1 General Information

Calibration Kit Overview

The Agilent 85052B 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 85052B calibration kit includes the following items:

- user's and service guide
- offset opens and shorts, broadband loads and sliding load terminations
- 3.5 mm gage set
- three 3.5 mm adapters
- 5/16 in, 90 N-cm (8 in-lb) torque wrench
- open-end wrench
- two data disks that contain the calibration definitions 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.

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 beads are designed to minimize return loss and are separated far enough so that interaction between the beads is minimized. 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.

Sliding Loads

The sliding loads in this kit are designed to provide excellent performance from 3 GHz to 26.5 GHz. The inner and outer conductors of the airline portion are precision machined to state-of-the-art tolerances. Although the sliding load has exceptional return loss, its superior load stability qualifies it as a high-performance device.

The sliding load was designed with the ability to extend the inner conductor for connection purposes and then pull it back to a preset pin depth. This feature is critical since it minimizes the possibility of damage during the connection, while maintaining a minimum pin depth to optimize performance.

Calibration Definitions

The calibration kit must be selected and the calibration definitions for the devices in the kit installed in the network analyzer prior to performing a calibration. Refer to your network analyzer user's guide for instructions on selecting the calibration kit and performing a calibration.

The calibration definitions can be:

- resident within the analyzer
- loaded from the provided disk
- entered from the front panel

This Calibration Kit Supports the Following Network Analyzers

The calibration definitions for the kit are permanently installed in the internal memory or hard disk of the following network analyzers.

8719ET/ES	8753/ET/ES
8720ET/ES	PNA Series
8722ET/ES	

If this calibration kit is used with other network analyzers, the calibration definitions must be manually entered into the network analyzer. Refer to your network analyzer user's guide for instructions.

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 on page 2-4 for typical and observed pin depth limits.

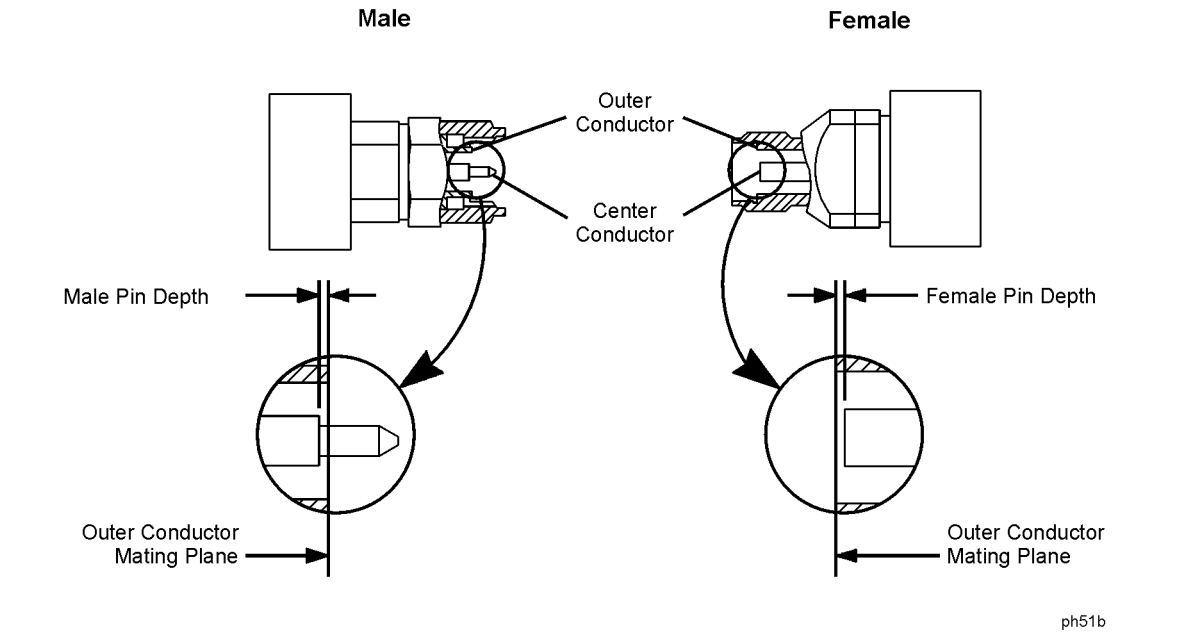
Pin Depth

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 +0.00006 to –0.00116 in
Adapter	–0.0025 to –0.0254 mm 0 to –0.0010 in	+0.0041 to –0.0041 mm +0.00016 to –0.00016 in	+0.0016 to –0.0295 mm +0.00006 to –0.00116 in
Sliding loads	0 to –0.0076 mm 0 to –0.00030 in	+0.0041 to –0.0041 mm +0.00016 to –0.00016 in	+0.0041 to –0.0117 mm +0.00016 to –0.00046 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 85052B 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
Sliding loads[a]	Return loss ≥ 44 dB (ρ ≤ 0.00631)	> 3 to ≤ 26.5
Offset opens[b]	± 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[b]	± 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 sliding load termination include the quality of the airline portions within the sliding load combined with the effective stability of the sliding element.

b. 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).