choices are:

`INPut`	Correct the port only when the port is used as an Input
`OUTPut`	Correct the port only when the port is used as an Output
`BOTH`	Correct the port when the port is used as either an Input or an Output (or both)

Remote Command	`[:SENSe]:CCORrection:CSET:DIRection INPut | OUTPut | BOTH` `[:SENSe]:CCORrection:CSET:DIRection?`

Example	Firstly, select Correction 4:
	`:CCOR:CSET:SEL 4`
	Set Correction 4 to Input:
	`:CCOR:CSET:DIR INP`

Dependencies	For Inputs, the only choice is `INPut`, so an empty table cell is displayed. For Outputs, the only choice is `OUTPut`, so an empty table cell is displayed. If the SCPI command is sent while one of these ports is selected, it is accepted but ignored For a port that can be either an Input or an Output (or both), such as RFHD, RFFD or T/R, all three choices are available
Preset	Not affected by Preset. Set to `BOTH` by **Restore Input/Output Defaults**
State Saved	Saved in State
Backwards Compatibility SCPI	The following SCPI will result in the selection of `BOTH` (included for compatibility with early Multitouch implementations): `[:SENSe]:CCORrection:CSET:DIRection BIDirectiona`

6.5.7.7 Description

Sets an ASCII description field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to appear in a screen capture.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:DESCription "text"` `[:SENSe]:CORRection:CSET[1]|2|…|16:DESCription?`
Example	`:CORR:CSET1:DESC "11941A Antenna correction"`
Notes	45 chars max; may not fit on display if max chars used
Preset	Unaffected by a Preset. Set to empty by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.7.8 Comment

Shows the **Comment** field for the selected Complex Correction. The **Comment** field is loaded from the third line of the `.s2p` file. (Note that, if line 3 begins with "!", the ! is not displayed in the **Comment** field.)

Remote Command	`[:SENSe]:CCORection:CSET:COMMent "text"` `[:SENSe]:CCORection:CSET:COMMent?`

Example	Firstly, select Correction 4:
	`:CCOR:CSET:SEL 4`
	`:CCOR:CSET:COMM "this is a comment"`

Notes	60 chars max; may not fit on display if max chars used

Preset	Unaffected by Preset. Set to empty by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.7.9 File

Shows the file from which the selected correction was loaded. If correction was loaded with a SCPI command (see "Set Data (Remote Command Only)" on page 849) displays “(SCPI)”. If no correction is loaded, displays “(No correction loaded)”

Notes	60 chars max; may not fit on display if max chars used
State Saved	Saved in instrument state

6.5.7.10 Freq Interpolation (Remote Command Only)

Controls how the correction values per-bucket are calculated. We interpolate between frequencies in either the logarithmic or linear scale.

This setting is handled and stored individually per correction set.

VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E only support Linear Interpolation.

See "Freq Interpolation" on page 840 under Corrections.

Remote Command	`[:SENSe]:CCORrection:CSET:X:SPACing LINear | LOGarithmic` `[:SENSe]:CCORrection:CSET:X:SPACing?`

Example	Firstly, select Correction 4:
	`:CCOR:CSET:SEL 4`
	Set linear interpolation:
	`:CCOR:CSET:X:SPAC LIN`

Preset	Unaffected by Preset. Set to `LINear` by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.7.11 Set Data (Remote Command Only)

Lets you set the magnitude part of a complex correction’s data via a SCPI command. This is provided for compatibility with the similar command for standard corrections, to allow you to use Complex Corrections as an extension to standard corrections.

Sending this command sets the phase part of the selected correction to 0 for all points.

The command takes an ASCII series of alternating frequency and amplitude points, each value separated by commas.

The values sent in the command will totally replace all existing correction points in the specified set.

A Complex Correction array can contain 30000 points maximum.

Remote Command	`[:SENSe]:CCORrection:CSET:DATA <freq>, <ampl>, ...` `[:SENSe]:CCORrection:DATA?`

Example	Firstly, select Correction 4:
	`:CCOR:CSET:SEL 4`
	This defines two correction points at (10 MHz, -1.0 dB) and (20 MHz, 1.0 dB) for correction set 4:
	`:CCOR:CSET:DATA 10000000,-1.0,20000000,1.0`

Preset	Empty after **Restore Input/Output Defaults**. Survives a shutdown or restart of instrument application (including a power cycle)
State Saved	Saved in instrument state
Min/Max	

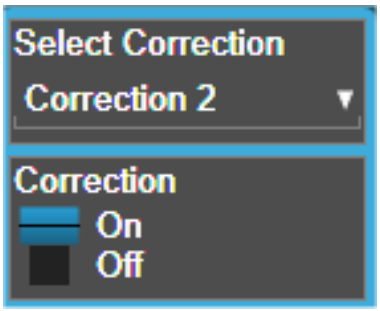
	Min	Max
Freq	0 Hz	+¥
Amptd	–1000 dBm	+1000 dBm

6.5.8 Apply Corrections

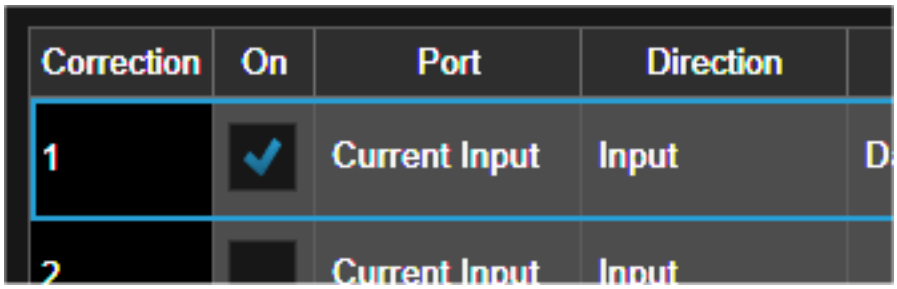
When you turn on **Apply Corrections**, all of the corrections that are turned **On** are applied to the measured data. When you turn off **Apply Corrections**, no corrections are applied, *even if* they are turned **On**.

With this switch you can turn the entire Corrections system on and off without affecting the settings of any individual Corrections. Turning **Apply CorrectionsOn** or **Off** has no effect on the On/Off switches under the individual corrections.

Apply Corrections affects both normal corrections and complex corrections. Normal corrections are turned **On** or **Off** using the **Correction** switch under **Select Correction**:



Complex corrections are turned **On** or **Off** using the checkboxes in the **Complex Corrections** dialog:



See Correction and "Complex Corrections" on page 844.

Remote Command	`[:SENSe]:CORRection:CSET:ALL[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET:ALL[:STATe]?`
Example	`:SENS:CORR:CSET:ALL OFF` This command makes sure that no amplitude corrections are applied, regardless of their individual on/off settings
Couplings	Whenever you turn on any correction or complex correction, **Apply Corrections** is automatically set to ON
Preset	Not affected by Preset. Set to OFF by **Restore Input/Output Defaults**
State Saved	Saved in instrument state
Annunciation	When ON, 'CORREC' appears in the Meas Bar as long as at least one of the individual corrections is enabled

6.5.9 Delete All Corrections

Erases all correction values for all Amplitude Correction sets and Complex Corrections.

When this key is pressed a prompt is placed on the screen that says "Please press Enter or OK key to delete all corrections. Press ESC or Cancel to close this dialog." The deletion is only performed if you press **OK** or **Enter**.

Remote Command	`[:SENSe]:CORRection:CSET:ALL:DELete`
Example	`:CORR:CSET:ALL:DEL`

6.5.10 Correction Group On/Off

Turns the **Correction Group** on or off. The **Correction Group** allows you to preload Correction files and associate them with specific frequency ranges, so that they can be switched in and out during a sweep at the appropriate frequencies. Use the control **Edit Correction Group** below to set up a **Correction Group**.

The state of each correction is set dynamically depending on the active measurement frequency. Only the correction selected for the range that matches the active measurement frequency will be turned on, and *vice versa*.

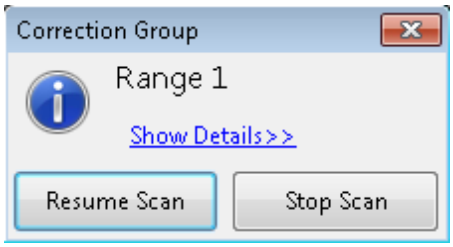
Note that the corrections in the **Correction Group**, although they are loaded into memory, are independent of the main **Correction** registers at the top of the **Corrections** menu, and do not display under the **Select Correction**, **Correction On/Off** or **Edit Correction** functions.

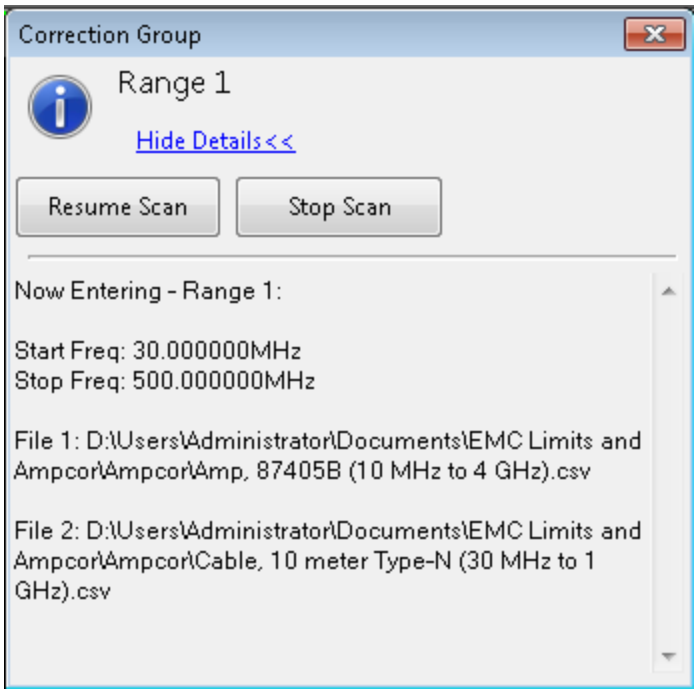
Remote Command	`[:SENSe]:CORRection:CSET:GROup[:STATe] ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET:GROup[:STATe]?`
Example	`:SENS:CORR:CSET:GRO ON`
Dependencies	Supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if Option EMC or EMI Receiver Mode is present. If you switch to other measurements or Mode, **Correction Group** is turned off, and the **Correction Group** functions are not visible Not supported in SA6210A
Couplings	When on, Correction 1 through 8 is set to `OFF` and the correction on/off state keys are grayed out. If the grayed-out key is pressed, it generates an advisory message. If sending the SCPI to turn it on, this same message is generated as part of Settings conflict
Preset	Not affected by Preset. Set to `OFF` by **Restore Input/Output Defaults**
State Saved	Saved in instrument state
Annotation	If *any* Correction Group is turned on, Corr in the Meas Bar displays in amber to indicate Correction Group are in use

6.5.11 Break

If **Break** is **On**, the scan or sweep pauses when it reaches the boundary of correction group ranges. At the same time, a window of size ~ 6.5cm x 3.5 cm appears at the upper right-hand corner of the graticule.

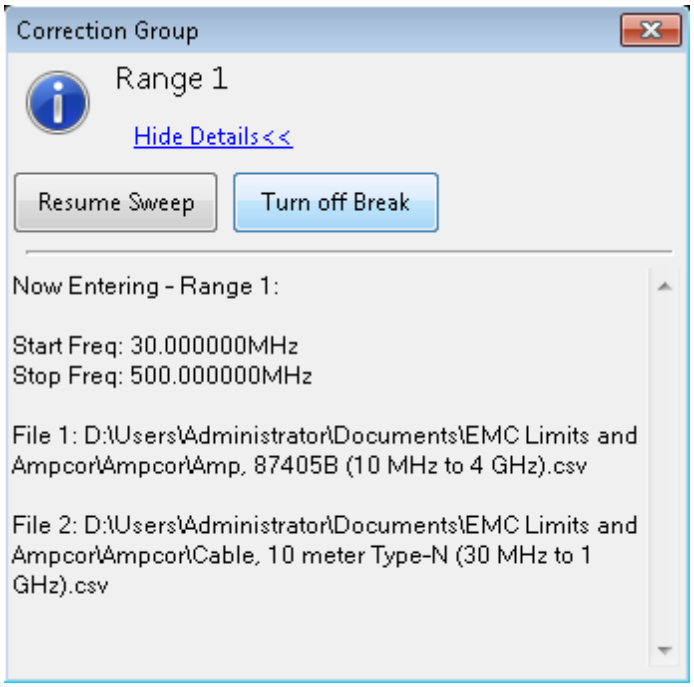
When running Frequency Scan measurements in EMI Receiver Mode, the message prompt appears as below. You are given the option to resume the scan or stop the scan.





When running the Swept SA measurement in SA Mode, the message prompt appears as below. You are given the option to resume the sweep or turn off the break. If in Continuous sweep, the sweep will resume after the break is turned off.





Remote Command	`[:SENSe]:CORRection:CSET:GROup:BReak ON | OFF | 1 | 0` `[:SENSe]:CORRection:CSET:GROup:BReak?`
Example	`:SENS:CORR:CSET:GRO:BR ON`

Notes	When running the Frequency Scan measurement in EMI Receiver Mode, if break is turned on when a SCPI is sent to start the scan, the scan pauses when it reaches the boundary of correction group ranges. Bit 8 (Paused) of status operation register is set to true. To resume, send `:INITiate2:RESume`. To stop the scan, send `:ABORt`
	When running the Swept SA measurement in SA Mode, the break state does not affect the operation of sweep when SCPI to control the sweep is sent. Instead, the SCPI commands close the message prompt if it is showing at the point the commands are sent, and the break is turned off. The SCPI includes:
	`:INITitate:IMMEdiate`
	`:INITitate:RESTart`
	`:INITitate:CONTinuous ON | OFF | 1 | 0`
	`:ABORt`

Dependencies	**Correction Group** is supported in EMI Receiver Mode, and in SA Mode if Option EMC or EMI Receiver mode is present. If you switch to other measurements or Modes, **Correction Group** is turned off, and the **Correction Group** functions (such as **Break**) are not visible
Preset	Not affected by Preset. Set to `OFF` by **Restore Input/Output Defaults**
State Saved	Saved in instrument state

6.5.12 Reload Corrections From Files

Because the correction data for the Correction Group is loaded into memory from correction files at the time the group is defined, it will be necessary to reload some or all of the data if any of the files change. This function reloads all of the correction data from all of the correction files defined in all of the ranges in the Correction Group.

Remote Command	`[:SENSe]:CORRection:CSET:GROup:RELoad`
Example	`:MMEM:STOR:CORR:GRO:REL`
Notes	If invalid data is found in the files, the Correction Group will be set to off, and an Execution error is generated. Error icon appears on the status column correction group table
Dependencies	Correction Group is supported in EMI Receiver Mode, and in SA Mode if Option EMC or EMI Receiver Mode is present. If you switch to other measurements or Modes, Correction Group is turned off, and the Correction Group functions (such as Reload Correction From File) are not visible
Annotation	If reload fails, error icons appear in the status column of correction group editor for the range that has the error

6.5.13 Edit Correction Group

Opens the Table Editor for the correction group. The content of correction group table including the correction data loaded from the files is not affected by Preset, and it survives a power cycle. You can set it to empty with Restore Input/Output Defaults.

Dependencies	Correction Group is supported in EMI Receiver Mode, and in SA Mode if Option EMC or EMI Receiver Mode is present. If you switch to other measurements or Modes, Correction Group is turned off, and the Correction Group functions (such as Edit Correction Group) are not visible

6.5.13.1 Go to Row

Lets you move through the table to edit the desired point.

Min	1
Max	2000

6.5.13.2 Insert Row Below

Inserts a point below the current point. The new point is a copy of the current point and becomes the current point. The new point is not yet entered into the underlying

table, and the data in the row is displayed in light gray. To enter the row into the table, press the Enter key, or tap either value and edit it.

6.5.13.3 Delete Row

Deletes the currently-selected Complex Correction and clears all entries in that row to the default.

Remote Command	`[:SENSe]:CCORrection:CSET:DELete`

Example	Select correction 3:
	`:CCOR:CSET:SEL 3`
	Delete correction 3:
	`:CCOR:CSET:DEL`

6.5.13.4 Select File

Indicate the correction files in which the specify file and remove file operations will take effect.

Preset	Unaffected by a Preset. Set to empty by Restore Input/Output Defaults

6.5.13.5 Specify File

Displays the file browsing menu. When a file is selected, correction data will be loaded from the file. The correction data remains until the file is removed or the range is deleted.

Notes	If the file is empty, error -250 is reported. If the file does not exist error -256 is reported. If there is a mismatch of data type, error -250 is reported Only one file with antenna unit can be supported per range. If you try to add another file which contains an antenna unit, a Mass Storage error is generated All ranges have to use a common antenna unit. If you try to add a correction file that contains a different antenna unit, a Mass Storage error is generated If you try to add a correction file that contains data that does not cover the range frequency, the file cannot be added, and an Execution error is generated

6.5.13.6 Remove File

Removes the selected file. When a file is removed, correction data for that file will be removed as well.

Dependencies	The key is grayed-out if the file has not been specified. If the grayed-out key is pressed, an advisory message is generated

6.5.13.7 Correction Trace Display

Lets you view the correction traces of all corrections that are added to the range currently selected. A 2-column table showing frequency and the accumulated amplitude correction is displayed in the left pane.

Preset	OFF
State Saved	Saved in instrument state

6.5.13.8 Description

Shows the Description field for the selected Complex Correction. The Description field is loaded from the second line of the .s2p file. (Note that, if line 2 begins with "!", the ! is not displayed in the Description field.)

Remote Command	[:SENSe]:CCORrection:CSET:DESCription "text" [:SENSe]:CCORrection:CSET:DESCription?
Example	Firstly, select Correction 4: :CCOR:CSET:SEL 4 :CCOR:CSET:DESC "PNA data import 1-1-18"
Notes	45 chars max; may not fit on display if max chars used
Preset	Unaffected by Preset. Set to empty by Restore Input/Output Defaults
State Saved	Saved in instrument state

6.5.13.9 Comment

Provides a comment of up to 60 characters by which you can easily identify the correction group. The comments are stored in the exported file and can be displayed in the active function area by selecting them as the active function, if desired to be in a saved screen dump.

Remote Command	[:SENSe]:CORRection:CSET:GROup:COMMent "text" [:SENSe]:CORRection:CSET:GROup:COMMent?
Example	:CORR:CSET:GRO:COMM "For internal only"
Notes	60 chars max; may not fit on display if max chars used
Preset	Unaffected by Preset. Set to empty by Restore Input/Output Defaults
State Saved	Saved in instrument state

6.5.13.10 Start Frequency

Touching a Start Frequency value makes the touched row the current row and lets you edit the start frequency.

Notes	You cannot set Start Frequency to a value greater than or equal to Stop Frequency. You cannot set Start Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, Stop Frequency will change to maintain a minimum span of 10 Hz If you change the Start Frequency of the selected range to a value smaller than the previous range's Stop Frequency, the Stop Frequency of the previous range will change to the same value If you change the Start Frequency of the selected range to a value out of the correction data frequency range, an error icon appears on the status column, and an Execution error is generated
Preset	Unaffected by Preset. Set to empty by Restore Input/Output Defaults
Min	0
Max	1 THz

6.5.13.11 Stop Frequency

Touching a Stop Frequency value makes the touched row the current row and lets you edit the stop frequency.

Notes	You cannot set Start Frequency to a value greater than or equal to Stop Frequency. You cannot set Start Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, Stop Frequency will change to maintain a minimum span of 10 Hz If you change the Start Frequency of the selected range to a value smaller than the previous range's Stop Frequency, the Stop Frequency of the previous range will change to the same value If you change the Start Frequency of the selected range to a value out of the correction data frequency range, an error icon appears on the status column, and an Execution error is generated
Preset	Unaffected by Preset. Set to empty by Restore Input/Output Defaults
Min	0
Max	1 THz

6.5.14 Merge Correction Data (Remote Command Only)

Accepts an ASCII series of alternating frequency and amplitude points, each value separated by commas. The difference between this command and Set Data is that this merges new correction points into an existing set.

If any new point has the same frequency as an existing correction point, the existing point's amplitude is replaced by that of the new point.

An Ampcor array can contain 2000 total points, maximum.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:DATA:MERGe <freq>, <ampl>, ...`
Example	`:CORR:CSET1:DATA:MERGE 15000000,-5.0,25000000,5.0` This adds two correction points at (15 MHz, -5.0 dB) and (25 MHz, 5.0 dB) to whatever values already exist in correction set 1
Preset	Empty after **Restore Input/Output Defaults**. Survives shutdown/restart of instrument application (including power cycle)

Min/Max

	Min	Max
Freq	0 Hz	1 THz
Amptd	-1000 dBm	+1000 dBm

6.5.15 Set (Replace) Data (Remote Command Only)

Accepts an ASCII series of alternating frequency and amplitude points, each value separated by commas.

The values sent in the command totally replace all existing correction points in the specified set.

An Ampcor array can contain 2000 points maximum.

Remote Command	`[:SENSe]:CORRection:CSET[1]|2|…|16:DATA <freq>, <ampl>, ...` `[:SENSe]:CORRection:CSET[1]|2|…|16:DATA?`
Example	`:CORR:CSET1:DATA 10000000,-1.0,20000000,1.0` This defines two correction points at (10 MHz, -1.0 dB) and (20 MHz, 1.0 dB) for correction set 1
Preset	Empty after **Restore Input/Output Defaults**. Survives a shutdown or restart of instrument application (including a power cycle)
State Saved	Saved in instrument state
Min	Freq: 0 Hz Amptd: –1000 dBm
Max	Freq: 1 THz Amptd: +1000 dBm

6.5.16 Correction Group Range Data (Remote Command Only)

Accepts an ASCII series of alternating start frequency, stop frequency and file names, each value separated by commas.

The values sent in the command replace the content of correction group.

The default path for CSV files is:

`D:\My Documents\amplitudeCorrections\`

Remote Command	`[:SENSe]:CORRection:CSET:GROup[1]|2|…|10:DATA <startFreq>,<stopFreq>,<filename1>,<filename2>,…,<filename8>`
	See Notes below for explanation of the `<filenameN>` parameters
	`[:SENSe]:CORRection:CSET:GROup[1]|2|…|10:DATA?`

Example	`:CORR:CSET:GRO:DATA 10000000,20000000,"myAmpcor.csv"` `myAmpcor.csv` refers to the Amplitude Correction data from the file `myAmpcor.csv` in the default path
Notes	`<filename>` is the string containing the path of the correction files <filename2>, <filename3>, <filename4>, <filename5>, <filename6>, <filename7>, <filename8> are optional. You can define only <filename1>. The file name defined is added to corresponding File keys based on the sequence sent in the command. File keys with no file name set in the SCPI will be emptied Data for ranges 1 to 10 must be set in ascending order. If you try to set the data for a correction group range that is not connecting to the range currently available, a Data out of range error is generated If the file defined in data is empty, error -250 is reported. If the file does not exist, error -256 is reported. If there is a mismatch of data type, error -250 is reported Only one file with antenna unit can be supported per range. If you try to add another file that contains an antenna unit, a Mass Storage error is generated All ranges have to use a common antenna unit. If you try to add a correction file that contains a different antenna unit, a Mass Storage error is generated
Preset	Reset to *Not a Number* (9.91e+37) for frequencies and "" for File 1 through File 8 after **Restore Input/Output Defaults**. Survives a shutdown or restart of instrument application (including a power cycle)
State Saved	Saved in instrument state
Min	Start Freq and Stop Freq: 0 Hz
Max	Start Freq and Stop Freq:1 THz

6.5.17 Delete Correction Group Range (Remote Command Only)

Deletes all range values of the **Corrections Group**.

Remote Command	`[:SENSe]:CORRection:CSET:GROup:DELete`
Example	`:CORR:CSET:GRO:DEL`
Notes	Sending this command when no range is defined in table is accepted without error

6.6 Freq Ref Input

Lets you configure the External Frequency Reference input on the rear panel.

6.6.1 Freq Ref Input

Specifies the frequency reference as being the internal reference, an external reference at the rear panel input labeled EXT REF IN, a 1 pulse per second signal at the EXT REF IN input, or automatically sensing the appropriate reference.

See "More Information" on page 863

Remote Command	`[:SENSe]:ROSCillator:SOURce:TYPE INTernal | EXTernal | SENSe | PULSe` `[:SENSe]:ROSCillator:SOURce:TYPE?`

Example	`:ROSC:SOUR:TYPE SENS`
	`:ROSC:SOUR:TYPE INT`
	`:ROSC:SOUR:TYPE EXT`
	`:ROSC:SOUR:TYPE PULS`

Dependencies	The `PULSe` parameter, and support of the 1 pps signal at the EXT REF IN input, are not available in some models. If not available, the choice does not appear, and sending the `PULSe` parameter via SCPI generates an error For VXT models M9420A/10A/11A/15A and M9410E/11E/15E/16E, the only available selection is `EXTernal`, unless M9420A/10A/11A/15A is configured in MIMO mode as Primary module. If configured in MIMO mode as Primary module, the available selection is `INTernal | EXTernal | SENSe` For EXM, the only available selections are `INTernal | EXTernal | SENSe` For E7760B and M8920A/20B, the only available selections are `INTernal | EXTernal` Not available in UXM
Preset	Unaffected by Preset, but set to `EXTernal` in VXT models M9420A/10A/11A/15A, `INTernal` for E7760B, and `SENSe` for other models, by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state
Annunciation	In the Meas Bar: If you set this to Internal and no external reference is plugged in: Freq Ref: Internal If you set this to Internal and an external reference between 1 and 50 MHz, or a 1 pps signal, IS plugged in: Freq Ref: Internal (in amber, as a warning sign) If you set this to External and an External Reference between 1 and 50 MHz is plugged in: Freq Ref: External

	If you set this to External and no External Reference is sensed: Freq Ref: External (in amber, as a warning sign) When set to Pulse and a 1 pps signal is plugged in: Freq Ref: Pulse If you set this to Pulse and no Pulse Reference is sensed: Freq Ref: Pulse (in amber, as a warning sign) When set to Sense and neither a signal between 1 and 50 MHz nor a 1 pps signal is detected at the EXT REF IN input, "Sense:Int" is displayed: Freq Ref: Sense,Int When set to Sense and a signal within 5 ppm of the External Ref Freq (as set on the Ext Ref Freq control) is detected at the EXT REF IN input: Freq Ref: Sense,Ext When set to Sense and a 1 pps signal is detected at the EXT REF IN input, "Sense:Pulse" is displayed: Freq Ref: Sense,Pls
Status Bits/OPC dependencies	`STATus:QUEStionable:FREQuency` bit 1 set if unlocked Note: In EXM, the status bit is not set for non-controlling instances. To determine whether the frequency reference is unlocked, the controlling instance must be queried
Backwards Compatibility Notes	Freq Ref In was not saved in state in the legacy instruments. It is part of state in X-Series

Remote Query

Remote Command	`[:SENSe]:ROSCillator:SOURce?`
Notes	Returns the current switch setting. This means: – If it was set to `SENSe` but there is no external reference nor 1pps signal, so the instrument is actually using the internal reference, then this query returns `INTernal`, not `SENSe` – If it was set to `SENSe` and there is an external reference present, the query returns `EXTernal`, not `SENSe` – If it was set to `SENSe` and there is a 1 pps signal present, the query returns `PULSe`, not `SENSe` – If it was set to `EXTernal`, then the query returns `EXTernal` – If it was set to `INTernal`, then the query returns `INTernal` – If it was set to `PULSe`, then the query returns `PULSe` Note: In EXM, the SCPI query always returns `INTernal` for non-controlling instances
Preset	For VXT models M9420A/10A/11A/15A: `EXTernal` For E7760B, M8920A/20B: `INTernal` All other models: `SENSe`
Backwards	`[:SENSe]:ROSCillator:SOURce?` was query-only in ESA which always returned whichever

Compatibility Notes	reference the instrument was using. The instrument automatically switched to the ext ref if it was present In PSA (which had no sensing), `[:SENSe]:ROSCillator:SOURce` set the reference (INT or EXT), so again its query returned the actual routing Thus, the query is 100% backwards compatible with both instruments Backwards Compatibility Command
Notes	For PSA compatibility the command form is provided and is directly mapped to `[:SENSe]:ROSCillator:SOURce:TYPE` Note: In EXM, the command does nothing for non-controlling instances
Backwards Compatibility SCPI	`[:SENSe]:ROSCillator:SOURce INTernal|EXTernal`

More Information

When the frequency reference is set to internal, the internal 10 MHz reference is used even if an external reference is connected.

When the frequency reference is set to external, the instrument will use the external reference. However, if there is no external signal present, or it is not within the proper amplitude range, a condition error message is generated. When the external signal becomes valid, the error is cleared.

When the frequency reference is set to Pulse, the instrument expects a 1 pulse per second signal at the EXT REF IN input. The instrument uses this signal to adjust the frequency of the internal reference.

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set on the **External Ref Freq** control), it will automatically switch to the external reference. If it senses a 1 pulse per second signal, it enters Pulse mode, wherein the signal is used to adjust the internal reference. When no signal is present, it automatically switches to the internal reference. No message is generated as the reference switches between pulse, external and internal. The monitoring of the external reference occurs approximately on 1 millisecond intervals, and never occurs in the middle of a measurement acquisition, only at the end of the measurement (end of the request).

If for any reason the instrument's frequency reference is not able to obtain lock, Status bit 1 in the Questionable Frequency register will be true and a condition error message is generated. When lock is regained, Status bit 1 in the Questionable Frequency register will be cleared and the condition error will be cleared.

If an external frequency reference is being used, you must enter the frequency of the external reference if it is not exactly 10 MHz. The External Ref Freq key is provided for this purpose.

For VXT models M9420A/10A/11A/15A, there is no internal frequency reference. To work correctly, a 100MHz external frequency reference signal is needed to connect to the front panel of the module. The default Freq Ref In setting is “External” and it cannot be set to any other types.

For VXT models M9410A/11A, External Freq Ref Input controls the “100 MHz In” port on the front panel. For VXT models M9415A/16A, External Freq Ref Input controls the “REF In” port on the front panel. For M941xE, the External Freq Ref Input is the reference in port on M941xA module.

NOTE **In EXM, a common frequency reference module serves all instrument instances, but only one instance of the software application can change the reference input type (INT or EXT or SENSE). The software application allowed to change the reference input is called the primary or controlling instance; by default, the leftmost instrument instance is the controlling instance. This can be changed in the config file “`E66XXModules.config`” located in the folder `E:\Keysight\Instrument`. For the non-controlling instance(s) the reference input types (in SCPI commands, and in the Virtual Front Panel menus) are blanked and unavailable for use.**

Sense

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set by External Ref Freq), it uses this signal as an External Reference. If it senses a 1 pulse per second signal, it uses this signal to adjust the internal reference by adjusting the User setting of the Timebase DAC. When no signal is present, it automatically switches to the internal reference.

If set to `SENSe` and the instrument senses a 1 pulse per second signal, it sets the System, Alignments, Timebase DAC setting to User. This setting survives Preset and Power Cycle but is set to Calibrated by System, Restore Defaults, Align or System, Restore Defaults, All

Internal

The internal reference is used. A 1 pps signal at the EXT REF IN port, or a signal there between 1 and 50 MHz, causes a warning triangle to appear in the settings panel next to the word “INTERNAL”, but will otherwise be ignored.

External

The external reference is used.

Pulse

The internal reference continues to be the frequency reference for the instrument in that it determines the reference contribution to the phase noise, but its average frequency is adjusted to follow the 1 pps signal at the EXT REF IN input. Therefore, the instrument frequency accuracy will be dominated by the aging rate of the 1 pps signal instead of the aging rate of the internal reference, except during the time it takes to lock to a new 1 pps signal, approximately 10 minutes.

Sets the System, Alignments, Timebase DAC setting to “User”. This setting survives Preset and Power Cycle, but it set to “Calibrated” on a System, Restore Defaults, Align or a System, Restore Defaults, All

When a 1 pps signal is present at the EXT REF IN input, and either Pulse or Sense is selected, the internal reference frequency is affected by this signal; in effect, it “learns” a new accuracy setting. This setting can be seen by going to the System, Alignments, Timebase Dac menu, and looking at the User key in that menu. You will note that User has become automatically selected, and that the value shown on the User key is the updated value of the timebase DAC as “learned” from the 1 pps signal. Note that this replaces any value the user might have previously set on this key.

Once the setting is learned the user may remove the 1 pps signal; the User setting for the Timebase DAC is retained until you manually select “Calibrated” or execute a System, Restore Defaults, Align or a System, Restore Defaults, All. If you want to make the User setting permanent there is information in the Service Guide that tells you how to change the Calibrated setting of the Timebase DAC.

Note also that if the 1 pps signal is removed when Sense is selected, the instrument will simply switch to the normal state of the Internal reference and display SENSE:INT in the Settings Panel. However, if the 1 pps signal is removed when Pulse is selected, the instrument will generate an error

The J7203A Atomic Frequency Reference is an accessory for the X-Series Signal Analyzer that provides a highly accurate 1 pps timebase to use in conjunction with the Pulse setting. With the J7203A, the 1 pps signal is guaranteed to meet the input requirements of the EXT REF IN port, and the improved accuracy of the instrument’s internal frequency reference is specified. This is the only 1 pps signal that is guaranteed to function properly with the X-Series.

6.6.2 Ext Ref Freq

This key tells the instrument the frequency of the external reference. When the external reference is in use (either because the reference has been switched to External or because the Reference has been switched to Sense and there is a valid external reference present) this information is used by the instrument to determine the internal settings needed to lock to that particular external reference signal.

For the instrument to stay locked, the value entered must be within 5 ppm of the actual external reference frequency. So, it is important to get it close, or you risk an unlock condition.

Note that this value only affects the instrument's ability to lock. It does not affect any calculations or measurement results. See "Freq Offset" in the Frequency section for information on how to offset frequency values.

Remote Command	`[:SENSe]:ROSCillator:EXTernal:FREQuency <freq>` `[:SENSe]:ROSCillator:EXTernal:FREQuency?`

Example	Set the external reference frequency to 20 MHz, but does not select the external reference:
	`:ROSC:EXT:FREQ 20 MHz`
	Select the external reference:
	`:ROSC:SOUR:TYPE EXT`

Dependencies	Still available with **Internal** or **Pulse** selected, to allow setup for when **External** is in use. However, the setting has no effect if the Internal Reference is in use (**Freq Ref In** set to **Internal**, **Pulse**, or `SENSE:INT` or `SENSE:PULSE`) Not available in UXM For VXT models M9420A/10A/11A/15A/16A and M9410E/11E/15E/16E: only 100 MHz is available
Preset	Unaffected by **Mode Preset**, **Input/Output Preset**, or **Restore Defaults, Input/Output**, but set to 100 MHz for VXT models and 10 MHz for other models, by **Restore Defaults, Misc**, or **Restore Defaults, All**, or **Default External Ref Freq**
State Saved	Power On Persistent (survives power cycle)
Min/Max	See "Minimum & Maximum Values" on page 866

Minimum & Maximum Values

Model	Min	Max
CXA, N897xB, E7760B, M8920A/20B, CXA-m	10 MHz	10 MHz
EXA without option R13	10 MHz	10 MHz
EXA with option R13	10 MHz	20 MHz
MXA, PXA, EXM	10 MHz	50 MHz

Model	Min	Max
VXT models	100 MHz	100 MHz
M9410E/11E/15E/16E	100 MHz	100 MHz
All other models	1 MHz	100 MHz

6.6.3 Default External Ref Freq

Restores the External Ref Freq to its default of 10 MHz.

When you set an External Ref Freq value with the Ext Ref Freq control, that Frequency is persistent; is not affected by Mode Preset or Input/Output Preset, and survives shutdown and power cycle. This control allows you to reset the External Ref Freq to its default value.

NOTE **The persistence of the External Ref Freq is a new behavior as of firmware version A.18.00, necessitating the addition of this control. In versions before A.18.00, the frequency reset on a power cycle/restart. Thus, you may need to use this command to retain backwards compatibility.**

Remote Command	`[:SENSe]:ROSCillator:EXTernal:FREQuency:DEFault`
Example	`:ROSC:EXT:FREQ:DEF` Resets the external ref frequency
Notes	Command only; no query
Dependencies	Grayed-out if the Ext Ref Freq is already set to the default Does not appear in EXM, UXM, VXT models or M8920A/20B

6.6.4 LO Ref Input

This parameter sets the LO Reference signal Input to External or Internal.

Remote Command	`[:SENSe]:ROSCillator:LO:INPut INTernal | EXTernal`
	See "Option Details" on page 868
	`[:SENSe]:ROSCillator:LO:INPut?`

Example	`:ROSC:LO:INP EXT` `:ROSC:LO:INP?`
Dependencies	Only available in VXT models M9410A/11A/15A/16A when MIMO is on
Preset	`INTernal`
State Saved	Saved in instrument state

Option Details

Parameter	SCPI	Notes
Internal	INTernal	When Internal is selected, internal reference signal will be used to synchronize the LO board
External	EXTernal	When External is selected, external reference signal will be used to synchronize the LO board. Route the correct reference signal to the specified port before changing the LO Ref Input to External For VXT models M9410A/11A, a 4.8 GHz reference signal is required to rout to the 4.8 GHz In port

6.6.5 Ref Lock BW

Lets you adjust the Frequency Reference phase lock bandwidth. This control is available in some models of X-Series.

It is possible to improve the phase noise of the instrument by several dB, even tens of dB, by using an external reference with excellent phase noise. When an external reference is used the instrument's close-in phase noise improves to match that of the reference.

Normally a narrow loop bandwidth is used to phase lock to the external reference. However, the Ref Lock BW control allows you to choose a wider loop bandwidth to reduce the phase noise at low offset frequencies, especially 4 to 400 Hz offset. The Wide setting represents about a 60 Hz loop bandwidth, the Narrow setting about 15 Hz.

When using an external reference with superior phase noise, Keysight recommends setting the external reference phase-locked-loop bandwidth to Wide to take advantage of that superior performance.

When using an external reference with inferior phase noise performance, Keysight recommends setting the bandwidth to Narrow.

In these relationships, inferior and superior phase noise are with respect to –134 dBc/Hz at 30 Hz offset from a 10 MHz reference. Because most reference sources have phase noise behavior that falls off at a rate of 30 dB/decade, this is usually equivalent to –120 dBc/Hz at 10 Hz offset.

In instruments with EP1 or EP2, this control only affects the external reference loop bandwidth. In instruments with EP0, this control also affects the loop bandwidth used when the Internal reference is selected (reference set manually to Internal or Pulse, or set to Sense and set by sensing to Internal or Pulse).

Remote Command `[:SENSe]:ROSCillator:BANDwidth WIDE | NARRow`

`[:SENSe]:ROSCillator:BANDwidth?`

Example	`:ROSC:BAND WIDE`
Dependencies	In instruments with EP1 or EP2: the control is available (not grayed-out) even with **Internal** or **Pulse** selected, to allow setup for when **External** is in use. However, the setting has no effect if the Internal Reference is in use Only appears in instruments equipped with the required hardware Does not appear in EXM, UXM, VXT models, or E7760B
Preset	SA6210A: `WIDE` All other models: `NARRow` Unaffected by Preset, but set to the preset value by **Restore Input/Output Defaults** or **Restore System Defaults -> All**
State Saved	Saved in Input/Output state

6.6.6 Reference Oscillator On/Off (Remote Command Only)

Provided for PSA code compatibility.

In PSA it turned the Reference Oscillator on and off, however in the X-Series the reference oscillator cannot be turned off, so no hardware is affected when it is received.

If queried it returns the state you set with the command, but note that this does not necessarily reflect the actual state of the Reference Oscillator, which is always `ON`.

Example	`:ROSCillator:OUTP ON`
Preset	Unaffected by Preset, but set to `ON` by **Restore Input/Output Defaults** or **Restore System Defaults -> All**
Backwards Compatibility SCPI	`[:SENSe]:ROSCillator:OUTPut[:STATe] ON|OFF|1|0` `[:SENSe]:ROSCillator:OUTPut[:STATe]?`

6.6.6.1 Select Ref

Lets you select the reference model to control.

The reference status is not saved in a state file, because Reference is a standard alone module.

Remote Command	`[:SENSe]:ROSCillator:PXIReference:SELect NONE | M9300a` `[:SENSe]:ROSCillator:PXIReference:SELect?`
Example	`:ROSC:PXIR:SEL M9300` `:ROSC:PXIR:SEL?`
Dependencies	Only Keysight M9300A Frequency Reference is supported
State Saved	No

6.6.6.2 Freq Ref In

Specifies the frequency reference as being the internal reference, an external reference at the front panel input labeled Ref In.

Remote Command	`[:SENSe]:ROSCillator:PXIReference:SOURce INTernal | EXTernal` `[:SENSe]:ROSCillator:PXIReference:SOURce?`
Example	`:ROSC:PXIR:SOUR INT` `:ROSC:PXIR:SOUR?`
Dependencies	Only available when Select Ref is not `NONE`
Preset	`INTernal`
State Saved	Saved in instrument state

6.6.6.3 External Freq Ref

Tells the PXIe Ref module the frequency of the external reference. When the external reference is in use this information is used by the Ref module to determine the internal settings needed to lock to that particular external reference signal.

For the instrument to stay locked, the value entered must be within 5 ppm of the actual external reference frequency. So, it is important to get it close, or you risk an unlock condition.

Remote Command	`[:SENSe]:ROSCillator:PXIReference:EXTernal:FREQuency <freq>` `[:SENSe]:ROSCillator:PXIReference:EXTernal:FREQuency?`

Example	Set the external reference frequency to 20 MHz, but does not select the external reference:
	`:ROSC:PXIR:EXT:FREQ 20 MHz`
	Select the external reference:
	`:ROSC:PXIR:SOUR EXT`

Dependencies	Only available when Select Ref is not `NONE`
Preset	10 MHz
State Saved	Yes
Min	1 MHz
Max	110 MHz

6.6.6.4 Ext Ref Locked (Remote Query Only)

Returns the External Reference locked status

Remote Command	`[:SENSe]:ROSCillator:PXIReference:EXTernal:LOCK?`
Example	`:ROSC:PXIR:EXT:LOCK?`
Notes	Returns “1” if the Freq Ref Input is External and Reference is locked. Otherwise returns “0” When the Freq Ref Input is External and Reference is unlocked, the following warning message appears in the status bar: `Settings Alert; M9300A Ext Ref Unlocked`
Dependencies	Only available when **Select Ref** is not `NONE`

6.7 Output

Accesses controls that configure various output settings, like the frequency reference output, IF outputs and analog output.

Not all measurements support all output functions. For example, the Swept SA Measurement does not support the Digital Bus function or the I/Q Cal Out function under the **Output** tab; although the controls are visible, the outputs do not function in this measurement.

In addition, if the appropriate license is not present, some controls may not appear. In Modes/Measurements that do not support particular controls, the controls may appear, but no output will be generated if they are selected.

This tab does not appear in EXM or VXT model M9420A.

6.7.1 Analog Out

Lets you control which signal is fed to the “Analog Out” connector on the instrument rear panel.

In the Auto state, the Analog Output will automatically be set to the most sensible setting for the current mode or measurement.

If you make a selection manually from the **Analog Out** menu, the manually selected choice will remain in force until you change it (or re-select Auto), even if you switch to a mode or measurement for which the selected output does not apply.

Remote Command	`:OUTPut:ANALog OFF | SVIDeo | LOGVideo | LINVideo | DAUDio`
	See "Option Details" on page 873
	`:OUTPut:ANALog?`

Example	`:OUTP:ANAL SVIDeo` causes the analog output type to be Screen Video
Dependencies	Not available in SA6210A
Preset	Unaffected by Preset, but set to `DAUDio` by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in Input/Output State
Backwards Compatibility Notes	Prior to A.04.00, `OFF` was the default functionality except when in the Analog Demod application or with Tune and Listen, in which case it was `DAUDio`, and there was no selection menu. For backwards compatibility with earlier X-Series firmware versions, Auto (`:OUTP:ANAL:AUTO ON`) duplicates the prior behavior The `DNWB` and `SANalyzer` parameters, which were legal in PSA but perform no function in the X-Series, are accepted without error

Auto Function

Remote Command	`:OUTPut:ANALog:AUTO OFF | ON | 0 | 1` `:OUTPut:ANALog:AUTO?`
Example	`:OUTP:ANAL:AUTO ON`
Preset	`ON`

Option Details

Source	SCPI	Notes
Off	`OFF`	The Analog Output is off
Screen Video	`SVIDeo`	Selects the analog output to be the screen video signal. In this mode, the pre-detector data is output to the Analog Out connector. The output looks very much like the trace displayed on the instrument's screen, and depends on the Log/Lin display Scale, Reference Level, and dB per division, but is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging)
Log Video	`LOGVideo`	Selects the analog output to be the log of the video signal. In this mode, the pre-detector data is output to the Analog Out connector with a Log scaling. The output is referenced to the current level at the mixer, does not depend on display settings like Reference Level or dB per division, and it is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging), but does change with input attenuation
Linear Video	`LINVideo`	Selects the analog output to be the envelope signal on a linear (voltage) scale. In this mode, the pre-detector data is output to the Analog Out connector with a Linear scaling. The output is based on the current Reference Level, and is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging)
Demod Audio	`DAUDio`	Selects the analog output to be the demodulation of the video signal. When Demod Audio is selected, the demodulated audio signal appears at this output whenever the Analog Demod application is demodulating a signal or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement

The table below specifies the range for each output.

Analog Out	Nominal Range exc (10% overrange)	Scale Factor	Notes
Off	0 V		
Screen Video	0 – 1 V open circuit	10%/division	8566 compatible
Log Video	0 – 1 V terminated	1/(192.66 dB/V)	dB referenced to mixer level, 1V out for –10 dBm at the mixer
Linear Video	0 – 1 V terminated	100%/V	Linear referenced to Ref Level, 1 V out for RF envelope at the Ref Level

Analog Out	Nominal Range exc (10% overrange)	Scale Factor	Notes
Demod Audio	(varies with instrument setting)		

Notes about the Analog Outputs

Screen Video

This mode is similar to the Analog Output of the HP 8566 family and the Video Out (opt 124) capability of the Keysight PSA analyzer (E444x), although there are differences in the behavior.

Screen Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Screen Video output will look different than it does in swept mode.

Because the Screen Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Screen Video is activated.

Screen Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Screen Video output.

The output holds at its last value during an alignment and during a marker count. After a sweep:

- If a new sweep is to follow (as in Continuous sweep mode), the output holds at its last value during the retrace before the next sweep starts. If the instrument is in zero-span, there is no retrace, as the instrument remains tuned to the Center Frequency and does not sweep. Therefore, in zero-span, the output simply remains live between display updates
- If no new sweep is to follow (as in Single sweep mode), the output remains live, and continues to show the pre-detector data

This function depends on optional capability; the selection is not available, and the command will generate an “Option not available” error unless you have Option YAV or YAS licensed in your instrument.

The Screen Video function is intended to be very similar to the 8566 Video Output and the PSA Option 124. However, unlike the PSA, it is not always on; it must be switched on by the Screen Video key. Also, unlike the PSA, there are certain dependencies (detailed above) – for example, the Quasi Peak Detector is unavailable when Screen Video is on.

Furthermore, the PSA Option 124 hardware was unipolar, and its large range was padded to be exactly right for use as a Screen Video output. In the X-Series, the hardware is bipolar and has a wider range to accommodate the other output choices. Therefore, the outputs will not match up exactly, and you may have to modify your setup when applying the X-Series in a PSA application.

Log Video

Log Video shows the RF Envelope with the Reference equal to the Mixer Level. The output is designed so that full scale (1 V) corresponds to -10 dBm at the mixer. The full range (0-1 V) covers 192.66 dB ; thus, 0 V corresponds to -202.66 dBm at the mixer.

Because the Log Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated.

Log Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Log Video output.

The output holds at its last value during an alignment, during a marker count, and during retrace (after a sweep and before the next sweep starts).

This function depends on optional capability. The choice will not appear, and the command will generate an “Option not available” error unless you have Option YAV licensed in your instrument.

Log Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Log Video output will look different than it does in swept mode.

Linear Video

Linear Video shows the RF Envelope with the Reference equal to the Ref Level. The scaling is set so that 1 V output occurs with an instantaneous video level equal to the reference level, and 0 V occurs at the bottom of the graticule. This scaling gives you the ability to control the gain without having another setup control for the key. But it requires you to control the look of the display (the reference level) in order to control the analog output.

This mode is ideal for looking at Amplitude Modulated signals, as the linear envelope effectively demodulates the signal.

Because the Linear Video output uses one of the two IF processing channels, only one detector is available while Linear Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated.

Linear Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing

channels. Consequently, if the user chooses an EMI Detector, there will be no Linear Video output.

The output holds at its last value during an alignment and during a marker count and during retrace (after a sweep and before the next sweep starts).

This function depends on optional capability; the choice will not appear, and the command will generate an “Option not available” error unless you have Option YAV licensed in your instrument.

Linear Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Linear Video output will look different than it does in swept mode.

Demod Audio

When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when Analog Demod Tune and Listen is operating in the Swept SA measurement.

If any other Analog Output is manually selected when in the Analog Demod mode or when Analog Demod Tune and Listen is operating in the Swept SA measurement, a condition warning message appears. This choice only appears if the Analog Demod application (N9063A), the N6141A or W6141A application, or Option EMC is installed and licensed, otherwise the choice will not appear, and the command will generate an “Option not available” error.

The output holds at its last value during an alignment and during a marker count. It is not held between sweeps, in order for Tune and Listen to work properly.

When Demod Audio is the selected Analog Output, all active traces are forced to use the same detector, and the CISPR detectors (QPD, EMI Avg, RMS Avg) are unavailable.

6.7.2 Screen Video Level

Lets you control the amplitude of the Analog Output when Screen Video is selected.

- The 1V (`NORMal`) setting provides a nominal output of 1 V peak-to-peak into an open circuit. This matches the traditional behavior of X-series instruments
- The 2V (`COMPatible`) setting provides a nominal output of 2 V peak-to-peak into an open circuit. This matches the legacy behavior of PSA and earlier analyzers

Remote Command	`:OUTPut:ANALog:SVIDeo NORMal | COMPatible`
	`:OUTPut:ANALog:SVIDeo?`
Example	`:OUTP:ANAL:SVID COMP`
	causes the Screen Video level to be 2 V

Dependencies	Only appears if Screen Video is the selected Analog Output
Preset	Unaffected by Preset, but set to NORM by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in Input/Output State

6.7.3 Digital Bus Out

Turns on the LVDS Digital Output port for outputting digital acquisition data.

- When ON, all acquisitions are streamed to the output port including acquisitions for internal purposes such as Alignment. The internal processing and routing of acquisitions continues as usual and is unaffected by the state of Bus Out
- When OFF, no signal appears on the LVDS port

Remote Command	`:OUTPut:DBUS[1][:STATe] ON | OFF | 1 | 0` `:OUTPut:DBUS[1][:STATe]?`
Example	`:OUTP:DBUS ON`
Dependencies	Requires option RTL or control is not displayed **Digital Bus Out** and **Wideband Digital Bus** cannot both be ON at the same time, so: - When **Wideband Digital Bus** is turned ON, if **Digital Bus Out** is already ON, an advisory message is displayed, "Wideband Digital Bus On, Digital Bus (narrow band) forced to Off" - When **Digital Bus Out** is turned ON, if **Wideband Digital Bus** is already ON, an advisory message is displayed, "Digital Bus (narrow band) On, Wideband Digital Bus forced to Off" Not available in SA6210A
Preset	OFF Set by **Restore Input/Output Defaults**
State Saved	Saved in Input/Output State

6.7.4 Wideband Digital Bus

Turns on the LVDS port on the Wideband IF, which causes the I/Q pairs from the current measurement to be sent to this port.

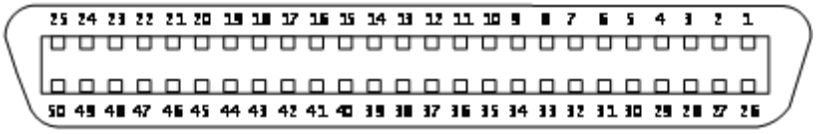
NOTE **This control is grayed-out in all Modes except RTSA, which offers the only measurement that supports wideband streaming.**

- When ON, the internal processing and routing of acquisitions continues as usual, and the display of measurement data is unaffected

– When OFF, no signal appears on the LVDS port

Remote Command	:OUTPut:DBUS2[:STATe] OFF | ON | 0 | 1 :OUTPut:DBUS2[:STATe]?
Example	:OUTP:DBUS2 ON
Notes	If this command is sent while running a measurement that does not support **Wideband Digital Bus**, the message "Settings conflict; Feature not supported for this measurement" is displayed
Dependencies	Requires option RTS or control is not displayed **Digital Bus Out** and **Wideband Digital Bus** cannot both be ON at the same time, so: – When **Wideband Digital Bus** is turned ON, if **Digital Bus Out** is already ON, an advisory message is displayed, "Wideband Digital Bus On, Digital Bus (narrow band) forced to Off" – When **Digital Bus Out** is turned ON, if **Wideband Digital Bus** is already ON, an advisory message is displayed, "Digital Bus (narrow band) On, Wideband Digital Bus forced to Off"
Preset	OFF Set by **Restore Input/Output Defaults**
State Saved	Saved in Input/Output State

Here is the Wideband LVDS connector as viewed from the rear panel. The pin assignments are listed below:



I-Cable

Connection	"-" pin #	"+" pin #
GND	1	26
N/C	2	27
Stream_I[00]	3	28
Stream_I[01]	4	29
Stream_I[02]	5	30
Stream_I[03]	6	31
GND	7	32
Stream_I[04]	8	33
Stream_I[05]	9	34
Stream_I[06]	10	35
Stream_I[07]	11	36
GND	12	37
Stream_I[08]	13	38

Connection	"-" pin #	"+" pin #
Stream_I[09]	14	39
Stream_I[10]	15	40
Stream_I[11]	16	41
GND	17	42
Stream_I[12]	18	43
Stream_I[13]	19	44
Stream_I[14]	20	45
Stream_I[15]	21	46
GND	22	47
GND	23	48
Stream_VALID	24	49
Stream_CLK	25	50

Q-Cable

Connection	"-" pin #	"+" pin #
GND	1	26
Stream_ALT	2	27
Stream_Q[00]	3	28
Stream_Q[01]	4	29
Stream_Q[02]	5	30
Stream_Q[03]	6	31
GND	7	32
Stream_Q[04]	8	33
Stream_Q[05]	9	34
Stream_Q[06]	10	35
Stream_Q[07]	11	36
GND	12	37
Stream_Q[08]	13	38
Stream_Q[09]	14	39
Stream_Q[10]	15	40
Stream_Q[11]	16	41
GND	17	42
Stream_Q[12]	18	43
Stream_Q[13]	19	44
Stream_Q[14]	20	45
Stream_Q[15]	21	46

Connection	"-" pin #	"+" pin #
GND	22	47
GND	23	48
Stream_MARK_1	24	49
Stream_MARK_2	25	50

Stream_I	16 bit "I" Data
Stream_Q[15:0]	16 bit "Q" Data
Stream_VALID	Data valid, when '1' then I/Q data is valid
Stream_CLK	150 MHz DDR clock
Stream_MARK_1	Stream Mark Bit 1
Stream_MARK_2	Stream Mark Bit 2
Stream_ALT	currently unused

6.7.5 Data Stream

Lets you choose data or a test pattern to output to the Wideband IF LVDS port. This can help you set up your streaming target devices.

Remote Command	`:OUTPut:DBUS2:DATA MEASure | TEST` `:OUTPut:DBUS2:DATA?`
Example	`:OUTP:DBUS2:DATA TEST`
Notes	Selecting `TEST` routes a test pattern to the Wideband Digital Bus stream output
Preset	`MEAS` (set by Restore Input/Output Defaults)
State Saved	Saved in Input/Output State

6.7.6 I/Q Cal Out

The Baseband I/Q "Cal Out" port can be turned on with either a 1 kHz or a 250 kHz square wave. This can be turned on independent of the input selection. Preset resets this to `OFF`.

Remote Command	`:OUTPut:IQ:OUTPut IQ1 | IQ250 | OFF` `:OUTPut:IQ:OUTPut?`
Example	`:OUTP:IQ:OUTP IQ1`
Dependencies	Only available with Option BBA
Couplings	An I/Q Cable Calibration or an I/Q Probe Calibration will change the state of the Cal Out port as needed by the calibration routine. When the calibration is finished the I/Q Cal Out is restored to the pre-calibration state

Preset	OFF
State Saved	Saved in instrument state
Range	1 kHz Square Wave | 250 kHz Square Wave | Off

6.7.7 Aux IF Out

Controls the signals that appear on the SMA output on the rear panel labeled AUX IF OUT

NOTE **Aux IF Out** is valid for the RF Input and for the External Mixer input. In external mixing, the Aux IF output level is set by factory default to accommodate expected IF levels for the RF path. When using the External Mixing path, the **Aux IF Out** levels (for all three options CR3, CRP and ALV) will therefore be uncalibrated.

Remote Command	:OUTPut:AUX SIF | AIF | LOGVideo | OFF See "Option Details" on page 881 and "Notes on the Aux IF Outputs" on page 882 below :OUTPut:AUX?
Dependencies	Does not appear in models that do not support the Aux IF Out
Preset	Unaffected by Preset, but set to OFF by Restore Input/Output Defaults or Restore System Defaults->All
State Saved	Saved in Input/Output state
Backwards Compatibility Notes	In PSA, the IF output had functionality equivalent to the SIF option in X-Series' Aux IF Out menu. In X-Series, it is necessary to switch Aux IF Out to SIF to get this functionality, whereas in PSA it is always on, since there are no other choices Hence, if you are migrating remote code from PSA, and you use the IF Output in PSA, you will need to add a command to switch this function to SIF

Option Details

The Aux IF Output options are:

Source	SCPI	Notes
Off	OFF	No signal is output from the AUX IF OUT connector on the rear panel The connector appears as an open-circuit (that is, it is not terminated in any way)
Second IF	SIF	The 2nd IF output is routed to the rear panel connector. Annotation on the menu panel shows the current 2nd IF frequency in use in the instrument
Arbitrary IF	AIF	The 2nd IF output is mixed with a local oscillator and mixer to produce an arbitrary IF output between 10 MHz and 75 MHz with 500 kHz resolution. The phase noise in this mode will not be as good as in Second IF mode The IF output frequency is adjustable, through an active function which appears on the

Source	SCPI	Notes
		menu panel, from 10 MHz to 75 MHz with 500 kHz resolution Note that, in instruments with Options B2X or B5X, the Arbitrary IF Output is only practical when the IF Bandwidth is <= 40 MHz, IF Path is <= 40 MHz, or FFT Width is <= 40 MHz
Fast Log Video	`LOGVideo`	The 2nd IF output is passed through a log amp and the log envelope of the IF signal is sent to the rear panel. The open circuit output level varies by about 25 mV per dB, with a top-of-screen signal producing about 1.6 Volts. The output impedance is nominally 50 ohms This mode is intended to meet the same requirement as Option E4440A-H7L Fast Rise Time Video Output on E4440A PSA Series, allowing you to characterize pulses with fast rise times using standard measurement suites on modern digital scopes

Notes on the Aux IF Outputs

Second IF

Does not appear unless Option CR3 is installed.

The frequency of the 2nd IF depends on the current IF signal path as shown in the table below:

IF Path Selected	Frequency of "Second IF" Output
10 MHz	322.5 MHz
25 MHz	322.5 MHz
40 MHz	250 MHz
85-160 MHz	300 MHz
255 MHz	750 MHz
510 MHz	877.1484375 MHz

The signal quality, such as signal to noise ratio and phase noise, are excellent in this mode.

Arbitrary IF

Does not appear unless Option CRP is installed.

The bandwidth of this IF output varies with band and center frequency, but is about 40 MHz at the -3 dB width. When the output is centered at lower frequencies in its range, signal frequencies at the bottom of the bandwidth will "fold". For example, with a 40 MHz bandwidth (20 MHz half-bandwidth), and a 15 MHz IF center, a signal -20 MHz relative to the spectrum analyzer center frequency will have a relative response of about -3 dB with a frequency 20 MHz below the 15 MHz IF center. This -5 MHz frequency will fold to become a +5 MHz signal at the IF output. Therefore, lower IF output frequencies are only useful with known band-limited signals.

Fast Log Video

Does not appear unless Option ALV is installed.

The output is off during an alignment but not during a marker count, and is not blanked during retrace (after a sweep and before the next sweep starts).

6.7.8 Arbitrary IF Freq

Sets the frequency of the Arbitrary IF when "Aux IF Out" on page 881 is set to `AIF`.

NOTE **In instruments with Options B2X or B5X, the Arbitrary IF Output is only practical when the IF Bandwidth is <= 40 MHz, IF Path is <= 40 MHz, or FFT Width is <= 40 MHz.**

Remote Command	`:OUTPut:AUX:AIF <value>` `:OUTPut:AUX:AIF?`
Example	`:OUTP:AUX:AIF 50 MHZ`
Dependencies	Only appears if "Aux IF Out" on page 881 is `AIF`
Preset	Unaffected by a Preset, but set to 70 MHz by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in Input/Output State
Min	10 MHz
Max	75 MHz

6.7.9 Ext/Wide IF Out

Causes the signal that is normally routed to the IF to be routed instead to the **Ext IF Out** connector on the rear panel (N9041B) or **Wide IF Out** connector on the front panel (N9042B) or rear panel (N9032B). This is available in N9041B when RF Input 2 is the selected input port and in N9032B/N9042B on RF Input and, when V3050A is attached, External RF Input.

Only one IF output (**Ext/Wide IF Out**, IF2 Out, or Aux IF Out) can be selected at a time, so switching Ext/Wide IF Out to `ON` changes IF2 Out and Aux IF Out to `OFF`, and setting Aux IF Out to something other than `OFF` or IF2 Out to `ON` forces Ext/Wide IF Out to `OFF`.

Remote Command	`:OUTPut:EIF ON | OFF | 1 | 0` `:OUTPut:EIF?`
Example	`:OUTP:EIF ON`
Dependencies	Only appears in N9041B, N9032B, and N9042B For N9041B, enabled when RF Input 2 is the selected input. When RF Input 2 is not selected, the

	control is grayed out and forced to Off and attempting to set it On will result in an error message For N9032B/N9042B, enabled on RF Input and on External RF Input when V3050A is attached When this switch is ON, no measurement is displayed, and the error "No result; meas invalid with Ext/Wide IF Out set to On" appears in the Status bar
Preset	OFF Not affected by **Mode Preset**, but set to OFF by **Input/Output Preset**
State Saved	Saved in Input/Output state
Annotation	None (but error message appears when on)
Status Bits/OPC dependencies	STATus:QUEStionable:INTegrity bit 1 is set when **Ext/Wide IF Out** is ON. This indicates an error, because no valid data is on the screen or available via SCPI. However, the signal at the **Ext/Wide IF Out** port is still valid given the other settings

6.7.10 IF2 Out

Causes the signal that is normally routed to the IF, when the 1 GHz IF Path is selected, to be routed instead to the **IF2 Out** connector on the rear panel.

Only one IF output (**Ext IF Out**, **IF2 Out**, or **Aux IF Out**) can be selected at a time, so switching **IF2 Out** to **On** changes **Ext IF Out** and **Aux IF Out** to **Off**, and setting **Aux IF Out** to something other than **Off** or **Ext IF Out** to **On** forces **IF2 Out** to **Off**.

This control only appears if Option H1G is installed. It is only available when the 1 GHz IF Path is chosen, either directly or indirectly. In all other paths it is visible but grayed out and forced to **Off**. Attempting to set it **On** when the 1GHz path is not selected generates an error.

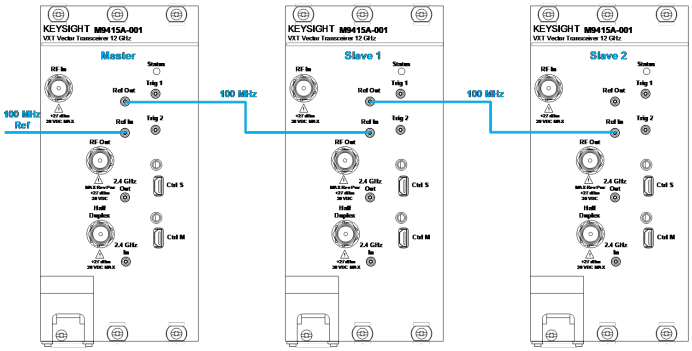
- Direct selection of the 1 GHz path: Measurements that directly support the 1 GHz path have a 1 GHz selection in the **IF Path** menu in **Meas Setup**
- Indirect selection of the 1 GHz path: certain measurements, like CCDF, always choose the widest available path, and so will choose the 1 GHz path if it is available, even if there is no **IF Path** menu in the measurement. **IF2 Out** will be visible when this results in the 1 GHz path being selected, even if there is no control or readout indicating that the 1 GHz path is chosen

Remote Command	:OUTPut:IF2 ON | OFF | 1 | 0 :OUTPut:IF2?
Example	:OUTP:IF2 ON
Dependencies	Only appears in UXA and only when Option HIG is installed When this is ON, no measurement is displayed, and the error "No result; meas invalid with IF2 Out set to On" appears in the Status bar
Preset	OFF Not affected by **Mode Preset** but set to OFF by **Input/Output Preset**

State Saved	Saved in Input/Output state
Annotation	None (but error message appears when on)
Status Bits/OPC dependencies	`STATus:QUEStionable:INTegrity` bit 1 is set when **IF2 Out** is `ON`. This indicates an error, because no valid data is on the screen or available via SCPI. However, the signal at the **IF2 Out** port is still valid given the other settings

6.7.11 REF Out

Lets you toggle the state of **REF Out**. The REF Out port is designed for MIMO, which provides the reference daisy chain for the Primary and Secondary modules.



Remote Command	`:OUTPut:EREFerence:OUTPut ON | OFF | 1 | 0` `:OUTPut:EREFerence:OUTPut?`
Example	`:OUTP:EREF:OUTP ON` `:OUTP:EREF:OUTP?`
Notes	Used to route the 100 MHz reference signal on the REF In port to the REF Out port
Dependencies	Only available in VXT models M9415A/16A and M9415E/16E when **Freq Ref Input** is External, and **Ext Ref Freq** is 100 MHz
Preset	`OFF`
Range	`ON|OFF`

6.7.12 LO Ref Out

Turns the LO Reference Signal Out on or off. **LO Ref Out** is used to provide reference daisy chain in MIMO or Phase Coherency.

For VXT models M9410A/11A, controls the **4.8 GHz Out** port on the front panel. Setting it ON outputs a 4.8 GHz reference signal.

Remote Command	`:OUTPut:ROSCillator:LO:OUTPut ON | OFF | 1 | 0` `:OUTPut:ROSCillator:LO:OUTPut?`
Example	`:OUTP:ROSC:LO:OUTP ON` `:OUTP:ROSC:LO:OUTP?`
Dependencies	Only available in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Preset	OFF

6.8 Trigger Output

Accesses controls that configure the **Trigger Output** settings.

6.8.1 Trig 1 – 4 Out

Selects the type of output signal that will be output from the available **Trig n Out** connectors, where **n** = 1, 2, 3, or 4.

Some instruments do *not* support **Trig 2 Out** through **Trig 4 Out** outputs, nor their associated controls.

For most instruments, **Trig 1 Out** applies to the connector labeled **Trigger 1**, but for VXT model M9420A, it is labeled **Trigger 4**.

The front panel includes separate controls for each available trigger: **Trig 1 Out** – **Trig 4 Out**. The remote command can be used for *any* of the **Trig n Out** connectors, by specifying the appropriate parameter (for example `TRIG1`, `TRIG2`, etc.).

NOTE **Option `TARMed` is *not* available in modular instruments.**

Remote Command	`:TRIGger[1]|2|…|4[:SEQuence]:OUTPut HSWP | MEASuring | MAIN | GATE | GTRigger | OEVen | TARMed | SPOint | S1Marker | S2Marker | S3Marker | S4Marker | PARB | FSYNc | OFF`
	See "Trigger Out Options" on page 888
	`:TRIGger[1]|2|…|4[:SEQuence]:OUTPut?`

Example	`:TRIG:OUTP HSWP` `:TRIG2:OUTP GATE`
Notes	**Trig 2 Out** is used as the source trigger out in EXM and VXT model M9420A The available choices in EXM and VXT model M9420A are `S1Marker`, `S2Marker`, `S3Marker`, `S4Marker` and `OFF` For Power Amplifier Mode, **Trig 2 Out** is set to Source Marker2 when **Burst Shape & Mask** is `ON`. In this case, **Trigger 2** is used to output PA Enable Mask
Dependencies	**Trig 2 Out** through **Trig 4 Out** are not supported in all models. In models that do not support them, the **Trig n Out** control is blanked, and sending the SCPI command for this output generates an error, "Hardware missing; Not available for this model number" Querying **Trig 2 Out** through **Trig 4 Out** in models that do not support them returns `OFF` For VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E: – When **Trig n Out Device** is `ANALyzer`, only `MEASuring`, `MAIN` and `OFF` are available – When **Trig n Out Device** is `SOURce`, only `S1Marker`, `S2Marker`, `S3Marker`, `S4Marker`, `PARB`, `FSYNc` and `OFF` are available

	For VXT model M9421A, **Trig 2 Out** is used as the Analyzer trigger output In SA6210A, only two out of four triggers can be used. In other words, at least two triggers should be `OFF`
Preset	Unaffected by Preset, but preset to the following values by **Restore Input/Output Defaults** or **Restore System Defaults->All**:

Trigger 1	Sweeping (`HSWP`)
Trigger 2	Gate
Trigger 3	Sweeping (`HSWP`)/In SA6210A, OFF
Trigger 4	Gate/In SA6210A, OFF

State Saved	Saved in instrument state

Trigger Out Options

Source	SCPI	Notes
Off	`OFF`	Selects no signal to be output to the **Trig n Out** connector
Sweeping	`HSWP`	Selects the Sweeping Trigger signal to be output to the **Trig n Out** connector when a measurement is made This signal has historically been known as `HSWP` (High = Sweeping), and is 5 V TTL level with 50 Ω output impedance
Measuring	`MEASuring`	Selects the Measuring trigger signal to be output to the **Trig n Out** connector. This signal is true while the Measuring status bit is true
Main Trigger	`MAIN`	Selects the current instrument trigger signal to be output to the **Trig n Out** connector Note: For multi segment sweeps, only the first sweep segment uses the selected trigger signal. All other sweep segments trigger using Free-Run and the trigger output will reflect that
Gate Trigger	`GTRigger`	Selects the gate trigger signal to be output to the **Trig n Out** connector. This is the source of the gate timing, not the actual gate signal
Gate	`GATE`	Selects the gate signal to be output to the **Trig n Out** connector. The gate signal has been delayed and its length determined by delay and length settings. When the polarity is positive, a high on the **Trig n Out** connector represents the time the gate is configured to pass the signal
Odd/Even Trace Point	`OEVen`	Selects either the odd or even trace points as the signal to be output to the **Trig n Out** connector when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the instrument is sweeping past the first point (Point 0) and every other following trace point. The opposite is true if the polarity is negative
Trigger Armed	`TARMed`	Selects the “trigger armed” trigger signal to be output to the **Trig n Out** connector. This signal is true when the instrument reaches its trigger armed state *Not* available in modular instruments

Source	SCPI	Notes
Source Point Trigger	SPOint	Selects the gate signal to be output to the **Trig n Out** connector for use as the Point Trigger when operating an external source in Tracking mode. When Ext Trigger 1 is selected as the Point Trigger under **Source**, the Source Point Trigger under **Trig 1 Out** automatically gets selected. A similar pattern is used for the other Ext Trigger inputs; for example, when Ext Trigger 2 is selected as the Point Trigger under **Source**, the Source Point Trigger under **Trig 2 Out** automatically gets selected
Source Marker 1	S1Marker	Only available in VXT and M941xE. For M9420A, only for TRIG2, for M9410A/11A/15A/16A available for both TRIG1 and TRIG2 Selects the Trigger Output at Marker 1 in the Waveform file that is currently playing
Source Marker 2	S2Marker	Only available in VXT and M941xE. For M9420A, only for TRIG2, for M9410A/11A/15A/16A and M9410E/11E/15E/16E available for both TRIG1 and TRIG2 Selects the Trigger Output at Marker 2 in the Waveform file that is currently playing
Source Marker 3	S3Marker	Only available in VXT and M941xE. For M9420A, only for TRIG2, for M9410A/11A/15A/16A and M9410E/11E/15E/16E available for both TRIG1 and TRIG2 Selects the Trigger Output at Marker 3 in the Waveform file that is currently playing
Source Marker 4	S4Marker	Only available in VXT and M941xE. For M9420A, only for TRIG2, for M9410A/11A/15A/16A and M9410E/11E/15E/16E available for both TRIG1 and TRIG2 Selects the Trigger Output at Marker 4 in the Waveform file that is currently playing
PerArb	PARB	Only available in VXT Models M9410A/11A/15A/16A and M9410E/11E/15E/16E Selects the Trigger Output as PerArb. PerArb is a synchronization trigger which is generated by the ARB at the beginning of each repetition of playing the signal
FSYNc	FSYNc	Only available in VXT Models M9410A/11A/15A/16A and M9410E/11E/15E/16E Selects the Trigger Output as FSYNc, routing the Periodic Timer Sync Source signal to the specified Trigger output. That is, the signal selected by :TRIGger[:SEQuence]:FRAMe:SYNC is routed to the specified trigger output The following example specifies that External 1 trigger will be used as the Periodic Timer Sync Source, and this signal will then be routed to the **Trigger 2** output: TRIG:FRAM:SYNC EXT1 TRIG2:OUTP FSYNc

6.8.2 Trig 1 – 4 Out Polarity

Sets the output to the **Trig n Out** connector to trigger on either the positive or negative polarity.

Remote Command	:TRIGger[1]|2|…|4[:SEQuence]:OUTPut:POLarity POSitive | NEGative :TRIGger[1]|2|…|4[:SEQuence]:OUTPut:POLarity?
Example	:TRIG1:OUTP:POL POS

Dependencies	You can only send `TRIG` parameters for the hardware you have; for example, you cannot send a `TRIG3` parameter if your hardware does not support `TRIG3`. Sending the command for an output you do not have generates an error, “Hardware missing; Not available for this model number” Querying a non-existent output returns `OFF` **Trig 2 Out Polarity** does not appear in EXM or VXT
Preset	Unaffected by Preset, but set to `POSitive` by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state

6.8.3 Trig 1 – 4 Out Device

Sets the output to the **Trig n Out** connector to trigger on either `ANALyzer` or `SOURce`.

Remote Command	`:TRIGger[1]|2|…|4[:SEQuence]:OUTPut:DIRection ANALyzer | SOURce` `:TRIGger[1]|2|…|4[:SEQuence]:OUTPut:DIRection?`
Example	`:TRIG1:OUTP:DIR ANAL`
Dependencies	Only available on VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Preset	Unaffected by Preset **Restore Input/Output Defaults** and **Restore System Defaults->All** preset the triggers as follows: **Trig n Out Device** → **Preset** 1, 3, 4 → `ANALyzer` 2 → `SOURce`
State Saved	Saved in instrument state

6.8.4 Src PXI Trig Out

Selects which signal will be routed to the backplane Source PXI Trigger Output Line.

Remote Command	`:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut S1Marker | S2Marker | S3Marker | S4Marker | PARB | OFF`
	See "Option details" on page 891
	`:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut?`

Example	`:TRIG:PXIE:SOUR:OUTP S1M` `:TRIG:PXIE:SOUR:OUTP?`
Dependencies	Only appears in EXM, VXT and M941xE
Preset	`OFF`
State Saved	Saved in instrument state

Option details

Here are details of all Source PXI Trigger Output options:

Source	SCPI	Notes
Off	`OFF`	Selects no signal to be output to the Source PXI backplane line
Source Marker 1	`S1Marker`	Selects the Trigger Output at Marker 1 in the Waveform file that is currently playing to be output to the Source PXI backplane line
Source Marker 2	`S2Marker`	Selects the Trigger Output at Marker 2 in the Waveform file that is currently playing to be output to the Source PXI backplane line
Source Marker 3	`S3Marker`	Selects the Trigger Output at Marker 3 in the Waveform file that is currently playing to be output to the Source PXI backplane line
Source Marker 4	`S4Marker`	Selects the Trigger Output at Marker 4 in the Waveform file that is currently playing to be output to the Source PXI backplane line
PerArb	`PARB`	A synchronization trigger that is generated by the ARB at the beginning of each repetition of playing the signal. This selection causes the PerArb Trigger Output that is currently playing to be output to the Source PXI backplane line Only available in VXT Models M9410A/11A/15A/16A and M9410E/11E/15E/16E

6.8.5 Src Trig Out Polarity

Sets the output to the Source PXI backplane trigger line to trigger on either the positive or negative polarity.

Remote Command	`:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:POLarity POSitive | NEGative` `:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:POLarity?`
Example	`:TRIG:PXIE:SOUR:OUTP:POL POS`
Dependencies	Only appears in EXM, VXT and M941xE
Preset	Unaffected by Preset, but set to `POSitive` by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state

6.8.6 Select Src PXI Line

Controls which backplane trigger line `TRIG[0…7]` is used for the Source Trigger Output.

Remote Command	`:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:LINE <line>` `:TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:LINE?`

Example	`:TRIGger:PXIE:SOURce:OUTPut:LINE 0`
Dependencies	Only appears in EXM, VXT and M941xE
Preset	4
State Saved	Saved in instrument state
Range	[0,7]

6.8.7 Analyzer PXI Trig Out

Selects the signal that will be output from Analyzer PXI Trigger Line (Backplane Trigger Line 0~3).

Remote Command	`:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut HSWP | MEASuring | MAIN | GATE | GTRigger | OEVen | OFF`
	See "Option Details" on page 892
	`:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut?`

Example	`:TRIG:PXIE:ANAL:OUTP HSWP`
Dependencies	Only available on certain modular analyzers, such as CXA-m, VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E For VXT models M9410A/11A/15A/16A, only `OFF`, `MEASuring` and `MAIN` are available
Preset	Unaffected by **Preset** but is preset to `OFF` by **Restore Input/Output Defaults** or **Restore System Defaults->All**
State Saved	Saved in instrument state

Option Details

Here are details of all Analyzer PXI Trigger Output options:

Source	SCPI	Notes
Off	`OFF`	Selects no signal to be output to the Analyzer PXI backplane trigger line
Sweeping (HSWP)	`HSWP`	Selects the Sweeping Trigger signal to be output to the Analyzer PXI backplane trigger line when a measurement is made. This signal has historically been known as "HSWP" (High = Sweeping), and is 5 V TTL level with 50-ohm output impedance
Measuring	`MEAS`	Selects the Measuring trigger signal to be output to the Analyzer PXI backplane trigger line. This signal is true while the Measuring status bit is true
Main Trigger	`MAIN`	Selects the current instrument trigger signal to be output to the Analyzer PXI backplane trigger line
Gate Trigger	`GTR`	Selects the gate trigger signal to be output to the Analyzer PXI backplane trigger line. This is the source of the gate timing, not the actual gate signal
Gate	`GATE`	Selects the gate signal to be output to the Analyzer PXI backplane trigger line. The gate signal has been delayed and its length determined by delay and length settings. When the

Source	SCPI	Notes
		polarity is positive, a high on the Trig Out connector represents the time the gate is configured to pass the signal
Odd/Even Trace Point	OEV	Selects either the odd or even trace points as the signal to be output to the Analyzer PXI backplane trigger line when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the instrument is sweeping past the first point (Point 0) and every other following trace point. The opposite is true if the polarity is negative

6.8.8 Analyzer Trig Out Polarity

Sets the output to the Analyzer PXI backplane trigger line to trigger on either the positive or negative polarity.

Remote Command	`:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:POLarity POSitive | NEGative` `:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:POLarity?`
Example	`:TRIG:PXIE:ANAL:OUTP:POL POS`
Dependencies	Only available on certain modular analyzers, such as CXA-m, VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Preset	Unaffected by Preset, but set to `POSitive` by **Restore Input/Output Defaults** or **Restore System Defaults->All** `POSitive`
State Saved	Saved in instrument state

6.8.9 Select Analyzer PXI Line

Controls which `PXI_TRIG[0…3]` is used for the Analyzer Trigger Output.

Remote Command	`:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:LINE <line>` `:TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:LINE?`
Example	`:TRIGger:PXIE:ANALyzer:OUTPut:LINE 0`
Dependencies	Only available on certain modular analyzers, such as CXA-m, VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Preset	0
State Saved	Saved in instrument state
Range	[0,3]

6.8.10 Source Internal Trig Out

Selects the signal which will be output from Source Internal Trigger Line.

NOTE In some software released in 2018 and 2019, the SCPI command for this function was as below:

`:TRIGger:SOURce:INTernal[:SEQuence]:OUTPut S1Marker|S2Marker|S3Marker|S4Marker|OFF`

It was necessary to change this SCPI in release A.24.00 due to internal conflicts in the software. User code written for the A.22.xx or A.23.xx instrument software which used the old form must be rewritten to use the form below.

Remote Command	`:TRIGger[:SEQuence]:INTernal:SOURce:OUTPut S1Marker | S2Marker | S3Marker | S4Marker | PARB | OFF` `:TRIGger[:SEQuence]:INTernal:SOURce:OUTPut?`
Example	`:TRIG:INT:SOUR:OUTP S1M`
Notes	`PARB` (Per ARB) -A synchronization trigger that is generated by the ARB at the beginning of each repetition of playing the signal
Dependencies	Only available on VXT models M9420A, M9410A/11A/15A/16A and M9410E/11E/15E/16E
Preset	Unaffected by Preset but preset by **Restore Input/Output Defaults** or **Restore System Defaults->All**. The value is Mode-dependent: Power Amplifier Mode: `S1Marker` All other Modes: `OFF`
State Saved	Saved in instrument state

6.8.11 Source Internal Trig Out Polarity

Sets the output to the Source Internal trigger line to trigger on either the positive or negative polarity.

NOTE In some software released in 2018 and 2019, the SCPI command for this function was as below:

`:TRIGger:SOURce:INTernal[:SEQuence]:OUTPut:POLarity POSitive|NEGative`

It was necessary to change this SCPI in release A.24.00 due to internal conflicts in the software. User code written for the A.22.xx or A.23.xx instrument software which used the old form must be rewritten to use the form below.

Remote Command	`:TRIGger[:SEQuence]:INTernal:SOURce:OUTPut:POLarity POSitive | NEGative` `:TRIGger[:SEQuence]:INTernal:SOURce:OUTPut:POLarity?`
Example	`:TRIG:INT:SOUR:OUTP:POL POS`
Dependencies	Only available on VXT models and M9410E/11E/15E/16E
Preset	Unaffected by **Preset**, but set to `POSitive` by **Restore Input/Output Defaults** or **Restore System**

	Defaults->All
State Saved	Saved in instrument state

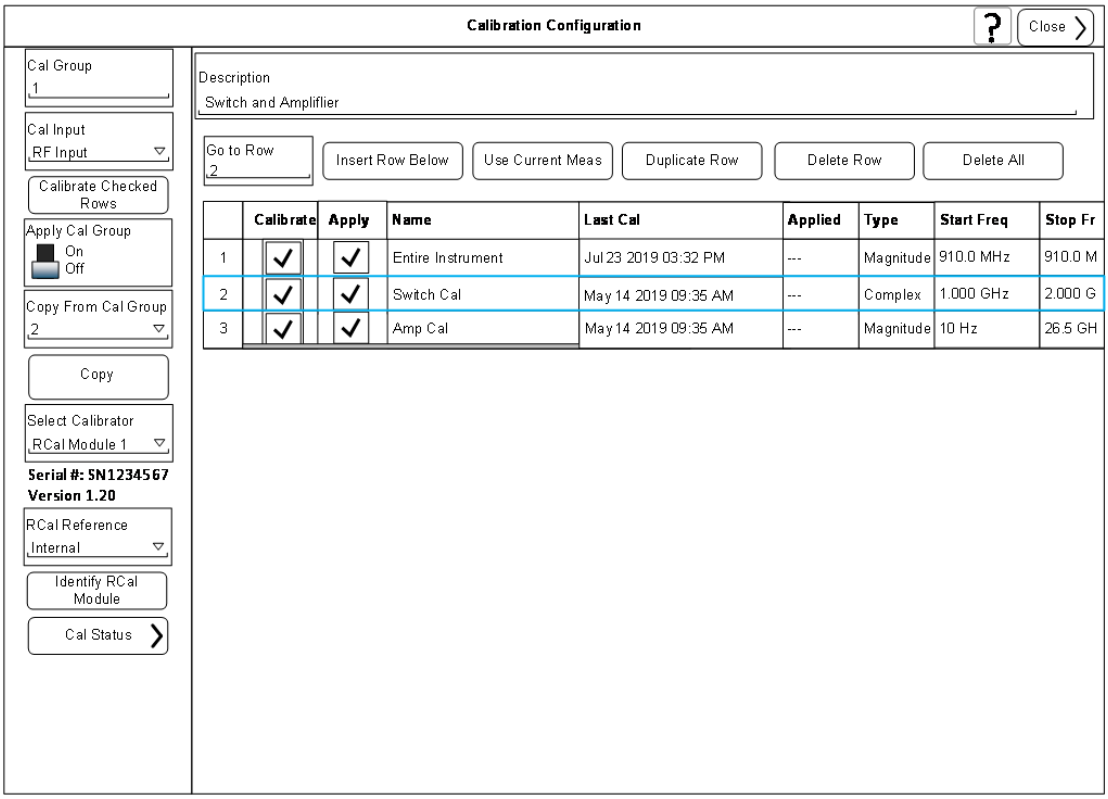
6.9 Calibration

Lets you configure the Comb Calibrator. This tab only appears when an RCal license is installed. Settings associated with the Calibrator are configured here.

6.9.1 Configuration

Opens the dialog shown below. This is a full screen dialog. Configuring of Cals is done using this dialog. The table consists of rows of Cals and Columns of Cal settings. You can scroll or swipe vertically or horizontally to view Cals or settings not currently shown on the screen.

Dialog with Example Table entries:



Full Cal Group Table with Example entries:

RCal Calibrations Table

Table will scroll vertically and horizontally

	Calibrate	Apply	Name	Last Cal	Applied	External Mixer	Cal Type
1	☑	☑	Entire Instrument	Aug 30 2018 03:32 PM	Yes	11970A : Normal	Vector
2	☑	☑	Wednesday with remote head	Sep 1 2018 02:27 PM	No	Custom : Normal	Vector
3	☑	☑	20190119 3:54pm	---	---	11970U : Normal	Vector
4	☐	☐	1 GHz – 3 GHz	---	---	11970V : Normal	Scalar
5	☐	☐	2 GHz – 4 GHz	---	---	K Band Single Harmonic No Doubler : Normal	Scalar
6	☐	☐	External Preamp	---	---	W Band Single Harmonic No Doubler : Normal	Scalar
7	☐	☐	(None)				
8	☐	☐	(None)				
9	☐	☐	(None)				
10	☐	☐	(None)				

Only shows when External Mixer is the selected Cal Input

Cal Type
Scalar
Vector

Start Freq	Stop Freq	Freq Step	Freq Points	Mech Atten	Mech Atten Start	Mech Atten Stop	Mech Atten Step	Elec Atten	Elec Atten Start
910.0 MHz	910.0 MHz	0 Hz	1	Step	0 dB	10 dB	2 dB	Step	0 dB
1.000 GHz	2.000 GHz	100.000 MHz	100	Reference	10 dB	10 dB	0 dB	Bypass	0 dB
10 Hz	26.5 GHz	0 Hz	3	All	0 dB	70 dB	2 dB	All	0 dB
1.000 GHz	3.000 GHz	100.00 MHz	20	Step	10 dB	50 dB	10 dB	Step	10 dB
2.000 GHz	4.000 GHz	10.000 MHz	200	Bypass	0 dB	70 dB	2 dB	All	0 dB
2.000 GHz	2.000 GHz	0 Hz	1	Reference	10 dB	10 dB	0 dB	Reference	10 dB

Mech Atten
Step
All
Bypass

Elec Atten
Step
All
Bypass

Elec Atten Stop	Elec Atten Step	Full Atten	Full Atten Start	Full Atten Stop	Freq Ext Atten	Freq Ext Atten Start	Freq Ext Atten Stop	IF Path
10 dB	5 dB	Step	0 dB	6 dB	Step	0 dB	6 dB	10 MHz
0 dB	0 dB	All	0 dB	0 dB	All	0 dB	0 dB	510 MHz
24 dB	1 dB	All	0 dB	20 dB	All	0 dB	20 dB	25 MHz
20 dB	2 dB	Step	6 dB	20 dB	Step	6 dB	20 dB	10 MHz
24 dB	1 dB	All	0 dB	24 dB	All	0 dB	24 dB	25 MHz
10 dB	0 dB	All	10 dB	10 dB	All	10 dB	10 dB	40 MHz

Step
All

Step
All

10 MHz
25 MHz
40 MHz
510 MHz
1 GHz
2 GHz
4 GHz

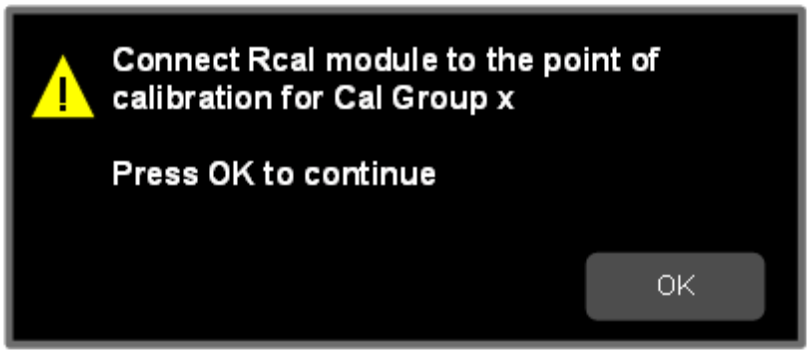
6.9.1.1 Cal Group

This is the same as "Cal Group" on page 932 in the Calibration tab.

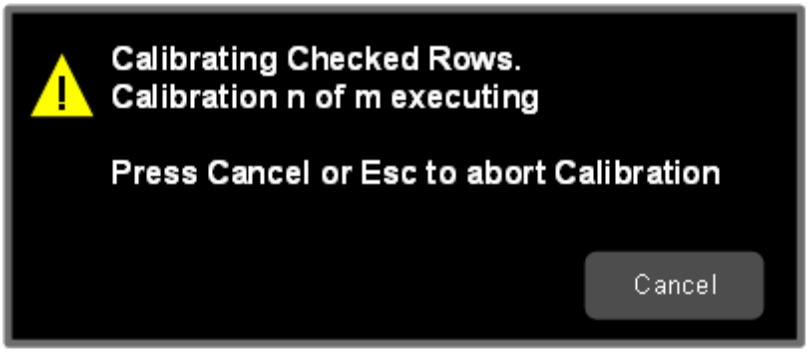
6.9.1.2 Calibrate Checked Rows

Executes the Cals within the currently selected Cal Group that have the Calibrate box checked in the RCal Configuration Table.

Once selected, the following dialog box is displayed;



When you click OK, the following dialog is displayed;



If there are multiple Cals being executed in a Cal Group, this dialog advises you when each Cal is complete. It also provides the ability to abort the Execute Cal Request.

If you choose to abort, calibrations that have completed use the new Cal data and update the Last Cal field. Calibrations that have not completed retain the existing Cal data and Last Cal timestamp, or show "---" if the Cal had never been executed.

Remote Command	`:SYSTem:CALibration:INITiate:SELected`
Example	`:SYST:CAL:INIT:SEL`
Notes	Cals cannot be applied until they have been calibrated. Once a Cal has been calibrated, the Last Cal field in the table displays the date and time the Cal was last calibrated
Dependencies	Applied to the currently selected Cal Group
Couplings	**Calibrate Selected** is disabled if there are no Calibrate checkboxes checked. If the disabled control is selected, the advisory message "Check the Calibrate box for the Cals you want to calibrate" is displayed

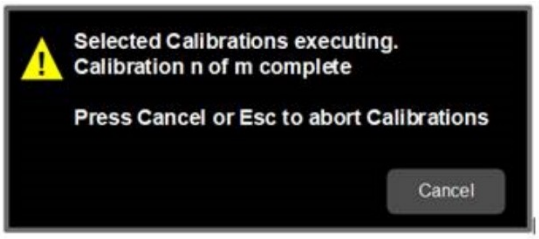
6.9.1.3 Apply Cal Group

This is the same as "Apply Cal Group" on page 932 in the **Calibration** tab.

6.9.1.4 Abort Calibration

Aborts the Calibration routine of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:ABORt`
Example	`:SYST:CAL:ABOR`
Dependencies	Aborts the currently running calibration. The previously-run calibrations will still be available, but the current calibration is halted, and next calibrations selected are not executed. Once the calibration starts, the modal dialog appears, and the abort can be executed by selecting **Cancel**



6.9.1.5 Copy From Cal Group

Determines the Cal Group from which existing rows are copied when using the "Copy" on page 900Group feature.

Remote Command	:SYSTem:CALibration:CGRoup:COPY:FROM <integer> :SYSTem:CALibration:CGRoup:COPY:FROM?
Example	:SYST:CAL:CGR:COPY:FROM 2 :SYST:CAL:CGR:COPY:FROM?
Preset	1
Min	1
Max	100

6.9.1.6 Copy

Lets you copy the settings in the Cal Group specified by the Copy From Cal Group parameter.

All the rows in the table are copied to the selected Cal Group. The columns Apply, Last Cal and Applied are set to their default values.

The group level parameters are also copied, with the exception of Apply Cal Group and Copy From Cal Group.

Remote Command	:SYSTem:CALibration:CGRoup:COPY
Example	:SYST:CAL:CGRoup:COPY
Dependencies	Applied to the currently selected Cal Group
Couplings	Disabled if Copy From Cal Group is the same as the currently selected Cal Group. If the disabled control is selected, the advisory message “Unable to Copy from same Cal Group” is displayed, and the same message is returned remotely as a Settings Conflict If you attempt to copy from a Cal Group that is empty, the advisory message “Copy From Cal Group is empty” is displayed, and the same message is returned remotely as a Settings Conflict

6.9.1.7 Tone Spacing Multiplier (Remote Command Only)

A multiplier to apply to the default tone spacing used when making vector calibrations. A value greater than one results in a larger tone space. A value smaller than one results in smaller tone space. Smaller tone space reduces the tone power and may result in longer calibration time.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:TSMultiplier <val>` `:SYSTem:CALibration:ROW[1]|2|…|100:TSMultiplier?`
Example	`:SYST:CAL:ROW2:TSM 0.5`
Preset	1
Min	0.125
Max	8

6.9.1.8 Cal Input

Maps the currently selected Cal Group to a particular I/O port. This control allows any Input port (including External Mixing, the RF2 input, etc.) to be mapped to a specific Cal Group

Remote Command	`:SYSTem:CALibration:INPut RFIN | RFIN2 || EMIXer | ERFIN`
	See "Option Details" on page 901
	`:SYSTem:CALibration:INPut?`

Example	`:SYST:CAL:INPut RFIN2`
Dependencies	`RFIN2|EMIXer` are only available on C/E/M/P/UXA analyzers with the appropriate options loaded `ERFIN` is only available if a V3050A unit is connected
State Saved	Saved in State

Option Details

Note that the presence of these ports is highly hardware dependent.

Cal Input	SCPI	Notes
RF Input	`RFIN`	Main RF Port Not available on EXM with hardware M9431A
RF Input 2	`RFIN2`	Second RF Port, labeled RF Input 2 Only available on certain instruments
External Mixer	`EMIX`	Requires option EXM
External RF	`ERFIN`	Only available if a V3050A unit is connected

6.9.1.9 Freq Offset

Lets you specify the frequency offset value. When the frequency offset state is ON, an annunciator is displayed on the main source view to indicate this state.

When the frequency offset is set to zero (0) and you set a new offset value, the displayed frequency value changes as follows, and the RF output frequency does not change:

Displayed value = output frequency + offset value

Where:

- output frequency equals the original frequency entered under Source, Frequency, Frequency
- offset value equals the value entered under Source, Frequency, Freq Offset

When the frequency offset is set to a value other than zero (0) and you enter a new frequency value under Source, Frequency, Frequency, the displayed frequency will be the same as the value entered and the RF output frequency will be equal to the value entered minus the offset value as follows:

Output frequency = entered frequency – offset frequency

Displayed frequency = output frequency + offset frequency

Displayed frequency = entered frequency

Where:

- entered frequency equals the frequency entered under Source, Frequency, Frequency
- offset frequency equals the value previously entered and set under Source, Frequency, Freq Offset

Remote Command	`:SOURce:FREQuency:OFFSet <freq>` `:SOURce:FREQuency:OFFSet?`
Example	`:SOUR:FREQ:OFFS 0 Hz`
Dependencies	Unavailable, and grayed-out, when List Sequencer is ON
Preset	0 Hz
Min/Max	–/+100.00 GHz

6.9.1.10 Select Calibrator

Selects the calibrator for the currently selected Cal Group to use for executing the calibration when multiple modules are connected.

Remote Command	`:SYSTem:CALibration:MODule:SELect NONE | RCM1 | RCM2 | RCM3 | RCM4 | RCM5 | RCM6 | RCM7 | RCM8 | RCM9 | RCM10` `:SYSTem:CALibration:MODule:SELect?`
Example	`:SYST:CAL:MODule:SELect RCM1`
Notes	Details of the RCal module are displayed beneath the control. If there are no modules connected, the text states “No Modules Connected” For SCPI, if the parameter sent is for a module that is not currently connected to the instrument, the message “Selected RCal module not connected” is generated
Dependencies	The SCPI command is applied to the currently selected Cal Group
State Saved	Saved in instrument state
Range	All connected RCal modules

6.9.1.11 Identify RCal Module

Control to connect to the RCal module of the currently selected Cal Group and blink its identity light

6.9.1.12 RCal Module Serial Number (Remote Query Only)

Returns the serial number of the specified module

Remote Command	`:SYSTem:CALibration:MODule[1]|2|...|10:SNUMber?`
Example	`:SYST:CAL:MOD:SNUM?`
Notes	If there is no module associated with the specified module number, returns an empty string

6.9.1.13 RCal Reference

Determines the reference type used by the RCal module of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:REFerence INTernal | EXTernal` `:SYSTem:CALibration:REFerence?`
Example	`:SYST:CAL:REF EXT`
Dependencies	The SCPI command is applied to the currently selected Cal Group

Preset	EXTernal
State Saved	Saved in instrument state
Range	INTernal|EXTernal

6.9.1.14 RCal Status

Opens a dialog that is used to provide the status of all active rows in all groups. Status can be one of the following: Calibrated, Applied, Calibration Failed or Apply Failed.

If a Calibration Fails, an error icon is shown in the Calibrate column of the row(s) that failed, with a message indicating the nature of the failure. If the failure cannot be addressed by the user, the error message “Calibration Failed. See Error Log” will be shown and details of the failure will be written to the SA Event Log.

Applying the Calibration can result in a warning if there is a mismatch between the currently executing instrument state and any of the following parameter settings;

- Cal Input
- Frequency
- IF Path
- IF Gain
- Phase Noise Optimization
- Preamp
- Coupling
- Mechanical Attenuator
- Electrical Attenuator
- Full Range Attenuator
- uW Path Control
- Mixing Mode
- External Mixer

When there is a mismatch a warning icon will be shown in the Applied column of the row(s) that had the mismatch with details in the format “<Parameter Name> does not match meas state”.

The Status dialog provides you with the group and row of a Calibration and its current state and any error details if the status is not OK.

RCal Status (Remote Query Only)

Returns a comma-separated list of the status of an individual row status in the format “Group”, “Row”, ‘Status’, “Details”

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:STATus?`
Example	Return a comma-separated list for the status of an individual row, in the format “Group”, “Row”, ‘Status’, “Details”: `:SYST:CAL:ROW2:STAT?`
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated

All RCal Status (Remote Query Only)

Returns a comma-separated list of all entries in the Cal Status table in the format “Group”, “Row”, ‘Status’, “Details”, which is repeated for each row in the table. If there are no entries in the table, returns an empty string.

Remote Command	`:SYSTem:CALibration:STATus:ALL?`
Example	Return a comma-separated list of all entries in the Cal Status table in the format “Group”, “Row”, ‘Status’, “Details”, repeated for each row in the table: `:SYST:CAL:STAT:ALL?`

6.9.1.15 Go to Row

Lets you move through the table to edit the desired point.

Min	1
Max	2000

6.9.1.16 Insert Row Below

Inserts a point below the current point. The new point starts from the current range stop frequency and becomes the current point. The new point is not yet entered into the underlying table, and the data in the row is displayed in light gray.

6.9.1.17 Description

Provides a description of up to 60 characters by which you can easily identify the correction group. The descriptions are stored in the exported file and can be displayed in the active function area by selecting them as the active function, if desired to be in a saved screen dump.

Remote Command	`[:SENSe]:CORRection:CSET:GROup:DESCription "text"` `[:SENSe]:CORRection:CSET:GROup:DESCription?`
Example	`:CORR:CSET:GRO:DESC "Radiated Setup"`
Notes	60 chars max; may not fit on display if max chars used
Preset	Unaffected by Preset. Set to empty by Restore Input/Output Defaults
State Saved	Saved in instrument state

6.9.1.18 Use Current Meas

Takes the settings from the current running measurement state to populate the Cal Row settings of the currently selected Cal Group.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:UCMeas`
Example	`:SYST:CAL:ROW2:UCM`
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the group table is empty and subopcode is omitted or 1, a new row is created and populated using the current running measurement If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated Pressing the control or sending the SCPI command in measurements that do not support this parameter generates error -221, "Settings conflict; Feature not supported for this measurement"

6.9.1.19 Duplicate Row

Creates a new row the currently selected row, and populates the new row with the settings from the selected row of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:DUPLicate`
Example	`:SYST:CAL:ROW2:DUPL`
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.9.1.20 Delete Row

Deletes the currently-selected point, whether or not that point is being edited, and selects the Navigate functionality. The point following the currently-selected point (or the point preceding if there is none) will be selected.

6.9.1.21 Delete All

Deletes all complex corrections and clears all entries in all rows to the default.

When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete all complex corrections. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press OK or Enter.

Remote Command	`[:SENSe]:CCORrection:CSET:ALL:DELete`
Example	`:CCOR:CSET:ALL:DEL`

6.9.1.22 Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When the Differential control is switched to Differential, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When the Differential control is switched to Single Ended, only the probe attached to the main port is calibrated.

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. See "I/Q Isolation Calibration" on page 794

6.9.1.23 Apply

Determines the Cal that is applied.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:APPLy:STATe ON | OFF | 1 | 0` `:SYSTem:CALibration:ROW[1]|2|…|100:APPLy:STATe?`
Example	`:SYST:CAL:ROW2:APPL:STAT ON` `:SYST:CAL:ROW2:APPL:STAT?`
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated

	You can only check the **Apply** checkbox for a Cal that has been executed. If you attempt to select the **Apply** checkbox for Cal's that have not been executed, the advisory message "Cal must be executed before it can be applied" is displayed If Apply Cal is ON, and you attempt to check the **Apply** checkbox for a Cal that is invalid for use with the current measurement state, the error "Cal invalid with current measurement settings is shown, and the checkbox remains unchecked
Couplings	When the **Apply** check box is checked, if the Apply Cal Group setting is OFF, it will be turned on. Calibrations are only applied when the Apply Cal Group is ON
Preset	All OFF
State Saved	Saved in instrument state
Range	ON|OFF
Annotation	If *any* Cal check box in any group is checked and Apply Cal Group for that group is ON, RCal in the Meas Bar displays in amber to indicate Calibrations are in use

6.9.1.24 Name

Sets an ASCII text field allowing you to name the selected Cal

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:NAME <string>` `:SYSTem:CALibration:ROW[1]|2|…|100:NAME?`
Example	`:SYST:CAL:ROW2:NAM "Monday AM Cal"`
Notes	45 chars max; may not fit on display if max chars used
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	"Cal #", where # is corresponding Cal number
State Saved	Saved in instrument state

6.9.1.25 Last Cal

Displays the date and time the selected Cal was last executed. Read only field.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:LAST?`
Example	Return data and time Cal 2 was last executed: `:SYST:CAL:ROW2:LAST?`
Notes	Returns a string containing the date and time the Cal was executed. If the Cal has never been executed, or any of the settings are changed, SCPI returns an empty string, and the front panel displays "---"
Dependencies	The SCPI query applies to the currently selected Cal Group

	If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.9.1.26 Cal Applied

Displays the status of a Cal once it is applied. Is either Yes or No, depending on if the Cal was successfully applied or not. See RCalStatus for more details. If it is not being applied, the field shows "---". Read-only field.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:CAPPlied?`
Example	Return Cal Stats of Cal 2: `:SYST:CAL:ROW2:CAPP?`
Notes	Returns a string containing the date and time the Cal was executed. If the Cal has never been executed, or any of the settings are changed, SCPI returns an empty string, and the front panel displays "---"
Dependencies	The SCPI query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

6.9.1.27 Cal Type

Specifies how the calibration is to be performed on the selected Cal. Options are;

- `MAGNitude`: A single CW tone is measured at the center of the screen for each frequency point
- `COMPlex`: A comb signal is measured across the full IF passband at each frequency point. Magnitude and Phase are measured

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:TYPE MAGNitude | COMPlex` `:SYSTem:CALibration:ROW[1]|2|…|100:TYPE?`
Example	`:SYST:CAL:ROW2:TYPE COMP`
Dependencies	Only available if the selected RCal module has a license for complex calibrations. If it does not, this control is disabled The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`MAGNitude`
State Saved	Saved in instrument state
Range	`MAGNitude|COMPlex`

6.9.1.28 Start Freq

Specifies the start frequency of the selected Cal.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STARt <freq>` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STARt?`
Example	`:SYST:CAL:ROW2:FREQ:STAR 1e9`
Notes	Max values depend on Hardware Options (503, 507, 508, 513, 526)
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated By direct entry: You cannot set Start Frequency > Stop Frequency. You can set the Start frequency = Stop frequency. If you set Start Frequency = Stop Frequency, "Freq Step" on page 911 is adjusted to 0, and "Freq Points" on page 912 is adjusted to 1 With the knob or step keys: If you set Start Frequency = Stop Frequency, **Freq Step** is adjusted to 0, and **Freq Points** is adjusted to 1
Couplings	If you change the start frequency of the selected range to a value > the range's stop frequency, the stop frequency of the previous range is changed to the same value. **Freq Step** is set to 0 Hz and **Freq Points** is set to 1 If you change the start frequency <= min frequency of the instrument, the start frequency of the selected range is set to the minimum frequency of the instrument If you change the start frequency >= maximum frequency of the instrument, the start frequency of the selected range is set to the maximum frequency of the instrument and the stop frequency of selected range is set to the maximum frequency of the instrument. **Freq Step** is set to 0 Hz and **Freq Points** is set to 1
Preset	Depends on the instrument maximum frequency
State Saved	Saved in instrument state
Min	If **Scale Type** is set to Lin, the min Start Frequency changes to -80 MHz
Max	Depends on the instrument maximum frequency – 10 Hz minimum span

6.9.1.29 Stop Freq

Specifies the stop frequency of the selected Cal.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STOP <freq>` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STOP?`
Example	`:SYST:CAL:ROW2:FREQ:STOP 1e9`
Notes	Max values depend on Hardware Options

Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated By direct entry: You cannot set Stop frequency < Start frequency. You cannot set Start frequency = Stop frequency. You can set Start frequency = Stop frequency. If you set Start Frequency = Stop Frequency, "Freq Step" on page 911 is adjusted to 0, and "Freq Points" on page 912 is adjusted to 1 With the knob or step keys: If you set Start Frequency = Stop Frequency, **Freq Step** is adjusted to 0, and **Freq Points** is adjusted to 1
Couplings	If you change the stop frequency of the selected range to a value < the range's start frequency the start frequency of the range is changed to the same value. **Freq Step** is set to 0 Hz and **Freq Points** is set to 1 If you change the stop frequency >=the maximum frequency of the instrument, the stop frequency of the selected range is set to the maximum frequency of the instrument If you change stop frequency <= the minimum frequency of the instrument, the stop frequency of the selected range is set to the minimum frequency of the instrument and the start frequency of the selected range is set to the minimum frequency of the instrument. **Freq Step** is set to 0 Hz and **Freq Points** is set to 1
Preset	Depends on the instrument maximum frequency
State Saved	Saved in instrument state
Min	If **Scale Type** is Lin, the min Stop Frequency is changed to -79.999990 MHz
Max	Depends on the instrument maximum frequency

6.9.1.30 Freq Step

Specifies the step frequency of the selected Cal. This determines the points between the start and stop frequencies to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STEP <freq>` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STEP?`
Example	`:SYST:CAL:ROW2:FREQ:STEP 1e9`
Notes	Max values depend on Hardware Options
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated You cannot set **Freq Step** > Stop frequency - Start frequency Attempts to set **Freq Step** > Stop frequency - Start frequency results in **Freq Step** being set to Stop frequency - Start frequency
Couplings	Coupled to "Freq Points" on page 912. Changing **Freq Step** adjusts **Freq Points** using (((Stop Freq – Start Freq) / Freq Step) + 1) and clips to the next integer value, which may result in **Freq Step** being

	clipped too If **Freq Step** is set to a value > Stop Freq – Start Freq **Stop Freq** is increased, and **Freq Points** is set to 1
Preset	All 10 kHz
State Saved	Saved in instrument state
Min	1 Hz
Max	Depends on the instrument maximum frequency

6.9.1.31 Freq Points

Specifies the frequency points of the selected Cal. This determines the points between the start and stop frequencies to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:POINts` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:POINts?`
Example	`:SYST:CAL:ROW2:FREQ:POIN 100`
Couplings	Coupled to "Freq Step" on page 911. Changing **Freq Points** adjusts **Freq Step** using (Stop Freq – Start Freq) / (Freq Points – 1) and clips to the next integer value, which may result in **Freq Step** being clipped
Preset	1
Min	1
Max	100000

6.9.1.32 Mech Atten Type

Specifies the Mech Atten type to use:

- `STEP`: Use multiple Mech Atten states determined by Mech Atten Start, Mech Atten Stop and Mech Atten Step
- `ALL`: Use all the attenuator states
- `BYPass`: Bypasses the attenuator

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:TYPE STEP | ALL | BYPass` `:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:TYPE?`
Example	`:SYST:CAL:ROW3:ATT:TYPE STEP`
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`STEP`

State Saved	Saved in instrument state
Range	STEP|ALL|BYPass

6.9.1.33 Mech Atten Start

Determines the first Mechanical Attenuator to be used in the Calibration

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STARt <rel_ampl> :SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STARt?
Example	:SYST:CAL:ROW3:ATT:STARt 20
Dependencies	Disabled unless "Mech Atten Type" on page 912 is STEP The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled to "Mech Atten Stop" on page 913. **Mech Atten Start** must be <= **Mech Atten Stop**. If **Mech Atten Start** > **Mech Atten Stop**, then **Mech Atten Stop** = **Mech Atten Start**
Preset	10 dB
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it must be directly entered from the keypad or via SCPI. This is to protect against adjusting the attenuation to a dangerously small value, which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that, in the single attenuator configuration, the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and is reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB

6.9.1.34 Mech Atten Stop

Determines the last Mechanical Attenuator to be used in the Calibration

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STOP <rel_ampl> :SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STOP?
Example	:SYST:CAL:ROW3:ATT:STOP 30
Dependencies	Disabled unless "Mech Atten Type" on page 912 is STEP The SCPI command applies to the currently selected Cal Group

	If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled to "Mech Atten Start" on page 913. **Mech Atten Start** must be <= **Mech Atten Stop**. If **Mech Atten Start** > **Mech Atten Stop**, then **Mech Atten Stop** = **Mech Atten Start**
Preset	10 dB
State Saved	Saved in instrument state
Min	0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it must be directly entered from the keypad or via SCPI. This is to protect against adjusting the attenuation to a dangerously small value which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased
Max	CXA Option 503 or 507: 50 dB EXA: 60 dB All other models: 70 dB Note that, in the single attenuator configuration, the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and is reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB

6.9.1.35 Mech Atten Step

Determines the Mech Attenuation Step. This determines the points between the Mechanical Attenuation min and max to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STEP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STEP?`
Example	`:SYST:CAL:ROW2:ATT:STEP 2dB`
Dependencies	Disabled unless "Mech Atten Type" on page 912 is `STEP` The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	2 dB
State Saved	Saved in instrument state
Min	2 dB
Max	10 dB

6.9.1.36 Elec Atten Type

Specifies the Elec Atten type to use:

- STEP: Use multiple Elec Atten states determined by Elec Atten Start, Elec Atten Stop and Elec Atten Step
- ALL: Use all the attenuator states
- BYPass: Bypasses the attenuator

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:TYPE STEP | ALL | BYPass :SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:TYPE?
Example	:SYST:CAL:ROW3:EATT:TYPE STEP
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	STEP
State Saved	Saved in instrument state
Range	STEP|ALL|BYPass

6.9.1.37 Elec Atten Start

Determines the first Electronic Attenuator to be used in the Calibration

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STARt <rel_ampl> :SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STARt?
Example	:SYST:CAL:ROW3:EATT:STARt 0
Dependencies	Only appears in Dual Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no "electronic attenuator" there is only a single integrated attenuator (which has both a mechanical and electronic stage) Disabled unless "Elec Atten Type" on page 914 is STEP The electronic attenuator is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz, or 0-3 GHz, depending on the model). If the low band ranges from 0-3.6 GHz, and Stop Frequency of the Calibration is > 3.6 GHz, then this parameter is grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, or the electronic attenuator is unavailable, then this parameter is grayed-out If either of the above is true, and if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable is sent If both of the above are true, pressing the control generates error message -221, in other words, the frequency range lockout takes precedence The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled to Elec Atten Stop. Elec Atten Start must be <= Elec Atten Stop. If Elec Atten Start > Elec

	Atten Stop, Elec Atten Stop = Elec Atten Start
Preset	0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	24 dB

6.9.1.38 Elec Atten Stop

Determines the last Electrical Attenuator to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STOP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STOP?`
Example	`:SYST:CAL:ROW3:EATT:STOP 10`
Dependencies	Only appears in Dual Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage) Disabled unless "Elec Atten Type" on page 914 is `STEP` The electronic attenuator is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz or 0-3 GHz, depending on the model). If the low band ranges from 0-3.6 GHz, and Stop Frequency of the Calibration is > 3.6 GHz, then this parameter is grayed out If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator is unavailable, then this parameter is grayed out If either of the above is true, and if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable is sent If both of the above are true, pressing the control generates error message -221, in other words, the frequency range lockout takes precedence For SCPI, this query applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated
Couplings	Coupled to Elec Atten Start. Elec Atten Stop must be >= Elec Atten Start. If Elec Atten Stop < Elec Atten Start, Elec Atten Start = Elec Atten Stop
Preset	0 dB
State Saved	Saved in instrument state
Min	0 dB
Max	24 dB

6.9.1.39 Elec Atten Step

Determines the Elec Attenuation Step. This determines the points between the Electric Attenuation min and max to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STEP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STEP?`
Example	`:SYST:CAL:ROW2:EATT:STEP 2dB`
Dependencies	Disabled unless "Elec Atten Type" on page 914 is `STEP` The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	1 dB
State Saved	Saved in instrument state
Min	1 dB
Max	24 dB

6.9.1.40 Full Range Atten Type

Specifies the Full Range Atten type to use. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

- `STEP`: Use multiple Full Range Atten states determined by Full Range Atten Start and Full Range Atten Stop
- `ALL`: Use all the attenuator states

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:TYPE STEP | ALL |` `:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:TYPE?`
Example	`:SYST:CAL:ROW3:FATT:TYPE STEP`
Dependencies	Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`STEP`
State Saved	Saved in instrument state
Range	`STEP|ALL|`

6.9.1.41 Full Range Atten Start

Determines the first Full Range Attenuator to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STARt <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STARt?`
Example	`:SYST:CAL:ROW3:FATT:STARt 0`
Dependencies	Only appears in N9041B, when the RF input is selected, and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed Disabled unless "Full Range Atten Type" on page 917 is `STEP` The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled to Full Range Atten Stop. Full Range Atten Start must be <= Full Range Atten Stop. If Full Range Atten Start > Full Range Atten Stop, Full Range Atten Stop = Full Range Atten Start
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB

6.9.1.42 Full Range Atten Stop

Determines the last Full Range Attenuator to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STOP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STOP?`
Example	`:SYST:CAL:ROW3:FAT:PT:STOP 10`
Dependencies	Only appears in N9041B, when the RF input is selected, and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed Disabled unless "Full Range Atten Type" on page 917 is `STEP` The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled to Full Range Atten Start. Full Range Atten Stop must be >= Full Range Atten Start. If Full Atten Stop < Full Range Atten Start, Full Range Atten Start = Full Range Atten Stop
Preset	20 dB
State Saved	Saved in instrument state
Min	0 dB
Max	Only valid values are 0, 6, 14, 20 dB

6.9.1.43 Frequency Extender Attenuation Type

Specifies the Frequency Extender Attenuation type to use. **Frequency Extender Attenuation** is applied to the frequency extender's high frequency input signal path (for example, with a V3050A frequency extender, the high frequency path is 50 GHz to 110 GHz).

- `STEP`: Use multiple Frequency Extender Attenuation states determined by Frequency Extender Attenuation Start and Frequency Extender Attenuation Stop
- `ALL`: Use all the attenuator states

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:TYPE STEP | ALL` `:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:TYPE?`
Example	`:SYST:CAL:ROW3:FEAT:TYPE STEP`
Dependencies	Only applies, and is only visible, when the External RF (ERFIN) input is selected The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`STEP`
State Saved	No
Range	`STEP|ALL|REFerence`

6.9.1.44 Frequency Extender Attenuation Start

Determines the first Frequency Extender Attenuator to be used in the Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STARt <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STARt?`
Example	`:SYST:CAL:ROW3:FEAT:STARt 0`
Dependencies	Only applies, and is only visible, when the External RF (`ERFIN`) input is selected Disabled unless "Frequency Extender Attenuation Type" on page 919 is `STEP` The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled to Frequency Extender Attenuation Stop. Frequency Extender Attenuation Start must be <= Frequency Extender Attenuation Stop. If Frequency Extender Attenuation Start > Frequency Extender Attenuation Stop, Frequency Extender Attenuation Stop = Frequency Extender Attenuation Start
Preset	0 dB
State Saved	Saved in instrument state

Min	0 dB
Max	V3050A: 26 dB

6.9.1.45 Frequency Extender Attenuation Stop

Determines the last Frequency Extender Attenuation to be used in the Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STOP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STOP?`
Example	`:SYST:CAL:ROW3:FEAT:PT:STOP 26`
Dependencies	Only applies, and is only visible, when the External RF (ERFIN) input is selected Disabled unless "Frequency Extender Attenuation Type" on page 919 is `STEP` The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled to Frequency Extender Attenuation Start. Frequency Extender Attenuation Stop must be >= Frequency Extender Attenuation Start. If Frequency Extender Attenuation Stop < Frequency Extender Attenuation Start, Frequency Extender Attenuation Start = Frequency Extender Attenuation Stop
Preset	26 dB
State Saved	Saved in instrument state
Min	0 dB
Max	V3050A: 26 dB

6.9.1.46 Frequency Extender Atten Step

Determines the Frequency Extender Attenuation Step. This determines the points between the Frequency Extender Attenuation min and max to use for Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STEP <rel_ampl>` `:SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STEP?`
Example	`:SYST:CAL:ROW2:FEAT:STEP 2dB`
Dependencies	Only applies, and is only visible, when the External RF (`ERFIN`) input is selected The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	1 dB
State Saved	No
Min	1 dB
Max	V3050A: 26 dB

6.9.1.47 IF Path

Determines the IF Path to be used in the Calibration.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:IF:PATH B10M | B25M | B40M | B85M | B125M | B140M | B160M | B255M | B510M | B1G | B1500M | B2G | B4G | EXT` `:SYSTem:CALibration:ROW[1]|2|…|100:IF:PATH?`
Example	`:SYST:CAL:ROW2:IF:PATH B25M`

Notes

`B10M`	10 MHz
`B25M`	25 MHz
`B40M`	40 MHz
`B85M`	85 MHz
`B125M`	125 MHz
`B140M`	140 MHz
`B160M`	160 MHz
`B255M`	255 MHz
`B510M`	510 MHz
`B1G`	1 GHz
`B1500M`	1.5 GHz
`B2G`	2 GHz
`B4G`	4 GHz
`EXT`	Depends on the hardware

In cases where the path is not available but is selected via SCPI, generates error -241,"Hardware missing; Option not installed"

Dependencies

Path	Availability requires Installation of:
25 MHz	25 MHz or wider IF Bandwidth option
40 MHz	40 MHz or wider IF Bandwidth option
85 MHz	85 MHz or wider IF Bandwidth option
125 MHz	125 MHz or wider IF Bandwidth option
140 MHz	Option B1X
160 MHz	Option B1Y. B1Y cannot be installed without B1X
255 MHz	Option B2X or wider IF Bandwidth option
510 MHz	Option B5Y or wider IF Bandwidth option
1 GHz	Option H1G/B1G or wider IF Bandwidth option
2 GHz	Option B2G(R20) or wider IF Bandwidth option

	Path	Availability requires Installation of:
	4 GHz	Option B4G(R40) or wider IF Bandwidth option
	1.5 GHz	Option R15
	If Option B85 *and* either Option B1A or Option B1X are installed, the 85 MHz option does not appear, and `B85M` is disabled. Sending the command to select `B85M` in this case generates an error -221, "Settings Conflict; Use wider bandwidth selection"	
	If Option B1A *and* Option B1X are both installed, the 125 MHz option does not appear, and `B125M` is disabled. Sending the command to select `B125M` in this case generates an error -221, "Settings Conflict; Use wider bandwidth selection"	
	In cases where the path is not available, but is selected via SCPI, error -241,"Hardware missing; Option not installed" is generated	
	The preset value depends on the Digital IF BW setting of the default measurement	
Preset	If the 25 MHz path is not available, presets to 10 MHz	
State Saved	No	
Range	`B10M | B25M | B40M | B85M | B125M | B140M | B160M | B255M | B510M | B1G | B1500M | B2G | B4G | EXT`	

6.9.1.48 IF Gain

Determines the IF Gain to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:IF:GAIN[:STATe]AUTO|HIGH|LOW|ALL` `:SYSTem:CALibration:ROW[1]|2|…|100:IF:GAIN[:STATe]?`
Example	`:SYST:CAL:ROW3:IF:GAIN ALL`
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	`AUTO`
State Saved	Saved in instrument state
Range	Auto | High Gain | Low Gain | All

6.9.1.49 Preamp

Determines if the Preamp is to be used in the Calibration

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:BAND OFF | LOW | FULL` `:SYSTem:CALibration:ROW[1]|2|…|100:POWer:GAIN:BAND?`
Example	`:SYST:CAL:ROW2:POWer:GAIN:BAND OFF`
Dependencies	The SCPI command applies to the currently selected Cal Group

	If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	OFF
State Saved	Saved in instrument state
Range	OFF|LOW|FULL

6.9.1.50 Low Noise Amplifier (LNA)

Determines if the LNA is to be used in the Calibration.

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:LNA[:STATe] ON | OFF | 1 | 0 :SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:LNA[:STATe]?
Example	:SYST:CAL:ROW2:POW:GAIN:LNA ON :SYST:CAL:ROW2:POW:GAIN:LNA?
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	OFF
State Saved	No
Range	ON|OFF

6.9.1.51 µW Path Control

Determines the µW Path Control to be used in the Calibration.

Option	SCPI
Standard Path	STD
Low Noise Path	LNPath
µW Presel Bypass	MPBypass
Full Bypass	FULL

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:MW:PATH STD | LNPath | MPBypass | FULL :SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:MW:PATH?
Example	:SYST:CAL:ROW2:POW:MW:PATH FULL
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated

	This column is not shown in the table unless *either* Option MPB or Option LNB is present and licensed The Low Noise Path selection does not appear unless Option LNP is present and licensed The µW Presel Bypass selection does not appear unless Option MPB is present and licensed The Full Bypass selection does not appear unless Options LNP, MPB and FBP are installed and licensed In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated
Preset	`STD`
State Saved	Saved in instrument state
Range	`STD|LNPath|MPBypass|FULL`

6.9.1.52 Coupling

Some probe types allow coupling to reject low frequencies. This filters out the DC component of a signal that is composed of a DC bias plus some AC signal. This control is visible only for probe types that have this capability.

Remote Command	`:INPut:COUPling:Q DC | LFR1 | LFR2` `:INPut:COUPling:Q?`

Example	Turn off low frequency rejection on the Q channel, allowing signals down to DC:
	`:INP:COUP:Q DC`
	Turn on low frequency rejection on the Q channel for frequencies lower than 1.7 Hz:
	`:INP:COUP:Q LFR1`
	Turn on low frequency rejection on the Q channel for frequencies lower than 0.14 Hz:
	`:INP:COUP:Q LFR2`

Notes	Only some probe types support **Coupling**. For those that do, each probe type has its own **Coupling** setting. As probes are changed, the **Coupling** value will reflect the new probe's setting. Changing **Coupling** affects only the current probe type's setting and leaves all others unchanged
Preset	`DC`
State Saved	Saved with probe calibration data. Survives a power cycle and is not affected by a Preset or Restore
Range	DC | AC 1.7 Hz LFR1 | AC 0.14 Hz LFR2

6.9.1.53 Phase Noise Optimization

Selects the LO (local oscillator) phase noise behavior for various desired operating conditions.

For full details, see "Parameter Options & Installed Options" on page 925 below.

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe] 1 | … | 5`

	For the meaning of each numeric option value, see "Parameter Options & Installed Options" on page 925 below `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe]?`
Example	Select optimization for best wide offset phase noise: `:SYST:CAL:ROW1:FREQ:SYNT 2`
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled with "Phase Noise Optimization All Option" on page 930 When **Phase Noise Optimization All** is `ON`, selects all available LO mappings, and Phase Noise Optimization parameter will display **All** in the Configuration table. SCPI Query is still available to determine which parameter will be displayed when **Phase Noise Optimization All** is `OFF`
Preset	2
State Saved	Yes
Range	See "Ranges" on page 930 below
Min	1
Max	5

Parameter Options & Installed Options

The Phase Noise Optimization control lets you optimize the setup and behavior of the Local Oscillator (LO) depending on your specific measurement conditions. You may wish to trade off noise and speed, for example, to make a measurement faster without regard to noise or with optimum noise characteristics without regard to speed.

Parameter Values Summary

Option	#	Description
"Balanced" on page 926	1	– In instruments with EP0, balances close-in phase noise with spur avoidance – In instruments without EP0 optimizes phase noise for small frequency offsets from the carrier
"Best Wide-offset" on page 927	2	Optimizes phase noise for wide frequency offsets from the carrier
"Fast Tuning" on page 927	3	Optimizes LO for tuning speed
"Best Close-in" on page 926	4 or 1*	– In instruments with EP0, emphasizes close-in phase noise performance without regard to spur avoidance – In instruments without EP0, this setting is accepted but no action is

Option	#	Description
		taken
"Best Spurs" on page 927	5	– In instruments with EP0, emphasizes spur avoidance over close-in phase noise performance – In instruments without EP0, this setting is accepted but no action taken
Auto	-	Automatically selects LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions

*Dependent on Option EP0 installation. See "Best Close-in" on page 926 below.

The actual behavior varies somewhat depending on model number and option; for example, you always get Fast Tuning by choosing Option #3, but in some models, "Fast Tuning" on page 927 is identical in effect to "Best Close-in" on page 926.

Best Close-in

Without option EP0

```
:FREQ:SYNT 1
```

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out.

The actual frequency offset within which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset <20 kHz]

With option EP0

```
:FREQ:SYNT 4
```

In instruments with Option EP0, the LO is configured for the best possible close-in phase noise (offsets up to 600 kHz from the carrier), regardless of spurious products that occur with some center frequencies. Because this is generally less desirable for close-in measurements than the "Balanced" on page 926 setting, parameter 1 selects "Balanced" on page 926 in EP0 instruments, in the interests of optimizing code compatibility across the family. Parameter 4 selects "Best Close-in" on page 926, which is usually not as good a choice as "Balanced" on page 926.

Balanced

```
:FREQ:SYNT 1
```

In instruments with EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Best Spurs

```
:FREQ:SYNT 5
```

In instruments with EP0, the LO is configured for better phase noise than the "Best Wide-offset" on page 927 case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-in" on page 926 case mostly within ±1 octave around 300 kHz offset. Spurs are even lower than in the "Balanced" on page 926 case at better than –90 dBc, whether or not the carrier is on-screen.

This setting is never selected when Phase Noise Optimization is in Auto, you must select it manually.

Best Wide-offset

```
:FREQ:SYNT 2
```

The LO phase noise is optimized for wider offsets from the carrier. Optimization is especially improved for offsets from 70 kHz to 300 kHz. Closer offsets are compromised and the throughput of measurements (especially remote measurements where the center frequency is changing rapidly), is reduced.

The actual frequency offset beyond which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset >30 kHz]

In instruments with Option EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Fast Tuning

```
:FREQ:SYNT 3
```

In this mode, the LO behavior compromises phase noise at many offsets from the carrier in order to allow rapid measurement throughput when changing the center frequency or span. The term "Fast Tuning" on page 927 refers to the time it takes to move the local oscillator to the start frequency and begin a sweep; this setting does not impact the actual sweep time in any way.

In instruments with EP1, the LO behavior compromises phase noise at offsets below 4 MHz in order to improve measurement throughput. The throughput is especially affected when moving the LO more than 2.5 MHz and up to 10 MHz from the stop frequency to the next start frequency.

In instruments with Option EP0, this is the same configuration as "Best Spurs" on page 927. It is available with the "Fast Tuning" on page 927 label for convenience,

and to make the user interface more consistent with other X-Series instrument family members.

(In models whose hardware does not provide for a "Fast Tuning" on page 927 option, the settings for "Best Close-in" on page 926 are used if "Fast Tuning" on page 927 is selected. This gives the fastest possible tuning for that hardware set.)

Auto

```
:FREQ:SYNT:AUTO ON
```

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. The selection rules are as follows.

Auto Optimization Rules

X-Series instruments have several grades of LO, offering different configurations when in the Auto Mode. The rules for Auto selection are as follows:

Models with Option	Conditions	Selection
EP0 Models with option EP0 have a two stage local oscillator, which switches to a single loop for fast tuning (available in UXA)	Center frequency is < 699.9 kHz	"Balanced" on page 926
	Span > 114.1 MHz, *or* RBW > 800 kHz	"Fast Tuning" on page 927
	RBW > 290 kHz, *or* Span > 4.2 MHz	"Best Wide-offset" on page 927
	Other conditions	"Balanced" on page 926
EP1 Models with option EP1 have a two-loop local oscillator, which switches to a single loop for fast tuning (available in XA6/PXA)	Span > 44.44 MHz, *or* RBW > 1.9 MHz, *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 927
	Center frequency is < 195 kHz, *or* CF >= 1 MHz *and* Span <= 1.3 MHz *and* RBW <= 75 kHz	"Best Close-in" on page 926
	All other conditions	"Best Wide-offset" on page 927
EP2 Models with option EP2 use a different loop bandwidth for the fast-tuning choice, which is a compromise	CF < 130 kHz , *or* CF > 12 MHz *and* Span < 495 kHz *and* RBW < 40 kHz	"Best Close-in" on page 926

Models with Option	Conditions	Selection
between tuning speed and phase noise, giving good tuning speed at all offsets. Although not as good as for "Best Close-in" on page 926; this is useful when you have to look across a wide range of spans (available, for example, in XA5/MXA for excellent phase noise)	Span > 22 MHz, *or* RBW > 400 kHz, *or* CF ≤ 12 MHz *and* Span < 495 kHz *and* RBW < 23 kHz	"Fast Tuning" on page 927
	All other conditions	"Best Wide-offset" on page 927
EP4 (available in CXA for improved phase noise)	Span > 101 MHz *or* RBW > 1.15 MHz *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 927
	CF is < 109 kHz *or* CF >= 4.95 MHz *and* Span <= 666 kHz *and* RBW < 28 kHz	"Best Close-in" on page 926
	All other conditions	"Best Wide-offset" on page 927
All Other Models Note that in these models, the hardware does not actually provide for an extra-fast tuning option, so the settings for "Fast Tuning" on page 927 are actually the same as "Best Close-in" on page 926, but the rules are implemented this way so that the user who doesn't care about phase noise but does care about tuning speed doesn't have to remember which of the other two settings gives faster tuning	Span > 12.34 MHz, *or* RBW > 250 kHz, *or* Source Mode is set to “Tracking”	"Fast Tuning" on page 927
	Center frequency is < 25 kHz, *or* CF >= 1 MHz *and* Span <= 141.4 kHz *and* RBW <= 5 kHz	"Best Close-in" on page 926
	All other conditions	"Best Wide-offset" on page 927

In all the above cases:

- The RBW to be used in the calculations is the equivalent –3 dB bandwidth of the current RBW filter
- The rules apply whether in swept spans, zero span, or FFT spans

Ranges

Option	Option #	Phase Noise Option	Range
No EPx Option	1	Best Close-in	[offset < 20 kHz]
	2	Best Wide-offset	[offset > 30 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP0	4	Best Close-in	[offset < 600 kHz]
	1	Balanced	[offset < 600 kHz]
	5	Best Spurs	[offset < 600 kHz]
	2	Best Wide-offset	[offset > 800 kHz]
	3	Fast Tuning	[same as Best Close-In]
EP1	1	Best Close-in	[offset < 140 kHz]
	2	Best Wide-offset	[offset > 160 kHz]
	3	Fast Tuning	[single loop]
EP2, EP3, EP5	1	Best Close-in	[offset < 70 kHz]
	2	Best Wide-offset	[offset > 100 kHz]
	3	Fast Tuning	[medium loop bw]
EP4	1	Best Close-in	[offset < 90 kHz]
	2	Best Wide-offset	[offset > 130 kHz]
	3	Fast Tuning	[same as Best Close-In]
SA6210A with EPB	4	Best Close-in	[offset < 10 kHz]
	1	Balanced	[offset < 10 kHz]
	5	Best Spurs	[offset < 10 kHz]
	2	Best Wide-offset	[offset < 10 MHz]
	3	Fast Tuning	[same as Best Close-In]

6.9.1.54 Phase Noise Optimization All Option

Selects all available LO settings

Remote Command	`:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis:ALL[:STATe] ON | OFF | 1 | 0` `:SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis:ALL[:STATe]?`
Example	`:SYST:CAL:ROW1:FREQ:SYNT:ALL ON`
Notes	When this parameter is ON, it overrides the Phase Noise Optimization parameter, and selects all available LO settings
Dependencies	The SCPI command applies to the currently selected Cal Group

	If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Couplings	Coupled with "Phase Noise Optimization" on page 924. When this parameter is ON, it selects all available LO mappings, and **Phase Noise Optimization** parameter displays **All** in the Configuration table. When this parameter is OFF, the **Phase Noise Optimization** parameter displays its previously set value in the Configuration table
Preset	OFF
State Saved	Saved in instrument state
Range	ON|OFF

6.9.1.55 Mixing Mode

Determines the LO Mixing Mode to be used.

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:LO:MMODe NORMal | ALTernate | ALL :SYSTem:CALibration:ROW[1]|2|…|100:LO:MMODe?
Example	:SYST:CAL:ROW3:LO:MMOD NORM
Dependencies	The SCPI command applies to the currently selected Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221,Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	NORMal
State Saved	Saved in instrument state
Range	NORMal|ALTernate|ALL

6.9.1.56 Match State

Determines if the Cal settings must match exactly when applying the correction. If not, the system may find the closest matching state or interpolate between states.

Remote Command	:SYSTem:CALibration:ROW[1]|2|…|100:MATCh[:STATe] ON | OFF | 1 | 0 :SYSTem:CALibration:ROW[1]|2|…|100:MATCh[:STATe]?
Example	:SYST:CAL4:MATC ON :SYST:CAL4:MATC?
Dependencies	The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated
Preset	All True
State Saved	Saved in instrument state
Range	True | False

6.9.2 Cal Group

Specifies the selected Calibration Group. You can use different Cal Groups for different external hardware configurations. The Cal Group is also an important concept when sending SCPI commands to the Calibration System, because in each case the SCPI command is directed to the currently-selected Cal Group, which is the Cal Group that is modified by the SCPI command.

Remote Command	`:SYSTem:CALibration:CGRoup <integer>` `:SYSTem:CALibration:CGRoup?`
Example	`:SYST:CAL:CGR 2` `:SYST:CAL:CGR?`
Dependencies	Not available in SA6210A
Preset	1
Min	1
Max	100

6.9.3 Apply Cal Group

Controls whether or not the checked Apply rows of the currently selected Cal Group are applied.

Remote Command	`:SYSTem:CALibration:CGRoup:APPLy <bool>` `:SYSTem:CALibration:CGRoup:APPLy?`
Example	`:SYST:CAL:CGR:APPL ON` `:SYST:CAL:CGR:APPL?`
Dependencies	The SCPI command is applied to the currently selected Cal Group You can only turn on Apply Cal Group if at least one Cal for the currently selected group has been executed. If you attempt to select Apply Cal Group before any Cals have been executed, the advisory message “At least one Row must be calibrated before it can be applied” is displayed Not available in SA6210A
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`
Annotation	If *any* Cal Group is `ON`, RCal in the Meas Bar displays in amber, to indicate that Calibrations are in use

6.9.4 All Apply Cal Group Off

Turns off Apply Cal Group for all groups.

Remote Command	`:SYSTem:CALibration:CGRoup:APPLy:AOFF`
Example	`:SYST:CAL:CGR:APPL:AOFF`
Dependencies	Not available in SA6210A

6.9.5 Connection

Opens the Connection dialog, which provides step-by-step instructions for its use.

6.10 Calibrator Control

Lets you select a calibrator and control the calibrator settings.

6.10.1 Cal Source

Lets you select the calibrator to control.

Remote Command	`:SYSTem:CALibration:TUNE[:SELected] NONE | REF50 | REF4800 | TUNAble | CALOUT | RCM1 | RCM2 | RCM3 | RCM4 | RCM5 | RCM6 | RCM7 | RCM8 | RCM9 | RCM10` `:SYSTem:CALibration:TUNE[:SELected]?`
Example	`:SYST:CAL:TUNE:SEL TUNABLE` `:SYST:CAL:TUNE?`
Notes	Options are:
Dependencies	If the selected calibrator is not available, it does not appear in the dropdown. If you send SCPI to select a calibrator that is not available, the instrument generates an error
Couplings	Selecting `REF50` sets the RF Calibrator to `REF50` Selecting `REF4800` sets the RF Calibrator to `REF4800` Selecting a calibrator source other than `REF50` or `REF4800` sets RF Calibrator to `OFF`
Preset	Unaffected by **Mode Preset**. Set to `NONE` by **Restore Input/Output Defaults** or **Restore System Defaults->All**

`NONE`	No calibrator selected
`TUNAble`	Tunable internal calibrator presents in N9042B, SA6210A
`CALOUT`	Tunable calibrator available through CALOUT front panel port in N9042B
`REF50`	50 MHz calibrator Not supported in SA6210A
`REF4800`	4.8 GHz calibrator Not supported in SA6210A
`RCM1 – RCM10`	RCal module Not supported in SA6210A

6.10.2 Output

Lets you set the selected calibrator's RF power output state.

Remote Command	`:SYSTem:CALibration:TUNE:OUTput[:STATe] ON | OFF | 1 | 0` `:SYSTem:CALibration:TUNE:OUTput[:STATe]?`

Example	`:SYST:CAL:TUNE:OUTP ON` `:SYST:CAL:TUNE:OUTP?`
Preset	Unaffected by **Mode Preset**. Set to `OFF` by **Restore Input/Output Defaults** or **Restore System Defaults->All**

6.10.3 Frequency

Lets you set the selected calibrator's frequency.

Remote Command	`:SYSTem:CALibration:TUNE:FREQuency <freq>` `:SYSTem:CALibration:TUNE:FREQuency?`
Example	Set source frequency to 150 MHz: `:SYST:CAL:TUNE:FREQ 150000000`
Preset	Unaffected by **Mode Preset**. Set to 1 GHz or 100 MHz in SA6210A by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Min/Max	Depends on the selected calibrator For SA6210A, Mix: 10 MHz, Max: 55 GHz

6.10.4 Signal

Lets you set the selected calibrator's signal type.

Remote Command	`:SYSTem:CALibration:TUNE:TYPE CW | COMB` `:SYSTem:CALibration:TUNE:TYPE?`
Example	`:SYST:CAL:TUNE:TYPE CW` `:SYST:CAL:TUNE:TYPE?`
Dependencies	If the selected calibrator does not support a signal type, then that type is disabled in the dropdown Changing the signal type to a disabled option generates an error
Preset	Unaffected by **Mode Preset**. Set to `CW` by **Restore Input/Output Defaults** or **Restore System Defaults->All**

6.10.5 Cal Comb Spacing

Lets you set the calibrator's comb spacing, when the signal type is `COMB`.

Remote Command	`:SYSTem:CALibration:TUNE:SPACing <freq>` `:SYSTem:CALibration:TUNE:SPACing?`
Example	Set comb spacing to 1 MHz: `:SYST:CAL:TUNE:SPAC 1000000`

Dependencies	Only appears when COMB is selected as "Signal" on page 935 If the selected calibrator does not support the Comb signal, attempting to set the spacing generates an error
Preset	Unaffected by **Mode Preset.** Set to 0 Hz by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Min/Max	Depends on the selected calibrator

6.10.6 Calibrator Reference

Determines the frequency reference type used by the RCal module of the currently selected Cal Group

Remote Command	`:SYSTem:CALibration:TUNE:REFerence INTernal | EXTernal` `:SYSTem:CALibration:TUNE:REFerence?`
Example	Set the calibrator frequency reference to Internal: `:SYSTem:CALibration:TUNE:REFerence INTERNAL`
Dependencies	Only displayed when an RCal module is the selected calibrator
Preset	Unaffected by **Mode Preset**. Set to preset value by **Restore Input/Output Defaults** or **Restore System Defaults->All**
Range	`INTernal|EXTernal`

6.11 Advanced

6.11.1 T/R Port High Power Attenuator

Controls whether additional attenuation is added at the T/R Port. The T/R port has two output paths, one that provides a 16 dB attenuator, another that bypasses this attenuator. When this control is ON, the path includes the 16 dB attenuator, so the maximum output level for this path is 0 dBm. When this control is OFF, the 16 dB attenuator is bypassed, so the maximum output level for this path is +5 dBm.

Example

```
:FEED:RF:PORT:TR:HPOW:ATT ON
```

6.12 Aux I/O Control

This menu is only available with Option LSN, indicating that the LISN IO board is installed. It is used to control each of the eight control lines out of the rear panel connector independently. There are eight bits of control lines. The LISN Control (Mode setup) of the EMI Receiver application affects the **AUX I/O Control** settings. Whenever you change the LISN Control in Mode Setup, the corresponding AUX I/O Control data lines will also be changed. The selection at the AUX I/O Control does not affect the LISN Control (Mode Setup) setting.

6.12.1 Data 0 – Data 7

Sets the value for Data 0 through Data 7 respectively.

Remote Command	`:OUTPut:AUX:IO:DATA<n> OFF | ON | 0 | 1` where `<n>` in an integer 0 - 7
Example	`:OUTP:AUX:IO:DATA0 OFF`
Notes	Unaffected by **Mode Preset**, but **Input/Output Preset** presets the value to `ON` for all 8 data lines
Preset	`ON`
Range	`OFF|ON`

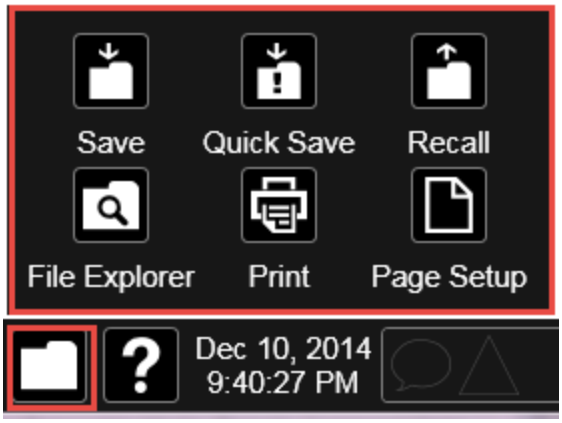
6.12.2 Aux IO Control (Remote Command Only)

Sets/Queries the value for all 8 data lines.

Remote Command	`:OUTPut:AUX:IO <Value>` `:OUTPut:AUX:IO?`
Example	`:OUTP:AUX:IO 31`
Notes	Unaffected by **Mode Preset**, but **Input/Output Preset** presets the value to `ON` for all 8 data lines
Couplings	The states of Data 0 to Data 7 under the **AUX I/O Control** panel (**Input/Output** menu) change according to the keyed-in AUX IO value
Preset	31
Min	0
Max	255
Backwards Compatibility SCPI	`:OUTPut:UPORt <Value>`

7 Save/Recall/Print

This section describes the functions that can be accessed via the front panel **Save**, **Quick Save**, and **Recall** hardkeys, as well as via the controls in the front-panel folder icon, as shown below.



7.1 Quick Save

Quick Save repeats the previous save at the touch of a single button. Whatever you saved before gets saved again to the same directory, and with a filename derived from the previous filename.

You access Quick Save by pressing the folder icon at the bottom of the display and then pressing the Quick Save icon. If your instrument has phyiscal front-panel keys, you can press the Quick Save hardkey. In addition, if you have a PC keyboard plugged in, the sequence CTL-Q will perform a Quick Save.

Quick Save repeats the most recent save that was performed from the Save menu, with the following exceptions:

- Register saves are not remembered as Saves for the purpose of the Quick Save function
- If the current measurement does not support the last non-register save that was performed, an informational message is generated, “File type not supported for this measurement”

Quick Save repeats the last type of qualified save (that is, a save qualified by the above criteria) in the last save directory by creating a unique filename using the Auto File Naming algorithm described below.

If the previous save was a Screen Image save, Quick Save saves a Screen Image when the Quick Save button is pressed. This image is *exactly* what is on the screen when the Quick Save button is pressed. Quick Save does *not* force a dialog exit or navigate in any way, it simply snaps the image on the screen and saves it. This lets you save images of dialogs and setup screens that would be impossible to save using the Save dialog.

NOTE **When Quick Save is pressed the display theme changes to the theme specified by the Screen Image Theme control in order to take the screen shot, and then changes back to the Display Theme, but no navigation is performed, and no dialogs are exited.**

If Quick Save is pressed after startup and before any qualified Save has been performed, the Quick Save function performs a Screen Image save using the current settings for Screen Image saves (current theme, current directory), which then becomes the “last save” for the purpose of subsequent Quick Saves.

The Auto File Naming feature automatically generates a file name for use when saving a file. The filename consists of a prefix and suffix separated by a dot, as is standard for the Windows file system. A default prefix exists for each of the available file types:

Type	Default Prefix	Menu
State	State_	(Save/Recall)
Trace + State	State_	(Save/Recall)
Screen	Screen_	(Save/Recall)
Amplitude Corrections	Ampcor_	(Import/Export)
Traces	Trace_	(Import/Export)
Limit Lines	Limit_	(Import/Export)
Measurement Result	MeasR_	(Import/Export)
Capture Buffer	CapBuf_	(Import/Export)

A four-digit number is appended to the prefix to create a unique file name. The numbering sequence starts at 0000 within each Mode for each file type and updates incrementally to 9999, then wraps to 0000 again. It remembers where it was through a Mode Preset and when leaving and returning to the Mode. It is reset by Restore Misc Defaults and Restore System Defaults and subsequent running of the instrument application. So, for example, the first auto file name generated for State files is `State_0000.state`. The next is `State_0001`, and so forth.

One of the key features of Auto File Name is that we guarantee that the Auto File Name will never conflict with an existing file.The algorithm looks for the next available number. If it gets to 9999, then it looks for holes. If it find no holes, that is no more numbers are available, it gives an error.

For example, if when we get to State_0010.state there is already a State_0010.state file in the current directory, it advances the counter to State_0011.state to ensure that no conflict will exist (and then it verifies that State_0011.state also does not exist in the current directory and advances again if it does, and so forth).

If you enter a file name for a given file type, then the prefix becomes the filename you entered instead of the default prefix, followed by an underscore. The last four letters (the suffix) are the 4-digit number.

For example, if you save a measurement results file as "`fred.csv`", then the next auto file name chosen for measurement results save will be `fred_0000.csv`.

NOTE **Although 0000 is used in the example above, the number that is used is actually the current number in the Meas Results sequence, that is, the number that would have been used if you had not entered your own file name.**

NOTE **If the filename you entered ends with _dddd, where d=any digit, making it look just like an auto file name, then the next auto file name picks up where you left off with the suffix being dddd + 1.**

Quick Save Mode

Quick Save can be operated in the Normal mode and in a special “Prompt” mode. There is a switch on the User Interface page of the System menus that lets you control this.

When Quick Save Mode is in Normal (the default setting), the instrument does an immediate save of a new file of the same type and to the same directory as the previous Save action. When Quick Save Mode is in the Prompt state, instead of immediately performing a Save, the Alpha Keyboard pops up with the proposed auto-filename in the entry area. The user can then press Enter to accept the auto filename, or edit the name and press Enter. This allows you to easily save a file with a custom file name.

Notes No remote command for this key specifically

7.2 Recall

The **Recall** dialog lets you recall previously saved states, traces and other items to the instrument from files on the instrument's internal storage, from removable devices, and from directories on the network. You access the **Recall** dialog by pressing the folder icon at the bottom of the display and then pressing the **Recall** icon. If your instrument has physical front-panel keys, you can press the **Recall** hardkey.

The dialog has section tabs running down the left side, which you use to specify what you want to recall, similar to the **Save** dialog. You choose the recall item and then complete the recall by choosing a register or file location from which to recall the item.

Notes	No remote command for this key specifically, but `:MMEM:LOAD` is available for specific file types. For example: `:MMEM:LOAD:STATe <filename>` If you try to recall a State file for a mode that is not licensed or not available in the instrument, an error message will occur and the state will not change
Backwards Compatibility Notes	In legacy analyzers, it was possible to load a state without affecting the trace data, limit lines or correction data. Similarly (since User Preset is actually loading a state), it was possible to do a User Preset without affecting the trace data, limit lines or correction data In the X-Series, "state" always includes all of this data; so, whenever state is loaded, all of the traces, limit lines and corrections are affected. Although this differs from previous behavior, it is desirable behavior, and should not cause adverse issues for users Recall for the X-Series supports backward compatibility in the sense that you can recall a state file from any X-Series model number and any version of X-Series software. This is only possible if part of the recalling process goes through a limiting step after recalling the mode settings, at least for settings that may vary with version number, model number, option and license differences. If you try to recall a state file onto an instrument with less capability than what was available on the instrument during the save, the recall will ignore the state it doesn't support, and it will limit the recalled setting to what it allows Example: if the saved state includes preamp ON, but the recalling instrument does not have a preamp; the preamp is limited to OFF. Conversely, if you save a state without a preamp, the preamp is OFF in the state file. When this saved file is recalled on an instrument with a licensed preamp, the preamp is changed to OFF. Another example is if the saved state has center frequency set to 20 GHz, but the instrument recalling the saved state is a different model and only supports 13.5 GHz. In this case, the center frequency is limited along with any other frequency-based settings. Since the center frequency can't be preserved in this case, the recall limiting tries to at least preserve span to keep the measurement setup as intact as possible Note that there is no state file compatibility outside of the X-Series. For example, you cannot recall a state file from ESA or PSA

7.2.1 Recall From File / Open

For every Recall type, a button appears called Recall From File or Open. Recall From File appears for recall types that also include registers (like State and Trace+State), and Open appears for all other recall types.

When you push the Recall From File or Open button, a dialog slides in from the right which allows you to see what files are saved in the current directory. See "Save to File / Save As" on page 975 for a depiction of this screen for the Save menu, which is similar to Recall.

The default directory is the internal directory for the current Mode and save type, on the D: drive. You may also change to another Mode's state directory by pressing the dropdown in the upper right corner labeled "Mode". Once you have chosen a directory, the files in that directory whose extension matches the current data type (e.g., .state or .trace) are displayed in the right-hand window of the dialog. You can sort this list by name, date, file size or extension by tapping the Name, Date, Size, or Content header at the top of each column. A second tap toggles the sort order between Ascending and Descending.

Also displayed is a path depiction showing the path to the current directory. In the example shown, the path is `D:\Users\Instrument\Documents\SA\screen`. Tapping any element of this path lets you select an alternate route. Tapping the "Computer" arrow lets you select a different drive.

Tapping the "back" arrow navigates to the previously selected directory.

If you plug in a removable drive (e.g., a thumb drive), the browser immediately navigates to the root of that drive. Furthermore, if you had a thumb drive in and you were in a directory on the thumb, and then you exit the browser, when you come back in you are still in the same directory on that removable drive. If you remove the thumb drive, you return to the directory you had been in before the thumb drive was plugged in.

Note that for each data type there is a "current" directory, and it is the last directory used by either Save or Recall for that Mode. For example, if in SA Mode you save a Corrections file to a particular directory, then when you go to recall a Correction in SA Mode, you should be pointing at that directory. Or if in EMC Mode you recall a Limit from a particular directory then when in EMC Mode you go to save a Limit, it should be pointing at that same directory. There is one "current" directory for each data type for each Mode (not one for Save and one for Recall).

The Filename field, just below the Path field, shows the filename that will be used. The File Name field is loaded with the name of the selected file. You may edit the filename by tapping it, which brings up the onscreen alpha keyboard. Press the "Done" button on this keyboard when you are done editing.

Select a file to load and press **Recall**. After a successful recall, a message "File <filename> recalled" or "State Register <register number> recalled" is displayed in an info box for a few seconds.

The **Files of Type** field shows the file suffix for the type of file you have selected to recall. This field only appears for files which have multiple file types that can be recalled. These file types are:

Amplitude Corrections:

- Amplitude Corrections (`*.csv`)
- Legacy Cable Corrections (`*.cbl`)
- Legacy User Corrections (`*.amp`)
- Legacy Other Corrections (`*.oth`)
- Legacy Antenna Corrections (`*.ant`)

Limits:

- Limit Data (`*.csv`)
- Legacy Limit Data (`*.lim`)

7.2.2 State

Lets you choose a register or file from which to recall the state.

See the description under **Save**"State" on page 977 for information on state files and their contents and the default paths. State files have the extension ".state".

For rapid recall, the **State** menu lists 16 registers from which you can recall states. Pressing a Register button initiates the recall. You can also select a file from which to recall by pressing **Recall From File**.

Since each state file is only for one Mode, the settings for other Modes are unaffected when it is loaded. **Recall State** will cause a Mode switch if the state being recalled is not from the current active Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

Remote Command	`:MMEMory:LOAD:STATe <filename>`
Example	Load the state file data (on the default file directory path) into the instrument state:

	`:MMEM:LOAD:STAT "MyStateFile.state"`
Notes	When you pick a file to recall, the instrument first verifies that the file is recallable in the current instrument by checking the software version and model number of the instrument. If there is a mismatch between the file and the instrument, the recall function tries to recall as much as possible. It may limit settings that differ based on model number, licensing or version number. In general, variables in the instrument which are not contained in the state file will be unaffected, and variables in the state file which are not contained in the instrument will be ignored The recall proceeds by aborting the currently running measurement, clearing any pending operations, and then loading the State from the saved state file. You can open state files from any Mode, so recalling a State file switches the instrument to the Mode that was active when the save occurred. After switching to the Mode of the saved state file, Mode settings and data (if any for the Mode) become those from the saved file. The active measurement becomes the measurement which was running when the state file was saved and the data relevant to the measurement (if there is any) is recalled After recalling the state, the **Recall State** function does the following: – Clears the input and output buffers – Status Byte is set to 0 – Executes `*CLS` If the file specified is empty an error is generated. If the specified file does not exist, another error is generated. If there is a mismatch between the file and the proper file type, an error is generated. If there is a mismatch between file version or model number or instrument version or model number, a warning is displayed. Then it returns to the **State** menu and the **File Open** dialog disappears After the recall, the instrument exits the **Recall** menu and returns to the previous menu
Backwards Compatibility SCPI	`:MMEMory:LOAD:STATe 1,<filename>` The "1" is simply ignored

7.2.2.1 Recall Type

If you have a built-in Source in your instrument, you may wish, when recalling **State**, to recall only the part of the state file that applies to the instrument, and leave the Source unaffected. Or you may wish to recall only the part of the state file that applies to the Source, and leave the instrument unaffected.

Lets you choose whether you wish to recall the entire Analyzer + Source state (`ALL`), just the Analyzer State `ANALyzer`), or just the Source State (`SOURce`).

Remote Command	`:MMEMory:LOAD:RTYPe ALL | ANALyzer | SOURce`
Example	`:MMEM:LOAD:RTYP ALL`
Dependencies	Only available in models with a built-in source, such as VXT models
Preset	`ALL`
Range	`ALL|ANALyzer|SOURce`

7.2.2.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the State to be recalled from the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

Although these 16 registers are the only registers available from the front panel, there are 128 state registers available in the instrument. Registers 17-128 are only available from the SCPI interface, using the `*RCL` command.

There is one set of 128 state registers in the instrument, not one set for each Mode. When a state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

The date displayed follows the format specified in the Date Format setting in the Control Panel. The time shows hours and minutes.

After the recall completes, the message "Register <register number> recalled" is displayed.

If you are in the Spectrum Analyzer Mode, and you are recalling a register that was saved in the Spectrum Analyzer Mode, then after the recall, you will still be in the RecallRegister menu. If the recall causes you to switch Modes, then after the recall, you will be in the Frequency menu.

If a requested register is empty an error is generated.

Example	`*RCL 1`
Range	1-16 from front panel, 1-128 from SCPI

7.2.2.3 Edit Register Names

You may enter a custom name on any of the Register keys, to help you remember what you are using that state to recall. To do this, press the Name field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the Done button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

For more information and the SCPI command, see "Edit Register Names" on page 979 under Save, State.

7.2.3 Trace+State

Lets you choose a register or file for recalling the state.

See Save, "State" on page 977 for information on state files and their contents and the default paths. State files have the extension "`.state`".

For rapid recall, the Trace+State menu lists 16 registers from which you can recall trace+state files. Pressing a Register control initiates the recall. You can also select a file from which to recall by pressing Recall From File.

Since each trace+state file is only for one Mode, the settings for other Modes are unaffected when it is loaded. Recall Trace+State will cause a mode switch if the trace+state being recalled is not from the current active Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

Trace+State files have the extension `.trace`.

The Trace+State selection only appears for measurements that support trace saves. It is blanked for modes that do not support trace saves. Saving Trace is identical to saving State, except that a `.trace` extension is used on the file instead of `.state`, and internal flags are set in the file indicating which trace was saved.

Remote Command	`:MMEMory:LOAD:TRACe TRACE1 | … | TRACE6,<filename>` `:MMEMory:LOAD:TRACe:REGister TRACE1 | … | TRACE6,<integer>`

Example	Loads the trace file data (on the default file directory path) into the specified trace; if it is a "single trace" save file, that trace is loaded to trace 2, and is set to be not updating:
	`:MMEM:LOAD:TRAC TRACE2,"MyTraceFile.trace"`
	Restore the trace data in register 2 to Trace 1:
	`:MMEM:LOAD:TRAC:REG TRACE1,2`

Notes	When you perform the recall, the recalling Trace function must first verify the file is recallable in this instrument by checking instrument software version and model number, since it includes State. If everything matches, a full recall proceeds by aborting the currently running measurement, and loading the state from the saved state file to as close as possible to the context in which the save occurred. You can open .trace files from any mode that supports them, so recalling a Trace file switches to the mode that was active when the save occurred. After switching to the mode of the saved state file, mode settings and data (if any for the mode) are loaded with values from the saved file and the saved measurement of the mode becomes the newly active measurement, and the data relevant to the measurement (if there is any) is recalled Once the state is loaded, the trace data must be loaded. The internal flags are consulted to see which

trace to load and the To Trace setting to see where to load it. Trace data is always loaded with the specified trace set to View, so that the data is visible and not updating (so as not to erase the recalled data). If the file is an "all trace" file, all traces are loaded with the saved data (to the original trace the data was saved from) and set to View. Traces whose data is not loaded are restored to the update state that existed when they were saved

After recall, the instrument exits the Recall menu and returns to the previous menu

Some Modes and measurements do not have 6 available traces. For example, Phase Noise Mode:
`:MMEMory:LOAD:TRACe TRACE1|TRACE2|TRACE3,<filename>`

Some Modes and measurements have more than 6 traces. For example, Realtime SA Mode:
`:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8 | TRACE9 | TRACE10 | TRACE11 | TRACE12 | ALL,<filename>`

7.2.3.1 Recall To Trace

Lets you select which Trace to recall to. Not all Modes have the same number of available traces. The default is the currently selected trace, selected in this or any other menu with Trace selection. If you have selected `ALL`, then that remains selected until you specifically change it to a single trace, regardless of the trace selected in the Trace menu.

If the `.trace` file is an "all trace" type, To Trace is ignored, and the traces each go back to the trace from which they were saved.

7.2.3.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the specified trace(s) and the state of the currently active mode to be recalled from the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

There is one set of 16 trace+state registers in the instrument, not one set for each Mode. When trace+state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

The date displayed follows the format specified in the Date Format setting under the Control Panel. The time shows hours and minutes.

After the recall completes, the message `Register <register number> recalled` is displayed. If a requested register is empty, an error is generated.

Recalling state from a Register is the same as recalling state from a Trace+State File.

Example	`*RCL 1`
Range	1-16

7.2.3.3 Edit Register Names

You may enter a custom name on any of the Register keys, to help you remember what you are using that state to recall. To do this, press the Name field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the Done button on this keyboard when you are done editing

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

For more information and the SCPI command, see "Edit Register Names" on page 979 under Save, State.

7.2.4 Screen Config + State

Lets you load the complete configuration of all your screens from a file which you specify.

Note that recalling a screen config file wipes out your current screen configuration; you do not see a warning before it loads, but there is a note on the Recall page letting you know what is going to happen.

The filenames are of the form:

`State_0001.screen`

Remote Command	`:MMEMory:LOAD:SCONfig <filename>`
Example	Load the screen configuration from the file `MyScreenConfig.screen` in the default directory: `:MMEM:LOAD:SCON "myScreenConfig.screen"`

7.2.5 Measurement Data

Lets you specify a data type (for example, trace data) and choose a file from which to import the data.

Measurement Data files are comma-separated value (CSV) files, and contain the requested data in a form that can be imported into Excel or other spreadsheets, as

well as header data that gives information on relevant instrument settings at the time the save occurred.

For more on **Measurement Data** files, see "Measurement Data" on page 984 under **Save**.

Since the commonly exported data files are in CSV format, you can edit the data prior to importing it. This allows you to export a data file, manipulate the data in Excel (for example) and then import it.

7.2.5.1 Data Type

Lets you select the data type to recall.

Notes	There is no SCPI command for Data Type, as the type is implied in the SCPI command for each item
Dependencies	The **Data Type** menu for any given measurement only contains data types that are supported by that measurement. Data types that are not importable do not appear, even if they *do* appear in the corresponding **Save** menu

7.2.6 Limit

Lets you select a file from which to import the **Limit** data.

Limit files are CSV files, and contain the limit data in a form that can be imported into Excel or similar spreadsheets, as well as header data that provides information on the limit.

See the **Save Limit** description ("Limit" on page 987) for information on Limit files and their contents and the default paths. **Limit** files have the extension `.csv`.

For backwards compatibility, older limit files with the extension `.lim` can be read into the instrument, but you can only *save* limits as `.csv` files.

A set of preloaded **Limits** files can be found in the directory:

`Documents/EMC Limits and Ampcor/Limits`

Remote Command	`:MMEMory:LOAD:LIMit LLINE1 | LLINE2 | LLINE3 | LLINE4 | LLINE5 | LLINE6,<filename>`
Example	Import the 2nd Limit Line from the file `myLimitLine2.csv` in the current path: `:MMEM:LOAD:LIM LLINE2,"myLimitLine2.csv"`
Dependencies	Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type In the Log Plot measurement in Phase Noise Mode, there are only three Limit Lines, so the valid parameters are `LLINE1 | LLINE2 | LLINE3` This key only appears if you have the proper option installed in your instrument
Couplings	When a limit line is loaded from mass storage, it is automatically turned on. This allows the user to see

	it, thus confirming the load. The Margin settings will match those when the limit was saved The instrument cannot mix **Limits** domains (X Axis Unit must be **Frequency** or **Time** for both **Limits**). So, when a **Limits** file is loaded, the instrument sets the **Limits** domain (X Axis Unit) to match that of the file. If this changes the **Limits** domain from what it was before the file was loaded, all **Limits** data in all **Limits** sets is erased before the data loads. If this operation is over the remote interface, there is no warning if this occurs, so care should be taken to know the domain of the file you are loading
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which limit file was loaded
Status Bits/OPC dependencies	Sequential - aborts the current measurement

7.2.6.1 Select Limit

Selects the Limit register into which the recalled **Limit** will be placed, for example, **Limit 1**.

Preset	Not part of **Preset**, but is reset to `LLINE1` by **Restore Mode Defaults** Survives shutdown

7.2.7 Correction

Allows you to import Amplitude Corrections files in the PC-readable CSV format.

Amplitude Correction files contain the correction data in a form that can be imported into Excel or similar spreadsheets, as well as header data that provides information on the correction.

For backwards compatibility, older limit files with the extensions `.amp`, `.cbl`, `.ant` and `.oth` can be read into the instrument.

A set of preloaded **Corrections** files can be found in the directory:

`Documents\EMC Limits and Ampcor\Ampcor`

The default path for CSV files is:

`Documents\amplitudeCorrections\`

Antenna corrections are a particular kind of Amplitude Corrections – they are distinguished in the corrections file by having **Antenna Unit** set to a value other than **None**. When the Amplitude Correction is an Antenna correction and the **Antenna Unit** in the file is not **None**, the Y-Axis Unit setting changes to match the Antenna (Transducer) Unit in the file.

Remote Command	`:MMEMory:LOAD:CORRection 1 | … | 8, <filename>`
Example	Recall the Amplitude Correction data from the file `myAmpcor.csv` in the current directory to the

	2nd Amplitude Correction table, and turns on Correction 2: `:MMEM:LOAD:CORR 2, "myAmpcor.csv"`
Dependencies	Only one Transducer units can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key is grayed-out in measurements that do not. The key does not show at all if no measurements in the Mode support it Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type This key does not appear unless you have the proper option installed in your instrument This command will generate an "Option not available" error unless you have the proper option installed in your instrument
Couplings	When a correction file is loaded from mass storage, it is automatically turned on (**Correction**`ON`) and **Apply Corrections** is set `ON`. This allows you to see its effect, thus confirming the load
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which file was recalled
Backwards Compatibility SCPI	`:MMEMory:LOAD:CORRection ANTenna|CABLe|OTHer|USER, <filename>` For backwards compatibility, `ANTenna` maps to 1, `CABle` maps to 2, `OTHer` maps to 3 and `USER` maps to 4

7.2.7.1 Select Correction

Selects the register into which the recalled **Correction** will be placed, for example, **Correction 1**.

Preset	Not part of **Preset**, but reset to **Correction 1** by **Restore Input/Output Defaults** Survives a shutdown

7.2.8 Complex Correction

Imports **Complex Corrections** files in the PC-readable `.s2p` format.

Complex Correction files contain amplitude and phase correction data in a form that can be imported into Excel or similar spreadsheets, as well as header data that gives information on the correction.

The default path for Complex Corrections files is:

`Documents\complexCorrections\`

Remote Command	`:MMEMory:LOAD:CCORrection <integer>, <filename>`
Example	Recall the **Complex Correction** data from the file `mycor.s2p` in the current directory to the 2nd Complex Correction table, and turns on **Complex Correction 2**:

	`:MMEM:LOAD:CCOR 2, "mycor.s2p"`
Dependencies	Not supported by all measurements. The tab does not appear at all if no measurements in the Mode support it Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type
Couplings	When a complex correction file is loaded from mass storage, it is automatically turned ON and **Apply Corrections** is set ON. This allows you to see its effect, thus confirming the load
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which file was recalled

7.2.8.1 Select Complex Correction

Selects the register into which the recalled **Complex Correction** will be placed, for example, **Complex Correction 1**.

Preset	Not part of **Preset**, but is reset to Correction 1 by **Restore Input/Output Defaults** Survives a shutdown

7.2.9 Recall VDI CCD Correction

Imports VDI CCD External Mixer Correction files in the PC-readable CSV (.csv) format.

The default path for VDI CCD External Mixer Correction files is the instrument's `Documents` folder.

Remote Command	`:MMEMory:LOAD:VCORrection <filename>`
Example	`:MMEM:LOAD:VCOR "vdi_ccd_corr.csv"`
Dependencies	Requires the EXW (External Mixing Wide Bandwidth) and Ampcor (Amplitude Correction) licenses VDI CCD Corrections are not supported by all measurements. The tab does not appear at all if no measurements in the Mode support it Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type If the file is empty, message –250 is reported. If the file does not exist, message –256 is reported. If there is a mismatch between the file and the destination data type, message –250 is reported
Couplings	When a VDI CCD correction file is loaded into memory, if the correction matches the current external mixer setup and "Select VDI CCD Correction" on page 779 is NONE, the selected VDI CCD Correction is set to the serial number of the matching correction data
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which file was recalled

7.2.10 Mask

The Mask data type is used to import and export Mask files for measurements that use masks, such as cellular comms and real-time measurements.

7.2.11 Sequence

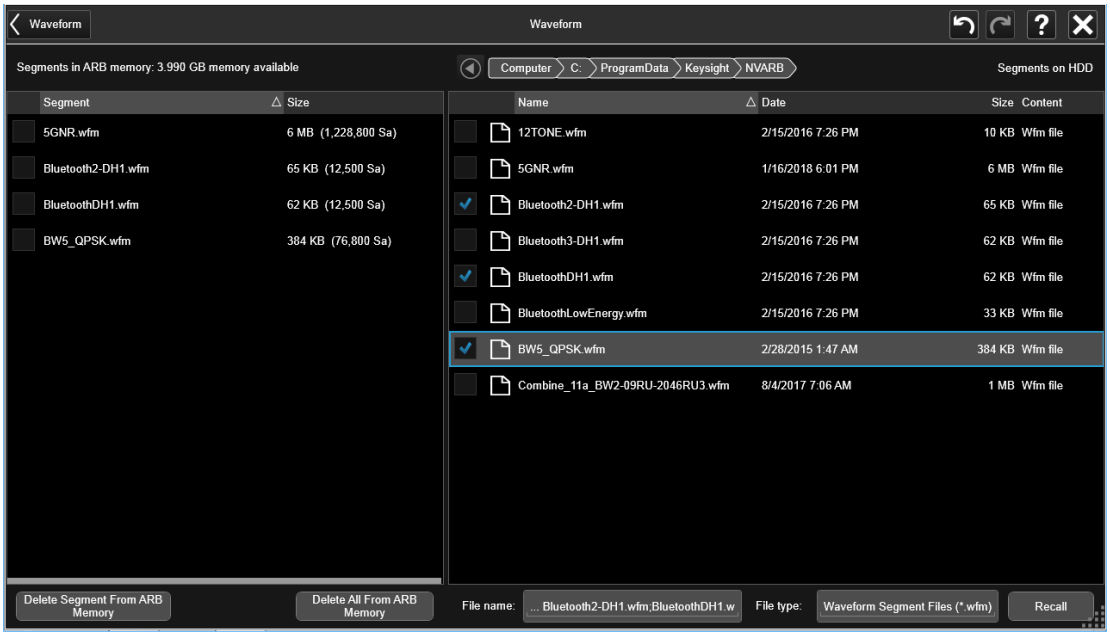
These need to be brought over for the EXT and/or Sequence Analyzer when they are available in the Touch UI

7.2.12 Waveform

Recalls waveforms into the ARB memory of an Internal Source.

When you select the Waveform tab in the Save dialog,, a hint appears saying "Recalls files from Mass Storage to the ARB and lets you manage the ARB memory at the same time."

You then tap Recall From File to display the Recall Waveform dialog.



The left-hand window shows the files in ARB memory. The right-hand window shows the files on the hard drive.

You can select one or more waveform files in the right-hand window. Each file selected has a blue check box in it. To select a single file, tap that file's row. To select additional files, tap the check box in the row of the desired additional files.

When you have selected the file or files that you wish to recall, tap Recall. The file(s) are recalled into the ARB memory, and appear in the left-hand window.

If a file of the same name already exists within ARB memory, it is overwritten. If you wish to load two segments of the same name, you must rename one of the segments before loading it into ARB memory. To rename a segment, you can either use Windows File Explorer, or `:MMEMory:COPY`.

You can select one or more segments in the left-hand window and tap "Delete Segments from ARB memory" to delete the selected files. You can also delete all files in ARB memory by tapping "Delete All from ARB memory.

You can change the current directory by tapping on an element of the file path at the top of the screen and selecting the desired subdirectory in the list that appears, and repeating until you have the path you want. The current directory is used for manually loading waveform segments into ARB memory for playback, and as a search location for waveform segments that are required to be loaded into ARB memory for playback of a waveform sequence or a list sequence.

File Type allows you to specify a waveform format. The available file types are listed below:

Type	Extension	Notes
Waveform Files	`.wfm`	Keysight Signal Studio files
Binary Files	`.bin`	Interleaved IQ data files. They could be single precision or double precision customer created files. One-byte marker may be added
CSV Files	`.csv`	Comma-separated value file. Could be generated by Excel
Text Files	`.txt`	
Matlab Files	`.mat`	Should be Level 4, Level 5 or HDF5 MAT-files (only Level 5 Matlab file is supported in X24)

Waveforms in `.csv`, `.txt` and `.mat` formats are supported by models with a built-in source, such as VXT and EXM.

`.txt` files are formatted according to the following rules:

1. Text files only contain the IQ information. Data in the right column represents the amplitude of real(I) points, Data in the left column represents the amplitude of imaginary(Q) points
2. The amount of data should be multiple of two (IQ pairs)

3. The data range is from -1e10 to1e10, the data type should be `int`, `float` or `double`. 16 digits or fewer for every data is acceptable
4. The values are separated by comma or tab. Extra commas or tabs are ignored
5. Use **Enter** to separate IQ pairs

Example for text file data:

```
0.46425922,-0.57411048
0.47184454,-0.58435995
0.48107329,-0.59014958
0.49223323,-0.58998679
0.50419607,-0.58558843
0.51679158,-0.57721768
0.53005322,-0.56481976
0.54373011,-0.54879346
0.55759183,-0.52950807
0.57141409,-0.50732489
```

Rules 1-3 above also apply to `.csv` data.

Dependencies	Only appears if your hardware includes an Internal Source, such as in VXT

7.2.12.1 Load Segment to ARB Memory

Loads a single segment to ARB memory. Same as pressing the **Recall** button with a single waveform selected.

Remote Command	`:SOURce:RADio:ARB:LOAD <string>` `<string>` - specifies the path name of the file to load from the HDD into ARB memory. May be a <full path + filename>, or <"NVWFM" MSUS + colon + filename>

Example	`:SOUR:RAD:ARB:LOAD "D:\NVARB\testwaveform.bin"`
	or
	`:SOUR:RAD:ARB:LOAD "NVWFM:testwaveform.bin"`

Notes	Because loading the file involves a delay of unpredictable length, this command should be followed by `*OPC?`, which holds off subsequent commands until the loading operating is complete If you specify a file over SCPI, but the file is not at the specified location, an error is generatedIf you try to load a waveform file but the file contains less than 500 IQ samples, an error is generated VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E: If you try to load a waveform file but the file contains less than 1024 IQ samples, an error is generated If you try to load a Signal Studio waveform `*.wfm` that contains invalid waveform header, an error is generated

	If the ARB is ON when you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform is replayed after the ARB operation is finished ARB can be loaded into ARB memory even if required licenses are not present on the instrument. In this case, a GUI-only warning message -800, "Operation complete; Loaded <filename> successfully, but no license <required licenses> installed". You can install required licenses according to <required licenses> string to license it, or multi-pack license it When in Sequence Analyzer Mode, and **Include Source** is **Yes**, an attempt to load a file to ARB memory is rejected with an error. When **Include Source** is **No**, and if there is insufficient free ARB memory to load the selected waveform, an error is generated
Remote Command	`:SOURce:RADio:ARB:LOAD:ALL <string>` `<string>` specifies the directory on the HDD to load the files into ARB memory from
Example	`:SOUR:RAD:ARB:LOAD:ALL "D:\nvarb"`
Notes	Loads all the segment files within the currently selected directory into ARB memory. If a file of the same name already exists within ARB memory, it is overwritten. If you wish to load two segments of the same name, you must rename one of the segments before loading it into ARB memory. To rename a segment, either use Windows File Explorer, or `:MEMory:COPY` If you specify a directory over SCPI, but the directory does not exist, an error is generated If the ARB is ON, and you then load or delete a file to ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform is replayed after the ARB operation is finished When in Sequence Analyzer Mode, and **Include Source** is **Yes**, an attempt to load all files from a directory to ARB memory is rejected with an error. When **Include Source** is **No** and there is insufficient free ARB memory to load all the waveforms, when the ARB memory is full, the copy ceases, and an error is generated

7.2.12.2 Delete Segment From ARB Mem

Deletes a segment from ARB memory.

Remote Command	`:SOURce:RADio:ARB:DELete <string>` `<string>` specifies the waveform to be deleted from the ARB playback memory
Example	`:SOUR:RAD:ARB:DEL "testwaveform.bin"`
Notes	It is possible to delete files from within the ARB memory when the ARB is ON. However, if you attempt to delete the file that is currently playing an error is generated It is possible to delete a file from within the ARB memory when the sequencer state is ON, and the file is not being used by the List Sequencer. If you attempt to delete a file that is being used by the list sequencer, an error is generated When the Sequencer state of the List Sequencer is **On**, even if ARB state is **On**, the selected waveform will not be played. In this case, if the selected waveform is not used in List Sequence, it can be deleted, and the ARB state is turned **Off** If the ARB is ON and you load a file to ARB memory or delete a file from ARB memory, the playing

	waveform segment may not keep phase continuity during the ARB memory operation. The waveform is replayed after the ARB operation is finished When in Sequence Analyzer Mode, and **Include Source** is **Yes**, an attempt to delete a file from ARB memory is rejected with an error . When **Include Source** is **No**, and you specify a file that does not exist within ARB memory, an error is generated

7.2.12.3 Delete All From ARB Memory

Removes all segments from ARB memory.

Remote Command	`:SOURce:RADio:ARB:DELete:ALL`
Example	`:SOUR:RAD:ARB:DELete:ALL`
Notes	If you attempt to delete all files from ARB memory when there are waveform files used in the Sequencer function of the List Sequencer and the Sequencer state is ON, all files except the files currently being used in list sequencer are deleted, and an error is generated If the ARB is ON and you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform is replayed after the ARB operation is finished When in Sequence Analyzer Mode, and **Include Source** is **Yes**, an attempt to delete all files from ARB memory is rejected with an error. When **Include Source** is **No**, and you attempt to delete all files from ARB memory when the ARB is currently playing a file, all files except the one playing are deleted and an error is generated

7.2.12.4 Set Default Directory (Remote Command Only)

Sets the default directory for loading ARB files from SCPI.

Remote Command	`:SOURce:RADio:ARB:DEFault:DIRectory <string>` `:SOURce:RADio:ARB:DEFault:DIRectory?`
Example	`:SOUR:RAD:ARB:DEF:DIR "D:\ArbFiles"` `:SOUR:RAD:ARB:DEF:DIR?`
Notes	Sets the default directory to be used as a search location for waveform segments that are required to be loaded into ARB memory for playback of a waveform sequence, and as a search location for selecting waveforms using SCPI
State Saved	Persistent, survives a power cycle and a preset but not saved in the instrument state

7.2.12.5 Query ARB Memory File List (Remote Query Only)

Queries the instrument for the list of waveform segments in the ARB memory.

NOTE Returns a string for waveform segment names in ARB memory. If you want a string list of waveform segments in the ARB memory, use "Query ARB Memory Full File List (Remote Query Only)" on page 960.

Remote Command	`:SOURce:RADio:ARB:CATalog?`
Example	`:SOUR:RAD:ARB:CATalog?`
Notes	The return data is in the following format:

`<integer>`	memory used
`<integer>`	memory free
`<string>…`	comma separated list of waveform segments within ARB memory

7.2.12.6 Query ARB Memory Full File List (Remote Query Only)

Queries the instrument for the string list of waveform segments in the ARB memory. Returns a string list for waveform segment names in the ARB memory.

Remote Command	`:SOURce:RADio:ARB:FCATalog?`
Example	`:SOUR:RAD:ARB:FCATalog?`
Notes	The return data is in the following format:

`<integer>`	Memory used
`<integer>`	Memory free
`<integer>`	File count in ARB memory
`<string>,<string>, … <string>`	Comma-separated string list of waveform segments within ARB memory

Example:

`:SOUR:RAD:ARB:FCAT?`

EXT returns: 27499,2069653,3,"c2k.wfm","gsm.wfm","wcdma.wfm"

7.2.13 Power Sensor Cal Factor

Selects a file to which to export the Power Sensor Cal factor data.

Cal Factor files are XML files, and contain the cal factor data and header data that gives information on the power sensor.

The default path for Cal Factor Files is:

`Documents\<mode name>\data\PSCF`

where <mode name> is the parameter used to select the mode with :INST:SEL (for example, MRECEIVE for Measuring Receiver Mode). Hence, a Cal Factor file from any measurement in the Measuring Receiver mode would be stored in:

Documents\MRECEIVE\data\PSCF

Cal Factor files have the extension .xml. The default filename is <Sensor Model>_<Sensor Serial Number>_0000.xml, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory. If the sensor model or serial number is blank, the default filename is PSCF_0000.xml.

Remote Command	:MMEMory:STORe:PSCFactor <file_name>
Example	:MMEM:STOR:PSCF "myPSCF.xml"
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI
Dependencies	Only appears if you have the proper option installed in your instrument

7.2.14 DPD Model

Lets you recall a DPD model from a file. Possible types are:

File Type	"DPD Algorithm (formerly DPD Model Type)" on page 313	
Look up table (LUT)	Look-up table	LUT
Memory Polynomial Coefficients	Memory Polynomial	MPOLynomial
Volterra Series Coefficients	Volterra Series	VOLTerra
GMP Coefficients	GMP	GMP

Remote Command	:MMEMory:LOAD:PAMPlifier:DPD:MODel <filename>
Example	:MMEM:LOAD:PAMP:DPD:MOD "LUT_001.csv”
Status Bits/OPC dependencies	Sequential – aborts the current measurement

7.2.14.1 Shaping Table

Lets you load a shaping table from a CSV file.

Remote Command	:MMEMory:LOAD:PAMPlifier:SHAPing <index>,<filename>
Example	:MMEM:LOAD:PAMP:SHAP 2,"C:\Shaping Table 001.csv”
Notes	<index> is one-based

7.2.14.2 Filter Mask

Lets you load a filter mask from a CSV file.

Remote Command	`:MMEMory:LOAD:PAMPlifier:FMASk <index>,<filename>`
Example	`:MMEM:LOAD:PAMP:FMAS 2,"C:\Filter Mask 001.csv”`
Notes	`<index>` is one-based

7.2.14.3 Memory Polynomial and Volterra Coefficients Files

This section includes details of:

- "Sample file" on page 969
- "Coefficient Lengths" on page 971
- "How to apply the coefficients to signal" on page 972

Sample file

The following is a sample file for a Volterra coefficients file, with Memory order = 4, Nonlinear order = 9, Cross term order = 2, and Odd Order Only = True.

The file format is simple and explicit.

`DPD_ModelType`,Volterra

`DPD_MemoryOrder`,4

`DPD_NonlinearOrder`,9

`DPD_CrossTermOrder`,2

`DPD_OddOrderOnly`,True

`DPDScale` is average rms voltage of PA_Out waveform when extracting DPD model coefficients and can be used with 3 steps:

1. Calculate rms voltage ratio of PA_Out waveform to PA_In waveform which is normalized
2. Apply ratio got from step 1 on normalized PA_In waveform by multiplying calculation
3. Apply DPD model coefficients on waveform got from step 2 to get pre-distorted waveform which then to be normalized before downloading to signal generator

`DPD_Scale`,0.0999999999999086

DPD Model coefficients:

(1.00223 + 0.00970452i)

(-0.001965723 - 0.01462447i)

(-0.008369884 - 0.002737971i)

(0.01452063 + 0.01492864i)

(-0.006762785 - 0.006566553i)

(-0.01567868 - 0.01343224i)

(-0.141361 - 0.1372522i)

(0.1328902 + 0.1311074i)

(-0.05909718 - 0.07043044i)

(-0.001788079 + 0.01183834i)

(-1.562534 - 1.031141i)

(3.446798 + 4.501282i)

(-2.0815 - 3.004885i)

(0.06725498 + 0.8596171i)

(0.9134464 + 0.1463772i)

(35.86065 - 67.05225i)

(-80.63958 - 104.1732i)

(30.86995 + 55.34027i)

(5.221638 - 5.483259i)

(-18.13741 - 3.452169i)

(221.5443 - 2034.443i)

(657.9685 + 838.8614i)

(-199.259 - 441.7861i)

(-29.6007 + 17.26444i)

(103.4851 + 11.09599i)

(0.1350661 + 0.1316225i)

(-0.06501895 - 0.06489465i)

(5.014235 + 4.609146i)

(-0.8907772 - 0.668824i)

(-5.902434 - 8.141459i)

(1.636723 + 3.281262i)

(-46.47874 + 348.1572i)

(-6.124507 - 60.3042i)

(-33.16697 - 508.8666i)

(53.4192 + 129.6637i)

(100.1206 + 335.9822i)

(-35.58208 - 117.2356i)

(-2366.625 + 9791.407i)

(307.5222 - 554.9667i)

(4812.173 - 17976.19i)

(-880.0538 + 1257.174i)

(-3440.768 + 15373.81i)

(230.9595 - 1877.854i)

(308.9818 - 5781.878i)

(126.123 + 1276.467i)

Coefficient Lengths

The coefficient lengths depend on the following settings:

`ModelType`	Memory Polynomial (MP) Volterra
`MemoryOrder`	integer
`NonlinearOrder`	integer
`CrossTermOrder`	integer
`OddOrderOnly`	true/false

ModelType is MP

If `OddOrderOnly` is false, then CoeffsLength = `NonlinearOrder` * (`MemoryOrder` + 1), otherwise CoeffsLength = Int((`NonlinearOrder` + 1)/2) * (`MemoryOrder` + 1)

ModelType is Volterra

In the following formulae, K = integer value of (NonlinearOrder + 1) / 2

OddOrderOnly	NonlinearOrder Modulo 2	CoeffsLength
False	0	NonlinearOrder * (MemoryOrder + 1) + CrossTermOrder * K * K
False	Not 0	NonlinearOrder * (MemoryOrder + 1) + CrossTermOrder * K * (K - 1)
Ture	All	K * (MemoryOrder + 1) + CrossTermOrder * K * (K - 1) / 2

How to apply the coefficients to signal

The coefficient terms include three parts and x(n) is the signal

1. The first (M+1) terms are linear ones:

$$\sum_{m=0}^{M} A_m \mathbf{x}(\mathbf{n}-\mathbf{m})$$

2. The next [(N–1)*(M+1)] terms are nonlinear memory ones:

$$\sum_{m=0}^{M} \sum_{i=2}^{N} B_{mi}\, \mathbf{x}(\mathbf{n}-\mathbf{m})|\mathbf{x}(\mathbf{n}-\mathbf{m})|^{i-1}$$

3. The final CrossTermOrder * K * (K - 1) Cross terms:

$$\sum_{i=2}^{N} \sum_{\substack{k=2 \\ even}}^{i-1} \sum_{m=1}^{Mc} C_{ikm} \mathbf{x}\left(\mathbf{n}\right)|\mathbf{x}(\mathbf{n})|^{i-k-1}|\mathbf{x}(\mathbf{n}-\mathbf{m})|^{k}$$

N is nonlinear order, M is memory order, M_c is cross term order

Example

For a VS model, M = 3, N = 7, Mc = 2, and OddOnly=False:

The total coefficient = NonlinearOrder * (MemoryOrder + 1) + CrossTermOrder * K * (K - 1)

- K = (N+1)/2 = 4
- NonlinearOrder = 7

- `MemoryOrder` = M = 3
- `CrossTerOrder` = Mc = 2

The total coefficient = 7 * (3+1) + 2*4*3 = 28 + 24 = 52

The first 4 rows are for (linear) first term.

The following 24 rows are for non-linear term.

The last 24 rows are for cross term.

DPD model coefficients	i	m or mc	k
(0.9923834 - 0.0688246i)	1	0	
(0.009121345 + 0.09958731i)	1	1	
(-0.003731483 - 0.04926638i)	1	2	
(0.003178823 + 0.009270425i)	1	3	
(0.1050554 + 0.2615542i)	2	0	
(-0.1960344 + 0.2551244i)	3	0	
(-0.05284269 + 0.2814199i)	4	0	
(-0.08978885 + 0.1683919i)	5	0	
(-5.373211 - 7.845236i)	6	0	
(4.185133 - 6.303975i)	7	0	
(0.04859135 - 6.782347i)	2	1	
(1.990016 - 3.944813i)	3	1	
(92.34649 + 107.3027i)	4	1	
(-45.11784 + 78.1015i)	5	1	
(10.46086 + 79.12997i)	6	1	
(-23.19806 + 45.35479i)	7	1	
(-674.381 - 734.5322i)	2	2	
(261.0566 - 504.7762i)	3	2	
(-118.29 - 482.9114i)	4	2	
(150.866 - 269.9011i)	5	2	
(2340.527 + 2477.872i)	6	2	
(-779.9598 + 1644.741i)	7	2	
(498.4517 + 1470.436i)	2	3	
(-509.4805 + 803.0765i)	3	3	
(-2988.495 - 3289.668i)	4	3	
(951.2399 - 2097.184i)	5	3	
(-743.6622 - 1764.386i)	6	3	
(691.3024 - 942.3693i)	7	3	

DPD model coefficients	i	m or mc	k
(-0.1263262 - 0.650161i)	2	1	2
(-0.3747423 - 0.02498049i)	2	2	2
(7.010307 + 20.97011i)	3	1	2
(10.03712 + 3.329743i)	3	2	2
(-154.2084 - 296.7939i)	4	1	2
(-66.22286 - 73.32394i)	4	2	2
(-5.163648 + 8.445268i)	4	1	4
(7.99472 - 1.23104i)	4	2	4
(1310.116 + 2131.671i)	5	1	2
(-127.4266 + 580.2892i)	5	2	2
(267.4845 - 132.9592i)	5	1	4
(-228.4352 + 3.870729i)	5	2	4
(-5076.974 - 7686.163i)	6	1	2
(2237.753 - 1971.085i)	6	2	2
(-1617.836 + 818.2574i)	6	1	4
(1775.605 + 126.852i)	6	2	4
(-210.0519 - 125.9987i)	6	1	6
(15.33679 + 23.90327i)	6	2	6
(7104.332 + 10971.44i)	7	1	2
(-4796.39 + 2407.17i)	7	2	2
(3189.456 - 1834.208i)	7	1	4
(-4353.581 - 473.8938i)	7	2	4
(744.45 + 527.6855i)	7	1	6
(-30.16959 - 194.0241i)	7	2	6

7.2.15 Loss Comp

Sets the import file type to Loss Compensation Before DUT Table or to Loss Compensation After DUT Table.

Mode	NFIGURE
Parameter Name	Recall Loss Comp
Control Path	Recall
Parameter Type	ImmediateAction
SCPI Command	`:MMEMory:LOAD:LOSS BEFore | AFTer,<file_name>`
SCPI Example	`:MMEM:LOAD:LOSS BEF,"C:\LossBefore.csv"` `:MMEM:LOAD:LOSS AFT,"C:\LossAfter.csv"`

Notes	Three file formats are supported: – Loss Compensation file (`.csv`) – Legacy Loss Compensation file (`.loss`) – S parameter file (`.s2p`)
Soft Key Label	Loss Comp
Backwards Compatibility SCPI	`:MMEMory:LOAD:LOSS`
Initial S/W Revision	A.04.00

For `.s2p` files, only the `S21` component is used for the loss compensation.

The CSV format contains the following data:

```
File Type
Application Name: Measurement Name
Version and Model Number
Loss Comp Data
```

Below is an example of a valid CSV Loss Compensation file:

```
[Filetype LossCompensation]
[NF:NFIG]
Ver. ***, Model ***
10, 1.0000
20, 2.0000
30, 3.0000
40, 4.0000
50, 5.0000
60, 6.0000
```

7.2.16 Shaping Table

Lets you load a shaping table from a CSV file.

Remote Command	`:MMEMory:LOAD:PAMPlifier:SHAPing <index>,<filename>`
Example	`:MMEM:LOAD:PAMP:SHAP 2,"C:\Shaping Table 001.csv”`
Notes	`<index>` is one-based

7.2.17 Filter Mask

Lets you load a filter mask from a CSV file.

Remote Command	:MMEMory:LOAD:PAMPlifier:FMASk <index>,<filename>
Example	:MMEM:LOAD:PAMP:FMAS 2,"C:\Filter Mask 001.csv"
Notes	<index> is one-based

7.2.18 Memory Polynomial and Volterra Coefficients Files

This section includes details of:

- "Sample file" on page 969
- "Coefficient Lengths" on page 971
- "How to apply the coefficients to signal" on page 972

7.2.18.1 Sample file

The following is a sample file for a Volterra coefficients file, with Memory order = 4, Nonlinear order = 9, Cross term order = 2, and Odd Order Only = True.

The file format is simple and explicit.

DPD_ModelType,Volterra

DPD_MemoryOrder,4

DPD_NonlinearOrder,9

DPD_CrossTermOrder,2

DPD_OddOrderOnly,True

DPDScale is average rms voltage of PA_Out waveform when extracting DPD model coefficients and can be used with 3 steps:

1. Calculate rms voltage ratio of PA_Out waveform to PA_In waveform which is normalized
2. Apply ratio got from step 1 on normalized PA_In waveform by multiplying calculation
3. Apply DPD model coefficients on waveform got from step 2 to get pre-distorted waveform which then to be normalized before downloading to signal generator

DPD_Scale,0.0999999999999086

DPD Model coefficients:

(1.00223 + 0.00970452i)

(-0.001965723 - 0.01462447i)

(-0.008369884 - 0.002737971i)

(0.01452063 + 0.01492864i)

(-0.006762785 - 0.006566553i)

(-0.01567868 - 0.01343224i)

(-0.141361 - 0.1372522i)

(0.1328902 + 0.1311074i)

(-0.05909718 - 0.07043044i)

(-0.001788079 + 0.01183834i)

(-1.562534 - 1.031141i)

(3.446798 + 4.501282i)

(-2.0815 - 3.004885i)

(0.06725498 + 0.8596171i)

(0.9134464 + 0.1463772i)

(35.86065 - 67.05225i)

(-80.63958 - 104.1732i)

(30.86995 + 55.34027i)

(5.221638 - 5.483259i)

(-18.13741 - 3.452169i)

(221.5443 - 2034.443i)

(657.9685 + 838.8614i)

(-199.259 - 441.7861i)

(-29.6007 + 17.26444i)

(103.4851 + 11.09599i)

(0.1350661 + 0.1316225i)

(-0.06501895 - 0.06489465i)

(5.014235 + 4.609146i)

(-0.8907772 - 0.668824i)

(-5.902434 - 8.141459i)

(1.636723 + 3.281262i)

(-46.47874 + 348.1572i)

(-6.124507 - 60.3042i)

(-33.16697 - 508.8666i)

(53.4192 + 129.6637i)

(100.1206 + 335.9822i)

(-35.58208 - 117.2356i)

(-2366.625 + 9791.407i)

(307.5222 - 554.9667i)

(4812.173 - 17976.19i)

(-880.0538 + 1257.174i)

(-3440.768 + 15373.81i)

(230.9595 - 1877.854i)

(308.9818 - 5781.878i)

(126.123 + 1276.467i)

7.2.18.2 Coefficient Lengths

The coefficient lengths depend on the following settings:

`ModelType`	Memory Polynomial (MP) Volterra
`MemoryOrder`	integer
`NonlinearOrder`	integer
`CrossTermOrder`	integer
`OddOrderOnly`	true/false

ModelType is MP

If `OddOrderOnly` is false, then CoeffsLength = `NonlinearOrder` * (`MemoryOrder` + 1), otherwise CoeffsLength = Int((`NonlinearOrder` + 1)/2) * (`MemoryOrder` + 1)

ModelType is Volterra

In the following formulae, K = integer value of (`NonlinearOrder` + 1) / 2

OddOrderOnly	NonlinearOrder Modulo 2	CoeffsLength
False	0	NonlinearOrder * (MemoryOrder + 1) + CrossTermOrder * K * K
False	Not 0	NonlinearOrder * (MemoryOrder + 1) + CrossTermOrder * K * (K - 1)
Ture	All	K * (MemoryOrder + 1) + CrossTermOrder * K * (K - 1) / 2

7.2.18.3 How to apply the coefficients to signal

The coefficient terms include three parts and x(n) is the signal

1. The first (M+1) terms are linear ones:

$$\sum_{m=0}^{M} A_m \mathbf{x}(\mathbf{n}-\mathbf{m})$$

2. The next [(N–1)*(M+1)] terms are nonlinear memory ones:

$$\sum_{m=0}^{M} \sum_{i=2}^{N} B_{mi}\, \mathbf{x}(\mathbf{n}-\mathbf{m})|\mathbf{x}(\mathbf{n}-\mathbf{m})|^{i-1}$$

3. The final CrossTermOrder * K * (K - 1) Cross terms:

$$\sum_{i=2}^{N} \sum_{\substack{k=2 \\ even}}^{i-1} \sum_{m=1}^{Mc} C_{ikm}\mathbf{x}\left(\mathbf{n}\right)|\mathbf{x}(\mathbf{n})|^{i-k-1}|\mathbf{x}(\mathbf{n}-\mathbf{m})|^{k}$$

N is nonlinear order, M is memory order, M_c is cross term order

Example

For a VS model, M = 3, N = 7, Mc = 2, and OddOnly=False:

The total coefficient = NonlinearOrder * (MemoryOrder + 1) + CrossTermOrder * K * (K - 1)

- K = (N+1)/2 = 4
- NonlinearOrder = 7
- MemoryOrder = M = 3
- CrossTerOrder = Mc = 2

The total coefficient = 7 * (3+1) + 2*4*3 = 28 + 24 = 52

The first 4 rows are for (linear) first term.

The following 24 rows are for non-linear term.

The last 24 rows are for cross term.

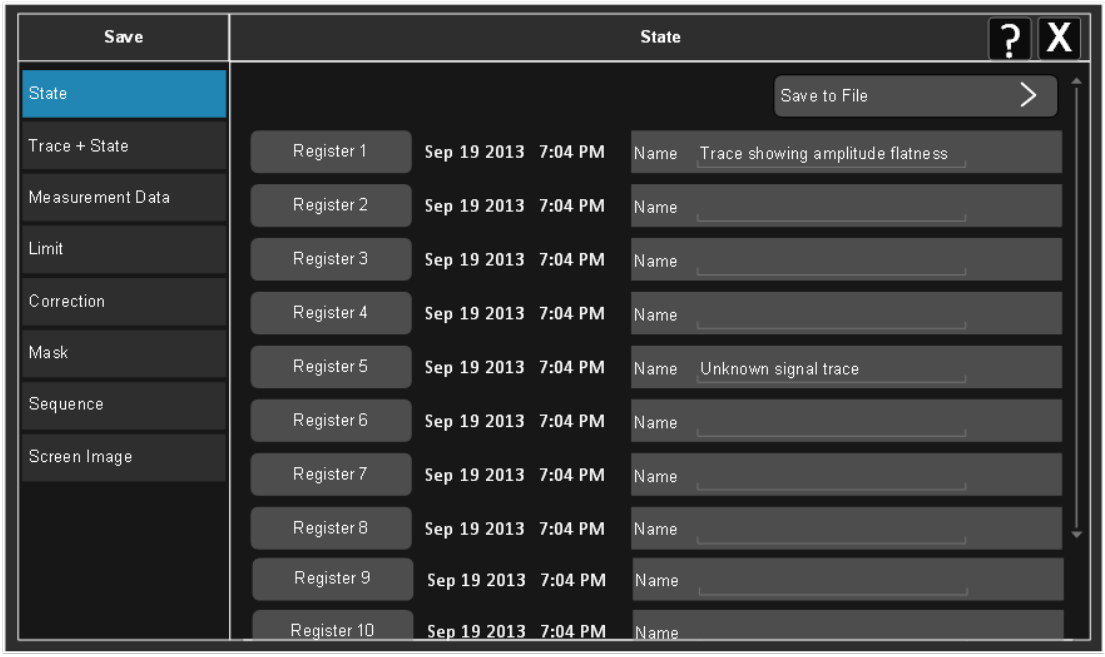
DPD model coefficients	i	m or mc	k
(0.9923834 - 0.0688246i)	1	0	
(0.009121345 + 0.09958731i)	1	1	
(-0.003731483 - 0.04926638i)	1	2	
(0.003178823 + 0.009270425i)	1	3	
(0.1050554 + 0.2615542i)	2	0	
(-0.1960344 + 0.2551244i)	3	0	
(-0.05284269 + 0.2814199i)	4	0	
(-0.08978885 + 0.1683919i)	5	0	
(-5.373211 - 7.845236i)	6	0	
(4.185133 - 6.303975i)	7	0	
(0.04859135 - 6.782347i)	2	1	
(1.990016 - 3.944813i)	3	1	
(92.34649 + 107.3027i)	4	1	
(-45.11784 + 78.1015i)	5	1	
(10.46086 + 79.12997i)	6	1	
(-23.19806 + 45.35479i)	7	1	
(-674.381 - 734.5322i)	2	2	
(261.0566 - 504.7762i)	3	2	
(-118.29 - 482.9114i)	4	2	
(150.866 - 269.9011i)	5	2	
(2340.527 + 2477.872i)	6	2	
(-779.9598 + 1644.741i)	7	2	
(498.4517 + 1470.436i)	2	3	
(-509.4805 + 803.0765i)	3	3	
(-2988.495 - 3289.668i)	4	3	
(951.2399 - 2097.184i)	5	3	
(-743.6622 - 1764.386i)	6	3	
(691.3024 - 942.3693i)	7	3	
(-0.1263262 - 0.650161i)	2	1	2
(-0.3747423 - 0.02498049i)	2	2	2
(7.010307 + 20.97011i)	3	1	2
(10.03712 + 3.329743i)	3	2	2
(-154.2084 - 296.7939i)	4	1	2
(-66.22286 - 73.32394i)	4	2	2
(-5.163648 + 8.445268i)	4	1	4

DPD model coefficients	i	m or mc	k
(7.99472 - 1.23104i)	4	2	4
(1310.116 + 2131.671i)	5	1	2
(-127.4266 + 580.2892i)	5	2	2
(267.4845 - 132.9592i)	5	1	4
(-228.4352 + 3.870729i)	5	2	4
(-5076.974 - 7686.163i)	6	1	2
(2237.753 - 1971.085i)	6	2	2
(-1617.836 + 818.2574i)	6	1	4
(1775.605 + 126.852i)	6	2	4
(-210.0519 - 125.9987i)	6	1	6
(15.33679 + 23.90327i)	6	2	6
(7104.332 + 10971.44i)	7	1	2
(-4796.39 + 2407.17i)	7	2	2
(3189.456 - 1834.208i)	7	1	4
(-4353.581 - 473.8938i)	7	2	4
(744.45 + 527.6855i)	7	1	6
(-30.16959 - 194.0241i)	7	2	6

7.3 Save

The Save dialog lets you save states, traces, screen images and other items from the instrument to files on the instrument's internal storage, to removable devices, and to directories on the network. You access the dialog by pressing the folder icon at the bottom of the display and then pressing the Save icon. If your instrument has physical front-panel keys, you can press the Save hardkey.

The dialog has tabs running down the left side, which you use to specify what you want to save.



You choose the save item and then complete the save by choosing a register or file location to which to save the item.

Notes

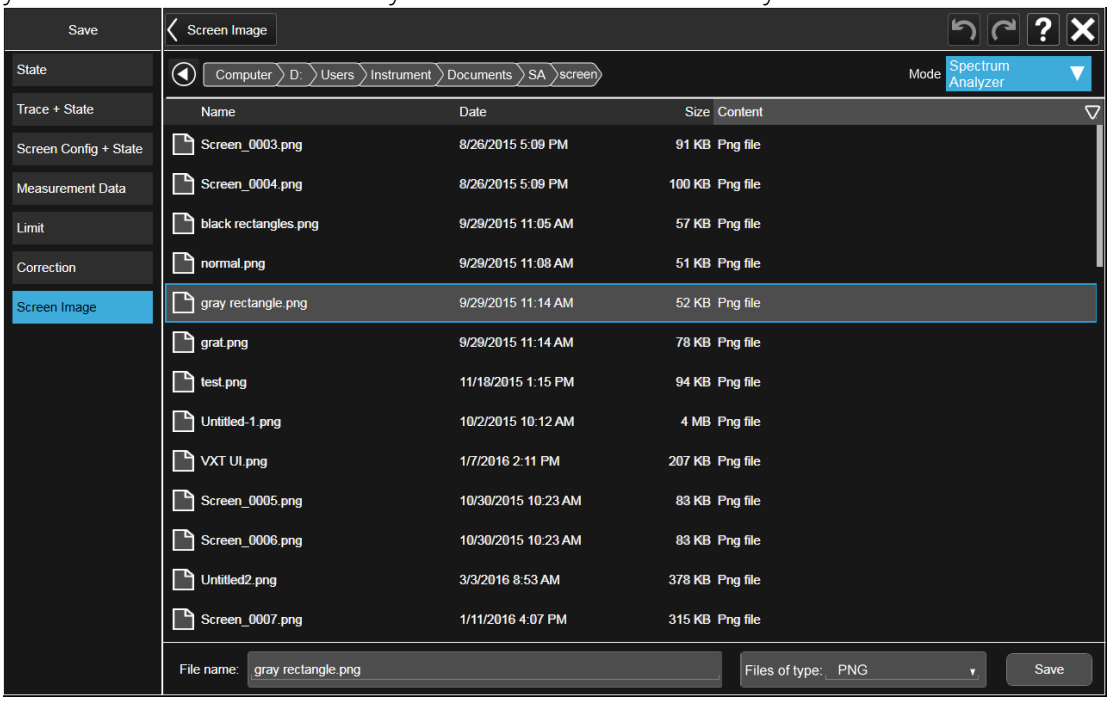
No remote command for this key specifically, but `:MMEM:STORe` is available for specific file types

Example: `:MMEM:STOR:STATe <filename>`

7.3.1 Save to File / Save As

For every Save type, a control appears labeled Save to File or Save As. Save to File appears for save types that also include registers (like State and Trace+State), and Save As appears for all other save types.

When you press Save to File or Save As, a dialog slides in from the right that allows you to see what files are already saved in the current directory.



The default directory is the internal directory for the current Mode and save type, on the `D:` drive. You may also change to another Mode's state directory by pressing the dropdown in the upper right corner labeled Mode. Once you have chosen a directory, the files in that directory whose extension matches the current data type (for example, `.state` or `.trace`) are displayed in the right-hand window of the dialog. You can sort this list by name, date, file size or extension by tapping the Name, Date, Size, or Content header at the top of each column. A second tap toggles the sort order between Ascending and Descending.

Also displayed is a path depiction showing the path to the current directory. In the example above, the path is `D:\Users\Instrument\Documents\SA\screen`. Tapping any element of this path lets you select an alternate route. Tapping the Computer arrow lets you select a different drive.

Tapping the "Back" arrow navigates to the previously selected directory.

Note: Using the C: drive is strongly discouraged, due to the risk of data being overwritten during an instrument software upgrade.

If you plug in a removable drive (for example, a thumb drive), the browser immediately navigates to the root of that drive. Furthermore, if you had a thumb drive in and you were in a directory on the thumb, and then you exit the browser, when you come back in you are still in the same directory on that removable drive. If

you remove the thumb drive, you return to the directory you had been in before the thumb drive was plugged in.

Note that for each data type there is a “current” directory, and it is the last directory used by either Save or Recall for that Mode. For example, if in SA Mode you save a Corrections file to a particular directory, then when you go to recall a Correction in SA Mode, you should be pointing at that directory. Or if in EMC Mode you recall a Limit from a particular directory then when in EMC Mode you go to save a Limit, it should be pointing at that same directory. There is one “current” directory for each data type for each Mode (not one for Save and one for Recall).

The Filename field, just below the Path field, shows the filename that will be used. The File Name field is initially loaded with an automatically generated filename specific to the appropriate Save Type. The automatically generated filename is guaranteed not to conflict with any filename currently in the directory. You may edit the filename by tapping it, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

Select a file to overwrite, type in a file name, or use the name suggested by the instrument (guaranteed not to conflict with any file in the current directory), and press Save. If the file specified already exists, a dialog will appear that allows you to replace the existing file by selecting OK, or you can Cancel the request.

After a successful save, a message "File <filename> saved" or "State Register <register number> saved" is displayed in an info box for a few seconds.

See "Quick Save" on page 940 for details of the automatic file naming algorithm.

7.3.2 State

Selects a register or file for saving the state.

State files contain essentially all the information required to return the instrument to the measurement and settings that were in effect at the time of the save. State files are in a proprietary binary form (for speed) and cannot be read or edited by PC software, but can be loaded back into the instrument to restore the state.

State files contain all the settings of the Input/Output system as well, even though Input/Output variables are outside of the Mode’s state and unaffected by Mode Preset, because these are needed to restore the complete setup.

Persistent System settings (for example, GPIB address) are affected by neither Mode Preset nor Restore Mode Defaults, nor are they included in a saved State file.

For rapid saving, the State menu lists 16 registers to which you can save states. Pressing a Register button initiates the save. You can also select a file to which to save by pressing Save to File.

The default path for all State files is:

```
Documents\<mode name>\state
```

where <mode name> is the parameter used to select the Mode with :INST:SEL (for example, SA for Spectrum Analyzer Mode).

State files have the extension .state. The default filename is State_0000.state, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance that were saved by another instance.**

Remote Command	:MMEMory:STORe:STATe <filename>
Example	Store the current instrument state data in the file MyStateFile.state in the default directory: :MMEM:STOR:STATe "MyStateFile.state"
Notes	Both single and double quotes are supported for any filename parameter over remote After saving to a register, that register's menu key is updated with the date the time, unless a custom label has been entered for that key After saving to a register, you remain in the Save State menu, so that you can see the Register key update. After saving to a file, the instrument automatically returns to the previous menu and any Save As dialog goes away
Backwards Compatibility SCPI	:MMEMory:STORe:STATe 1,<filename> The "1" is simply ignored. The command is sequential

7.3.2.1 Register 1 thru Register 16

Selecting any one of these register buttons causes the state of the currently active Mode to be saved to the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

Although these 16 registers are the only registers available from the front panel, there are 128 state registers available in the instrument. Registers 17-128 are only available from the SCPI interface, using the *SAV command.

There is one set of 128 state registers in the instrument, not one set for each Mode. When a state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to**

overwrite files and/or registers from one instance that were saved by another instance.

The date displayed follows the format specified in the **Date Format** setting under the **Control Panel**. The time shows hours and minutes.

After the save completes, the corresponding register menu key annotation is updated with the date and time and the message `Register <register number> saved` is displayed.

Example	`*SAV 1`
Range	1-16 from front panel, 1-128 from SCPI

7.3.2.2 Edit Register Names

You may enter a custom name for any of the **Registers**, to help you remember what you are using that state to save. To do this, press the **Name** field for the register you want to rename, which displays the onscreen alpha keyboard. Press **Done** on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

The register names are stored within the state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state will not change that register name. Another consequence of this is that the names will be persistent through a power cycle. Also, if a named state file is transferred to another instrument, it will bring its custom name along with it.

If you try to edit the name of an empty register, the instrument first saves the state to have a file to put the name in. If you load a named state file into an instrument with older firmware, it ignores the metadata.

The `*SAV` and `*RCL` commands are not affected by the custom register names, nor are the `:MMEM` commands.

Remote Command	`:MMEMory:REGister:STATe:LABel <reg number>,"label"` `:MMEMory:REGister:STATe:LABel? <reg number>`
Example	`:MMEM:REG:STAT:LAB 1,"my label"`
Notes	`<reg number>` is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222, "Data out of range; Invalid register label number" `"label"` is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150,"String data error; Label clipped to 30 characters" `"label"` of zero length erases the custom label and restores the default (time and date) label. For example, `:MMEM:REG:STAT:LAB 1,""`

Preset	The names are unaffected by **Preset** or power cycle but are set to the default label (time and date) on **Restore System Defaults>Misc**

7.3.3 Trace+State

Selects a register or file for saving selected traces and the state.

Trace+State files contain essentially all the information required to return the instrument to the measurement and settings that were in effect at the time of the save, as well as the data for one or all traces. **Trace+State** files are in a proprietary binary form (for speed) and cannot be read or edited by PC software, but can be loaded back into the instrument to restore the state and trace(s).

Trace+State files contain all the settings of the **Input/Output** system as well, even though **Input/Output** variables are outside of the Mode's state and unaffected by **Mode Preset**, because these are needed to restore the complete setup.

Persistent **System** settings (for example, GPIB address) are affected by neither **Mode Preset** nor **Restore Mode Defaults,** nor are they included in a saved **Trace+State** file.

For rapid saving, the **Trace+State** menu lists 16 registers to which you can save trace+state files. The **Trace+State** registers are separate registers from the **State** registers. Pressing a **Register** button initiates the save. You can also select a file to which to save by pressing **Save to File**.

The default path for all **Trace+State** files is the same as that for **State** files:

`Documents\<mode name>\state`

where `<mode name>` is the parameter used to select the mode with `:INST:SEL` (for example, `BASIC` for IQ Analyzer Mode).

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance that were saved by another instance.**

Trace+State files have the extension `.trace`. The default filename is `State_0000.trace`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

The **Trace+State** selection only appears for measurements that support trace saves. It is blanked for modes that do not support trace saves. Saving **Trace** is identical to saving **State** except a `.trace` extension is used on the file instead of `.state`, and internal flags are set in the file indicating which trace was saved.

See "More Information" on page 981.

Remote Command	`:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | ALL,<filename>` `:MMEMory:STORe:TRACe:REGister TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | ALL,<integer>`

Example	Save the file `myState.trace` on the default path and flags it as a "single trace" file with Trace 1 as the single trace (even though all of the traces are in fact stored):
	`:MMEM:STOR:TRAC TRACE1,"myState.trace"`
	Save the file `myState.trace` on the default path and flags it as an "all traces" file:
	`:MMEM:STOR:TRAC ALL,"myState.trace"`
	Store trace 1 data in trace register 2:
	`:MMEM:STOR:TRAC:REG TRACE1,2`

Notes	This command actually performs a **Save State**, which in the Swept SA measurement includes the trace data. However, it flags it (in the file) as a "save trace" file of the specified trace (or all traces)
	Some Modes and measurements do not have available all 6 traces. The Phase Noise Mode command, for example, is:
	`:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | ALL,<filename>`
	Some modes and measurements have more than 6 traces available. The Realtime SA Mode command, for example, is:
	`:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8 | TRACE9 | TRACE10 | TRACE11 | TRACE12 | ALL,<filename>`
	The range for the register parameter is 1-5
	When you initiate a save, if the file already exists, a dialog will appear that allows you to replace the existing file by selecting **OK** or you can cancel the request. If you select **OK**, the file will be overwritten. Using the `C:` drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade
	Both single and double quotes are supported for any filename parameter over remote
	After saving to a register, that register's menu key is updated with the date and time of the save
	After saving to a register, you remain in the **Save Trace** menu, so that you can see the **Register** key update. After saving to a file, the instrument automatically returns to the previous menu and any **Save As** dialog goes away

More Information

In measurements that support saving **Traces**, for example, Swept SA, the **Trace** data is saved along with the **State** in the **State** file. When recalling the **State**, the **Trace** data is recalled as well. Traces are recalled exactly as they were stored, including the writing mode and update and display modes. If a Trace was updating and visible when the **State** was saved, it returns updating and visible, and its data will be rewritten right away. When you use **State** to save and recall traces, any trace whose data must be preserved should be placed in **View** or **Blank** mode before saving.

The following table describes the **Trace Save** and **Recall** possibilities:

You want to recall state and one trace's data, leaving other traces unaffected	Save Trace+State from 1 trace. Make sure that no other traces are updating (they should all be in View or Blank mode) when the save is performed	On recall, specify the trace you want to load the one trace's data into. This trace loads in view. All other traces' data will be unaffected, although their trace mode will be as it was when the state save was performed
You want to recall all traces	Save Trace+State from ALL traces	On recall, all traces come back in View (or Blank if they were in Blank or Background when saved)
You want all traces to load exactly as they were when saved	Save State	On recall, all traces' mode and data will be exactly as they were when saved. Any traces that were updating will have their data immediately overwritten

7.3.3.1 Save From Trace

Selects the trace to be saved. The default is the currently selected trace, selected in this this or any other menu with Trace selection. If you have chosen All then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the Trace menu.

When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

7.3.3.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the specified trace(s) and the state of the currently active mode to be saved to the specified register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

There is one set of 16 trace+state registers in the instrument, not one set for each Mode. When trace+state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance that were saved by another instance.**

The date displayed follows the format specified in the Date Format setting in Control Panel. The time shows hours and minutes.

After the save completes, the corresponding register menu key annotation is updated with the date and time and the message `Register <register number> saved` is displayed.

Example	`*SAV 1`
Range	1-16

7.3.3.3 Edit Register Names

You may enter a custom name for any of the registers, to help you remember what you are using that trace+state to save. To do this, press the Name field for the register you want to rename, which displays the onscreen alpha keyboard. Press the Done button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

The register names are stored within the trace+state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state does not change that register name. Another consequence of this is that the names are persistent through a power cycle. Also, if a named state file is transferred to another instrument, it brings its custom name along with it.

If you try to edit the name of an empty register, the instrument will first save the trace+state to have a file to put the name in. If you load a named state file into an instrument with older firmware, it ignores the metadata.

Remote Command	`:MMEMory:REGister:TRACe:LABel <reg number>,"label"` `:MMEMory:REGister:TRACe:LABel? <reg number>`
Example	`:MMEM:REG:TRAC:LAB 1,"my label"`
Notes	`<reg number>` is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222, "Data out of range; Invalid register label number" `"label"` is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150, "String data error; Label clipped to 30 characters" `"label"` of zero length erases the custom label and restores the default (time and date) label, e.g., `:MMEM:REG:TRAC:LAB 1,""`
Preset	The names are unaffected by Preset or power cycle but are set to the default label (time and date) on Restore System Defaults > Misc

7.3.4 Screen Config + State

Saves the complete configuration of all your screens to a file. You choose a file to which to export the data.

Remote	`:MMEMory:STORe:SCONfig <filename>`

Command	
Example	Store the current screen configuration in the file `myScreenConfig.screen` in the default directory: `:MMEM:STOR:SCON "myScreenConfig.screen"`

7.3.5 Measurement Data

Specifies a data type (for example, trace data) and choose a file to which to export the data.

Measurement Data files are comma-separated Value (CSV) files, and contain the requested data in a form that can be imported into Excel or similar spreadsheets, as well as header data that gives information on relevant instrument settings at the time the save occurred.

The main application of Measurement Data files is for importing data to a PC for analysis, but in some cases Measurement Data files can also be imported back into the instrument to recreate the data object that existed at the time of the save. For example, most Trace data files can be imported back into the instrument.

The default path for Measurement Data Files is:

`Documents\<mode name>\data`

with the subdirectory reflecting the data type and where `<mode name>` is the parameter used to select the Mode with `:INST:SEL` (for example, `SA` for Spectrum Analyzer Mode) and `<measurement name>` is the parameter used to select the measurement with `:CONF` (for example, `SAN` for Swept SA). For example, a Peak Table file from Swept SA in SA Mode would be stored in:

`Documents\SA\data\SAN\results`

Measurement Data files have extension `.csv`. The default filename is `Prefix_0000.csv`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory, and “Prefix” is dependent on the data type:

Type	Default Prefix
Traces	`Trace_`
Measurement Result	`MeasR_`
Capture Buffer	`CapBuf_`

For example, the default filename for a trace data file in an empty directory would be `Trace_0000.csv`

7.3.5.1 Save From

Selects the specific item to be saved, for example, if you are exporting trace data you may specify Trace 1, Trace 2, etc.

The default for traces is the currently selected trace, selected in this this or any other menu with Trace selection. If you have chosen **All** then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the Trace menu. The **All** selection saves all six traces in one CSV file with the x-axis data in the first column and the individual trace data in succeeding columns. The header data and x-axis data in this file reflect the current settings of the measurement. Note that any traces that are in **View** or **Blank** may have different x-axis data than the current measurement settings; but this different x-axis data is *not* output to the file.

Preset	Not part of **Preset**, but is reset to by **Restore Mode Defaults** Survives shutdown

7.3.5.2 Data Type

You choose the data type to save by using the radio button selection box. Below are the specifications for Data files for each measurement.

Notes	There is no SCPI command for **Data Type**, as the type is implied in the SCPI command for each item
Dependencies	The **Data Type** menu for any given measurement only contains data types that are supported by that measurement

Meas Results

Meas Results files contain information that describes the current state of the instrument, as detailed in Meas Result File Contents below.

This command is only available in certain measurements, such as:

- PowerSuite: Channel Power, OBW, ACP, Spectrum Emissions Mask, Spurious Emissions, Power Stat CCDF, Transmit Power, Monitor Spectrum, IQ Waveform
- IQ Analyzer: Complex Spectrum
- Phase Noise: Log Plot and Spot Frequency
- WCDMA: Code Domain, Mod Accuracy, Power Control, and QPSK EVM
- Analog Demod: AM, FM, PM and FM Stereo

- Noise Figure
- Pulse

In general, the data in the Meas Results file matches the data which is returned to a measurement data query (`:FETCh?`, `:READ?`, `:MEASure?`). These queries and the results they return are documented for each measurement, and can be found in the Help for that measurement (or in the manual for that measurement) in the section titled **Remote Command Results**.

In the `MeasResults` file, you will see a column for each value of `n`. Each column contains the value for the corresponding value of n in the **Remote Command Results** table.

For example, Complex Spectrum allows values of `n` up to 17, and the `MeasResults` file for Complex Spectrum has 17 columns. So, the data returned when you send `:FETCh:SPECtrum1?` matches the data in the column labeled `MeasResult1` of the Meas Results file. See the example below:

Response to FETCh:SPECtrum1?

2.125444221E+01,6.487077992E+07,2.050000000E+02,6.004725051E+07,3.921568627E+04,2.370000000E+02,0.000000000E+00,1.000000000E-07,1.000000000E+00,2.360000000E-05,2.500000000E+01

MeasResult1 column from Meas Results file

MeasResult1
-21.25444221
64870779.92
205
60047250.51
39215.68627
237
0
1.00E-07
1
2.36E-05
25

In addition, examples of the Meas Results files are given for each data type in the Help below.

Remote Command	`:MMEMory:STORe:RESults <string>`
Example	`:MMEM:STOR:RES "MeasR_0000.csv"`

Notes	If the save is initiated via SCPI and the file already exists, the file will be overwritten The SCPI command exports measurement results to the file specified as the parameter in the default path. The default path is: `Documents\<current mode>\data\<measurement name>\results` where `<mode name>` is the parameter used to select the mode with the `:INST:SEL` command (for example, `SA` for Spectrum Analyzer Mode) and `<measurement name>` is the parameter used to select the measurement with the `:CONF`: command (for example, `SAN` for the Swept SA measurement) To save in a non-default path, specify the absolute file path Using the `C:` drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade The SCPI parameter is a quoted string, which specifies the filename. Both single and double quotes are supported for any filename parameter over SCPI
Annotation	After the save is complete, an advisory is displayed in the window so that the user can confirm which file was saved
Status Bits/OPC dependencies	Sequential – waits for the previous measurement to complete

7.3.6 Limit

Lets you choose a file to which to export the **Limit** data.

Limit files are CSV files, and contain the limit data in a form that can be imported into Excel or similar spreadsheets, as well as header data that gives information on the limit.

The default path for most Limits files is:

`My Documents\<mode name>\data\limits`

where `<mode name>` is the parameter used to select the mode with the `:INST:SEL` command (for example, `SA` for Spectrum Analyzer). Hence a **Limit** file from any measurement in Spectrum Analyzer Mode would be stored in:

`My Documents\SA\data\limits`

The default path for **Limit** files from the Log Plot measurement in Phase Noise Mode is:

`My Documents\PNOISE\data\LPL\limits`

The default filename is `Limit_0000.csv`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

For backwards compatibility, older limit files with the extension `.lim` can be read into the instrument, but you can only save limits as `.csv` files.

Remote Command	`:MMEMory:STORe:LIMit LLINE1 | … | LLINE6,<filename>`

Example	Save the 2nd Limit Line to the file `myLimitLine2.csv` in the current path: `:MMEM:STOR:LIM LLINE2,"myLimitLine2.csv"`
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten Using the `C:` drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI
Dependencies	Only appears if you have the proper option installed in your instrument In the Log Plot measurement in Phase Noise Mode, there are only three Limit Lines, so the valid parameters are `LLINE1 | LLINE2 | LLINE3`
Preset	1 Not part of **Preset**, but reset by **Restore Mode Defaults** Survives power cycles
State Saved	The selected Limit number is saved in instrument state
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete

Limit File Contents

Limits may be exported into a data file with a `.csv` extension. They may be imported from that data file; they may also be imported from a legacy limit file with a `.lim` extension. The `.lim` files meet the specification for limit files contained in the EMI measurement guide, HP E7415A.

.csv file format

Except for information in quotes, limit line files are not case sensitive. Information in bold is required verbatim; other text is example text, and italic text is commentary which should not be present in the file.

The first five lines are system-required header lines, and must be in the correct order:

Limit	*Data file type name*
"FCC Part 15"	*File Description*
"Class B Radiated"	*Comment*
A.01.00.R0001,N9020A	*Instrument Version, Model Number*
P13 EA3 UK6 ,01	*Option List, File Format Version*

The next few lines describe the parameters; on export they will be in the order shown, on import they can be in any order. If some parameters are missing, they will revert to the default.

Type, Upper	*Upper|Lower*
X Axis Unit, MHz	*MHz|S; other units should be converted; this also specifies the domain*
Amplitude Unit, dBm	*dBm|V; all other units should be converted appropriately*
Frequency Interpolation, Linear	*Logarithmic|Linear*
Amplitude Interpolation, Logarithmic	*Logarithmic|Linear*
X Control, Fixed	*Fixed|Relative; on input we consider only the first three characters*
Y Control, Fixed	*Fixed|Relative; on input we consider only the first three characters*
Margin, 0	*Always in dB. A 0 margin is equivalent to margin off*
X Offset, 10	*Expressed in the X axis units*
Y Offset, 5	*Expressed in the Amplitude units*

The Amplitude Unit line in the limits file may contain a transducer (formerly "antenna") factor unit, for example:

Amplitude Unit=dBuV/m

Transducer factor units are dBuV/m, dBuA/m, dBpT, and dBG. In this case, the unit is treated exactly as though it were dBuV, meaning that all of the limits are interpreted to have units of dBuV. The box does NOT change Y Axis Units when such a limit is loaded in.

The X-Axis unit also specifies the domain (time or frequency). It is not possible to have both time-domain lines and frequency-domain lines at the same time; if a time-domain line is imported while the other lines are in the frequency domain (or vice-versa), all limit lines will be deleted prior to import.

If the sign of the margin is inappropriate for the limit type (for example a positive margin for an upper limit), the sign of the margin will be changed internally so that it is appropriate.

The remaining lines describe the data. Each line in the file represents an X-Y pair. The X values should be monotonically non-decreasing, although adjacent lines in the file can have the same X value as an aid to building a stair-stepped limit line. To specify a region over which there is no limit, use +1000 dBm for upper limits or –1000 dBm for lower limits.

The data region begins with the keyword DATA:

```
DATA
200.000000,–10.00
300.000000,–10.00
300.000000,–20.00
500.000000,–20.00
```

.lim file format

This is a legacy format which allows files saved from older instruments to be loaded into the X-Series. *Design of files in this format is not recommended.*

Except for name and description text (which is taken verbatim), limit line files are not case sensitive.

The file may optionally start with a description block, consisting of the single line `[DESCRIPTION]` followed by arbitrary text. If there is no Limit Line Name header, the description text will be used as the limit line description in the GUI. If there is a Limit Line Name header, the Limit Line Name will be used instead.

Arbitrary text

The header block begins with the single line `[HEADER]`, followed by some or all of the following fields, each with `<parameter name>=<parameter value>`. Excess white space around the "=" is ignored. If a field is not present or the data is invalid, the value is not changed when the limit line is loaded. Ordering of the fields is unimportant.

Limit Line Name="FCC Part 15;Class B Radiated"	
Type=Upper	Upper|Lower
Frequency Unit=MHz	For time domain limits, this should say "Time Unit"
Amplitude Unit=dBm	
Frequency Interpolation=Lin	Log|Lin; on input we consider only the first three characters
Amplitude Interpolation=Log	Log|Lin; on input we consider only the first three characters
Mode=Fixed	Fixed|Relative
Margin=0	Always in dB. A 0 margin is equivalent to margin off
Domain=Frequency	Frequency|Time
Delimiter=TAB	

The data block begins with the line `[DATA]`, and consists of any number of segments.

The Data lines represent segments – X1, Y1, X2, Y2. If the list of segments includes a gap in the middle on input, the space inside the gap will be set to ensure the limit does not fail: for upper limits maxtracevalue, for lower limits mintracevalue. If two segments overlap on input, the stricter of the two segments is used – for upper limits the lower segment, for lower limits the upper segment.

Thus, the following segments indicate into a –5 dB limit from 10 MHz to 20 MHz and 30 MHz to 40MHz:

10	–5	20	–5
30	–5	40	–5

If this was an upper limit, this would be translated into the following set of limit points:

10	–5

20		–5		
20		maxtracevalue		
30		maxtracevalue		
30		–5		
40		–5		
	30	–29.5	88	–29.5	
	88	–33	216	–33	note that we are stair-stepping the line
	230	–35.6	960	–35.6	The gap between 216 MHz and 230 MHz will never fail
	960	–43.5	5000	–43.5	

7.3.6.1 Select Limit

Selects the specific Limit to be saved, for example, Limit 1.

Preset	Not part of **Preset**, but reset to `LLINE1` by **Restore Mode Defaults** Survives shutdown

7.3.7 Correction

Exports Amplitude Corrections files in the PC-readable `.csv` format.

Amplitude Correction files contain the correction data in a form that can be imported into Excel or similar spreadsheets, as well as header data that gives information on the correction.

The default filename is `Ampcor_0000.csv`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

The default path for Corrections files is:

`Documents\amplitudeCorrections`

For backwards compatibility, older limit files with the extensions `.amp`, `.cbl`, `.ant` and `.oth` can be read into the instrument, but you can only save corrections as `.csv` files.

See "Correction Data File" on page 992

Remote Command	`:MMEMory:STORe:CORRection 1 | … | 8, <filename>`
Example	Save Correction 2 to the file `myAmpcor.csv` in the default path for Corrections files: `:MMEM:STOR:CORR 2 "myAmpcor.csv"`
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten

	To save in a non-default path, specify the absolute file path Using the `C:` drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI
Dependencies	Corrections are not supported by all measurements. If in a Mode in which some measurements support it, this key is grayed-out in measurements that do not. Does not appear at all if no measurements in the Mode support it Does not appear unless you have the proper option installed in your instrument
Annotation	After save is complete, an advisory is displayed in the message bar confirming which file was saved
Backwards Compatibility SCPI	`:MMEMory:STORe:CORRection ANTenna|CABLe|OTHer|USER, <filename>` For backwards compatibility, `ANTenna` maps to 1, `CABle` maps to 2, `OTHer` maps to 3 and `USER` maps to 4

Correction Data File

A Correction Data File contains a copy of one of the instrument correction tables. Corrections provide a way to adjust the trace display for predetermined gain curves (such as for cable loss).

Corrections files are text files in `.csv` (Comma-Separated Values) form, to make them importable into Excel or other spreadsheet programs. The format for Corrections files is as follows:

Line #	Type of field	Example	Notes
1	File type, must be “Amplitude Correction”	Amplitude Correction	May not be omitted
2	File Description (in quotes)	“Correction Factors for 11966E”	60 characters max; may be empty but may not be omitted. If exceeds 60 characters, error -233 Too much data reported
3	Comment (in quotes)	“Class B Radiated”	60 characters max; may be empty but may not be omitted. . If exceeds 60 characters, error -233 Too much data reported
4	Instrument Version, Model #	A.02.06,N9020A	May be empty but may not be omitted
5	Option List, File Format Version	K03 LFE EXM ,01	May be empty but may not be omitted
6	Freq Unit to be used for all frequency values in the file	Frequency Unit, MHz	assumed to be Hz if omitted

Line #	Type of field	Example	Notes
7	Transducer Unit	Antenna Unit, None	If omitted leaves the Transducer unit unchanged. The amplitude unit in the Transducer Unit field is a conversion factor that is used to adjust the Y Axis Units of the current mode, if the mode supports Transducer Units. For more details on transducer correction data, refer to the Input/Output, Corrections key description. Allowable values: dBuV/m, dBuA/m, dBG, dBpT, None
8	Freq Interpolation	Frequency Interpolation, Linear	if omitted leaves the Freq Interpolation unchanged. Allowable values: Linear, Logarithmic
9	Bias value in mA	Bias,0.00	If omitted leaves the Bias value unchanged (added as of A.08.50)
10	Bias State	Bias State,On	If omitted leaves the Bias State unchanged. Allowable values: On, Off (added as of A.08.50)
11	Overlap, two values, Freq1 and Freq2, separated by commas	Overlap,33500,40000	Uses Freq Unit from line 6. Thus, in this example Freq1=33.5 GHz, Freq2= 40.0 GHz (see note below). If omitted leaves the overlap unchanged (added as of A.08.50)
12	DATA marker	DATA	Corrections data begins in the next line

Lines 2 through 5 can be empty but must appear in the file. Lines 6 through 11 are optional, the lines can be left out of the file altogether.

The Overlap row and the two Bias rows apply only to external mixing. Both are read-only, they are never written by the instrument. The only way to insert or modify these rows is to edit the file with a text editor or a spreadsheet editor. These rows are intended for use by mixer manufacturers, as they allow the manufacturer to insert data about how the mixer corrections were generated and how they should be applied. The Bias rows allow you to specify whether to turn Bias on or off when the Correction is turned on and to specify a Bias value (turning off the Correction does not change the Bias, but turning it back on again sets it to the value specified in the file). The Overlap row allows you to specify an overlap region in which two different corrections may be applied. It is expected that in the corrections data itself, there will be TWO corrections values exactly at Max Freq, otherwise Overlap is ignored. The way the overlap is processed is as follows: if at any given time the current instrument Start Freq is greater than Freq 1 and lower than Freq 2, and the current Stop Freq is greater than Freq 2, extend the first correction point at or above Freq 2 down to Freq 1, rather than using the correction data between Freq1 and Freq2.

Only one Transducer units can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit. Note that the legacy term “Antenna Unit” is still used in the correction file, even though the more modern term “Transducer Unit” is used in the user interface.

Similarly, the Bias rows can only be used in Correction register 1, because there can only be one setting for Bias at any given time. If a Correction file with a Bias or Bias State row is loaded into any Correction register but 1, an error is generated: Mass storage error; Can only load Bias Settings into Correction 1

The data follows the DATA row, as comma separated X, Y pairs; one pair per line.

For example, suppose you have an Antenna to correct for on an N9020A version A.02.06 and the correction data is:

- 0 dB at 200 MHz
- 17 dB at 210 MHz
- 14.8 dB at 225 MHz

Then the file will look like:

- Amplitude Correction
- "Correction Factors for 11966E"
- "Class B Radiated"
- A.02.06,N9020A
- P13 EA3 UK6,01
- Frequency Unit, MHz
- Antenna Unit, dBuV/m
- Frequency Interpolation, Linear
- DATA
- 200.000000,0.00
- 210.000000,17.00
- 225.000000,14.80

The choices for the 1 of N fields in the metadata are as follows:

- Frequency Unit: Hz, kHz, MHz, GHz
- Antenna Unit: dBuV/m, dBuA/m, dBG, dBpT, None
- Frequency Interpolation: Logarithmic, Linear

7.3.7.1 Select Correction

Selects the specific Correction to be saved, for example, Correction 1.

Preset	Not part of a **Preset**, but reset to **Correction 1** by **Restore Input/Output Defaults** Survives a shutdown

7.3.8 Mask

The **Mask** data type is used to import and export Mask files for measurements that use masks, such as cellular comms and real-time measurements.

7.3.9 Waveform Sequence

Saves waveform sequences from the ARB memory of an Internal Source. When you open the Save **Waveform Sequence** dialog and press **Save**, the current waveform sequence is saved to the selected directory.

Notes	No remote command, front panel only
Dependencies	Only appears if your hardware includes an Internal Source, such as in VXT

7.3.10 Screen Image

Selects a file for saving the contents of the display.

Screen Image files are PNG (Portable Network Graphics) files with the same resolution as the data display. They contain the image that was on the screen before you opened the **Save** dialog. When the **Screen Image** key is pressed, a "thumbnail" of the captured image is displayed, with the note “This is the image that will be saved” below it.

After you have completed the save, a message “File image.png saved” (assuming `image.png` was the filename you used).

NOTE **As of firmware release A.17.50, sending `*CLS` (Clear Status) removes any message displayed on the screen. If you do not want to see the “File saved”**

message after sending :MMEM:STOR:SCR (described below), send the following sequence (substituting your file name for filename.png): :MMEM:STOR:SCR "filename.png";*CLS

NOTE

As of firmware release A.19.50, saving a screen image removes any informational message displayed on the screen before it captures the screen. This is useful if you are sending "save image" commands in rapid sequence, as it keeps the "File saved" message from one screen capture from appearing in the next screen capture. Error messages are still captured.

If you send a succession of screen image commands *too* rapidly, the system may not have time to remove the previous message before the next screen capture. Sending screen image commands more rapidly than twice per second is not advised.

The default path for State Files is:

Documents\<mode name>\screen

where <mode name> is the parameter used to select the mode with :INST:SEL, for example, SA for Spectrum Analyzer Mode.

Screen Image files have extension .png. The default filename is Screen_0000.png, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

After you have completed the save, the Quick Save front-panel key lets you quickly repeat the last save performed, using an auto-named file, with new current screen data.

Remote Command	:MMEMory:STORe:SCReen <filename>
Example	Store the current screen image in the file MyScreenFile.png in the default directory: :MMEM:STOR:SCR "myScreen.png"
Backwards Compatibility SCPI	:HCOPy:SDUMp:DATA? returns the screen image in a <DEFINITE LENGTH ARBITRARY RESPONSE DATA> element. The response data is IEEE Block format; the controlling computer can strip the header and store the result as a .png file

Blocking Screen Capture (Remote Command Only)

This command works *only* when the measurement is in Single mode (see "Sweep/Measure" on page 410). When the command is sent, it blocks the SCPI client, waits for the current refresh to complete, then captures the screen shot and

saves it. In some instances, a single measurement is taken, and a screen shot of that measurement is captured.

This command ensures that the last-measured data is refreshed on the screen before it is captured, by blocking the command and waiting for refresh to complete. The command may time out, in which case it must be re-sent.

If timeout occurs, or if the active measurement is in **Continuous** mode, an error is returned.

Remote Command	`:MMEMory:STORe:SCReen:BLOCked <filename>`
Example	Wait for the current screen refresh to complete before capturing the screen shot, then store the current screen image in the file `MyScreenFile.png` in the default directory: `:MMEM:STOR:SCR:BLOC "myScreen.png"`

7.3.10.1 Theme

Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image. You can choose between themes to be used when saving the screen image.

See "More Information" on page 998 for examples of the themes.

Remote Command	`:MMEMory:STORe:SCReen:THEMe FILLed | OUTLine` `:MMEMory:STORe:SCReen:THEMe?`
Example	`:MMEM:STOR:SCR:THEM OUTL`
Preset	`FILLed`; not part of **Preset**, but reset by **Restore Misc Defaults** or **Restore System Defaults All**
Backwards Compatibility SCPI	`:MMEMory:STORe:SCReen:THEMe TDColor|TDMonochrome|FCOLor|FMONochrome`

Backwards Compatibility Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models are mapped as follows:
	`TDColor` and `TDMonochrome` are both mapped to `FILLed`
	(exact full color representation of what is on the screen)
	`FCOLor` and `FMONochrome` are both mapped to `OUTLine`
	(uses color for traces and other items, but most filled areas are white)
	There is no Monochrome theme in B-models, so the A-models monochrome commands yield color
	`:MMEM:STOR:SCR:THEM?` always returns `FILLed` or `OUTLine`, never `FCOLor`, `FMONochrome`, `TDColor`, or `TDMonochrome`
	There is no monochrome theme in the X-Series Touch UI

More Information

- The `FILLed` theme is an exact representation of the information on the display
- The `OUTLine` theme eliminates most of the filled areas, in order to save ink when the image is printed. In addition, the yellow trace color is changed to be more orange, to improve visibility against a white background. Note that some objects remain filled. In particular, the selected marker remains filled with the green marker color, in order to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display

7.3.11 Power Sensor Cal Factor

Selects a file to which to export the Power Sensor Cal factor data.

Cal Factor files are XML files, and contain the cal factor data and header data that gives information on the power sensor.

The default path for Cal Factor Files is:

`Documents\<mode name>\data\PSCF`

where `<mode name>` is the parameter used to select the mode with `:INST:SEL` (for example, `MRECEIVE` for Measuring Receiver Mode). Hence, a Cal Factor file from any measurement in the Measuring Receiver mode would be stored in:

`Documents\MRECEIVE\data\PSCF`

Cal Factor files have the extension `.xml`. The default filename is `<Sensor Model>_<Sensor Serial Number>_0000.xml`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory. If the sensor model or serial number is blank, the default filename is `PSCF_0000.xml`.

Remote Command	`:MMEMory:STORe:PSCFactor <file_name>`
Example	`:MMEM:STOR:PSCF "myPSCF.xml"`
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten Using the `C:` drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI
Dependencies	Only appears if you have the proper option installed in your instrument

7.3.12 DPD Results

Lets you save a DPD model, Pre-distorted Waveform, or PA model to a file.

DPD model

File Type	"DPD Algorithm (formerly DPD Model Type)" on page 313	
Look up table (LUT)	Look-up table	LUT
Memory Polynomial Coefficients	Memory Polynomial	MPOLynomial
Volterra Series Coefficients	Volterra Series	VOLTerra
GMP Coefficients	GMP	GMP

Pre-distorted Waveform

The waveform that Reference signal is applied by DPD model, it encrypted and can be played on a signal generator.

You can specify which DPD results you wish to save:

Result	File Extension
DPD Model	*.csv
Pre-distorted Waveform	*.wfm

PA model

Options are the same as for "DPD model" on page 999 above. Note that **PA model** does *not* support MATLAB Script.

GMP Coefficients Index file

Because the polynomial representation of GMP is complex, a **GMP Coefficients Index** file is created automatically at the same time as the GMP coefficients file, to specify how the coefficients are applied to the polynomial.. The index file name is the same as that of the GMP coefficients file, plus the suffix _Index.

For example, if the GMP coefficients file name is:

DPDModel_GMP_0001.csv

then the corresponding index file name is

DPDModel_GMP_0001_Index.csv

In this case, the content of the index file is as below:

k,q,m

0,0,0

0,1,0

1,0,0

1,1,0

2,0,0

2,1,0

3,0,0

3,1,0

4,0,0

Where the k, q, m is the notation in the GMP polynomial,

$$y[n] = \sum_{q=0}^{Q_a} \sum_{k=0}^{K_a-1} a_q x[n-q]|x[n-q]|^k + \sum_{q=0}^{Q_b} \sum_{m=1}^{M_b} \sum_{k=1}^{K_b} b_{mqk} x[n-q]|x[n-q-m]|^k + \sum_{m=1}^{M_c} \sum_{q=m}^{Q_c} \sum_{k=1}^{K_c} c_{mqk} x[n-q]|x[n-q+m]|^k$$

where:

K_a is sync order
Q_a is sync memory depth
K_b is lag order
Q_b is lag memory depth
M_b is maximum lag
K_c is lead order
Q_c is lead memory depth
M_c is maximum lead

7.3.12.1 Save DPD Model

Remote Command	`:MMEMory:STORe:PAMPlifier:DPD:MODel <filename>`
Example	`:MMEM:STOR:PAMP:DPD:MOD "LUT_001.csv”`
Status Bits/OPC dependencies	Sequential – aborts the current measurement

7.3.12.2 Save Pre-distorted Waveform

Remote Command	`:MMEMory:STORe:PAMPlifier:DPD:PWAVeform <filename>`
Example	`:MMEM:STOR:PAMP:DPD:PWAV "WLAN_80M_LUT_001.wfm”`
Status Bits/OPC dependencies	Sequential – aborts the current measurement

7.3.12.3 Save PA Model

Remote Command	`:MMEMory:STORe:PAMPlifier:PA:MODel <filename>`
Example	`:MMEM:STOR:PAMP:PA:MOD "LUT_001.csv”`
Status Bits/OPC dependencies	Sequential – aborts the current measurement

7.3.12.4 Shaping Table

A specified shaping table can be saved as a CSV file.

Remote Command	`:MMEMory:STORe:PAMPlifier:SHAPing <index>,<filename>`
Example	`:MMEM:STOR:PAMP:SHAP 2,"C:\Shaping Table 001.csv”`
Notes	`<index>` is one-based

7.3.12.5 Trace

Displays a menu to let you to select a group of traces to be saved. Options include:

- ACP Spectrum
- AM-AM
- AM-PM
- EVM vs. power
- Raw main time
- DPD iteration
- Envelope
- ET Auto Timing Alignment
- SEM Spectrum

Once a trace is selected, the name of the selected trace is annotated on the Save From Trace control.

The file is in CSV format, and contains the data of the traces of the selected group. The traces contained in each group are:

Group	SCPI	Traces
ACP Spectrum	SPECtrum	Frequency (Hz)
		Pre-DPD ACP spectrum (dBm)
		Post-DPD ACP spectrum (dBm)
AM-AM	AMAM	Pre-DPD Power (AM-AM) (dBm)
		Pre-DPD AM-AM (dBm)
		Pre-DPD Normalized AM-AM (dB)
		Post-DPD Power (AM-AM) (dBm)
		Post-DPD AM-AM (dBm)
		Post-DPD Normalized AM-AM (dB)
		Pre-DPD Power (Fitting Curve) (dBm)
		Pre-DPD Normalized Fitting Curve (dB)
		Post-DPD Fitting Curve (dBm)
		Post-DPD Normalized Fitting Curve (dB)
AM-PM	AMPM	Pre-DPD Power (AM-PM) (dBm)
		Pre-DPD AM-PM (Degree)
		Post-DPD Power (AM-PM) (dBm)
		Post-DPD AM-PM (Degree)
		Pre-DPD Fitting Curve (dBm)
		Pre-DPD Fitting Curve (Degree)
		Post-DPD Fitting Curve (dBm)
		Post-DPD Fitting Curve (Degree)
Raw Main Time	RAWMaintime	Time (s)
		Pre-DPD Raw Main Time (dBm)
		Post-DPD Raw Main Time (dBm)

Group	SCPI	Traces
EVM vs. Power	EVMPower	Power (dBm) For 5GNR and LTEA-FDD: – RMS EVM vs. Power of all the component carriers (% or dB) – Carrier power vs. power of all the component carriers (dBm) – DPD status for each power level For WLAN: – RMS EVM vs. power (% or dB) – ncEVM vs. power (% or dB) – Average burst power vs. power (dBm) – DPD status for each power level

Group	SCPI	Traces
DPD Iteration	DITeration	DPD Iteration Index ACP Offset A Lower (dBc) vs. DPD Iteration ACP Offset A Upper (dBc) vs. DPD Iteration ACP Offset B Lower (dBc) vs. DPD Iteration ACP Offset B Upper (dBc) vs. DPD Iteration Output Power vs. DPD Iteration Gain vs. DPD Iteration Crest Factor Out vs. DPD Iteration Delta EVM vs. DPD Iteration For 5GNR and LTEA-FDD: RMS EVM of all the component carriers (% or dB) vs. DPD Iteration For WLAN: RMS EVM (% or dB) vs. DPD Iteration ncEVM (% or dB) vs. DPD Iteration SEM Offset A Lower Delta Limit vs. DPD Iteration SEM Offset A Lower Frequency vs. DPD Iteration SEM Offset A Upper Delta Limit vs. DPD Iteration SEM Offset A Upper Frequency vs. DPD Iteration SEM Offset B Lower Delta Limit vs. DPD Iteration SEM Offset B Lower Frequency vs. DPD Iteration SEM Offset B Upper Delta Limit vs. DPD Iteration SEM Offset B Upper Frequency vs. DPD Iteration SEM Offset C Lower Delta Limit vs. DPD Iteration SEM Offset C Lower Frequency vs. DPD Iteration SEM Offset C Upper Delta Limit vs. DPD Iteration SEM Offset C Upper Frequency vs. DPD Iteration
Envelope **Only** available on M9410A/11A/15A/16A	ENVelope	**"Envelope Source" on page 386** / **Data** USER — The user-defined envelope resampled to 1 GSa/s NPWaveform — The envelope data generated based on the reference waveform and resampled to 1GSa/s PWAVeform — The envelope data generated based on the pre-distorted waveform obtained at the last DPD iteration and resampled to 1GSa/s

Group	SCPI	Traces
ET Auto Timing Alignment **Only** available on M9410A/11A/15A	ATALignment	Coarse alignment ACP offset A (negative) relative power vs. Envelope Delay
		Coarse alignment ACP offset A (positive) relative power vs. Envelope Delay
		The fitting curve constructed based on the coarse alignment ACP offset A (negative) relative power trace
		The fitting curve constructed on the coarse alignment ACP offset A (positive) relative power trace
		Balance alignment ACP offset A
		The fitting curve constructed based on the balance alignment ACP offset A trace
SEM Spectrum	SEMask	Frequency (Hz)
		Pre-DPD SEM spectrum (dBm)
		Post-DPD SEM spectrum (dBm)

The default filename is `Trace_0000.csv`, where the 4-digit suffix is the lowest number that does not conflict with any filename in the current directory.

The default path for **Trace** data files is:

`<My Documents>\Keysight\Instrument\PA\data\PAMPlifier\trace`

Remote Command	`:MMEMory:STORe:TRACe:DATA SPECtrum | AMAM | AMPM | EVMPower | RAWMaintime | DITeration | ENVelope | ATALignment | SEMask,<filename>`
Example	Export the ACP spectrum trace to the file `demo.csv` under `C:\temp`: `:MMEM:STOR:TRAC:DATA SPEC, "C:\temp\demo.csv"`
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten Using the `C:` drive is strongly discouraged, because data on this drive may be overwritten during an instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI The number of selections available depend on the current Mode and measurement
Couplings	When you select which trace to save, that trace becomes the current trace, and displays on top of all the other traces
Preset	Not part of Preset, but reset to `CSV` by **Restore Mode Defaults**
Range	ACP Spectrum | AM-AM | AM-PM | EVM vs. Power | Raw Main Time | DPD Iteration | Envelope | ET Auto Timing Alignment | SEM Spectrum
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete

7.3.12.6 Filter Mask

A specified filter mask can be saved as a .csv file.

Remote Command	`:MMEMory:STORe:PAMPlifier:FMASk <index>,<filename>`
Example	`:MMEM:STOR:PAMP:FMAS 2,"C:\Filter Mask 001.csv”`
Notes	`<index>` is one-based

7.3.13 Shaping Table

A specified shaping table can be saved as a CSV file.

Remote Command	`:MMEMory:STORe:PAMPlifier:SHAPing <index>,<filename>`
Example	`:MMEM:STOR:PAMP:SHAP 2,"C:\Shaping Table 001.csv”`
Notes	`<index>` is one-based

7.3.14 Trace

Displays a menu to let you to select a group of traces to be saved. Options include:

- ACP Spectrum
- AM-AM
- AM-PM
- EVM vs. power
- Raw main time
- DPD iteration
- Envelope
- ET Auto Timing Alignment
- SEM Spectrum

Once a trace is selected, the name of the selected trace is annotated on the Save From Trace control.

The file is in CSV format, and contains the data of the traces of the selected group. The traces contained in each group are:

Group	SCPI	Traces
ACP Spectrum	SPECtrum	Frequency (Hz)
		Pre-DPD ACP spectrum (dBm)
		Post-DPD ACP spectrum (dBm)
AM-AM	AMAM	Pre-DPD Power (AM-AM) (dBm)
		Pre-DPD AM-AM (dBm)
		Pre-DPD Normalized AM-AM (dB)
		Post-DPD Power (AM-AM) (dBm)
		Post-DPD AM-AM (dBm)
		Post-DPD Normalized AM-AM (dB)
		Pre-DPD Power (Fitting Curve) (dBm)
		Pre-DPD Normalized Fitting Curve (dB)
		Post-DPD Fitting Curve (dBm)
		Post-DPD Normalized Fitting Curve (dB)
AM-PM	AMPM	Pre-DPD Power (AM-PM) (dBm)
		Pre-DPD AM-PM (Degree)
		Post-DPD Power (AM-PM) (dBm)
		Post-DPD AM-PM (Degree)
		Pre-DPD Fitting Curve (dBm)
		Pre-DPD Fitting Curve (Degree)
		Post-DPD Fitting Curve (dBm)
		Post-DPD Fitting Curve (Degree)
Raw Main Time	RAWMaintime	Time (s)
		Pre-DPD Raw Main Time (dBm)
		Post-DPD Raw Main Time (dBm)

Group	SCPI	Traces
EVM vs. Power	EVMPower	Power (dBm) For 5GNR and LTEA-FDD: – RMS EVM vs. Power of all the component carriers (% or dB) – Carrier power vs. power of all the component carriers (dBm) – DPD status for each power level For WLAN: – RMS EVM vs. power (% or dB) – ncEVM vs. power (% or dB) – Average burst power vs. power (dBm) – DPD status for each power level

Group	SCPI	Traces
DPD Iteration	DITeration	DPD Iteration Index ACP Offset A Lower (dBc) vs. DPD Iteration ACP Offset A Upper (dBc) vs. DPD Iteration ACP Offset B Lower (dBc) vs. DPD Iteration ACP Offset B Upper (dBc) vs. DPD Iteration Output Power vs. DPD Iteration Gain vs. DPD Iteration Crest Factor Out vs. DPD Iteration Delta EVM vs. DPD Iteration For 5GNR and LTEA-FDD: RMS EVM of all the component carriers (% or dB) vs. DPD Iteration For WLAN: RMS EVM (% or dB) vs. DPD Iteration ncEVM (% or dB) vs. DPD Iteration SEM Offset A Lower Delta Limit vs. DPD Iteration SEM Offset A Lower Frequency vs. DPD Iteration SEM Offset A Upper Delta Limit vs. DPD Iteration SEM Offset A Upper Frequency vs. DPD Iteration SEM Offset B Lower Delta Limit vs. DPD Iteration SEM Offset B Lower Frequency vs. DPD Iteration SEM Offset B Upper Delta Limit vs. DPD Iteration SEM Offset B Upper Frequency vs. DPD Iteration SEM Offset C Lower Delta Limit vs. DPD Iteration SEM Offset C Lower Frequency vs. DPD Iteration SEM Offset C Upper Delta Limit vs. DPD Iteration SEM Offset C Upper Frequency vs. DPD Iteration
Envelope **Only** available on M9410A/11A/15A/16A	ENVelope	**"Envelope Source" on page 386** / **Data** USER / The user-defined envelope resampled to 1 GSa/s NPWaveform / The envelope data generated based on the reference waveform and resampled to 1GSa/s PWAVeform / The envelope data generated based on the pre-distorted waveform obtained at the last DPD iteration and resampled to 1GSa/s

Group	SCPI	Traces
ET Auto Timing Alignment Only available on M9410A/11A/15A	ATALignment	Coarse alignment ACP offset A (negative) relative power vs. Envelope Delay
		Coarse alignment ACP offset A (positive) relative power vs. Envelope Delay
		The fitting curve constructed based on the coarse alignment ACP offset A (negative) relative power trace
		The fitting curve constructed on the coarse alignment ACP offset A (positive) relative power trace
		Balance alignment ACP offset A
		The fitting curve constructed based on the balance alignment ACP offset A trace
SEM Spectrum	SEMask	Frequency (Hz)
		Pre-DPD SEM spectrum (dBm)
		Post-DPD SEM spectrum (dBm)

The default filename is `Trace_0000.csv`, where the 4-digit suffix is the lowest number that does not conflict with any filename in the current directory.

The default path for **Trace** data files is:

`<My Documents>\Keysight\Instrument\PA\data\PAMPlifier\trace`

Remote Command	`:MMEMory:STORe:TRACe:DATA SPECtrum | AMAM | AMPM | EVMPower | RAWMaintime | DITeration | ENVelope | ATALignment | SEMask,<filename>`
Example	Export the ACP spectrum trace to the file `demo.csv` under `C:\temp`: `:MMEM:STOR:TRAC:DATA SPEC, "C:\temp\demo.csv"`
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten Using the `C:` drive is strongly discouraged, because data on this drive may be overwritten during an instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI The number of selections available depend on the current Mode and measurement
Couplings	When you select which trace to save, that trace becomes the current trace, and displays on top of all the other traces
Preset	Not part of Preset, but reset to `CSV` by **Restore Mode Defaults**
Range	ACP Spectrum | AM-AM | AM-PM | EVM vs. Power | Raw Main Time | DPD Iteration | Envelope | ET Auto Timing Alignment | SEM Spectrum
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete

7.3.15 Filter Mask

A specified filter mask can be saved as a .csv file.

Remote Command	`:MMEMory:STORe:PAMPlifier:FMASk <index>,<filename>`
Example	`:MMEM:STOR:PAMP:FMAS 2,"C:\Filter Mask 001.csv”`
Notes	`<index>` is one-based

7.3.16 Remote Only Commands

The following commands execute file system operations such as move, copy, and transfer data from a file.

7.3.16.1 Mass Storage Catalog (Remote Query Only)

Remote Command	`:MMEMory:CATalog? [<directory_name>]` The string `<directory_name>` must be a valid logical path. If no string then it uses the current directory
Example	`:MMEM:CAT? "C:\"`

Notes	Queries disk usage information (drive capacity, free space available) and obtains a list of files and directories in a specified directory in the following format:
	`<numeric_value>,<numeric_value>,\{<file_entry>\}`
	It returns two numeric parameters and as many strings as there are files and directories
	The first parameter indicates the total amount of storage currently used in bytes
	The second parameter indicates the total amount of storage available, also in bytes. `<file_entry>` is a string. Each `<file_entry>` indicates the name, type, and size of one file in the directory list:
	`<file_name>,<file_type>,<file_size>`
	As the Windows file system has an extension that indicates file type, `<file_type>` is always empty. `<file_size>` provides the size of the file in bytes. For directories, `<file_entry>` is surrounded by square brackets and both `<file_type>` and `<file_size>` are empty

7.3.16.2 Mass Storage Change Directory (Remote Command Only)

Remote Command	`:MMEMory:CDIRectory [<directory_name>]`
	`<directory_name>` must be a valid logical path
	`:MMEMory:CDIRectory?`

Example	`:MMEM:CDIR "C:\TEMP"`

Notes	Changes the current directory for a mass memory file system. The `<directory_name>` parameter is a string. If no parameter is specified, the directory is set to the `*RST` value At `*RST`, this value is set to the default user data storage area, that is the user's Documents folder Query returns full path of the current directory as a quoted string

7.3.16.3 Mass Storage Copy (Remote Command Only)

Remote Command	`:MMEMory:COPY <string>,<string>[,<string>,<string>]` `<string>` must be a valid logical path
Example	`:MMEM:COPY "C:\TEMP\Screen_0000.png","C:\"`
Notes	Copies an existing file to a new file or an existing directory to a new directory If no directory is specified, uses the current directory Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists This command will generate an "access denied" error if the destination is a restricted folder (for example, `C:\Windows`) and you do not have Power User or Administrator privileges

7.3.16.4 Mass Storage Device Copy (Remote Command Only)

Transfers data to/from a file and a peripheral device.

Remote Command	`:MMEMory:COPY:DEVice <source_string>,<dest_string>` `<source_string>` and `<dest_string>` must be valid logical paths
Notes	The strings must be a valid logical path or a valid device keyword. If `dest_string` is a device keyword, the data is copied from the source file to the device. If `source_string` is a device keyword, the data is copied to the source file from the device Valid device keywords are: `SNS` (smart noise source) An error is generated if the file or device is not found

7.3.16.5 Mass Storage Delete (Remote Command Only)

Remote Command	`:MMEMory:DELete <file_name>[,<directory_name>]` `<file_name>` and `<directory_name>` must be valid logical paths
Example	`:MMEM:DEL "Screen_0000.png"`

Notes	If no directory is specified, uses the current directory Removes a file from the specified directory. `<file_name>` specifies the file name to be removed. This command generates an "access denied" error if the file is in a restricted folder (for example, `C:\Windows`) and you do not have Power User or Administrator privileges

7.3.16.6 Mass Storage Data (Remote Command Only)

Creates a file containing the specified data *or* queries the data from an existing file.

Remote Command	`:MMEMory:DATA <file_name>, <data>`
	`<file_name>` must be a valid logical path
	`:MMEMory:DATA? <file_name>`

Example	`:MMEM:DATA? "MyFile.txt"`
Notes	If no directory is specified, uses the current directory The command form `:MMEMory:DATA <file_name>,<data>` loads `<data>` into the file `<file_name>`. `<data>` is in 488.2 block format. `<file_name>` is string data The response to `:MMEMory:DATA? <file_name>` is the associated `<data>` in block format

7.3.16.7 Mass Storage Make Directory (Remote Command Only)

Remote Command	`:MMEMory:MDIRectory <directory_name>` `<directory_name>` must be a valid logical path
Example	`:MMEM:MDIR "C:\TEMP\NewDir"`
Notes	Creates a new directory. `<directory_name>` specifies the name to be created Generates an "access denied" error if the new directory would be in a restricted folder (for example, `C:\Windows`) and you do not have Power User or Administrator privileges

7.3.16.8 Mass Storage Move (Remote Command Only)

Remote Command	`:MMEMory:MOVE <string>,<string>[,<string>,<string>]` `<string>` must be valid logical paths
Example	`:MMEM:MOVE "C:\TEMP\Screen_0000.png","C:\"`
Notes	Moves an existing file to a new file or an existing directory to a new directory Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists

	This command generates an “access denied” error if the destination is a restricted folder (for example, `C:\Windows`) and you do not have Power User or Administrator privileges

7.3.16.9 Mass Storage Remove Directory (Remote Command Only)

Remote Command	`:MMEMory:RDIRectory <directory_name>` `<directory_name>` must be a valid logical path
Example	`:MMEM:RDIR "C:\TEMP\NewDir"`
Notes	Removes a directory. The `<directory_name>` parameter specifies the directory name to be removed. All files and directories under the specified directory will also be removed This command generates an “access denied” error if the folder is a restricted folder (for example, `C:\Windows`) or is in a restricted folder and you do not have Power User or Administrator privileges

7.3.16.10 Mass Storage Determine Removable Media (Remote Query Only)

Used to determine whether any removable media devices are connected to the instrument. Primarily, these are USB memory devices plugged-in to the front panel or rear panel USB ports. On instruments with PC6 or PC7 CPUs, one SD card slot is available for removable media. The instrument’s primary disk drive is *not* a removable media device.

Remote Command	`:MMEMory:RMEDia:LIST?`
Example	`:MMEM:RMED:LIST?`
Notes	The return value is a string containing a list of partition identifiers, which are removable media devices. Each identifier will be separated by a comma. If no removable media is present, an empty string is returned Examples: – One removable device present results in a return string of “F:” – Two removable devices present results in a return string of “F:,G:” No removable devices present results in a return string of “”

7.3.16.11 Mass Storage Determine Removable Media Label (Remote Command Only)

Used to set or query a removable media device’s label.

Remote Command	`:MMEMory:RMEDia:LABel <partition>,<string>` `:MMEMory:RMEDia:LABel? <partition>`
Example	`:MMEM:RMED:LAB "F:","My Device"`

Notes	If the <partition> specified does not exist or is not a removable media device, the error -252, "Missing Media" is generated Setting the removable media label requires Administrative privileges. If the currently logged-in user does not have appropriate privileges, error "-221, Settings conflict; Administrator privileges required" is generated

7.3.16.12 Mass Storage Determine Removable Media Write-protect status (Remote Query Only)

Used to query a removable media device's write-protect status.

Remote Command	:MMEMory:RMEDia:WPRotect? <partition>
Example	:MMEM:RMED:WPR? "F:"
Notes	The return value is 1 if the device is write-protected, and 0 if the device is write-enabled If the <partition> specified does not exist or is not a removable media device the error -252, "Missing Media" is generated
Preset	The return value depends on the SD card installed

7.3.16.13 Mass Storage Determine Removable Media size (Remote Query Only)

Queries a removable media device's total memory size (not available memory size).

Remote Command	:MMEMory:RMEDia:SIZE? <partition>
Example	:MMEM:RMED:SIZE? "F:"
Notes	The return value is integer value in GBytes. Any device that is less than 1 GB returns 0 GB If the <partition> specified does not exist or is not a removable media device, the error -252,"Missing Media" is generated

7.3.16.14 :SYSTem:SET (Remote Command Only)

Obtains the state of the currently active mode in a form that can then be loaded back into the instrument quickly.

Remote Command	:SYSTem:SET <instrument state in IEEE Block> :SYSTem:SET?
Notes	The query returns current instrument state of the active mode in IEEE Block data format. The state is in a machine-readable format only, as follows: <syst set preamble><state block data> Where:

`<syst set preamble>` is the format:

`#NMMM`

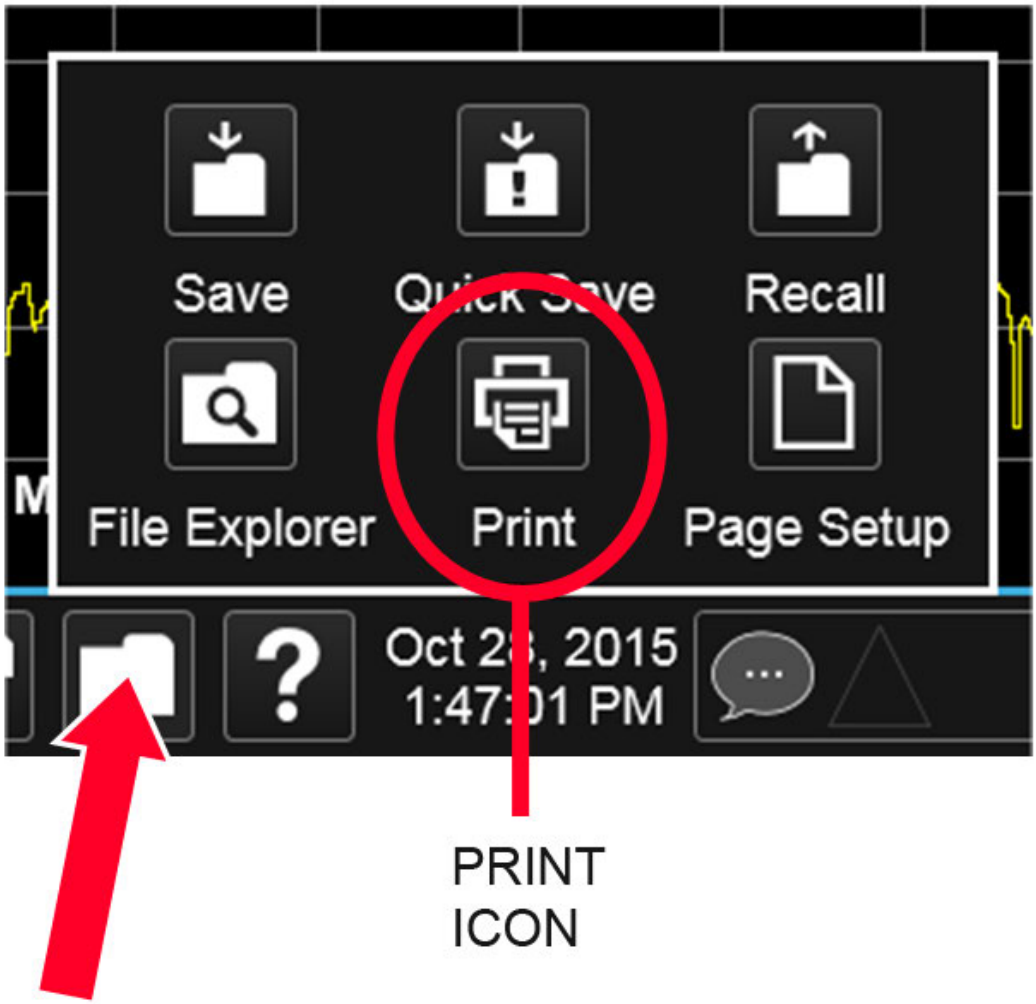
- `N` = number of digits that comprise `MMM`
- `MMM` = length in bytes of following data

`<state block data>` is machine readable state data

Example response: `#42016<state data>`

The state is recalled by sending the `:SYST:SET?` response data to the instrument. From example above:`:SYST:SET #42016<state data>`

7.4 Print



Opens a dialog for configuring printing (to the printer of your choice).

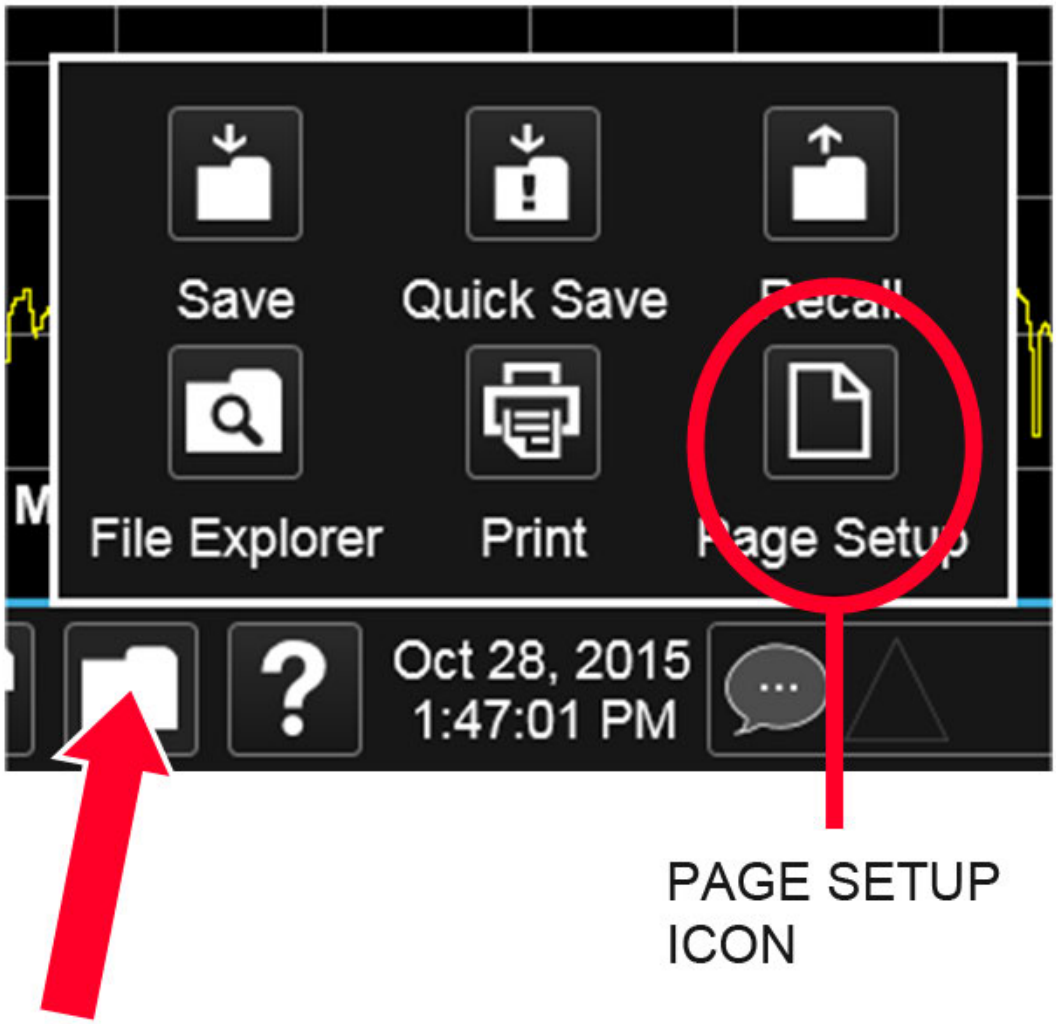
The `:HCOPy` command is equivalent to pressing the PRINT key.

Remote Command `:HCOPy[:IMMediate]`

`:HCOPy:ABORt` can be used to abort a print that is already in progress. Sending `:HCOPy:ABORt` causes the instrument to stop sending data to the printer, although the printer may continue or even complete the print, depending on how much data was sent to the printer before you sent the `:ABORt` command.

Remote Command `:HCOPy:ABORt`

7.5 Page Setup



Opens a Windows Page Setup dialog that allows you to control aspects of the pages sent to the printer when the **PRINT** hardkey is pressed.

Depending on the abilities of the attached printer, paper size, paper source, page orientation and margins may all be set. There are no SCPI commands for controlling these parameters.

The dialog also has a dropdown control to let you select the Display Theme to use when printing. **Page Setup** themes are the same as those for **Screen Image**"Theme" on page 997.

The **Theme** control has a corresponding SCPI command:

Remote Command	`:SYSTem:PRINt:THEMe FILLed | OUTLine` `:SYSTem:PRINt:THEMe?`
Example	`:SYST:PRIN:THEM OUTL`
Preset	`OUTL`; not part of **Preset**, but reset by **Restore Misc Defaults** or **Restore System Defaults All** and survives subsequent running of the modes
State Saved	No
Backwards Compatibility SCPI	`:SYSTem:PRINt:THEMe TDColor|TDMonochrome|FCOLor|FMONochrome`
Backwards Compatibility Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from A-models are mapped as follows: `TDColor` and `TDMonochrome` are both mapped to `FILLed`: Exact full color representation of what is on the screen `FCOLor` and `FMONochrome` are both mapped to `OUTLine`: Uses color for traces and other items, but most filled areas are white There is no Monochrome theme in B-models, so the A-models' monochrome commands yield color `:SYST:PRINT:THEM?` always returns `FILLed` or `OUTLine`; never `FCOLor`, `FMONochrome`, `TDColor`, or `TDMonochrome`

8 Trigger

8.1 Trigger

Contains controls that let you select the trigger source, and setup of each of the trigger sources. The instrument is designed to allow triggering from many sources, for example, Free Run, Video, External, RF Burst, etc.

In general, each Measurement can have a different Trigger Source, and each Measurement remembers its previous-Trigger Source.

8.1.1 Select Trig Source

Specifies the trigger source for the currently selected instrument input (RF or I/Q). If you change inputs, the new input remembers the trigger source it was last programmed to for the current measurement and uses that trigger source. When in External Mixing, the instrument uses the RF trigger source. You can *directly* set the trigger source for the RF Input and for the I/Q input using SCPI commands; see "Trigger Source Presets" on page 1027, "Trigger Parameter Applicability" on page 1029 ,and "I/Q Trigger Source (Remote Command Only)" on page 1032.

In general, each measurement can have a different trigger source, and each measurement remembers its previously-set trigger source. Not every trigger source is available for every measurement, so the available choices for Select Trig Source may vary from Mode to Mode, and from measurement to measurement. The trigger sources that are available for each measurement are shown in "List of Available Trigger Sources" on page 1022 below.

Note that the controls available on the Trigger tab change depending on which trigger source is selected. Tap each trigger source in the table in "List of Available Trigger Sources" on page 1022 to see which parameters are available for that trigger source.

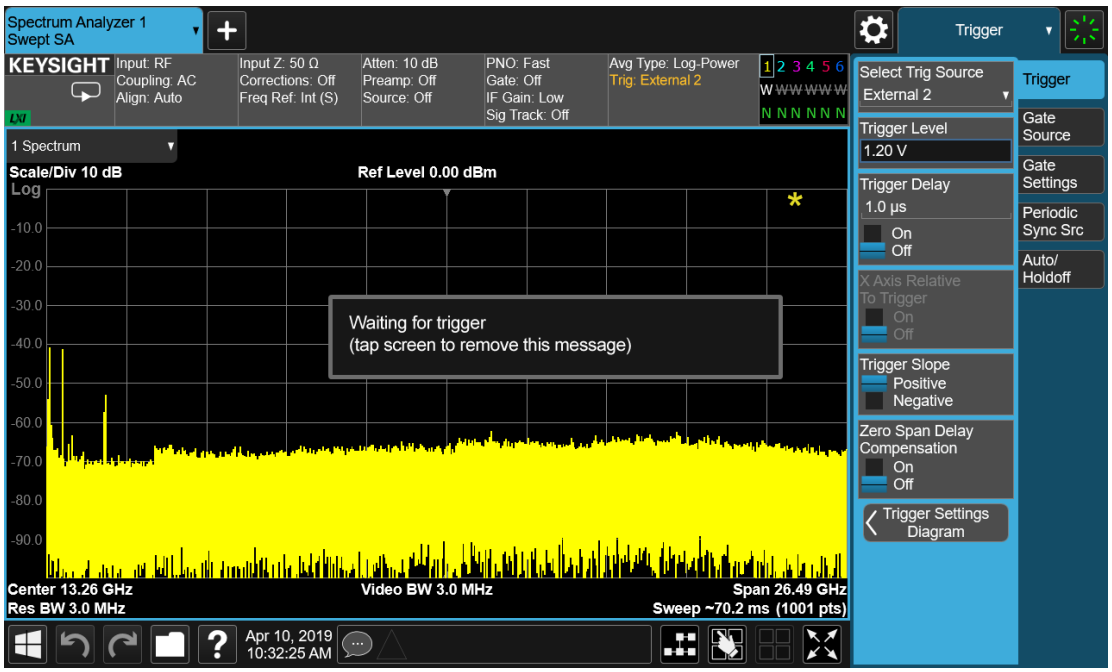
Note that most measurements require the inclusion of a `<measurement>` parameter in the trigger source command, *except* for the Swept SA and RTSA measurements. For backwards compatibility, no `<measurement>` parameter is used when setting the trigger source for the Swept SA or RTSA measurements.

Waiting for Trigger

After you select a trigger source, the instrument will start its next measurement when that trigger source is satisfied. For example, if you choose External 1, the next measurement will start when the appropriate signal appears at the Trigger 1 In connector.

If the trigger source is not satisfied (for example, if no signal at the appropriate level appears at the Trigger 1 In connector), after approximately 2 seconds a popup

message appears that says, “Waiting for trigger”. The trigger annotation in the **Meas Bar** also turns amber, as shown below:



Tap anywhere on the screen (except on the message itself) to clear the popup. The annotation remains amber until the trigger conditions are satisfied.

For more details, see also "Trigger Parameter Applicability" on page 1029, "Trigger Setup Parameters" on page 1030, "Backwards Compatibility SCPI" on page 1030, "RF Trigger Source (Remote Command Only)" on page 1031, and "I/Q Trigger Source (Remote Command Only)" on page 1032.

List of Available Trigger Sources

The tables show which trigger sources are available for which Modes and measurements, with the following exceptions:

- Noise Figure Mode supports only **Gate** triggering
- the Disturbance Analyzer measurement in EMI Mode does not support triggering
- the Tx Band Spur measurement in GSM/EDGE Mode does not support triggering
- For some models (like N9042B) with ADC trigger: some IF Paths do not support **Video** trigger, instead they support **ADC** trigger

"Free Run" on page 1033	`IMMediate`	All modes and measurements, except those measurements that support no triggers at all

"Video" on page 1033	VIDeo	All modes except RTSA and Pulse In Spectrum Analyzer Mode, all measurements except ACP and List Sweep In WCDMA, MSR, Short Range Comms, VMA, and LTE Modes, all measurements except ACP In WLAN Mode, all measurements In Phase Noise Mode, all measurements except Log Plot and Spot Frequency
"ADC" on page 1034	ADC	"Mode/Measurement supporting ADC and EXTernal3/5" on page 1024 in N9042B and models with H1G Not supported in SA6210A
"Line" on page 1035	LINE	All Modes except EMI, Avionics and Analog Demod In Spectrum Analyzer Mode, all measurements except List Sweep In WLAN and GSM/EDGE Modes, all measurements except Power vs. Time In LTE and 5G NR Modes, all measurements except Transmit On/Off Power In Short Range Comms, Mode all measurements except Modulation Analysis In MSR Mode, all measurements Not supported in SA6210A
Level [Mode: RTSA, PULSEX]	LEVel	RTSA and Pulse Modes only
FMT [Mode: RTSA, PULSEX]	FMT	RTSA and Pulse Modes only
"External 1/Trig 1" on page 1035	EXTernal1	All modes and measurements
"External 2/Trig 2" on page 1036	EXTernal2	All modes and measurements
"External 3/Trig 3" on page 1037	EXTernal3	All modes and measurements in SA6210A "Mode/Measurement supporting ADC and EXTernal3/5" on page 1024 in the following models – N9032B with option R10, R15, R20, – N9042B with option R10, R15, R20, R40 – Models with option H1G
"Trig 4 " on page 1038	EXTernal4	All modes and measurements in SA6210A
"Trig 5" on page 1039	EXTernal5	Not supported in SA6210A
"RF Burst" on page 1040	RFBurst	All Modes except EMI In Spectrum Analyzer Mode, all measurements except List Sweep Not supported in SA6210A
"Periodic" on page 1041	FRAMe	All Modes except EMI In Spectrum Analyzer Mode, all measurements except List Sweep

		Not supported in SA6210A
TV [Mode: SA]	TV	Spectrum Analyzer Mode only, and only in the Swept SA measurement Not supported in SA6210A

I/Q Triggers

"I/Q Mag" on page 1043	IQMag	All Modes except EMI, Avionics, RTSA, Analog Demod and Pulse In Spectrum Analyzer Mode, only in Power Stat CCDF and Burst Power
"Input I" on page 1043	IINPut	In WCDMA Mode, only in Power Stat CCDF and IQ Waveform In GSM/EDGE Mode, only in EVM, GMSK Phase & Freq Error, Transmit Power and IQ Waveform
"Input Q" on page 1044	QINPut	In Phase Noise Mode, only in IQ Waveform In Bluetooth Mode, only in Transmit Analysis
"I (Demodulated)" on page 1044	IDEMod	In LTE Mode, only in Power Stat CCDF, Modulation Analysis, Conformance EVM, and IQ Waveform
"Q (Demodulated)" on page 1045	QDEMod	In WLAN Mode, only in Power Stat CCDF, Modulation Analysis, Spectral Flatness, and IQ Waveform In Short Range Comms Mode, only in Power Stat CCDF and Modulation Analysis
"Aux I/Q Mag" on page 1045	AIQMag	In VMA Mode, only in Power Stat CCDF, Digital Demod and IQ Waveform In CQM Mode, only in Group Delay, Power Stat CCDF, and IQ Waveform
"PXI" on page 1046	PXI	All Modes and measurements (only found in modular analyzers)
"Internal" on page 1046	INTernal	All Modes and measurements (only found in modular analyzers)
"Audio External" on page 1039	AEXTernal	Via the TRIG IN connector on the M9260A Audio Analyzer module
"Prot Channel Detection" on page 1047	PRTChandet	Base Station Emulation; valid UL signal detected (PUSCH/PUCCH/PRACH/SRS)
"Prot Frame Aligned" on page 1047	PRTFrame	Base Station Emulation; periodic technology format radio frame with data frame aligned to the BSE timing
"Prot Event" on page 1048	PRTEvent	Base Station Emulation events

Mode/Measurement supporting ADC and EXTernal3/5

Trigger Source ADC and **EXTernal3/5** are available only in certain modes and measurements that use Wideband DIF, as follows:

5GNR	Transmit On|Off, Modulation Analysis, Power Stat CCDF, and IQ Waveform measurements only
ADEMOD	Not supported
AVIONICS	Not supported

BT	Not supported
CQM	Group Delay, Power Stat CCDF, and IQ Waveform measurements only
EMI	Not supported
GSMEDGE	IQ Waveform and Transmit Power measurements only
LTEAFDD, LTEATDD	Power Stat CCDF, IQ Waveform, and Transmit On|Off measurements only
MSR	Power Stat CCDF, and IQ Waveform measurements only
PA	Power Amplifier measurement
PNOISE	IQ Waveform measurement only
PULSEX	Pulse measurement only
SA	Power Stat CCDF and Burst Power measurements only
SRCOMMS	Modulation Analysis, Power Stat CCDF, and IQ Waveform measurements only
VMA	Digital Demod, Custom OFDM, IQ Waveform, and Power Stat CCDF measurements only
WCDMA	QPSK EVM, Power Stat CCDF, and IQ Waveform measurements only
WLAN	Spectral Flatness, Modulation Analysis, Power Vs Time, Power Stat CCDF, and IQ Waveform measurements only

Remote Command

Swept SA and RTSA measurements

```
:TRIGger[:SEQuence]:SOURce EXTernal1 | … | EXTernal4 EXTernal5 | AEXTernal | IMMediate | LEVel | FMT | LINE | ADC | FRAMe | RFBurst | VIDeo | TV | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal | PRTChandet | PRTFrame | PRTEvent
```

```
:TRIGger[:SEQuence]:SOURce?
```

All other measurements

```
:TRIGger:<meas>[:SEQuence]:SOURce EXTernal1 | EXTernal2 | EXTernal3 | EXTernal4 | EXTernal5 | AEXTernal | IMMediate | LEVel | FMT | LINE | ADC | FRAMe | RFBurst | VIDeo | TV | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal | PRTChandet | PRTFrame | PRTEvent
```

```
:TRIGger:<meas>[:SEQuence]:SOURce?
```

For option details, see "List of Available Trigger Sources" on page 1022 above

Example

The following commands set the **External 1** trigger input for various measurements

Swept SA and RTSA measurements:

```
:TRIG:SOUR EXT1
```

Other Spectrum Analyzer Mode measurements:

Harmonics:

```
:TRIG:HARM:SOUR EXT1
```

Power Suite measurements (appear in many Modes):

Channel Power:

```
:TRIG:CHP:SOUR EXT1
```

Notes

For some of the trigger parameters, the tie-in to the parameter is not obvious. These are:

`IMMediate`, selects **Free Run**

	FRAMe , selects **Periodic Trigger** FMT, selects **Frequency Mask Trigger** AEXTernal, selects **Audio External** trigger, using the TRIG IN connector on the M9260A Audio Analyzer module For most measurements, the <measurement> keyword follows TRIGger. For SA and RTSA Modes, do *not* use the <measurement> keyword. Using the wrong command form will result in an Undefined Header error Other trigger-related commands are found in the :INITiate and :ABORt SCPI command subsystems *OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned Available ranges and presets can vary from mode to mode **FMT (Pulse and RTSA Modes):** The amplitude resolution of the Frequency Mask is coupled to the Scale/Division. There are 256 vertical points therefore the amplitude resolution is computed using the algorithm: (10 * Scale/Div) / # Vertical Points
Dependencies	Not all trigger sources are available for each input. See "RF Trigger Source (Remote Command Only)" on page 1031 and "I/Q Trigger Source (Remote Command Only)" on page 1032 commands for detailed information on which trigger sources are available for each input If the models do not have corresponding External trigger input, the selection is not shown and sending a command generates a “Hardware missing; Not available for this model number” error For E7760, the only available selections are: EXTernal1|IMMediate|INTernal|RFBurst|VIDeo For UXM, the only available selections are: EXTernal1|IMMediate|PRTChandet|PRTFrame|PRTEvent In Pulse Mode, when Option B2X and H1G are installed and Digital IF BW is greater than 255.176 MHz, only three trigger sources, IMMediate, LEVel, and EXTernal3 are available **Level Trigger (Pulse and RTSA Modes):** Level trigger is allowed in average detector mode When Level Trigger is the selected trigger source in the Spectrum measurement, Spectrum minimum Acquisition Time is limited to the PVT minimum Acquisition Time. If the Spectrum Acquisition Time changed as a result of going into **Level** trigger, a message is posted “Min Acq Time is 200 usec when Level Trigger is ON”. When **Level** trigger is no longer the selected trigger source, Spectrum minimum Acquisition Time is restored **FMT (Pulse and RTSA Modes):** If you were not in **Free Run** when you entered the FMT Setup View, you can change trigger source to **Free Run** while in the editor. This lets you configure the mask with a continually updating trace. When exiting FMT Setup View, the trigger source changes back to **FMT** For Power Stat CCDF and IQ Waveform measurements in 5G NR and LTEATDD Modes, switching the radio direction changes this parameter to the preset value In Transmit On|Off Power measurement in 5G NR and LTEATDD Modes, the value changes as follows – If changed to uplink: Periodic

	– If changed to downlink: External 1 except for models with the H1G option. With the H1G option, it changes as follows – External 1, when Info BW ≤ 255 MHz – External 3, when Info BW ≥ 256 MHz
Couplings	**FMT (Pulse and RTSA Modes):** A remote user can enter or access FMT data via `:TRIGger[:SEQuence]:FMT[1]|2:DATA` The upper and lower masks can have different freq/ampl pairs therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask
Preset	See "Trigger Source Presets" on page 1027 below
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears

Trigger Source Presets

The preset values for each measurement after **Mode Preset** or **Meas Preset** are as follows:

Meas	Mode	Preset for RF	Preset for IQ
Swept SA	`SA`	`IMM`	IQ not supported
CHP	`SA, WCDMA, MSR,SRCOMMS, 5GNR, WLAN`	`IMM`	IQ not supported
OBW	`SA, WCDMA, LTEAFDD, LTEATDD, BT, 5GNR, WLAN`	1xEVDO: `EXT1` Others: `IMM`	IQ not supported
Transmit Analysis	`BT`	`RFB`	`IQM`
Adjacent Channel Power	`BT`	`IMM`	IQ not supported
LE In-band Emissions	`BT`	`IMM`	IQ not supported
EDR In-band Spurious Emissions	`BT`	RF Burst	IQ not supported
CCDF	`SA, WCDMA, LTEAFDD, LTEATDD, MSR,SRCOMMS, 5GNR, WLAN, CQM`	LTEATDD: – BTS: External 1 – MS: Periodic Timer Others: `IMM`	LTEATDD: - BTS: `EXT1` - MS: `FRAM` Others: `IMM`
ACP	`SA, WCDMA, LTEAFDD, LTEATDD, MSR,SRCOMMS, 5GNR`	`IMM`	IQ not

Meas	Mode	Preset for RF	Preset for IQ
			supported
Tx Power	SA, GSM	RFBurst	IMM
SPUR	SA, WCDMA, MSR, LTEAFDD, LTEATDD, 5GNR, WLAN	IMM	IQ not supported
SEM	SA, WCDMA, MSR, LTEAFDD, LTEATDD, SRCOMMS, 5G NR, WLAN	IMM	IQ not supported
CDP	WCDMA	IMM	IMM
RHO	WCDMA	IMM	IMM
PCON	WCDMA	IMM	IMM
QPSK	WCDMA	EXT1	IMM
MON	All except: SA, BASIC	IMM	IQ not supported
WAV	All except: SA	LTEATDD: – BTS: External 1 – MS: Periodic Timer GSM/EDGE: RFBurst All others: IMM	LTEATDD: - BTS: EXT1 - MS: FRAM GSM/EDGE: IQM All others: IMM
EVM	LTEAFDD, LTEATDD, SRCOMMS, 5GNR, WLAN	IMM	IMM
PVT	WLAN	RFB	IQ not supported
Spectral Flatness	WLAN	IMM	IMM
SPEC	BASIC	IMM	IMM
LOG Plot	PN	IMM	IQ not supported
Spot Freq	PN	IMM	IQ not supported
GMSK PVT	EDGE/GSM	RFB	IMM
GMSK PFER	EDGE/GSM	RFB	IQM
GMSK ORFS	EDGE/GSM	RFB	IQ not supported
EDGE PVT	EDGE/GSM	RFB	IMM
EDGE EVM	EDGE/GSM	RFB	IQM
EDGE ORFS	EDGE/GSM	Periodic Timer	IQ not supported
Combined WCDMA	WCDMA	IMM	IQ not supported

Meas	Mode	Preset for RF	Preset for IQ
Combined GSM	EDGE/GSM	RFB	IQ not supported
List Power Step	WCDMA, EDGE/GSM	IMM	IQ not supported
Transmit On/Off Power	LTETDD, LTEATDD, 5GNR	BTS: External 1 (External3 when IFBW ≥ 256 MHz with H1G option) MS: Periodic Timer	BTS: EXT1 MS: FRAM
Transmit Analysis	BLUETOOTH	RFB	IQ not supported
Adjacent Channel Power	BLUETOOTH	IMM	IQ not supported
LE In-band Emissions	BLUETOOTH	IMM	IQ not supported
EDR In-band Spurious Emissions	BLUETOOTH	Periodic Timer	IQ not supported
Conformance EVM	LTEAFDD, LTEATDD, MSR	IMM	IMM
Spectrum & PvT	RTSA	IMM	IQ not supported
Pulse	PULSEX	IMM	IQ not supported
AM, FM, PM, FM Stereo	ADEMOD	IMM	IQ not supported
PAvT	SA, 5GNR, VMA	IMM	IMM
Group Delay	CQM	IMM	IMM

Trigger Parameter Applicability

The **Trigger** menus let you select the trigger source and trigger settings for a sweep or measurement. In triggered operation (basically, any trigger source other than **Free Run**), the instrument will begin a sweep or measurement only when the selected trigger conditions are met, generally when your trigger source signal meets the specified trigger level and polarity requirements. (In FFT measurements, the trigger controls when the data acquisition begins for FFT conversion.)

For each of the trigger sources, you may define a set of operational parameters or settings, which will be applied when that source is selected as the current trigger source. Examples of these settings are **Trigger Level**, **Trigger Delay**, and **Trigger Slope**. You may apply different settings for each source; so, for example, you could have a **Trigger Level** of 1 V for **External 1** trigger and –10 dBm for **Video** trigger.

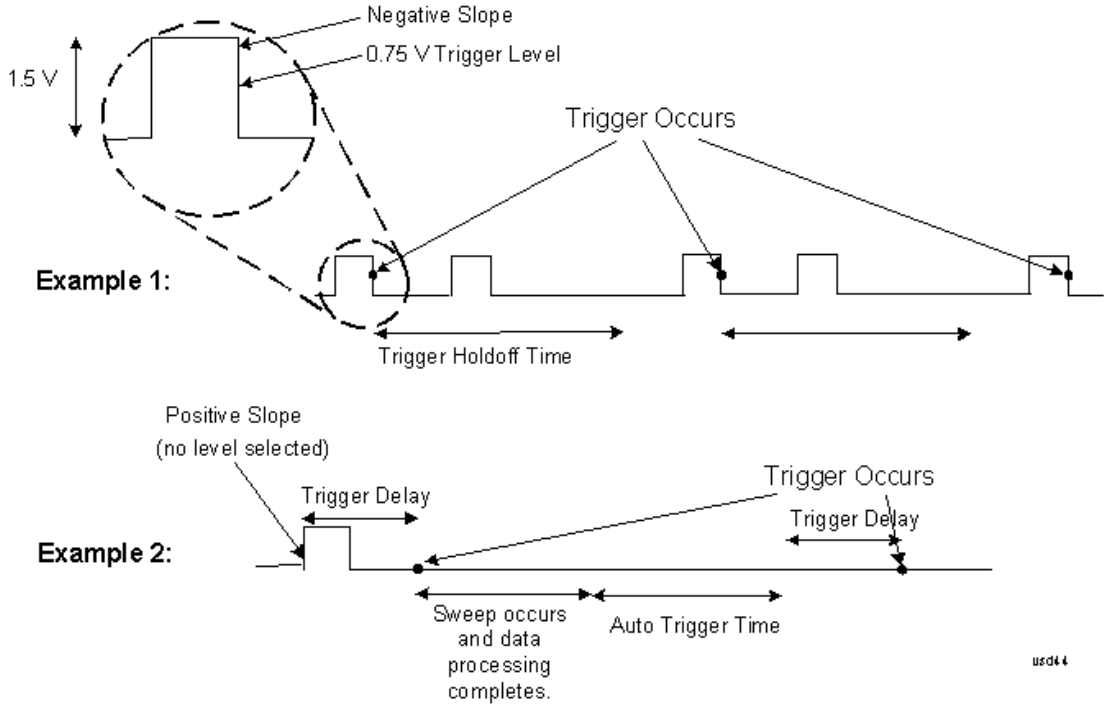
Once you have established the settings for a given trigger source, they generally will remain unchanged for that trigger source as you go from measurement to measurement within a Mode (although the settings can change as you go from Mode to Mode). Furthermore, the trigger settings within a Mode are the same for the Trigger menu, the Gate Source menu, and the Periodic Sync Src menu. That is, if Ext1 trigger level is set to 1 V in the Trigger menu, it will appear as 1 V in both the Gate Source and the Periodic Sync Src menus. For these reasons, the trigger settings commands are not qualified with the measurement name, the way the trigger source commands are.

Trigger Setup Parameters

The following examples show trigger setup parameters using an external trigger source.

Example 1 illustrates the trigger conditions with negative slope and no trigger occurs during trigger Holdoff time.

Example 2 illustrates the trigger conditions with positive slope, trigger delay, and auto trigger time.



Backwards Compatibility SCPI

The following SCPI commands are provided for Backwards Compatibility:

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:SOURCe EXTernal`
	For backward compatibility, the parameter `EXTernal` is mapped to `EXTernal1`
	`[:SENSe]:<measurement>:TRIGger:SOURce`
	This backwards compatibility alias command is provided for ESA/PSA compatibility
	This backwards compatibility command does not apply to the Swept SA measurement, for that just use `:TRIGger:SOURCe`
	This backwards compatibility command does not apply to the monitor spectrum, log plot and spot frequency measurements
	`[:SENSe]:<measurement>:TRIGger:SOURce IF`
	In earlier instruments, the parameter IF was used by apps for the video trigger, so using the IF parameter selects `VIDeo` triggering. Sending IF in the command causes `VID` to be returned to a query
	`[:SENSe]:ACPR:TRIGger:SOURce`
	This backwards Compatibility SCPI command is provided to support the same functionality as `[:SENSe]:ACPr:TRIGger:SOURce` (PSA W-CDMA, PSA cdma2000 and PSA 1xEVDO) due to the fact that the `ACPr` node conflicts with the `ACPower` node
	The legacy command:
	`:TRIGger[:SEQuence]:RFBurst:FSELectivity[:STATe] OFF | ON | 0 | 1`
	is not supported in the X-Series, as the hardware to do Frequency Selective burst triggers does not exist in X-Series

RF Trigger Source (Remote Command Only)

Selects the trigger to be used for the specified measurement when RF is the selected input. The RF trigger source can be queried and changed even while another input is selected, but it is inactive until RF becomes the selected input.

Note the inclusion of the <measurement> parameter in the command below. Because each measurement remembers its own trigger source, the command must be qualified with the measurement name.

Remote Command	Swept SA and RTSA measurements
	`:TRIGger[:SEQuence]:RF:SOURce EXTernal1 | EXTernal2 | EXTernal3 | EXTernal4 | AEXTernal | IMMediate | LEVel | FMT | LINE | ADC | FRAMe | RFBurst | VIDeo | TV | PXI | INTernal | PRTChandet | PRTFrame | PRTEvent`
	`:TRIGger[:SEQuence]:RF:SOURce?`
	All other measurements
	`:TRIGger:<meas>[:SEQuence]:RF:SOURce EXTernal1 | EXTernal2 | EXTernal3 | EXTernal4 | AEXTernal | IMMediate | LEVel | FMT | LINE | ADC | FRAMe | RFBurst | VIDeo | TV | PXI | INTernal | PRTChandet | PRTFrame | PRTEvent`
	`:TRIGger:<meas>[:SEQuence]:RF:SOURce?`
	For option details, see "List of Available Trigger Sources" on page 1022 above

Example	`:TRIG:ACP:RF:SOUR EXT1`

	`:TRIG:RF:SOUR VID`
Notes	`*OPC` should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned Available ranges, and presets can vary from Mode to Mode
Dependencies	The available choices for VXT are: Free Run, Video, Internal, External 1, External 2, RF Burst, Periodic and PXI In VXT, Internal is only in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E, not in models M9420/21A, and Internal and Periodic are not available in Spectrum Analyzer Mode `PXI` is only found in VXT The available choices for EXM are Free Run, Video, Internal, External 1, External 2, RF Burst, and Periodic The available choices for UXM are Free Run, External 1, Prot Channel Detection, Prot Frame Aligned, and Prot Event Prot Channel Detection, Prot Frame Aligned, and Prot Event are only available in UXM The available choices for E7760 are Free Run, External 1, Internal, Video and RF Burst If the models do not have corresponding External trigger input, the selection is not shown and sending a command generates a “Hardware missing; Not available for this model number” error
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 seconds. This message goes away when a trigger signal appears

I/Q Trigger Source (Remote Command Only)

Selects the trigger to be used for the specified measurement when I/Q (which requires Option BBA) is the selected input. The I/Q trigger source can be queried and changed even while another input is selected, but it is inactive until I/Q becomes the selected input.

Remote Command	`:TRIGger:<measurement>[:SEQuence]:IQ:SOURce EXTernal1 | EXTernal2 | IMMediate | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag`
	For option details, see "List of Available Trigger Sources" on page 1022 above
	`:TRIGger:<measurement>[:SEQuence]:IQ:SOURce?`

Example	`:TRIG:WAVeform:SOUR IQM` Selects I/Q magnitude triggering for the IQ Waveform measurement and the I/Q input
Notes	Not all measurements support all trigger sources Note that not all trigger sources are available for each input, and that the available parameters are model number and hardware dependent For the **I/Q Trigger Source,** the following trigger sources are available:

IMMediate	Free run triggering
EXTernal1 or EXTernal	Triggers on an externally connected trigger source on the rear panel
EXTernal2	Triggers on an externally connected trigger source on the front panel
IQMag	Triggers on the magnitude of the I/Q signal
IDEMod	Triggers on the I/Q signal's demodulated I voltage
QDEMod	Triggers on the I/Q signal's demodulated Q voltage
IINPut	Triggers on the I channel's ADC voltage
QINPut	Triggers on the Q channel's ADC voltage
AIQMag	Triggers on the magnitude of the auxiliary receiver channel I/Q signal

*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned

Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears

8.1.1.1 Free Run

Free Run triggering occurs immediately after the sweep/measurement is initiated.

Example	Swept SA measurement: :TRIG:SOUR IMM Measurements other than Swept SA: :TRIG:<meas>:SOUR IMM
Annunciation	Free Run (in the Meas Bar)

8.1.1.2 Video

The Video trigger condition is met when the video signal at the left edge of the graticule (the filtered and detected version of the input signal, including both RBW and VBW filtering) crosses the video trigger level with the chosen slope.

The Video trigger level is shown as a labeled line on the display. The line is displayed as long as Video is the selected trigger source. The Trigger Level line can be adjusted using the step keys, knob, or numeric keypad. It can also be dragged on the display with your finger or with a mouse.

When the detector selected for all active traces is the average detector, the video signal for triggering does not include any VBW filtering.

Log Plot and Spot Frequency measurements, in Phase Noise Mode, do not support **Video** Trigger.

The **Trigger** tab contains the following trigger-source dependent controls when **Video** is selected:

- "Trigger Level" on page 1048
- "Prot Frame Aligned" on page 1047
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present, which do not depend on the selected trigger source.

Note that **Video** Trigger is a software trigger of the acquired trace for some measurements and a hardware trigger of the IF envelope for others. Most measurements support one method or the other, although some (like ACP) do not support **Video** Trigger at all. For those measurements that support **Video** Trigger as a software trigger, the **Trigger Level** units depend on the current **Y Axis Unit** for the measurement; for those that support **Video** Trigger as an IF Envelope trigger, the units are typically dBm.

Example	Swept SA measurement:
	`:TRIG:SOUR VID`
	Measurements other than Swept SA:
	`:TRIG:<meas>:SOUR VID`

Annunciation	Video (in the Meas Bar)

8.1.1.3 ADC

Some IF Paths in certain models (such as N9042B) in IQ Measurements have an **ADC Trigger**. ADC is like **Video** trigger, but with 2 limitations due to a lack of post-processing.

First, the trigger is not limited to the current measurement's setup IF BW. The trigger sees everything in the passband, so measurements like IQA Complex Spectrum can be triggered outside of the current Digital IF BW.

The final limitation is, due to lack of post-processing, the amplitude accuracy of **ADC Trigger** is less than the video trigger.

If ADC Trigger is available for at least one IF Path on a model, then ADC Trigger will always be available as a trigger option in IQ Measurements. However, it is only selectable (not grayed-out) when using IF Paths that support it.

If "Video" on page 1033 Trigger is selected, and measurement setup (IF Path or IF BW) is changed to a path that only supports ADC Trigger instead, then ADC Trigger will be selected and *vice versa*.

Example	Measurements other than Swept SA: `:TRIG:<meas>:SOUR ADC`
Annunciation	ADC (in the Meas Bar)

8.1.1.4 Line

When LINE is selected, start of a new sweep/measurement will be synchronized with the next cycle of the line voltage.

Line trigger is not available when operating from a "dc power source", for example, when the instrument is powered from batteries.

Line trigger is not available when using modular instruments like the VXT.

The Trigger tab contains the following trigger-source-dependent controls when LINE is selected:

- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that are not dependent on the selected trigger source.

Example	`:TRIG:SOUR LINE`
	Swept SA measurement
	`:TRIG:<meas>:SOUR LINE`
	Measurements other than Swept SA

Annunciation	LINE (in the Meas Bar)

8.1.1.5 External 1/Trig 1

When `EXTernal1` is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 1 IN input connector on the rear panel.

Grayed-out if External 1/Trig 1 is in use by Point Trigger in the Source Setup menu of Swept SA. Forced to `IMM` if already selected and Point Trigger is set to `EXTernal1`.

The **Trigger** tab contains the following trigger-source-dependent controls when `EXTernal1` is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Level" on page 1048
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054
- "Zero Span Delay Compensation" on page 1065

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:SOUR EXT1`
	Swept SA measurement
	`:TRIG:<meas>:SOUR EXT1`
	Measurements other than Swept SA

Notes	Triggers on an externally connected trigger source marked “Trigger 1 In” on the rear panel of standalone instruments, “Trigger 3” on the front panel of EXM and VXT models M9420A/21A, and “Trigger 1” on the front panel of VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Annunciation	Trig 5 (in the Meas Bar)

8.1.1.6 External 2/Trig 2

When `EXTernal2` is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 2 IN input connector on the rear panel.

Grayed-out if **External2/Trig2** is in use by Point Trigger in the **Source Setup** menu of Swept SA. Forced to `IMM` if already selected and Point Trigger is set to `EXTernal2`.

The **Trigger** tab contains the following trigger-source-dependent controls when `EXTernal2` is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Level" on page 1048
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054
- "Zero Span Delay Compensation" on page 1065

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:SOUR EXT2`
	Swept SA measurement
	`:TRIG:<meas>:SOUR EXT2`
	Measurements other than Swept SA

Notes	Triggers on an externally connected trigger source marked “Trigger 2 In” on the front panel of standalone instruments, and “Trigger 1” on the front panel of EXM and VXT models M9420A/21A, and “Trigger 2” on the front panel of VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E. In some models, there is no second External input. In these models, the External 2 selection is not shown and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” message
Annunciation	External 2 (in the Meas Bar)

8.1.1.7 External 3/Trig 3

When `EXTernal3` is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 3 IN input connector on the rear panel.

Grayed-out if External 3/Trig 3 is in use by Point Trigger in the Source Setup menu of Swept SA. This control only appears in certain models and option combinations, as follows.

- For N9032B/N9042B, selects the Precision External Trigger, but available only when IF Path is 255 MHz or wider. The resolution will be within one sample count of the 4.8 GHz ADC sampling rate for 255 ~ 2 GHz IF Paths, and within one sample count of the 10.2 GHz sampling rate for the 4 GHz IF Path
- For models with H1G, it is only available when the 1 GHz path is chosen either directly or indirectly; in all other paths it is visible but grayed-out. Direct and indirect selection of the 1 GHz path occurs as follows:
  - Direct: Measurements that directly support the 1 GHz path have a 1 GHz selection in the IF Path menu in Meas Setup
  - Indirect: Certain measurements, such as Power Statistics CCDF (PST), always select the widest available path, and so will select the 1 GHz path if it is available, even if there is no IF Path menu for the measurement. External 3/Trig 3 will be visible when this results in the 1 GHz path being selected, even if there is no control or readout indicating that the 1 GHz path has been selected

For a full list of Modes and measurements that support `EXTernal3`, see "Select Trig Source" on page 1021 in the "Select Trig Source" on page 1021 section.

When `EXTernal3` is set, and then becomes disabled because you switched away from the 1 GHz path, the trigger source selection reverts to the default ("Free Run" on page 1033).

Note that for SA6210A, it appears as normal trigger.

When EXTernal3 is selected, the Trigger tab displays the following trigger-source-dependent controls:

- "Prot Frame Aligned" on page 1047
- "Trigger Level" on page 1048
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	:TRIG:<meas>:SOUR EXT3
Notes	Triggers on an externally connected trigger source marked “Trigger 2 In” on the front panel of standalone instruments, and “Trigger 1” on the front panel of EXM and VXT models M9420A/21A, and “Trigger 2” on the front panel of VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E. In some models, there is no second External input. In these models, the External 2 selection is not shown and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” message
Annunciation	External 3/Trig 3 (in the Meas Bar)

8.1.1.8 Trig 4

When EXTernal4 is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 4 IN input connector on the rear panel.

Grayed-out if Trig 4 is in use by Point Trigger in the Source Setup menu of Swept SA. Forced to IMM if already selected and Point Trigger is set to EXTernal4.

The Trigger tab contains the following trigger-source-dependent controls when EXTernal4 is selected:

- "Trigger Level" on page 1048
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	:TRIG:SOUR EXT4 :TRIG:<meas>:SOUR EXT4
Annunciation	Trig 4 (in the Meas Bar)

8.1.1.9 Trig 5

When EXTernal5 is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 5 IN input connector on the rear panel.

Grayed-out if Trig 5 is in use by Point Trigger in the Source Setup menu of Swept SA. This control only appears in certain models and option combinations.

For SA6210A, selects the Precision External Trigger, but available only when IF Path is 480 MHz or wider.

For a full list of Modes and measurements that support EXTernal5, see "Select Trig Source" on page 1021 in the "Select Trig Source" on page 1021 section.

When EXTernal5 is set, and then becomes disabled because you switched away from the wideband path, the trigger source selection reverts to the default ("Free Run" on page 1033).

When EXTernal5 is selected, the Trigger tab displays the following trigger-source-dependent controls:

- "Trigger Level" on page 1048
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:SPEC:SOUR EXT5`
Annunciation	Trig 5 (in the Meas Bar)

8.1.1.10 Audio External

When AEXternal is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIG IN input connector on the front panel of the M9260A Audio Analyzer module. This is a TTL level input (*not* analog) that supports both rising edge and falling edge triggers.

Only appears in modular instruments, and only when the M9260A Audio Analyzer module is installed, such as in M8920A.

The Trigger tab contains the following trigger-source-dependent controls when AEXternal is selected:

- "Trigger Delay" on page 1051

– "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	Set Audio External as the trigger source for the Radio Test measurement: `:TRIG:RTES:SOUR AEXT`
Annunciation	Audio Ext (in the Meas Bar)

8.1.1.11 RF Burst

When RFBurst is selected, a new sweep/measurement starts when an RF burst envelope signal is identified from the signal at the RF Input connector.

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The instrument automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the instrument.

The Trigger tab contains the following trigger-source-dependent controls when RFBurst is selected:

– "Trigger Level Absolute/Relative" on page 1055

– "Absolute Trig Level" on page 1056

– "Relative Trig Level" on page 1057

– "Trigger Delay" on page 1051

– "Trigger Slope" on page 1054

– "Zero Span Delay Compensation" on page 1065

Additional controls are also present that do not depend on the selected trigger source.

Example	:TRIG:SOUR RFB Swept SA measurement :TRIG:<meas>:SOUR RFB Measurements other than Swept SA
Annunciation	RF Burst (in the Meas Bar)

8.1.1.12 Periodic

When FRAMe is selected, the instrument uses a built-in periodic timer signal as the trigger. Trigger occurrences are set by the Periodic Timer parameter, which is modified by Offset and Periodic Sync Src.

Use this trigger when there is a periodic signal but no reliable signal on which to trigger. You can synchronize the periodic signal with outside events (using Periodic Sync Src) to get closer to a reliable trigger signal (see "More Information" on page 1041 below).

If you do not have a sync source selected (OFF), then the internal timer is not synchronized with any external timing events.

The Trigger tab contains the following trigger-source-dependent controls when FRAMe is selected:

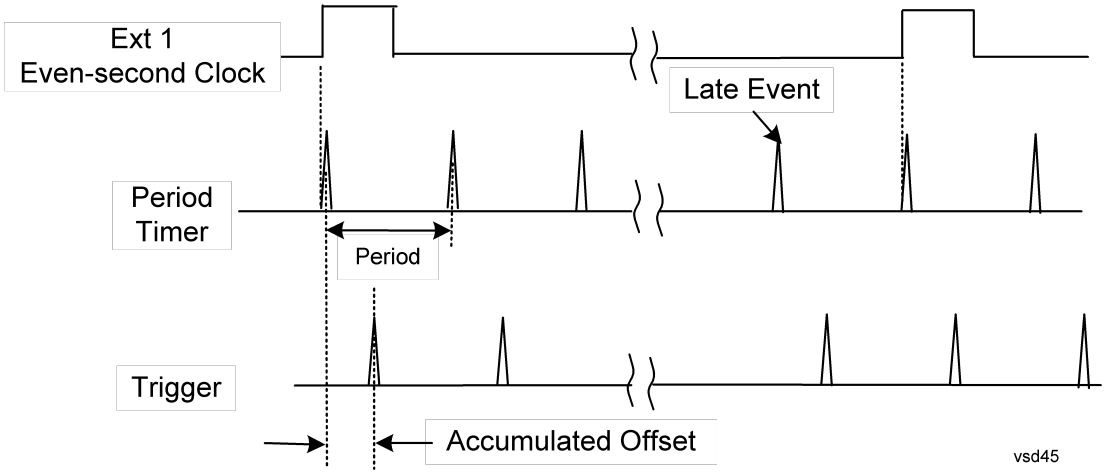
- "Period" on page 1058
- "Offset" on page 1059
- "Reset Offset Display" on page 1060
- "Sync Source" on page 1061
- "Trigger Delay" on page 1051

Additional controls are also present that do not depend on the selected trigger source.

Example	:TRIG:SOUR FRAM Swept SA measurement :TRIG:<meas>:SOUR FRAM Measurements other than Swept SA
Annunciation	Periodic (in the Meas Bar)

More Information

The graphic below shows the action of the periodic timer trigger.



A common application is measuring periodic burst RF signals for which a trigger signal is not easily available. For example, we might be measuring a TDMA radio that bursts every 20 ms. Let's assume that the 20 ms period is very consistent. Let's also assume that we do not have an external trigger source available that is synchronized with the period, and that the signal-to-noise ratio of the signal is not high enough to provide a clean RF burst trigger at all of the analysis frequencies. For example, we might want to measure spurious transmissions at an offset from the carrier that is larger than the bandwidth of the RF burst trigger. In this application, we can set the Periodic Timer to a 20.00 ms period and adjust the offset from that timer to position our trigger just where we want it. If we find that the 20.00 ms is not exactly right, we can adjust the period slightly to minimize the drift between the period timer and the signal to be measured.

A second way to use this feature would be to use Sync Source temporarily, instead of Offset. In this case, we might tune to the signal in a narrow span and use the RF Burst trigger to synchronize the periodic timer. Then we would turn the sync source off so that it would not miss-trigger. Miss-triggering can occur when we are tuned so far away from the RF burst trigger that it is no longer reliable.

A third example would be to synchronize to a signal that has a reference time element of much longer period than the period of interest. In some CDMA applications, it is useful to look at signals with a short periodicity, by synchronizing that periodicity to the "even-second clock" edge that happens every two seconds. Thus, we could connect the even-second clock trigger to Ext1 and then use Ext1 as the sync source for the periodic timer.

The figure below illustrates this third example. The top trace represents the even-second clock. It causes the periodic timer to synchronize with the leading edge shown. The instrument trigger occurs at a time delayed by the accumulated offset from the period trigger event. The periodic timer continues to run, and triggers continue to occur, with a periodicity determined by the instrument time base. The timer output (labeled "late event") will drift away from its ideal time due to imperfect matching between the time base of the signal being measured and the time base of

the instrument, and also because of imperfect setting of the period parameter. But the synchronization is restored on the next even-second clock event. ("Accumulated offset" is described in the in the Offset function section.)

8.1.1.13 I/Q Mag

When IQMag is selected, the trigger condition is met when the I/Q magnitude crosses the I/Q magnitude trigger level. The magnitude is measured at the output of the main I/Q digital receiver.

This trigger type is only valid for measurements that support I/Q inputs.

The Trigger tab contains the following trigger-source-dependent controls when IQMag is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:<meas>:SOUR IQM`
Annunciation	I/Q Mag (in the Meas Bar)

8.1.1.14 Input I

When IINPut is selected, the condition is met when the voltage at the I Input crosses the trigger level.

This trigger type is only valid for measurements that support I/Q inputs.

The Trigger tab contains the following trigger-source-dependent controls when IINPut is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:<meas>:SOUR IINP`
Annunciation	Input I (in the Meas Bar)

8.1.1.15 Input Q

When QINPut is selected, the condition is met when the voltage at the I Input crosses the trigger level.

This trigger type is only valid for measurements that support I/Q inputs.

The Trigger tab contains the following trigger-source-dependent controls when QINPut is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:<meas>:SOUR QINP`
Annunciation	Input Q (in the Meas Bar)

8.1.1.16 I (Demodulated)

When IDEMod is selected, the trigger condition is met when the I voltage crosses the I voltage trigger level.

This trigger type is only valid for measurements that support I/Q inputs.

The Trigger tab contains the following trigger-source-dependent controls when IDEMod is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:<meas>:SOUR IDEM`
Annunciation	I (Demod) (in the Meas Bar)

8.1.1.17 Q (Demodulated)

When QDEMod is selected, the trigger condition is met when the Q voltage crosses the Q voltage trigger level.

This trigger type is only valid for measurements that support the I/Q inputs.

The Trigger tab contains the following trigger-source-dependent controls when QDEMod is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:<meas>:SOUR QDEM`
Annunciation	Q (Demod) (in the Meas Bar)

8.1.1.18 Aux I/Q Mag

When AIQMag is selected, the trigger condition is met when the auxiliary receiver's I/Q magnitude output crosses the Auxiliary I/Q magnitude trigger level.

This trigger type is only valid for measurements that support I/Q inputs.

The Trigger tab contains the following trigger-source-dependent controls when AIQMag is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054
- "Trigger Center Frequency" on page 1064
- "Trigger BW" on page 1064

Additional controls are also present that do not depend on the selected trigger source.

Example	`:TRIG:<meas>:SOUR AIQM`
Annunciation	Aux I/Q Mag (in the Meas Bar)

8.1.1.19 PXI

When PXI is selected, a new sweep/measurement will start when detecting the signal from the PXI backplane trigger line.

This trigger type is only found in modular instrument products.

The Trigger tab contains the following trigger-source-dependent controls when PXI is selected:

- "Select PXI Line" on page 1066
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

Example	Swept SA measurement:
	`:TRIG:SOUR PXI`
	Measurements other than Swept SA:
	`:TRIG:<meas>:SOUR PXI`

Annunciation	PXI (in the Meas Bar)

8.1.1.20 Internal

When INTernal is selected, the trigger condition is met when detecting the signal from the internal RF Source module.

This trigger type is only found in modular instrument products.

The Trigger tab contains the following trigger-source-dependent controls when INTernal is selected:

- "Prot Frame Aligned" on page 1047
- "Trigger Delay" on page 1051
- "Trigger Slope" on page 1054

Additional controls are also present that do not depend on the selected trigger source.

For an Internal trigger to occur, there must be a trigger output from the internal RF source. This means that you must configure the Source Trigger Output before selecting Internal as the trigger source. To enable the Source Trigger Output, output

trigger should not be off if internal source works as list sequence mode and Trig 2 Out should not be off if internal source works as MXG mode. Otherwise, no trigger occurs, and measurement does not start.

Example	Swept SA measurement:
	`:TRIG:SOUR INTernal`
	Measurements other than Swept SA:
	`:TRIG:<meas>:SOUR INTernal`

Annunciation	Internal (in the Meas Bar)

8.1.1.21 Prot Channel Detection

Selects a protocol channel detection Base Station Emulation as the trigger. When PRTChandet is selected, a new sweep/measurement will start when the protocol channel detection trigger condition is met.

Prot Channel Detection trigger is defined as the Base Station Emulation protocol channel detection event of PUSCH, PUCCH, PRACH or SRS. With this trigger, the IQ data, and therefore the measurement, is aligned at the beginning of the LTE sub-frame where the particular event was detected. Channel transmission is aligned to the sub-frame boundary; therefore, the measurement is aligned with its transmission with the exception of SRS, which might not start at the beginning of the sub-frame containing the SRS as it might have an offset from the start of the sub-frame base on the SRS configuration, In this case, the trigger and measurement are aligned to the beginning of the sub-frame containing SRS as defined by this trigger type (which is not the beginning of the SRS itself due to the offset).

This trigger type is only available in UXM.

Example	`:TRIG:<meas>:SOUR PRTC`
Annunciation	Prot Chan Det (in the Meas Bar)

8.1.1.22 Prot Frame Aligned

Selects a protocol frame aligned Base Station Emulation as the trigger. When PRTFrame is selected, a new sweep/measurement will start when the protocol frame aligned data trigger condition is met.

Prot Frame Aligned trigger is aligned with the Base Station Emulation Protocol uplink frame timing boundary. It depends on the technology format of the base station call processing.

This trigger type is only available in UXM.

Example	`:TRIG:<meas>:SOUR PRTF`
Annunciation	Prot Frame (in the Meas Bar)

8.1.1.23 Prot Event

Selects a protocol frame aligned Base Station Emulation as the trigger. When PRTEvent is selected, a new sweep/measurement will start when the protocol frame aligned data trigger condition is met.

Prot Event trigger is defined as the Base Station Emulation protocol internal event such as the starting of a predefined uplink pattern for a relative power control ramp. With this trigger, the IQ data, and therefore the measurement, is aligned with the start of the desired uplink pattern.

This trigger type is only available in UXM.

Example	`:TRIG:<meas>:SOUR PRTE`
Annunciation	Prot Event (in the Meas Bar)

8.1.2 Trigger Level

Sets the amplitude level for trigger and gate sources that use level triggering. When the video signal crosses this level, with the chosen slope, the trigger occurs.

For any given Trigger, Gate, or Periodic Sync Src, the same Trigger Level is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

If Video is the selected trigger source, the trigger level displays as a green horizontal line with the label TRIG LVL just above it on the right:



If the value of trigger level is off screen low this line displays along the bottom of the graticule. If the value of trigger level is off screen high this line displays above the graticule but no farther above than 1.5 % of the graticule height (the same as the trace itself). Note that the `TRIG LVL` label cannot display above the graticule, so the label itself stops at the top of the graticule.

For the I/Q Triggers, the I/Q reference impedance is used for converting between power and voltage.

Trigger Level Parameters

Source	Example	Min	Max	Preset	Resolution	Step Key Incr	Knob Incr
Video	`TRIG:VID:LEV -40 dBm`	-170 dBm	+30 dBm	-25 dBm	.01 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
Level	`TRIG:LEV:LEV -40 dBm`	-170 dBm	+30 dBm	-25 dBm	.01 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
EXTernal1|2|3|4	`TRIG:EXT1:LEV 0.4 V`	-5 V VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E: 0 V	5 V VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E: 2.5 V	1.2 V	10 mV	0.5 V	0.1 V
I/Q Mag	`TRIG:IQM:LEV -30 dBm`	-200 dBm	100 dBm	-25 dBm	.1 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
I (Demod)	`TRIG:IDEM:LEV 0.5 V`	–1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Q (Demod)	`TRIG:QDEM:LEV 0.5 V`	–1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Input I	`TRIG:IINP:LEV 0.5 V`	–1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Input Q	`TRIG:QINP:LEV 0.5 V`	–1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Aux Chan I/Q Mag	`TRIG:AIQM:LEV -30 dBm`	–200 dBm	100 dBm	–25 dBm	.1 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
Internal	`TRIG:INT:LEV 1.2 V`	–5 V VXT models	5 V VXT models	1.2 V	10 mV	.5 V	.1 V

Source	Example	Min	Max	Preset	Resolution	Step Key Incr	Knob Incr
		M9410A/11A/15A/16A and M9410E/11E/15E/16E: 0 V	M9410A/11A/15A/16A and M9410E/11E/15E/16E: 2.5 V				
ADC	`TRIG:ADC:LEV -30 dBm`	–170 dBm	30 dBm	–25 dBm	.01 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:LEVel <ampl>`
	`:TRIGger[:SEQuence]:<trig_source>:LEVel?`
	where `<trig_source>` is one of:
	`EXTernal1 | EXTernal2 | EXTernal3 | EXTernal4 | VIDeo | ADC | LEVel | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | INTernal`

Example	`:TRIG:VID:LEV -40 dBm`
Dependencies	Only appears when VIDeo, EXTernal1|2|3|4, ADC, LEVel or an I/Q trigger is selected as the Trigger Source
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:IF:LEVel`
	taken as video trigger level
	`:TRIGger[:SEQuence]:IF:LEVel?`
	taken as video trigger level query
	`:TRIGger[:SEQuence]:EXTernal:LEVel`
	the parameter EXTernal is mapped to EXTernal1
	`:TRIGger[:SEQuence]:FRAMe:EXTernal1:LEVel`

More Information

For VideoTrigger Level, when sweep type = FFT, the video trigger uses the amplitude envelope in a bandwidth wider than the FFT width as a trigger source. This can be useful but does not have the same relationship between the displayed trace and the trigger level as in swept triggering.

For VideoTrigger Level the settable resolution of the function is 0.01 dB, even when the Y Axis Unit is linear. In Linear Y Axis Unit (for example, Volts) this requires 4 significant digits to display on the control.

For the Level trigger source, used in RTSA Mode, and in other measurements, External Gain and Ref Level Offset modify the actual trace data as it is taken and are taken into account by Trigger Level.

8.1.3 Trigger Delay

Controls a time delay that the instrument will wait to begin a sweep after meeting the trigger criteria, for Trigger and Gate sources that support Trigger Delay.

For any given Trigger, Gate, or Periodic Sync source, the same Trigger Delay is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

Negative trigger delays can be used. Negative trigger delay makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. You can use negative delay to pre-trigger the instrument in the time domain or FFT, but not in swept spans. Video trigger delay may be set to negative values, in time domain, FFT and even swept, but in swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:DELay <time>`
	`:TRIGger[:SEQuence]:<trig_source>:DELay?`
	where `<trig_source>` is one of:
	`LINE | EXTernal1 | EXTernal2 | EXTernal3 | EXTernal4 | AEXTernal | VIDeo | ADC | RFBurst | FRAMe | LEVel | FMT | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal`

Example	`:TRIG:VID:DEL:STAT ON` `:TRIG:VID:DEL 100 ms`
Dependencies	Only appears when VIDeo, LINE, EXTernal1|2|3|4, RFBurst, FRAMe, or an I/Q trigger is selected as the Trigger Source
Couplings	When FMT Trigger Criteria is `INSIDE` or `OUTSIDE`, FMT Trigger Delay State is forced to `OFF` FMT Trigger Delay MaxValue is dependent on the current AcquisitionTime. The equation is: MaxValue = 2^16 x AcqTime, but never to exceed 70 sec. Ex: In PVT View with a min PVT Acq Time of 200 us, this Trigger Delay MaxValue is 13.26 sec. In RT Spectrum and Spectrogram with a min Acq Time of 100 us, this Trigger Delay MaxValue is 6.55 sec. When the Acq Time is increased, this MaxValue also increases
State Saved	Saved in instrument state
Annotation	Trig Delay (in the Measurement Bar)

Backwards Compatibility Notes	For backward compatibility with VSA/PSA comms apps
	`:TRIGger[:SEQuence]:IF:DELay`
	`:TRIGger[:SEQuence]:DELay`
	The legacy `:TRIGger[:SEQuence]:DELay` command affects the delay for the `VID`, `LINE`, `EXT1`, `EXT2`, EXT3, EXT4, and `RFB` triggers

Auto Function

Remote Command	:TRIGger[:SEQuence]:<trig_source>:DELay:STATe OFF | ON | 0 | 1 :TRIGger[:SEQuence]:<trig_source>:DELay:STATe? where <trig_source> is one of: LINE | EXTernal1 | EXTernal2 | EXTernal3 | EXTernal4 | AEXTernal | VIDeo | ADC | RFBurst | FRAMe | LEVel | FMT | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal
Preset	OFF

Backwards Compatibility Commands

Preset	1 us
State Saved	Saved in instrument state
Backwards Compatibility SCPI	:TRIGger[:SEQuence]:DELay <time> :TRIGger[:SEQuence]:DELay? :TRIGger[:SEQuence]:DELay:STATe OFF|ON|0|1 :TRIGger[:SEQuence]:DELay:STATe?
Backwards Compatibility SCPI Example	:TRIG:DEL 1 ms

Notes	ESA commands for trigger offset, which allowed you to use a positive or negative delay when in zero span and in a Res BW >= 1 kHz. For ESA compatibility, X-series instruments keep track of this offset and adds it to the Trigger Delay for VIDeo, LINE, EXTernal1 or EXTernal2 whenever the value is sent to the hardware, if in Zero Span and RBW >= 1 kHz
Preset	Off, 0 s
State Saved	Saved in instrument state
Min/Max	–/+11 s
Backwards Compatibility SCPI	:TRIGger[:SEQuence]:OFFSet <time> :TRIGger[:SEQuence]:OFFSet?
Backwards Compatibility SCPI Example	:TRIG:OFFS ON :TRIG:OFFS -100 ms

Auto Function

Remote Command	:TRIGger[:SEQuence]:OFFSet:STATe OFF | ON | 0 | 1 :TRIGger[:SEQuence]:OFFSet:STATe?
Preset	OFF

Trigger Delay Parameters

Note: in Swept SA, when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

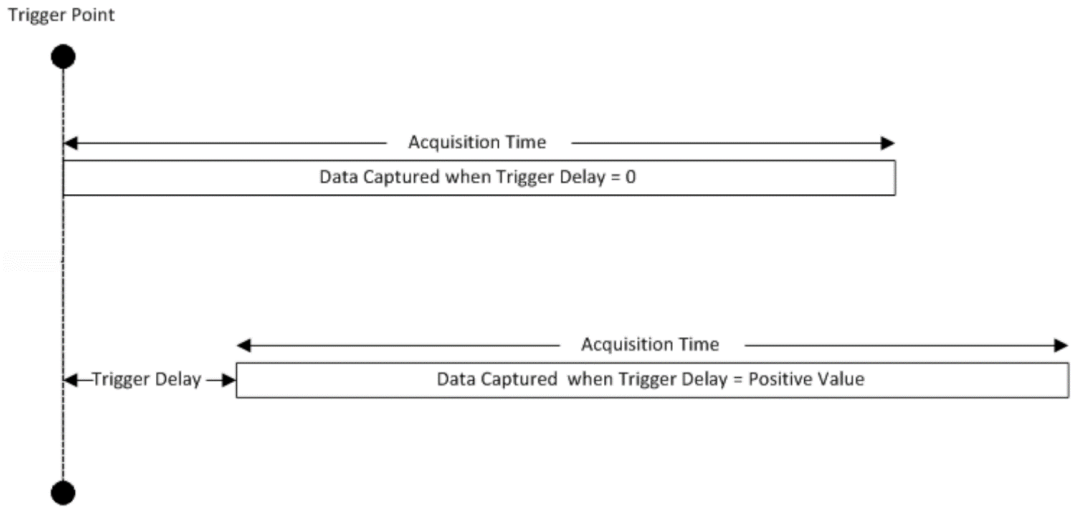
Source	Example	Preset	Min	Max	Resolution
Video	`TRIG:VID:DEL:STAT ON` `TRIG:VID:DEL 100 ms`	Off, 1 us	–150 ms (–10s in Swept SA Zero Span)	+500 ms	100 ns
Level	`TRIG:LEV:DEL:STAT ON` `TRIG:LEV:DEL 100 ms`	Off, 30 ms	0 ms	70 sec (but dependent on Acq Time like FMT)	Multiple of Acq Time (as is FMT)
FMT	`TRIG:FMT:DEL:STAT ON` `TRIG:FMT:DEL 100 ms`	Off, 30 ms	0 ms	70 sec (but dependent on Acq Time like FMT)	Multiple of Acq Time (as is FMT)
External 1|2|3|4	`TRIG:EXT1:DEL:STAT ON` `TRIG:EXT2:DEL 100 ms`	Off, 1 us	–150 ms (–10s in Swept SA Zero Span)	+500 ms	100 ns
Line	`TRIG:LINE:DEL:STAT ON` `TRIG:LINE:DEL 100 ms`	Off, 1 us	–150 ms (–10s in Swept SA Zero Span)	+500 ms	100 ns
RF Burst	`TRIG:RFB:DEL:STAT ON` `TRIG:RFB:DEL 100 ms`	Off, 1 us	–150 ms (–10s in Swept SA Zero Span)	+500 ms	100 ns
Periodic Timer	`TRIG:FRAM:DEL:STAT ON` `TRIG:FRAM:DEL 100 ms`	Off, 1 us	–150 ms (–10s in Swept SA Zero Span)	+500 ms	100 ns
I/Q Mag	`TRIG:IQM:DEL:STAT ON` `TRIG:IQM:DEL 10 ms`	Off, 1 us	–2.5 s	+10 s	10 ns
I (Demod)	`TRIG:IDEM:DEL:STAT ON` `TRIG:IDEM:DEL 10 ms`	Off, 1 us	–2.5 s	+10 s	10 ns
Q (Demod)	`TRIG:QDEM:DEL:STAT ON` `TRIG:QDEM:DEL 10 ms`	Off, 1 us	–2.5 s	+10 s	10 ns
Input I	`TRIG:IINP:DEL:STAT ON` `TRIG:IINP:DEL 10 ms`	Off, 1 us	–2.5 s	+10 s	10 ns
Input Q	`TRIG:QINP:DEL:STAT ON` `TRIG:QINP:DEL 10 ms`	Off, 1 us	–2.5 s	+10 s	10 ns
Aux Chan I/Q	`TRIG:AIQM:DEL:STAT ON`	Off, 1 us	–2.5 s	+10 s	10 ns

Source	Example	Preset	Min	Max	Resolution
Mag	`TRIG:AIQM:DEL 10 ms`				
PXI	`TRIG:PXI:DEL:STAT ON` `TRIG:PXI:DEL 10 ms`	Off, 1 us	–150 ms	+500 ms	100 ns
Internal	`TRIG:INT:DEL:STAT ON` `TRIG:INT:DEL 10 ms`	Off, 1 us	–150 ms	+500 ms	100 ns
Prot Channel Detection	`TRIG:PRTC:DEL:STAT ON` `TRIG:PRTC:DEL 1 ms`	Off, 1 ms	–10 ms	+10 ms	100 ns
Prot Frame Aligned	`TRIG:PRTF:DEL:STAT ON` `TRIG:PRTF:DEL 1 ms`	Off, 1 ms	–10 ms	+10 ms	100 ns
Prot Event	`TRIG:PRTE:DEL:STAT ON` `TRIG:PRTE:DEL 1 ms`	Off, 1 ms	–10 ms	+10 ms	100 ns

Note: in Bluetooth Mode, the preset value of Trigger Delay is always (On, –20us).

More Information

Here is the diagram for Frequency Mask Trigger (FMT) Trigger Delay:



8.1.4 Trigger Slope

Sets the trigger polarity for Trigger and Gate sources that support Trigger Slope. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

For any given Trigger, Gate, or Periodic Sync source, the same Trigger Slope is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:SLOPe POSitive | NEGative`
	`:TRIGger[:SEQuence]:<trig_source>:SLOPe?`
	where `<trig_source>` is one of:
	`LINE | EXTernal1 | EXTernal2 | EXTernal3 | EXTernal4 | AEXTernal | VIDeo | ADC | RFBurst | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal`

Example	`:TRIG:VID:SLOP NEG`
	`:TRIG:VID:SLOP?`
	`:TRIG:EXT1: SLOP NEG`

Dependencies	Only appears when VIDeo, LINE, EXTernal1|2|3|4, RFBurst, ADC or an I/Q trigger is selected as the Trigger Source
Preset	`POSitive`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:IF:SLOPe NEGative|POSitive`
	`:TRIGger[:SEQuence]:IF:SLOPe?`
	For backward compatibility with VSA/PSA comms apps
	`:TRIGger[:SEQuence]:EXTernal:SLOPe`
	For backward compatibility, the parameter `EXTernal` is mapped to `EXTernal1`
	`:TRIGger[:SEQuence]:FRAMe:EXTernal1:SLOPe`
	`:TRIGger[:SEQuence]:FRAMe:EXTernal2:SLOPe`

Preset	`POSitive`
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:SLOPe POSitive|NEGative` `:TRIGger[:SEQuence]:SLOPe?`
Backwards Compatibility SCPI Example	`:TRIG:SLOP NEG`

Note: when transitioning from Zero Span to Swept spans, the trigger delay is clipped to –150 ms if it had been longer in Zero Span.

8.1.5 Trigger Level Absolute/Relative

Selects either Absolute or Relative Burst Triggering.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE ABSolute | RELative` `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE?`

Example	Set the trigger level type of the RF burst trigger to Relative: `:TRIG:RFB:LEV:TYPE REL`
Dependencies	Only appears when RF Burst is selected as the trigger source
Preset	`ABSolute`
State Saved	Saved in instrument state

8.1.6 Absolute Trig Level

Sets the absolute trigger level for the RF burst envelope.

NOTE **When using the External Mixing path, Absolute Trigger Level is uncalibrated because the factory default was set to accommodate the expected IF levels for the RF path.**

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>` `:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?`
Example	Set the trigger level of the RF burst envelope signal to the absolute level of 10 dBm: `:TRIG:RFB:LEV:ABS 10 dBm`
Notes	Sending this command does not switch the setting from relative to absolute; to switch it you need to send `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE` For Bluetooth Mode, the default value is –50 dBm
Dependencies	Only appears when RF Burst is selected as the Trigger, Gate or Periodic Sync Source
Couplings	This same level is used for the RF Burst trigger source in the Trigger menu, for the RF Burst selection in the Gate Source menu, and also for the RF Burst selection in the Periodic Sync Src menu

Preset

Mode	Value
LTEA FDD/TDD	–40 dBm or –50 dBm Depends on hardware
5G NR	–40 dBm
All others	–20 dBm

State Saved	Saved in instrument state
Min	–200 dBm
Max	100 dBm
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:FRAMe:RFBurst:LEVel:ABSolute`

8.1.7 Relative Trig Level

Sets the relative trigger level for the RF burst envelope.

In some models, the relative burst trigger function is implemented in hardware. In other models, without the advanced triggering hardware required, the relative burst trigger function is implemented in software in some measurements, and is unavailable in other measurements.

When implemented in software, the relative RF Burst trigger function is implemented as follows:

1. The measurement starts with the absolute RF Burst trigger setting. If it cannot get a trigger with that level, auto trigger fires and the acquisition starts anyway. After the acquisition, the measurement searches for the peak in the acquired waveform and saves it
2. In the next cycle of the measurement, the measurement determines a new absolute RF Burst level based on the peak value from the first measurement and the Relative RF Burst Trigger Level (always 0 or negative dB) set by the user. The following formula is used: absolute RF Burst level = peak level of the previous acquisition + relative RF Burst level
3. If the new absolute RF Burst level differs from the previous by more than 0.5 dB, the new level is sent to the hardware; otherwise, it is not updated (to avoid slowing down the acquisition)

Steps 2 and 3 repeat for subsequent measurements.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:RELative <rel_ampl>` `:TRIGger[:SEQuence]:RFBurst:LEVel:RELative?`
Example	Set the trigger level of the RF burst envelope signal to the relative level of –10 dB: `:TRIG:RFB:LEV:REL -10 dB`
Notes	Sending this command does not switch the setting from absolute to relative; to switch it you need to send `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE` The relative trigger level is not available in some measurements. In those measurements the `RELative` parameter, and `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE` generates an error if sent
Dependencies	Grayed-out and **Absolute Trigger Level** selected if the required hardware is not present in your instrument and the current measurement does not support Relative triggering Only appears when **RF Burst** is selected as the trigger source
Preset	**Mode** – **Value** EDGEGSM – –25 dB All others – –6 dB

State Saved	Saved in instrument state
Min	–45 dB
Max	0 dB

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:RFBurst:LEVel`
	This legacy command is aliased to
	`:TRIGger[:SEQuence]:RFBurst:LEVel:RELative`
	because PSA had *only* relative burst triggering

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The instrument automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the instrument. Here is the RF Burst Trigger Bandwidth table for Swept SA Measurement in SA mode:

Model	Option	Span	Swp Type	FFT Width	Trigger BW, –10 dB	Notes
EXA	any	All	all	all	16 MHz	
MXA	w/o B25	All	all	all	16 MHz	
MXA	B25	Zero	N/A	N/A	16 MHz	
MXA	B25	All	Swept	N/A	16 MHz	
MXA	B25	< 8 MHz	FFT	all	16 MHz	
MXA	B25	≥ 8 MHz	FFT	25 MHz	30 MHz	
PXA	any	all	all	all	> 80 MHz	Exceptions(*)

(*) Exceptions: When the RF Burst Trigger Level Type is Absolute, the start frequency is below 300 MHz, and the sweep type is either Swept or FFT with an FFT width of less than 25 MHz, then the RF Burst Trigger Bandwidth is not >80 MHz. It would be 16 MHz except in the subcase of Sweep Type = FFT and FFT Width between 8 and 25 MHz inclusive, where it would be 30 MHz.

8.1.8 Period

Sets the period of the internal periodic timer clock. For digital communications signals, this is usually set to the frame period of your current input signal. In the case that sync source is not set to OFF, and the external sync source rate is changed for some reason, the periodic timer is synchronized at every external synchronization pulse by resetting the internal state of the timer circuit.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:PERiod <time>` `:TRIGger[:SEQuence]:FRAMe:PERiod?`

Example	`:TRIG:FRAM:PER 100 ms`
Dependencies	The invalid data indicator turns on when the period is changed, until the next sweep/measurement completes Only appears when **Periodic** Timer is selected as the Trigger or Gate Source
Couplings	The same period is used in the Gate Source selection of the period timer
Preset	**Mode** / **Value** EDGEGSM / 4.615383 ms 5G NR / 10 ms All Others / 20 ms
State Saved	Saved in instrument state
Min	100.000 ns
Max	559.0000 ms

8.1.9 Offset

Adjusts the accumulated offset between the periodic timer events and the trigger event. Adjusting the accumulated offset is different than setting an offset and requires explanation.

The periodic timer is usually not synchronized with any external events, so the timing of its output events has no absolute meaning. Since the timing relative to external events (RF signals) is important, you need to be able to adjust (offset) it. However, you have no direct way to see when the periodic timer events occur. All that you can see is the trigger timing. When you want to adjust the trigger timing, you will be changing the internal offset between the periodic timer events and the trigger event. Because the absolute value of that internal offset is unknown, we will just call that the accumulated offset. Whenever the Offset parameter is changed, you are changing that accumulated offset. You can reset the displayed offset using Reset Offset Display. Changing the display does not change the value of the accumulated offset, and you can still make additional changes to accumulated offset.

To avoid ambiguity, we define that an increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:OFFSet <time>` `:TRIGger[:SEQuence]:FRAMe:OFFSet?`
Example	`:TRIG:FRAM:OFFS 1.2 ms`
Notes	The front panel interface (for example, the knob), and this command, adjust the accumulated offset, which is shown on the control

	However, the actual amount sent to the hardware each time the offset is updated is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value. Note that the accumulated offset value is essentially arbitrary; it represents the accumulated offset from the last time the offset was zeroed (with the Reset Offset Display key) Note that this command does not change the period of the trigger waveform. Note also that Offset is used only when the sync source is set to `OFF`, otherwise delay is used, see "Trigger Delay" on page 1051. An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event When the SCPI command is sent the value shown on the control is updated with the new value. However, the actual amount sent to the hardware is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value The SCPI query simply returns the value currently showing on the key
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes Only appears when **Periodic** Timer is selected as the Trigger or Gate Source
Couplings	The same offset is used in the Gate Source selection of the period timer
Preset	0 s
State Saved	Saved in instrument state
Min/Max	–/+10.000 s

8.1.10 Reset Offset Display

Resets the value of the periodic trigger offset display setting to 0.0 seconds. The current displayed trigger location may include an offset value defined with the **Offset** key. Pressing this control redefines the currently displayed trigger location as the new trigger point that is 0.0 s offset. The **Offset** control can then be used to add offset relative to this new timing.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:OFFSet:DISPlay:RESet`
Example	`:TRIG:FRAM:OFFS:DISP:RES`
Dependencies	Only appears when **Periodic** Timer is selected as the Trigger or Gate Source

8.1.11 Offset Adjust (Remote Command Only)

Lets you advance the phase of the frame trigger by the amount you specify. It does *not* work in the same way as the related front panel keys.

The command does not change the period of the trigger waveform. If the command is sent multiple times, it advances the phase of the frame trigger an additional amount each time it is sent. Negative numbers are permitted.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:ADJust <time>`
Example	`:TRIG:FRAM:ADJ 1.2 ms`
Notes	Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see "Trigger Delay" on page 1051. An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event The front panel interface (for example, the knob) and the `:TRIG:FRAM:OFFS` command adjust the accumulated offset, which is shown on the active function display. However, the actual amount sent to the hardware is the delta value, that is, the current offset value minus the previous offset value When the SCPI command is sent the value shown on the control (and the Active Function, if this happens to be the active function) is updated by increasing it (or decreasing it if the value sent is negative) by the amount specified in the SCPI command This is no query for this command
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes
Couplings	The same offset is used in the Gate Source selection of the period timer
Preset	0 s
State Saved	Saved in instrument state
Min/Max	–/+10.000 s

8.1.12 Sync Source

For convenience, you can select the Periodic Timer Sync Source using this dropdown. You can also select it from the **Periodic Sync Src** tab, which also contains controls that let you configure the Sync Source.

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you might be triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

Example	`:TRIG:FRAM:SYNC EXT1`
	`:TRIG:FRAM:SYNC EXT2`
	`:TRIG:FRAM:SYNC RFB`
	`:TRIG:FRAM:SYNC OFF`

Dependencies	Only appears when **Periodic** Timer is selected as the Trigger or Gate Source
Preset	`OFF`
State Saved	Saved in instrument state

8.1.13 TV Line

Selects the **TV Line** number on which to trigger. Line number range is dependent on the settings of the "Standard" on page 1063 and "Field" on page 1062menus within the TV trigger setup functions. When the line number is incremented beyond the upper limit, the value will change to the lower limit and continue incrementing from there. When the line number is decremented below the lower limit, the value will change to the upper limit and continue decrementing from there.

Remote Command	`:TRIGger[:SEQuence]:TV:LINE <integer>` `:TRIGger[:SEQuence]:TV:LINE?`
Example	`:TRIG:TV:LINE 20` `:TRIG:TV:LINE?`
Dependencies	Only available in the Swept SA measurement Only appears when **TV** is selected as the trigger source
Preset	17
State Saved	Saved in instrument state
Min	1 The minimum value is the minimum line and rolls over to the maximum value. The minimum line number depends on which Field and standard are selected
Max	The maximum value is the maximum line and rolls over to the minimum value. The maximum line number depends on which Field and standard are selected Field 1 (`ODD`): – Maximum line is 263 for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 – Maximum line is 313 for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L Field 2 (`EVEN`): – The maximum line 262 for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 – The maximum line is 312 for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L Field = `ENTire` Frame: – 525, for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 – 625, for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L

8.1.14 Field

Selects the **Field** on which to trigger:

Entire Frame	ENTire	Causes the selected line number to be viewed as an offset into the entire frame starting with line 1, the first line in Field One
Field One	ODD	Causes the selected line number to be viewed as an offset into the first field starting with Line 1, the first line in Field One
Field Two	EVEN	Causes the selected line number to be viewed as an offset into the second field. If Line 1 is selected, it is the 264th line of the frame (NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M, PAL-60) or the 314th line of the frame (PAL-B,D,G,H,I, PAL-N, PAL-N-Combin, SECAM-L)

Remote Command	`:TRIGger[:SEQuence]:TV:FMODe ENTire | ODD | EVEN` `:TRIGger[:SEQuence]:TV:FMODe?`

Example	`:TRIG:TV:FMOD ENT`
	`:TRIG:TV:FMOD EVEN`
	`:TRIG:TV:FMOD ODD`

Dependencies	Only available in the Swept SA measurement Only appears when **TV** is selected as the trigger source Available only when Option B7B (TV trigger) is installed
Preset	`ENTire`
Range	`ENTire|ODD|EVEN`

8.1.15 Standard

Accesses the **Standard** menu keys, which select from the following TV standards:

NTSC-M	`MNTSc`
NTSC-Japan	`JNTSc`
NTSC-4.43	`NTSC443`
PAL-M	`MPAL`
PAL-B,D,G,H,I	`BPAL`
PAL-N	`NPAL`
PAL-N-Combin	`CPAL`
PAL-60	`PAL60`
SECAM-L	`LSEC`

As the TV standard is changed, the current line value is clipped as necessary to keep it valid for the chosen standard and field mode. For example, line 600 is selected in Entire Frame mode in PAL-N; if NTSC-M is selected, the line number is clipped to 525. Or, if line 313 is selected in Field 1 mode in PAL-N and NTSC-M is selected, the line number is clipped to 263. Changing back to the PAL-N standard will leave the line number at 263.

Remote Command	`:TRIGger[:SEQuence]:TV:STANdard MNTSc | JNTSc | NTSC443 | MPAL | BPAL | NPAL | CPAL | PAL60 | LSEC` `:TRIGger[:SEQuence]:TV:STANdard?`

Example	Set NTSC-M:
	`:TRIG:TV:STAN MNTS`
	Queries Standard
	`:TRIG:TV:STAN?`

Dependencies	Only available in the Swept SA measurement Only appears when **TV** is selected as the trigger source
Preset	`MNTS`
State Saved	Saved in instrument state
Range	`MNTSc|JNTSc|NTSC443|MPAL|BPAL|NPAL|CPAL|PAL60|LSEC`

8.1.16 Trigger Center Frequency

Sets the center frequency to be used by the auxiliary receiver for the **Auxiliary Channel I/Q Magnitude** trigger.

Remote Command	`:TRIGger[:SEQuence]:AIQMag:CENTer <freq>` `:TRIGger[:SEQuence]:AIQMag:CENTer?`
Example	`:TRIG:AIQM:CENT 10 MHz`
Notes	Trigger CF + 1/2 Trigger BW < Max Trigger CF – 1/2 Trigger BW > Min
Dependencies	Only appears when Aux Channel I/Q Mag is selected as the trigger source
Preset	0 Hz
State Saved	Saved in instrument state
Min/Max	–/+40 MHz

8.1.17 Trigger BW

Sets the information bandwidth used by the auxiliary receiver for the Auxiliary Channel I/Q Magnitude trigger.

Remote Command	`:TRIGger[:SEQuence]:AIQMag:BANDwidth <freq>` `:TRIGger[:SEQuence]:AIQMag:BANDwidth?`
Example	`:TRIG:AIQM:BAND 8 MHz`
Notes	The combined sample rate for the main and auxiliary receivers cannot exceed 100 MSa/sec. The bandwidth available to **Trigger BW** is limited to what is available after the main receiver's bandwidth (Info BW, sometimes pre-FFT BW) is set. Because of this limitation, the Max is not always achievable

	The combination of "Trigger Center Frequency" on page 1064 and **Trigger BW** is also limited: – Trigger CF + 1/2 Trigger BW < Max – Trigger CF – 1/2 Trigger BW > Min
Dependencies	Only appears when Aux Channel I/Q Mag is selected as the trigger source
Preset	Bandwidth option dependent: – No Opt: 10 MHz – Opt B25: 25 MHz – Opt S40: 40 MHz
State Saved	Saved in instrument state
Range	10 Hz to Maximum
Min	10 Hz
Max	Bandwidth option & I/Q input path-dependent: – No Opt, I or Q Only: 10 MHz, I+jQ: 20 MHz – Opt B25, I or Q Only: 25 MHz, I+jQ: 50 MHz – Opt S40, I or Q Only: 40 MHz, I+jQ: 80 MHz

8.1.18 Zero Span Delay Compensation

In **Zero Span**, there is a natural delay in the signal path, which comes from the RBW filter. This is usually desirable, as it lets you trigger on events and also see those events, because the signal is delayed from the trigger event. However, in some cases it is desirable to eliminate this delay, so that trigger events line up exactly with the zero-time point in **Zero Span**. You can use **Zero Span Delay Comp** to enable or disable zero span delay compensation.

Remote Command	`:TRIGger [:SEQuence]:EXTernal1|EXTernal2|EXTernal3|EXTernal4|RFBurst:DELay:COMPensation OFF | ON | 0 | 1` `:TRIGger [:SEQuence]:EXTernal1|EXTernal2|EXTernal3|EXTernal4|RFBurst:DELay:COMPensation?`

Example	`:TRIG:EXT1:DEL:COMP ON`
	`:TRIG:EXT1:DEL:COMP?`
	`:TRIG:EXT2:DEL:COMP ON`
	`:TRIG:RFB:DEL:COMP ON`

Dependencies	No effect except in zero-span, but not locked out in nonzero spans **Zero Span Delay Compensation** only appears in the Swept SA and List Power Step measurements. Only

	External and RF Burst triggers support it Does not appear in VXT If the SCPI command is sent when the control is not shown, an error is returned: -221, “Settings conflict; Feature not supported for this measurement” Only appears when EXTernal1|2|3|4 or RF Burst is selected as the Trigger, Gate or Periodic Sync Source
Preset	`OFF`
State Saved	Saved in instrument state

8.1.19 Select PXI Line

Controls which `PXI_TRIG[0..7]` backplane line is used for the trigger source.

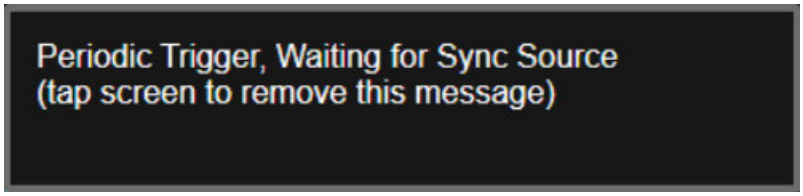
Only found in modular analyzer products.

Remote Command	`:TRIGger[:SEQuence]:PXI:LINE <line>` `:TRIGger[:SEQuence]:PXI:LINE?`
Example	`:TRIG:PXI:LIN 2`
Preset	0
State Saved	Saved in instrument state
Range	[0,7]

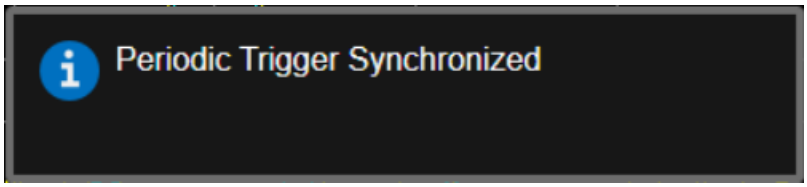
8.1.20 Reset Sync Monitor

Lets you reset the status of Synchronization for **Periodic** trigger This control works together with bit 6 “Waiting for Periodic Sync Source” in the `:STATus:OPERation:CONDition` status register.

When you first switch to **Periodic** trigger, RF Burst is the default Sync Source. The register will be set immediately. A “Periodic Trigger, Waiting for Sync Source” message will be generated after 2 seconds (if the instrument is not synchronized). The system is waiting for a RF Burst signal. You can tap the screen to remove the message.



Once RF burst signal is provided and the hardware synchronized, the register will be cleared and a “Periodic Trigger Synchronized” message will be generated.



When change to a new Sync Source other than Off, take External1 as an example. You'll get the condition register set to 1 and a pop-up message again. There are the following possible conditions:

- External1 is provided: the register is cleared, message is updated
- External1 is *not* provided, you set the Sync Source to Off: the register is cleared, message is cleared
- External1 is *not* provided, you set the Sync Source to External2: the register and message keep the same
- External1 is *not* provided, you set the Sync Source back to RF Burst: the register is cleared, message is also cleared. That's because the instrument is synchronized to RF Burst already. If you want to make a new synchronization, you have to press "Reset Sync Monitor" you send `:TRIG:FRAM:SMON:RES`

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SMONitor:RESet`
Example	`:TRIG:FRAM:SMON:RES`
Notes	This control works together with bit 1 "Waiting for Periodic Sync Source" in the `:STATus:OPERation:INSTrument:CONDition` status register A "Periodic Trigger, Waiting for Sync Source" message will be generated after pressing this control, and the status bit will be set A "Periodic Trigger Synchronized" message will be generated after successfully synchronizing to Sync Source, and the status bit will be cleared
Dependencies	Only functional when **Periodic** Trigger is selected as the **Trigger** or **Gate** Source, and **Sync Source** is not Off Only available in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Status Bits/OPC dependencies	Bit 6 of `:STATus:OPERation:CONDition` will be set after pressing this control

8.1.21 Trigger Optimization

Sets the trigger behavior for various desired operation conditions.

Remote Command	`:TRIGger[:SEQuence]:OPTimize:MODE NORMal | MJITter | HAMJitter`
	For option details, see "Options" on page 1068
	`:TRIGger[:SEQuence]:OPTimize:MODE?`

Example	Select trigger optimization for minimum jitter:

	`:TRIG:OPT:MOD MJIT`

Dependencies	Only appears in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
	Minimum jitter is functional only when digital IF BW is lower than 300 MHz. When **Trigger Optimization** is set to `MJITter` and it is not in effect, the following warning message appears in the status bar:
	`Settings Alert; Minimum Jitter is not available`
	When you select Hardware Accuracy Minimum Jitter, digital IF BW must be greater than 1 MHz. The jitter will be reduced when digital IF BW is lower than 300 MHz
	When **Trigger Optimization** is set to `HAMJitter` and digital IF BW is lower than 1 MHz, the following warning message appears:
	`Settings conflict; Hardware Accuracy Minimum Jitter is not available when IF BW is less than 1 MHz`
	Hardware Accuracy Minimum Jitter is only available in IQ Analyzer(Basic) Mode
	When **Trigger Optimization** is set to `HAMJitter` in other modes, the following warning message appears:
	`Illegal parameter value; The value HWAccMinjitter is disabled`

Preset	`NORMal`
State Saved	Yes
Range	`NORMal|MJITter|HAMJitter`

Options

Trigger optimization options are:

Trigger Optimization	SCPI	Notes
Normal	`NORMal`	No optimization
Minimum Jitter	`MJITter`	Optimizes trigger for minimum jitter. A software resample method is provided to reduce jitter, at the expense of some measurement speed The acquisition jitter depends on the digital IF BW, the jitter will be smaller when digital IF BW gets larger. For example, when the digital IF BW is 98.3 MHz in 5GNR, the jitter varies under 15ns. When set MJITter as trigger optimization type, the jitter will be reduced to 1ns This setting apples to all the trigger sources
Hardware Accuracy Minimum Jitter	`HAMJitter`	A hardware resample method is provided to reduce jitter when digital IF BW is lower than 300 MHz. When select Hardware Accuracy Minimum Jitter, digital IF BW must be greater than 1 MHz This setting is only available in IQ Analyzer(Basic) Mode

8.1.22 Trigger Settings Diagram

Lets you configure the **Trigger** system using a visual utility.

First, select what you want to configure (Trigger, Gate or Periodic Sync Source) by tapping the box for **Trigger**, **Gate** or **Periodic Sync Source**.

Next, tap any box in the gray row to choose a trigger source to connect to. For **Periodic Sync Source**, you can also tap **Off**.

The **Trigger Settings Diagram** changes depending on context. The trigger sources that are available change depending on which input you have selected.

8.2 Gate Source

Contains controls that let you select and configure **Gate** control signals.

This tab appears in the **Trigger** menu panel for measurements that support gating. In measurements that do not support gating, this tab does not appear.

The menus under the **Gate Source** tab are the same as those under the **Trigger** tab, with these exceptions:

- A smaller set of sources is available for gating.
- The **Free Run** and **Video** selections are not provided for **Gate**
- The Trig Delay controls are not present
- Relative RF Burst Triggering is not available, just Absolute
- There is an additional control, **Sync Holdoff**, under **Gate Source**

Any changes to the settings in the setup menus under each Gate Source selection (for example: Trigger Level, Trigger Delay, etc.) also affect the corresponding settings under the **Trigger** menu keys. The gate system uses the Trigger SCPI commands for the setup functions, since each setting affects both Gate and Trigger.

Example: to set the Trigger Level for External 1 Trigger, you use the command `:TRIG:EXT1:LEV`; to set the Trigger Level for External 1 Gate you use the same command, `:TRIG:EXT1:LEV`. By the same token, once you set the External 1 Trigger Level to 1V, it is 1V whether External 1 is being used as a Gate Source or a Trigger Source.

If a command is sent to the `TRIG` node to set the functions that are omitted from the **Gate Source** menus (**Auto Trig**, **Holdoff**, **Trig Delay**), it is accepted and the values stored, but the values are not visible from the **Gate Source** menus.

8.2.1 Select Gate Source

Selects the source of the Gate signal for performing Gated Trigger measurements.

This version of the **Select Gate Source** function is used in all measurements except the Pulse measurement application.

For the selection of the gate source the SCPI node, `:TRIGger[:SEQuence]:` is replaced by `[:SENSe]:SWEep:EGATe:` as shown in the remote command below. Because you can independently set the Gate Source and the trigger source, there is a separate SCPI command for the Gate Source.

Remote Command	`[:SENSe]:SWEep:EGATe:SOURce EXTernal1 | … | EXTernal4 | LINE | FRAMe | RFBurst | TV | VIDeo | PXI | INTernal` `[:SENSe]:SWEep:EGATe:SOURce?`
Example	`:SWE:EGAT:SOUR EXT1` `:SWE:EGAT:SOUR?`
Dependencies	Available selections differ depending on models as below

Benchtop	Line, External 1, External 2, RF Burst, Periodic, TV (Swept SA only)
VXT	Video, Internal, External 1, External 2, RF Burst, Periodic, PXI. – Internal and Periodic are not available in Spectrum Analyzer Mode. – Internal is available only in M9410A/11A/15A/16A and in M9410E/11E/15E/16E and unavailable in M9420/21A.
EXM	Video, Internal, External 1, External 2, RF Burst, Periodic

Not available in E7760

In some models, there is no second External input. In these models, the External 2 selection is not shown and the `EXTernal2` parameter will generate a “Hardware missing; Not available for this model number” error

Preset

Mode	Value	
GSM/EDGE Phase Noise	`FRAM`	
LTEATDD 5G NR	Direction is Downlink	`EXT1`
	Direction is Uplink	`FRAM`
All Others	`EXT1`	

8.2.2 Sync Holdoff

Applies only to the Periodic Timer. Specifies the duration that the sync source signal for the Periodic Timer must be kept false before the transition to true to be recognized as the sync timing. The periodic timer phase is aligned when the sync source signal becomes true, after the Holdoff time is satisfied.

A holdoff of 2 ms works with most WiMAX signals, but there may be cases where the burst off duration is less than 1 ms and this value will need to be changed.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff <time>` `:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff?`
Example	`:TRIG:FRAM:SYNC:HOLD 5`

	`:TRIG:FRAM:SYNC:HOLD?`
Dependencies	Only appears if **Periodic** is the selected Gate Source Does not appear in all Measurements. For example, does not appear in Swept SA
Preset	**Mode** / **Value** LTEATDD / ON, 1 ms 5G NR / ON, 250.0 us All others / OFF, 4 msec
State Saved	Saved in instrument state
Min	0 ms
Max	+500 ms

Auto Function

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe OFF | ON | 0 | 1` `:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe?`
Preset	**Mode** / **Value** LTEATDD, 5G NR / `ON` All others / `OFF`

8.3 Gate Settings

Contains controls that let you control the gating function. The Gate functionality is used to view signals best viewed by qualifying them with other events.

This tab appears in the Trigger menu panel for measurements that support gating. In measurements that do not support gating, this tab does not appear.

In the Swept SA measurement, the Gate controls, and all SCPI under the `[:SENSe]:SWEep:EGATe` SCPI node are unavailable when Source Mode is set to Tracking. This is because the Gate circuitry is used to sync the external source. If the Tracking Source is turned on, the Gate is turned off.

Gate setup parameters are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

Note that Sweep Time auto coupling rules and annotation are changed when Gate is on.

8.3.1 Gate On/Off

Turns the Gate function on or off.

When the Gate function is `ON`, the selected "Gate Method" on page 1078 is used along with the gate settings and the signal at the gate source to control the sweep and video system with the gate signal. Not all measurements allow every type of Gate Method.

If Gate were to be turned `ON` without a gate signal present, Marker Count operation would be unreliable, so it is locked out whenever Gate is on for measurements that support Marker Count.

Remote Command	`[:SENSe]:SWEep:EGATe[:STATe] OFF | ON | 0 | 1` `[:SENSe]:SWEep:EGATe[:STATe]?`
Example	`:SWE:EGAT ON` `:SWE:EGAT?`
Dependencies	The function is unavailable (grayed-out) and `OFF` when: – Gate Method is LO or Video and FFT Sweep Type is manually selected – Gate Method is FFT, and Swept Sweep Type is manually selected – Marker Count is ON The following are unavailable whenever Gate is on:

	– FFT under Sweep Type when Method=LO or Video or Swept under Sweep Type when Method=FFT – Marker Count While **Gate** is on, the Auto Rules for Sweep Type are modified so that the choice agrees with the Gate Method: i.e., FFT for Method = FFT and Swept for Method = LO or Video When in the ACP measurement: – When **Meas Method** is RBW or FAST, this function is unavailable, and the control is grayed-out – Whenever **Gate** is on, Meas Method, RBW, or FAST is unavailable and keys for those are grayed-out – When **Gate** is on, Offset Res BW and Offset Video BW are ignored (if you set these values) and the measurement works as if all Offset Res BW and all Offset Video BW are coupled with the Res BW and the Video BW under the BW menu. When **Gate** is on, the Offset BW control in the **Offset/Limit** menu is grayed-out
Preset	**Mode** / **Value** LTEATDD / ON All others / OFF
State Saved	Saved in instrument state
Range	OFF|ON
Annunciation	Annunciated in the Meas Bar ; if Gate is on, the word "Gate:" followed by the gate type appears, where – LO = Gated LO – Vid = Gated Video – FFT = Gated FFT
Backwards Compatibility SCPI	[:SENSe]:SWEep:TIME:GATE[:STATe] Available in SA and SCPILC Modes ESA compatibility
Backwards Compatibility Notes	In ESA, Trig Delay (On) and Gate (On) could not be active at the same time. This dependency does not exist in PSA or in X-Series

8.3.2 Gate View

Turning on **Gate View** puts the instrument into **Gate View**. When in **Gate View**, the regular view of the current measurement traces and results are reduced vertically to about 70% of the regular height. The **Zero Span** window, showing the positions of the Gate, is shown between the Measurement Bar and the reduced measurement window. By reducing the height of the measurement window, some of the annotation on the Data Display may not fit and is not shown.

Remote Command	`[:SENSe]:SWEep:EGATe:VIEW ON | OFF | 1 | 0` `[:SENSe]:SWEep:EGATe:VIEW?`
Example	Turn on **Gate View**: `:SWE:EGAT:VIEW ON`
Dependencies	In the Swept SA measurement: In **Gate View**, the regular **Sweep Time** (or **Acquisition Time**) control is grayed-out, to avoid confusing the user who wants to set Gate View Sweep Time. When pressed, the grayed-out control displays the informational message "Use Gate View Sweep Time in the Gate menu" In other measurements: When you turn **Gate View** on, the lower window takes on the current state of the instrument. On leaving **Gate View**, the instrument takes on the state of the lower window When you turn **Gate View** on, the upper window **Sweep Time** (or **Acquisition Time**) is set to Gate View Sweep Time (or Gate View Acquisition Time)
Couplings	These couplings apply to the Swept SA measurement: – When **Gate View** is turned on, the instrument is set to **Zero Span** – **Gate View** automatically turns off whenever a **Span** other than Zero is selected – **Gate View** automatically turns off if you press the **Swept Span** toggle under **Freq** while in **Gate View**, and the instrument returns to the **Span** it was in before entering **Gate View** (even if that is **Zero Span**) – When **Gate View** is turned on, the sweep time used is the Gate View Sweep Time – When **Gate View** is turned off, **Sweep Time** is set to the normal Swept SA measurement sweep time – If **Gate View** is on and **Gate** is off, then turning on **Gate** turns off **Gate View**
Preset	`OFF`
State Saved	Saved in instrument state
Range	`ON|OFF`
Annunciation	For Gate View to work properly, a gate signal must be present at the selected Gate Source. Therefore, in Gate View, any time more than 2 seconds passes with no gate signal, a pop-up message "Waiting for gate input" appears. This message goes away when a gate signal appears

Turning **Gate View** off returns the instrument to the normal measurement view.

In Swept SA, the normal measurement view is the single-window Swept SA view. When returning to this view, the Swept SA measurement returns to the **Span** it was in before entering **Gate View** (even if that is **Zero Span**).

The **Gate View** window is triggered from the **Gate Source**, with zero trigger delay. Also, when updating the **Gate View** window, the Gate itself must not operate. So, it is internally shut off while the gate view window is being updated. For the Swept SA measurement, this means that the Gate is internally shut off whenever the **Gate View** window is displayed. The measurement bar and controls continue to show the

Trigger source for the main sweep window and give no indication that the Gate is shut off or that the Gate View window is triggered from the Gate Source.

When in Gate View, vertical lines are displayed in the Gate View window as follows:

Green lines labeled GATESTART and GATE STOP are displayed at the gate edges as follows: in Edge Gate, a line is shown for Delay and one for the end of the Gate period, defined by Length. In Level Gate a line is shown only for Delay. You can adjust the position of the green lines by adjusting the gate length and the gate delay or by dragging them with your finger or the mouse.. These lines update in the Gate View window as the active function changes, even if the window is not being updated. In Gated LO and Gated Video, these lines are positioned relative to the delay reference line (not relative to 0 time). In Gated FFT, their location is relative to the left edge of the screen.

A blue line is displayed showing the delay reference, that is, the reference point for the Gate Delay within the Zero Span window. The blue line represents where (in time) the effective location of the gate start would be if the gate were programmed to zero delay.

A second blue line is displayed at the location that represents the boundary between "compensated IF" and "compensated LO" operating modes.The second blue line is labeled MIN FAST because it represents the minimum Gate Delay for fast Gated LO operation. This line is only displayed in Gated LO. You cannot scroll (knob) or decrement (down key) "Gate Delay" on page 1076 to less than that represented by the position of this line, it can only be set below this position manually, although once there it can be moved freely with the knob while below the line.

A yellow line in the Gated Video case only, is displayed at B_{length}, where B_{length} is the display point (bucket) length for the swept trace, which is given by the Sweep Time (or Acquisition Time) for that trace divided by number of Points - 1. So, it is referenced to 0 time, not to the delay reference. This line is labeled NEXT PT (it is not shown in the figure above because the figure above is for Gated LO). The yellow line represents the edge of a display point (bucket). Normally in Gated Video, the bucket length must be selected so that it exceeds the off time of the burst. There is another way to use the instrument in Gated Video measurements, and that is to set the bucket width much shorter than the off time of the burst. Then use the Max Hold trace function to fill in "missing" buckets more slowly. This lets you see some of the patterns of the Gated Video results earlier, though seeing a completely filled-in spectrum later.

8.3.3 Gate Delay

Controls the length of time from the time the gate condition goes True until the gate is turned on.

Remote	[:SENSe]:SWEep:EGATe:DELay <time>

Command	`[:SENSe]:SWEep:EGATe:DELay?`
Example	`:SWE:EGAT:DELay 500ms` `:SWE:EGAT:DELay?`
Notes	Units of time are required, or no units; otherwise, an invalid suffix error message is generated
Preset	**Mode** / **Value** GSM/EDGE / 600 us WLAN / 500 us 5G NR / 5 ms Others / 57.7 us
State Saved	Saved in instrument state
Min	0.0 us
Max	100 s
Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE:DELay` This backward compatibility command is available in SA and SCPILC Modes ESA compatibility

8.3.4 Gate Length

Controls the length of time that the gate is on after it opens.

Remote Command	`[:SENSe]:SWEep:EGATe:LENGth <time>` `[:SENSe]:SWEep:EGATe:LENGth?`
Example	`:SWE:EGAT:LENG 1` `:SWE:EGAT:LENG?`
Notes	Units of time are required, or no units; otherwise, an invalid suffix error message is generated
Dependencies	Grayed-out when Gate Method is set to `FFT`, in which case the label changes to that shown below  The control is also grayed-out if Gate Control = `LEVel`
Preset	**Mode** / **Value** GSM/EDGE / 200 us WLAN / 1.54 ms Others / 461.6 us

State Saved	Saved in instrument state
Min	100 ns
Max	5 s
Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE:LENGth` This backward compatibility command is available in SA and SCPILC Modes ESA compatibility

8.3.5 Gate Method

Lets you choose one of the three different types of gating. Not all types of gating are available for all measurements.

Remote Command	`[:SENSe]:SWEep:EGATe:METHod LO | VIDeo | FFT`
	For option details, see "LO" on page 1078, "Video" on page 1079 or "FFT" on page 1079
	`[:SENSe]:SWEep:EGATe:METHod?`

Example	`:SWE:EGAT:METH FFT`
Dependencies	Only available in the Swept SA measurement in Spectrum Analyzer Mode Unavailable when Gate is On and FFT Sweep Type manually selected When selected, Sweep Type is forced to Swept, and the FFT selection in Sweep Type is grayed-out Only the `FFT` method is supported in non-SA products Only the `FFT` method is supported by VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E
Preset	`LO`
State Saved	Saved in instrument state
Range	`Video|LO|FFT`
Annunciation	In Meas Bar

LO

In `LO` gating, when Gate is `ON`, the LO sweeps whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating is more sophisticated, and results in faster measurements. With Gated LO, the instrument only sweeps while the gate conditions are satisfied. This means that a sweep could take place over several gate events. It would start when the gate signal goes true and stop when it goes false, and then continue when it goes true again. But since the LO is sweeping as long as the gate conditions are satisfied, the sweep typically finishes much more quickly than with Gated Video.

When in zero span, there is no actual sweep performed. But data is only taken while the gate conditions are satisfied. So even though there is no sweep, the gate settings will impact when data is acquired.

Video

In `Video` gating, when Gate is `ON`, the video signal is allowed to pass through whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating may be thought of as a simple switch, which connects the signal to the input of the spectrum analyzer. When the gate conditions are satisfied, the switch is closed, and when the gate conditions are not satisfied, the switch is open. So, we only look at the signal while the gate conditions are satisfied.

With this type of gating, you usually set the instrument to sweep very slowly. In fact, a general rule is to sweep slowly enough that the gate is guaranteed to be closed at least once per data measurement interval (bucket). Then if the peak detector is used, each bucket will represent the peak signal as it looks with the gate closed.

FFT

In `FFT` gating, when Gate is `ON`, an FFT is performed whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source. This is an FFT measurement that begins when the gate conditions are satisfied. Since the time period of an FFT is approximately 1.83/RBW, you get a measurement that starts under predefined conditions and takes place over a predefined period. So, in essence, this is a gated measurement. You have limited control over the gate length, but it works in FFT sweeps, which the other two methods do not.

Gated FFT is not possible in zero span since the instrument is not sweeping, so in zero span the Gated LO method is used. Data is still only taken while the gate conditions are satisfied, so the gate settings do impact when data is acquired.

The Gate Length will be 1.83/RBW.

This is a convenient way to make a triggered FFT measurement under control of an external gating signal.

8.3.6 Control Edge/Level

Sets the method of controlling the gating function from the gating signal.

`EDGE`	The gate opens (after the Delay) on the selected edge (for example, positive) of the gate signal and closes on the alternate edge (for example, negative)
`LEVel`	The gate opens (after the Delay) when the gate signal has achieved a certain level and

stays open as long as that level is maintained

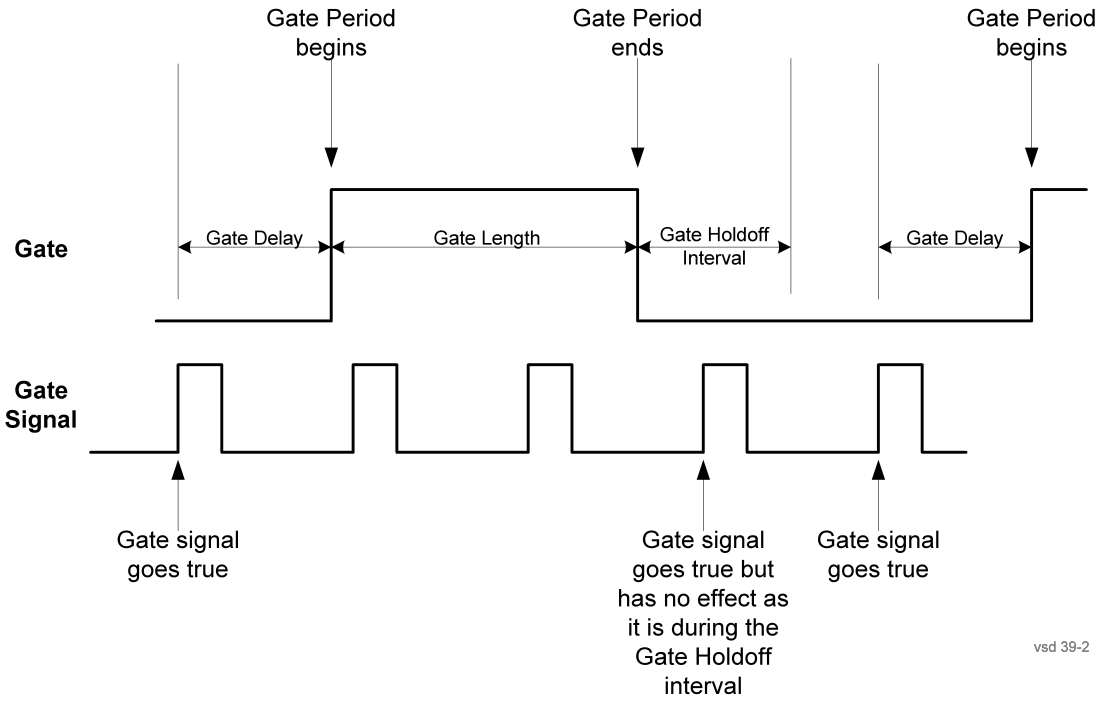
Remote Command	`[:SENSe]:SWEep:EGATe:CONTrol EDGE | LEVel` `[:SENSe]:SWEep:EGATe:CONTrol?`
Example	`:SWE:EGAT:CONT EDGE`
Dependencies	If the Gate Method is `FFT`, this control is grayed-out and `EDGE` is selected If the Gate Source is TV, Frame, or Line, this control is grayed-out and `EDGE` is selected
Preset	`EDGE`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`[:SENSe]:SWEep:EGATe:TYPE`
	`This backwards-compatibility command is available when the primary command is available`
	`[:SENSe]:SWEep:TIME:GATE:TYPE`
	This backwards-compatibility command is available in SA and SCPILC Modes
	ESA Compatibility

8.3.7 Gate Holdoff

Lets you increase or decrease the wait time after a gate event ends before the instrument will respond to the next gate signal.

After any Gate event finishes, the instrument must wait for the sweep system to settle before it can respond to another Gate signal. The instrument calculates a "wait time," taking into account a number of factors, including RBW and Phase Noise Optimization settings. The goal is to achieve the same accuracy when gated as in ungated operation. The figure below illustrates this concept:



When **Gate Holdoff** is Auto, the wait time calculated by the instrument is used. When Gate Time is in Manual, the user may adjust the wait time, usually decreasing it in order to achieve greater speed, but at the risk of decreasing accuracy.

When the **Method** control is set to **Video** or **FFT**, the **Gate Holdoff** function has no effect.

In measurements that do not support "Auto Function" on page 1082, the value shown when Auto is selected is "---" and the manually set holdoff is returned to a query.

Remote Command	`[:SENSe]:SWEep:EGATe:HOLDoff <time>` `[:SENSe]:SWEep:EGATe:HOLDoff?`
Example	`:SWE:EGAT:HOLD 0.0002` `:SWE:EGAT:HOLD?`
Couplings	When **Gate Holdoff** is **Auto**, the **Gate Holdoff** control shows the value calculated by the instrument for the wait time Pressing the **Gate Holdoff** control while it is in **Auto** and not selected, causes the control to become selected and lets you adjust the value. If the value is adjusted, the setting changes to **Man** Pressing the **Gate Holdoff** key, while it is in **Auto** and selected, does not change the value of **Gate Holdoff**, but causes the setting to change to **Man.** Now the user can adjust the value Pressing the control while it is in **Man** and selected, cause the value to change back to **Auto** Pressing the control while it is in **Man** and not selected, causes the control to become selected and lets you adjust the value When **Method** is set to **Video** or **FFT**, the **Gate Holdoff** function has no effect

Preset	Auto
State Saved	Saved in instrument state
Min	1 µsec
Max	1 sec

Auto Function

Remote Command	`[:SENSe]:SWEep:EGATe:HOLDoff:AUTO OFF | ON | 0 | 1` `[:SENSe]:SWEep:EGATe:HOLDoff:AUTO?`
Example	`:SWE:EGAT:HOLD:AUTO ON` `:SWE:EGAT:HOLD:AUTO?`
Preset	`ON`
State Saved	Saved in instrument state
Range	Auto | Man

8.3.8 Gate View Sweep Time

Controls the Sweep Time in the Gate View window. To provide an optimal view of the gate signal, the instrument initializes **Gate View Sweep Time** based on the current settings of Gate Delay and Gate Length.

NOTE **Since Gate View Sweep Time is used to calculate Gate Delay and Gate Length increments, it is maintained even when not in Gate View.**

NOTE **In instruments without sweeping hardware such as some modular analyzers, this control may be labeled Gate View Acquisition Time**

Remote Command	`[:SENSe]:SWEep:EGATe:TIME <time>` `[:SENSe]:SWEep:EGATe:TIME?`
Example	`:SWE:EGAT:TIME 500 ms`
Dependencies	Gate View Sweep Time is initialized: – On Preset (after initializing delay and length) – Every time the Gate Method is set/changed Additionally, in the Swept SA measurement, whenever you do a Preset, or leave Gate View, the instrument remembers the Gate Delay and Gate Length settings. Then, when returning to Gate View, if the current Gate Delay and/or Gate Length do not match the remembered values Gate View Sweep Time is re-initialized

Preset	**Mode**	**Value**
	GSM/EDGE	1 ms
	5G NR	10 ms
	Others	800 µs

State Saved	Saved in instrument state
Min	1 µs
Max	6000 s
Annotation	The gate view Sweep Time is displayed in the lower-right corner of the gate view window

8.3.9 Gate View Start Time

Controls the time at the left edge of the Gate View.

Remote Command	`[:SENSe]:SWEep:EGATe:VIEW:STARt <time>` `[:SENSe]:SWEep:EGATe:VIEW:STARt?`
Example	`:SWE:EGAT:VIEW:STAR 10ms`
Notes	Units of time are required or no units; otherwise, an invalid suffix error message is generated
Preset	0 ms
State Saved	Saved in instrument state
Min	0 –150 ms for non-sweeping hardware
Max	500 ms

8.3.10 Gate Delay Compensation

Lets you select an RBW-dependent value by which to adjust the gate delay, to compensate for changes in the delay caused by RBW effects. Youcan select between uncompensated operation and two types of compensation:

Uncompensated	`OFF`
Delay Until RBW Settled	`SETTled`
Compensate for RBW Group Delay	`GDELay`

For full details of these options, see "More Information" on page 1084

Remote Command	`[:SENSe]:SWEep:EGATe:DELay:COMPensation:TYPE OFF | SETTled | GDELay` `[:SENSe]:SWEep:EGATe:DELay:COMPensation:TYPE?`

Example	`:SWE:EGAT:DEL:COMP:TYPE SETT` `:SWE:EGAT:DEL:COMP:TYPE?`
Notes	Although this function is Meas Global, there are some measurements that do not support this function. In those measurements the control is not displayed, and the operation will be Uncompensated If some but not all measurements in a Mode support this function, then selecting a measurement that does not support it will not change the Meas Global selection; it will simply be "Uncompensated" while in that measurement. The SCPI command is still accepted while in that measurement If Gate Delay Compensation is not supported at all within a particular mode, the control is not displayed, and if the SCPI command is sent while in a measurement within that mode, an "Undefined Header" message is generated Note that, for modular products such as EXM and VXT, this function is not supported. In those products the control is not displayed and the SCPI is ignored, although it is accepted without error
Preset	**Mode** / **Value** TD-SCDMA, LTEA FDD/TDD, 5G NR: `GDELay` All others: `SETTled`
State Saved	Saved in instrument state
Range	`OFF|SETTled|GDELay`

More Information

Selecting Uncompensated means that the actual gate delay is as you set it.

Selecting Delay Until RBW Settled causes the gate delay to be increased above the user setting by an amount equal to 3.06/RBW. This compensated delay causes the GATE START and GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the Gate Delay control does *not* change.

Delay Until RBW Settled allows excellent measurements of gated signals, by allowing the IF to settle following any transient that affects the burst. Excellent measurements also require that the analysis region not extend into the region affected by the falling edge of the burst. Thus, excellent measurements can only be made over a width that declines with narrowing RBWs, which is achieved by decreasing the gate length below the user setting by an amount equal to 2.53/RBW. Therefore, for general purpose compensation, you will still want to change the gate length with changes in RBW even if the gate delay is compensated. The compensated Gate Length is limited by the instrument so that it will never go below 10% of the value shown on the Gate Length key, as otherwise the sweep times could get very long. Anytime the Gate Length and RBW values combine in such a way that this limiting takes place, a warning "Settings Alert; can't apply full Delay Comp"is

displayed. For measurements that contain multiple sweeps with different RBW like SEM and SPUR, the smallest RBW is used for this limiting.

Selecting Compensate for RBW Group Delay causes the gate delay to be increased above the user setting by an amount equal to 1.81/RBW. This compensated delay causes the GATE START, GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the Gate Delay control does *not* change. Compensate for RBW Group Delay also includes gate length compensation; the gate length itself is adjusted as necessary to attempt to compensate for delay effects imposed by the RBW.

Compensate for RBW Group Delay is similar to Delay Until RBW Settled but compensates for the group delay of the RBW filter, rather than the filter settling time. As the RBW gets narrow, this can allow the settling tail of the RBW to affect the beginning part of the gated measurement and allow the beginning of the RBW settling transient to affect the end of the gated measurement. These two effects are symmetric because the RBW response is symmetric. Because the gate length is not automatically compensated, some users might find this compensation to be more intuitive than compensation for RBW settling.

8.3.11 Min Fast Position Query (Remote Query Only)

Queries the position of the MIN FAST line, relative to the delay reference (REF) line. See "Gate View" on page 1074. If this query is sent while not in Gate view, the MinFast calculation is performed based on the current values of the appropriate parameters and the result is returned. Reading this value lets you set an optimal gate delay value for the current measurement setup.

Example	`:SWE:EGAT:MIN?`
Backwards Compatibility SCPI	`[:SENSe]:SWEep:EGATe:MINFast?`

8.3.12 Gate Preset (Remote Command Only)

Presets the time-gated spectrum analysis capability.

This command sets gate parameter values to the ESA preset values, as follows:

- Gate trigger type = edge
- Gate polarity = positive

- Gate delay = 1 us
- Gate length = 1 us

Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE:PRESet` ESA Compatibility

8.3.13 Gate Level (Remote Command Only)

Sets the gate input transition point level for the external TRIGGER inputs on the front and rear panel. This is a legacy command for PSA compatibility. It is simply an alias to the equivalent trigger level command.

Notes	This command is simply an alias to `:TRIGger[:SEQuence]:EXTernal[1]|2:LEVel`
Backwards Compatibility SCPI	`[:SENSe]:SWEep:EGATe:EXTernal[1]|2:LEVel <voltage>` `[:SENSe]:SWEep:EGATe:EXTernal[1]|2:LEVel?`

8.3.14 Gate Polarity (Remote Command Only)

Sets the polarity for the gate signal. This setup is now done using the gate trigger's slope setting.

When `POSitive` is selected, a positive-going edge (Edge) or a high voltage (Level) will satisfy the gate condition, after the delay set with the Gate Delay key. When `NEGative` is selected, a negative-going edge (Edge) or a low voltage (Level) will satisfy the gate condition after the delay.

Example	`:SWE:EGAT:POL NEG` `:SWE:EGAT:POL?`
Preset	`POSitive`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`[:SENSe]:SWEep:EGATe:POLarity NEGative|POSitive`
	`[:SENSe]:SWEep:EGATe:POLarity?`
	This backwards-compatibility command is available in Modes that support Gate Polarity parameter
	`[:SENSe]:SWEep:TIME:GATE:POLarity`
	This backwards-compatibility command is available in SA and SCPILC Modes
	ESA compatibility

Preset	`HIGH`
Backwards Compatibility	`[:SENSe]:SWEep:TIME:GATE:LEVel HIGH|LOW`

SCPI [:SENSe]:SWEep:TIME:GATE:LEVel?

ESA compatibility

8.4 Hardware-accelerated Stepped FFT Gating (Display only)

Enables or disables the hardware-accelerated stepped FFT gating feature:

- Enabling the Hardware Acceleration feature means that the Stepped FFT algorithm will run on the FPGA for configurations where speed improvements are possible
- Disabling the hardware-accelerated stepped FFT gating means the Stepped FFT software algorithm will always run on the CPU instead of the FPGA

When enabled, it is only used when applicable and determined by the current sweep configuration.

The default value is `ON`, and its value is power-on persistent.

Remote Command	`[:SENSe]:SWEep:EGATe:HACCelerate:ENABle OFF | ON | 0 | 1`
Example	`:SWEep:EGATe:HACCelerate:ENABle ON`
Notes	Value `ON` means the hardware accelerated stepped FFT gating is used intelligently Value `OFF` means the hardware accelerated stepped FFT gating is always disabled
Dependencies	Only valid in ACP, CHP and SEM measurements
State Saved	Saved in instrument state

8.5 Periodic Sync Src

Contains controls that let you select and configure the sync signal for the Periodic Timer Trigger.

For convenience controls for adjusting the level and slope of the selected sync source are provided here. Note that these settings match those in the Trigger and Gate Source menus; that is, each trigger source has only one value of level and slope, regardless of which menu it is accessed from.

8.5.1 Select Periodic Timer Sync Source

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you are triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

Note that, with Sync Source `OFF`, the timing will drift unless the signal source frequency is locked to the instrument frequency reference.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal1 | EXTernal2 | EXTernal3 | EXTernal4 | RFBurst | PXI | INTernal | OFF` `:TRIGger[:SEQuence]:FRAMe:SYNC?`

Example	`:TRIG:FRAM:SYNC EXT1`
	`:TRIG:FRAM:SYNC EXT2`
	`:TRIG:FRAM:SYNC RFB`
	`:TRIG:FRAM:SYNC OFF`

Dependencies	`PXI` and `INTernal` triggers are only found in modular analyzers such as VXT Not available in E7760 or UXM In some models, there is no second External input. In these models, the External 2 selection is not shown, and the `EXTernal2` parameter generates a “Hardware missing; Not available for this model number” message
Preset	**Mode** / **Value** GSM/EDGE, LTEAFDD, LTEATDD, 5G NR / `RFBurst` All others / `OFF`
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal` For backwards-compatibility, the parameter `EXTernal` is mapped to `EXTernal1`

8.6 Auto/Holdoff

Contains controls that let you adjust Auto Trigger and Trigger Holdoff parameters

This tab does not appear in Spectrum Analyzer Mode in VXT models M9420A/21A.

8.6.1 Trig Holdoff

Sets the holdoff time between triggers. When the trigger condition is satisfied, the trigger occurs, the delay begins, and the holdoff time begins. New trigger conditions will be ignored until the holdoff time expires. For a free-running trigger, the holdoff value is the minimum time between triggers.

Remote Command	`:TRIGger[:SEQuence]:HOLDoff <time>` `:TRIGger[:SEQuence]:HOLDoff?`
Example	`:TRIG:HOLD:STAT ON` `:TRIG:HOLD 100 ms`
Dependencies	Unavailable if the selected Input is `BBIQ`. If this is the case, the control is grayed-out if it is pressed the informational message “Feature not supported for this Input” is displayed. If the SCPI command is sent, the error “Settings conflict; Feature not supported for this Input” is generated

Preset

Mode	Value
GSM/EDGE, Bluetooth	10 µs
LTEATDD,LTEAFDD	19 ms
5G NR	4 ms
WLAN on VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E	2 us
All others	100 ms

State Saved	Saved in instrument state	
Min	0 s	
Max	VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E	2.86 s
	All others	0.5 s

Auto Function

Remote Command	`:TRIGger[:SEQuence]:HOLDoff:STATe OFF | ON | 0 | 1` `:TRIGger[:SEQuence]:HOLDoff:STATe?`

Preset

Mode	Value
GSM/EDGE, Bluetooth	ON
All others	OFF

8.6.2 Auto Trig

Sets the time that the instrument will wait for the trigger conditions to be met. If they are not met after that much time, then the instrument is triggered anyway.

Remote Command	:TRIGger[:SEQuence]:ATRigger <time> :TRIGger[:SEQuence]:ATRigger?
Example	:TRIG:ATR:STAT ON :TRIG:ATR 100 ms
Notes	The "time that the instrument will wait" starts when the instrument is ready for a trigger, which may be hundreds of ms after the data acquisition for a sweep is done. The "time" ends when the trigger condition is satisfied, not when the delay ends
Dependencies	Not available in Real Time Spectrum Analyzer Mode
Preset	Off, 100 ms
State Saved	Saved in instrument state
Min	1 ms
Max	100 s

Auto Function

Remote Command	:TRIGger[:SEQuence]:ATRigger:STATe OFF | ON | 0 | 1 :TRIGger[:SEQuence]:ATRigger:STATe?
Preset	OFF

8.6.3 Holdoff Type

Lets you set the Trigger **Holdoff Type**.

NOTE **Holdoff Type** is not supported by all measurements. If the current measurement does not support it, this control does not appear, and **Holdoff Type** is Normal. If **Holdoff Type** SCPI is sent while in such a measurement, the SCPI is accepted and the setting remembered, but it has no effect until a measurement is in force that supports **Holdoff Type**.

Trigger Holdoff Type functionality

NORMal	This is the “oscilloscope” type of trigger holdoff and is the setting when the **Holdoff Type** control does not appear. In this type of holdoff, no new trigger will be accepted until the holdoff interval has expired after the previous trigger
ABOVe	If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) and then remains above the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) after having been above the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed
BELow	If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) after having been below the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) and then remains below the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed

Remote Command	`:TRIGger[:SEQuence]:HOLDoff:TYPE NORMal | ABOVe | BELow` `:TRIGger[:SEQuence]:HOLDoff:TYPE?`
Example	`:TRIG:HOLD:TYPE NORM`

Preset

Modes	Setting
GSM/EDGE	BELow
Bluetooth	
WLAN on VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E	
All others	NORMal

State Saved: Saved in instrument state

9 Programming the Instrument

This section provides information about the instrument's SCPI programming interface. You can also operate the instrument remotely using some legacy programming languages by running the N9061C Remote Language Compatibility measurement application and the N9062C SCPI Language Compatibility measurement application.

9.1 List of Supported SCPI Commands

The SCPI commands available while using this application are listed below.

To find a command in the list, search according to its first alphanumeric character, ignoring any leading ":" or "[" characters. The sole exception to this is the asterisk [*] prefix, identifying IEEE 488.2 Common commands and queries; all these appear at the start of the list.

Note that most commands also have query forms. In cases where a command and its query are described in the same topic, the list below includes the command and query as a *single* item, with no suffix.

Suffix	Interpretation
No suffix	Command & Query, *or* Command only For details, click the link to view the command definition
?	Query only

*

*CAL
*CLS
*ESE
*ESR?
*IDN?
*OPC
*OPT?
*RCL
*RST
*SAV
*SRE
*STB?
*TRG
*TST?
*WAI

A

ABORt

C

CALCulate:<meas>:PLAY:MODE
CALCulate:<meas>:PLAY:SRATe

```
CALCulate:<meas>:PLAY:STARt
CALCulate:<meas>:PLAY:STEP:FORWard
CALCulate:<meas>:PLAY:STOP
CALCulate:CLIMits:FAIL?
CALCulate:DATA<n>:COMPress?
CALCulate:DATA[1]|2|…|6:PEAKs?
CALCulate:FPOWer:POWer[1,2,…,999]?
CALCulate:FPOWer:POWer[1,2,…,999]:CONFigure
CALCulate:FPOWer:POWer[1,2,…,999]:DEFine
CALCulate:FPOWer:POWer[1,2,…,999]:DEFine?
CALCulate:FPOWer:POWer[1,2,…,999]:FETCh?
CALCulate:FPOWer:POWer[1,2,…,999]:INITiate
CALCulate:FPOWer:POWer[1,2,…,999]:READ?
CALCulate:FPOWer:POWer[1,2,…,999]:READ1?
CALCulate:FPOWer:POWer[1,2,…,999]:READ2?
CALCulate:FPOWer:POWer[1,2,…,999]:RESet
CALCulate:PAMPlifier:MARKer[1]|2|…|12:MAXimum
CALCulate:PAMPlifier:MARKer[1]|2|…|12:MAXimum:LEFT
CALCulate:PAMPlifier:MARKer[1]|2|…|12:MAXimum:NEXT
CALCulate:PAMPlifier:MARKer[1]|2|…|12:MAXimum:RIGHt
CALCulate:PAMPlifier:MARKer[1]|2|…|12:MINimum
CALCulate:PAMPlifier:MARKer[1]|2|…|12:MODE
CALCulate:PAMPlifier:MARKer[1]|2|…|12:PTPeak
CALCulate:PAMPlifier:MARKer[1]|2|…|12:REFerence
CALCulate:PAMPlifier:MARKer[1]|2|…|12:TRACe
CALCulate:PAMPlifier:MARKer[1]|2|…|12:X
CALCulate:PAMPlifier:MARKer[1]|2|…|12:X:POSition
CALCulate:PAMPlifier:MARKer[1]|2|…|12:Y?
CALCulate:PAMPlifier:MARKer:AOFF
CALibration[:ALL]
CALibration[:ALL]:NPENding
CALibration:AUTO
CALibration:AUTO:ALERt
CALibration:AUTO:MODE
CALibration:AUTO:TIME:OFF?
CALibration:BASic:SCHeduler:STATe
CALibration:DATA:BACKup
CALibration:DATA:DEFault
CALibration:DATA:INTernal:BACKup
CALibration:DATA:INTernal:RESTore
CALibration:DATA:RESTore
CALibration:EMIXer
CALibration:EXPired
CALibration:FREQuency:REFerence:COARse
CALibration:FREQuency:REFerence:FINE
CALibration:FREQuency:REFerence:MODE
CALibration:INTernal:ASFRanges?
CALibration:INTernal:ASFRanges:EXTend[:STATe]
CALibration:INTernal:ASFRanges:FRANges
CALibration:INTernal:ASFRanges[:STATe]
CALibration:INTernal:EMPath
```

```
CALibration:INTernal:FAST[:ALL]
CALibration:INTernal:HBANd[:ALL]
CALibration:INTernal:LBANd[:ALL]
CALibration:INTernal:LOLeakage
CALibration:INTernal:RECeiver[:ALL]
CALibration:INTernal:RRHead:AMPLitude
CALibration:INTernal:RRHead:AMPLitude:FAST
CALibration:INTernal:RRHead:IFCable
CALibration:INTernal:RRHead:LOPower
CALibration:INTernal:RRHead:LOSync
CALibration:INTernal:SOURce[:ALL]
CALibration:INTernal:SOURce[:ALL]:NPENding
CALibration:INTernal:VXT:TRANsceiver
CALibration:IQ:FLATness:I
CALibration:IQ:FLATness:I|IBAR|Q|QBAR:TIME?
CALibration:IQ:FLATness:IBAR
CALibration:IQ:FLATness:Q
CALibration:IQ:FLATness:QBAR
CALibration:IQ:ISOLation
CALibration:IQ:ISOLation:TIME?
CALibration:IQ:PROBe:I
CALibration:IQ:PROBe:I|:TIME?
CALibration:IQ:PROBe:IBar
CALibration:IQ:PROBe:IBAR:TIME?
CALibration:IQ:PROBe:I:CLEar
CALibration:IQ:PROBe:Q
CALibration:IQ:PROBe:QBar
CALibration:IQ:PROBe:QBAR:TIME?
CALibration:IQ:PROBe:Q:CLEar
CALibration:IQ:PROBe:Q:TIME?
CALibration:NFLoor
CALibration:NRF
CALibration:NRF:NPENding
CALibration:NRFPselector
CALibration:PDELay:CORRection
CALibration:PDELay:SOURce
CALibration:PRESelector
CALibration:REFerence:CLOCk?
CALibration:REFerence:CLOCk:END?
CALibration:REFerence:CLOCk:INITialize?
CALibration:RF
CALibration:RF:NPENding
CALibration:RFPSelector:ALERt
CALibration:RFPSelector:CONDucted
CALibration:RFPSelector:FULL
CALibration:RFPSelector:ONLY
CALibration:RFPSelector:RADiated
CALibration:RFPSelector:SCHeduler:RECurrence
CALibration:RFPSelector:SCHeduler:RECurrence:DAY
CALibration:RFPSelector:SCHeduler:RECurrence:WEEK
```

```
CALibration:RFPSelector:SCHeduler:TASK
CALibration:RFPSelector:SCHeduler:TIME:NEXT?
CALibration:RFPSelector:SCHeduler:TIME:STARt
CALibration:RRHead:TDCorrection[:STATe]
CALibration:TDS
CALibration:TEMPerature:AGO?
CALibration:TEMPerature:CURRent?
CALibration:TEMPerature:CURRent:RRHead?
CALibration:TEMPerature:CURRent:RRHead:LO?
CALibration:TEMPerature:INTernal:AMPLitude:FAST?
CALibration:TEMPerature:INTernal:EMPath?
CALibration:TEMPerature:INTernal:FAST?
CALibration:TEMPerature:INTernal:HBANd?
CALibration:TEMPerature:INTernal:LBANd?
CALibration:TEMPerature:INTernal:LOLeakage?
CALibration:TEMPerature:INTernal:RECeiver?
CALibration:TEMPerature:INTernal:RRHead:AMPLitude?
CALibration:TEMPerature:INTernal:RRHead:AMPLitude:FAST?
CALibration:TEMPerature:INTernal:RRHead:IFCable?
CALibration:TEMPerature:INTernal:RRHead:LOPower?
CALibration:TEMPerature:INTernal:RRHead:LOSync?
CALibration:TEMPerature:INTernal:RRHead:NPOWer?
CALibration:TEMPerature:INTernal:SOURce?
CALibration:TEMPerature:INTernal:VXT:TRANsceiver?
CALibration:TEMPerature:LALL?
CALibration:TEMPerature:LIF?
CALibration:TEMPerature:LPReselector?
CALibration:TEMPerature:LRF?
CALibration:TEMPerature:MAXimum?
CALibration:TEMPerature:MINimum?
CALibration:TEMPerature:NFLoor?
CALibration:TEMPerature:OLDest:SEConds?
CALibration:TEMPerature:OLDest[:TEMPerature]?
CALibration:TEMPerature:PDELay:SOURce?
CALibration:TEMPerature:RFPSelector:LCONducted?
CALibration:TEMPerature:RFPSelector:LRADiated?
CALibration:TEMPerature:UPDown:CONVerter?
CALibration:TEMPerature:UPDown:CONVerter:FAST?
CALibration:TIME:ELAPsed:NFLoor?
CALibration:TIME:INTernal:AMPLitude:FAST?
CALibration:TIME:INTernal:EMPath?
CALibration:TIME:INTernal:FAST?
CALibration:TIME:INTernal:HBAN?
CALibration:TIME:INTernal:LBANd?
CALibration:TIME:INTernal:LOLeakage?
CALibration:TIME:INTernal:RECeiver?
CALibration:TIME:INTernal:RRHead:AMPLitude?
CALibration:TIME:INTernal:RRHead:AMPLitude:FAST?
CALibration:TIME:INTernal:RRHead:IFCable?
CALibration:TIME:INTernal:RRHead:LOPower?
CALibration:TIME:INTernal:RRHead:LOSync?
```

```
CALibration:TIME:INTernal:RRHead:NPOWer?
CALibration:TIME:INTernal:SOURce?
CALibration:TIME:INTernal:VXT:TRANsceiver?
CALibration:TIME:LALL?
CALibration:TIME:LIF?
CALibration:TIME:LPReselector?
CALibration:TIME:LRF?
CALibration:TIME:NFLoor?
CALibration:TIME:PDELay:SOURce?
CALibration:TIME:REFerence:CLOCk?
CALibration:TIME:RFPSelector:LCONducted?
CALibration:TIME:RFPSelector:LRADiated?
CALibration:TIME:UPDown:CONVerter?
CALibration:TIME:UPDown:CONVerter:FAST?
CALibration:UPDown:CONVerter
CALibration:UPDown:CONVerter
CALibration:UPDown:CONVerter:FAST
CALibration:YTF
CALibration:YTF:NPENding
CONFigure?
CONFigure:<measurement>[:NDEFault]
CONFigure:CATalog?
CONFigure:PAMPlifier
CONFigure:PAMPlifier
CONFigure:PAMPlifier:NDEFault
```

D

```
DISPlay:ACTivefunc[:STATe]
DISPlay:ANNotation:MBAR[:STATe]
DISPlay:ANNotation:SCReen[:STATe]
DISPlay:ANNotation:TRACe[:STATe]
DISPlay:BACKlight
DISPlay:ENABle
DISPlay:FSCReen[:STATe]
DISPlay:GRATicule[:STATe]
DISPlay:PAMPlifier:AMAM|AMPM:SHOW:COEFficient
DISPlay:PAMPlifier:AMAM:NORMalized
DISPlay:PAMPlifier:AMPM:SHOW:COEFficient
DISPlay:PAMPlifier:BGRaph[:STATe]
DISPlay:PAMPlifier:EVM:CARRier:INDex
DISPlay:PAMPlifier:SEMask:OFFSet:SABSolute
DISPlay:PAMPlifier:SEMask:VIEW[:SELect]
DISPlay:PAMPlifier:TRACe
DISPlay:PAMPlifier:TRACe:RFENvelope:POINt
DISPlay:PAMPlifier:UPDate:FAST:AMAM:RESult?
DISPlay:PAMPlifier:UPDate:FAST:AMPM:RESult?
DISPlay:PAMPlifier:UPDate:FAST:SCALe
DISPlay:PAMPlifier:UPDate:FAST[:STATe]
```

```
DISPlay:PAMPlifier:VIEW[:SELect]
DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:COUPle
DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y
[:SCALe]:PDIVision
DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y[:SCALe]:RLEVel
DISPlay:PAMPlifier:WINDow[1]|2|3|5|8|12|13:TRACe:Y
[:SCALe]:RPOSition
DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:COUPle
DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X
[:SCALe]:PDIVision
DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X[:SCALe]:RLEVel
DISPlay:PAMPlifier:WINDow[1]|2|5|8|12|13:TRACe:X
[:SCALe]:RPOSition
DISPlay:THEMe
DISPlay:UINTerface:CSIZe
DISPlay:UINTerface:HTABs
DISPlay:UINTerface:STAB
DISPlay:UINTerface:TYPE?
DISPlay:VIEW:ADVanced:CATalog?
DISPlay:VIEW:ADVanced:DELete
DISPlay:VIEW:ADVanced:DELete:ALL
DISPlay:VIEW:ADVanced:NAME
DISPlay:VIEW:ADVanced:REName
DISPlay:VIEW:ADVanced:SELect
DISPlay:VIEW:ADVanced:USER:CATalog?
DISPlay:WINDow[1]:ANNotation[:ALL]
```

F

```
FETCh:<measurement>[n]?
FETCh:PAMPlifier?
FORMat:BORDer
FORMat[:TRACe][:DATA]
```

H

```
HCOPy:ABORt
HCOPy[:IMMediate]
```

I

```
INITiate:<measurement>
INITiate:CONTinuous
INITiate[:IMMediate]
INITiate:PAMPlifier
INITiate:PAUSe
INITiate:RESTart
```

```
INITiate:RESume
INPut[1]:IQ[:I]:IMPedance
INPut[1]:IQ:Q:IMPedance
INPut:COUPling
INPut:COUPling:I
INPut:COUPling:Q
INPut:FEXTender:CABLe:CORRection
INPut:IMPedance:REFerence
INPut:IQ[:I]:DIFFerential
INPut:IQ:MIRRored
INPut:IQ:Q:DIFFerential
INPut:OFFSet:I
INPut:OFFSet:Q
INSTrument:CATalog?
INSTrument:CONFigure:<mode>:<meas>
INSTrument:COUPle:SCReen:INPut
INSTrument:DEFault
INSTrument:NSELect
INSTrument:SCReen:CATalog?
INSTrument:SCReen:CREate
INSTrument:SCReen:DELete
INSTrument:SCReen:DELete:ALL
INSTrument:SCReen:MULTiple?
INSTrument:SCReen:MULTiple[:STATe]
INSTrument:SCReen:ORIentation
INSTrument:SCReen:REName
INSTrument:SCReen:SELect
INSTrument:SCReen:STAB?
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument:UNLoad
```

L

```
LXI:IDENtify[:STATe]
```

M

```
MEASure:<measurement>[n]?
MEASure:PAMPlifier[n]?
MMEMory:CATalog?
MMEMory:CDIRectory
MMEMory:COPY
```

```
MMEMory:COPY:DEVice
MMEMory:DATA
MMEMory:DELete
MMEMory:HEADer:ID?
MMEMory:LOAD:CCORrection
MMEMory:LOAD:CORRection
MMEMory:LOAD:LIMit
MMEMory:LOAD:LOSS
MMEMory:LOAD:PAMPlifier:DPD:MODel
MMEMory:LOAD:PAMPlifier:FMASk
MMEMory:LOAD:PAMPlifier:SHAPing
MMEMory:LOAD:RTYPe
MMEMory:LOAD:SCONfig
MMEMory:LOAD:STATe
MMEMory:LOAD:TRACe
MMEMory:LOAD:TRACe:REGister
MMEMory:LOAD:VCORrection
MMEMory:MDIRectory
MMEMory:MOVE
MMEMory:RDIRectory
MMEMory:REGister:STATe:LABel
MMEMory:REGister:TRACe:LABel
MMEMory:RMEDia:LABel
MMEMory:RMEDia:LIST?
MMEMory:RMEDia:SIZE?
MMEMory:RMEDia:WPRotect?
MMEMory:STORe:CORRection
MMEMory:STORe:LIMit
MMEMory:STORe:PAMPlifier:DPD:MODel
MMEMory:STORe:PAMPlifier:DPD:PWAVeform
MMEMory:STORe:PAMPlifier:FMASk
MMEMory:STORe:PAMPlifier:PA:MODel
MMEMory:STORe:PAMPlifier:SHAPing
MMEMory:STORe:PSCFactor
MMEMory:STORe:QSAVe
MMEMory:STORe:RESults
MMEMory:STORe:SCONfig
MMEMory:STORe:SCReen
MMEMory:STORe:SCReen:BLOCked
MMEMory:STORe:SCReen:THEMe
MMEMory:STORe:STATe
MMEMory:STORe:TRACe
MMEMory:STORe:TRACe:DATA
MMEMory:STORe:TRACe:REGister
```

O

```
Other
Other
```

```
OUTPut:ANALog
OUTPut:ANALog:AUTO
OUTPut:ANALog:SVIDeo
OUTPut:AUX
OUTPut:AUX:AIF
OUTPut:AUX:IO
OUTPut:AUX:IO:DATA<n>
OUTPut:DBUS[1][:STATe]
OUTPut:DBUS2:DATA
OUTPut:DBUS2[:STATe]
OUTPut:EIF
OUTPut:EREFerence:OUTPut
OUTPut[:EXTernal][:STATe]
OUTPut:IF2
OUTPut:IQ:OUTPut
OUTPut:MODulation[:STATe]
OUTPut:ROSCillator:LO:OUTPut
```

R

```
READ:<measurement>[n]?
READ:PAMPlifier[n]?
```

S

```
[:SENSe]:<meas>:POWer:MWPath
[:SENSe]:<meas>:POWer:MW:PATH
[:SENSe]:<meas>:POWer:MWPath:AUTO
[:SENSe]:<meas>:POWer:MW:PATH:AUTO
[:SENSe]:<measurement>:PFILter[:STATe]
[:SENSe]:AFINput[1]|2:COUPling
[:SENSe]:AFINput[1]|2:IMPedance
[:SENSe]:AFINput[1]|2:LOW
[:SENSe]:CCARrier:REFerence
[:SENSe]:CCORection:CSET:COMMent
[:SENSe]:CCORrection:CSET:ALL:DELete
[:SENSe]:CCORrection:CSET:DATA
[:SENSe]:CCORrection:CSET:DELete
[:SENSe]:CCORrection:CSET:DESCription
[:SENSe]:CCORrection:CSET:DIRection
[:SENSe]:CCORrection:CSET:PORT
[:SENSe]:CCORrection:CSET:SELect
[:SENSe]:CCORrection:CSET[:STATe]
[:SENSe]:CCORrection:CSET:X:SPACing
[:SENSe]:CCORrection:DATA?
[:SENSe]:CORRection:BTS<port>:GAIN
[:SENSe]:CORRection:CSET[1]|2|…|16:ANTenna[:UNIT]
[:SENSe]:CORRection:CSET[1]|2|…|16:COMMent
```

```
[:SENSe]:CORRection:CSET[1]|2|…|16:DATA
[:SENSe]:CORRection:CSET[1]|2|…|16:DATA:MERGe
[:SENSe]:CORRection:CSET[1]|2|…|16:DELete
[:SENSe]:CORRection:CSET[1]|2|…|16:DESCription
[:SENSe]:CORRection:CSET[1]|2|…|16:DIRection
[:SENSe]:CORRection:CSET[1]|2|…|16:RF:PORT
[:SENSe]:CORRection:CSET[1]|2|…|16[:STATe]
[:SENSe]:CORRection:CSET[1]|2|…|16:X:SPACing
[:SENSe]:CORRection:CSET:ALL:DELete
[:SENSe]:CORRection:CSET:ALL[:STATe]
[:SENSe]:CORRection:CSET:GROup[1]|2|…|10:DATA
[:SENSe]:CORRection:CSET:GROup:BReak
[:SENSe]:CORRection:CSET:GROup:COMMent
[:SENSe]:CORRection:CSET:GROup:DELete
[:SENSe]:CORRection:CSET:GROup:DESCription
[:SENSe]:CORRection:CSET:GROup:RELoad
[:SENSe]:CORRection:CSET:GROup[:STATe]
[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]
[:SENSe]:CORRection:IQ:I:ATTenuation
[:SENSe]:CORRection:IQ:I:ATTenuation:RATio
[:SENSe]:CORRection:IQ:I:GAIN
[:SENSe]:CORRection:IQ[:I]:SKEW
[:SENSe]:CORRection:IQ:Q:GAIN
[:SENSe]:CORRection:IQ:Q:GAIN:COUPle
[:SENSe]:CORRection:IQ:Q:SKEW
[:SENSe]:CORRection:MS<port>:GAIN
[:SENSe]:CORRection:SA<port>:GAIN
[:SENSe]:FEED
[:SENSe]:FEED:AFALign
[:SENSe]:FEED:AFINput:PORT
[:SENSe]:FEED:AREFerence
[:SENSe]:FEED:DATA
[:SENSe]:FEED:DATA:STORe
[:SENSe]:FEED:IQ:TYPE
[:SENSe]:FEED[:RF]:PORT:INFormation?
[:SENSe]:FEED[:RF]:PORT[:INPut]
[:SENSe]:FEED:RF:PORT:OUTPut
[:SENSe]:FEED:RF:PORT:TR:HPOWer:ATTenuator[:STATe]
[:SENSe]:HDUPlex:PORT:INPut
[:SENSe]:HDUPlex:PORT:OUTPut
[:SENSe]:MIXer:BAND
[:SENSe]:MIXer:BIAS
[:SENSe]:MIXer:BIAS:STATe
[:SENSe]:MIXer:CIFLoss
[:SENSe]:MIXer:HARMonic
[:SENSe]:MIXer:LODoubler
[:SENSe]:MIXer:MPATh
[:SENSe]:MIXer:TTYPe
[:SENSe]:MIXer:TTYPE?
[:SENSe]:MIXer:UIFFreq
[:SENSe]:PAMPlifier:ACPower:BANDwidth:RESolution
```

```
[:SENSe]:PAMPlifier:ACPower:CARRier:CPSD
[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:BANDwidth[:INTegration]
[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:FILTer:ALPHa
[:SENSe]:PAMPlifier:ACPower:CARRier:LIST:METHod
[:SENSe]:PAMPlifier:ACPower:CARRier[:POWer]
[:SENSe]:PAMPlifier:ACPower:CARRier:RCARrier
[:SENSe]:PAMPlifier:ACPower:METHod
[:SENSe]:PAMPlifier:ACPower:NCORrection[:STATe]
[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:BANDwidth[:INTegration]
[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:FILTer:ALPHa
[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST[:FREQuency]
[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:METHod
[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:SIDE
[:SENSe]:PAMPlifier:ACPower:OFFSet:LIST:STATe
[:SENSe]:PAMPlifier:ACPower:OFFSet:TYPE
[:SENSe]:PAMPlifier:ACPower:PREFerence:TYPE
[:SENSe]:PAMPlifier:ACPower:TIME
[:SENSe]:PAMPlifier:ACPower:TIME:AUTO
[:SENSe]:PAMPlifier:ACPower:TYPE
[:SENSe]:PAMPlifier:AMAM[:STATe]
[:SENSe]:PAMPlifier:CARRier:COUNt
[:SENSe]:PAMPlifier:CARRier:LIST:COUPle
[:SENSe]:PAMPlifier:CARRier:LIST:EVM[:STATe]?
[:SENSe]:PAMPlifier:CARRier:LIST:OFFSet
[:SENSe]:PAMPlifier:CARRier:LIST:PPResent
[:SENSe]:PAMPlifier:CARRier:LIST:WIDTh
[:SENSe]:PAMPlifier:DPD[:ENABle]
[:SENSe]:PAMPlifier:DPD:GEXPansion
[:SENSe]:PAMPlifier:DPD:ILControl:THReshold
[:SENSe]:PAMPlifier:DPD:ITERation
[:SENSe]:PAMPlifier:DPD:ITERation:MEASure:RESTart
[:SENSe]:PAMPlifier:DPD:ITERation:MEASure[:STATe]
[:SENSe]:PAMPlifier:DPD:METHod
[:SENSe]:PAMPlifier:DPD:MODE
[:SENSe]:PAMPlifier:DPD:MODel:GMP:MAXimum:LAG
[:SENSe]:PAMPlifier:DPD:MODel:GMP:MAXimum:LEAD
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:LAG
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:LEAD
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:MEMory:SYNC
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:LAG
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:LEAD
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:LAG
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:LEAD
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SELection:SYNC
[:SENSe]:PAMPlifier:DPD:MODel:GMP:ORDer:NONLinear:SYNC
[:SENSe]:PAMPlifier:DPD:MODel:ILControl:ENABle
[:SENSe]:PAMPlifier:DPD:MODel:ILControl[:ENABle]?
[:SENSe]:PAMPlifier:DPD:MODel:ILControl[:TYPE]
[:SENSe]:PAMPlifier:DPD:MODel:LUT:AMAM:PORDer
[:SENSe]:PAMPlifier:DPD:MODel:LUT:AMPM:PORDer
```

```
[:SENSe]:PAMPlifier:DPD:MODel:LUT:SIZE
[:SENSe]:PAMPlifier:DPD:MODel:LUT[:TYPE]
[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:IALGorithm
[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:CTERm
[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:MEMory
[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:NONLiear?
[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:NONLinear
[:SENSe]:PAMPlifier:DPD:MODel:MPVolterra:ORDer:ODD
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:COMMand
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:FOLDer
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:DPD
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:LOSS
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:PA
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:PARM1|…|12
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:INPut:SGPower
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:DPD
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:LOSS
[:SENSe]:PAMPlifier:DPD:MODel:SCRipt:OUTPut:PA
[:SENSe]:PAMPlifier:DPD:MODel[:TYPE]
[:SENSe]:PAMPlifier:DPD:SINGle:EXTRaction
[:SENSe]:PAMPlifier:DPD:TIME:AUTO
[:SENSe]:PAMPlifier:DPD:TIME:LENGth
[:SENSe]:PAMPlifier:EQUalizer:CLEar
[:SENSe]:PAMPlifier:EQUalizer[:ENABle]
[:SENSe]:PAMPlifier:EQUalizer:SIGNal[:TYPE]
[:SENSe]:PAMPlifier:EQUalizer:TRAin
[:SENSe]:PAMPlifier:ET:BALignment:NUMBer
[:SENSe]:PAMPlifier:ET:CALignment:NUMBer
[:SENSe]:PAMPlifier:ET:DELay
[:SENSe]:PAMPlifier:ET:DELay:ALIGn
[:SENSe]:PAMPlifier:ET:DELay:OFFSet
[:SENSe]:PAMPlifier:ET:DELay:STEP
[:SENSe]:PAMPlifier:ET:ENVelope:CONVersion:AMPLitude
[:SENSe]:PAMPlifier:ET:ENVelope:CONVersion:TYPE
[:SENSe]:PAMPlifier:ET:ENVelope:ETSG:MODel
[:SENSe]:PAMPlifier:ET:ENVelope:FILE:DLENgth?
[:SENSe]:PAMPlifier:ET:ENVelope:FILE:NAME?
[:SENSe]:PAMPlifier:ET:ENVelope:OSRatio
[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:COMMent
[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:COPY
[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:DATA
[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:DELete
[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing[1]|2|…|12:DESCription
[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing:ALL:DELete
[:SENSe]:PAMPlifier:ET:ENVelope:SHAPing:INDex:SELect
[:SENSe]:PAMPlifier:ET:ENVelope:SOURce
[:SENSe]:PAMPlifier:ET:ENVelope:USER:SRATe
[:SENSe]:PAMPlifier:ET:ETPS:GAIN
[:SENSe]:PAMPlifier:ET:ETPS:IMPedance
[:SENSe]:PAMPlifier:ET:ETPS:PEPower
[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping:MAX
```

```
[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping:MIN
[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping[:STATe]?
[:SENSe]:PAMPlifier:ET:ETPS:VCC:CLIPping[:STATe]OFF|ON|0|1
[:SENSe]:PAMPlifier:ET:ETPS:VCC:OFFSet
[:SENSe]:PAMPlifier:ET:ETPS:VCM
[:SENSe]:PAMPlifier:ET:ETPS:VIN:NORMalize[:STATe]
[:SENSe]:PAMPlifier:ET:ETPS:VOUT:NORMalize[:STATe]
[:SENSe]:PAMPlifier:ET:ETSG:DC:OFFSet:HIGH
[:SENSe]:PAMPlifier:ET:ETSG:DC:OFFSet:LOW
[:SENSe]:PAMPlifier:ET:ETSG:EXPort
[:SENSe]:PAMPlifier:ET:ETSG:OUTPut[:STATe]
[:SENSe]:PAMPlifier:ET:ETSG:SRATe?
[:SENSe]:PAMPlifier:ET:ETSG:USER:DC:OFFSet:HIGH
[:SENSe]:PAMPlifier:ET:ETSG:USER:DC:OFFSet:LOW
[:SENSe]:PAMPlifier:ET:ETSG:USER:VOLTage:OFFSet
[:SENSe]:PAMPlifier:ET:ETSG:USER:VOLTage:PEAK
[:SENSe]:PAMPlifier:ET:ETSG:VOLTage:OFFSet?
[:SENSe]:PAMPlifier:ET:ETSG:VOLTage:PEAK?
[:SENSe]:PAMPlifier:ET:PTRigger:DELay
[:SENSe]:PAMPlifier:ET:PTRigger:SOURce
[:SENSe]:PAMPlifier:ET[:STATe]
[:SENSe]:PAMPlifier:ET:TRIGger:SOURce
[:SENSe]:PAMPlifier:EVM:FORMat
[:SENSe]:PAMPlifier:EVM:IQAVg:SKIP[:STATe]
[:SENSe]:PAMPlifier:EVM:OPTimize[:STATe]
[:SENSe]:PAMPlifier:EVM:REPort:DB
[:SENSe]:PAMPlifier:EVM[:STATe]
[:SENSe]:PAMPlifier:EVM:TIME
[:SENSe]:PAMPlifier:EVM:WLAN:NCORrection[:STATe]
[:SENSe]:PAMPlifier:FREQuency:OFFSet
[:SENSe]:PAMPlifier:FREQuency:OFFSet:MODE
[:SENSe]:PAMPlifier:FREQuency:SYNThesis:AUTO[:STATe]
[:SENSe]:PAMPlifier:FREQuency:SYNThesis[:STATe]
[:SENSe]:PAMPlifier:IF:GAIN:AUTO[:STATe]
[:SENSe]:PAMPlifier:IF:GAIN:LEVel
[:SENSe]:PAMPlifier:IF:GAIN:SELect
[:SENSe]:PAMPlifier:IQ:AVERage:COUNt
[:SENSe]:PAMPlifier:IQ:AVERage[:STATe]
[:SENSe]:PAMPlifier:IQ:AVERage:TYPE
[:SENSe]:PAMPlifier:MEAS:TYPE
[:SENSe]:PAMPlifier:PAModel[:ENABle]
[:SENSe]:PAMPlifier:PORDer:AMAM
[:SENSe]:PAMPlifier:PORDer:AMPM
[:SENSe]:PAMPlifier:POWer:CONTrol:MODE
[:SENSe]:PAMPlifier:POWer:GAIN
[:SENSe]:PAMPlifier:POWer:IN
[:SENSe]:PAMPlifier:POWer:IN:MAX
[:SENSe]:PAMPlifier:POWer:LOSS:IN
[:SENSe]:PAMPlifier:POWer:LOSS:OUT
[:SENSe]:PAMPlifier:POWer:OUT
```

```
[:SENSe]:PAMPlifier:POWer:SERVo:MITeration
[:SENSe]:PAMPlifier:POWer:SERVo:RANGe
[:SENSe]:PAMPlifier:POWer:SERVo[:STATe]
[:SENSe]:PAMPlifier:POWer:SERVo:TOLerance
[:SENSe]:PAMPlifier:POWer:SWEep:ALNA[:STATe]
[:SENSe]:PAMPlifier:POWer:SWEep:IN:DTHReshold
[:SENSe]:PAMPlifier:POWer:SWEep:IN:LTHReshold
[:SENSe]:PAMPlifier:POWer:SWEep:IN:STARt
[:SENSe]:PAMPlifier:POWer:SWEep:IN:STEP
[:SENSe]:PAMPlifier:POWer:SWEep:IN:STOP
[:SENSe]:PAMPlifier:POWer:SWEep:OUT:DTHReshold
[:SENSe]:PAMPlifier:POWer:SWEep:OUT:LTHReshold
[:SENSe]:PAMPlifier:POWer:SWEep:OUT:STARt
[:SENSe]:PAMPlifier:POWer:SWEep:OUT:STEP
[:SENSe]:PAMPlifier:POWer:SWEep:OUT:STOP
[:SENSe]:PAMPlifier:POWer:THReshold
[:SENSe]:PAMPlifier:RADio:STANdard
[:SENSe]:PAMPlifier:RADio:SYNC
[:SENSe]:PAMPlifier:SAVoid:AUTO
[:SENSe]:PAMPlifier:SAVoid:FREQuency
[:SENSe]:PAMPlifier:SEMask:CARRier:BANDwidth:RESolution
[:SENSe]:PAMPlifier:SEMask:CARRier:CPSD
[:SENSe]:PAMPlifier:SEMask:CARRier:INDex
[:SENSe]:PAMPlifier:SEMask:CARRier:LIST:BANDwidth[:INTegration]
[:SENSe]:PAMPlifier:SEMask:CARRier:PEAK[:POWer]
[:SENSe]:PAMPlifier:SEMask:CARRier[:POWer]
[:SENSe]:PAMPlifier:SEMask:CARRier:PREFerence:TYPE
[:SENSe]:PAMPlifier:SEMask:FILTer[:RRC]:ALPHa?
[:SENSe]:PAMPlifier:SEMask:FILTer[:RRC]:ALPHa
[:SENSe]:PAMPlifier:SEMask:FILTer[:RRC][:STATe]
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:BANDwidth:IMULti
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:BANDwidth[:RESolution]
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:FREQuency:STARt
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:FREQuency:STOP
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:SIDE
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STARt:ABSolute
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STARt:RCARrier
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STARt:SABSolute
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STATe
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:ABSolute
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:ABSolute:COUPle
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:RCARrier
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:RCARrier:COUPle
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:SABSolute
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:STOP:SABSolute:COUPle
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:TEST
[:SENSe]:PAMPlifier:SEMask:OFFSet:LIST:TEST:SABSolute
[:SENSe]:PAMPlifier:SEMask:OFFSet:TYPE
[:SENSe]:PAMPlifier:SEMask[:STATe]
[:SENSe]:PAMPlifier:SEMask:TIME
[:SENSe]:PAMPlifier:SEMask:TIME:AUTO
```

```
[:SENSe]:PAMPlifier:SEMask:TYPE
[:SENSe]:PAMPlifier:SPECtrum
[:SENSe]:PAMPlifier:SYNC:CONFidence
[:SENSe]:PAMPlifier:TRIGger:COMPensation[:STATe]
[:SENSe]:POWer:[RF]|RF2|ALL:RANGe:OPTimize
[:SENSe]:POWer[:RF]|:RF2:ATTenuation
[:SENSe]:POWer[:RF]|:RF2:ATTenuation:AUTO
[:SENSe]:POWer[:RF]|:RF2:PADJust
[:SENSe]:POWer[:RF]:ATTenuation
[:SENSe]:POWer[:RF]:ATTenuation:AUTO
[:SENSe]:POWer[:RF]:ATTenuation:STEP[:INCRement]
[:SENSe]:POWer[:RF]:EATTenuation
[:SENSe]:POWer[:RF]:EATTenuation:STATe
[:SENSe]:POWer[:RF]:FEXTender:ATTen
[:SENSe]:POWer[:RF]:FEXTender:ATTen:AUTO
[:SENSe]:POWer[:RF]:FRATten
[:SENSe]:POWer[:RF]:FRATten
[:SENSe]:POWer[:RF]:GAIN:BAND
[:SENSe]:POWer[:RF]:GAIN:LNA[:STATe]
[:SENSe]:POWer[:RF]:GAIN[:STATe]
[:SENSe]:POWer[:RF]:MW:PATH
[:SENSe]:POWer[:RF]:MW:PATH:AUTO:FULL
[:SENSe]:POWer[:RF]:PADJust
[:SENSe]:POWer[:RF]:PCENter
[:SENSe]:POWer[:RF]:RANGe:OPTimize
[:SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation
[:SENSe]:POWer[:RF]:RANGe:OPTimize:TYPE
[:SENSe]:POWer[:RF]:RFPSelector:NFILter[:STATe]
[:SENSe]:POWer[:RF]:RFPSelector[:STATe]
[:SENSe]:POWer[:RF]:SWPResel
[:SENSe]:POWer[:RF]:SWPResel:BW
[:SENSe]:POWer[:RF]:SWPresel:STAT?
[:SENSe]:POWer[:RF]:SWPResel:STATe
[:SENSe]:ROSCillator:BANDwidth
[:SENSe]:ROSCillator:EXTernal:FREQuency
[:SENSe]:ROSCillator:EXTernal:FREQuency:DEFault
[:SENSe]:ROSCillator:LO:INPut
[:SENSe]:ROSCillator:PXIReference:EXTernal:FREQuency
[:SENSe]:ROSCillator:PXIReference:EXTernal:LOCK?
[:SENSe]:ROSCillator:PXIReference:SELect
[:SENSe]:ROSCillator:PXIReference:SOURce
[:SENSe]:ROSCillator:SOURce?
[:SENSe]:ROSCillator:SOURce:TYPE
[:SENSe]:SEMask:OFFSet:LIST:STARt:ABSolute?
[:SENSe]:SEMask:OFFSet:LIST:STARt:RCARrier?
[:SENSe]:SEMask:OFFSet:LIST:STARt:SABSolute?
[:SENSe]:SEMask:OFFSet:LIST:STOP:ABSolute?
[:SENSe]:SEMask:OFFSet:LIST:STOP:RCARrier?
[:SENSe]:SEMask:OFFSet:LIST:STOP:SABSolute?
[:SENSe]:SIDentify:MODE
```

```
[:SENSe]:SIDentify[:STATe]
[:SENSe]:SOURce:ADDRess?
[:SENSe]:SOURce:ALC[:STATe]
[:SENSe]:SOURce:AWG:CONNect
[:SENSe]:SOURce:AWG:CONNect:STATe?
[:SENSe]:SOURce:AWG:DISConnect
[:SENSe]:SOURce:AWG:SLOT
[:SENSe]:SOURce:AWG:SLOT:AUTO
[:SENSe]:SOURce:CALibration:IQ:DC[:STATe]
[:SENSe]:SOURce:CHANnel
[:SENSe]:SOURce:CONNect
[:SENSe]:SOURce:CONNect:STATe?
[:SENSe]:SOURce:DISConnect
[:SENSe]:SOURce:FREQuency
[:SENSe]:SOURce:FREQuency:AUTO
[:SENSe]:SOURce:NAME?
[:SENSe]:SOURce:OUTPut
[:SENSe]:SOURce:PRESet:OFF
[:SENSe]:SOURce:RUNTime:SCALing
[:SENSe]:SOURce:SETTings:APPLy
[:SENSe]:SOURce:WAVeform:BSHape:DCYCle?
[:SENSe]:SOURce:WAVeform:BSHape[:STATe]
[:SENSe]:SOURce:WAVeform:BSHape:T1
[:SENSe]:SOURce:WAVeform:BSHape:T2?
[:SENSe]:SOURce:WAVeform:BSHape:T3
[:SENSe]:SOURce:WAVeform:BSHape:T4
[:SENSe]:SOURce:WAVeform:CFReduction:ALGorithm
[:SENSe]:SOURce:WAVeform:CFReduction:BSIZe
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:ALGorithm
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:APPLy
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:BSIZe
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:CPCT
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:FREQuency:PASS
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:FREQuency:STOP
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:MORDer
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:PRIPple
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FILTer:SATTenuation
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk
[1]|2|…|12:COMMent
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:COPY
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk[1]|2|…|12:DATA
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk
[1]|2|…|12:DELete
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk
[1]|2|…|12:DESCription
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk:ALL:DELete
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:FMASk:INDex:SELect
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:MITeration
[:SENSe]:SOURce:WAVeform:CFReduction:CONFig:PAPR:TARGet
[:SENSe]:SOURce:WAVeform:CFReduction:CPCT
```

```
[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:FREQuency:PASS
[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:FREQuency:STOP
[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:MORDer
[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:PRIPple
[:SENSe]:SOURce:WAVeform:CFReduction:FILTer:SATTenuation
[:SENSe]:SOURce:WAVeform:CFReduction:FMASk
[:SENSe]:SOURce:WAVeform:CFReduction:MITeration
[:SENSe]:SOURce:WAVeform:CFReduction:PAPR:AFTer?
[:SENSe]:SOURce:WAVeform:CFReduction:PAPR:BEFore?
[:SENSe]:SOURce:WAVeform:CFReduction:PAPR:TARGet
[:SENSe]:SOURce:WAVeform:CFReduction[:STATe]
[:SENSe]:SOURce:WAVeform:EXPort
[:SENSe]:SOURce:WAVeform:EXPort:IMMediate
[:SENSe]:SOURce:WAVeform:FTYPe
[:SENSe]:SOURce:WAVeform:IDLE:HEAD
[:SENSe]:SOURce:WAVeform:IQCount?
[:SENSe]:SOURce:WAVeform:LENGth?
[:SENSe]:SOURce:WAVeform:LOAD
[:SENSe]:SOURce:WAVeform:LOAD:CURRent
[:SENSe]:SOURce:WAVeform:LOAD:IMMediate
[:SENSe]:SOURce:WAVeform:LOCation
[:SENSe]:SOURce:WAVeform:LOCation:SOURce
[:SENSe]:SOURce:WAVeform:MODulation:ATTenuation
[:SENSe]:SOURce:WAVeform:MODulation:ATTenuation:AUTO
[:SENSe]:SOURce:WAVeform:NAME
[:SENSe]:SOURce:WAVeform:RRATio
[:SENSe]:SOURce:WAVeform:RRATio:ACTual?
[:SENSe]:SOURce:WAVeform:RRATio:ACTual:STRing?
[:SENSe]:SOURce:WAVeform:RRATio:PREDefined
[:SENSe]:SOURce:WAVeform:RRATio:PREDefined:AUTO
[:SENSe]:SOURce:WAVeform:SRATe
[:SENSe]:SOURce:WAVeform:TYPE
[:SENSe]:SWEep:EGATe:CONTrol
[:SENSe]:SWEep:EGATe:DELay
[:SENSe]:SWEep:EGATe:DELay:COMPensation:TYPE
[:SENSe]:SWEep:EGATe:HACCelerate:ENABle
[:SENSe]:SWEep:EGATe:HOLDoff
[:SENSe]:SWEep:EGATe:HOLDoff:AUTO
[:SENSe]:SWEep:EGATe:LENGth
[:SENSe]:SWEep:EGATe:METHod
[:SENSe]:SWEep:EGATe:SOURce
[:SENSe]:SWEep:EGATe[:STATe]
[:SENSe]:SWEep:EGATe:TIME
[:SENSe]:SWEep:EGATe:VIEW
[:SENSe]:SWEep:EGATe:VIEW:STARt
[:SENSe]:VCORrection:DELete
[:SENSe]:VCORrection:SELect
SERVice[:PRODuction]:SOURce:MCONtrol:MPLicense[:STATe]
SOURce:AM[:DEPTh][:LINear]
SOURce:AM:INTernal:FREQuency
```

```
SOURce:AM:INTernal:FREQuency:STEP[:INCRement]
SOURce:AM:STATe
SOURce:FM[:DEViation]
SOURce:FM:INTernal:FREQuency
SOURce:FM:INTernal:FREQuency:STEP[:INCRement]
SOURce:FM:STATe
SOURce:FREQuency:CHANnels:BAND
SOURce:FREQuency:CHANnels:NUMBer
SOURce:FREQuency:COUPling
SOURce:FREQuency:COUPling:OFFSet
SOURce:FREQuency[:CW]
SOURce:FREQuency:OFFSet
SOURce:FREQuency:REFerence
SOURce:FREQuency:REFerence:SET
SOURce:FREQuency:REFerence:STATe
SOURce:FREQuency:STEP[:INCRement]
SOURce:LIST:INITiation:ARMed?
SOURce:LIST:NUMBer:STEPs
SOURce:LIST:REPetition:TYPE
SOURce:LIST:SETup:AMPLitude
SOURce:LIST:SETup:CLEar
SOURce:LIST:SETup:CNFRequency
SOURce:LIST:SETup:DURation:TYPE
SOURce:LIST:SETup:INPut:TRIGger
SOURce:LIST:SETup:OUTPut:TRIGger
SOURce:LIST:SETup:RADio:BAND
SOURce:LIST:SETup:RADio:BAND:LINK
SOURce:LIST:SETup:TOCount
SOURce:LIST:SETup:TRANsition:TIME
SOURce:LIST:SETup:WAVeform
SOURce:LIST[:STATe]
SOURce:LIST:STEP[1]|2|…|1000:SETup
SOURce:LIST:STEP[1]|2|…|1000:SETup:AMPLitude
SOURce:LIST:STEP[1]|2|…|1000:SETup:CNFRequency
SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TCOunt
SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TCOunt
SOURce:LIST:STEP[1]|2|…|1000:SETup:DURation:TYPE
SOURce:LIST:STEP[1]|2|…|1000:SETup:INPut:TRIGger
SOURce:LIST:STEP[1]|2|…|1000:SETup:OUTPut:TRIGger
SOURce:LIST:STEP[1]|2|…|1000:SETup:RADio:BAND
SOURce:LIST:STEP[1]|2|…|1000:SETup:RADio:BAND:LINK
SOURce:LIST:STEP[1]|2|…|1000:SETup:TRANsition:TIME
SOURce:LIST:STEP[1]|2|…|1000:SETup:WAVeform
SOURce:LIST:TRIGger[:IMMediate]
SOURce:LIST:TRIGger:INITiate[:IMMediate]
SOURce:LIST:TRIGger:OUTPut:TYPE
SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer
SOURce:PM[:DEViation]
SOURce:PM:INTernal:FREQuency
SOURce:PM:INTernal:FREQuency:STEP[:INCRement]
SOURce:PM:STATe
```

```
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT
SOURce:POWer[:LEVel][:IMMediate]:OFFSet
SOURce:POWer:REFerence
SOURce:POWer:REFerence:STATe
SOURce:POWer:STEP[:INCRement]
SOURce:PRESet
SOURce:RADio:ARB:BASeband:FREQuency:OFFSet
SOURce:RADio:ARB:BASeband:POWer
SOURce:RADio:ARB:CATalog?
SOURce:RADio:ARB:CATalog?
SOURce:RADio:ARB:DEFault:DIRectory
SOURce:RADio:ARB:DELete
SOURce:RADio:ARB:DELete:ALL
SOURce:RADio:ARB:FCATalog?
SOURce:RADio:ARB:FCATalog?
SOURce:RADio:ARB:HEADer:CLEar
SOURce:RADio:ARB:HEADer:INFormation?
SOURce:RADio:ARB:HEADer:SAVE
SOURce:RADio:ARB:IQADjustment:DELay
SOURce:RADio:ARB:IQADjustment:GAIN
SOURce:RADio:ARB:IQADjustment:[STATe]
SOURce:RADio:ARB:LOAD
SOURce:RADio:ARB:LOAD:ALL
SOURce:RADio:ARB:MARKer:CLEar
SOURce:RADio:ARB:MDEStination:ALCHold
SOURce:RADio:ARB:MDEStination:PULSe
SOURce:RADio:ARB:MPLicensed:NAME:LOCKed?
SOURce:RADio:ARB:MPLicensed:UID:LOCKed?
SOURce:RADio:ARB:MPOLarity:MARKer1|…|4
SOURce:RADio:ARB:NR5G:PHASe:FILTer:BANDwidth
SOURce:RADio:ARB:NR5G:PHASe:FILTer[:STATe]
SOURce:RADio:ARB:NR5G:PHASe:SCS
SOURce:RADio:ARB:NR5G:PHASe[:STATe]
SOURce:RADio:ARB:RETRigger
SOURce:RADio:ARB:RMS
SOURce:RADio:ARB:RMS:CALCulate
SOURce:RADio:ARB:RMS:CALCulation:MODE
SOURce:RADio:ARB:RSCaling
SOURce:RADio:ARB:SCLock:RATE
SOURce:RADio:ARB:SEQuence[:MWAVeform]
SOURce:RADio:ARB:SEQuence:SYNC
SOURce:RADio:ARB[:STATe]
SOURce:RADio:ARB:TRIGger:INITiate
SOURce:RADio:ARB:TRIGger[:SOURce]
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe
SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DELay:STATe
```

```
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe
SOURce:RADio:ARB:TRIGger:SYNC[:STATe]
SOURce:RADio:ARB:TRIGger:TYPE
SOURce:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE]
SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]
SOURce:RADio:ARB:WAVeform
SOURce:RADio:BAND:LINK
SOURce:SYNC:CONFig
SOURce:SYNC:CONNected?
SOURce:SYNC:REMote:ADDRess
SOURce:SYNC:REMote:ADDRess:ADD
SOURce:SYNC:REMote:ADDRess:DELete
SOURce:SYNC:REMote:IPPort
SOURce:SYNC:REMote:SEC<integer>?
SOURce:SYNC:REMote:SECondary<integer>
SOURce:SYNC:RTSetting:STATe
SOURce:SYNC:SETTings:ENABle
SOURce:SYNC:SETTings:SEGMent2:ENABle
SOURce:SYNC:SETTings:SEGMent2:FREQuency
SOURce:SYNC:STARt
SOURce:SYNC:STOP
SOURce:SYNC:TYPE
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation[:EVENt]?
STATus:OPERation:INSTrument:CONDition?
STATus:OPERation:INSTrument:ENABle
STATus:OPERation:INSTrument[:EVENt]?
STATus:OPERation:INSTrument:NTRansition
STATus:OPERation:INSTrument:PTRansition
STATus:OPERation:NTRansition
STATus:OPERation:PTRansition
STATus:PRESet
STATus:QUEStionable:CALibration:CONDition?
STATus:QUEStionable:CALibration:ENABle
STATus:QUEStionable:CALibration[:EVENt]?
STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?
STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle
STATus:QUEStionable:CALibration:EXTended:FAILure[:EVENt]?
STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition
STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition
STATus:QUEStionable:CALibration:EXTended:NEEDed:CONDition?
STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle
STATus:QUEStionable:CALibration:EXTended:NEEDed[:EVENt]?
STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition
STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition
STATus:QUEStionable:CALibration:NTRansition
STATus:QUEStionable:CALibration:PTRansition
STATus:QUEStionable:CALibration:SKIPped:CONDition?
STATus:QUEStionable:CALibration:SKIPped:ENABle
```

```
STATus:QUEStionable:CALibration:SKIPped[:EVENt]?
STATus:QUEStionable:CALibration:SKIPped:NTRansition
STATus:QUEStionable:CALibration:SKIPped:PTRansition
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:FREQuency:CONDition?
STATus:QUEStionable:FREQuency:ENABle
STATus:QUEStionable:FREQuency[:EVENt]?
STATus:QUEStionable:FREQuency:NTRansition
STATus:QUEStionable:FREQuency:PTRansition
STATus:QUEStionable:INTegrity:CONDition?
STATus:QUEStionable:INTegrity:ENABle
STATus:QUEStionable:INTegrity[:EVENt]?
STATus:QUEStionable:INTegrity:NTRansition
STATus:QUEStionable:INTegrity:OUTPut:CONDition?
STATus:QUEStionable:INTegrity:OUTPut:ENABle
STATus:QUEStionable:INTegrity:OUTPut[:EVENt]?
STATus:QUEStionable:INTegrity:OUTPut:NTRansition
STATus:QUEStionable:INTegrity:OUTPut:PTRansition
STATus:QUEStionable:INTegrity:PTRansition
STATus:QUEStionable:INTegrity:SIGNal:CONDition?
STATus:QUEStionable:INTegrity:SIGNal:ENABle
STATus:QUEStionable:INTegrity:SIGNal[:EVENt]?
STATus:QUEStionable:INTegrity:SIGNal:NTRansition
STATus:QUEStionable:INTegrity:SIGNal:PTRansition
STATus:QUEStionable:INTegrity:UNCalibrated:CONDition?
STATus:QUEStionable:INTegrity:UNCalibrated:ENABle
STATus:QUEStionable:INTegrity:UNCalibrated[:EVENt]?
STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition
STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition
STATus:QUEStionable:NTRansition
STATus:QUEStionable:POWer:CONDition?
STATus:QUEStionable:POWer:ENABle
STATus:QUEStionable:POWer[:EVENt]?
STATus:QUEStionable:POWer:NTRansition
STATus:QUEStionable:POWer:PTRansition
STATus:QUEStionable:POWer:PTRansition?>
STATus:QUEStionable:PTRansition
STATus:QUEStionable:TEMPerature:CONDition?
STATus:QUEStionable:TEMPerature:ENABle
STATus:QUEStionable:TEMPerature[:EVENt]?
STATus:QUEStionable:TEMPerature:NTRansition
STATus:QUEStionable:TEMPerature:PTRansition
SYSTem:APPLication:CATalog[:NAME]?
SYSTem:APPLication:CATalog[:NAME]:COUNt?
SYSTem:APPLication:CATalog:OPTion?
SYSTem:APPLication:CATalog:REVision?
SYSTem:APPLication[:CURRent][:NAME]?
SYSTem:APPLication[:CURRent]:OPTion?
```

```
SYSTem:APPLication[:CURRent]:REVision?
SYSTem:APPLication:LOADed?
SYSTem:CALibration:ABORt
SYSTem:CALibration:CGRoup
SYSTem:CALibration:CGRoup:APPLy
SYSTem:CALibration:CGRoup:APPLy:AOFF
SYSTem:CALibration:CGRoup:COPY
SYSTem:CALibration:CGRoup:COPY:FROM
SYSTem:CALibration:DELete:ALL
SYSTem:CALibration:DESCription
SYSTem:CALibration:FREQuency:OFFSet
SYSTem:CALibration:INITiate:SELected
SYSTem:CALibration:INPut
SYSTem:CALibration:MODule[1]|2|...|10:SNUMber?
SYSTem:CALibration:MODule:SELect
SYSTem:CALibration:REFerence
SYSTem:CALibration:ROW[1]|2|…|100:APPLy:STATe
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STARt
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STEP
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|…|100:ATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:CALibrate:STATe
SYSTem:CALibration:ROW[1]|2|…|100:CAPPlied?
SYSTem:CALibration:ROW[1]|2|…|100:COUPling
SYSTem:CALibration:ROW[1]|2|…|100:DELete
SYSTem:CALibration:ROW[1]|2|…|100:DUPLicate
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STARt
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STEP
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|…|100:EATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STARt
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|…|100:FATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STARt
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STEP
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:STOP
SYSTem:CALibration:ROW[1]|2|…|100:FEATtenuation:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:POINts
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STARt
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STEP
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:STOP
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis:ALL[:STATe]
SYSTem:CALibration:ROW[1]|2|…|100:FREQuency:SYNThesis[:STATe]
SYSTem:CALibration:ROW[1]|2|…|100:IF:GAIN[:STATe]?
SYSTem:CALibration:ROW[1]|2|…|100:IF:GAIN
[:STATe]AUTO|HIGH|LOW|ALL
SYSTem:CALibration:ROW[1]|2|…|100:IF:PATH
SYSTem:CALibration:ROW[1]|2|…|100:INSert
SYSTem:CALibration:ROW[1]|2|…|100:LAST?
SYSTem:CALibration:ROW[1]|2|…|100:LO:MMODe
```

```
SYSTem:CALibration:ROW[1]|2|…|100:MATCh[:STATe]
SYSTem:CALibration:ROW[1]|2|…|100:NAME
SYSTem:CALibration:ROW[1]|2|…|100:POWer:GAIN:BAND?
SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:BAND
SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:GAIN:LNA[:STATe]
SYSTem:CALibration:ROW[1]|2|…|100:POWer[:RF]:MW:PATH
SYSTem:CALibration:ROW[1]|2|…|100:STATus?
SYSTem:CALibration:ROW[1]|2|…|100:TSMultiplier
SYSTem:CALibration:ROW[1]|2|…|100:TYPE
SYSTem:CALibration:ROW[1]|2|…|100:UCMeas
SYSTem:CALibration:STATus:ALL?
SYSTem:CALibration:TUNE:FREQuency
SYSTem:CALibration:TUNE:OUTput[:STATe]
SYSTem:CALibration:TUNE:REFerence
SYSTem:CALibration:TUNE[:SELected]
SYSTem:CALibration:TUNE:SPACing
SYSTem:CALibration:TUNE:TYPE
SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess
SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle]
SYSTem:COMMunicate:LAN:INSTrument:PORT?
SYSTem:COMMunicate:LAN:IPV4:CONFig
SYSTem:COMMunicate:LAN:IPV6:CONFig
SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?
SYSTem:COMMunicate:LAN:PHYSical:IPADdress:LIST?
SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle
SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle
SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle
SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTrol?
SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle
SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle
SYSTem:COMMunicate:USB:CONNection?
SYSTem:COMMunicate:USB:PACKets?
SYSTem:COMMunicate:USB:STATus?
SYSTem:CONFigure[:SYSTem]?
SYSTem:CSYStem?
SYSTem:DATE
SYSTem:DEFault
SYSTem:DISPlay:BACKlight:INTensity
SYSTem:DISPlay:CFORmat
SYSTem:DISPlay:HINTs?
SYSTem:DISPlay:HINTs[:STATe]
SYSTem:DISPlay:LANGuage
SYSTem:DISPlay:MPPosition
SYSTem:DISPlay:MPTab
SYSTem:DISPlay:NEPimmediate
SYSTem:ERRor[:NEXT]?
SYSTem:ERRor:OVERload[:STATe]
SYSTem:ERRor:PUP?
SYSTem:ERRor:VERBose
SYSTem:HELP:HEADers?
```

```
SYSTem:HID?
SYSTem:IDN
SYSTem:IDN:CONFigure
SYSTem:KLOCk
SYSTem:LICense[:FPACk]:WAVeform:ADD
SYSTem:LICense[:FPACk]:WAVeform:CLEar
SYSTem:LICense[:FPACk]:WAVeform:FREE?
SYSTem:LICense[:FPACk]:WAVeform:LOCK
SYSTem:LICense[:FPACk]:WAVeform:NAME?
SYSTem:LICense[:FPACk]:WAVeform:REPLace
SYSTem:LICense[:FPACk]:WAVeform:STATus?
SYSTem:LICense[:FPACk]:WAVeform:UID?
SYSTem:LICense[:FPACk]:WAVeform:USED?
SYSTem:LKEY
SYSTem:LKEY?
SYSTem:LKEY:BORRow
SYSTem:LKEY:BORRow:LIST?
SYSTem:LKEY:BORRow:NETWork:COUT:ENABle
SYSTem:LKEY:BORRow:RETurn
SYSTem:LKEY:COUT?
SYSTem:LKEY:COUT:LIST?
SYSTem:LKEY:DELete
SYSTem:LKEY:LIST?
SYSTem:LKEY:SOFTware:SUPPort:EXPiration:DATE?
SYSTem:LKEY:WAVeform:ADD
SYSTem:LKEY:WAVeform:CLEar
SYSTem:LKEY:WAVeform:FREE?
SYSTem:LKEY:WAVeform:LOCK
SYSTem:LKEY:WAVeform:NAME?
SYSTem:LKEY:WAVeform:REPLace
SYSTem:LKEY:WAVeform:STATus?
SYSTem:LKEY:WAVeform:UID?
SYSTem:LKEY:WAVeform:USED?
SYSTem:LOCK:NAME?
SYSTem:LOCK:OWNer?
SYSTem:LOCK:RELease
SYSTem:LOCK:REQuest?
SYSTem:LOFF
SYSTem:LWSTation
SYSTem:METRics:FPANel?
SYSTem:METRics:SCPI?
SYSTem:METRics:STIMe?
SYSTem:MRELay:COUNt?
SYSTem:OPTions?
SYSTem:PDOWn
SYSTem:PERSona:DEFault
SYSTem:PERSona:MANufacturer
SYSTem:PERSona:MANufacturer:DEFault
SYSTem:PERSona:MODel
SYSTem:PERSona:MODel:DEFault
SYSTem:PON:APPLication:LLISt
```

```
SYSTem:PON:APPLication:VMEMory[:AVAilable]?
SYSTem:PON:APPLication:VMEMory:TOTal?
SYSTem:PON:APPLication:VMEMory:USED?
SYSTem:PON:APPLication:VMEMory:USED:NAME?
SYSTem:PON:ETIMe?
SYSTem:PON:FPGA:LOAD
SYSTem:PON:FPGA:PREFerence
SYSTem:PON:MODE
SYSTem:PON:TIME?
SYSTem:PON:TYPE
SYSTem:PRESet
SYSTem:PRESet:FULL
SYSTem:PRESet:USER
SYSTem:PRESet:USER:ALL
SYSTem:PRESet:USER:SAVE
SYSTem:PRINt:THEMe
SYSTem:PUP
SYSTem:PUP:PROCess
SYSTem:SECurity:USB:WPRotect[:ENABle]
SYSTem:SEQuencer
SYSTem:SET
SYSTem:SHOW
SYSTem:SOFTware:VERSion:DATE?
SYSTem:TEMPerature:HEXTreme?
SYSTem:TEMPerature:LEXTreme?
SYSTem:TIME
SYSTem:VERSion?
```

T

```
TRACe:CLEar
TRACe[:DATA]
TRIGger:<meas>[:SEQuence]:RF:SOURce
TRIGger:<meas>[:SEQuence]:SOURce
TRIGger:<measurement>[:SEQuence]:IQ:SOURce
TRIGger[1]|2|…|4[:SEQuence]:OUTPut
TRIGger[1]|2|…|4[:SEQuence]:OUTPut:DIRection
TRIGger[1]|2|…|4[:SEQuence]:OUTPut:POLarity
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:LINE
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:POLarity
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:LINE
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:POLarity
TRIGger[:SEQuence]:<trig_source>:DELay
TRIGger[:SEQuence]:<trig_source>:DELay:STATe
TRIGger[:SEQuence]:<trig_source>:LEVel
TRIGger[:SEQuence]:<trig_source>:SLOPe
TRIGger[:SEQuence]:AIQMag:BANDwidth
```

```
TRIGger[:SEQuence]:AIQMag:CENTer
TRIGger[:SEQuence]:ATRigger
TRIGger[:SEQuence]:ATRigger:STATe
TRIGger
[:SEQuence]:EXTernal1|EXTernal2|EXTernal3|EXTernal4|RFBurst:DELay
:COMPensation
TRIGger[:SEQuence]:FRAMe:ADJust
TRIGger[:SEQuence]:FRAMe:OFFSet
TRIGger[:SEQuence]:FRAMe:OFFSet:DISPlay:RESet
TRIGger[:SEQuence]:FRAMe:PERiod
TRIGger[:SEQuence]:FRAMe:SMONitor:RESet
TRIGger[:SEQuence]:FRAMe:SYNC
TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff
TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe
TRIGger[:SEQuence]:HOLDoff
TRIGger[:SEQuence]:HOLDoff:STATe
TRIGger[:SEQuence]:HOLDoff:TYPE
TRIGger[:SEQuence]:INTernal:SOURce:OUTPut
TRIGger[:SEQuence]:INTernal:SOURce:OUTPut:POLarity
TRIGger[:SEQuence]:OFFSet:STATe
TRIGger[:SEQuence]:OPTimize:MODE
TRIGger[:SEQuence]:PXI:LINE
TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute
TRIGger[:SEQuence]:RFBurst:LEVel:RELative
TRIGger[:SEQuence]:RFBurst:LEVel:TYPE
TRIGger[:SEQuence]:RF:SOURce
TRIGger[:SEQuence]:SOURce
TRIGger[:SEQuence]:TV:FMODe
TRIGger[:SEQuence]:TV:LINE
TRIGger[:SEQuence]:TV:STANdard
```

U

```
UNIT:PAMPlifier:ACPower:POWer:PSD
```

9.2 IEEE 488.2 Common Commands

The instrument supports the following subset of IEEE 488.2 Common Commands, as defined in Chapter 10 of IEEE Standard 488.2–1992. As indicated below, some of these commands correspond directly to instrument front-panel functionality, while others are available only as remote commands.

- "*CAL? - Calibration Query" on page 1120 (Align Now All equivalent)
- "*CLS - Clear Status" on page 1121
- "*ESE - Standard Event Status Enable" on page 1121
- "*ESR? - Standard Event Status Register Query" on page 1122
- "*IDN? - Identification Query" on page 1122
- "*OPC? - Operation Complete" on page 1123
- "*OPT? - Query Instrument Options" on page 1124
- "*RCL - Recall Instrument State" on page 1124 (Recall State equivalent)
- "*RST - Reset" on page 1124 (Mode Preset equivalent)
- "*SAV - Save Instrument State" on page 1125 (Save State equivalent)
- "*SRE - Service Request Enable" on page 1125
- "*STB? - Status Byte Query" on page 1126
- "*TRG - Trigger" on page 1126
- "*TST? - Self Test Query" on page 1126
- "*WAI - Wait-to-Continue" on page 1127

9.2.1 *CAL? - Calibration Query

`*CAL?` Performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful. A one is returned if any part of the alignment fails. The equivalent SCPI command is `:CALibrate[:ALL]?`

Remote Command	`*CAL`
Example	`*CAL?`

	Runs a full alignment and returns 0 if no problems encountered
Status Bits/OPC dependencies	See "Align Now All" on page 496

9.2.2 *CLS - Clear Status

Clears the "Status Byte Register" on page 1158, by emptying the error queue and clearing all bits in all the event registers, and consequently all bits in the Status Byte Register.

The Status Byte Register summarizes the states of the other registers. It is also responsible for generating service requests.

Remote Command	`*CLS`
Example	`*CLS` Clears the error queue and the Status Byte Register
Notes	For related commands, see `:SYSTem:ERRor[:NEXT]?` See also `:STATus:PRESet` and all commands in the "Status Register System & STATus Subsystem" on page 1149
Status Bits/OPC dependencies	Resets all bits in all event registers to 0, which resets all the Status Byte Register bits to 0 also

9.2.3 *ESE - Standard Event Status Enable

Sets the desired bits in the Event Enable sub-register of the "Standard Event Status Register" on page 1162, which enables the corresponding bits in the Standard Event Status Register. This register monitors I/O errors and synchronization conditions such as operation complete, request control, query error, device-dependent error, status execution error, command error, and power on. The selected bits are `ORed` to become a summary bit (bit 5) in the "Status Byte Register" on page 1158, which can be queried.

The query returns the state of this register.

Numeric values for bit patterns can be entered using decimal or hexadecimal representations (0 to 32767, equivalent to `#H0` to `#H7FFF`).

Remote Command	`*ESE <integer>` `*ESE?`

Example	`*ESE 36`
	Enables the Standard Event Status Register to monitor query and command errors (bits 2 and 5)
	`*ESE?`

	Returns 36, indicating that the query and command status bits are enabled
Notes	For related commands, see the "Status Register System & STATus Subsystem" on page 1149 and `:SYSTem:ERRor[:NEXT]?`
Preset	255
State Saved	Not saved in state
Min	0
Max	255

9.2.4 *ESR? - Standard Event Status Register Query

Queries and clears the "Standard Event Status Register" on page 1162. (This is a destructive read.) The value returned is a hexadecimal number that reflects the current state (0/1) of all the bits in the register.

Remote Command	`*ESR?`
Example	`*ESR?` Returns 1 if there is either a query or command error, otherwise returns zero
Notes	For related commands, see "Status Register System & STATus Subsystem" on page 1149
Min	0
Max	255
Status Bits/OPC dependencies	Standard Event Status Register (bits 0 – 7)

9.2.5 *IDN? - Identification Query

Returns a string of instrument identification information. The string contains the model number, serial number, and firmware revision.

The response is organized into four fields separated by commas. The field definitions are as follows:

1. Manufacturer
2. Model
3. Serial number
4. Firmware version

Remote Command	`*IDN?`

Example	`*IDN?`
	Returns instrument identification information, such as:
	`Keysight Technologies,N9040B,US01020004,A.15.02`

Example	`:ID?`
	Returns model number, such as:
	`N9040B`

Notes	Provided for backwards compatibility: In **Remote Language Compatibility** Mode, `ID?` returns the model number of the emulated instrument In any other Mode, the returned model number is that of the actual instrument
Backwards Compatibility SCPI	`:ID?`

9.2.6 *OPC? - Operation Complete

Sets bit 0 in the "Standard Event Status Register" on page 1162 (SESR) to “1” when pending operations have finished, that is when all overlapped commands are complete. It does not hold off subsequent operations. You can determine when the overlapped commands have completed either by polling the OPC bit in SESR, or by setting up the status system so that a service request (SRQ) is asserted when the OPC bit is set.

`*OPC?` returns “1” after all the current overlapped commands are complete, so it holds off subsequent commands until the "1" is returned, then the program continues. This query can be used to synchronize events of other instruments on the external bus.

Remote Command	`*OPC` `*OPC?`

Example	`:INIT:CONT 0`
	Selects single sweeping
	`:INIT:IMM`
	Initiates a sweep
	`*OPC?`
	Holds off any further commands until the sweep is complete

Notes	Not global to all remote ports or front panel. `*OPC` only affects operations that were initiated on the same port that the `*OPC` command was issued from `*OPC` is an overlapped command, but `*OPC?` is sequential `*OPC?` does *not* holdoff the completion of GUI update commands , such as `:MMEM:LOAD:SCON "myScreenConfig.screen"`

9.2.7 *OPT? - Query Instrument Options

Returns a string of all installed instrument options. It is a comma separated list with quotes, such as:

`"550,B25,B40,BBA,CRP,CRW,EA3,EDP,ESC,EXM,FBP,LNP,MPB,NF2,RTS,EMC,FP2"`

Remote Command	`*OPT?`

9.2.8 *RCL - Recall Instrument State

Recalls the instrument state from the specified instrument memory register.

- If the state being loaded has a newer firmware revision than that of the instrument, no state is recalled, and an error is reported
- If the state being loaded has the same firmware revision as that of the instrument, the state will be loaded
- If the state being loaded has an older firmware revision than that of the instrument, then the instrument will only load the parts of the state that apply to the older revision

Remote Command	`*RCL <register #>`
Example	`*RCL 7` Recalls the instrument state that is currently stored in register 7 (register 8 in the UI)
Notes	Registers 0 through 15 are accessible from the front panel in menu keys for Recall Registers. Register 0 corresponds to the front panel Register 1
Min	0
Max	127
Status Bits/OPC dependencies	The command is sequential

9.2.9 *RST - Reset

`*RST` is equivalent to `:SYST:PRES;:INIT:CONT OFF`, which is a Mode Preset in the Single measurement state. This command is preferred over the Mode Preset command `:SYST:PRES`, because optimal remote programming occurs with the instrument in the Single measurement state.

`*RST` clears all pending OPC bits and sets the Status Byte to 0.

Remote Command	`*RST`
Notes	Sequential
Couplings	`*RST` causes the currently running measurement to be aborted and causes the default measurement to be active. `*RST` gets the mode to a consistent state, with all of the default couplings set
Status Bits/OPC dependencies	Clears all pending OPC bits. The "Status Byte Register" on page 1158 is set to 0

9.2.10 *SAV - Save Instrument State

Saves the current instrument state and mode to the specified instrument memory register.

Remote Command	`*SAV <register #>`
Example	`*SAV 9` Saves the instrument state in register 9 (register 10 in the UI)
Notes	Registers 0 through 15 are accessible from the front panel in menu keys for Save Registers. Register 0 corresponds to the front panel Register 1
Min	0
Max	127
Status Bits/OPC dependencies	The command is sequential

9.2.11 *SRE - Service Request Enable

Enables the desired bits of the "Service Request Enable Register" on page 1161.

The query returns the value of the register, indicating which bits are currently enabled.

Numeric values for bit patterns can be entered using decimal or hexadecimal representations (0 to 32767, equivalent to `#H0` to `#H7FFF`).

Remote Command	`*SRE <integer>` `*SRE?`
Example	`*SRE 22` Enables bits 1, 2, and 4 in the Service Request Enable Register
Notes	For related commands, see "Status Register System & STATus Subsystem" on page 1149 and `:SYSTem:ERRor[:NEXT]?`
Preset	0

Min	0
Max	255
Status Bits/OPC dependencies	Service Request Enable Register (all bits, 0 – 7)

9.2.12 *STB? - Status Byte Query

Returns the value of the "Status Byte Register" on page 1158 without erasing its contents.

Remote Command	`*STB?`
Example	`*STB?` Returns a decimal value for the bits in the Status Byte Register For example, if `16` is returned, it indicates that bit 5 is set and one of the conditions monitored in the Standard Event Status Register is set
Notes	See related command `"*CLS - Clear Status" on page 1121`
Status Bits/OPC dependencies	Status Byte Register (all bits, 0 – 7)

9.2.13 *TRG - Trigger

Triggers the instrument. Use `:TRIGger[:SEQuence]:SOURce` to select the trigger source.

Remote Command	`*TRG`
Example	`*TRG` Triggers the instrument to take a sweep or start a measurement, depending on the current instrument settings
Notes	See related command `:INITiate:IMMediate`

9.2.14 *TST? - Self Test Query

Performs the internal self-test routines and returns a number indicating the success of the testing. The value returned is 0 if the test is successful, or 1 if it fails.

Remote Command	`*TST?`
Example	`*TST?`

	Runs the self-test routines and returns 0=passed, 1=some part failed

9.2.15 *WAI - Wait-to-Continue

Causes the instrument to wait until all overlapped commands are completed before executing any additional commands. There is no query form.

Remote Command	`*WAI`
Example	`:INIT:CONT OFF; INIT;*WAI` Sets the instrument to single sweep. Starts a sweep and waits for its completion
Notes	`*WAI does not wait for the completion of user-interface-related commands, such as :MMEM:LOAD:SCON "myScreenConfig.screen"`
Status Bits/OPC dependencies	Not global to all remote ports or front panel. `*OPC` only considers operation that was initiated on the same port that the `*OPC` command was issued from

9.3 SCPI Operation and Results Query

You can use SCPI commands for remote control of measurements and querying of measurement results data. There are several alternative commands you can use to control the measurement, depending on how you wish to operate the instrument. There are also a number of queries that you can use to extract the measurement data.

In this section, Mode refers to a Measurement Application, for example, Spectrum Analyzer or 5G NR.

9.3.1 Mode Control

Use either `:INSTrument:SELect` or `:INSTrument:NSELect` to select the "Mode" on page 58.

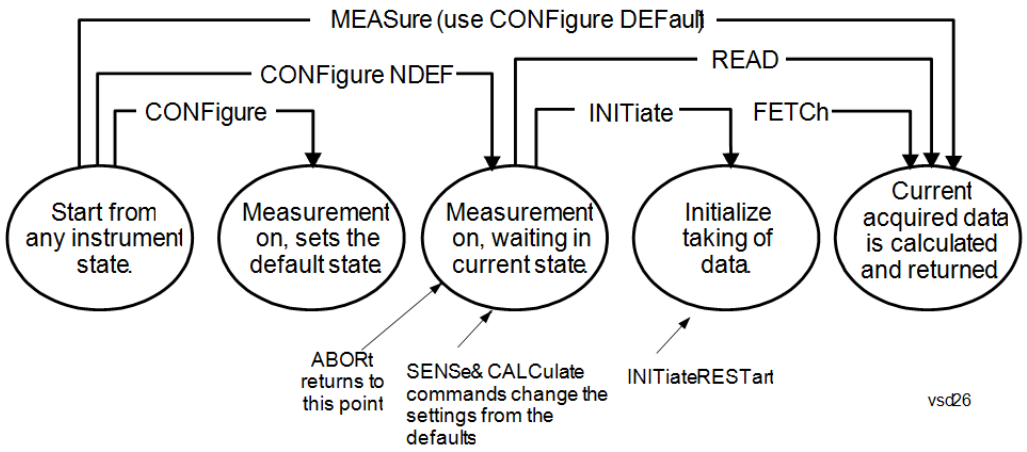
`:INSTrument:CONFigure` causes a Mode *and* Measurement switch at the same time. This results in faster overall switching than sending `:INSTrument:SELect` and `:CONFigure` separately, as described in Mode.

9.3.2 Measurement Control

This section describes the measurement control commands listed below, and their functions.

"CONFigure" on page 1129	Switches to the desired measurement. Presets all measurement settings to their defaults, *unless* `:NDEFault` is specified
"INITiate" on page 1130	Starts the measurement
"FETCh" on page 1130	Queries the data without starting the measurement. If a measurement is already in progress, waits for completion
"READ" on page 1131	Starts the measurement with the current settings and queries the data
"MEASure" on page 1132	Switches to the desired measurement, presets all measurement settings to their defaults, starts the measurement and queries the data

The relationship between the command forms is illustrated in the diagram below. `:FETCh`, `:READ` and `:MEASure` are queries that return measurement data.



9.3.2.1 CONFigure

Stops the current measurement (if any) and sets up the instrument for the specified measurement using the measurement's default settings. Does not initiate the collection of measurement data unless `:INIT:CONT` is `ON`. If you change any measurement settings after using `:CONFigur`e, "READ" on page 1131 can be used to initiate a measurement without changing the settings back to their defaults.

Normally `:CONFigure` presets the measurement after selecting it; but, if sent with the `NDEFault` parameter, it selects it without performing a Preset.

Remote Command	`:CONFigure:<measurement>[:NDEFault]` `:CONFigure?`

Example	Select and preset the Swept SA measurement:
	`:CONF:SAN`
	Select the Swept SA measurement *without* presetting:
	`:CONF:SAN:NDEF`
	Query the current measurement:
	`:CONF?`

Remote Command	`:CONFigure:CATalog?`
Example	`:CONF:CATalog?` returns a quoted string of all licensed measurement names in the current mode. For example, `"SAN, CHP, OBW, ACP, PST, TXP, SPUR, SEM, LIST"` for the Spectrum Analyzer mode

9.3.2.2 INITiate

Initiates a trigger cycle for the specified measurement, but does not output any data. You must then use `:FETCh<meas>` to return data. If a measurement other than the current one is specified, the instrument will switch to that measurement and then initiate it.

Remote Command	`:INITiate:<measurement>`
Example	Switch to the `SANalyzer` (Swept SA) measurement if not already there, then start the measurement: `:INIT:SAN`

`:INITiate` does not change any of the measurement settings. For example, if you have already run the ACP measurement and you send `:INIT:ACP?` it initiates a new ACP measurement using the same instrument settings as the last time ACP was run.

If another measurement is running, `:INIT` switches to the specified measurement. For example, suppose you are running the channel power measurement. If you send `:INIT:ACP?` it changes from channel power to ACP and initiates an ACP measurement.

If your selected measurement is currently in the idle state, it restarts the measurement. Depending upon the measurement and the number of averages, there may be multiple data acquisitions, with multiple trigger events, for one full trigger cycle.

CAUTION

`:INIT` allows additional commands *while* the measurement is in progress.

Be aware that such additional commands may change measurement settings. They may cause the measurement in progress to be discarded, and a new measurement may start.

To wait for the completion of a measurement after sending `:INITiate`, send "*WAI - Wait-to-Continue" on page 1127, or "*OPC? - Operation Complete" on page 1123, or use "FETCh" on page 1130.

9.3.2.3 FETCh

Places selected data from the most recent measurement into the output buffer. Use `:FETCh` if you have already made a valid measurement and you want to retrieve data. You can issue `:FETCh` multiple times with differing `[n]` values without restarting or re-making the measurement, for example, both scalars and trace data from a single measurement.

Remote Command	`:FETCh:<measurement>[n]?`

Example	Fetch item 2 (Trace 2) from the SAN (Swept SA) measurement when the measurement completes. If not in the Swept SA measurement, returns an error: `:FETCh:SAN2?` `:FETCh` does not change any of the measurement settings, it simply reads the results of the current measurement. `:FETCh` may be used to return results other than those specified with the original `:READ` or `:MEASure` query that you sent. You can only `:FETCh` results from the measurement that is currently active, it does not change to a different measurement. An error message is reported if a measurement other than the current one is specified. If you need to get new measurement data, use "READ" on page 1131, which is equivalent to "INITiate" on page 1130 followed by `:FETCh`. The measurement results for `n` = 1 (usually the scalar result) will be returned if the optional `[n]` value is not included, or is set to 1. If the `[n]` value is set to a value other than 1, the selected data results will be returned. See each measurement for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster than the ASCII format. See "Format Data: Numeric Data (Remote Command Only)" on page 1136. Note that the data returned by `:FETCh?` uses the data setting specified by "Format Data: Numeric Data (Remote Command Only)" on page 1136 and "Format Data: Byte Order (Remote Command Only)" on page 1137 commands ,and can return real or ASCII data. If the format is set to `INT,32`, it returns `REAL,32` data.

9.3.2.4 READ

Initiates a trigger cycle for the specified measurement and outputs the requested data. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results.

Remote Command	`:READ:<measurement>[n]?`
Example	Switch to the SANalyzer (Swept SA) measurement if not already there, start the measurement, and return item 2 (Trace 2) from the measurement when the measurement completes: `:READ:SAN2?` `:READ` does not change any of the measurement settings. For example, if you have already run the ACP measurement and you send `:READ:ACP?`, it initiates a new ACP measurement using the same instrument settings as the last time ACP was run. `:READ` switches to the specified measurement if the instrument is not already there. For example, suppose you have already run the ACP measurement but now you are running the Channel Power measurement. When you send `:READ:ACP?`, it changes

from Channel Power back to ACP and, using the previous ACP settings, initiates the measurement and return results.

The measurement results for `n` = 1 (usually the scalar result) will be returned if the optional `[n]` value is not included, or is set to 1. If the `[n]` value is set to a value other than 1, the selected data results will be returned. See each measurement for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster than the ASCII format. See "Format Data: Numeric Data (Remote Command Only)" on page 1136.

Note that the data returned by `:READ?` uses the data setting specified by "Format Data: Byte Order (Remote Command Only)" on page 1137) and "Format Data: Numeric Data (Remote Command Only)" on page 1136, and can return real or ASCII data. If the format is set to `INT,32` it returns `REAL,32` data.

`:READ` blocks other SCPI communication, waiting until the measurement is complete before returning results.

For more details of how measurements proceed, see also "INITiate" on page 1130.

9.3.2.5 MEASure

Stops the current measurement (if any) and sets up the instrument for the specified measurement using the measurement's default settings, initiates a trigger cycle for the specified measurement, and outputs the requested data.

Remote Command	`:MEASure:<measurement>[n]?`
Example	Switch to the `SANalyzer` (Swept SA) measurement, start the measurement, and read back item 2 (Trace 2) when the measurement completes `:MEAS:SAN2?`

This is a fast single-command way to make a measurement using the measurement's default settings. These are the settings and units that conform to the Mode Setup settings (for example, Radio Standard) that you have currently selected.

Stops the current measurement (if any) and sets up the instrument for the specified measurement using the measurement's defaults.

Initiates the data acquisition for the measurement.

Blocks other SCPI communication, waiting until the measurement is complete before returning results.

Depending on the measurement and the number of averages, there may be multiple data acquisitions, with multiple trigger events.

After the data is valid, returns the scalar results, or the trace data, for the specified measurement. The type of data returned may be defined by an `[n]` value that is sent with the command.

If the optional `[n]` value is not included, or is set to 1, scalar measurement results will be returned. If the `[n]` value is other than 1, the selected trace data results will be returned. See each command for details of which types of scalar results or trace data results are available.

The default format for data output is ASCII. (Older versions of Spectrum Analysis and Phase Noise mode measurements only use ASCII.) The binary data formats should be used for handling large blocks of data, because transfers are smaller and faster than when using the ASCII format. See "Format Data: Numeric Data (Remote Command Only)" on page 1136 for more information.

If you need to change some of the measurement parameters from the measurement's default settings, you can set up the measurement with `:CONFigure`. Use the commands in the `:SENSe:<measurement>` and `:CALCulate:<measurement>` subsystems to change the settings, then you can use `:READ?` to initiate the measurement and query the results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use `:READ?` if you want to use those persistent settings. If you want to go back to the default settings, use `:MEASure?`.

Note that the data returned to `:MEASure?` uses the data setting specified by "Format Data: Byte Order (Remote Command Only)" on page 1137 and "Format Data: Numeric Data (Remote Command Only)" on page 1136, and can return real or ASCII data. If the format is set to `INT,32` it returns `REAL,32` data.

9.3.2.6 Unselected Measurements' Parameter Values

Changing parameter values of unselected measurements keeps those changes pending until the measurement is next selected. Querying such values may or may not return expected value. To ensure the appropriate value is returned, first select the measurement.

9.3.3 Trace Formatting Commands

The following commands and queries are available to format and manipulate trace data.

9.3.3.1 Clear Trace (Remote Command Only)

Clears the selected trace (from the front panel) or the specified trace (from SCPI). Does not affect the state of any function or variable in the instrument. Loads

mintracevalue into all of the points in the selected trace, unless the trace is in Min Hold in which case it loads maxtracevalue. This occurs even if Update = Off.

Remote Command	`:TRACe:CLEar TRACE1 | … | TRACE6`
Example	Clear Trace 1: `:TRAC:CLE TRACE1`

9.3.3.2 Send/Query Trace Data (Remote Command Only)

Allows trace data to be sent to the instrument or queried from the instrument. The response to the query is a list of the amplitude points which comprise the requested trace in the current Y Axis Unit of the instrument. The X Axis Unit is that of the destination trace (for send) or the source trace (for query).

See:

- "Query Trace Data" on page 1134
- "More Information" on page 1135

Remote Command	`:TRACe[:DATA] TRACE1 | … | TRACE6, <data>`

Notes	The `TRACe[:DATA]` command is of the form:
	`:TRACe:DATA <trace>,<data>`
	where `<trace>` can be one of the following parameters:
	`TRACE1, TRACE2, TRACE3, TRACE4, TRACE5, TRACE6`
	and where `<data>` can be
	- ASCII data, which consists of a string of values separated by comma
	or
	- `REAL` or `INT`eger sent as a definite length block, with a header describing the data to follow

Couplings	Sweep points will affect the amount of data `:FORMat:DATA` describes the different types of data formats that can be used with trace data Use `:FORMat:BORDer` to set the byte order

Query Trace Data

Remote Command	`:TRACe[:DATA]? TRACE1 | … | TRACE6`
Example	Send five points to Trace 1. Assuming that `:FORMat:DATA` is set to `ASCii`, Y Axis Unit is set to dBm, and sweep points is set to 5, this will result in Trace 1 consisting of the five points -1 dBm, -2 dBm, -3 dBm, -4 dBm, and -5 dBm: `:TRAC TRACE1,-1,-2,-3,-4,-5`

	Query the instrument for the contents of trace 2: `:TRAC? TRACE2`
Backwards Compatibility Notes	In X-Series, the legacy `RAWTRACE,LLINE1,LLINE2` parameters for trace data query are no longer available

More Information

The format and byte order of the sent or received data depend on "Format Data: Numeric Data (Remote Command Only)" on page 1136 and "Format Data: Byte Order (Remote Command Only)" on page 1137. `ASCII` data consists of a string of comma separated values. `REAL` or `INTeger` data is sent as a definite length block, with a header describing the data to follow.

For example, a four-point trace might look like this if in ASCII (`FORMat:DATA ASCii`):

```
-5.87350E+01, -5.89110E+01, -5.87205E+01, -5.12345E+01<NL><END>
```

and like this if in `INTeger` with 4 bytes per point (`FORMat:DATA INT,32`):

```
#216<16 bytes of data><NL><END>
```

where the 2 in the #216 means “2 digits of numeric data to follow”, and the 16 is the 2 digits and means “16 binary bytes to follow” (this is the definite length block format).

Note that the data is terminated with `<NL><END>`. (For GPIB this is newline, or linefeed, followed by EOI set true. For LAN, this is newline only.)

The data format set by "Format Data: Numeric Data (Remote Command Only)" on page 1136 and "Format Data: Byte Order (Remote Command Only)" on page 1137 is used both for sending data to the instrument and receiving data from the instrument.

When sending data to the instrument, the data block must contain exactly the number of points currently specified in Sweep, Points or an error message will be generated and there will be no change to the target trace.

No units terminator (for example, dB or V) is used when sending data; the data is taken as being in the current Y Axis Unit of the instrument.

When a trace is sent to the instrument, it immediately overwrites all of the data in the target trace. Consequently, the trace should be inactive in order to achieve predictable results. If you send trace data while a trace is active, and particularly if a sweep or an Average or Max/Min Hold sequence is already in progress, you may end up with a trace that combines the data you sent with measurement data. Similarly, when querying trace data, it is best if the instrument is not sweeping during the query.

Therefore, it is generally advisable to be in **Single** sweep, or have the trace in **View**, when sending trace data to the instrument or querying trace data from the instrument.

9.3.3.3 Format Data: Numeric Data (Remote Command Only)

Specifies the format of the trace data input and output.

Specifies the formats used for trace data during data transfer across any remote port. Affects only the data format for setting and querying trace data for `:TRACe[:DATA]`, `:TRACe[:DATA]?`, `:CALCulate:DATA[n]?` and `:FETCh:SANalyzer[n]?`.

Remote Command	`:FORMat[:TRACe][:DATA] ASCii | INTeger,32 | REAL,32 | REAL,64` `:FORMat[:TRACe][:DATA]?`
Notes	The query response is: `ASCii`: ASC,8 `REAL,32`: REAL,32 `REAL,64`: REAL,64 `INTeger,32`: INT,32 When the numeric data format is REAL or ASCii, data is output in the current Y Axis unit. When the data format is INTeger, data is output in units of m dBm (.001 dBm) The `INT,32` format returns binary 32-bit integer values in internal units (m dBm), in a definite length block
Dependencies	Sending a data format spec with an invalid number (for example, `INT,48`) generates no error. The instrument simply uses the default (8 for `ASCii`, 32 for `INTeger`, 32 for `REAL`) Sending data to the instrument which does not conform to the current `FORMat` specified, results in an error. Sending ASCII data when a definite block is expected generates message -161 "Invalid Block Data" and sending a definite block when ASCII data is expected generates message -121 "Invalid Character in Number"
Preset	`ASCii`
Backwards Compatibility Notes	Note that the `INT,32` format is only applicable to `:TRACe:DATA`. This preserves backwards compatibility for the Swept SA measurement. For all other commands/queries that honor `:FORMat:DATA`, if `INT,32` is sent the instrument will behave as though it were set to `REAL,32`

The specifications for each output type are:

`ASCii` Amplitude values are in ASCII, in the current Y Axis Unit, one ASCII character per digit, values separated by commas, each value in the form: `SX.YYYYYEsZZ`, where:

S = sign (+ or -)

X = one digit to left of decimal point

Y = 5 digits to right of decimal point

E = E, exponent header

s = sign of exponent (+ or -)

	ZZ = two-digit exponent
REAL,32	Binary 32-bit real values in the current Y Axis Unit, in a definite length block
REAL,64	Binary 64-bit real values in the current Y Axis Unit, in a definite length block

9.3.3.4 Format Data: Byte Order (Remote Command Only)

Selects the binary data byte order for data transfer and other queries.

Controls whether binary data is transferred in normal or swapped mode. Affects only the byte order for setting and querying trace data for :TRACe[:DATA], :TRACe[:DATA]? , :CALCulate:DATA[n]? and :FETCh:SANalyzer[n]?.

By definition, any command that depends on this setting uses *any* format supported by :FORMat:DATA.

- NORMal order is a byte sequence that begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last in the sequence: 1|2|3|4
- SWAPped order is when the byte sequence begins with the LSB first, and ends with the MSB last in the sequence: 4|3|2|1

Remote Command	:FORMat:BORDer NORMal | SWAPped :FORMat:BORDer?
Preset	NORMal

9.3.3.5 Calculate/Compress Trace Data Query (Remote Command Only)

Returns compressed data for the currently selected measurement and sub-opcode [n].

n = any valid sub-opcode for that measurement. See the :MEASure:<measurement>? query description of your specific measurement for information on the data that can be returned.

The data is returned in the current Y Axis Unit of the instrument. The command is used with a sub-opcode <n> (default = 1) to specify the trace. With trace queries, it is best if the instrument is not sweeping during the query. Therefore, it is generally advisable to be in Single sweep, or Update = Off.

This command is used to compress or decimate a long trace to extract and return only the desired data. A typical example would be to acquire N frames of GSM data and return the mean power of the first burst in each frame. The command can also be used to identify the best curve fit for the data.

Remote	:CALCulate:DATA<n>:COMPress? BLOCk | CFIT | MAXimum | MINimum | MEAN | DMEan | RMS | SAMPle | SDEViation | PPHase [,<soffset>[,<length>[,<roffset>

Command	`[,<rlimit>]]]]`
Notes	The command supports 5 parameters, but the last 4 (`<soffset>, <length>, <roffset>, <rlimit>`) are optional. The optional parameters must be entered in the specified order. For example, if you want to specify <length>, then you must also specify <soffset>. See details below for a definition of each of these parameters This command uses the data in the format specified by "Format Data: Byte Order (Remote Command Only)" on page 1137, returning either binary or ASCII data As an example, to query the mean power of a set of GSM bursts: – Supply a signal that is a set of GSM bursts – Select the IQ Waveform measurement (in IQ Analyzer Mode) – Set the sweep time to acquire at least one burst – Set the triggers such that acquisition happens at a known position relative to a burst – Query the mean burst levels using, :`CALC:DATA2:COMP? MEAN,24e-6,526e-6` (These parameter values correspond to GSM signals, where 526e-6 is the length of the burst in the slot and you just want 1 burst) **BLOCk or block data** Returns all the data points from the region of the trace data that you specify. For example, it could be used to return the data points of an input signal over several timeslots, excluding the portions of the trace data that you do not want. (This is x,y pairs for trace data and I,Q pairs for complex data.) **CFIT or curve fit** Applies curve fitting routines to the data. `<soffset>` and `<length>` are required to define the data that you want. <roffset> is an optional parameter for the desired order of the curve equation. The query will return the following values: the x-offset (in seconds) and the curve coefficients ((order + 1) values). `MIN`, `MAX`, `MEAN`, `DME`, `RMS`, `SAMP`, `SDEV` and `PPH` return one data value for each specified region (or `<length>`) of trace data, for as many regions as possible until you run out of trace data (using `<roffset>` to specify regions), or they return the number of regions you specify (using `<rlimit>`) ignoring any data beyond that. **MINimum** Returns the minimum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the minimum magnitude of the I/Q pairs is returned.

MAXimum

Returns the maximum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the maximum magnitude of the I/Q pairs is returned.

MEAN

Returns a single value that is the arithmetic mean of the data point values (in dB/ dBm) for the specified region(s) of trace data. For I/Q trace data, the mean of the magnitudes of the I/Q pairs is returned. See the following equations.

NOTE **If the original trace data is in dB, this function returns the arithmetic mean of those log values, not log of the mean power which is a more useful value. The mean of the log is the better measurement technique when measuring CW signals in the presence of noise. The mean of the power, expressed in dB, is useful in power measurements such as Channel Power. To achieve the mean of the power, use the RMS option.**

Equation 1: Mean Value of Data Points for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{Xi \in \text{region(s)}} Xi$$

where Xi is a data point value, and n is the number of data points in the specified region(s).

Equation 2: Mean Value of I/Q Data Pairs for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{Xi \in \text{region(s)}} |Xi|$$

where |Xi| is the magnitude of an I/Q pair, and n is the number of I/Q pairs in the specified region(s).

DMEan

Returns a single value that is the mean power (in dB/ dBm) of the data point values for the specified region(s) of trace data. See the following equation:

Equation 3: DMEan Value of Data Points for Specified Region(s)

$$DME = 10 \times \log_{10}\left(\frac{1}{n}\sum_{Xi \in region(s)} 10^{\frac{Xi}{10}}\right)$$

RMS

Returns a single value that is the average power on a root-mean-squared voltage scale (arithmetic rms) of the data point values for the specified region(s) of trace data. See the following equation.

Equation 4: RMS Value of Data Points for Specified Region(s)

$$RMS = \sqrt{\frac{1}{n}\sum_{Xi \in region(s)} Xi^2}$$

where Xi is a data point value, and n is the number of data points in the specified region(s).

For I/Q trace data, the rms of the magnitudes of the I/Q pairs is returned. See the following equation.

NOTE **This function is very useful for I/Q trace data. However, if the original trace data is in dB, this function returns the rms of the log values which is not usually needed.**

Equation 5: RMS Value of I/Q Data Pairs for Specified Region(s)

$$RMS = \sqrt{\frac{1}{n}\sum_{Xi \in region(s)} Xi\ Xi^*}$$

where Xi is the complex value representation of an I/Q pair, Xi* its conjugate complex number, and n is the number of I/Q pairs in the specified region(s).

Once you have the rms value for a region of trace data (linear or I/Q), you may want to calculate the mean power. You must convert this rms value (peak volts) to power in dBm:

*10 x log[10 * (rms value)2]*

SAMPle

Returns the first data value (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the first I/Q pair is returned.

SDEViation

Returns a single value that is the arithmetic standard deviation for the data point values for the specified region(s) of trace data. See the following equation.

Equation 6: Standard Deviation of Data Point Values for Specified Region(s)

$$SDEV = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} (Xi - \overline{X})^2}$$

where Xi is a data point value, X is the arithmetic mean of the data point values for the specified region(s), and n is the number of data points in the specified region(s).

For I/Q trace data, the standard deviation of the magnitudes of the I/Q pairs is returned. See the following equation.

Equation 7: Standard Deviation of I/Q Data Pair Values for Specified Region(s)

$$SDEV = \sqrt{\frac{1}{n} \sum_{Xi \in region(s)} (|Xi| - \overline{X})^2}$$

where |Xi| is the magnitude of an I/Q pair, X is the mean of the magnitudes for the specified region(s), and n is the number of data points in the specified region(s).

PPHase

Returns the x,y pairs of both rms power (dBm) and arithmetic mean phase (radian) for every specified region and frequency offset (Hz). The number of pairs is defined by the specified number of regions. This parameter can be used for I/Q vector (n=0) in Waveform (time domain) measurement and all parameters are specified by data point in PPHase.

The rms power of the specified region may be expressed as:

Power = 10 x log [10 x (RMS I/Q value)] + 10.

The RMS I/Q value (peak volts) is:

$$\sqrt{\frac{1}{n}\sum_{Xi \in \text{region}} Xi\ Xi^*}$$

where Xi is the complex value representation of an I/Q pair, Xi* its conjugate complex number, and n is the number of I/Q pairs in the specified region.

The arithmetic mean phase of the specified region may be expressed as:

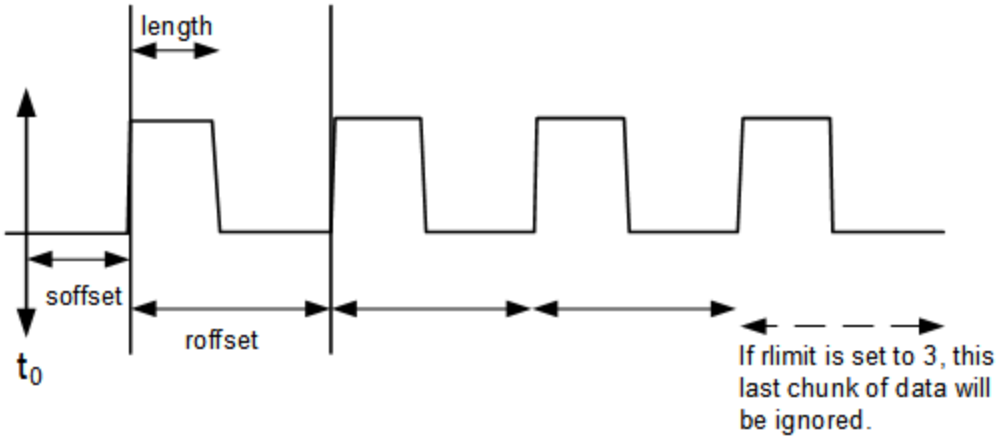
$$\frac{1}{n}\sum_{Yi \in \text{region}} Yi$$

where Yi is the unwrapped phase of I/Q pair with applying frequency correction and n is the number of I/Q pairs in the specified region.

The frequency correction is made by the frequency offset calculated by the arithmetic mean of every specified region's frequency offset. Each frequency offset is calculated by the least square method against the unwrapped phase of I/Q pair.

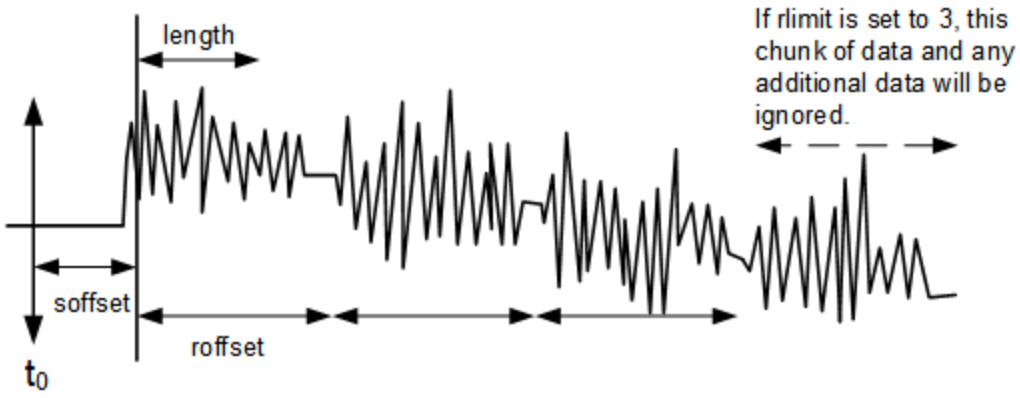
Sample Trace Data - Constant Envelope

(See below for explanation of variables.)



Sample Trace Data - Not Constant Envelope

(See below for explanation of variables.)



`<soffset>` Optional real number, in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces

Specifies the amount of data at the beginning of the trace that will be ignored before the decimation process starts. It is the time or frequency change from the start of the trace to the point where you want to start using the data. The default value is zero

`<length>` Optional real number, in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces

Defines how much data will be compressed into one value. This parameter has a default value equal to the current trace length

`<roffset>` Optional real number, in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces

Defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field. This parameter has a default value equal to the `<length>` variable. Note that this parameter is used for a completely different purpose when curve fitting (see "CFIT or curve fit" on page 1138 above)

`<rlimit>` Optional integer

Specifies the number of data items that you want returned. Ignores any additional items beyond that number. You can use the Start offset and the Repeat limit to pick out exactly what part of the data you want to use. The default value is all the data

9.3.3.6 Calculate Peaks of Trace Data (Remote Command Only)

Returns a list of all the peaks for the currently selected measurement and sub-opcode `[n]`. The peaks must meet the requirements of the peak threshold and excursion values.

`n` = any valid sub-opcode for the current measurement. See the `:MEASure:<measurement>` command description of your specific measurement for information on the data that can be returned.

The command can only be used with specific sub-opcodes with measurement results that are trace data. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm. In many measurements the sub-opcode `n` = 0, is the raw trace data, which cannot be searched for peaks, and sub-opcode `n` = 1, is often calculated results values which also cannot be searched for peaks.

This command uses the data setting specified by "Format Data: Byte Order (Remote Command Only)" on page 1137 and "Format Data: Numeric Data (Remote Command Only)" on page 1136, and can return real or ASCII data. If the format is set to `INT,32`, it returns `REAL,32` data.

The command has four types of parameters:

1. Threshold (in dBm)
2. Excursion (in dB)
3. Sorting order (amplitude, frequency, time)
4. Optional in some measurements: Display line use (all, > display line, < display line)

Remote Command

For Swept SA measurement:

```
:CALCulate:DATA[1]|2|…|6:PEAKs? <threshold>,<excursion>[,AMPLitude | FREQuency | TIME[,ALL | GTDLine | LTDLine]]
```

For most other measurements:

```
:CALCulate:DATA[1]|2|…|6:PEAKs? <threshold>,<excursion>[,AMPLitude | FREQuency | TIME]
```

Notes

Parameters:

`<n>`	The trace that will be used: `[1]|2|…|6`
`<threshold>`	The level below which trace data peaks are ignored Note that the threshold value is required and is always used as a peak criterion. To effectively disable the threshold criterion for this command, provide a substantially low threshold value such as –200 dBm Note also that the threshold value used in this command is independent of and has no effect on the threshold value stored under the Peak Criteria menu
`<excursion>`	The minimum amplitude variation (rise and fall) required for a signal to be identified as peak

Note that the excursion value is required and is always used as a peak criterion. To effectively disable the excursion criterion for this command, provide the minimum value of 0.0 dB

Note also that the excursion value used in this command is independent of and has no effect on the excursion value stored under the Peak Criteria menu

Values must be provided for threshold and excursion. The sorting and display line parameters are optional (defaults are `AMPLitude` and `ALL`)

Note that there is always a Y-axis value for the display line, regardless of whether the display line state is on or off. It is the current Y-axis value of the display line which is used by this command to determine whether a peak should be reported

Sorting order:

`AMPLitude`	Lists the peaks in order of descending amplitude, with the highest peak first If this optional parameter not sent, this is the default
`FREQuency`	Lists the peaks in order of occurrence, left to right across the x-axis
`TIME`	Lists the peaks in order of occurrence, left to right across the x-axis

Peaks vs. Display Line:

`ALL`	Lists all of the peaks found (default if optional parameter not sent)
`GTDLine` Greater than display line	Lists all of the peaks found above the display line
`LTDLine` Less than display line	Lists all of the peaks found below the display line

For example, for Swept SA measurement in Spectrum Analyzer Mode:

```
:CALC:DATA4:PEAK? -40,10,FREQ,GTDL
```

Identifies the peaks of trace 4 that are above –40 dBm, with excursions of at least 10 dB. The peaks are returned in order of increasing frequency, starting with the lowest frequency. Only the peaks that are above the display line are returned

Query Results:

If `:FORMat:DATA REAL,32` is selected, returns a list of floating-point numbers. The first value in the list is the number of peak points that are in the following list. A peak point consists of two values: a peak amplitude followed by its corresponding frequency (or time)

If no peaks are found, the peak list consists of only the number of peaks, (0)

9.3.3.7 Smooth Trace Data (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use `:CALCulate:DATA:COMPress` instead.

Smoothes the trace according to the number of points specified in `:TRACe:MATH:SMOoth:POINts`. There is no equivalent front panel function.

The purpose of this function is to perform a spatial video averaging, as compared to the temporal version supplied by the video-average command `[:SENSe]:AVERage:TYPE VIDeo`. The functions of `:TRACe:MATH:SMOoth <trace>` and `[:SENSe]:AVERage:TYPE VIDeo|POWer` are not interchangeable.

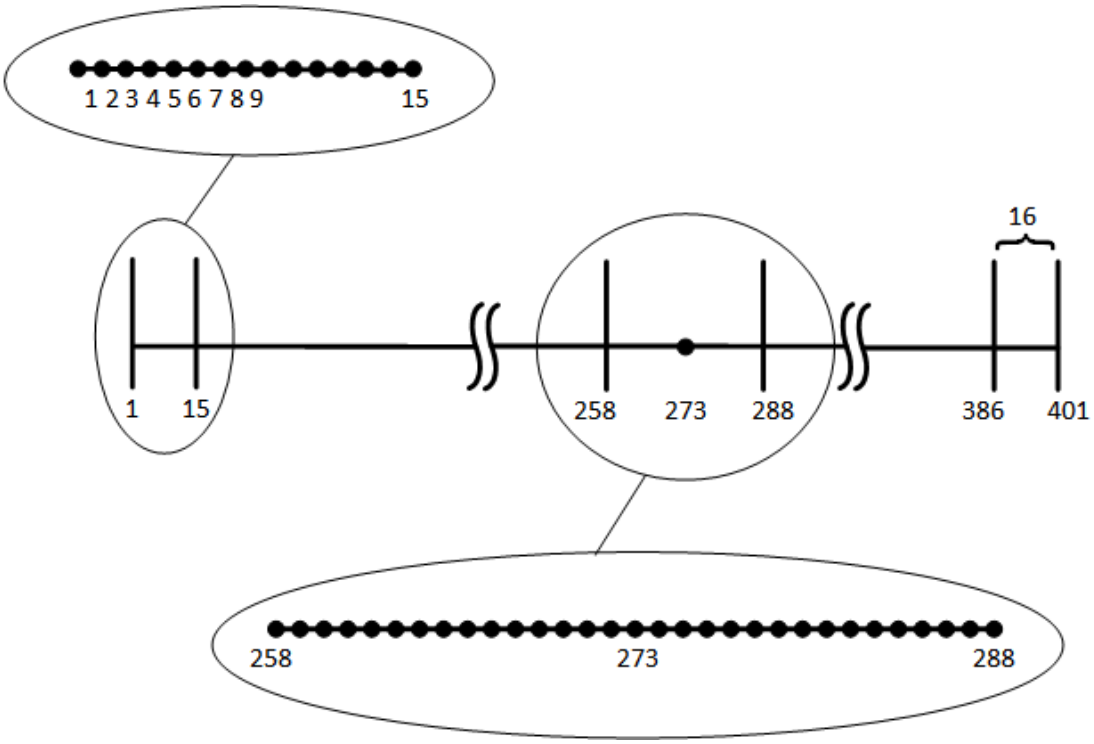
Backwards Compatibility SCPI

`:TRACe:MATH:SMOoth TRACE1 | … | TRACE6`

Each point value is replaced with the average of the values of the selected number of points, with half of those points located on each side of any particular point (when possible). Refer to the illustration below, which shows a 401-point trace with a smoothing number of 31. Think of the trace points as “buckets” of data. To smooth (arbitrary) point 273, the instrument averages buckets 258 through 288 and applies that value to point 273.

Increasing the number of points increases smoothing at the cost of decreasing resolution.

The amount of smoothing decreases at the end points. Because `:TRACe:MATH:SMOoth <trace>` averages values that occur before and after the data point in time, display irregularities can be caused at the start and stop frequencies. To avoid possible irregularities (signal distortion) at the ends of the trace, use small values for the smooth parameter.



Smoothing With 401 Trace Points and 31 Smoothing Points

Refer to the illustration above for a discussion of this end-point smoothing phenomena. With 31 smoothing points and a 401-point trace, point 16 will be the first point to have full 31-bucket smoothing. Likewise, point 386 will be the last point with full 31-bucket smoothing. Under the conditions stated, points 2 through 15 will be smoothed as follows: Point 2 is derived from averaging buckets 1 through 3. Point 3 is derived from averaging buckets 1 through 5, Point 4 is derived from averaging buckets 1 through 7, and so forth until point 16 is reached. The quantity of buckets used for the smoothing running average increases at the rate of 2 buckets per point, from point 1 to point ([smoothing number+1]/2), at which time the full number of smoothing points is utilized. The same characteristic occurs at the completion of the trace, beginning at point 386, beyond which the number of averaging buckets begins to decrease until point 401 is reached.

By replacing the value of each point in a trace with the average of the values of a number of points centered about that point, any rapid variations in noise or signals are smoothed into more gradual variations. It thereby performs a function similar to reducing the video bandwidth without the corresponding changes in sweep time; as such, frequency resolution is decreased. Also, signal peaks are reduced with large smoothing values. This can cause the amplitude to appear to be less than its actual value.

9.3.3.8 Number of Points for Smoothing (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use `:CALCulate:DATA:COMPress` instead.

Specifies the number of points that will be smoothed. Increasing the number of points increases smoothing at the cost of decreasing resolution. If the number of points is an even number, then the number of points is increased by one. If the number of points is larger than the number of sweep points, then the number of sweep points is used, unless the number of sweep points is even, in which case the number of points will be the sweep points minus one. The number of points smoothed is always an odd number.

Example	`:TRAC:MATH:SMO:POIN 501`
Notes	Only odd values are allowed If an even value of `<integer>` is specified, adds 1 unless `<integer>` = number of sweep points, in which case subtract 1 Used with `TRACe:MATH:SMOoth`
Preset	11
Min	3
Max	Number of sweep points
Backwards Compatibility	`:TRACe:MATH:SMOoth:POINts <integer>`

SCPI	`:TRACe:MATH:SMOoth:POINts?`

9.3.3.9 Mean Trace Data (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use `:CALCulate:DATA:COMPress` instead.

Returns the mean of the amplitudes of the trace amplitude elements in measurement units.

Example	`:TRAC:MATH:MEAN? TRACE2`
Backwards Compatibility SCPI	`:TRACe:MATH:MEAN? TRACE1 | … | TRACE6`

9.4 Status Register System & STATus Subsystem

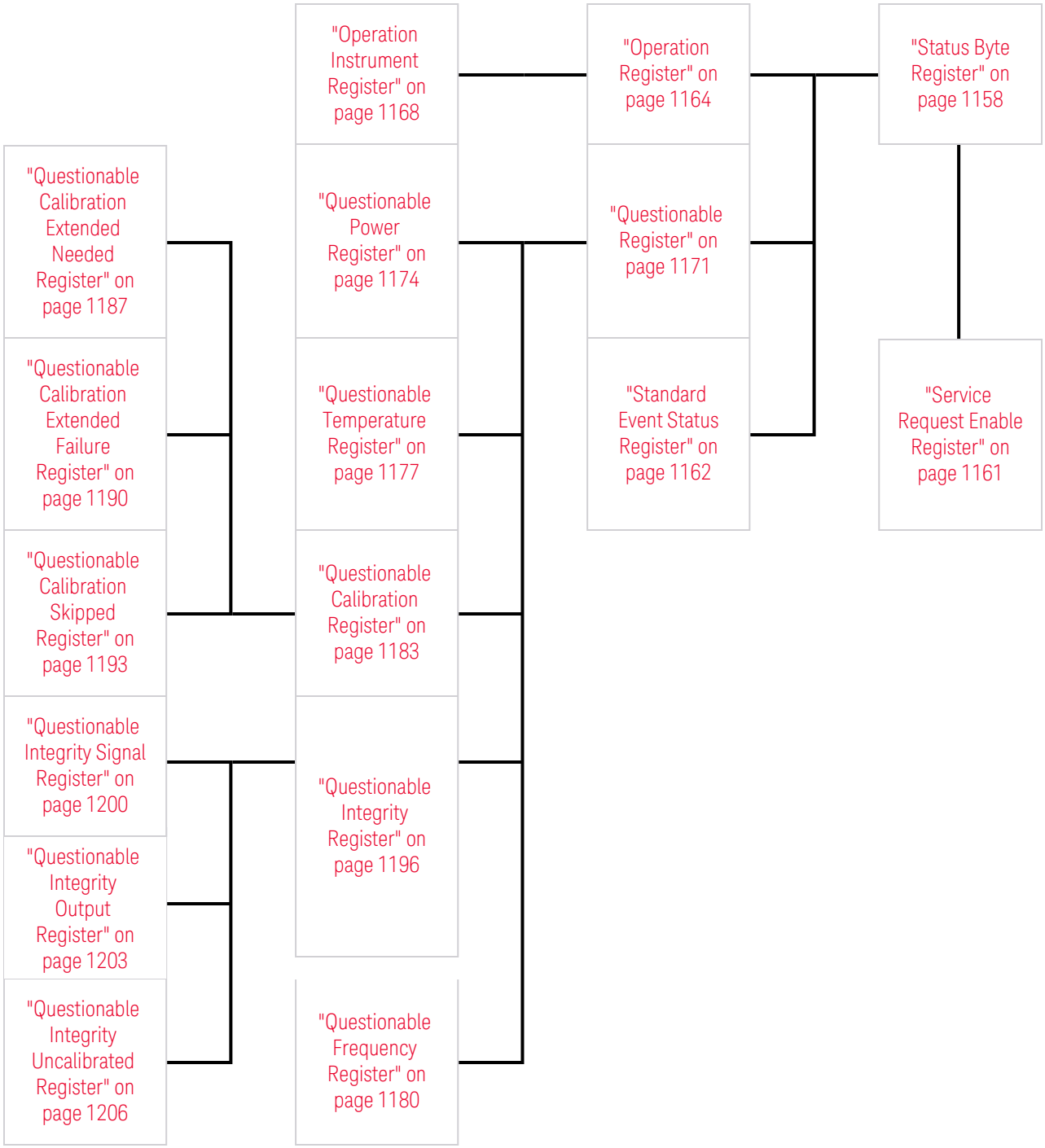
This section provides an overview of the X-Series SCPI status register system, and how to manage the registers. For detailed programming information on each status register, see "Status Subsystem Registers and Commands" on page 1158.

The SCPI `STATus` Subsystem allows you to monitor a number of status conditions within the instrument through the use of a hierarchy of status registers containing bits which go true or false depending on various conditions.

9.4.1 Status Register System Diagram

The diagram below provides a top-level overview of all the Status Registers and their interconnections.

To navigate to detailed information about each Register, click on a register name:


"Questionable Calibration Extended Needed Register" on page 1187
"Questionable Calibration Extended Failure Register" on page 1190
"Questionable Calibration Skipped Register" on page 1193
"Questionable Integrity Signal Register" on page 1200
"Questionable Integrity Output Register" on page 1203
"Questionable Integrity Uncalibrated Register" on page 1206
"Operation Instrument Register" on page 1168
"Questionable Power Register" on page 1174
"Questionable Temperature Register" on page 1177
"Questionable Calibration Register" on page 1183
"Questionable Integrity Register" on page 1196
"Questionable Frequency Register" on page 1180
"Operation Register" on page 1164
"Questionable Register" on page 1171
"Standard Event Status Register" on page 1162
"Status Byte Register" on page 1158
"Service Request Enable Register" on page 1161

Detailed System Diagram

As from the X-Apps 2023 update, the fully-detailed system diagram that previously appeared here is still available, but, for improved readability, it is now published as a separate high-resolution PDF. You can download the document from Keysight's web site at:

http://literature.cdn.keysight.com/litweb/pdf/N9040-90056.pdf

9.4.2 Status Register Hierarchy

The Status Register system contains multiple registers, arranged in a hierarchy. The lower-level registers propagate their data to the higher-level registers in the data structures by means of summary bits.

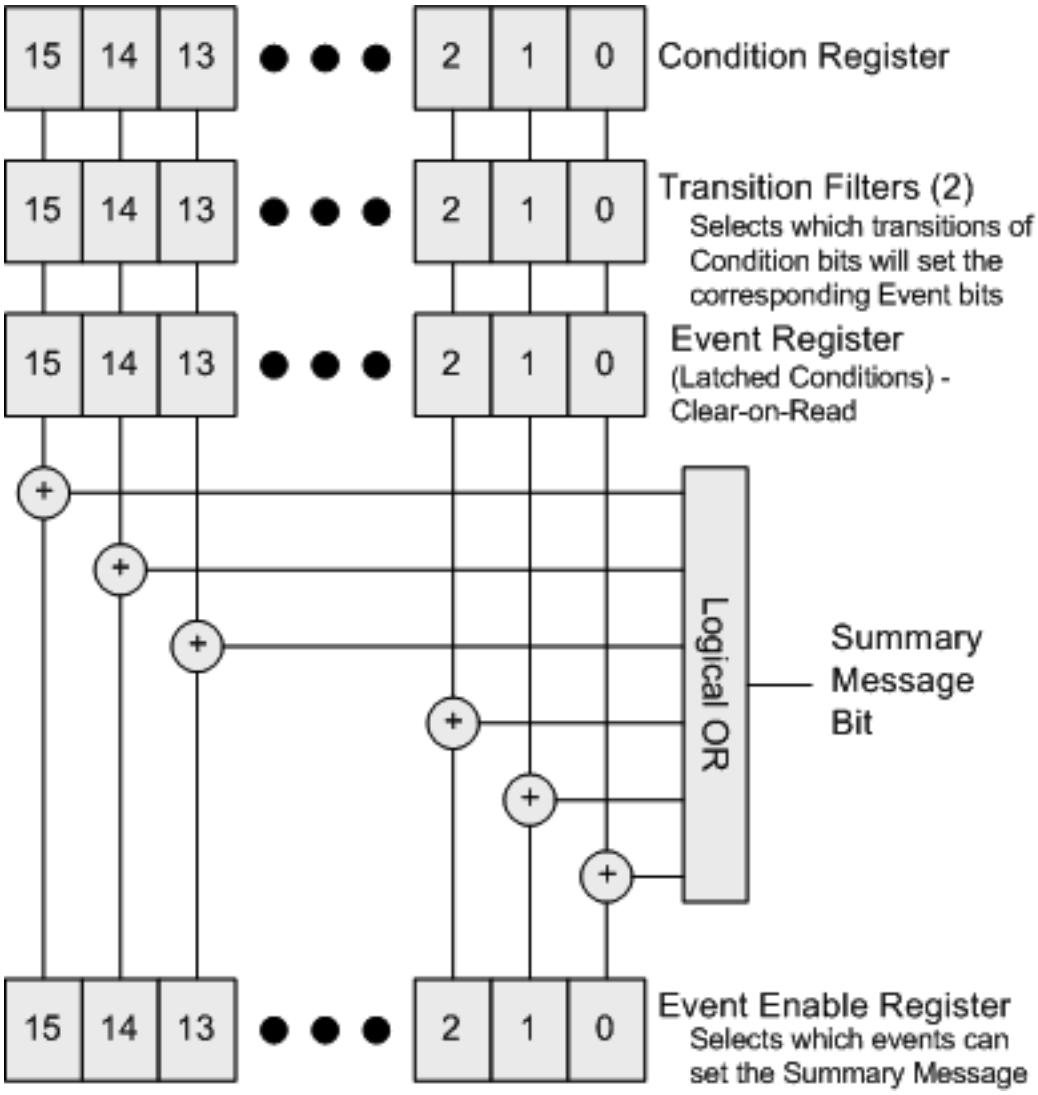
The "Status Byte Register" on page 1158 is at the top of the hierarchy and contains general status information for the instrument's events and conditions. All other individual registers are used to determine the specific events or conditions.

The "Operation Register" on page 1164 and "Questionable Register" on page 1171 are sets of registers that monitor the overall instrument condition. They are accessed using `:STATus:OPERation` and `:STATus:QUEStionable` commands in the `STATus` subsystem. Each composite status register set consists of five sub-registers:

1	Condition Register	Reports the real-time state of the signals monitored by this register set. There is no latching or buffering for a condition register
2	Positive Transition Register	Transition Filter Register Controls which signals will set a bit in the event register when the signal makes a low to high transition (when the condition bit changes from 0 to 1)
3	Negative Transition Register	Transition Filter Register Controls which signals will set a bit in the event register when the signal makes a high to low transition (when the condition bit changes from 1 to 0)
4	Event Register	Latches any signal state changes, in the way specified by the filter registers. Bits in the event register are never cleared by signal state changes. Event registers are cleared when read. They are also cleared by *CLS and by presetting the instrument
5	Event Enable Register	Controls which of the bits, being set in the event register, will be summarized as a single output for the register set. Summary bits are then used by the next higher register

Each status register produces a summary message bit.

The diagram below shows how the sub-registers relate to each other.



The settings of the Transition Filter registers determine whether or not a bit set in a Condition register ripples through to the Event register, as follows:

- If a bit is set in the Positive Transition Register, then the corresponding bit in the Event register is set when the condition bit goes from low to high (false to true, off to on)
- Conversely, if a bit is set in the Negative Transition Register then the Event register bit is set when the condition bit goes from high to low
- If *both* Transition Filter registers are set true, then the event bit for that condition is set whenever there is any change in the bit. If an event bit is set, the Event Enable Register determines whether or not it will OR into the summary bit that is sent to the next level of register. If this bit is set, then the corresponding event bit will be included

Note that the Event Register is "Clear-on-Read": when any bit is read, it is automatically cleared.

Questionable Registers

These registers report abnormal operating conditions. The status register hierarchy is:

- The summary outputs from the six `QUEStionable:<keyword>` detail registers are inputs to the "Questionable Register" on page 1171
- The summary output from the "Questionable Register" on page 1171 is an input to the Status Byte Register
- The summary output from the is an input to the "Operation Register" on page 1164. The inputs to the "Operation Condition Query" on page 1165 Register indicate the real time state of the instrument. The "Operation Event Query" on page 1166 Register summary output is an input to the Status Byte Register

Note that, in E4406A only, the "Operation Enable" on page 1166 Register has an additional function. It is `ANDed` with the "Operation Condition Query" on page 1165 Register to determine the instrument busy state, which is checked by "*OPC? - Operation Complete" on page 1123 and "*WAI - Wait-to-Continue" on page 1127 . If the `ANDed` result is non-zero, the instrument is considered busy.

9.4.3 Status Register SCPI Commands

Monitoring of instrument conditions is done at the highest level using the following IEEE 488.2 common commands.

For complete command descriptions, see "IEEE 488.2 Common Commands" on page 1120. Individual status registers can be set and queried using the commands described in "Status Subsystem Registers and Commands" on page 1158.

`*CLS`	Clear Status	Clears the status byte by emptying the error queue and clearing all the event registers
`*ESE` `*ESE?`	Event Status Enable	Sets and queries the bits in the enable register part of the Standard Event Status Register
`*ESR?`	Event Status Register	Queries and clears the event register part of the Standard Event Status Register
`*OPC` `*OPC?`	Operation Complete	Sets the Standard Event Status Register to monitor the completion of all commands. The query stops any new commands from being processed until the current processing is complete, then returns a '1'
`*PSC` `*PSC?`	Power-on State Clear	Sets the power-on state so that it clears the Service Request Enable Register and the event status enable register at power on

*SRE *SRE?	Service Request Enable	Sets and queries the value of the Service Request Enable Register
*STB?	Status Byte	Queries the value of the Status Byte Register without erasing its contents

9.4.4 How to Use Status Registers

A program often needs to be able to detect and manage error conditions or changes in instrument status.

There are two methods you can use to programmatically access the information in status registers:

- The "Polling Method" on page 1154
- The "Service Request (SRQ) Method" on page 1155

The Polling Method works well if you do not need to know about changes the moment they occur. To detect a change using this method, the program must repeatedly read the registers.

Use the SRQ Method if you must know immediately when a condition changes.

Either method allows you to monitor one or more conditions.

9.4.4.1 Polling Method

In this method, the instrument has a passive role. It only tells the controller that conditions have changed when the controller asks the right question.

Use this method when:

- your programming language/development environment does not support SRQ interrupts
- you want to write a simple, single-purpose program and don't want the added complexity of setting up an SRQ handler

To monitor a condition:

- Determine which register contains the bit that reports the condition
- Send the unique SCPI query to read that register
- Examine the bit to see if the condition has changed

Monitoring Options

You can monitor conditions in various ways:

1	Check the current instrument hardware and firmware status	Do this by querying the condition registers, which continuously monitor status. These registers represent the current state of the instrument. Bits in a condition register are updated in real time When the condition monitored by a particular bit becomes true, the bit is set to 1. When the condition becomes false, the bit is reset to 0
2	Monitor a particular condition (bit)	You can enable a particular bit(s), using the "Standard Event Status Enable Register" on page 1163. The instrument will then monitor that particular condition. If the bit becomes true (0 to 1 transition) in the Event Register, it will stay set until the Event Register is cleared. Querying the Event Register allows you to detect that this condition occurred, even if the condition no longer exists. The Event Register can only be cleared by querying it, or by sending `*CLS`
3	Monitor a particular type of change in a condition (bit)	By default, the Transition Registers are set if the condition goes from 0 to 1 (false to true, or a positive transition), but you can change this behavior so the selected condition is detected if the bit goes from 1 to 0 (true to false, or a negative transition) You can also detect *both* types of transitions, or neither If both Transition Registers are set to 0 for a particular bit position, that bit is *not* set in the "Standard Event Status Enable Register" on page 1163 for either type of change

9.4.4.2 Service Request (SRQ) Method

In this method, the instrument takes a more active role, by informing the controller when there has been a condition change, without the controller asking.

Use this method when:

- you need time-critical notification of changes
- you are monitoring more than one device which supports SRQs
- you need to have the controller do something else while waiting
- you can't afford the performance penalty inherent to polling

Using the Service Request (SRQ) Method

Your language, bus, and programming environment must be able to support SRQ interrupts, for example, BASIC used with VXI-11.3 (GPIB over LAN). When you monitor a condition with the SRQ method, you must:

- Determine which bit monitors the condition
- Determine how that bit reports to the request service (RQS) bit of the status byte
- Send SCPI commands to enable the bit that monitors the condition and to enable the summary bits that report the condition to the RQS bit
- Enable the controller to respond to service requests

When the condition changes, the instrument sets its RQS bit. The controller is informed of the change as soon as it occurs. As a result, the time the controller would otherwise have used to monitor the condition can be used to perform other tasks. Your program determines how the controller responds to the SRQ.

Bit 6 of the "Status Byte Register" on page 1158 is the request service (RQS) bit. Use *SRE to configure the RQS bit to report changes in instrument status. When such a change occurs, the RQS bit is set. It is cleared when the Status Byte Register is queried using *SRE? (with a serial poll.) It can be queried *without* erasing the contents by using *STB?.

When a register being set causes a summary bit in the status byte to change from 0 to 1, the instrument can initiate the service request (SRQ) process. However, the process is only initiated if *both* the following conditions are true:

The corresponding bit of the Service Request Enable Register is also set to 1

The instrument does not have a service request pending. (A service request is considered to be pending between the time the instrument's SRQ process is initiated and the time the controller reads the Status Byte Register)

The SRQ process sets the SRQ true. It also sets the status byte's request service (RQS) bit to 1. Both actions are necessary to inform the controller that the instrument requires service. Setting the SRQ line *only* informs the controller that some device on the bus requires service. Setting the RQS bit allows the controller to determine which instrument requires service.

If your program enables the controller to detect and respond to service requests, it should instruct the controller to perform a serial poll when the SRQ is set true. Each device on the bus returns the contents of its Status Byte Register in response to this poll. The device whose RQS bit is set to 1 is the device that requested service.

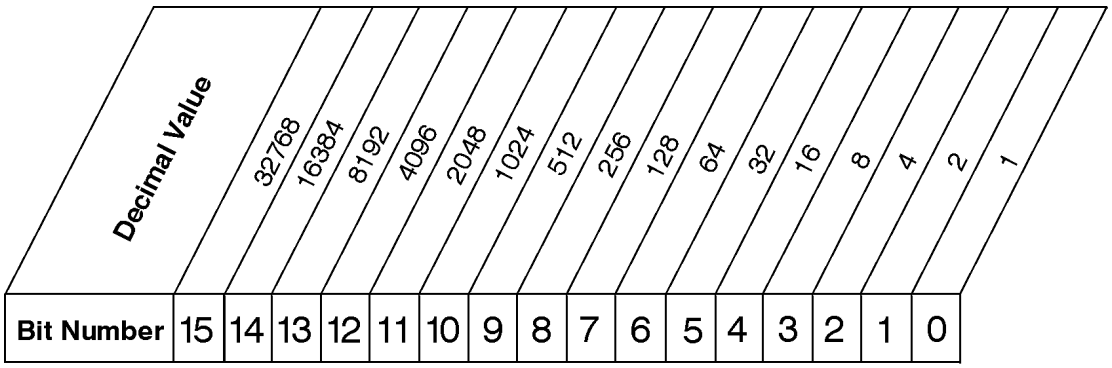
NOTE **When you read the instrument's Status Byte Register using a serial poll, the RQS bit is reset to 0. Other bits in the register are not affected.**

If the Status Byte Register is configured to SRQ on end-of-measurement, and the measurement is in Continuous mode, then restarting a measurement (via :INIT) can cause the measuring bit to pulse low. This causes an SRQ even though you have not actually reached the "end-of-measurement" condition. To avoid this:

- Set `:INITiate:CONTinuous OFF`
- Set/enable the status registers
- Restart the measurement (send `:INIT`)

9.4.5 Status Register Bit Parameters

The diagram below shows a typical status register, in this case the "Operation Enable" on page 1166 Register. Each bit in a register is represented by a numerical value based on its location. When a command requires a bit pattern to be sent as its parameter, that can be entered as a numeric value using decimal or hexadecimal representations. (where 0 to 32767 is equivalent to `#H0` to `#H7FFF`). If you want to enable more than one bit, you send the sum of all the bits that you want to monitor.



STATus:OPERation:ENABle <num>
STATus:OPERation:ENABle?

Standard Operation Event Enable Register

ck730a

NOTE **Bit 15 is not used to report status.**

Example 1

To enable bit 0 and bit 6 of the Standard Event Status Register, you would send the command `*ESE 65` because 1 + 64 = 65

The results of a query are evaluated in a similar way. If the `*STB?` command returns a decimal value of 140, (140 = 128 + 8 + 4) then bit 7 is true, bit 3 is true and bit 2 is true

Example 2

Suppose you want to know if an Auto-trigger Timeout occurs, but you only cared about that specific condition. So, you would want to know what was happening with bit 10 in the Status Questionable Integrity Register, and not about any other bits

It is usually a good idea to start by clearing all the status registers, using `*CLS`

Sending `:STAT:QUES:INT:ENAB 1024` lets you monitor only bit 10 events, instead of the default monitoring all the bits in the register. The register default is for positive transition events (0 to 1 transition), that is, when an auto-trigger timeout occurs. If instead, you want to know when the Auto-trigger timeout condition is cleared, then you set `:STAT:QUES:INT:PTR 0` and `:STAT:QUES:INT:NTR 32767`

Now, the only output from the "Questionable Integrity Register" on page 1196 will come from a bit 10 positive transition, and goes to the Integrity Sum bit 9 of the "Questionable Register" on page 1171

If you want only to monitor bit 9 of the same register, send `:STAT:QUES:ENAB 512`

The "Questionable Register" on page 1171 output goes to the “Status Questionable Summary” bit 3 of the "Status Byte Register" on page 1158. The output from this register can be enabled using `*SRE 8`.

Finally, you can use the serial polling functionality available for the particular bus/software that you are using to monitor the Status Byte Register, or you could use `*STB?` to poll the Status Byte Register.

9.4.6 Status Subsystem Registers and Commands

The Status Subsystem registers monitor various events and conditions in the instrument. Software written to control the instrument may need to monitor some of these events and conditions.

To set and query status registers, you can use the `STATus` subsystem SCPI commands and queries.

NOTE **All status register commands are sequential. You can send them in the middle of an ongoing overlapped command to get the current status. You can also send them following a sequential command. In this case, the status register command waits for the completion of the previously-sent sequential command before performing the action.**

***Most commands are sequential commands*; only a few are overlapped.**

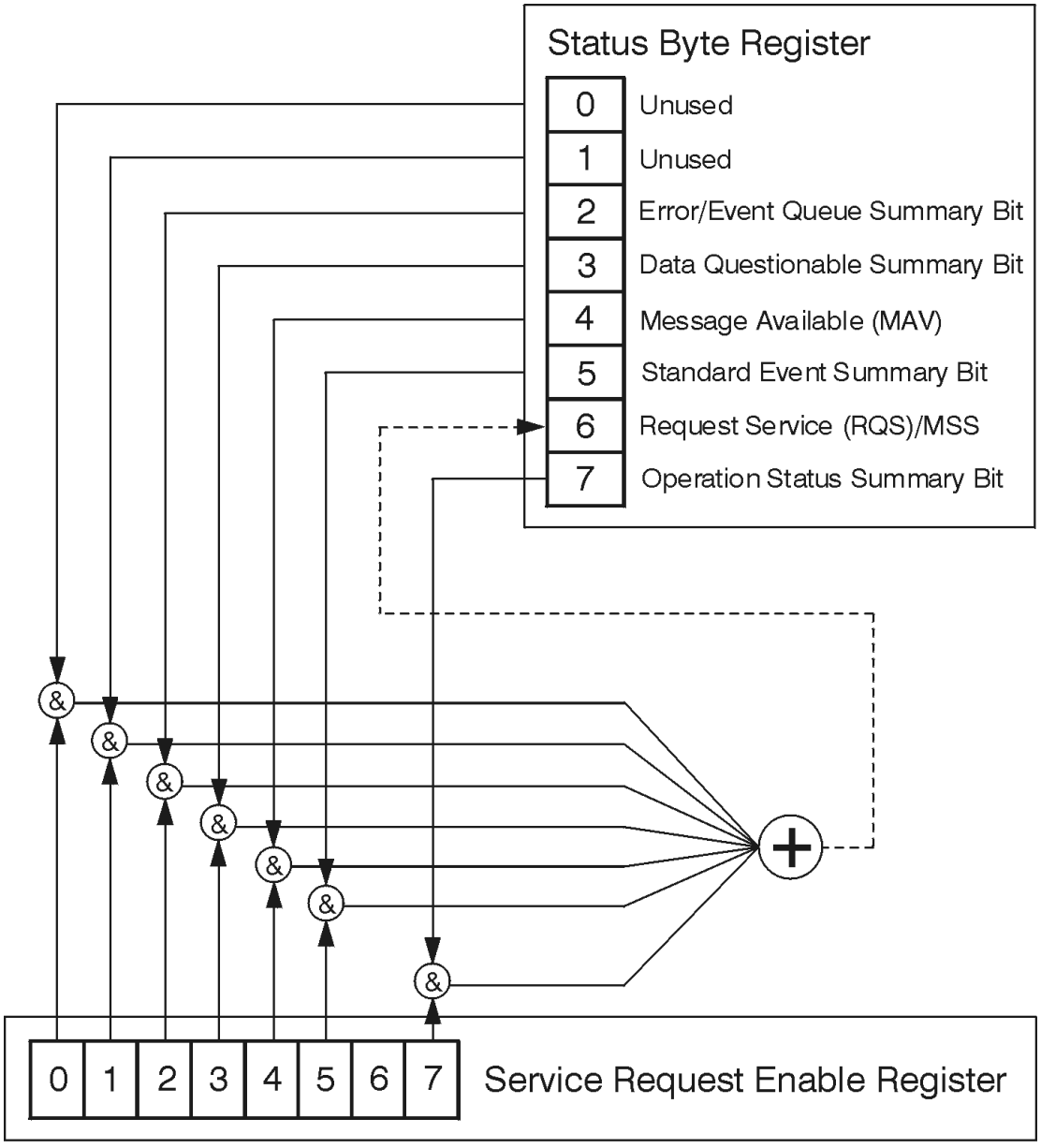
If a command *is* overlapped, then that is explicitly stated in the command description.

See also the Keysight X-Series Signal Analyzers Instrument Messages manual for more detail on the instrument conditions that can cause these bits to be set.

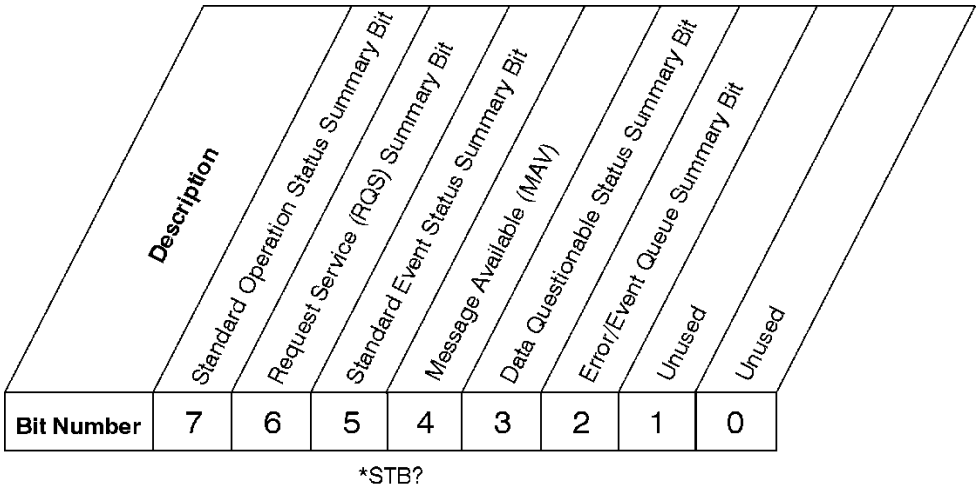
9.4.6.1 Status Byte Register

Provides a one-byte overview of the entire `STATus` subsystem. All the other registers funnel into this register via summary bits, as shown in the "Status Register System

Diagram" on page 1149.



ck776a



Bit	Description
0, 1	These bits are always set to 0
2	A 1 in this bit position indicates that the SCPI error queue is not empty which means that it contains at least one error message
3	A 1 in this bit position indicates that the data questionable summary bit has been set. The Data Questionable Event Register can then be read to determine the specific condition that caused this bit to be set
4	A 1 in this bit position indicates that the instrument has data ready in the output queue. There are no lower status groups that provide input to this bit
5	A 1 in this bit position indicates that the standard event summary bit has been set. The Standard Event Status Register can then be read to determine the specific event that caused this bit to be set
6	A 1 in this bit position indicates that the instrument has at least one reason to report a status change. This bit is also called the master summary status bit (MSS)
7	A 1 in this bit position indicates that the standard operation summary bit has been set. The Standard Operation Event Register can then be read to determine the specific condition that caused this bit to be set

To query the Status Byte Register, send "*STB? - Status Byte Query" on page 1126. The response will be the decimal sum of the bits that are set to 1. For example, if bit number 7 and bit number 3 are set to 1, the decimal sum of the 2 bits is 128 plus 8, so the decimal value 136 is returned.

*STB does *not* clear the status register.

The RQS bit is read and reset by a serial poll. The same bit position (MSS) is read non-destructively by *STB?. If you serial-poll bit 6, it is read as RQS, but if you send *STB, it reads bit 6 as MSS. For more information refer to Section 11 of: IEEE Standard 488.2–1992

In addition to the Status Byte Register, the status byte group also contains the "Service Request Enable Register" on page 1161, which lets you select which bits in the Status Byte Register will trigger a service request.

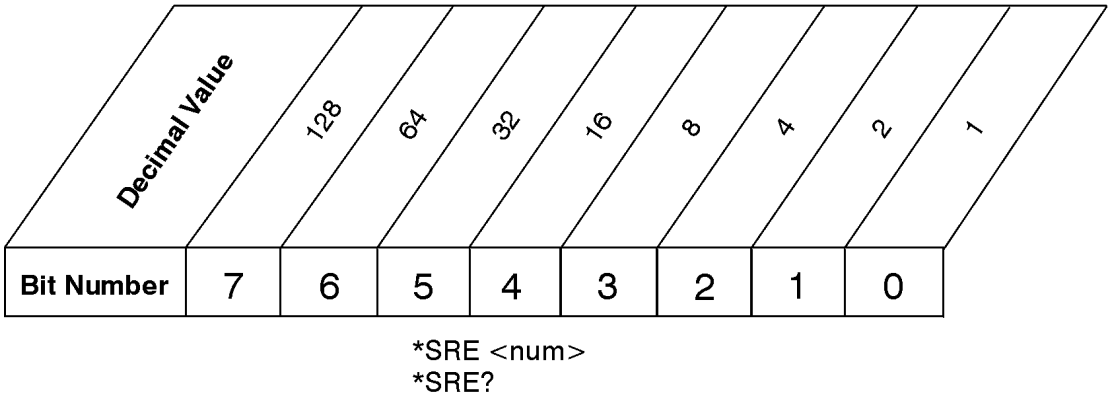
Service Request Enable Register

Enables the desired bits of the Service Request (SRQ) subsystem.

Send *SRE <integer>, where <integer> is the sum of the decimal values of the bits you want to enable plus the decimal value of bit 6. For example, assume that you want to enable bit 7 so that whenever the Standard Operation Status Register summary bit is set to 1 it will trigger a service request. Send the command *SRE 192 (because 192 = 128 + 64). You must always add 64 (the numeric value of RQS bit 6) to your numeric sum when you enable any bits for a service request.

*SRE? returns the decimal value of the sum of the bits previously enabled with *SRE <integer>.

This register presets to zeros (0).



Service Request Enable Register

ck726a

See also "*SRE - Service Request Enable" on page 1125

Preset the Status Byte

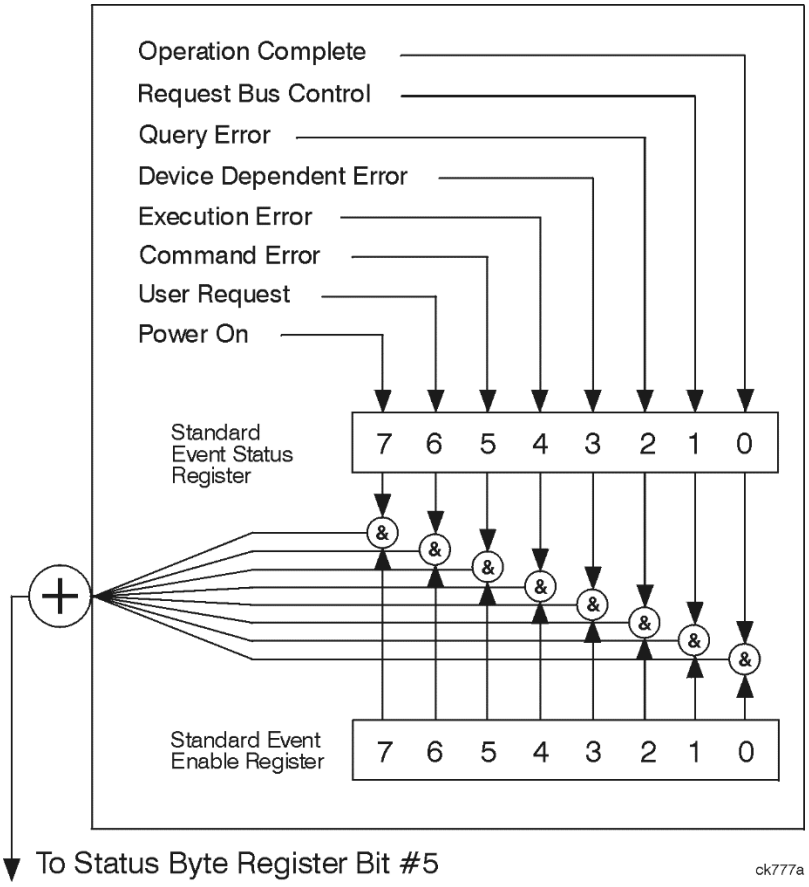
Sets bits in most of the enable and transition registers to their default state.

- Presets:
- All Transition Filters
- All Enable Registers
- Error/Event Queue Enable

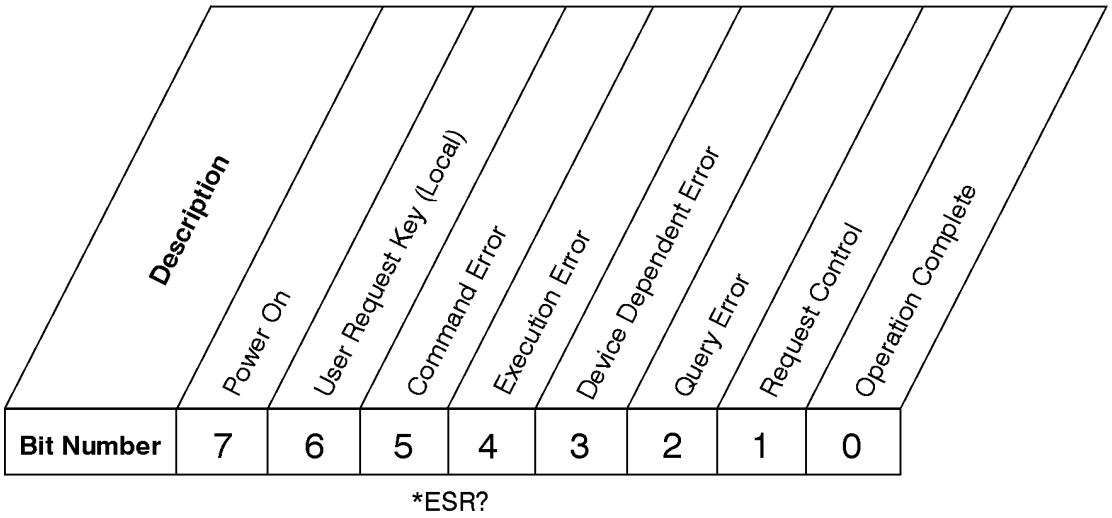
Has no effect on Event Registers, Error/Event QUEue, IEEE 488.2 ESE, and SRE Registers, as described in: IEEE Standard 488.2–1992

Remote Command	`:STATus:PRESet`
Example	`:STAT:PRES`

9.4.6.2 Standard Event Status Register



The Standard Event Status Register contains the following bits:



*ESR?

Standard Event Status Register

ck727a

Bit	Description
0	A 1 in this bit position indicates that all pending operations were completed following execution of the *OPC command
1	For GPIB handshaking to request control. Currently it is set to 0, because there are no implementations where the spectrum analyzer controls another instrument
2	A 1 in this bit position indicates that a query error has occurred. Query errors have SCPI error numbers from -499 to -400
3	A 1 in this bit position indicates that a device dependent error has occurred. Device dependent errors have SCPI error numbers from -399 to -300 and 1 to 32767
4	A 1 in this bit position indicates that an execution error has occurred. Execution errors have SCPI error numbers from -299 to -200
5	A 1 in this bit position indicates that a command error has occurred. Command errors have SCPI error numbers from -199 to -100
6	A 1 in this bit position indicates that the LOCAL key has been pressed. This is true even if the instrument is in local lockout mode
7	A 1 in this bit position indicates that the instrument has been turned off and then on

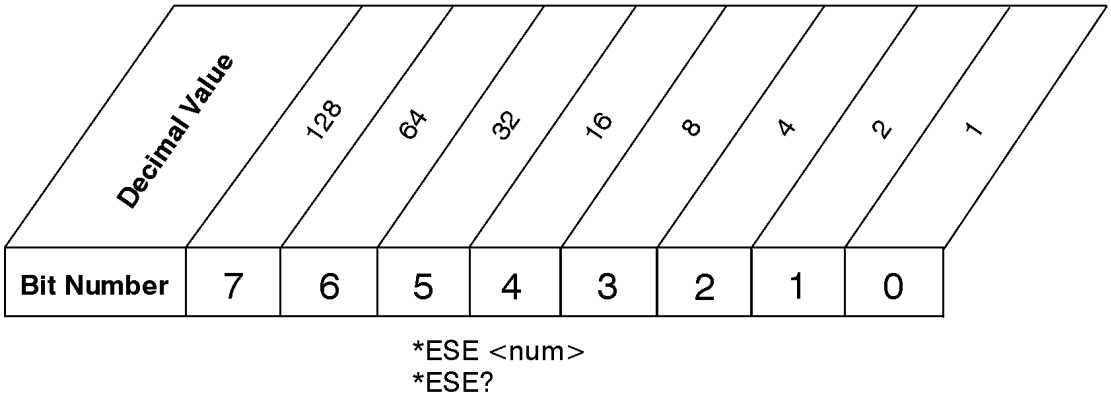
The Standard Event Status Register is used to determine the specific events that set bit 5 in the "Status Byte Register" on page 1158. To query this register, send *ESR?. The response will be the decimal sum of the bits that are enabled (set to 1). For example, if bit number 7 and bit number 3 are enabled, the decimal sum of the 2 bits is 128 plus 8, so the decimal value 136 is returned. See also "*ESR? - Standard Event Status Register Query" on page 1122

Standard Event Status Enable Register

In addition to the "Standard Event Status Register" on page 1162, the Standard Event status group also contains a Standard Event Status Enable Register. This

register lets you choose which bits in the Standard Event Status Register will set the summary bit (bit 5 of the Status Byte Register) to 1. Send `*ESE <integer>`, where `<integer>` is the sum of the decimal values of the bits you want to enable. For example, to enable bit 7 and bit 6 so that whenever either of those bits is set to 1, the standard event status summary bit of the Status Byte Register will be set to 1, send `*ESE 192` (128 + 64). `*ESE?` returns the decimal value of the sum of the bits previously enabled with `*ESE <integer>`.

The standard event status enable register presets to zeros (0).



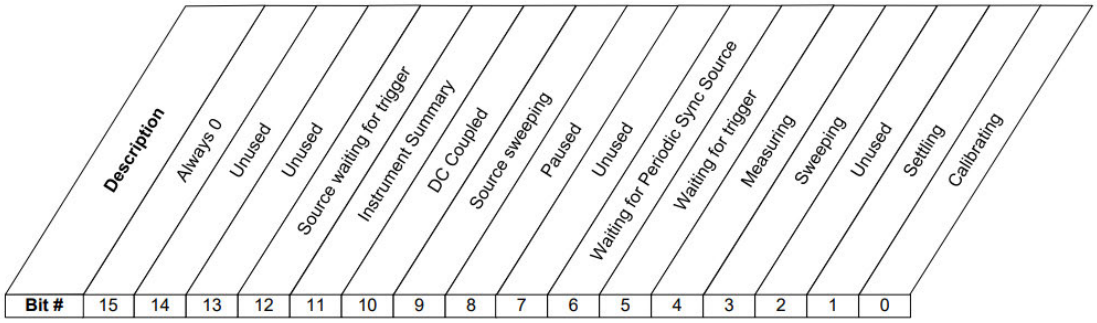
Standard Event Status Enable Register ck728a

See also "*ESE - Standard Event Status Enable" on page 1121

9.4.6.3 Operation Register

This register and the "Questionable Register" on page 1171 are sets of registers that monitor the overall instrument condition. They are accessed using `:STATus:OPERation` and `:STATus:QUEStionable`.

This register monitors the current instrument measurement state and various instrument operations for a quick summary of what is happening within the instrument. It checks to see if the instrument is calibrating, sweeping, or waiting for a trigger (see also "*OPC? - Operation Complete" on page 1123).



STATus:OPERation Register

Bit	Condition	Operation
0	Calibrating	The instrument is busy executing its Align Now process
1	Settling	The instrument circuitry is settling
3	Sweeping	The instrument is busy taking a sweep
4	Measuring	The instrument is busy making a measurement. Measurements often require multiple sweeps. They are initiated by user-interface keys or with the `MEASure` group of commands The bit is valid for most X-Series Modes
5	Waiting for trigger	The instrument is waiting for the trigger conditions to be met, then it will trigger a sweep or measurement
6	Waiting for Periodic Sync Source	The instrument is waiting for the Periodic trigger Sync Source conditions to be met, then the sweep or measurement period will be synchronized
8	Paused	The measurement is paused
9	Source Sweeping	The List Sequencer is running, or Freq Scan results are available The List Sequencer or Waveform Sequences are running, specifically, in VXT models: M9410A/11A/15A/16A, M9410E/11E/15E/16E, E6680A/80E/81A, S9110A/01A/06A/08A/15A/30A, M8920B
10	DC Coupled	The instrument is DC coupled
11	Instrument Summary	The summary bit for the "Operation Instrument Register" on page 1168
12	Source Waiting for Trigger	The built in source is waiting for a trigger

Filter Registers

- "Operation Condition Query" on page 1165
- "Operation Enable" on page 1166
- "Operation Event Query" on page 1166
- "Operation Negative Transition" on page 1167
- "Operation Positive Transition" on page 1167

Operation Condition Query

Returns the decimal value of the sum of the bits in the Status Operation Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:OPERation:CONDition?`
Example	`:STAT:OPER:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Operation Enable

Determines which bits in the "Operation Event Query" on page 1166 Register will set the Operation Status Summary bit (bit 7) in the "Status Byte Register" on page 1158.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

NOTE **The preset condition is to have all bits in this enable register set to 0. To have any Operation Events reported to the Status Byte Register, one or more bits need to be set to 1.**

Remote Command	`:STATus:OPERation:ENABle <integer>` `:STATus:OPERation:ENABle?`
Example	`:STAT:OPER:ENAB 1` Sets the register so that Align Now events will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Operation Event Query

Returns the decimal value of the sum of the bits in the Operation Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:OPERation[:EVENt]?`
Example	`:STAT:OPER?`
Preset	0

Status Bits/OPC dependencies	Sequential command

Operation Negative Transition

Determines which bits in the "Operation Condition Query" on page 1165 Register will set the corresponding bit in the "Operation Event Query" on page 1166 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:OPERation:NTRansition <integer>` `:STATus:OPERation:NTRansition?`
Example	`:STAT:OPER:NTR 1` Align Now operation complete will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Operation Positive Transition

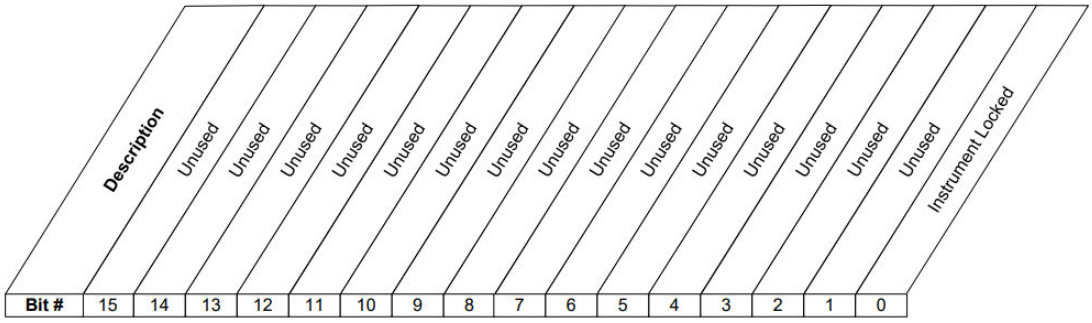
Determines which bits in the "Operation Condition Query" on page 1165 Register will set the corresponding bit in the "Operation Event Query" on page 1166 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:OPERation:PTRansition <integer>` `:STATus:OPERation:PTRansition?`
Example	`:STAT:OPER:PTR 1` Align Now operation beginning will be reported to the Status Byte Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.4 Operation Instrument Register

Monitors instrument-related operations and summarizes them in bit 11 of the "Operation Register" on page 1164.



STATus:OPERation:INSTrument Register

Bit	Condition	Operation
0	Instrument Locked	The instrument is locked

Filter Registers

- "Operation Instrument Condition" on page 1168
- "Operation Instrument Enable" on page 1169
- "Operation Instrument Event Query" on page 1169
- "Operation Instrument Negative Transition" on page 1170
- "Operation Instrument Positive Transition" on page 1170

Operation Instrument Condition

Returns the decimal value of the sum of the bits in the Status Operation Instrument Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:OPERation:INSTrument:CONDition?`
Example	`:STAT:OPER:INST:COND?`
Preset	0
Status Bits/OPC depend-encies	Sequential command

Operation Instrument Enable

Determines which bits in the "Operation Instrument Condition" on page 1168 Register will set bits in the "Operation Instrument Event Query" on page 1169 Register, which also sets the Instrument Summary bit (bit 11) in the "Operation Instrument Register" on page 1168.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

NOTE **The preset condition is to have all bits in this enable register set to 0. To have any Instrument Events reported to the Status Byte Register, one or more bits need to be set to 1.**

Remote Command	`:STATus:OPERation:INSTrument:ENABle <integer>` `:STATus:OPERation:INSTrument:ENABle?`
Example	`:STAT:OPER:INST:ENAB 1` Sets the register so that Instrument Locked will be reported to the Status Byte Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Operation Instrument Event Query

Returns the decimal value of the sum of the bits in the Operation Instrument Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:OPERation:INSTrument[:EVENt]?`
Example	`:STAT:OPER:INST?`
Preset	0
Status Bits/OPC depend-encies	Sequential command

Operation Instrument Negative Transition

Determines which bits in the "Operation Condition Query" on page 1165 Register will set the corresponding bit in the "Operation Event Query" on page 1166 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:OPERation:INSTrument:NTRansition <integer>` `:STATus:OPERation:INSTrument:NTRansition?`
Example	`:STAT:OPER:INST:NTR 1` Instrument Locked being cleared will be reported to the Instrument Summary of the Status Operation Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Operation Instrument Positive Transition

Determines which bits in the "Operation Condition Query" on page 1165 Register will set the corresponding bit in the "Operation Event Query" on page 1166 Register when the condition register bit has a positive transition (0 to 1).

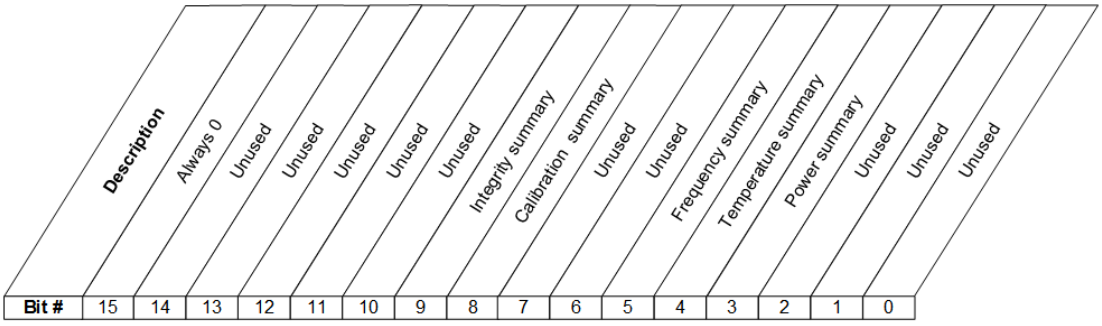
The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:OPERation:INSTrument:PTRansition <integer>` `:STATus:OPERation:INSTrument:PTRansition?`
Example	`:STAT:OPER:INST:PTR 1` Instrument Locked being set will be reported to the Instrument Summary of the Status Operation Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.5 Questionable Register

This register and the "Operation Register" on page 1164 monitor the overall instrument condition. They are accessed using `:STATus:OPERation` and `:STATus:QUEStionable`.

This register monitors the instrument's condition to see if anything questionable has happened. It detects anything that might cause an error or a bad measurement, such as a hardware problem, an out-of-calibration situation, or an unusual signal. All the bits are summary bits from lower-level event registers.



STATus:QUEStionable Register

Bit	Condition	Operation
3	Power summary	Summary bit for "Questionable Power Register" on page 1174
4	Temperature summary	Summary bit for "Questionable Temperature Register" on page 1177
5	Frequency summary	Summary bit for "Questionable Frequency Register" on page 1180
8	Calibration summary	Summary bit for "Questionable Calibration Register" on page 1183
9	Integrity summary	Summary bit for "Questionable Integrity Register" on page 1196

Filter Registers

- "Questionable Condition" on page 1172
- "Questionable Enable" on page 1172
- "Questionable Event Query" on page 1173
- "Questionable Negative Transition" on page 1173
- "Questionable Positive Transition" on page 1173

Questionable Condition

Returns the decimal value of the sum of the bits in the Questionable Condition Register.

NOTE **The data in this register is continuously updated and reflects current conditions.**

Remote Command	`:STATus:QUEStionable:CONDition?`
Example	`:STAT:QUES:COND?`
Preset	0
Status Bits/OPC depend-encies	Sequential command

Questionable Enable

Determines which bits in the "Questionable Event Query" on page 1173 Register will set the Questionable Status Summary bit (bit3) in the "Status Byte Register" on page 1158.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

NOTE **The preset condition is all bits in this enable register set to 0. To report any Questionable Events to the Status Byte Register, one or more bits need to be set to 1. The "Standard Event Status Register" on page 1162 should be queried after each measurement to check the Questionable Status Summary (bit 3). If it is equal to 1, a condition during the test may have made the test results invalid. If it is equal to 0, this indicates that no hardware problem or measurement problem was detected by the analyzer.**

Remote Command	`:STATus:QUEStionable:ENABle <integer>` `:STATus:QUEStionable:ENABle?`
Example	`:STAT:QUES:ENAB 16` Sets the register so that questionable temperature events will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Event Query

Returns the decimal value of the sum of the bits in the Questionable Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable[:EVENt]?`
Example	`:STAT:QUES?`
Preset	0
Status Bits/OPC depend-encies	Sequential command

Questionable Negative Transition

Determines which bits in the "Questionable Condition" on page 1172 Register will set the corresponding bit in the "Questionable Event Query" on page 1173 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:NTRansition <integer>` `:STATus:QUEStionable:NTRansition?`
Example	`:STAT:QUES:NTR 16` Temperature summary 'questionable cleared' will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Positive Transition

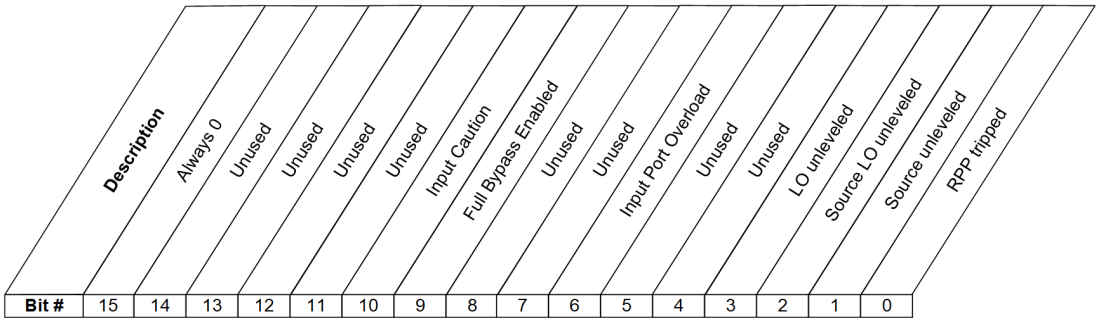
Determines which bits in the "Questionable Condition" on page 1172 Register will set the corresponding bit in the "Questionable Event Query" on page 1173 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:PTRansition <integer>` `:STATus:QUEStionable:PTRansition?`
Example	`:STAT:QUES:PTR 16` Temperature summary 'questionable asserted' will be reported to the Status Byte Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.6 Questionable Power Register

Monitors power-related conditions within the instrument and summarizes them in bit 3 of the "Questionable Register" on page 1171.



STATus:QUEStionable:POWer Register

Bit	Condition	Operation
0	RPP tripped	(not currently in use)
1	Source Unleveled	The built-in source is not properly leveled
2	Source LO Unleveled	(not currently in use)
3	LO Unleveled	(not currently in use)
6	Input Port Overload	A power overload condition exists at an input port
9	Full Bypass Enabled	Frontend circuitry is bypassed, use caution to protect the mixer
10	Input Caution	Input circuitry is configured such that care is required to prevent damage

Filter Registers

– "Questionable Power Condition" on page 1175
– "Questionable Power Enable" on page 1175
– "Questionable Power Event Query" on page 1176
– "Questionable Power Negative Transition" on page 1176
– "Questionable Power Positive Transition" on page 1176

Questionable Power Condition

Returns the decimal value of the sum of the bits in the Questionable Power Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:POWer:CONDition?`
Example	`:STAT:QUES:POW:COND?`
Preset	0
Status Bits/OPC depend-encies	Sequential command

Questionable Power Enable

Determines which bits in the "Questionable Power Condition" on page 1175 Register will set bits in the Questionable Power Event Register, which also sets the Power Summary bit (bit 3) in the "Questionable Register" on page 1171.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:ENABle <integer>` `:STATus:QUEStionable:POWer:ENABle?`
Example	`:STAT:QUES:POW:ENAB 2` Source Unlevelled will be reported to the Power Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Power Event Query

Returns the decimal value of the sum of the bits in the Questionable Power Event Query Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:POWer[:EVENt]?`
Example	`:STAT:QUES:POW?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Power Negative Transition

Determines which bits in the "Questionable Power Condition" on page 1175 Register will set the corresponding bit in the "Questionable Power Event Query" on page 1176 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:NTRansition <integer>` `:STATus:QUEStionable:POWer:NTRansition?`
Example	`:STAT:QUES:POW:NTR 2` Source Unlevelled being cleared will be reported to the Power Summary of the Status Questionable Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Power Positive Transition

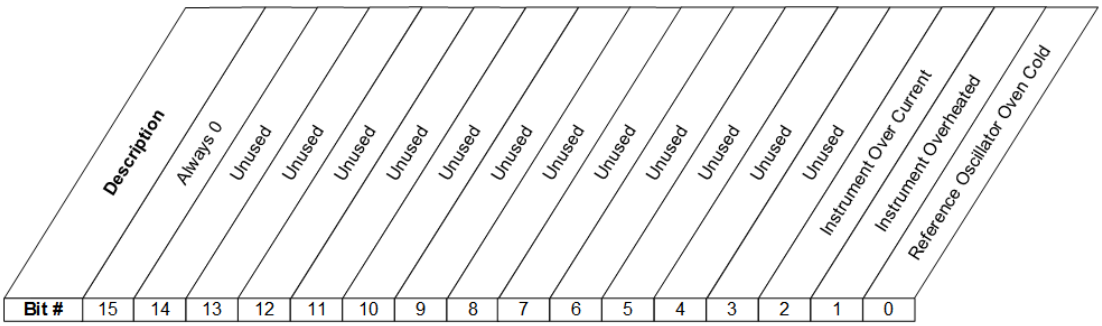
Determines which bits in the "Questionable Power Condition" on page 1175 Register will set the corresponding bit in the "Questionable Power Event Query" on page 1176 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:PTRansition <integer>` `:STATus:QUEStionable:POWer:PTRansition?>`
Example	`:STAT:QUES:POW:PTR 32` Source Unlevelled being set will be reported to the Power Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.7 Questionable Temperature Register

Monitors temperature-related conditions within the instrument and summarizes them in bit 4 of the "Questionable Register" on page 1171.



STATus:QUEStionable:TEMPerature Register

Bit	Condition	Operation
0	Reference Oscillator Oven Cold	(not currently in use)
1	Instrument overheated (over temperature)	Excessive heat has been detected in some part of the instrument
2	Instrument over current	Excessive heat has been detected in some part of the instrument; the instrument should be restarted

Filter Registers

- "Questionable Temperature Condition" on page 1178
- "Questionable Temperature Enable" on page 1178

– "Questionable Temperature Event Query" on page 1179
– "Questionable Temperature Negative Transition" on page 1179
– "Questionable Temperature Positive Transition" on page 1179

Questionable Temperature Condition

Returns the decimal value of the sum of the bits in the Questionable Temperature Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:TEMPerature:CONDition?`
Example	`:STAT:QUES:TEMP:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Enable

Determines which bits in the "Questionable Temperature Condition" on page 1178 Register will set bits in the "Questionable Temperature Event Query" on page 1179 Register, which also sets the Temperature Summary bit (bit 4) in the "Questionable Register" on page 1171.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:TEMPerature:ENABle <integer>` `:STATus:QUEStionable:TEMPerature:ENABle?`
Example	`:STAT:QUES:TEMP:ENAB 2` Instrument Overheated will be reported to the Temperature Summary of the Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Event Query

Returns the decimal value of the sum of the bits in the Questionable Temperature Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:TEMPerature[:EVENt]?`
Example	`:STAT:QUES:TEMP?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Negative Transition

Determines which bits in the "Questionable Temperature Condition" on page 1178 Register will set bits in the "Questionable Temperature Event Query" on page 1179 Register, when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:TEMPerature:NTRansition <integer>` `:STATus:QUEStionable:TEMPerature:NTRansition?`
Example	`:STAT:QUES:TEMP:NTR 2` Instrument Overheated being cleared will be reported to the Temperature Summary of the Status Questionable Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Positive Transition

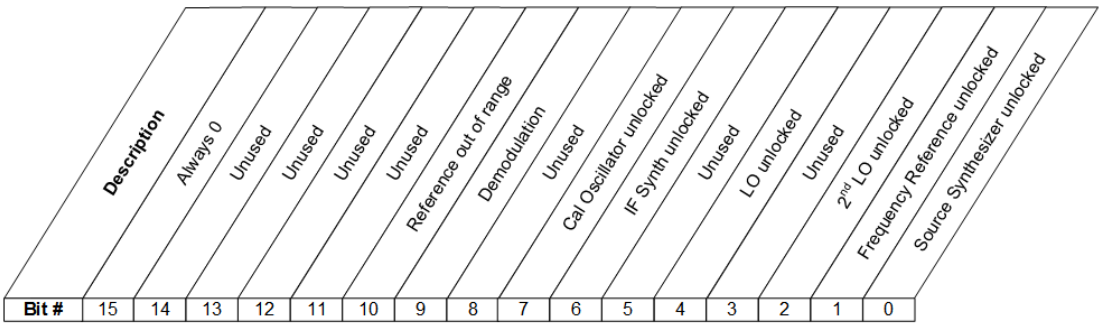
Determines which bits in the "Questionable Temperature Condition" on page 1178 Register will set bits in the "Questionable Temperature Event Query" on page 1179 Register, when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:TEMPerature:PTRansition <integer>` `:STATus:QUEStionable:TEMPerature:PTRansition?`
Example	`:STAT:QUES:TEMP:PTR 2` Instrument Overheated being set will be reported to the Temperature Summary of the Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.8 Questionable Frequency Register

Monitors frequency-related conditions within the instrument and summarizes them in bit 5 of the "Questionable Register" on page 1171.



STATus:QUEStionable:FREQuency Register

Bit	Condition	Operation
0	Source Synth Unlocked	The synthesizer in the built-in source is not locked
1	Frequency Reference Unlocked	The instrument's frequency reference is unlocked
2	2nd LO Unlocked	The instrument's second LO (local oscillator) is unlocked
4	LO Unlocked	The instrument's main LO (local oscillator) is unlocked
6	IF Synth Unlocked	The synthesizer in the IF is not locked
7	Cal Osc Unlocked	The oscillator used for internal calibrations is not locked
9	Demodulation	Demodulation cannot be performed due to an out-of-range frequency

Bit	Condition	Operation
10	Reference missing or out of range	The signal being fed to a reference input is missing or too high or low in frequency for the reference to lock

Filter Registers

- "Questionable Frequency Condition" on page 1181
- "Questionable Frequency Enable" on page 1181
- "Questionable Frequency Event Query" on page 1182
- "Questionable Frequency Negative Transition" on page 1182
- "Questionable Frequency Positive Transition" on page 1183

Questionable Frequency Condition

Returns the decimal value of the sum of the bits in the Questionable Frequency Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:FREQuency:CONDition?`
Example	`:STAT:QUES:FREQ:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Enable

Determines which bits in the "Questionable Frequency Condition" on page 1181 Register will set bits in the "Questionable Temperature Event Query" on page 1179 Register, which also sets the Frequency Summary bit (bit 5) in the "Questionable Register" on page 1171.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:FREQuency:ENABle <integer>` `:STATus:QUEStionable:FREQuency:ENABle?`
Example	`:STAT:QUES:FREQ:ENAB 2` Frequency Reference Unlocked will be reported to the Frequency Summary of the Status

	Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Event Query

Returns the decimal value of the sum of the bits in the Questionable Frequency Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:FREQuency[:EVENt]?`
Example	`:STAT:QUES:FREQ?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Negative Transition

Determines which bits in the "Questionable Frequency Condition" on page 1181 Register will set the corresponding bit in the "Questionable Frequency Event Query" on page 1182 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:FREQuency:NTRansition <integer>` `:STATus:QUEStionable:FREQuency:NTRansition?`
Example	`:STAT:QUES:FREQ:NTR 2` Frequency Reference 'regained lock' will be reported to the Frequency Summary of the Status Questionable Register
Preset	0
Min	0
Max	32767

Status Bits/OPC dependencies	Sequential command

Questionable Frequency Positive Transition

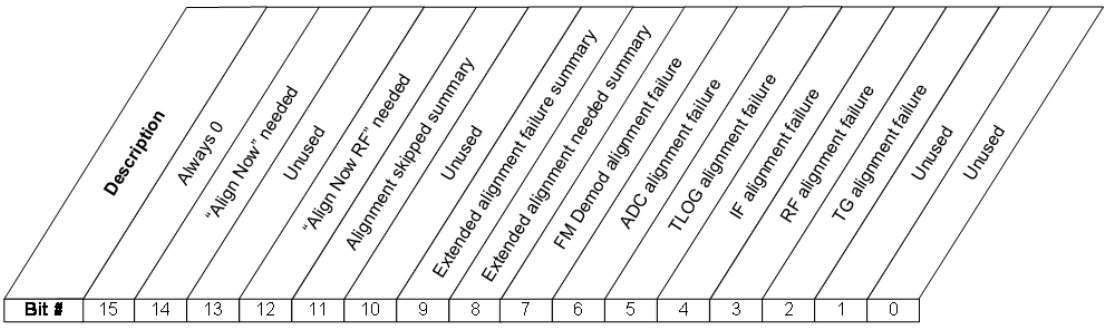
Determines which bits in the "Questionable Frequency Condition" on page 1181 Register will set the corresponding bit in the "Questionable Frequency Event Query" on page 1182 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:FREQuency:PTRansition <integer>` `:STATus:QUEStionable:FREQuency:PTRansition?`
Example	`:STAT:QUES:FREQ:PTR 2` Frequency Reference 'became unlocked' will be reported to the Frequency Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.9 Questionable Calibration Register

Monitors calibration-related conditions within the instrument and summarizes them in bit 8 of the "Questionable Register" on page 1171. Three of the bits are summary bits from lower-level event registers.



STATus:QUEStionable:CALibration Register

Bit	Condition	Operation
2	TG Alignment Failure	The Tracking Generator failed to align properly
3	RF Alignment Failure	The RF section (frontend) failed to align properly
4	IF Alignment Failure	The IF section failed to align properly
5	LO Alignment Failure	The LO (local oscillator) failed to align properly
6	ADC Alignment Failure	The ADC section failed to align properly
7	FM Demod Alignment Failure	The FM Demod section failed to align properly
8	Extended Align Needed Summary	Summary bit for "Questionable Calibration Extended Needed Register" on page 1187
9	Extended Align Failure Summary	Summary bit for "Questionable Calibration Extended Failure Register" on page 1190
11	Align Skipped Sum Summary	Summary bit for "Questionable Calibration Skipped Register" on page 1193
12	“Align Now RF” required	Go to the System, Alignments, Align Now menu and perform an “Align Now RF”
14	“Align Now” required	Go to the System, Alignments, Align Now menu and perform an “Align Now All” or an “Align Now Expired”

Filter Registers

- "Questionable Calibration Condition" on page 1184
- "Questionable Calibration Enable" on page 1185
- "Questionable Calibration Event Query" on page 1185
- "Questionable Calibration Negative Transition" on page 1186
- "Questionable Calibration Positive Transition" on page 1186

Questionable Calibration Condition

Returns the decimal value of the sum of the bits in the Questionable Calibration Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:CALibration:CONDition?`
Example	`:STAT:QUES:CAL:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Enable

Determines which bits in the "Questionable Calibration Condition" on page 1184 Register will set bits in the "Questionable Calibration Event Query" on page 1185 Register, which also sets the Calibration Summary bit (bit 8) in the "Questionable Register" on page 1171.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:ENABle <integer>` `:STATus:QUEStionable:CALibration:ENABle?`
Example	`:STAT:QUES:CAL:ENAB 16384` Can be used to query if an alignment is needed, if you have turned off the automatic alignment process
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Event Query

Returns the decimal value of the sum of the bits in the Questionable Calibration Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:CALibration[:EVENt]?`
Example	`:STAT:QUES:CAL?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Negative Transition

Determines which bits in the "Questionable Calibration Condition" on page 1184 Register will set the corresponding bit in the "Questionable Calibration Event Query" on page 1185 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:NTRansition <integer>` `:STATus:QUEStionable:CALibration:NTRansition?`
Example	`:STAT:QUES:CAL:NTR 16384` "Align All Now Needed" being cleared will be reported to the Calibration Summary of the Status Questionable Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Positive Transition

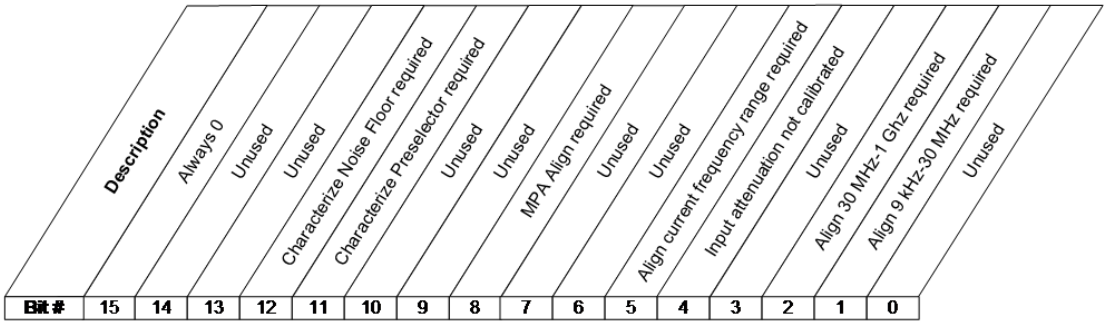
Determines which bits in the "Questionable Calibration Condition" on page 1184 Register will set the corresponding bit in the "Questionable Calibration Event Query" on page 1185 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:PTRansition <integer>` `:STATus:QUEStionable:CALibration:PTRansition?`
Example	`:STAT:QUES:CAL:PTR 16384` "Align All Now Needed" being set will be reported to the Calibration Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.10 Questionable Calibration Extended Needed Register

Monitors conditions that occur because a calibration or alignment is required to guarantee accurate measurements. It summarizes them in bit 8 of the "Questionable Calibration Register" on page 1183.



STATus:QUEStionable:CALibration:EXTended:NEEDed Register

Bit	Condition	Operation
1	Align 9kHz-30MHz required	EMI receiver alignment required, 9kHz-30 MHz (conducted band)
2	Align 30MHz-1GHz required	EMI receiver alignment required, 30 MHz-1 GHz (radiated band)
4	Input Attenuation not calibrated	The input attenuator is uncalibrated
5	Align current frequency range required	Alignment for current set frequency range is needed. It is suggested to process Align Selected Freq Range for the frequency range in use
8	MPA Align required	The Multiport Adaptor must be calibrated (EXT only)
11	Characterize Preselector required	Go to the System, Alignments, Advanced menu and perform a “Characterize Preselector”
12	Characterize Noise Floor required	Go to the System, Alignments, Advanced menu and perform a “Characterize Noise Floor”

Filter Registers

- "Questionable Calibration Extended Needed Condition" on page 1188
- "Questionable Calibration Extended Needed Enable" on page 1188
- "Questionable Calibration Extended Needed Event Query" on page 1189

– "Questionable Calibration Extended Needed Negative Transition" on page 1189
– "Questionable Calibration Extended Needed Positive Transition" on page 1189

Questionable Calibration Extended Needed Condition

Returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:CONDition?`
Example	`:STAT:QUES:CAL:EXT:NEED:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Enable

Determines which bits in the "Questionable Calibration Extended Needed Condition" on page 1188 will set bits in the "Questionable Calibration Extended Needed Event Query" on page 1189 Register, which also sets bit 14 of the "Questionable Calibration Register" on page 1183.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle <integer>` `:STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle?`
Example	`:STAT:QUES:CAL:EXT:NEED:ENAB 2` Can be used to query if an EMI conducted alignment is needed
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Event Query

Returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed[:EVENt]?`
Example	`:STAT:QUES:CAL:EXT:NEED?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Negative Transition

Determines which bits in the "Questionable Calibration Extended Needed Condition" on page 1188 Register will set the corresponding bit in the "Questionable Calibration Extended Needed Event Query" on page 1189 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition <integer>` `:STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition?`
Example	`:STAT:QUES:CAL:EXT:NEED:NTR 2` Conducted alignment required bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Positive Transition

Determines which bits in the "Questionable Calibration Extended Needed Condition" on page 1188 Register will set the corresponding bit in the "Questionable

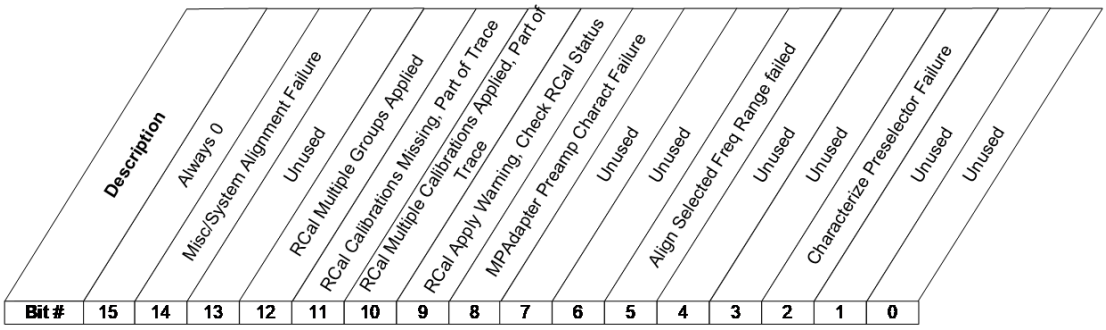
Calibration Extended Needed Event Query" on page 1189 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition <integer>` `:STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition?`
Example	`:STAT:QUES:CAL:EXT:NEED:PTR 2` Conducted alignment required bit being set will be reported
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.11 Questionable Calibration Extended Failure Register

Monitors conditions that occur because a calibration or alignment has failed to complete properly. It summarizes them in bit 9 of the "Questionable Calibration Register" on page 1183.



STATus:QUEStionable:CALibration:EXTended:FAILure Register

Bit	Condition	Operation
2	Characterize Preselector Failure	The preselector characterization failed
5	Align Selected Freq Range failed	The alignment for selected frequency range failed
8	MPAdapter Preamp Charact Failure	The Multiport Adaptor must be calibrated (EXT only)
9	RCal Apply Warning, Check RCal Status	The calibration request sent to the RCal module failed

Bit	Condition	Operation
10	RCal Multiple Calibrations Applied, Part of Trace	More than one calibration is being applied to part of the trace for current measurement
11	RCal Calibrations Missing, Part of Trace	The calibration being applied is not being applied to all of the trace for the current measurement
12	RCal Multiple Groups Applied	More than one calibrated row is being applied to the current measurement
14	Misc/System Alignment Failure	Miscellaneous/System alignments have failed

Filter Registers

- "Questionable Calibration Extended Failure Condition" on page 1191
- "Questionable Calibration Extended Failure Enable" on page 1191
- "Questionable Calibration Extended Failure Event Query" on page 1192
- "Questionable Calibration Extended Failure Negative Transition" on page 1192
- "Questionable Calibration Extended Failure Positive Transition" on page 1193

Questionable Calibration Extended Failure Condition

Returns the decimal value of the sum of the bits in the Questionable Calibration Extended Failure Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?`
Example	`:STAT:QUES:CAL:EXT:FAIL:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Enable

Determines which bits in the "Questionable Calibration Extended Failure Condition" on page 1191 Register will set bits in the "Questionable Calibration Extended Failure Event Query" on page 1192 Register, which also sets bit 9 of the "Questionable Calibration Register" on page 1183.

The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle <integer> :STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle?
Example	:STAT:QUES:CAL:EXT:FAIL:ENAB 1 Can be used to query if an EMI conducted alignment failed
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Event Query

Returns the decimal value of the sum of the bits in the Questionable Calibration Extended Failure Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	:STATus:QUEStionable:CALibration:EXTended:FAILure[:EVENt]?
Example	:STAT:QUES:CAL:EXT:FAIL?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Negative Transition

Determines which bits in the "Questionable Calibration Extended Failure Condition" on page 1191 Register will set the corresponding bit in the "Questionable Calibration Extended Failure Event Query" on page 1192 Register when the condition register bit has a negative transition (1 to 0).

The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition <integer> :STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition?
Example	:STAT:QUES:CAL:EXT:FAIL:NTR 1

	Conducted alignment failed bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Positive Transition

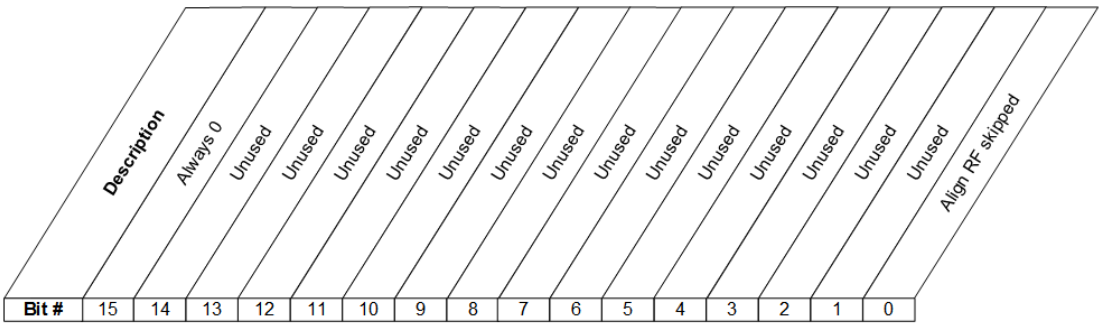
Determines which bits in the "Questionable Calibration Extended Failure Condition" on page 1191 Register will set the corresponding bit in the "Questionable Calibration Extended Failure Event Query" on page 1192 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition <integer>` `:STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition?`
Example	`:STAT:QUES:CAL:EXT:FAIL:PTR 1` Conducted alignment failed bit being set will be reported
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.12 Questionable Calibration Skipped Register

Monitors conditions that occur because a calibration or alignment has been skipped due to various settings or conditions. It summarizes them in bit 11 of the "Questionable Calibration Register" on page 1183.



STATus:QUEStionable:CALibration:SKIPped Register

Bit	Condition	Operation
0	Align RF skipped	During an alignment, the calibration of the RF section (frontend) of the instrument was not performed. This can be caused by an interfering user signal present at the RF Input See "Align Now" on page 494, and "Align Now All" on page 496

Filter Registers

- "Questionable Calibration Skipped Condition" on page 1194
- "Questionable Calibration Skipped Enable" on page 1195
- "Questionable Calibration Skipped Event Query" on page 1195
- "Questionable Calibration Skipped Negative Transition" on page 1195
- "Questionable Calibration Skipped Positive Transition" on page 1196

Questionable Calibration Skipped Condition

Returns the decimal value of the sum of the bits in the Questionable Calibration Skipped Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:CONDition?`
Example	`:STAT:QUES:CAL:SKIP:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Enable

Determines which bits in the "Questionable Calibration Skipped Condition" on page 1194 Register will set bits in the "Questionable Calibration Skipped Event Query" on page 1195 Register, which also sets bit 11 of the "Questionable Calibration Register" on page 1183.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:ENABle <integer>` `:STATus:QUEStionable:CALibration:SKIPped:ENABle?`
Example	`:STAT:QUES:CAL:SKIP:ENAB 1` Can be used to query if an RF alignment skipped condition is detected
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Event Query

Returns the decimal value of the sum of the bits in the Questionable Calibration Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped[:EVENt]?`
Example	`:STAT:QUES:CAL:SKIP?`
Preset	0
Status Bits/OPC depend-encies	Sequential command

Questionable Calibration Skipped Negative Transition

Determines which bits in the "Questionable Calibration Skipped Condition" on page 1194 Register will set the corresponding bit in the "Questionable Calibration

Skipped Event Query" on page 1195 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:NTRansition <integer>` `:STATus:QUEStionable:CALibration:SKIPped:NTRansition?`
Example	`:STAT:QUES:CAL:SKIP:NTR 1` RF Align Skipped bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Positive Transition

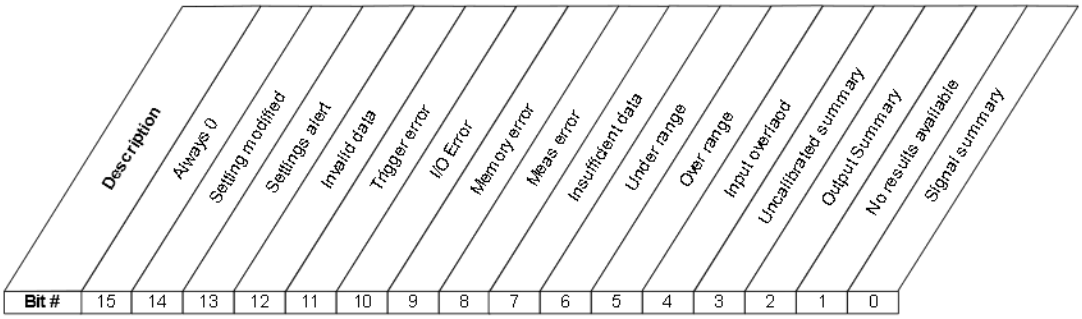
Determines which bits in the "Questionable Calibration Skipped Condition" on page 1194 Register will set the corresponding bit in the "Questionable Calibration Skipped Event Query" on page 1195 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:PTRansition <integer>` `:STATus:QUEStionable:CALibration:SKIPped:PTRansition?`
Example	`:STAT:QUES:CAL:SKIP:PTR 1` RF Align Skipped bit being set will be reported
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.13 Questionable Integrity Register

Monitors measurement integrity-related conditions within the instrument and summarizes them in bit 9 of the "Questionable Register" on page 1171. Two of the bits are summary bits from lower-level event registers.



STATus:QUEStionable:INTegrity Register

Bit	Condition	Operation
0	Signal Summary	The summary bit for the "Questionable Integrity Signal Register" on page 1200
1	No Result	The current measurement is incompatible with a setting or combination of settings, such as the selected Input, Radio Standard, etc.
2	Output Summary	The summary bit for the "Questionable Integrity Output Register" on page 1203
3	Uncalibrated Summary	The summary bit for the "Questionable Integrity Uncalibrated Register" on page 1206
4	Input Overload	A signal overload condition exists
5	Over Range	The signal at the input for this measurement is too high. You should increase the attenuation or decrease the signal level
6	Under Range	The signal at the input for this measurement is too low. You should decrease the attenuation or increase the signal level
7	Insufficient Data	Signal or settings conditions did not allow enough data to be taken during an acquisition for a valid measurement
8	Meas Error	(not currently in use)
9	Memory Error	There is not enough memory to perform the desired operation
10	I/O Error	I/O settings are preventing communication with an instrument or peripheral
11	Trigger Error	Signal or settings conditions did not allow enough data to be taken during an acquisition for a valid measurement
12	Invalid data	The Invalid Data indicator (* in upper right of display) is on, indicating that onscreen data may be stale and not match the current settings
13	Settings Alert	Settings are not right for a valid measurement, but the instrument is nonetheless allowing a measurement to be taken
14	Setting Modified	Settings are not right for a valid measurement, and the instrument is using different settings than the ones you entered in order to take a measurement

Filter Registers

– "Questionable Integrity Condition" on page 1198
– "Questionable Integrity Enable" on page 1198
– "Questionable Integrity Event Query" on page 1199
– "Questionable Integrity Negative Transition" on page 1199
– "Questionable Integrity Positive Transition" on page 1199

Questionable Integrity Condition

Returns the decimal value of the sum of the bits in the Questionable Integrity Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:INTegrity:CONDition?`
Example	`:STAT:QUES:INT:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Enable

Determines which bits in the "Questionable Integrity Condition" on page 1198 Register will set bits in the "Questionable Integrity Event Query" on page 1199 Register, which also sets the Integrity Summary bit (bit 9) in the "Questionable Register" on page 1171.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:ENABle <integer>` `:STATus:QUEStionable:INTegrity:ENABle?`
Example	`:STAT:QUES:INT:ENAB 8` Uncalibrated Summary will be reported to the Integrity Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Event Query

Returns the decimal value of the sum of the bits in the Questionable Integrity Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:INTegrity[:EVENt]?`
Example	`:STAT:QUES:INT?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Negative Transition

Determines which bits in the "Questionable Integrity Condition" on page 1198 Register will set the corresponding bit in the "Questionable Integrity Event Query" on page 1199 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:NTRansition?`
Example	`:STAT:QUES:INT:NTR 8` Uncalibrated Summary being cleared will be reported to the Integrity Summary of the Status Questionable Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Positive Transition

Determines which bits in the "Questionable Integrity Condition" on page 1198 Register will set the corresponding bit in the "Questionable Integrity Event Query"

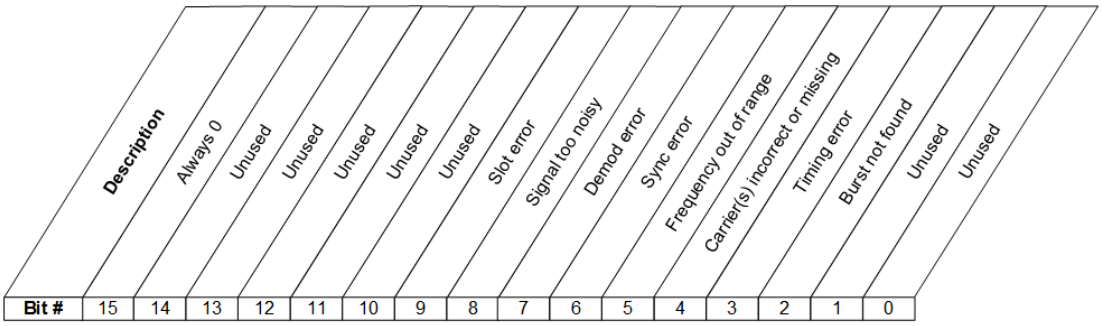
on page 1199 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:PTRansition <integer>` `:STATus:QUEStionable:INTegrity:PTRansition?`
Example	`:STAT:QUES:INT:PTR 8` Uncalibrated Summary being set will be reported to the Integrity Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.14 Questionable Integrity Signal Register

Monitors conditions that occur because a measurement may not be able to return an accurate or valid result due to signal conditions. It summarizes them in bit 0 of the "Questionable Integrity Register" on page 1196.



STATus:QUEStionable:INTegrity:SIGNal Register

Bit	Condition	Operation
2	Burst not found	The instrument is expecting a bursted signal, but such a signal cannot be detected because of inappropriate parameter settings or incorrect signal content
3	Timing Error	The instrument cannot establish appropriate timing from the signal
4	Carrier(s) incorrect or missing	The instrument cannot find the expected carrier(s) within the frequency ranges in which it is looking
5	Frequency out of range	One or more system or signal input frequencies are out of range

Bit	Condition	Operation
6	Sync error	The instrument cannot establish sync with the measured signal
7	Demod error	The instrument cannot demodulate the signal due to inappropriate signal or settings conditions
8	Signal Too Noisy	The instrument cannot measure the desired signal because it is too noisy
9	Slot Error	No valid signal slot found in captured data

Filter Registers

- "Questionable Integrity Signal Condition" on page 1201
- "Questionable Integrity Signal Enable" on page 1201
- "Questionable Integrity Signal Event Query" on page 1202
- "Questionable Integrity Signal Negative Transition" on page 1202
- "Questionable Integrity Signal Positive Transition" on page 1203

Questionable Integrity Signal Condition

Returns the decimal value of the sum of the bits in the Questionable Integrity Signal Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:CONDition?`
Example	`:STAT:QUES:INT:SIGN:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Enable

Determines which bits in the "Questionable Integrity Signal Condition" on page 1201 Register will set bits in the "Questionable Integrity Signal Event Query" on page 1202 Register, which also sets the Integrity Summary bit (bit 9) in the "Questionable Register" on page 1171.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:ENABle <integer>` `:STATus:QUEStionable:INTegrity:SIGNal:ENABle?`
Example	`:STAT:QUES:INT:SIGN:ENAB 4` Burst Not Found will be reported to the Integrity Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Event Query

Returns the decimal value of the sum of the bits in the Questionable Integrity Signal Event Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal[:EVENt]?`
Example	`:STAT:QUES:INT:SIGN?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Negative Transition

Determines which bits in the "Questionable Integrity Signal Condition" on page 1201 Register will set the corresponding bit in the "Questionable Integrity Signal Event Query" on page 1202 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:SIGNal:NTRansition?`
Example	`:STAT:QUES:INT:SIGN:NTR 4` Burst not found being cleared will be reported to the Integrity Summary of the Status Questionable Register

Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Positive Transition

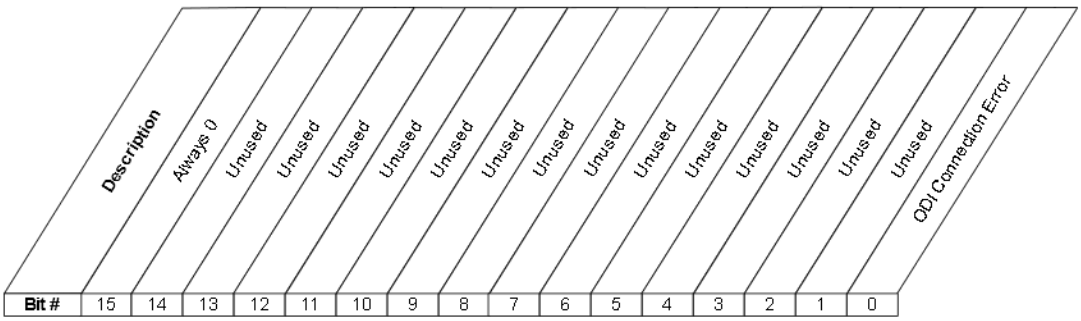
Determines which bits in the "Questionable Integrity Signal Condition" on page 1201 Register will set the corresponding bit in the "Questionable Integrity Signal Event Query" on page 1202 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:PTRansition <integer>` `:STATus:QUEStionable:INTegrity:SIGNal:PTRansition?`
Example	`:STAT:QUES:INT:SIGN:PTR 4` Burst not found being set will be reported to the Integrity Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.15 Questionable Integrity Output Register

Monitors conditions that occur in connection status currently limited to ODI streaming . It summarizes them in bit 2 of the "Questionable Integrity Register" on page 1196.



STATus:QUEStionable:INTegrity:OUTPut Register

Bit	Condition	Operation
0	ODI Connection Error	ODI Connection Error This bit is never triggered, only its aliases are

Filter Registers

- "Questionable Integrity Output Condition" on page 1204
- "Questionable Integrity Output Enable" on page 1204
- "Questionable Integrity Output Event Query" on page 1205
- "Questionable Integrity Output Negative Transition" on page 1205
- "Questionable Integrity Output Positive Transition" on page 1206

Questionable Integrity Output Condition

Returns the decimal value of the sum of the bits in the Questionable Integrity Output Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:INTegrity:OUTPut:CONDition?`
Example	`:STAT:QUES:INT:OUTP:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Output Enable

Determines which bits in the "Questionable Integrity Output Condition" on page 1204 Register will set the corresponding bit in the "Questionable Integrity Output Event Query" on page 1205 Register, which also sets the Data Output Summary bit (bit 2) in the "Questionable Integrity Register" on page 1196.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:OUTPut:ENABle` `:STATus:QUEStionable:INTegrity:OUTPut:ENABle?`
Example	`:STAT:QUES:INT:OUTP:ENAB 1`

	Oversweep (Meas Uncal) is reported to the Integrity Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Output Event Query

Returns the decimal value of the sum of the bits in the "Questionable Integrity Output Condition" on page 1204 Register.

NOTE **The register requires that the associated `PTRansition` or `NTRansition` filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:INTegrity:OUTPut[:EVENt]?`
Example	`:STAT:QUES:INT:OUTP?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Output Negative Transition

Determines which bits in the "Questionable Integrity Output Condition" on page 1204 Register will set the corresponding bit in the "Questionable Integrity Output Event Query" on page 1205 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:OUTPut:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:OUTPut:NTRansition?`
Example	`:STAT:QUES:INT:OUTP:NTR 1` Oversweep cleared is reported to the Integrity Summary of the Status Questionable Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Output Positive Transition

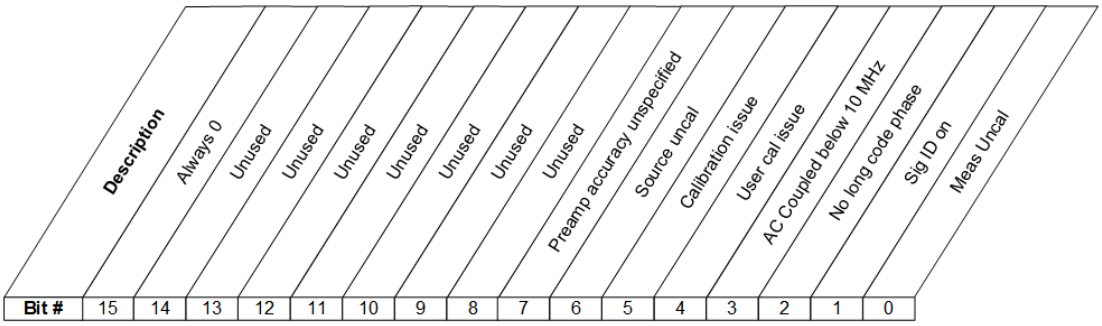
Determines which bits in the "Questionable Integrity Output Condition" on page 1204 Register will set the corresponding bit in the "Questionable Integrity Output Event Query" on page 1205 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:OUTPut:PTRansition <integer>` `:STATus:QUEStionable:INTegrity:OUTPut:PTRansition?`
Example	`:STAT:QUES:INT:OUTP:PTR 1` Oversweep set is reported to the Integrity Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

9.4.6.16 Questionable Integrity Uncalibrated Register

Monitors conditions that occur because a measurement may not be able to return an accurate or valid result due to a mismatch between instrument settings and the signal, placing the instrument in an uncalibrated state for that signal. It summarizes them in bit 3 of the "Questionable Integrity Register" on page 1196.



STATus:QUEStionable:INTegrity:UNCalibrated Register

Bit	Condition	Operation
0	Meas Uncal	A Meas Uncal warning is being displayed; generally, this means the sweep time must be reduced or the RBW increased
1	Signal ID on	In external mixing, the Sig ID function is on, which will impact the

Bit	Condition	Operation
		trace results
2	No Long Code Phase	The long code phase that identifies an access channel cannot be found (WCDMA)
3	AC coupled: Accy unspec'd <10 MHz	The instrument is AC coupled but is operating below 10 MHz, where the blocking capacitor will impact measurement accuracy
4	User cal issue	In noise figure measurements, the User Cal has not been performed or has been invalidated
5	Calibration issue	In noise figure measurements, one or more calibration or measurement frequency point exceeds the currently loaded Cal or Meas ENR Table frequency ranges
6	Source uncal	While using a Tracking Source, settings are putting it into an uncalibrated operational state
7	Preamp accuracy unspecified below XX MHz	The preamp is being used but is operating below frequencies for which its accuracy is specified

Filter Registers

– "Questionable Integrity Uncalibrated Condition" on page 1207
– "Questionable Integrity Uncalibrated Enable" on page 1208
– "Questionable Integrity Uncalibrated Event Query" on page 1208
– "Questionable Integrity Uncalibrated Negative Transition" on page 1208
– "Questionable Integrity Uncalibrated Positive Transition" on page 1209

Questionable Integrity Uncalibrated Condition

Returns the decimal value of the sum of the bits in the Questionable Integrity Uncalibrated Condition Register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:CONDition?`
Example	`:STAT:QUES:INT:UNC:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Enable

Determines which bits in the "Questionable Integrity Uncalibrated Condition" on page 1207 Register will set bits in the "Questionable Integrity Uncalibrated Event Query" on page 1208 Register, which also sets the Data Uncalibrated Summary bit (bit 3) in the "Questionable Integrity Register" on page 1196.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle` `:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle?`
Example	`:STAT:QUES:INT:UNC:ENAB 1` Oversweep (Meas Uncal) is reported to the Integrity Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Event Query

Returns the decimal value of the sum of the bits in the "Questionable Integrity Uncalibrated Condition" on page 1207 Register.

NOTE **The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated[:EVENt]?`
Example	`:STAT:QUES:INT:UNC?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Negative Transition

Determines which bits in the "Questionable Integrity Uncalibrated Condition" on page 1207 Register will set the corresponding bit in the "Questionable Integrity

Uncalibrated Event Query" on page 1208 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition?`
Example	`:STAT:QUES:INT:UNC:NTR 1` Oversweep cleared is reported to the Integrity Summary of the Status Questionable Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Positive Transition

Determines which bits in the "Questionable Integrity Uncalibrated Condition" on page 1207 Register will set the corresponding bit in the "Questionable Integrity Uncalibrated Event Query" on page 1208 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition <integer>` `:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition?`
Example	`:STAT:QUES:INT:UNC:PTR 1` Oversweep set is reported to the Integrity Summary of the Status Questionable Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10 Hardware-Accelerated Fast Power Measurement (Remote Command Only)

The Fast Power option (FP2) enables very fast channel power measurements for instruments with the prerequisite hardware (DP2 and/or B40). It accomplishes this by performing real-time overlapped FFTs at the hardware layer, using software for basic post-processing before returning the result. The upshot of this approach is improved throughput for user applications that require many sequential power measurements.

The analysis bandwidth of FP2 may be limited by the licenses in the instrument.

NOTE **FP2 is remote-only, which means the instrument does not switch to any particular Mode or measurement. FP2 commands can be sent while another application is in use on the front panel.**

Each Fast Power measurement can be predefined using an array index, and up to 1000 measurements can be stored. In the following documentation, instances of [1,2,...,999] can be substituted with a particular measurement index, for example, `:CALC:FPOW:POW1?`, `:CALC:FPOW:POW2?`, `:CALC:FPOW:POW134?`. In this way, power measurements can be defined one time in a batch, and then executed multiple times without having to redefine them, similar to “list mode” on other measurements.

In addition to basic channel power measurements, there are several other measurement “functions” for each channel, including peak power, peak frequency, and power spectral density.

10.1 Reset Fast Power Measurement (Remote Command Only)

Resets the measurement configuration to the defaults.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:RESet`
Example	`:CALC:FPOW:POW1:RES`
Notes	Option FP2 is required

10.2 Define Fast Power Measurement (Remote Command Only)

Fast Power acquisitions are configured using this command, which accepts a comma-delimited string of configuration parameters and their appropriate values.

All parameters are specified in the subsections below.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:DEFine "configuration string"`
Example	`:CALC:FPOW:POW1:DEF "CenterFrequency=2e9,AcquisitionTime=0.005"`
Notes	See the following subsections for a list of measurement variables that can be defined in the configuration string

10.2.1 Acquisition Time

Example	`:CALC:FPOW:POW1:DEF "AcquisitionTime=0.002"`
Notes	Sets the time in which the entire spectrum is measured. An increase in the acquisition time yields an improvement in measurement repeatability
Preset	0.001 s
Range	0 s to 1 s

10.2.2 Center Frequency

Example	`:CALC:FPOW:POW1:DEF "CenterFrequency=2e9"`
Notes	Sets the frequency in which the measurement is centered around. "Channel Offset Frequency Array" on page 1220 is calculated relative to the center frequency
Preset	1 GHz
Range	0 Hz to maximum instrument frequency

10.2.3 DC Coupled

Example	`:CALC:FPOW:POW1:DEF "DCCoupled=True"`	
Notes	Lets you specify whether the DC blocking capacitor is utilized. Set to `True` when measuring frequencies below 10 MHz	
Preset	`False`	
Range	`True`	DC Coupled
	`False`	AC Coupled

10.2.4 Detector Type

Example	`:CALC:FPOW:POW1:DEF "DetectorType=Peak"`
Notes	Option FP2 is required Lets you specify whether an RMS average or peak value is used during the measurement
Preset	`RmsAverage`
Range	`RmsAverage, Peak`

10.2.5 Do Noise Correction

Example	`:CALC:FPOW:POW1:DEF "DoNoiseCorrection=True"`	
Notes	When noise correction is enabled, the linear noise power contributed by the instrument is subtracted from all measurements. This effectively lowers the noise floor of the instrument When noise correction is enabled, the first measurement for a given set of input parameters will take extra time. This is because the instrument takes an extra acquisition with the RF input disconnected from the instrument's front end to measure the noise of just the instrument. The measured noise floor is stored in a cache so the noise acquisition will occur only once for the same state settings. In other words, if noise correction was turned on and the instrument made an acquisition at frequency A, then frequency B, and back again to frequency A, the hidden initial noise floor acquisition would only occur for the first acquisition at frequency A and the cached noise floor would be used the second time frequency A was measured	
Preset	`False`	
Range	`True`	Enable noise correction
	`False`	Disable noise correction

10.2.6 Do Spur Suppression

Example	`:CALC:FPOW:POW1:DEF "DoSpurSuppression=True"`
Notes	When measuring very low-level signals, or when large out-of-band inputs are input into the instrument, sometimes unwanted spurs and residuals can appear in the measured spectrum. Spur suppression is a method to help minimize the levels of these internally generated spurs and residuals When spur suppression is enabled, the instrument will automatically take two acquisitions using two different internal analog LO frequencies. The FFT spectrums from both acquisitions are combined by taking the minimum power between both traces on a per FFT bin basis. External signals will have the same amplitude for both traces and therefore will return the expected amplitudes. However, low level spurs and residuals generated internally to the instrument tend to move to different FFT bins depending

	on the internal analog LO frequency used, and therefore tend to be suppressed using this spur suppression method Because two acquisitions, rather than a single acquisition, are made when spur suppression is enabled, the measurement time will always be slower when spur suppression is enabled
Preset	`False`
Range	`True` Enable spur suppression `False` Disable spur suppression

10.2.7 Electronic Attenuator Bypass

Example	`:CALC:FPOW:POW1:DEF "ElecAttBypass =False"`
Notes	Lets you either utilize or bypass the electronic attenuator. The electronic attenuator is only available for frequencies up to 3.6 GHz. Set to `True` when using frequencies above 3.6 GHz. Set to `False` when using the preamp
Preset	`True`
Range	`True` Bypass electronic attenuator `False` Use electronic attenuator

10.2.8 Electronic Attenuation

Example	`:CALC:FPOW:POW1:DEF "ElecAttenuation=10"`
Notes	Option EA3 is required The electronic attenuation value parameter sets the amount of electrical attenuation from 0 to 24 dB (1 dB steps) Set `ElecAttBypass` = `False` to make sure the electronic attenuator path is enabled
Preset	0 dB
Range	0 – 24 dB (1 dB steps)

10.2.9 External Reference Frequency

Example	`:CALC:FPOW:POW1:DEF "ExternalReferenceFrequency=10"`
Notes	This is the user-specified frequency of the external reference. Used when "Frequency Reference Source" on page 1215 is set to `ExternalFrequencyReference`, or `AutoExternalFrequencyReference` when the external source is present. Unused if `FrequencyReferenceSource` is set to `InternalFrequencyReference`

Preset	10 MHz

10.2.10 Frequency Reference Source

Example	`:CALC:FPOW:POW1:DEF "FrequencyReferenceSource= InternalFrequencyReference"`
Notes	Specifies which frequency reference source should be used for this request: – If `ExternalFrequencyReference` is selected and no external reference is present, the frequency reference unlocks but the data acquisition will continue – If `AutoExternalFrequencyReference` is selected, the hardware senses whether an external source is present before starting the data acquisition. If no external source is present then the internal source is selected, and the data acquisition will continue
Preset	`InternalFrequencyReference`
Range	`InternalFrequencyReference, ExternalFrequencyReference, AutoExternalFrequencyReference`

10.2.11 IF Gain

Example	`:CALC:FPOW:POW1:DEF "IFGain=10"`
Notes	Lets you specify the gain at the IF stage anywhere from -6 to 16 dB (1 dB steps). This is an advanced feature; for most cases this should remain at its default value of 0 dB
Preset	0 dB
Range	–6 to 16 dB (1 dB steps)

10.2.12 IF Type

Example	`:CALC:FPOW:POW1:DEF "IFType=B25M"`
Notes	Lets you select between different IF paths. For example, if the signal is less than 25 MHz wide, then you can select the B25M path to take advantage of additional filtering on this analog IF path
Preset	`B40M`
Range	`B10M, B25M, B40M`

10.2.13 Include Power Spectrum

Example	`:CALC:FPOW:POW1:DEF "IncludePowerSpectrum=True"`
Notes	Lets you read data on the entire spectrum for diagnostic purposes. It is not recommended for production use For details of the binary format of the response, see "Diagnostic Binary Read Fast Power Measurement

	(Remote Command Only)" on page 1228	
Preset	`False`	
Range	`True`	Returns both channel power and full power spectrum
	`False`	Returns only channel power

10.2.14 Mechanical Attenuation

Example	`:CALC:FPOW:POW1:DEF "MechAttenuation=10"`
Notes	Sets the amount of mechanical attenuation anywhere from 0 to 70 dB (2 dB steps)
Preset	0 dB
Range	0 to 70 dB (2 dB steps)

10.2.15 Preamp Mode

Example	`:CALC:FPOW:POW1:DEF "PreAmpMode=Low"`
Notes	The license for the appropriate preamp is required Specifies whether the preamps are being utilized. `Low` allows any preamps up to 3.6 GHz, and `Full` allows all licensed preamps. Set `ElecAttBypass` = `True` to utilize any preamps (see "Electronic Attenuator Bypass" on page 1214)
Preset	`Off`
Range	`Off, Low, Full`

10.2.16 Resolution Bandwidth Mode

Example	`:CALC:FPOW:POW1:DEF "PreAmpMode=Low"`
Notes	Lets you specify whether the RBW filter is automatically or manually set. The BestSpeed value minimizes measurement time, while the Narrowest value minimizes RBW size (minimum of two FFT bins per RBW) To manually specify an RBW, set this parameter to `Explicit`, and set "Resolution Bandwidth" on page 1217 to the desired value
Preset	`BestSpeed`
Range	`BestSpeed, Narrowest, Explicit`

10.2.17 Resolution Bandwidth

Example	`:CALC:FPOW:POW1:DEF "ResolutionBW=25e3"`
Notes	Sets the 3-dB bandwidth of the RBW filter. "Resolution Bandwidth Mode" on page 1216 must be set to `Explicit` to manually set the RBW
Preset	0 Hz

10.2.18 Trigger Delay

Example	`:CALC:FPOW:POW1:DEF "TriggerDelay=0.025"`
Notes	Sets the time after an external trigger is detected until the measurement is performed
Preset	0 s
Range	0 to 1 s

10.2.19 Trigger Level

Example	`:CALC:FPOW:POW1:DEF "TriggerLevel=2"`
Notes	Sets the voltage value at which an external trigger is detected
Preset	1.2 V
Range	–5 to 5 V

10.2.20 Trigger Slope

Example	`:CALC:FPOW:POW1:DEF "TriggerSlope=Negative"`
Notes	Specifies the direction of the edge trigger voltage for detection
Preset	`Positive`
Range	`Positive, Negative`

10.2.21 Trigger Source

Example	`:CALC:FPOW:POW1:DEF "TriggerSource=Ext1"`
Notes	Lets you select whether the measurement triggers freely, or is controlled by an external input Ext1 and Ext2 correspond to Trigger 1 In and Trigger 2 In, respectively
Preset	`Free`
Range	`Free, Ext1, Ext2`

10.2.22 Trigger Timeout

Example	`:CALC:FPOW:POW1:DEF "TriggerTimeout=0.1"`
Notes	Sets the time in which the instrument will wait for a trigger before automatically performing the measurement
Preset	1 s
Range	0 to 1 s

10.2.23 Signal Input

Example	`:CALC:FPOW:POW1:DEF "SignalInput=Fp50MHzCW"`
Notes	Lets you select between using the main RF input or the internal instrument reference CW signal of 50 MHz
Preset	`FpMainRf`
Range	`FpMainRf, Fp50MHzCW`

10.2.24 Use Preselector

Example	`:CALC:FPOW:POW1:DEF "UsePreSelector=True"`	
Notes	Lets you either utilize or bypass the front-end tunable filter at frequencies above 3.6 GHz. For frequencies below 3.6 GHz, the preselector is automatically bypassed, so you do not need to set this parameter to `False` in those cases	
Preset	`False`	
Range	`True`	Use preselector above 3.6 GHz
	`False`	Preselector bypassed

10.2.25 Channel Bandwidth Array

Example	`:CALC:FPOW:POW1:DEF "Bandwidth=[3.84e6, 5e6, 3.84e6]"`
Notes	Defines the bandwidth of each channel that will be measured All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter
Preset	[1e6]
Range	0 to 40 MHz

10.2.26 Channel Filter Type Array

Example	`:CALC:FPOW:POW1:DEF "FilterType=[RRC, IBW, RRC]"`
Notes	Lets you select either an integration bandwidth (IBW) filter, or a root-raised-cosine (RRC) filter. The integration bandwidth filter weighs all frequencies within the bandwidth equally. The root-raised-cosine filter has an associated shape parameter, defined by the FilterAlpha parameter All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter
Preset	`[IBW]`
Range	`IBW, RRC`

10.2.27 Channel Filter Alpha Array

Example	`:CALC:FPOW:POW1:DEF "FilterAlpha=[0.5, 0.0, 0.5]"`
Notes	Lets you adjust the alpha value associated with the root-raised-cosine (RRC) filter type Set `FilterType` to `RRC` to utilize this parameter All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter
Preset	[0.22]
Range	0.0 to 1.0

10.2.28 Channel Measurement Function Array

Example	`:CALC:FPOW:POW1:DEF "Function=[BandPower, PeakPower, BandPower]"`
Notes	Defines what measurement is being made for each individually-specified channel. For details, see "Parameter Options" on page 1219 All array parameters should have the same number of elements Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter
Preset	`BandPower`
Range	`BandPower, BandDensity, PeakPower, PeakFrequency, XdBBandwidth, OccupiedBandwidth`

Parameter Options

Option	Description	Unit
`BandPower`	Total power within the specified bandwidth of the channel	dBm

Option	Description	Unit
BandDensity	Total power density within the specified bandwidth of the channel	dBm/Hz
PeakPower	The peak power value within the specified bandwidth of the channel	dBm
PeakFrequency	The frequency that corresponds to the peak power value within the specified bandwidth of the channel. This frequency is relative to the center frequency	Hz
XdBBandwidth	The half power (–3.01 dB) bandwidth of the highest amplitude signal that resides within the channel dB is configurable using "Channel x-dB Bandwidth Array" on page 1220	Hz
OccupiedBandwidth	The bandwidth at which 99% of the total power resides within the channel Percentage is configurable using "Channel Occupied Bandwidth Percent Array" on page 1220	Hz

10.2.29 Channel Offset Frequency Array

Example	:CALC:FPOW:POW1:DEF "OffsetFrequency=[-5e6, 0, 5e6]"
Notes	Defines the difference between the center frequency to the center frequency of each channel All array parameters should have the same number of elements
Preset	[0]
Range	0 to 20 MHz

10.2.30 Channel Occupied Bandwidth Percent Array

Example	:CALC:FPOW:POW1:DEF "OccupiedBandwidthPercent =[0.95, 0.95, 0.95]"
Notes	Only applies to channels whose "Channel Measurement Function Array" on page 1219 is set to OccupiedBandwidth. The occupied bandwidth percent parameter specifies the percent of total power in these channels. The valid range for this parameter is 0.0 to 1.0, where 1.0 represents 100%. The default for this parameter is 0.99, which will return the bandwidth that contains 99% of the total channel power
Preset	[0.99]
Range	0 – 1.0

10.2.31 Channel x-dB Bandwidth Array

Example	:CALC:FPOW:POW1:DEF " XdBBandwidth =[-6.02, -3.01, -1.0]"
Notes	Only applies to channels whose "Channel Measurement Function Array" on page 1219 is set to XdBBandwidth. The X dB bandwidth parameter is used to specify the power relative to the peak channel power over which the bandwidth is calculated. The parameter value must be a negative number

Preset	[–3.01]
Range	–200 to 0 dB

10.3 Define Fast Power Measurement Query (Remote Query Only)

Retrieves a list of all defined parameters in an ASCII string format

The following is an example of returned results:

```
"DCCoupled=False,ElecAttBypass=True,ElecAttenuation=0,IFGain=0,MechAttenuation=
0,PreAmpMode=Off,PreSelectorOffset=0,UsePreSelector=False,ExternalReferenceFreq
uency=10000000,FrequencyReferenceSource=AutoExternalFrequencyReference,IFType=B
40M,LOMode=SLW,SignalInput=FpMainRf,AcquisitionTime=0.001,CenterFrequency=10000
00000,ResolutionBW=0,ResolutionBWMode=BestSpeed,DetectorType=RmsAverage,Bandwid
th=[1000000],OffsetFrequency=[0],Function=[BandPower],FilterType=
[IBW],FilterAlpha=[0.22],OccupiedBandwidthPercent=[0.99],XdBBandwidth=
[3.01],DoNoiseCorrection=False,DoSpurSuppression=False,MeasurementMethod=Hardwa
reFFT,IncludePowerSpectrum=False,TriggerDelay=0,TriggerLevel=1.2,TriggerSlope=P
ositive,TriggerSource=Free,TriggerTimeout=1
,Trigger1Output=Off,Trigger1OutputPolarity=Positive,Trigger2Output=Off,Trigger2
OutputPolarity=Positive"
```

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:DEFine?`
Example	`:CALC:FPOW:POW1:DEF?`
Notes	Retrieves a list of all defined parameters in an ASCII format

10.4 Configure Fast Power Measurement (Remote Command Only)

Begins hardware setup and returns immediately, with no acquisition made. This can be used in parallel with other hardware operations to effectively hide the hardware setup time.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:CONFigure`
Example	`:CALC:FPOW:POW1:CONF`
Notes	Option FP2 is required

10.5 Initiate Fast Power Measurement (Remote Command Only)

Begins an acquisition and returns immediately. The results of the measurement can be retrieved using `:FETCh`.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:INITiate`
Example	`:CALC:FPOW:POW1:INIT`
Notes	Option FP2 is required

10.6 Fetch Fast Power Measurement (Remote Command Only)

Used to retrieve the results of an acquisition initiated by `:INIT`. The returned results are in *ASCII string* format. The string begins and ends with quotation marks.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:FETCh?`
Example	`:CALC:FPOW:POW1:FETC?`
Notes	Option FP2 is required Returns m comma-separated ASCII values, where m corresponds to the number of bandwidths defined 1. Declared function return in the 1st specified channel 2. Declared function return in the 2nd specified channel ... m. Declared function return in the last specified channel The `INIT` and `FETC?` command sequence has the same effect as a single `CALC:FPOW:POW[n]?` query. Units of the returned values depend on "Channel Measurement Function Array" on page 1219 for each channel

10.7 Execute Fast Power Measurement (Remote Command Only)

Shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *ASCII string* format. The string begins and ends with quotation marks.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]?`
Example	`:CALC:FPOW:POW1?`
Notes	Option FP2 is required For return format, see notes for "Fetch Fast Power Measurement (Remote Command Only)" on page 1225

10.8 Binary Read Fast Power Measurement (Remote Command Only)

Shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *binary format*.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:READ?` `:CALCulate:FPOWer:POWer[1,2,…,999]:READ1?`
Example	`:CALC:FPOW:POW1:READ?` `:CALC:FPOW:POW1:READ1?`
Notes	Option FP2 is required Returns m 4-byte floating point binary values (Little-Endian), where m corresponds to the number of bandwidths defined

10.9 Diagnostic Binary Read Fast Power Measurement (Remote Command Only)

Shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *binary format*. This command is used primarily for diagnostic purposes, to test for ADC overloads and to visibly inspect the spectrum.

For details of the data returned, see "Results Format" on page 1228.

Remote Command	`:CALCulate:FPOWer:POWer[1,2,…,999]:READ2?`
Example	`:CALC:FPOW:POW1:READ2?`
Notes	Option FP2 is required

Results Format

Spectrum data is only returned if `IncludePowerSpectrum` is set to `True` (see "Include Power Spectrum" on page 1215). If `IncludePowerSpectrum` is `False`, the number of spectrum points is zero (0).

Units of the returned values are dependent on the `Function` parameter per channel (e.g., dBm for `BandPower`, Hz for `PeakFrequency`).

Returns binary data (Little-Endian) that contains information on number of channels *m*, along with ADC over range and full spectrum data.

The following is the binary format of the response:

Bandwidth Return Value

1	Number of channels specified, *m* [4-byte int]
2	Declared function result for the 1st specified channel [4-byte float]
3	Declared function result for the 2nd specified channel [4-byte float]
…	
m + 1	Declared function result for the last (*m*th) specified channel [4-byte float]

ADC Over Range

1	ADC over-range occurred (1: true, 0: false) [2 byte short]

Spectrum Data

1	Number of points in the spectrum data, *k* [4-byte int]
2	Start frequency of spectrum data (Hz) [8-byte double]
3	Step frequency of spectrum data (Hz) [8-byte double]

4	FFT bin at 1st point (dBm) [4-byte float]
5	FFT bin at 2nd point (dBm) [4-byte float]
...	
k + 3	FFT bin at last (kth) point (dBm) [4-byte float]



This information is subject to change without notice.
© Keysight Technologies 2020-2025
Edition 8, December 2025
N9055-90001
www.keysight.com