85056K Calibration Kit

1 General Information

Calibration Kit Overview

The Agilent 85056K 2.4 mm/2.92 mm calibration kit was designed to give network analyzer systems with 2.4 mm test ports the ability to perform measurements on devices with 2.92 mm connectors. The kit can be used to achieve calibrated measurements of 2.92 mm devices up to 40 GHz, and 2.4 mm devices up to 50 GHz.

Kit Contents

The 85056K calibration kit includes the following items:

- User's and Service Guide
- 2.4 mm offset opens and shorts
- 2.4 mm broadband terminations
- 2.4 mm to 2.4 mm adapters
- 2.4 mm to 2.92 mm adapters
- 5/16 in, 90 N-cm (8 in-lb) torque wrench
- 5/16 in, 56 N-cm (5 in-lb) torque wrench
- 7 mm open-end wrench
- data disk that contain the calibration definitions of the devices in the calibration kit (only for the 8510-series network analyzers)
- a data disk set that contains specifications and performance verification software for the 8510-series network analyzers.

Broadband Loads

The broadband loads are metrology-grade, 50Ω terminations that have been optimized for performance up to 50 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, allowing them to be used in calibration procedures for non-insertable devices.

Sliding Loads (Option 001 only)

The sliding loads in this kit are designed to provide excellent performance from 4 GHz to 50 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 connection, while maintaining a minimum pin depth to optimize performance.

Compatible Network Analyzers

The 85056K calibration kits are intended to be used with the following Agilent network analyzers:

- 8510
- 872*x* Series
- 8753 Family
- PNA Series

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

Options

The following options are available for the 85056K:

Option 001

Includes the following items:

- 2.4 mm sliding loads
- 2.4 mm connector gages
- Centering Bead (for gaging 2.4 mm sliding loads)

2 Specifications

Environmental Requirements

Table 2-1 Environmental Requirements

Parameter	Limits
Operating temperature[a]	+20 °C to +26 °C (+68 °F to +79 °F)
Error-corrected temperature range[b]	±1 °C of measurement calibration temperature
Storage temperature	–40 °C to +75 °C (–40 °F to +167 °F)
Altitude	
Operation	< 4,500 meters (≈15,000 feet)
Storage	< 15,000 meters (≈50,000 feet)
Relative humidity	Always non-condensing
Operation	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," 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.

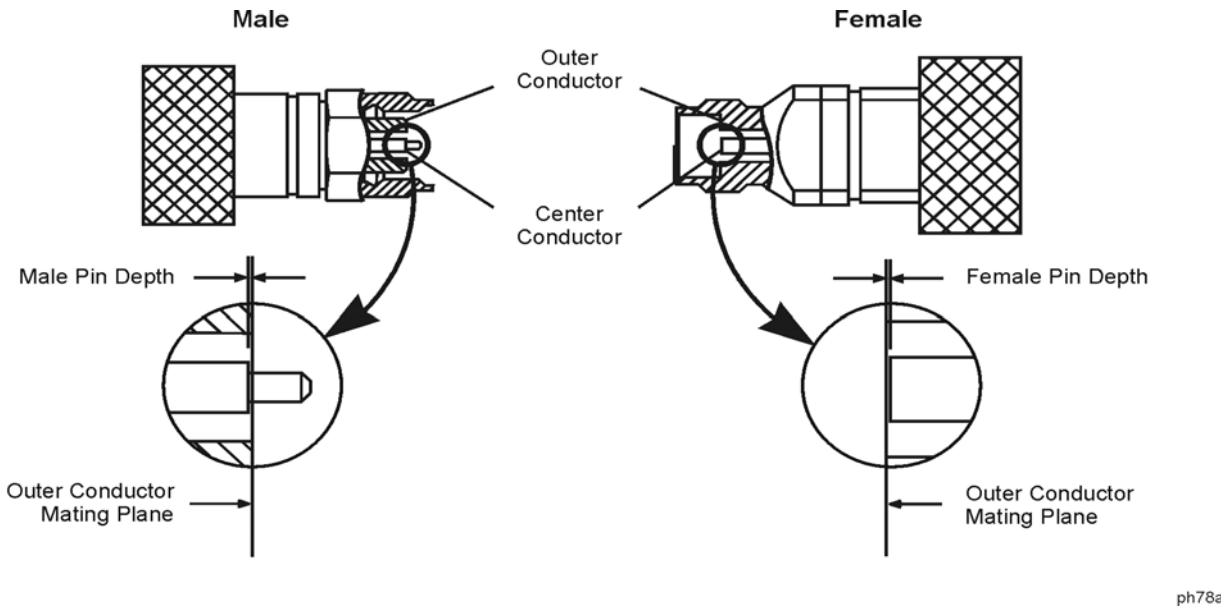
Pin Depth

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	+0.0030 to –0.0030 mm +0.00012 to –0.00012 in	+0.0030 to –0.0157 mm +0.00012 to –0.00062 in
Shorts	0 to –0.0127 mm 0 to –0.00050 in	+0.0015 to –0.0015 mm +0.00006 to –0.00006 in	+0.0015 to –0.0142 mm +0.00006 to –0.00056 in
Fixed loads	–0.0025 to –0.0203 mm –0.00010 to –0.00080 in	+0.0030 to –0.0030 mm +0.00012 to –0.00012 in	+0.0005 to –0.0234 mm +0.00002 to –0.00092 in
Sliding loads	0 to –0.0127 mm 0 to –0.00050 in	+0.0015 to –0.0015 mm +0.00006 to –0.00006 in	+0.0015 to –0.0142 mm +0.00006 to –0.00056 in
Adapters (2.4 to 2.4)	0 to –0.0381 mm 0 to –0.00150 in	+0.0030 to –0.0030 mm +0.00012 to –0.00012 in	+0.0030 to –0.0411 mm +0.00012 to –0.00162 in
Adapters (2.4 to 2.92)[c]	0 to –0.0381 mm 0 to –0.00150 in	+0.0030 to –0.0030 mm +0.00012 to –0.00012 in	+0.0030 to –0.0411 mm +0.00012 to –0.00162 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.
c. The 2.4 mm to 2.92 mm adapters require a 3.5 mm connector gage to measure the 2.92 mm end. Refer to Table 6-2 for Agilent part numbers and ordering information.

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 85056K Calibration Kit

Device	Specification	Frequency (GHz)
Broadband loads (male and female)	Return loss ≥ 42 dB (ρ ≤ 0.00794) Return loss ≥ 34 dB (ρ ≤ 0.01995) Return loss ≥ 30 dB (ρ ≤ 0.03162) Return loss ≥ 26 dB (ρ ≤ 0.05019)	dc to ≤ 4 > 4 to ≤ 20 > 20 to ≤ 26.5 > 26.5 to ≤ 50
Sliding loads[a,b] (male and female)	Return loss ≥ 42 dB (ρ ≤ 0.00794) Return loss ≥ 40 dB (ρ ≤ 0.01000) Return loss ≥ 38 dB (ρ ≤ 0.01259) Return loss ≥ 36 dB (ρ ≤ 0.01585)	4 to ≤ 20 > 20 to ≤ 36 > 36 to ≤ 40 > 40 to ≤ 50
Adapters (2.4 mm to 2.4 mm)	Return loss ≥ 32 dB (ρ ≤ 0.02512) Return loss ≥ 30dB (ρ ≤ 0.03162) Return loss ≥ 25dB (ρ ≤ 0.05623) Return loss ≥ 20 dB (ρ ≤ 0.10000)	dc to ≤ 4 > 4 to ≤ 26.5 > 26.5 to ≤ 40 > 40 to ≤ 50
Adapters[c] (2.4 mm to 2.92 mm)	Return loss ≥ 24 dB (ρ ≤ 0.06310)	dc to ≤ 40
Offset opens[d] (male and female)	± 0.5 ° deviation from nominal ± 1.25 ° deviation from nominal ± 1.75 ° deviation from nominal ± 2.25 ° deviation from nominal	dc to ≤ 2 > 2 to ≤ 20 > 20 to ≤ 40 > 40 to ≤ 50
Offset shorts[d] (male and female)	± 0.5 ° deviation from nominal ± 1.25 ° deviation from nominal ± 1.5 ° deviation from nominal ± 2.0 ° deviation from nominal	dc to ≤ 2 > 2 to ≤ 20 > 20 to ≤ 40 > 40 to ≤ 50

a. For Option 001 only
b. The specifications for the sliding load termination include the quality of the airline portions within the sliding load combined with the effective stability element.
c. The 2.4 mm to 2.92 mm adapters are tested two at at time (connected together) at the factory.
d. 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".

Supplemental Electrical Characteristics

Table 2-4 lists the typical electrical characteristics of the 2.4 mm to 2.92 mm adapters in this kit. Values in this table are *not* specifications, but are intended to provide useful application information by giving typical, but non-warranted, performance parameters.

Table 2-4 2.4 mm to 2.92 mm adapter Characteristics

Frequency (GHz)	Parameter	Typical Value
DC to ≤ 2	Return Loss	≥ 38 dB (≤ 0.01259 ρ)
> 2 to ≤ 20	Return Loss	≥ 35 dB (≤ 0.01778 ρ)
> 20 to ≤ 40	Return Loss	≥ 30 dB (≤ 0.03162 ρ)
DC to ≤ 40	Electrical Length	39.631 ps ±0.14 ps
DC to ≤ 40	Insertion Loss	< 0.075 dB (> 0.99140 ρ)

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 8510 *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," for more information.