User's and Service Guide

Agilent Technologies 85052D
3.5 mm Economy Calibration Kit

This manual directly applies to 85052D calibration kits with serial number prefix 3106A.

Agilent Technologies

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Contents

1 General Information

Calibration Kit Overview

The Agilent 85052D 3.5 mm calibration kit is used to calibrate Agilent network analyzers up to 26.5 GHz for measurements of components with 3.5-mm connectors.

Kit Contents

The 85052D calibration kit includes the following items:

- user’s and service guide
- offset opens and shorts, and broadband loads
- three 3.5 mm adapters
- 5/16 in, 90 N-cm (8 in-lb) torque wrench
- 7 mm open-end wrench
- data disks that contain the calibration constants of the devices in the calibration kit.

NOTE A backup copy of each data disk and printout should be made immediately upon receipt of the calibration kit. Refer to your analyzer user’s guide for instructions on duplicating a disk.

For measurement convenience, the kit also contains three 3.5 mm adapters. The adapters are primarily intended for use in measuring non-insertable devices, but can also be used as a connector saver.

Refer to Chapter 6 , “Replaceable Parts.” for a complete list of kit contents and their associated part numbers.

Broadband Loads

The broadband loads are metrology-grade terminations that have been optimized for performance up to 26.5 GHz. The rugged internal structure provides for highly repeatable connections. A distributed resistive element on sapphire provides excellent stability and return loss.

Offset Opens and Shorts

The offset opens and shorts are built from parts that are machined to the current state-of-the-art in precision machining.

The offset short’s inner conductors have a one-piece construction, common with the shorting plane. The construction provides for extremely repeatable connections.

The offset opens have inner conductors that are supported by a strong, low-dielectric constant plastic to minimize compensation values.

Both the opens and shorts are constructed so that the pin depth can be controlled very tightly, thereby minimizing phase errors. The lengths of the offsets in the opens and shorts are designed so that the difference in phase of their reflection coefficients is approximately 180 degrees at all frequencies.

Adapters

Like the other devices in the kit, the adapters are built to very tight tolerances to provide good broadband performance and to ensure stable, repeatable connections.

The adapters are designed so that their nominal electrical lengths are the same, which allows them to be used in calibration procedures for non-insertable devices.

Calibration Definitions

The calibration kit must be selected prior to performing a calibration. In addition, the calibration definitions for the devices in the kit must be installed in the analyzer if not permanently stored in the internal memory or hard drive.

The calibration definitions can be:

- recalled from the analyzer (if stored in internal memory or the hard drive)
- loaded from the provided disk
- entered from the front panel (polynomial models only)

Refer to your network analyzer user's guide (8510 family) or online Help (PNA family) for instructions on selecting the calibration kit, installing (if necessary) the calibration definitions, and performing a calibration.

Equipment Required but Not Supplied

Some items are required or recommended for successful operation of your kit, but are not supplied with the kit. Refer to Table 6-2 on page 6-3 for a list of these items and for ordering information.

Incoming Inspection

Refer to Chapter 6 , “Replaceable Parts.” to verify a complete shipment. Use Table 1-1 to record the serial numbers of all serialized devices in your kit.

Check for damage. The foam-lined storage case provides protection during shipping. If the case or any device appears damaged, or if the shipment is incomplete, refer to “Contacting Agilent” on page 5-4. Agilent will arrange for repair or replacement of incomplete or damaged shipments without waiting for a settlement from the transportation company. See "Returning a Kit or Device to Agilent," on page 5-3.

Recording the Device Serial Numbers

In addition to the kit serial number, the devices in the kit are individually serialized (serial numbers are labeled onto the body of each device). Record these serial numbers in Table . Recording the serial numbers will prevent confusing the devices in this kit with similar devices from other kits.

The adapters included in the kit are for measurement convenience only and are not serialized.

Table 1-1 Serial Number Record for the 85052D

Device	Serial Number
Calibration kit	______________________
Broadband load –m–	______________________
Broadband load –f–	______________________
Open –m–	______________________
Open –f–	______________________
Short –m–	______________________
Short –f–	______________________

Calibration Kits Documented in This Manual

This manual applies to any 8552B calibration kit with serial number prefix 3106A. If your calibration kit has a different serial number prefix, refer to the next section for information on how this manual applies.

Calibration Kit History

This section describes calibration kits with serial number prefixes lower that the ones listed on the title page.

85052D Kits with Serial Prefix 3027A

These calibration kits did not have the calibration constants disk to support the Agilent 8510C network analyzer. The part numbers provided in this manual are the recommended replacement parts for these kits. The devices in these kits should meet the specifications published in this manual.

Clarifying the Sex of a Connector

In this manual and in the prompts of the PNA calibration wizard, the sex of calibration devices and adapters is referred to in terms of the calibration device connector. For example, the label `OPEN` –m– refers to a male open with a male connector.

8510-series, 872x, and 875x ONLY: In contrast, during a measurement calibration, the network analyzer softkey menus label a 1.85 mm calibration device with reference to the sex of the analyzer’s test port connector—not the calibration device connector. For example, the label `SHORT(F)` refers to the short that is to be connected to the female test port. This will be a male short from the calibration kit.

Connector gages are referred to in terms of the connector that it measures. For instance, a male connector gage has a female connector on the gage so that it can measure male devices.

Preventive Maintenance

The best techniques for maintaining the integrity of the devices in the kit include:

- routine visual inspection
- cleaning
- proper gaging

- proper connection techniques

All of these are described in Chapter 3. Failure to detect and remove dirt or metallic particles on a mating plane surface can degrade repeatability and accuracy and can damage any connector mated to it. Improper connections, resulting from pin depth values being out of the observed limits (see Table 2-2 on page 2-4) or from bad connection techniques, can also damage these devices.

2 Specifications

Environmental Requirements

Table 2-1 Environmental Requirements

Parameter	Limits
Temperature	
Operating[a]	+20 °C to +26 °C
Storage	−40 °C to +75 °C
Error-corrected range[b]	±1 °C of measurement calibration temperature
Altitude	
Operating	< 4,500 meters (≈15,000 feet)
Storage	< 15,000 meters (≈50,000 feet)
Relative humidity	Always non-condensing
Operating	0 to 80% (26 °C maximum dry bulb)
Storage	0 to 90%

a. The temperature range over which the calibration standards maintain conformance to their specifications.

b. The allowable network analyzer ambient temperature drift during measurement calibration and during measurements when the network analyzer error correction is turned on. Also, the range over which the network analyzer maintains its specified performance while correction is turned on.

Temperature—What to Watch Out For

Changes in temperature can affect electrical characteristics. Therefore, the operating temperature is a critical factor in performance. During a measurement calibration, the temperature of the calibration devices must be stable and within the range shown in Table 2-1.

IMPORTANT Avoid unnecessary handling of the devices during calibration because your fingers are a heat source.

Mechanical Characteristics

Mechanical characteristics such as center conductor protrusion and pin depth are *not* performance specifications. They are, however, important supplemental characteristics related to electrical performance. Agilent Technologies verifies the mechanical characteristics of the devices in the kit with special gaging processes and electrical testing. This ensures that the device connectors do not exhibit any center conductor protrusion or improper pin depth when the kit leaves the factory.

"Gaging Connectors" on page 3-6 explains how to use gages to determine if the kit devices have maintained their mechanical integrity. Refer to Table 2-2 for typical and observed pin depth limits.

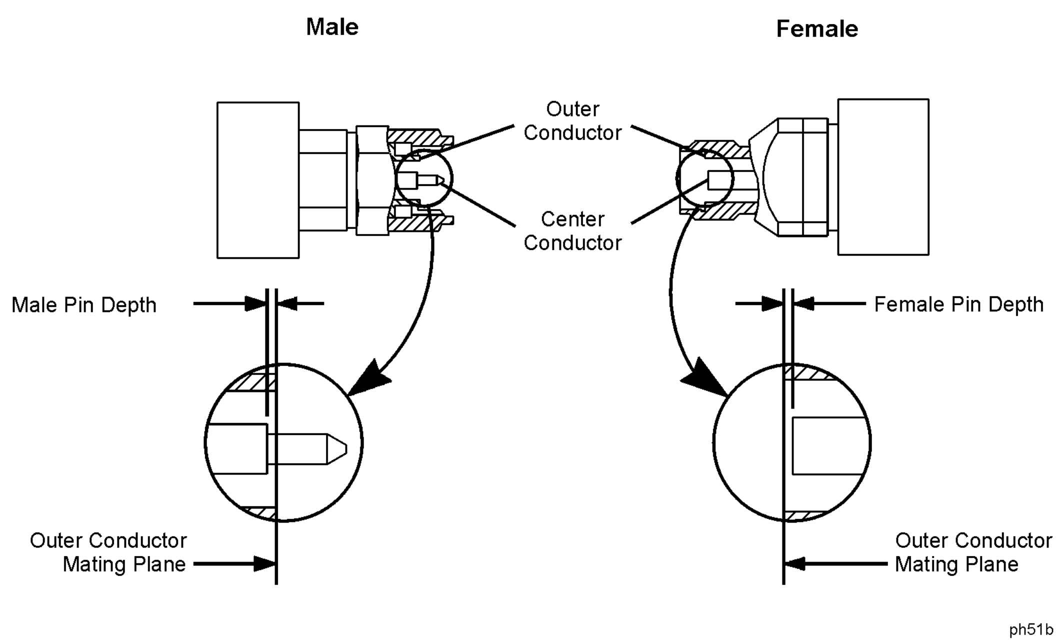
Pin Depth

Pin depth is the distance the center conductor mating plane differs from being flush with the outer conductor mating plane. See Figure 2-1. The pin depth of a connector can be in one of two states: either protruding or recessed.

Protrusion is the condition in which the center conductor extends beyond the outer conductor mating plane. This condition will indicate a positive value on the connector gage.

Recession is the condition in which the center conductor is set back from the outer conductor mating plane. This condition will indicate a negative value on the connector gage.

Figure 2-1 Connector Pin Depth



The pin depth value of each calibration device in the kit is not specified, but is an important mechanical parameter. The electrical performance of the device depends, to some extent, on its pin depth. The electrical specifications for each device in the kit take into account the effect of pin depth on the device's performance. Table 2-2 lists the typical pin depths and measurement uncertainties, and provides observed pin depth limits for the devices in the kit. If the pin depth of a device does not measure within the *observed* pin depth limits, it may be an indication that the device fails to meet electrical specifications. Refer to Figure 2-1 for a visual representation of proper pin depth (slightly recessed).

Table 2-2 Pin Depth Limits

Device	Typical Pin Depth	Measurement Uncertainty[a]	Observed Pin Depth Limits[b]
Opens	0 to –0.0127 mm 0 to –0.00050 in	+0.0064 to –0.0064 mm +0.00025 to –0.00025 in	+0.0064 to –0.0191 mm +0.00025 to –0.00075 in
Shorts	0 to –0.0127 mm 0 to –0.00050 in	+0.0041 to –0.0041 mm +0.00016 to –0.00016 in	+0.0041 to –0.0168 mm +0.00016 to –0.00066 in
Fixed loads	–0.0025 to –0.0254 mm –0.0001 to –0.0010 in	+0.0041 to –0.0041 mm +0.00016 to –0.00016 in	+0.0016 to –0.0295 mm +0.0006 to –0.00116 in
Adapter	–0.0025 to –0.0254 mm –0.0001 to –0.0010 in	+0.0041 to –0.0041 mm +0.00016 to –0.00016 in	+0.0016 to –0.0295 mm +0.0006 to –0.00116 in

a. Approximately +2 sigma to –2 sigma of gage uncertainty based on studies done at the factory according to recommended procedures.
b. Observed pin depth limits are the range of observation limits seen on the gage reading due to measurement uncertainty. The depth could still be within specifications.

Electrical Specifications

The electrical specifications in Table 2-3 apply to the devices in your calibration kit when connected with an Agilent precision interface.

Table 2-3 Electrical Specifications for 85052D 3.5 mm Devices

Device	Specification	Frequency (GHz)
Broadband loads	Return loss ≥ 46 dB (ρ ≤ 0.00501)	dc to ≤ 2
(male and female)	Return loss ≥ 44 dB (ρ ≤ 0.00631)	> 2 to ≤ 3
	Return loss ≥ 38 dB (ρ ≤ 0.01259)	> 3 to ≤ 8
	Return loss ≥ 36 dB (ρ ≤ 0.01585)	> 8 to ≤ 20
	Return loss ≥ 34 dB (ρ ≤ 0.01995)	> 20 to ≤ 26.5
Offset opens[a]	±0.65° deviation from nominal	dc to ≤ 3
(male and female)	±1.20° deviation from nominal	> 3 to ≤ 8
	±2.00° deviation from nominal	> 8 to ≤ 20
	±2.00° deviation from nominal	> 20 to ≤ 26.5
Offset shorts[a]	±0.50° deviation from nominal	dc to ≤ 3
(male and female)	±1.00° deviation from nominal	> 3 to ≤ 8
	±1.75° deviation from nominal	> 8 to ≤ 20
	±1.75° deviation from nominal	> 20 to ≤ 26.5
Adapters	Return loss ≥ 30 dB (ρ ≤ 0.03162)	dc to ≤ 8
	Return loss ≥ 28 dB (ρ ≤ 0.03981)	> 8 to ≤ 18
	Return loss ≥ 26 dB (ρ ≤ 0.05012)	> 18 to ≤ 26.5

a. The specifications for the opens and shorts are given as allowed deviation from the nominal model as defined in the standard definitions (see "Nominal Standard Definitions" on page A-8).

Residual Errors after Calibration

The 8510 "Specifications and Performance Verification" software can be used to obtain a printout of the residual errors after a calibration has been performed. Refer to the "Specifications and Performance Verification" section of the 8510C *On-Site Service Manual* for information on how to use the software.

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST) to the extent allowed by the institute's calibration facility, and to the calibration facilities of other International Standards Organization members. See "How Agilent Verifies the Devices in Your Kit" on page 4-2 for more information.

3 Use, Maintenance, and Care of the Devices

Electrostatic Discharge

Protection against electrostatic discharge (ESD) is essential while connecting, inspecting, or cleaning connectors attached to a static-sensitive circuit (such as those found in test sets).

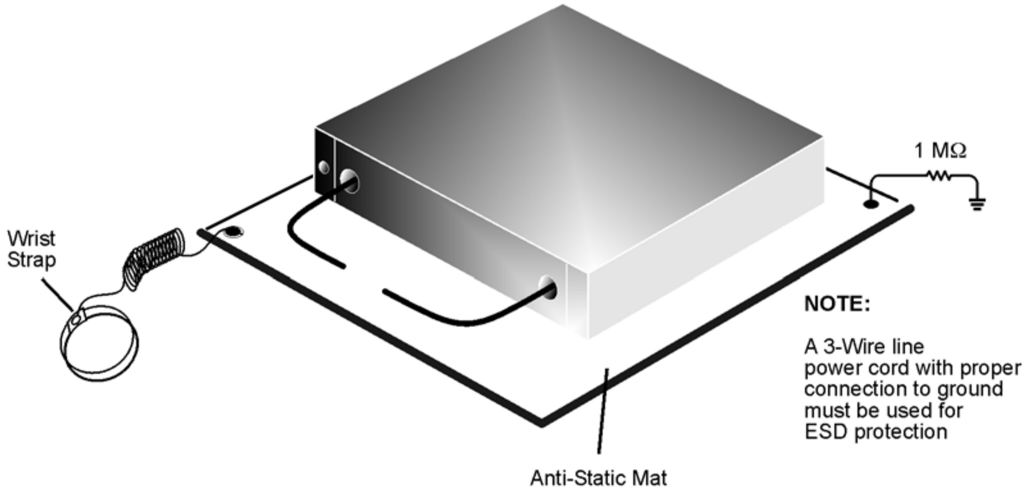
Static electricity can build up on your body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. Devices such as calibration components and devices under test (DUT), can also carry an electrostatic charge. To prevent damage to the test set, components, and devices:

- *always* wear a grounded wrist strap having a 1 MΩ resistor in series with it when handling components and devices or when making connections to the test set.
- *always* use a grounded, conductive table mat while making connections.
- *always* wear a heel strap when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.
- *always* ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port or cable connector briefly.
- *always* ground the center conductor of a test cable before making a connection to the analyzer test port or other static-sensitive device. This can be done as follows:

  1. Connect a short (from your calibration kit) to one end of the cable to short the center conductor to the outer conductor.
  2. While wearing a grounded wrist strap, grasp the outer shell of the cable connector.
  3. Connect the other end of the cable to the test port.
  4. Remove the short from the cable.

Figure 3-1 shows a typical ESD protection setup using a grounded mat and wrist strap. Refer to Table 6-2 on page 6-3 for information on ordering supplies for ESD protection.

Figure 3-1 ESD Protection Setup



Visual Inspection

Visual inspection and, if necessary, cleaning should be done every time a connection is made. Metal particles from the connector threads may fall into the connector when it is disconnected. One connection made with a dirty or damaged connector can damage both connectors beyond repair.

In some cases, magnification is necessary to see damage to a connector; a magnifying device with a magnification of ≥10x is recommended. However, not all defects that are visible only under magnification will affect the electrical performance of the connector. Use the following guidelines when evaluating the integrity of a connector.

Look for Obvious Defects and Damage First

Examine the connectors first for obvious defects and damage: badly worn plating on the connector interface, deformed threads, or bent, broken, or misaligned center conductors. Connector nuts should move smoothly and be free of burrs, loose metal particles, and rough spots.

What Causes Connector Wear?

Connector wear is caused by connecting and disconnecting the devices. The more use a connector gets, the faster it wears and degrades. The wear is greatly accelerated when connectors are not kept clean, or are not connected properly.

Connector wear eventually degrades performance of the device. Calibration devices should have a long life if their use is on the order of a few times per week. Replace devices with worn connectors.

The test port connectors on the network analyzer test set may have many connections each day, and are, therefore, more subject to wear. It is recommended that an adapter be used as a test port saver to minimize the wear on the test set's test port connectors.

Inspect the Mating Plane Surfaces

Flat contact between the connectors at all points on their mating plane surfaces is required for a good connection. See Figure 2-1 on page 2-3. Look especially for deep scratches or dents, and for dirt and metal particles on the connector mating plane surfaces. Also look for signs of damage due to excessive or uneven wear or misalignment.

Light burnishing of the mating plane surfaces is normal, and is evident as light scratches or shallow circular marks distributed more or less uniformly over the mating plane surface. Other small defects and cosmetic imperfections are also normal. None of these affect electrical or mechanical performance.

If a connector shows deep scratches or dents, particles clinging to the mating plane surfaces, or uneven wear, clean and inspect it again. Devices with damaged connectors should be discarded. Determine the cause of damage before connecting a new, undamaged connector in the same configuration.

Inspect Female Connectors

Inspect the contact fingers in the female center conductor carefully. These can be bent or broken, and damage to them is not always easy to see. A connector with damaged contact fingers will not make good electrical contact and must be replaced.

NOTE This is particularly important when mating nonprecision to precision devices.

The female 3.5 mm connectors in this calibration kit are metrology-grade, precision slotless connectors (PSC). Precision slotless connectors are used to improve accuracy. With PSCs on test ports and standards, the accuracy achieved when measuring at 50 dB return loss levels is comparable to using conventional slotted connectors measuring devices having only 30 dB return loss. This represents an accuracy improvement of about 10 times.

Conventional female center conductors are slotted and, when mated, are flared by the male pin. Because physical dimensions determine connector impedance, this change in physical dimension affects electrical performance, making it very difficult to perform precision measurements with conventional slotted connectors.

The precision slotless connector was developed to eliminate this problem. The PSC has a center conductor with a solid cylindrical shell, the outside diameter of which does not change when mated. Instead, this center conductor has an internal contact that flexes to accept the male pin.

Cleaning Connectors

Clean connectors are essential for ensuring the integrity of RF and microwave coaxial connections.

1. **Use Compressed Air or Nitrogen**

WARNING **Always use protective eyewear when using compressed air or nitrogen.**

Use compressed air (or nitrogen) to loosen particles on the connector mating plane surfaces. Clean air cannot damage a connector or leave particles or residues behind.

You can use any source of clean, dry, low-pressure compressed air or nitrogen that has an effective oil-vapor filter and liquid condensation trap placed just before the outlet hose.

Ground the hose nozzle to prevent electrostatic discharge, and set the air pressure to less than 414 kPa (60 psi) to control the velocity of the air stream. High-velocity streams of compressed air can cause electrostatic effects when directed into a connector. These electrostatic effects can damage the device. Refer to “Electrostatic Discharge” earlier in this chapter for additional information.

2. **Clean the Connector Threads**

WARNING **Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.**

Use isopropyl alcohol with adequate ventilation and avoid contact with eyes, skin, and clothing. It causes skin irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling.

In case of spill, soak up with sand or earth. Flush spill area with water.

Dispose of isopropyl alcohol in accordance with all applicable federal, state, and local environmental regulations.

Use a lint-free swab or cleaning cloth moistened with isopropyl alcohol to remove any dirt or stubborn contaminants on a connector that cannot be removed with compressed air or nitrogen. Refer to Table 6-2 on page 6-3 for part numbers for isopropyl alcohol and cleaning swabs.

a. Apply a small amount of isopropyl alcohol to a lint-free cleaning swab.

b. Clean the connector threads.

c. Let the alcohol evaporate, then blow the threads dry with a gentle stream of clean, low-pressure compressed air or nitrogen. Always completely dry a connector before you reassemble or use it.

3. **Clean the Mating Plane Surfaces**

a. Apply a small amount of isopropyl alcohol to a lint-free cleaning swab.

b. Clean the center and outer conductor mating plane surfaces. Refer to Figure 2-1 on page 2-3. When cleaning a female connector, avoid snagging the swab on the center conductor contact fingers by using short strokes.

c. Let the alcohol evaporate, then blow the connector dry with a gentle stream of clean, low-pressure compressed air or nitrogen. Always completely dry a connector before you reassemble or use it.

4. **Inspect**

Inspect the connector to make sure that no particles or residue remain. Refer to “Visual Inspection” on page 3-3.

Gaging Connectors

The gages available from Agilent Technologies are intended for preventive maintenance and troubleshooting purposes only. They are effective in detecting excessive center conductor protrusion or recession, and conductor damage on DUTs, test accessories, and the calibration kit devices. Do not use the gages for precise pin depth measurements. See Table 6-2 on page 6-3 for part number information.

Connector Gage Accuracy

The connector gages are only capable of performing coarse measurements. They do not provide the degree of accuracy necessary to precisely measure the pin depth of the kit devices. This is partially due to the repeatability uncertainties that are associated with the measurement. Only the factory—through special gaging processes and electrical testing—can accurately verify the mechanical characteristics of the devices.

With proper technique, the gages are useful in detecting gross pin depth errors on device connectors. To achieve maximum accuracy, random errors must be reduced by taking the average of at least three measurements having different gage orientations on the connector. Even the resultant average can be in error by as much as ± 0.0001 inch due to systematic (biasing) errors usually resulting from worn gages and gage masters. The information in Table 2-2 on page 2-4 assumes new gages and gage masters. Therefore, these systematic errors were not included in the uncertainty analysis. As the gages undergo more use, the systematic errors can become more significant in the accuracy of the measurement.

The measurement uncertainties in Table 2-2 are primarily a function of the assembly materials and design, and the unique interaction each device type has with the gage. Therefore, these uncertainties can vary among the different devices. For example, note the difference between the uncertainties of the opens and shorts.

The observed pin depth limits in Table 2-2 add these uncertainties to the typical factory pin depth values to provide practical limits that can be referenced when using the gages. See "Pin Depth" on page 2-3. Refer to "Kit Contents" on page 1-2 for more information on the design of the calibration devices in the kit.

NOTE When measuring pin depth, the measured value (resultant average of three or more measurements) contains measurement uncertainty and is not necessarily the true value. Always compare the measured value with the *observed* pin depth limits (which account for measurement uncertainties) in Table 2-2 on page 2-4 to evaluate the condition of device connectors.

When to Gage Connectors

Gage a connector at the following times:

- Prior to using a device for the first time, record the pin depth measurement so that it can be compared with future readings. (It will serve as a good troubleshooting tool when you suspect damage may have occurred to the device.)
- If either visual inspection or electrical performance suggests that the connector interface may be out of typical range (due to wear or damage, for example).
- If a calibration device is used by someone else or on another system or piece of equipment.
- Initially, after every 100 connections, and after that, as often as experience indicates.

Gaging Procedures

Gaging 3.5 mm Connectors

NOTE Always hold a connector gage by the gage barrel, below the dial indicator. This gives the best stability, and improves measurement accuracy. (Cradling the gage in your hand or holding it by the dial applies stress to the gage plunger mechanism through the dial indicator housing.)

1. Select the proper gage for your connector. Refer to Table 6-1 on page 6-2 for gage part numbers.
2. Inspect and clean the gage, gage master, and device to be gaged. Refer to "Visual Inspection" and "Cleaning Connectors" earlier in this chapter.
3. Zero the connector gage (refer to Figure 3-2):
   a. While holding the gage by the barrel, and without turning the gage or the device, connect the gage to the gage master by interconnecting the male and female connectors. Connect the nut finger tight. Do not overtighten.
   b. Using an open-end wrench to keep the device body from rotating, use the torque wrench included in the kit to tighten the connecting nut to the specified torque. Refer to "Final Connection Using a Torque Wrench" on page 3-10 for additional information.
   c. As you watch the gage pointer, gently tap the barrel of the gage to settle the reading.

      The gage pointer should line up exactly with the zero mark on the gage. If not, adjust the zero set knob until the gage pointer lines up exactly with the zero mark.
   d. Remove the gage master.
4. Gage the device connector (refer to Figure 3-2):
   a. While holding the gage by the barrel, and without turning the gage or the device, connect the gage to the device by interconnecting the male and female connectors. Connect the nut finger-tight. Do not overtighten.
   b. Using an open-end wrench to keep the device body from rotating, use the torque wrench included in the kit to tighten the connecting nut to the specified torque. Refer to "Final Connection Using a Torque Wrench" on page 3-10 for additional information.
   c. Gently tap the barrel of the gage with your finger to settle the gage reading.
   d. Read the gage indicator dial. Read *only* the black ± signs; *not* the red ± signs.

      For maximum accuracy, measure the connector a minimum of three times and take an average of the readings. After each measurement, rotate the gage a quarter-turn to reduce measurement variations that result from the gage or the connector face not being exactly perpendicular to the center axis.
   e. Compare the average reading with the observed pin depth limits in Table 2-2 on page 2-4.

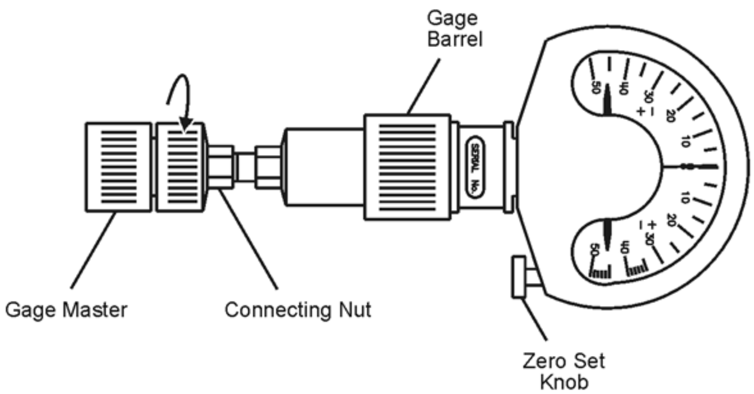
Figure 3-2 Gaging 3.5 mm Connectors

Note:

Although male devices are shown in this illustration,
the procedure is essentially the same for female devices.

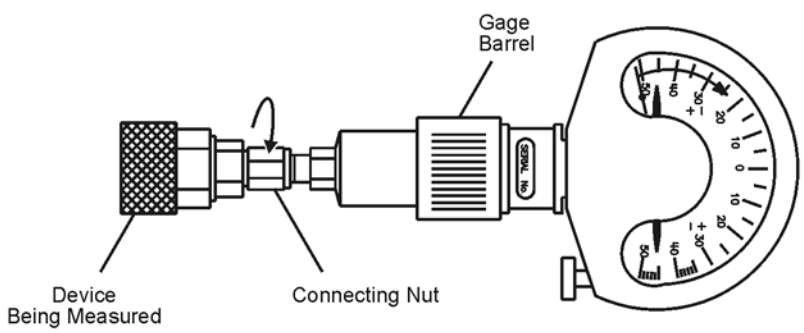
Zero the Connector Gage

- Connect the gage to the gage master.
- Torque the connecting nut.
- Gently tap the gage barrel to settle the reading.
- Using the zero set knob, adjust the gage pointer to line up exactly with the zero mark.
- Remove the gage master.



Gage the Device Connector

- Connect the gage to the device being measured.
- Torque the connecting nut.
- Gently tap the gage barrel to settle the reading.
- Read recession or protrusion from the gage.
- Remove the device.
- Repeat two additional times and average the three readings.



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Connections

Good connections require a skilled operator. *The most common cause of measurement error is bad connections.* The following procedures illustrate how to make good connections.

How to Make a Connection

Preliminary Connection

1. Ground yourself and all devices. Wear a grounded wrist strap and work on a grounded, conductive table mat. Refer to "Electrostatic Discharge" on page 3-2 for ESD precautions.
2. Visually inspect the connectors. Refer to "Visual Inspection" on page 3-3.
3. If necessary, clean the connectors. Refer to "Cleaning Connectors" on page 3-4.
4. Use a connector gage to verify that all center conductors are within the observed pin depth values in Table 2-2 on page 2-4. Refer to "Gaging Connectors" on page 3-6.
5. Carefully align the connectors. The male connector center pin must slip concentrically into the contact finger of the female connector.
6. Push the connectors straight together and tighten the connector nut finger tight.

CAUTION Do *not* turn the device body. Only turn the connector nut. Damage to the center conductor can occur if the device body is twisted.

   Do *not* twist or screw the connectors together. As the center conductors mate, there is usually a slight resistance.

7. The preliminary connection is tight enough when the mating plane surfaces make uniform, light contact. Do not overtighten this connection.

   A connection in which the outer conductors make gentle contact at all points on both mating surfaces is sufficient. Very light finger pressure is enough to accomplish this.

8. Make sure the connectors are properly supported. Relieve any side pressure on the connection from long or heavy devices or cables.

Final Connection Using a Torque Wrench

Use a torque wrench to make a final connection. Table 3-1 provides information about the torque wrench recommended for use with the calibration kit. A torque wrench is included in the calibration kit. Refer to Table 6-1 on page 6-2 for replacement part number and ordering information.

Table 3-1 Torque Wrench Information

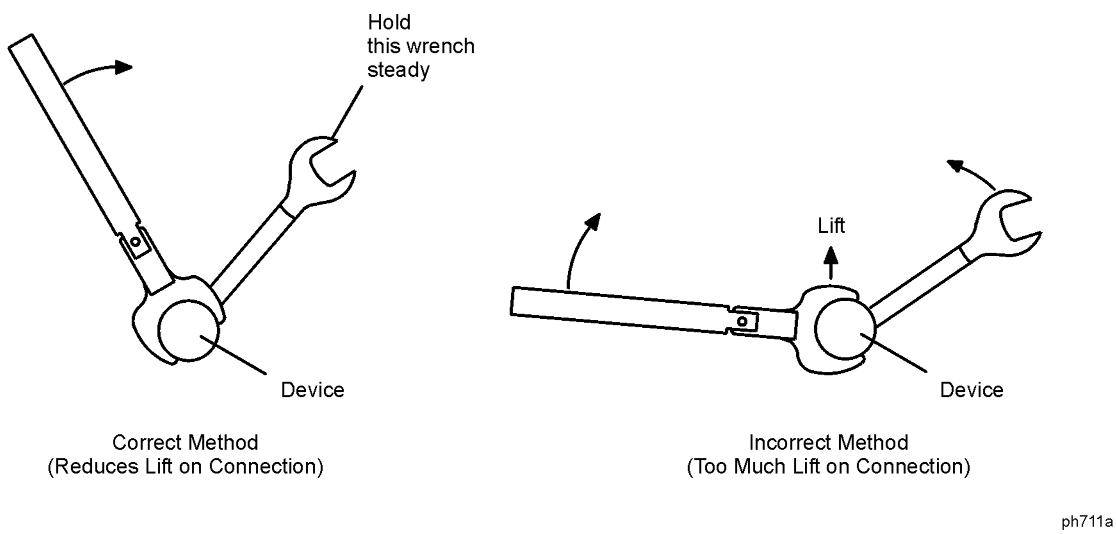
Connector Type	Torque Setting	Torque Tolerance
3.5 mm	90 N-cm (8 in-lb)	±9.0 N-cm (±0.8 in-lb)

Using a torque wrench guarantees that the connection is not too tight, preventing possible connector damage. It also guarantees that all connections are equally tight each time.

Prevent the rotation of anything other than the connector nut that you are tightening. It may be possible to do this by hand if one of the connectors is fixed (as on a test port). However, it is recommended that you use an open-end wrench to keep the body of the device from turning.

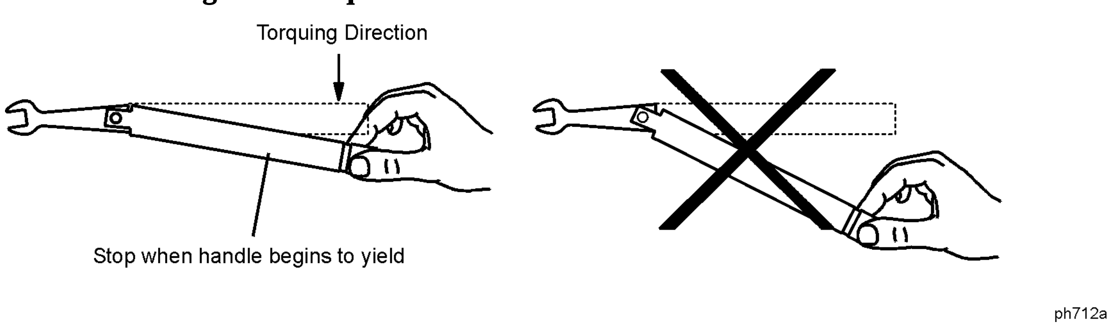
1. Position both wrenches within 90 degrees of each other before applying force. See Figure 3-3. Wrenches opposing each other (greater than 90 degrees apart) will cause a lifting action which can misalign and stress the connections of the devices involved. This is especially true when several devices are connected together.

Figure 3-3 Wrench Positions



2. Hold the torque wrench lightly, at the end of the handle only (beyond the groove). See Figure 3-4.

Figure 3-4 Using the Torque Wrench



3. Apply downward force perpendicular to the wrench handle. This applies torque to the connection through the wrench.

   Do not hold the wrench so tightly that you push the handle straight down along its length rather than pivoting it; otherwise, you apply an unknown amount of torque.

4. Tighten the connection just to the torque wrench break point. The wrench handle gives way at its internal pivot point. See Figure 3-4 on page 3-11. Do not tighten the connection further.

CAUTION You don't have to fully break the handle of the torque wrench to reach the specified torque; doing so can cause the handle to kick back and loosen the connection. Any give at all in the handle is sufficient torque.

How to Separate a Connection

To avoid lateral (bending) force on the connector mating plane surfaces, always support the devices and connections.

CAUTION Do *not* turn the device body. Only turn the connector nut. Damage to the center conductor can occur if the device body is twisted.

1. Use an open-end wrench to prevent the device body from turning.
2. Use another open-end wrench to loosen the connecting nut.
3. Complete the separation by hand, turning only the connecting nut.
4. Pull the connectors straight apart without twisting, rocking, or bending either of the connectors.

Handling and Storage

- Install the protective end caps and store the calibration devices in the foam-lined storage case when not in use.
- Never store connectors loose in a box, or in a desk or bench drawer. This is the most common cause of connector damage during storage.
- Keep connectors clean.
- Do not touch mating plane surfaces. Natural skin oils and microscopic particles of dirt are easily transferred to a connector interface and are very difficult to remove.
- Do not set connectors contact-end down on a hard surface. The plating and the mating plane surfaces can be damaged if the interface comes in contact with any hard surface.

4 Performance Verification

Introduction

The performance of your calibration kit can only be verified by returning the kit to Agilent Technologies for recertification. The equipment required to verify the specifications of the devices in the kit has been specially manufactured and is not commercially available.

How Agilent Verifies the Devices in Your Kit

Agilent verifies the specifications of these devices as follows:

1. The residual microwave error terms of the test system are verified with precision airlines and shorts that are directly traced to the National Institute of Standards and Technology (NIST). The airline and short characteristics are developed from mechanical measurements. The mechanical measurements and material properties are carefully modeled to give very accurate electrical representation. The mechanical measurements are then traced to NIST through various plug and ring gages and other mechanical measurements.
2. Each calibration device is electrically tested on this system. For the initial (before sale) testing of the calibration devices, Agilent includes the test measurement uncertainty as a guardband to guarantee each device meets the published specification. For recertifications (after sale), no guardband is used and the measured data is compared directly with the specification to determine the pass or fail status. The measurement uncertainty for each device is, however, recorded in the calibration report that accompanies recertified kits.

These two steps establish a traceable link to NIST for Agilent to the extent allowed by the institute's calibration facility. The specifications data provided for the devices in the kit is traceable to NIST through Agilent Technologies.

Recertification

The following will be provided with a recertified kit:

- a new calibration sticker affixed to the case
- a certificate of calibration
- a calibration report for each device in the kit listing measured values, specifications, and uncertainties

NOTE A list of NIST traceable numbers may be purchased upon request to be included in the calibration report.

Agilent Technologies offers a *Standard* calibration for the recertification of the kit. For more information, contact Agilent Technologies. Refer to “Contacting Agilent” on page 5-4 for a list of offices.

How Often to Recertify

The suggested initial interval for recertification is 12 months or sooner. The actual need for recertification depends on the use of the kit. After reviewing the results of the initial recertification, you may establish a different recertification interval that reflects the usage and wear of the kit.

NOTE The recertification interval should begin on the date the kit is *first used* after the recertification date.

Where to Send a Kit for Recertification

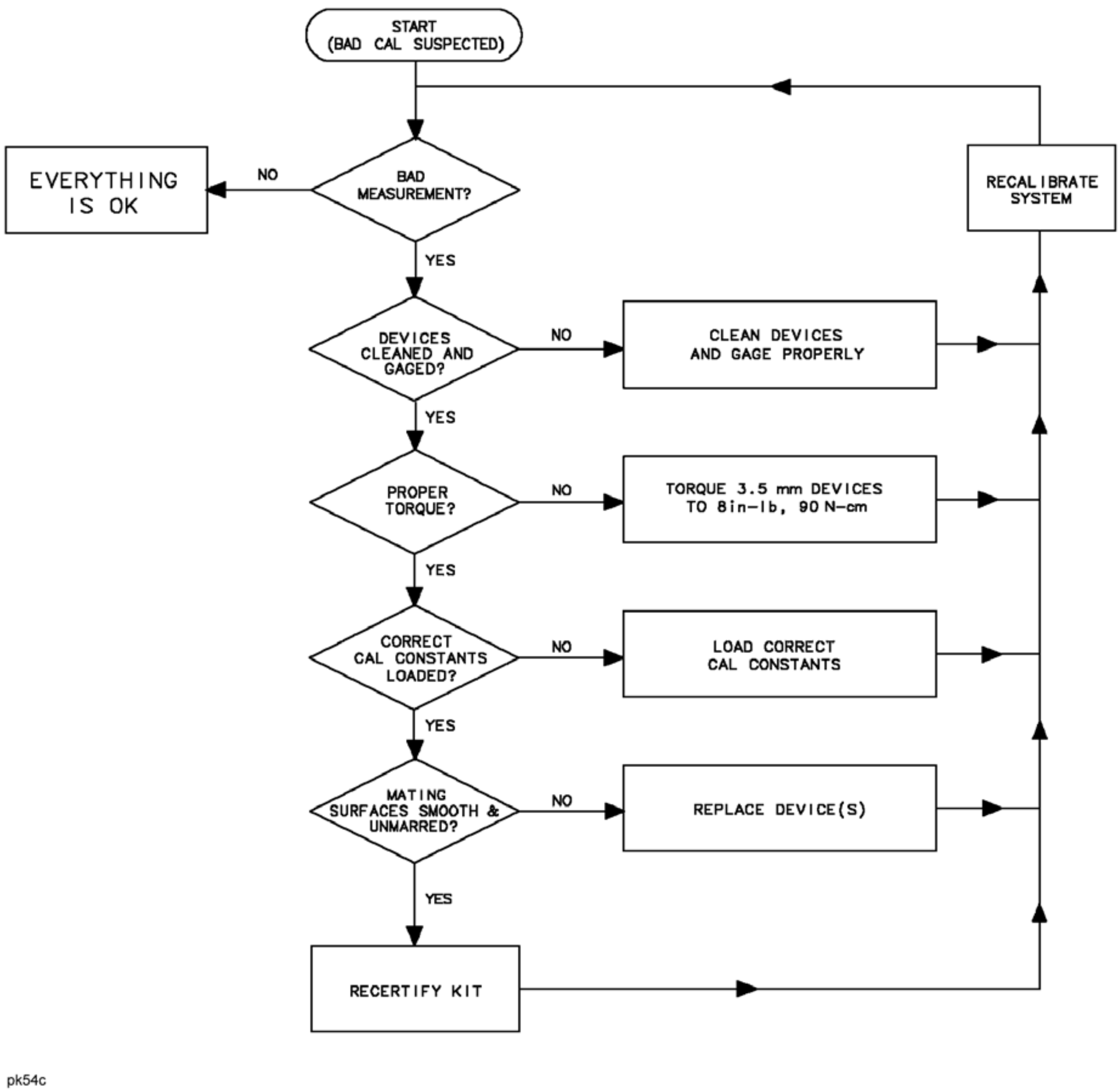
Contact Agilent Technologies for information on where to send your kit for recertification. Contact information is listed on page 5-4. Refer to “Returning a Kit or Device to Agilent” on page 5-3 for details on sending your kit.

5 Troubleshooting

Troubleshooting Process

If you suspect a bad calibration, or if your network analyzer does not pass performance verification, follow the steps in Figure 5-1.

Figure 5-1 Troubleshooting Flowchart



Returning a Kit or Device to Agilent

If your kit or device requires service, contact Agilent Technologies for information on where to send it. See "Contacting Agilent" on page 5-4 for contact information. Include a service tag (located near the end of this manual) on which you provide the following information:

- your company name and address
- a technical contact person within your company, and the person's complete telephone number
- the model number and serial number of the kit
- the part number and serial number of each device
- the type of service required
- a *detailed* description of the problem and how the device was being used when the problem occurred (such as calibration or measurement)

Where to Look for More Information

This manual contains limited information about network analyzer system operation. For complete information, refer to the instrument documentation. If you need additional information, contact Agilent Technologies.

Contacting Agilent

This information supersedes all prior HP contact information.			
Online assistance: www.agilent.com/find/assist			
Americas			
Brazil *(tel)* (+55) 11 3351 7012 *(fax)* (+55) 11 3351 7024	**Canada** *(tel)* 888 447 7378 *(fax) 905 282 6495*	**Mexico** *(tel)* 1 800 254 2440 *(fax)* 1 800 254 4222	**United States** *(tel)* 800 829 4444 *(alt)* (+1) 303 662 3998 *(fax)* 800 829 4433
Asia Pacific and Japan			
Australia *(tel)* 1 800 225 574 *(fax)* 1 800 681 776 *(fax)* 1 800 225 539	**China** *(tel)* 800 810 0508 *(alt)* 800 810 0510 *(fax)* 800 810 0507 *(fax)* 800 810 0362	**Hong Kong** *(tel)* 800 933 229 *(fax)* 800 900 701	**India** *(tel)* 1600 112 626 *(fax)* 1600 112 727 *(fax)* 1600 113 040
Japan (Bench) *(tel)* 0120 32 0119 *(alt)* (+81) 426 56 7799 *(fax)* 0120 01 2144	**Japan (On-Site)** *(tel)* 0120 802 363 *(alt)* (+81) 426 56 7498 *(fax)* (+81) 426 60 8953	**Singapore** *(tel)* 1 800 275 0880 *(fax)* (+65) 6755 1235 *(fax)* (+65) 6755 1214	**South Korea** *(tel)* 080 778 0011 *(fax)* 080 778 0013
Taiwan *(tel)* 0800 047 669 *(fax)* 0800 047 667 *(fax)* 886 3492 0779	**Thailand** *(tel)* 1 800 2758 5822 *(alt)* (+66) 2267 5913 *(fax)* 1 800 656 336	**Malaysia** *(tel)* 1800 880 399 *(fax)* 1800 801 054	
Europe			
Austria *(tel)* 0820 87 44 11* *(fax)* 0820 87 44 22	**Belgium** *(tel)* (+32) (0)2 404 9340 *(alt)* (+32) (0)2 404 9000 *(fax)* (+32) (0)2 404 9395	**Denmark** *(tel)* (+45) 7013 1515 *(alt)* (+45) 7013 7313 *(fax)* (+45) 7013 1555	**Finland** *(tel)* (+358) 10 855 2100 *(fax)* (+358) (0) 10 855 2923
France *(tel)* 0825 010 700* *(alt)* (+33) (0)1 6453 5623 *(fax)* 0825 010 701*	**Germany** *(tel)* 01805 24 6333* *(alt)* 01805 24 6330* *(fax)* 01805 24 6336*	**Ireland** *(tel)* (+353) (0)1 890 924 204 *(alt)* (+353) (0)1 890 924 206 *(fax)*(+353) (0)1 890 924 024	**Israel** *(tel)* (+972) 3 9288 500 *(fax)* (+972) 3 9288 501
Italy *(tel)* (+39) (0)2 9260 8484 *(fax)* (+39) (0)2 9544 1175	**Luxemburg** *(tel)* (+32) (0)2 404 9340 *(alt)* (+32) (0)2 404 9000 *(fax)* (+32) (0)2 404 9395	**Netherlands** *(tel)* (+31) (0)20 547 2111 *(alt)* (+31) (0)20 547 2000 *(fax)* (+31) (0)20 547 2190	**Russia** *(tel)* (+7) 095 797 3963 *(alt)* (+7) 095 797 3900 *(fax)* (+7) 095 797 3901
Spain *(tel)* (+34) 91 631 3300 *(alt)* (+34) 91 631 3000 *(fax)* (+34) 91 631 3301	**Sweden** *(tel)* 0200 88 22 55* *(alt)* (+46) (0)8 5064 8686 *(fax)* 020 120 2266*	**Switzerland (French)** *(tel)* 0800 80 5353 opt. 2* *(alt)* (+33) (0)1 6453 5623 *(fax)* (+41) (0)22 567 5313	**Switzerland (German)** *(tel)* 0800 80 5353 opt. 1* *(alt)* (+49) (0)7031 464 6333 *(fax)* (+41) (0)1 272 7373
Switzerland (Italian) *(tel)* 0800 80 5353 opt. 3* *(alt)* (+39) (0)2 9260 8484 *(fax)* (+41) (0)22 567 5314	**United Kingdom** *(tel)* (+44) (0)7004 666666 *(alt)* (+44) (0)7004 123123 *(fax)* (+44) (0)7004 444555		
(tel) = primary telephone number; *(alt)* = alternate telephone number; *(fax)* = FAX number; * = in country number 8/03/04			

6 Replaceable Parts

Introduction

Table 6-1 lists the replacement part numbers for the 85052D calibration kit. Table 6-2 lists the replacement part numbers for items *not* included in the calibration kit that are either required or recommended for successful operation of the kit.

To order a listed part, note the description, the part number, and the quantity desired. Telephone or send your order to Agilent Technologies. See "Contacting Agilent" on page 5-4 for contact information.

Table 6-1 Replaceable Parts for the 85052D Calibration Kit

Description	Qty per kit	Agilent Part Number
Calibration Devices (3.5 mm)		
Broadband load –m–[a]	1	00902-60003
Broadband load –f–[a]	1	00902-60004
Offset short –m–	1	85052-60006
Offset short –f–	1	85052-60007
Offset open –m–	1	85052-60008
Offset open –f–	1	85052-60009
Adapters (3.5 mm)		
–f– to –f–	1	85052-60012
–m– to –f–	1	85052-60013
–m– to –m–	1	85052-60014
Protective End Caps for Connectors		
For 3.5 mm –f– connectors	As Required	1401-0202
For 3.5 mm –m– connectors	As Required	1401-0208
Wrench		
5/16 in, 90 N-cm (8 in-lb) torque wrench	1	8710-1765
7 mm open-end wrench	1	8710-1761
Calibration Kit Storage Case		
Box (without foam pads)	1	5180-7900
Foam pad (for lid)	1	5181-5543
Foam pad (for lower case)	1	85052-80031

Table 6-1 Replaceable Parts for the 85052D Calibration Kit

Description	Qty per kit	Agilent Part Number
Disk holder	1	5180-8491
Miscellaneous Items		
Calibration constants disk (8510, 872*x* series)	1	85052-10012
Calibration constants disk (PNA series)	1	85052-10017
Specifications and performance verification disk[b]	1	08510-10033
User's and service guide	1	85052-90079
Connector care–quick reference card	1	08510-90360

a. Broadband load has replaced lowband load.
b. See the 8510C *On-Site Service Manual* for instructions on using the disk.

Table 6-2 Items Not Included in the Calibration Kit

Description	Qty	Agilent Part Number
ESD Protection Devices		
Grounding wrist strap	1	9300-1367
5 ft grounding cord for wrist strap	1	9300-0980
2 ft by 4 ft conductive table mat with 15 ft grounding wire	1	9300-0797
ESD heel strap	1	9300-1308
Connector Cleaning Supplies		
Isopropyl alcohol	30 ml	8500-5344
Foam-tipped cleaning swabs	100	9301-1243
Miscellaneous Items		
3.5 mm –f– pin-depth gage[a]	1	11752-60105
3.5 mm –m– pin-depth gage[a]	1	11752-60106
3.5 mm slotless connector contact repair kit[b]	1	85052-60049

a. Refer to "Clarifying the Sex of a Connector" on page 1-5.
b. All female connectors on the precision devices in this kit are slotless connectors. Refer to "Inspect Female Connectors" on page 3-4.

Figure 6-1 Replaceable Parts for the 85052D Calibration Kit

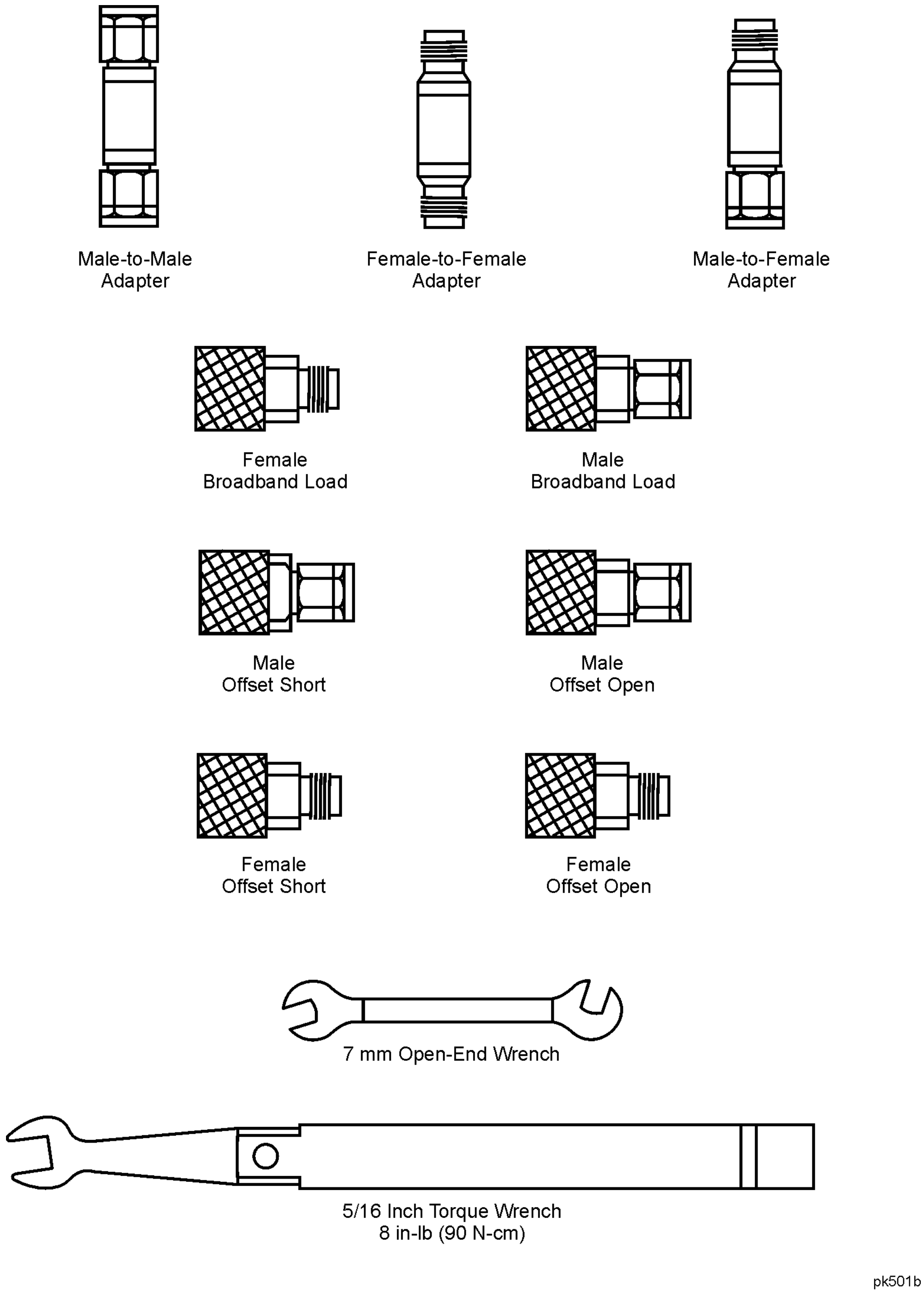
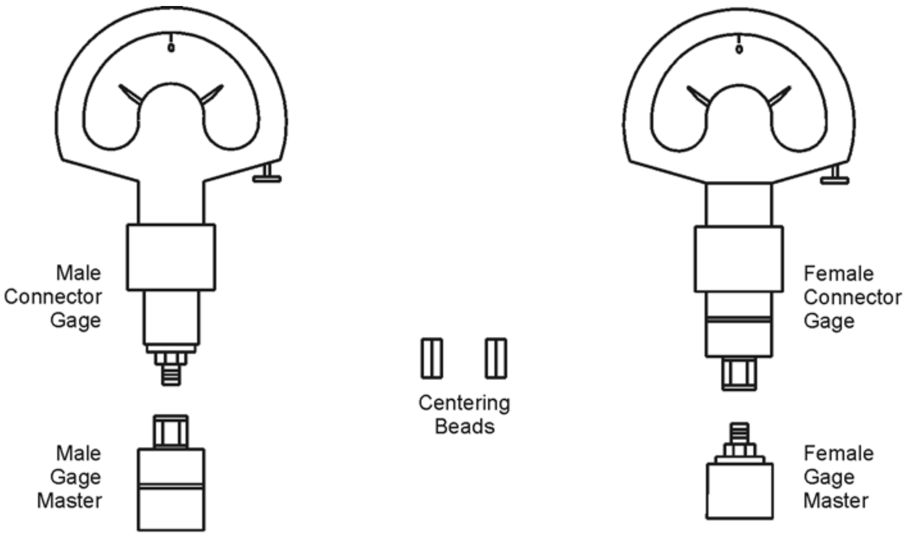


Figure 6-2 Replaceable Parts for the 85052D Calibration Kit



Not Shown:

- Calibration constants disk
- Specifications and performance verification disk
- Storage case
- Protective end caps
- User's and Service Guide

Note: Gages are not included in the kit.

pk501c

A Standard Definitions

Standard Class Assignments

Class assignment organizes calibration standards into a format compatible with the error models used in the measurement calibration. A class or group of classes corresponds to the systematic errors to be removed from the measured network analyzer response. Tables A-1 through A-3 list the classes of the devices in the kit for various network analyzers. This information resides on the calibration constants disk included in the kit.

Table A-1 Standard Class Assignments for the 8510 Network Analyzer

Disk File Name: CK_35mmD3								Calibration Kit Label: 3.5 mm D.3
Class	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**Standard Class Label**
$S_{11}A$	2							Open
$S_{11}B$	1							Short
$S_{11}C$	9							Loads
$S_{22}A$	2							Open
$S_{22}B$	1							Short
$S_{22}C$	9							Loads
Forward transmission	11							Thru
Reverse transmission	11							Thru
Forward match	11							Thru
Reverse match	11							Thru
Forward isolation[a]	9							Isol'n Std
Reverse isolation	9							Isol'n Std
Frequency response	1	2	11					Response
TRL thru								Undefined
TRL reflect								Undefined
TRL line								Undefined
Adapter	13	5	6	7	8			Adapter
TRL Option								
Cal Z_0: _____ System Z_0 __X__ Line Z_0								
Set ref: __X__ Thru _____ Reflect								
Lowband frequency: ________								

a. The forward isolation standard is also used for the isolation part of the response and isolation calibration.

Table A-2 Standard Class Assignments for the 872x Series Network Analyzer

Calibration Kit Label: [3.5 mm]								
Class	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**Standard Class Label**
$S_{11}A$	2							Open
$S_{11}B$	1							Short
$S_{11}C$	3							Loads
$S_{22}A$	2							Open
$S_{22}B$	1							Short
$S_{22}C$	3							Loads
Forward transmission	4							Thru
Reverse transmission	4							Thru
Forward match	4							Thru
Reverse match	4							Thru
Response	1	2	4					Response
Response & isolation	1	2	4					Response
TRL thru	4							Thru
TRL reflect	2							Open
TRL line or match	3							Loads
TRL Option								
Cal Z_0: _____ System Z_0 __X__ Line Z_0								
Set ref: __X__ Thru _____ Reflect								
Lowband frequency: ______								

Table A-3 Standard Class Assignments for the PNA Series Network Analyzer

Calibration Kit Label: **3.5 mm 85052D**	
Class	**A**
$S_{11}A$	2
$S_{11}B$	1
$S_{11}C$	3
$S_{21}T$	4
$S_{22}A$	2
$S_{22}B$	1
$S_{22}C$	3
$S_{12}T$	4

Notes:

1. **If you are performing a TRL calibration:**
   - $S_{21}T$ and $S_{12}T$ must be defined as *thru* standards.
   - $S_{11}A$ and $S_{22}A$ must be defined as *reflection* standards.
   - $S_{11}B$, $S_{11}C$, $S_{22}B$, and $S_{22}C$ must be defined as *line* standards.
2. **If you are performing a TRM calibration:**
   - $S_{21}T$ and $S_{12}T$ must be defined as *thru* standards.
   - $S_{11}A$ and $S_{22}A$ must be defined as *reflection* standards.
   - $S_{11}B$, $S_{11}C$, $S_{22}B$, and $S_{22}C$ must be defined as *match* standards.
3. **If you are performing an LRM calibration:**
   - $S_{21}T$ and $S_{12}T$ must be defined as *line* standards.
   - $S_{11}A$ and $S_{22}A$ must be defined as *reflection* standards.
   - $S_{11}B$, $S_{11}C$, $S_{22}B$, and $S_{22}C$ must be defined as *match* standards.
4. **$S_{11}B$ and $S_{11}C$ must be defined as the same standard.**
5. **$S_{22}B$ and $S_{22}C$ must be defined as the same standard**.

For additional information on performing TRL, TRM, and LRM calibrations, refer to your PNA series network analyzers embedded help system.

Blank Forms

The standard class assignments may be changed to meet your specific requirements. Tables A-4 through A-6 are provided to record the modified standard class assignments.

Table A-4 Blank Form for the 8510 Network Analyzer

Disk File Name: ____________________								Calibration Kit Label: _______________
Class	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**Standard Class Label**
$S_{11}A$								
$S_{11}B$								
$S_{11}C$								
$S_{22}A$								
$S_{22}B$								
$S_{22}C$								
Forward transmission								
Reverse transmission								
Forward match								
Reverse match								
Forward isolation[a]								
Reverse isolation								
Frequency response								
TRL thru								
TRL reflect								
TRL line								
Adapter								
TRL Option								
Cal Z_0: ____ System Z_0 ____ Line Z_0								
Set ref: ____ Thru ____ Reflect								
Lowband frequency[b]: _________								

a. The forward isolation standard is also used for the isolation part of the response and isolation calibration.
b. Broadband loads are used for frequencies up to 2 GHz.

Table A-5 Blank Form for the 872*x* Series Network Analyzer

Calibration Kit Label: ________________								
Class	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**Standard Class Label**
$S_{11}A$								
$S_{11}B$								
$S_{11}C$								
$S_{22}A$								
$S_{22}B$								
$S_{22}C$								
Forward transmission								
Reverse transmission								
Forward match								
Reverse match								
Response								
Response & isolation								
TRL thru								
TRL reflect								
TRL line or match								
TRL Option								
Cal Z_0: _____ System Z_0 _____ Line Z_0								
Set ref: _____ Thru _____ Reflect								
Lowband frequency[a]: ___________								

a. Broadband loads are used for frequencies up to 2 GHz.

Table A-6 Blank Form for the PNA Series Network Analyzer

Calibration Kit Label: ____________	
Class	**A**
$S_{11}A$	
$S_{11}B$	
$S_{11}C$	
$S_{21}T$	
$S_{22}A$	
$S_{22}B$	
$S_{22}C$	
$S_{12}T$	

Notes:

1. **If you are performing a TRL calibration:**
   - $S_{21}T$ and $S_{12}T$ must be defined as *thru* standards.
   - $S_{11}A$ and $S_{22}A$ must be defined as *reflection* standards.
   - $S_{11}B$, $S_{11}C$, $S_{22}B$, and $S_{22}C$ must be defined as *line* standards.
2. **If you are performing a TRM calibration:**
   - $S_{21}T$ and $S_{12}T$ must be defined as *thru* standards.
   - $S_{11}A$ and $S_{22}A$ must be defined as *reflection* standards.
   - $S_{11}B$, $S_{11}C$, $S_{22}B$, and $S_{22}C$ must be defined as *match* standards.
3. **If you are performing an LRM calibration:**
   - $S_{21}T$ and $S_{12}T$ must be defined as *line* standards.
   - $S_{11}A$ and $S_{22}A$ must be defined as *reflection* standards.
   - $S_{11}B$, $S_{11}C$, $S_{22}B$, and $S_{22}C$ must be defined as *match* standards.
4. **$S_{11}B$ and $S_{11}C$ must be defined as the same standard.**
5. **$S_{22}B$ and $S_{22}C$ must be defined as the same standard**.

For additional information on performing TRL, TRM, and LRM calibrations, refer to your PNA series network analyzers embedded help system.

Nominal Standard Definitions

Standard definitions provide the constants needed to mathematically model the electrical characteristics (delay, attenuation, and impedance) of each calibration standard. The nominal values of these constants are theoretically derived from the physical dimensions and material of each calibration standard, or from actual measured response. These values are used to determine the measurement uncertainties of the network analyzer. The standard definitions in Tables A-7 through A-9 list typical calibration kit parameters used by the following network analyzers to specify the mathematical model of each device. This information must be loaded into the network analyzer to perform valid calibrations. Refer to your network analyzer user's guide for instructions on loading calibration constants.

NOTE The values in the standard definitions table are valid *only* over the specified operating temperature range.

Setting the System Impedance

This kit contains only 50 ohm devices. Ensure the system impedance (Z_0) is set to 50 ohms. Refer to your network analyzer user's guide for instructions on setting system impedance.

Version Changes

Class assignments and standard definitions may change as more accurate model and calibration methods are developed. The disk shipped with the kit for use with the 8510 will contain the most recent version. The default version that comes with the 872*x* network analyzer firmware may be outdated.

Table A-7 Standard Definitions for the 8510 Network Analyzer

System Z_0[a] = 50.0 Ω **Calibration Kit Label: 3.5 mm D.3**
Disk File Name: CK_35MMD3

Standard[b] Number	Standard[b] Type	$C0 \times 10^{-15}$ F / $L0 \times 10^{-12}$ H	$C1 \times 10^{-27}$ F/Hz / $L1 \times 10^{-24}$ H/Hz	$C2 \times 10^{-36}$ F/Hz^2 / $L2 \times 10^{-33}$ H/Hz^2	$C3 \times 10^{-45}$ F/Hz^3 / $L3 \times 10^{-42}$ H/Hz^3	Fixed or Sliding[c]	Offset Delay in ps	Offset Z_0 Ω	Offset Loss in GΩ/s	Frequency in GHz[d] Min	Frequency in GHz[d] Max	Coax or Waveguide	Standard Label
1	Short[e]	2.0765	−108.54	2.1705	−0.01		31.785	50	2.36	0	999	Coax	Short
2	Open[e]	49.433	−310.131	23.1682	−0.15966		29.243	50	2.2	0	999	Coax	Open
3													
4													
5	Open[f]	6.9558	−1.0259	−0.01435	0.0028		0	50	0	0	999	Coax	3.5/2.92
6	Open[f]	5.9588	−11.195	0.5076	−0.00243		0	50	0	0	999	Coax	3.5/SMA
7	Open[f]	13.4203	−1.9452	0.5459	0.01594		0	50	0	0	999	Coax	2.92/SMA
8	Open[f]	8.9843	−13.9923	0.3242	−0.00112		0	50	0	0	999	Coax	2.4/1.85
9	Load					Fxd	0	50	0	0	999	Coax	Broadband
11	Delay/thru						0	50	0	0	999	Coax	Thru
12													
13	Delay/thru						94.75	50	2.51	0	999	Coax	Adapter
14													
15													
16													
17													
18													
19													
20													
21													

a. Ensure system Z_0 of network analyzer is set to this value.
b. Open, short, load, delay/thru, or arbitrary impedance.
c. Load or arbitrary impedance only.
d. For waveguide, the lower frequency is the same as F_{CO}.
e. Typical values only. Disk values may be different.
f. This standard type (open) is used to accurately model the adapter listed in the Standard Label column.

Table A-8 Standard Definitions for the 872*x* Network Analyzer

System Z_0[a] = 50.0 Ω							Calibration Label: [3.5mm]						
Standard[b]							Offset			Frequency in GHz[d]			
Number	Type	C0 ×10^{-15} F	C1 ×10^{-27} F/Hz	C2 ×10^{-36} F/Hz^2	C3 ×10^{-45} F/Hz^3	Fixed[c] or Sliding	Delay in ps	Z_0 in Ω	Loss in GΩ/s	Min	Max	Coax or Waveguide	Standard Label
1	Short	0	0	0	0		31.798	50	2.191	0	999	Coax	Short
2	Open	49.43	−310.13	23.17	−0.16		29.243	50	2.2	0	999	Coax	Open
3	Load					Fxd	0	50	2.2	0	999	Coax	Broadband
4	Delay/ thru						0	50	2.2	0	999	Coax	Thru
5													
6													
7													
8													

a. Ensure system Z_0 of network analyzer is set to this value.
b. Open, short, load, delay/thru, or arbitrary impedance.
c. Load or arbitrary impedance only.
d. For waveguide, the lower frequency is the same as F_{CO}.

Table A-9 Standard Definitions for the PNA Series Network Analyzer

System Z_0[a] = 50.0 Ω							Calibration Kit Label: 3.5 mm Model 85052D							
Standard[b]		$C0 \times 10^{-15}$ F	$C1 \times 10^{-27}$ F/Hz	$C2 \times 10^{-36}$ F/H^2	$C3 \times 10^{-45}$ F/Hz^3		Offset			Frequency in GHz[c]			
Number	Type	$L0 \times 10^{-12}$ H	$L1 \times 10^{-24}$ H/Hz	$L2 \times 10^{-33}$ H/Hz^2	$L3 \times 10^{-45}$ H/Hz^3	Fixed or sliding	Delay in ps	Z_0 Ω	Loss in GΩ/s	Min	Max	Coax or Waveguide	Standard Label
1	Short	2.0765	–108.54	2.1705	–0.01		31.785	50	2.366	0	999	Coax	Short
2	Open	49.433	–310.131	23.1682	–0.1597		29.243	50	2.2	0	999	Coax	Open
3	Broadband Load					Fxd	0	50	0	0	999	Coax	Broadband
4	Thru						0	50	0	0	999	Coax	Thru
5													
6													
7													
8													

a. Ensure system Z_0 of network analyzer is set to this value.
b. Open, short, load, delay/thru, or arbitrary impedance.
c. For waveguide, the lower frequency is the same as F_{CO}.

Blank Form

The standard definitions may be changed to meet your specific requirements. Tables A-10 through A-12 are provided to record the modified standard definitions.

Table A-10 Blank Form for the 8510 Network Analyzer

System Z_0[a] = ____________ **Calibration Kit Label: _____________________________**
Disk File Name: _______________________________

Standard[b]		$C0 \times 10^{-15}$ F	$C1 \times 10^{-27}$ F/Hz	$C2 \times 10^{-36}$ F/Hz^2	$C3 \times 10^{-45}$ F/Hz^3		Offset			Frequency in GHz[d]			
Number	Type	$L0 \times 10^{-12}$ H	$L1 \times 10^{-24}$ H/Hz	$L2 \times 10^{-33}$ H/Hz^2	$L3 \times 10^{-42}$ H/Hz^3	Fixed or sliding[c]	Delay in ps	Z_0 Ω	Loss in GΩ/s	Min	Max	Coax or Waveguide	Standard Label
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													

a. Ensure system Z_0 of network analyzer is set to this value.
b. Open, short, load, delay/thru, or arbitrary impedance.
c. Load or arbitrary impedance only.
d. For waveguide, the lower frequency is the same as F_{CO}.

Table A-11 Blank Form for the 872*x* Network Analyzer

System Z_0[a] = ________													Calibration Label:________	
Standard[b]							Offset			Frequency in GHz[d]				
Number	Type	C0 ×10^{-15} F	C1 ×10^{-27} F/Hz	C2 ×10^{-36} F/Hz^2	C3 ×10^{-45} F/Hz^3	Fixed[c] or Sliding	Delay in ps	Z_0 in Ω	Loss in GΩ/s	Min	Max	Coax or Waveguide	Standard Label	
1														
2														
3														
4														
5														
6														
7														
8														

a. Ensure system Z_0 of network analyzer is set to this value.
b. Open, short, load, delay/thru, or arbitrary impedance.
c. Load or arbitrary impedance only.
d. For waveguide, the lower frequency is the same as F_{CO}.

Table A-12 Blank Form for the PNA Series Network Analyzer

System Z_0[a] = ______________ Calibration Kit Label: __________________________

Standard[b]		$C0 \times 10^{-15}$ F	$C1 \times 10^{-27}$ F/Hz	$C2 \times 10^{-36}$ F/Hz^2	$C3 \times 10^{-45}$ F/Hz^3		Offset			Frequency in GHz[c]			
Number	Type	$L0 \times 10^{-12}$ H	$L1 \times 10^{-24}$ H/Hz	$L2 \times 10^{-33}$ H/Hz^2	$L3 \times 10^{-45}$ H/Hz^3	Fixed or sliding	Delay in ps	Z_0 Ω	Loss in GΩ/s	Min	Max	Coax or Waveguide	Standard Label
1	Short												
2	Open												
3	Broadband Load												
4	Thru												
5													
6													
7													
8													

a. Ensure system Z_0 of network analyzer is set to this value.
b. Open, short, load, delay/thru, or arbitrary impedance.
c. For waveguide, the lower frequency is the same as F_{CO}.

Index

Index