

User's and Service Guide

Agilent Technologies 85058V 1.85 mm Verification Kit



Agilent Part Number: 85058-90007

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Agilent Technologies

October 17, 2005

Agilent Part Number: 85058-90011

To: Users of the Agilent 85058V 1.85mm Verification Kit

Subject: Return Loss Specification of 40dB Attenuator in 85058V Verification Kit

Dear Customer,

The minimum return loss of the 85058-60125 40dB attenuator in the 40 GHz – 67 GHz range is 16dB rather than the value printed in the *Agilent 85058V 1.85mm Verification Kit User's and Service Guide*, part number 85058-90007 (print date October 2003). This change will not affect the performance of the 85058V verification kit as every kit is provided with fully characterized data. The User's and Service Guide will be updated soon to reflect this change.

Sincerely,

Srinivas Sundaram,

Srinivas Sundaram
Electronic Measurements Group
Agilent Technologies
Santa Rosa, California

1 General Information

Verification Kit Overview

The Agilent 85058V 1.85 mm verification kit provides a set of standards with known characteristics, traceable to primary standards in the Agilent Technologies calibration lab. This set of standards is used to verify your measurement calibration and also to verify that your network analyzer system is operating within its specifications. The frequency range covered by the 85058V is from 10 MHz to 67 GHz.

Kit Contents

The 85058V verification kit includes the following items:

- 10 dB attenuator
- 40 dB attenuator
- 25 Ω mismatch beaded line
- 50 Ω beaded line
- ASCII-format data disk that contains printable, factory-measured verification data

Refer to [Chapter 6](#) for a complete list of contents and their associated part numbers.

NOTE A file containing the verification data for your kit is maintained for one year from the time of measurement. If you lose this data, see [“Contacting Agilent” on page 5-4](#) for a list of telephone numbers.

Compatible Calibration Kit and Network Analyzers

The 85058V verification kit is intended to be used with the 85058B/E 1.85 mm calibration kits and Agilent PNA-series network analyzers.

The verification data disk contains the calibration report and the factory-measured S-parameter data for the devices in this kit. It also contains the uncertainty limits used in the system verification procedure. This data is unique to each kit.

NOTE A backup copy of each verification data disk and printout should be made immediately upon receipt of this kit. Refer to your analyzer’s online Help for instructions on duplicating a disk.

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 6-4](#) for a list of these items and for ordering information.

Incoming Inspection

Verify that the shipment is complete by referring to [Table 6-1 on page 6-2](#).

Check for damage. The foam-lined storage case provides protection during shipping. Verify that this case and its contents are not damaged.

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. Refer to [“Returning a Kit or Device to Agilent Technologies” on page 5-4](#) for instructions.

Recording the Device Serial Numbers

In addition to the kit serial number, the devices in this kit are individually serialized. [Figure 1-1](#) shows an example of the laser-engraved serial number located on the nut of both beaded lines. The serial numbers of both attenuators are printed on the labels, located on the bodies of the devices. Record these serial numbers in [Table 1-1](#). Recording the serial numbers will prevent confusing the devices in this kit with similar devices from other kits.

Figure 1-1 Serial Number Engraved on the Nut of a Beaded Line



Table 1-1 Serial Number Record for the 85058V

Device	Serial Number
Verification kit	_____
10 dB attenuator	_____
40 dB attenuator	_____
50Ω beaded line	_____
25Ω mismatch beaded line	_____

Clarifying the Sex of Connectors

In this document and in the prompts of the PNA calibration wizard, the sex of device connectors and adapters is referred to in terms of the center conductor. For example, a connector or device designated as 1.85 mm –f– has a 1.85 mm female center conductor.

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.

Table 1-2 Clarifying the Sex of Connectors: Examples

Terminology	Meaning
Short –f–	Female short (female center conductor)
Short (f)	Male short (male center conductor) to be connected to female port

A connector gage is 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 this 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 specification (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	Required Values/Ranges
Temperature	
Operating ^a	+20 °C to +26 °C (+68 °F to +79 °F)
Storage	-40 °C to +75 °C (-40 °F to +167 °F)
Error-corrected range ^b	±1 °C (1.8 °F) 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

Due to the thermal properties of the devices, electrical characteristics will change with temperature. Therefore, the operating temperature is a critical factor in their performance, and must be stable before use.

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

Mechanical Characteristics

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

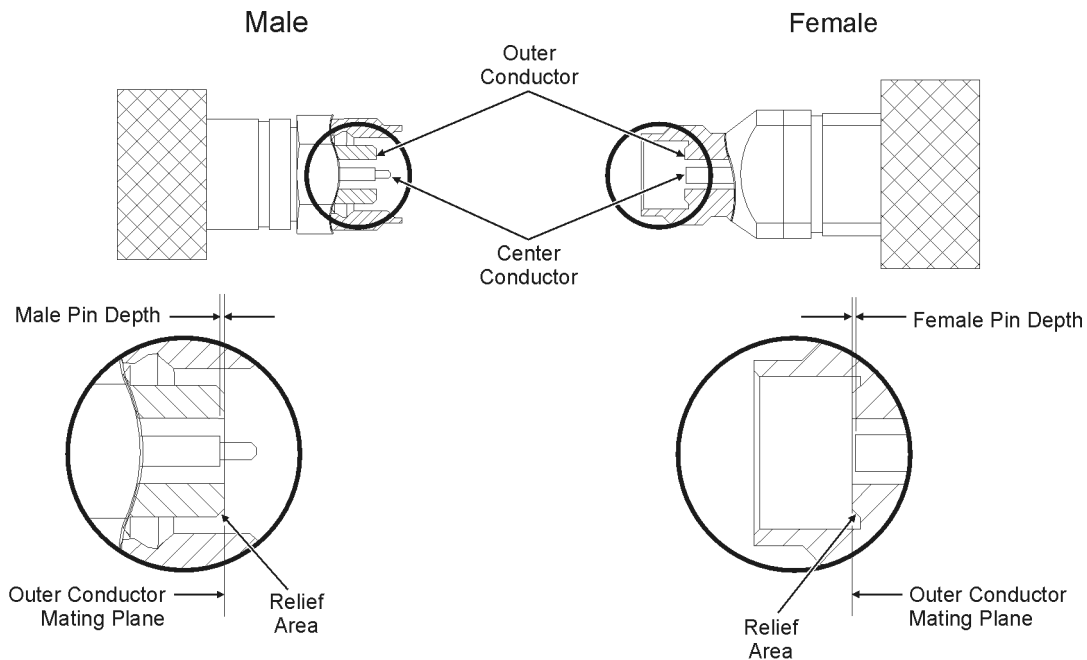
“Gaging Connectors” on page 3-8 explains how to use gages to determine if the kit devices have maintained their mechanical integrity. Refer to Table 2-2, “Connector Pin Depths,” for allowable recession.

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 conditions:

- **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



conn185_new

Supplemental Characteristics

Supplemental characteristics are provided as additional information that may be helpful in applying the devices. These characteristics are typical of most devices but are not warranted.

Table 2-2 Connector Pin Depths

Connectors	Allowable Recession	
	millimeters	inches
Attenuators	0.000 to -0.025	0.0000 to -0.001
Beaded lines	0.0000 to -0.013	0.0000 to -0.0005

Electrical Specifications

At the factory, each verification device is electrically characterized on a network analyzer measurement system. These factory measurements are traceable to the National Institute of Standards and Technology (NIST) through mechanical and electrical paths (for more information on traceability, contact Agilent Technologies. Refer to [Table 5-1 on page 5-4](#) for a list of contacts.

The factory-measured data for each device is supplied in print and on disk with your kit.

Table 2-3 Electrical Specifications for the 40 dB Attenuator (85058-60125)

Frequency Range (Hz)	Reflection	Transmission			
	Minimum Return Loss (dB)	Maximum Magnitude (dB)	Minimum Phase ^a (degrees)	Minimum Magnitude (dB)	Maximum Phase ^a (dB)
10 MHz to 45 MHz (Typical)	38	42.5	-12	37.0	0
45 MHz to 2 GHz)	35	40.0	-86	39.0	0
2 GHz to 20 GHz	23	41.0	-850	39.5	-80
20 GHz to 40 GHz	19	42.5	-1705	39.5	-835
40 GHz to 67 GHz	19	44.0	-2920	39.0	-1680
67 GHz to 70 GHz (Typical)	15	45.0	-3070	39.5	-2870

a. Unwrapped phase.

Table 2-4 Electrical Specifications for the 10 dB Attenuator (85058-60126)

Frequency Range (Hz)	Reflection	Transmission			
	Minimum Return Loss (dB)	Maximum Magnitude (dB)	Minimum Phase ^a (degrees)	Minimum Magnitude (dB)	Maximum Phase ^a (dB)
10 MHz to 45 MHz (Typical)	38	10.5	-3	9.5	0
45 MHz to 2 GHz)	36	10.5	-90	9.6	-2
2 GHz to 20 GHz	22	11.5	-885	9.3	-80
20 GHz to 40 GHz	21	11.5	-1765	9.3	-865
40 GHz to 67 GHz	19	12	-2960	8.0	-1740
67 GHz to 70 GHz (Typical)	12	12	-3096	7.0	-2920

a. Unwrapped phase.

Table 2-5 Electrical Specifications for the 50 Ω Beaded Line (85058-60116)

	Reflection	Transmission	
Frequency Range (Hz)	Minimum Return Loss (dB)	Maximum Magnitude (dB)	Minimum Phase ^a (degrees)
10 MHz to 45 MHz (Typical)	22	0.6	-15
45 MHz to 2 GHz	32	0.2	-70
2 GHz to 20 GHz	29	0.3	-635
20 GHz to 40 GHz	23	0.4	-1260
40 GHz to 67 GHz	21	0.6	-2105
67 GHz to 70 GHz (Typical)	8	1.5	-2240

a. Unwrapped phase.

Table 2-6 Electrical Specifications for the 25 Ω Mismatch Beaded Line (85058-60117)

	Reflection	Transmission	
Frequency Range (Hz)	Minimum Return Loss (dB)	Maximum Magnitude (dB)	Minimum Phase ^a (degrees)
10 MHz to 45 MHz (Typical)	23	0.6	-10
45 MHz to 2 GHz	7	1.0	-75
2 GHz to 30 GHz	4	2.4	-945
30 GHz to 67 GHz	3	2.6	-2110
67 GHz to 70 GHz (Typical)	3	2.4	-2250

a. Unwrapped phase.

3 Use, Maintenance, and Care of the Devices

Electrostatic Discharge

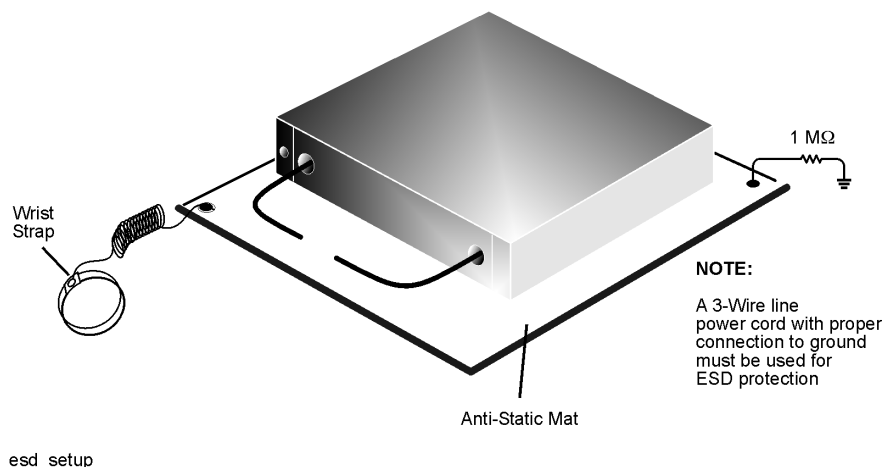
Protection against electrostatic discharge (ESD) is essential while connecting, inspecting, or cleaning connectors attached to a static-sensitive circuit (such as those found in test sets).

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 M Ω 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 a wrist strap. Refer to Table 6-2 on page 6-4 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.

CAUTION Devices with damaged connectors should be immediately discarded or clearly marked and set aside for repair. A damaged device will in turn damage any good connector to which it is attached. Determine the cause of the damage before connecting a new, undamaged connector in the same configuration.

In some cases, magnification is necessary to see damage to a connector; a magnifying device with a magnification of $\geq 10\times$ 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 or 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. Verification devices should have a long life if their use is on the order of a few times per week. Replace devices with worn connectors.

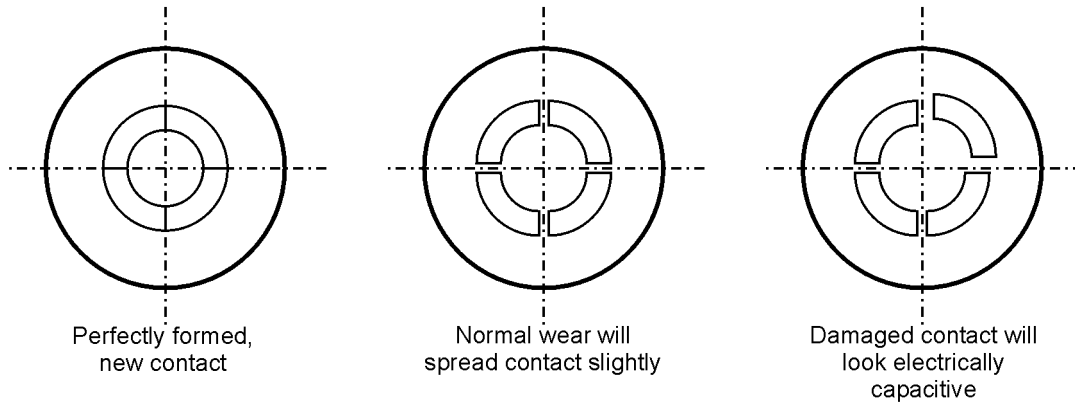
The test port connectors on the network analyzer test set may have many connections each day, and are, therefore, more subject to wear. It is recommended that an adapter be used as a test port saver to minimize the wear on the test set's test port connectors.

Connector Contacts

See [Figure 3-2 on page 3-4](#) for visual guidelines when evaluating the contact integrity of a connector.

NOTE Notice the location of the cross hairs in relationship to the center of the figures.

Figure 3-2 Contact Integrity

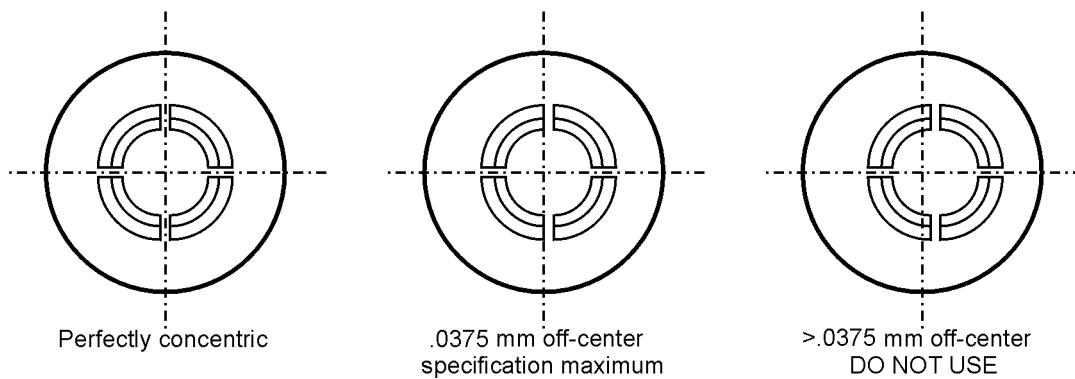


integ

Concentricity

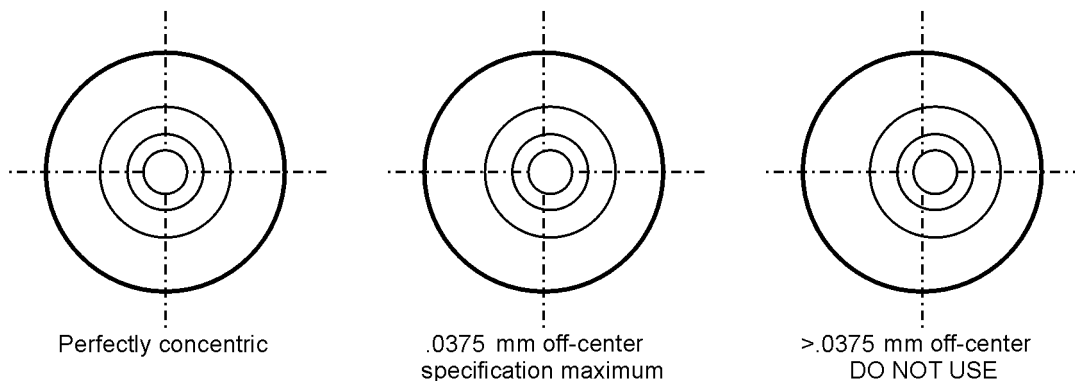
Figure 3-3 and Figure 3-4 show the concentricity of both the male and female 1.85 mm connectors. Inspect the connectors with a minimum magnification of 10X.

Figure 3-3 Concentricity of a Female Connector



feconnect

Figure 3-4 Concentricity of a Male Connector



maconnect

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.

Inspect Female Connectors

The 1.85 mm slotted female connector is designed and fabricated to meet and exceed the performance requirements of an instrument-grade connector. In order to maintain this performance level, the female contacts of each device should be inspected prior to use. Refer to [Figure 3-2 on page 3-4](#). Make sure that the contacts are formed symmetrically. The outside edge of the contacts must be very sharp. Also, the center conductor must be free of nicks, scratches, and dings.

NOTE	Inspection of connectors is particularly important when mating nonprecision to precision devices.
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Cleaning Connectors

1. Use Compressed Air or Nitrogen

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

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.

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” on page 3-2](#) 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 6-4](#) 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 the Connector

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 verification kit devices. *Do not use the gages for precise pin depth measurements.*

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 then, 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. As the gages undergo more use, the systematic errors can become more significant in the accuracy of the measurement.

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. This serves 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 verification 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 Male 1.85 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.)

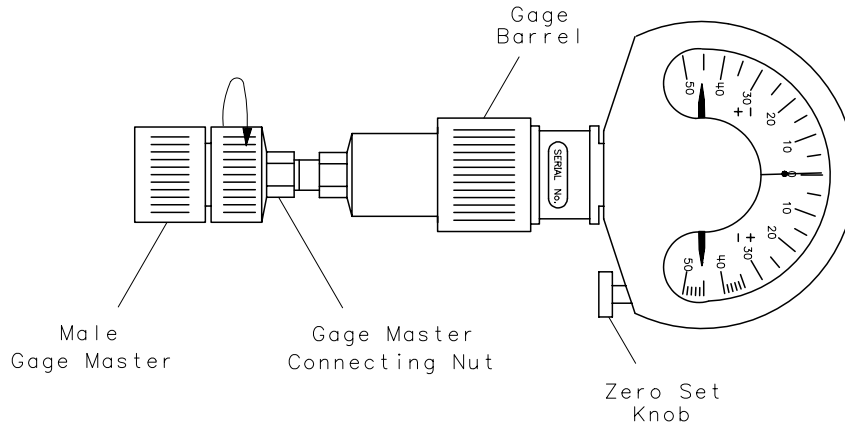
1. Select the proper gage for your connector. The 1.85 mm connectors are gaged with the same gages and in the same way as precision 2.4 mm connectors. (Refer to [Table 6-2 on page 6-4](#) for gage set part number.)
2. Inspect and clean the gage, gage master, and device to be gaged. Refer to [“Visual Inspection” on page 3-3](#) and [“Cleaning Connectors” on page 3-6](#).
3. Zero the connector gage (refer to [Figure 3-5](#)):
 - a. While holding the gage by the barrel, and without turning the gage or the gage master, screw the gage master connecting nut onto the male gage, just until you meet resistance. Connect the nut finger tight. Do not overtighten.
 - b. Use the torque wrench recommended for use with this kit to tighten the connecting nut to 90 N-cm (8 in-lb). Refer to [“Connections” on page 3-13](#) for more information.
 - c. Loosen the dial lock screw on the gage and rotate the gage dial so that the pointer corresponds to the correction value noted on the gage master. Do not adjust the gage dial to zero, unless the correction value on the gage master is zero.
 - d. Tighten the dial lock screw and remove the gage master.
 - e. Attach and torque the gage master to the gage once again to verify that the setting is repeatable. Remove the gage master.
4. Gage the device connector (refer to [Figure 3-5](#)):
 - a. While holding the gage by the barrel, and without turning the gage or the device, screw the connecting nut of the device being measured onto the gage, just until you meet resistance. Connect the nut finger-tight. Do not overtighten.
 - b. Use the torque wrench recommended for use with this kit to tighten the connecting nut to 90 N-cm (8 in-lb). Refer to [“Connections” on page 3-13](#) for more 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 \pm signs; *not* the red \pm 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 3-5 Gaging Male 1.85 mm Connectors

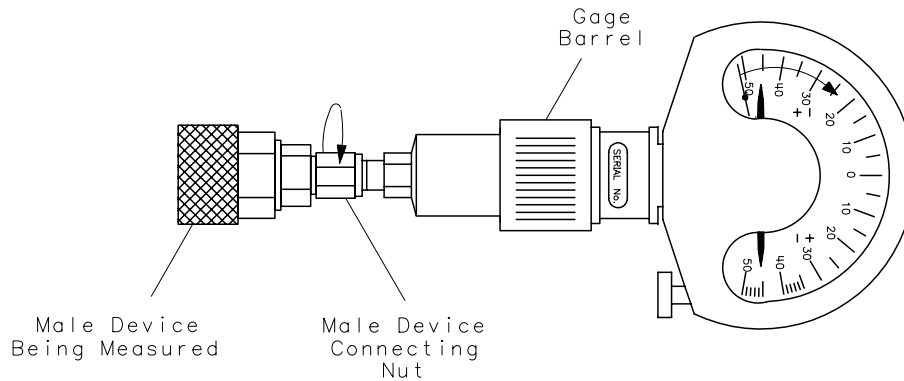
Zero the Connector Gage

- Screw the male gage master connecting nut onto the male gage.
- 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

- Screw the male device connecting nut onto the male gage.
- Torque the connecting nut.
- Gently tap the gage barrel to settle the reading.
- Read recession or protrusion from the gage.
- Remove the device.



wj615d

Gaging Female 1.85 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.)

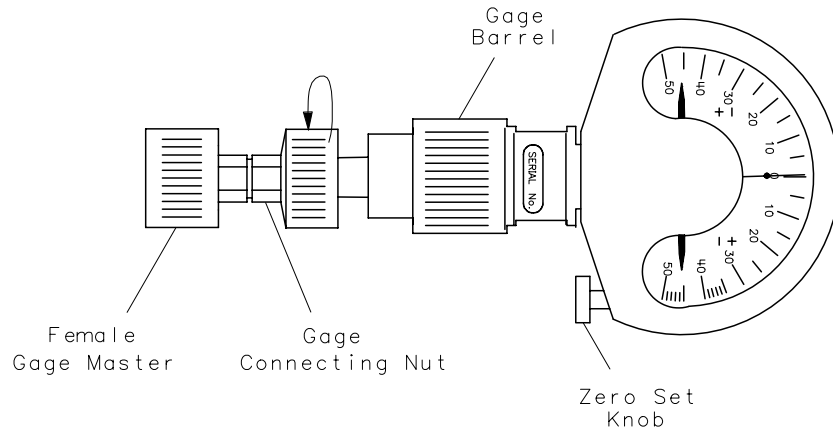
1. Select the proper gage for your connector. The 1.85 mm connectors are gaged with the same gages and in the same way as precision 2.4 mm connectors. (Refer to [Table 6-2 on page 6-4](#) for gage part numbers).
2. Inspect and clean the gage, gage master, and device to be gaged. Refer to [“Visual Inspection” on page 3-3](#) and [“Cleaning Connectors” on page 3-6](#) earlier in this chapter.
3. Zero the connector gage (refer to [Figure 3-6](#)):
 - a. While holding the gage by the barrel, and without turning the gage or the gage master, screw the gage connecting nut onto the female gage master, just until you meet resistance. Connect the nut finger-tight. Do not overtighten.
 - b. Use the torque wrench recommended for use with this kit to tighten the connecting nut to 90 N-cm (8 in-lb). Refer to [“Connections” on page 3-13](#) for more information.
 - c. Loosen the dial lock screw on the gage and rotate the gage dial so that the pointer corresponds to the correction value noted on the gage master. Do not adjust the gage dial to zero, unless the correction value on the gage master is zero.
 - d. Tighten the dial lock screw and remove the gage master.
 - e. Attach and torque the gage master to the gage once again to verify that the setting is repeatable. Remove the gage master.
4. Gage the device connector (refer to [Figure 3-6](#)):
 - a. While holding the gage by the barrel, and without turning the gage or the device, screw the gage connecting nut onto the device being measured, just until you meet resistance. Connect the nut finger-tight. Do not overtighten.
 - b. Use the torque wrench recommended for use with this kit to tighten the connecting nut to 90 N-cm (8 in-lb). Refer to [“Connections” on page 3-13](#) for more 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 \pm signs; *not* the red \pm 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 3-6 Gaging Female 1.85 mm Connectors

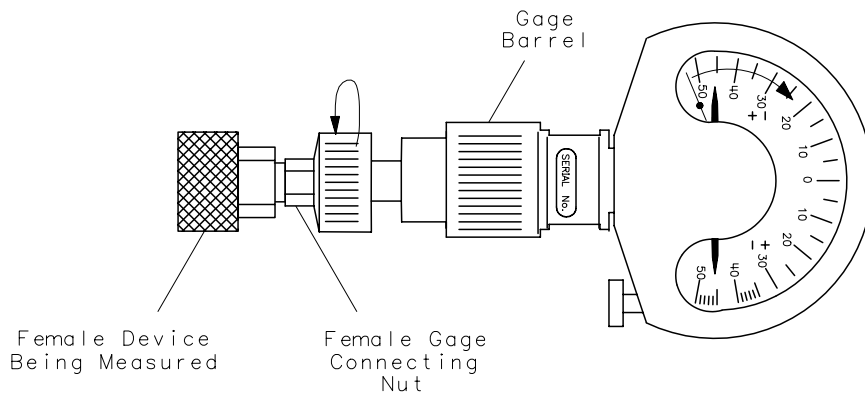
Zero the Connector Gage

- Screw the female gage connecting nut onto the female 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

- Screw the female gage connecting nut onto the female device.
- Torque the connecting nut.
- Gently tap the gage barrel to settle the reading.
- Read recession or protrusion from the gage.
- Remove the device.



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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 3-6](#).
4. Use a connector gage to verify that all center conductors are within the pin depth values listed in [Table 2-2 on page 2-4](#). Refer to [“Gaging Connectors” on page 3-8](#).
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. Turn only the connector nut. Damage to the center conductor can occur if the device body is rotated.

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 verification kit. A torque wrench is not included in the verification kit. Refer to [Table 6-2 on page 6-4](#) for part number and ordering information.

Table 3-1 Torque Wrench Information

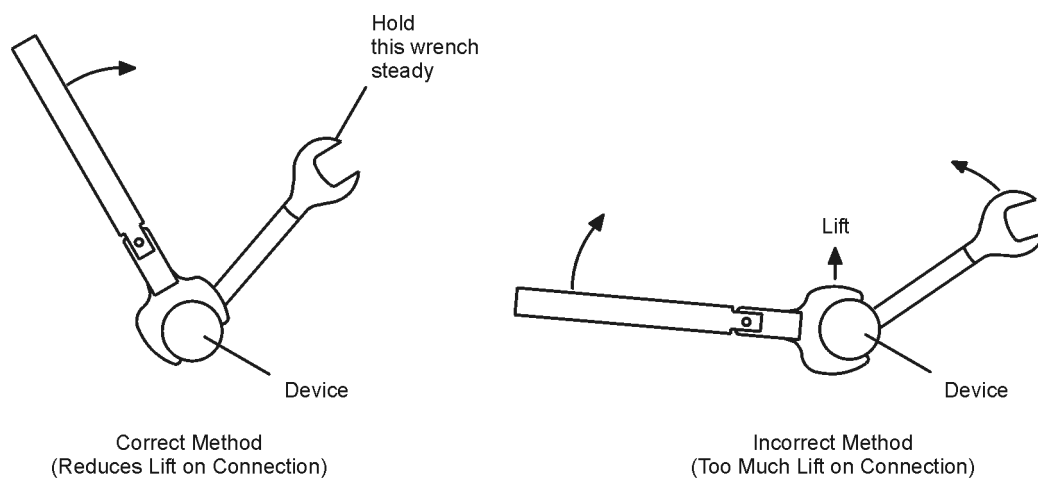
Connector Type	Torque Setting	Torque Tolerance
1.85 mm	90 N-cm (8 in-lb)	±9.0 N-cm (±0.8 in-lb)

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 3-7](#). 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.

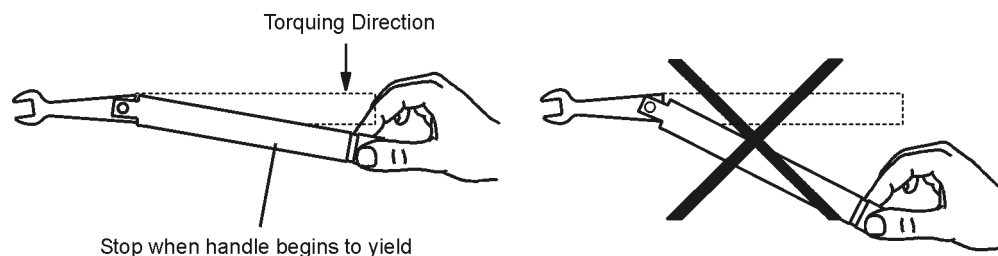
Figure 3-7 Wrench Positions



ph711a

2. Hold the torque wrench lightly, at the end of the handle only (beyond the groove). See [Figure 3-8](#).

Figure 3-8 Using the Torque Wrench



ph712a

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.

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.

4. Tighten the connection just to the torque wrench break point. The wrench handle gives way at its internal pivot point. See [Figure 3-8](#). Do not tighten the connection further.

How to Separate a Connection

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

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

Handling and Storage

- Do install the protective end caps and store the devices in the foam-lined storage case when not in use.
- Do keep connectors and beaded lines clean.
- Do *not* store connectors and beaded lines loose in a box, or in a desk or bench drawer. This is the most common cause of connector damage during storage.
- 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 verification 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 device is electrically tested on this system. The measurement uncertainty for each device is recorded in the calibration report that accompanies every kit.

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

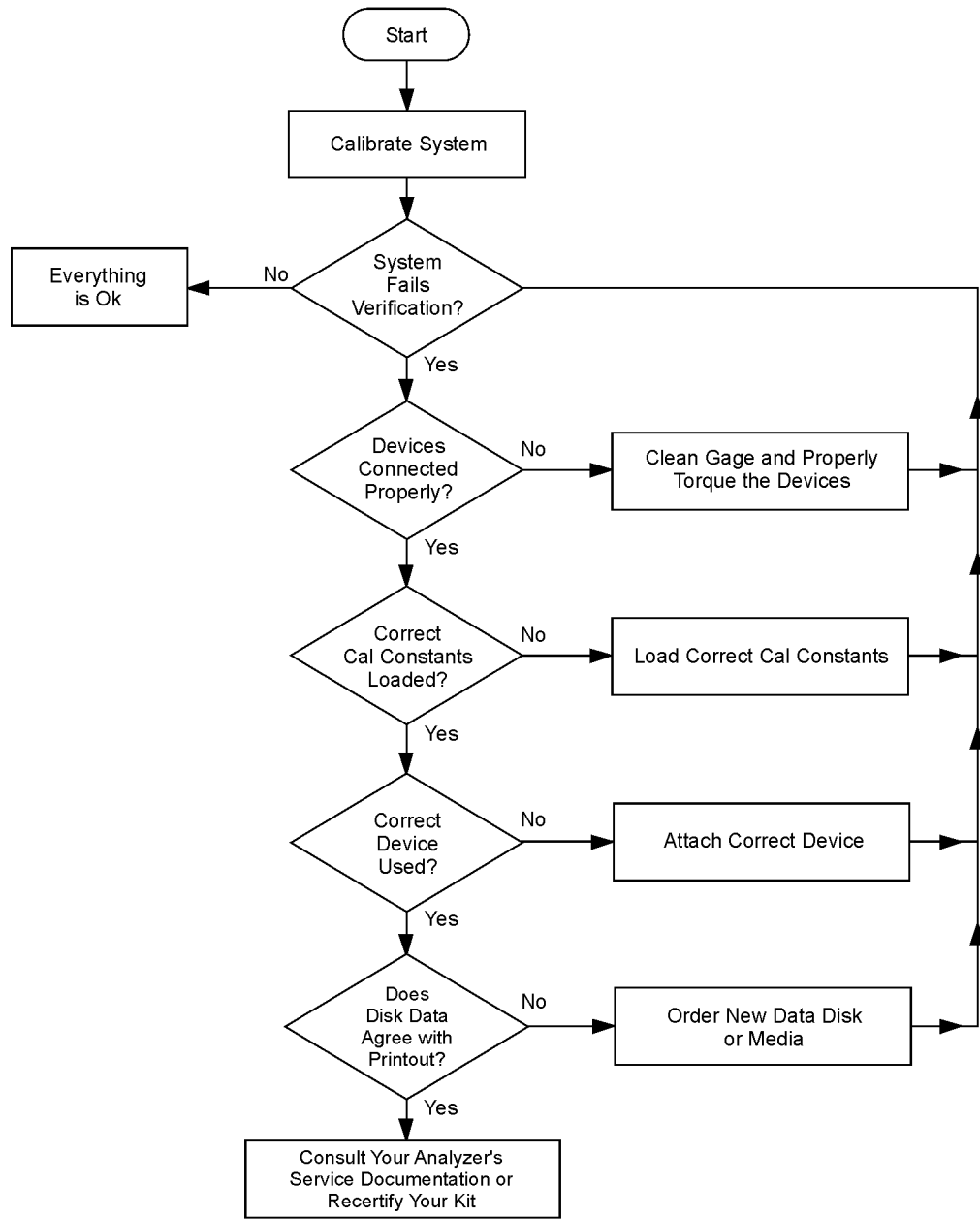
Contact Agilent Technologies for information on where to send your kit for recertification. Contact information is listed on [Table 5-1 on page 5-4](#). Refer to [“Returning a Kit or Device to Agilent Technologies” on page 5-4](#) for details on sending your kit.

5 Troubleshooting

Troubleshooting Process

If your network analyzer does not pass performance verification, follow the steps in [Figure 5-1](#) to determine the cause of the failure and the correct action to take to correct the failure.

Figure 5-1 Troubleshooting Flowchart



test

Returning a Kit or Device to Agilent Technologies

If your kit or device requires service, contact Agilent Technologies for information on where to send it. See [Table 5-1](#) for contact information. Include a service tag (located at the back 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 including country code and area code
- the model number and serial number of the kit (if returning a complete kit)
- the part number and serial number of each device being returned
- the type of service required
- a *detailed* description of the problem (if applicable) and how the device was being used when the problem occurred

Contacting Agilent

Table 5-1 Contacting Agilent

Online assistance: www.agilent.com/find/assist			
United States <i>(tel)</i> 1 800 452 4844	Latin America <i>(tel)</i> (305) 269 7500 <i>(fax)</i> (305) 269 7599	Canada <i>(tel)</i> 1 877 894 4414 <i>(fax)</i> (905) 282-6495	Europe <i>(tel)</i> (+31) 20 547 2323 <i>(fax)</i> (+31) 20 547 2390
New Zealand <i>(tel)</i> 0 800 738 378 <i>(fax)</i> (+64) 4 495 8950	Japan <i>(tel)</i> (+81) 426 56 7832 <i>(fax)</i> (+81) 426 56 7840	Australia <i>(tel)</i> 1 800 629 485 <i>(fax)</i> (+61) 3 9210 5947	Singapore <i>(tel)</i> 1 800 375 8100 <i>(fax)</i> (65) 836 0252
Malaysia <i>(tel)</i> 1 800 828 848 <i>(fax)</i> 1 800 801 664	Philippines <i>(tel)</i> (632) 8426802 <i>(tel) (PLDT subscriber only):</i> 1 800 16510170 <i>(fax)</i> (632) 8426809 <i>(fax) (PLDT subscriber only):</i> 1 800 16510288	Thailand <i>(tel) outside Bangkok:</i> (088) 226 008 <i>(tel) within Bangkok:</i> (662) 661 3999 <i>(fax)</i> (66) 1 661 3714	Hong Kong <i>(tel)</i> 800 930 871 <i>(fax)</i> (852) 2506 9233
Taiwan <i>(tel)</i> 0800-047-866 <i>(fax)</i> (886) 2 25456723	People's Republic of China <i>(tel) (preferred):</i> 800-810-0189 <i>(tel) (alternate):</i> 10800-650-0021 <i>(fax)</i> 10800-650-0121	India <i>(tel)</i> 1-600-11-2929 <i>(fax)</i> 000-800-650-1101	

6 Replaceable Parts

Introduction

Table 6-1 lists the replacement part numbers for items included in the 85058V verification kit and Figure 6-1 illustrates the attenuators and beaded lines.

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

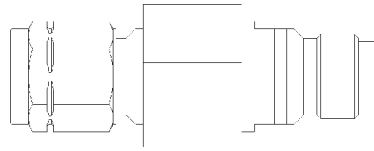
To order a listed part, note the description, the part number, and the quantity desired. Telephone or send your order to Agilent Technologies. See Table 5-1 on page 5-4 for contact information.

Table 6-1 Replaceable Parts for the 85058V 1.85 mm Verification Kit

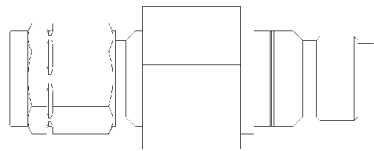
Description	Qty Per Kit	Agilent Part Number
Attenuators		
40 dB attenuator with data	1	85058-60125
10 dB attenuator with data	1	85058-60126
Beaded Lines		
50Ω beaded line with data	1	85058-60116
25Ω mismatch beaded line with data	1	85058-60117
Miscellaneous Items		
Storage unit:		
Box	1	5180-7899
Foam pad, bottom	1	85058-80127
Foam pad, top	1	5180-8490
Disk Holder	1	5180-8491
User's and service guide	1	85058-90007 ^a
Verification data disk (PNA Series)	1	85058-10004

a. See "Printing Copies of This Document" on page ii.

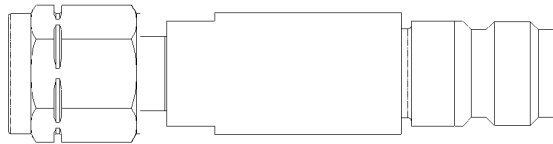
Figure 6-1 Component Identification Sheet for the 85058V



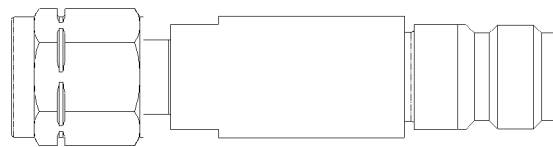
50 ohm Beaded Line



25 ohm Mismatch Beaded Line



10 dB Attenuator



40 dB Attenuator

Not Shown:

- Verification Data Disk
- User's and Service Guide
- Storage Unit

58v_components

Table 6-2 Items Not Included in the Verification Kit

Description	Qty	Agilent Part Number
Connector Gages (1.85 mm)		
Male connector gage set ^a	1	11752-60108
Female connector gage set ^a	1	11752-60107
Wrenches		
20 mm, 90N-cm (8 in-lb) torque	1	8710-1764
5/16 in, 90N-cm (8 in-lb) torque ^b	1	8710-1765
5/16 in, open-end wrench	1	8720-0015
Spanner wrench	1	08513-20014
ESD Protection Devices		
Grounding wrist strap	1	9300-1367
5 ft grounding cord for wrist strap	1	9300-0980
2 x 4 ft conductive table mat and 15 ft ground wire	1	9300-0797
ESD heel strap (for conductive floors)	1	9300-1308
Connector Cleaning Supplies		
Isopropyl alcohol	30 ml	8500-5344
Cleaning swabs	100	9301-1243

a. Included in the 85058B 1.85 mm Calibration Kit.

b. Included in both the 85058B and the 85058E 1.85 mm Calibration Kits.

A Microwave Connector Care

Principles of Microwave Connector Care

Proper connector care and connection techniques are critical for accurate, repeatable measurements.

Refer to the calibration kit documentation for connector care information. Prior to making connections to the network analyzer, carefully review the information about inspecting, cleaning, and gaging connectors.

Having good connector care and connection techniques extends the life of these devices. In addition, you obtain the most accurate measurements.

For additional connector care instruction, contact the nearest Agilent Technologies sales or service office about course numbers HP/Agilent 85050A+24A and 85050A+24D.

See the following table for quick reference tips about connector care.

Table A-1. Connector Care Quick Reference

Handling and Storage	
Do	Do Not
Keep connectors clean Extend sleeve or connector nut Use plastic end-caps during storage	Touch mating-plane surfaces Set connectors contact — end down
Visual Inspection	
Do	Do Not
Inspect all connectors carefully Look for metal particles, scratches, and dents	Use a damaged connector — ever
Connector Cleaning	
Do	Do Not
Try compressed air first Use isopropyl alcohol Clean connector threads	Use any abrasives Get liquid into plastic support beads
Gaging Connectors	
Do	Do Not
Clean and zero the gage before use Use the correct gage type Use correct end of calibration block Gage all connectors before first use	Use an out-of-spec connector
Making Connections	
Do	Do Not
Align connectors carefully Make preliminary connection lightly Turn only the connector nut Use a torque wrench for final connect	Apply bending force to connection Over tighten preliminary connection Twist or screw any connection Tighten past torque wrench “break” point

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