2.4 mm Adaptors and Calibration Accessories

KEYSIGHT

OPERATING NOTE

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Warranty

Custom systems are warranted by contractual agreement between Keysight Technologies and the customer.

Certification

Keysight Technologies certifies that this product met its published specifications at the time of shipment from the factory.

Documentation Warranty

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Assistance

Product maintenance agreements and other customer assistance agreements are available for Keysight Technologies products.

For assistance, call your local Keysight Technologies Sales and Service Office (refer to “Service and Support” on page iv).

Service and Support

You can find a list of local service representatives on the Web at:

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

Safety and Regulatory Information

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. This product has been designed and tested in accordance with international standards.

WARNING

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

CAUTION

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

Instrument Markings

	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The C-Tick mark is a registered trademark of the Australian Spectrum Agency.
	The CSA mark is a registered trademark of the Canadian Standards Association.

1SM1-A		This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPER 11, Clause 4).
		This symbol indicates that the power line switch is ON.
		This symbol indicates that the power line switch is OFF or in STANDBY position.

Safety Earth Ground 

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Before Applying Power

Verify that the product is configured to match the available main power source as described in the input power configuration instructions in this manual. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

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Overview

This document applies to Keysight slotless 2.4 mm coaxial to waveguide adapters, calibration accessories, between-series adapters, and within-series adapters.

For general information about the care and maintenance of these and similar types of connectors, refer to the *Microwave Connector Care Quick Reference Card* (part no. 08510-90360).

Receiving Inspection

Inspect the packaging and all parts for damage. Keep all packaging materials for return shipment, if necessary. If any part is missing or damaged, notify the carrier and your nearest Keysight Technologies office immediately.

Storage and Shipping Environment

NOTE

Storage or operation within an environment other than that specified below may cause damage to the product and may void the warranty.

The products should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment.

Temperature	–55° to +75 °C
Relative humidity	less than 95% at +40 °C
Altitude	less than 15,300 m (50,000 ft)

Operating Environment

The operating environment should be within the following limitations.

Temperature	0 to +55 °C
Relative humidity	less than 95% at +40 °C
Altitude	less than 4600 m (15,000 ft)

Specifications and Model Numbers

These characteristics provide information useful in applying the device using typical, non-warranted performance parameters. These are denoted as typical, nominal, or approximate.

All of these products have metrology grade 2.4 mm connectors. They are compatible with OS-50 (from M/A-COM Omni Spectra) and APC-2.4 (from Amphenol Products) connectors.

Table 1 Waveguide Adapters

Type	Sex	Waveguide	Model	Frequency (GHz)	Return Loss[1]	Repeatability[2] (Typically Better Than)
2.4 mm	female	WR-28	R281A	26.5 to 40	≥24 dB	–50 dB
2.4 mm	male		R281B	26.5 to 40	≥24 dB	–50 dB
2.4 mm	female	WR-22	Q281A	33 to 50	≥22 dB	–50 dB
2.4 mm	male		Q281B	33 to 50	≥22 dB	–50 dB

1. At the 2.4 mm port only.
2. Repeatability = 20 Log $|\Delta\Gamma|$ where $|\Delta\Gamma| = |\Gamma m_1 - \Gamma m_2|$. This is the difference between two measurements Γm_1, and Γm_2 before and after one disconnect/connect cycle. Repeatability depends upon proper torque and pin-depth.

Table 2 Calibration Accessories (dc to 50 GHz)

Type	Sex	Model	Electrical Specifications	Repeatability[1] (Typically Better Than)
2.4 mm short	male	85140A	At 50 GHz, 6 ° from nominal [2,3]	–50 dB
2.4 mm short	female	85140B	At 50 GHz, 6 ° from nominal [2,3]	–50 dB
2.4 mm short	male	85141A	At 50 GHz, 6 ° from nominal [3,4]	–44 dB
2.4 mm short	female	85141B	At 50 GHz, 6 ° from nominal [3,4]	–44 dB
2.4 mm 50 Ω Termination	male	85138A	≥30 dB (dc to 26.5 GHz) ≥25 dB (26.5 to 40 GHz) ≥20 dB (40 to 50 GHz)	–40 dB
2.4 mm 50 Ω Termination	female	85138B	≥30 dB (dc to 26.5 GHz) ≥25 dB (26.5 to 40 GHz) ≥20 dB (40 to 50 GHz)	–40 dB

1. Repeatability = 20 Log $|\Delta\Gamma|$ where $|\Delta\Gamma| = |\Gamma m_1 - \Gamma m_2|$. This is the difference between two measurements Γm_1, and Γm_2 before and after one disconnect/connect cycle. Repeatability depends upon proper torque and pin-depth.
2. This specification applies to the location of the effective shorting plane.
3. Nominal, in this case, is the center of the distribution of all parts manufactured over time.
4. The phase shift of any Keysight 85141A/B open relative to any Keysight 85140A/B short is 180° 12°.

Table 3 Adapters

Type (from)	Type (to)	Model	Return Loss[1]	Repeatability[1,2] (Typically Better Than)
2.4 mm (male)	2.4 mm (male)	11900A	≥32 (dc to 26.5 GHz)	–50 dB
2.4 mm (female)	2.4 mm (female)	11900B	≥25 (26.5 to 40 GHz)	–45 dB
2.4 mm (male)	2.4 mm (female)	11900C	≥20 (40 to 50 GHz)	–40 dB
2.4 mm (male)	APC 3.5 (male)	11901A	≥32 (dc to 26.5 GHz)	–45 dB
2.4 mm (female)	APC 3.5 (female)	11901B	≥28 (20 to 26.5 GHz)	–45 dB
2.4 mm (male)	APC 3.5 (female)	11901C	≥28 (20 to 26.5 GHz)	–45 dB
2.4 mm (female)	APC 3.5 (male)	11901D	≥28 (20 to 26.5 GHz)	–45 dB
2.4 mm (male)	APC 7[3]	11902A	≥30 (dc to 18 GHz)	–50 dB
2.4 mm (female)	APC 7[3]	11902B	≥30 (dc to 18 GHz)	–50 dB
2.4 mm (male)	Type-N (male)	11903A	≥28 (dc to 18 GHz)	–48 dB
2.4 mm (female)	Type-N (female)	11903B	≥28 (dc to 18 GHz)	–48 dB
2.4 mm (male)	Type-N (female)	11903C	≥28 (dc to 18 GHz)	–48 dB
2.4 mm (female)	Type-N (male)	11903D	≥28 (dc to 18 GHz)	–48 dB
2.4 mm (male)	K 2.92[4] (male)	11904A	≥24 (dc to 40 GHz)	–40 dB
2.4 mm (female)	K 2.92[4] (female)	11904B	≥24 (dc to 40 GHz)	–40 dB
2.4 mm (male)	K 2.92[4] (female)	11904C	≥24 (dc to 40 GHz)	–40 dB
2.4 mm (female)	K 2.92[4] (male)	11904D	≥24 (dc to 40 GHz)	–40 dB

1. At the 2.4 mm port only.
2. Repeatability = 20 Log $|\Delta\Gamma|$ where $|\Delta\Gamma| = |\Gamma m_1 - \Gamma m_2|$. This is the difference between two measurements Γm_1, and Γm_2 before and after one disconnect/connect cycle. Repeatability depend upon proper torque and pin-depth.
3. APC 7 is a U.S. registered trademark of the Bunker Ramo corporation.
4. The K connector is developed and manufactured by the Wiltron Company (Morgan Hill, CA).

Care, Connection and Torque

Stable and repeatable measurements can only be achieved if the devices are clean and undamaged. Careful and consistent connections are also necessary to achieve maximum stability and repeatability. Therefore, always handle the devices with care, do not overtighten them, and keep them properly stored when not in use.

Table 4 2.4 mm Metrology Grade Adapter Torques and Pin Depth

Connector Type	Torque (0.5 lb inch)	Torque Wrench Part Number	Pin Depth (male or female)	Connector Gage Kit Part Number	Protection End Cap Part Number
2.4 mm	8 lb in (90 N-cm)	8710-1765	0 to 0.0015 inch (0 to 0.038 mm)	85056-60018 (m) 85056-60017 (f)	1401-0202(f) 1401-0095 (m)
K 2.92 mm	8 lb in (90 N-cm)	8710-1765	0 to 0.002 inch (0 to 0.05 mm)	85052-60042 (m) 85052-60043 (f)	1401-0202(f) 1401-0208 (m)
3.5 mm	8 lb in (90 N-cm)	8710-1765	0 to 0.002 inch (0 to 0.05 mm)	85052-60042 (m) 85052-60043 (f)	1401-0202(f) 1401-0208 (m)
7 mm	12 lb in (136 N-cm)	8710-1766	Without Collet: 0 to 0.002 inch (0 to 0.05 mm)	85054-60049	1401-0123

Repair

If the product fails to operate within the specifications listed in the data sheet, contact Keysight for information on repair or replacement.

NOTE

Attempting to service or repair the product may void the warranty.

Notes

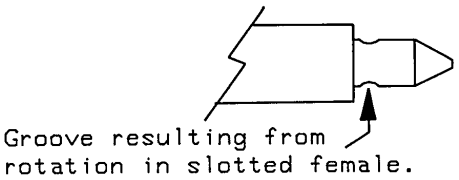

Figure 1 Male Pin Grooving

Always inspect male pins for damage. The male pin may have a groove worn in it (Figure 1). This groove is the result of improper connection techniques. For example, rotating the connector body instead of the nut will cause the male pin to rotate in the female pin. This will cause a groove to wear into the male pin. If a damaged pin is used, it may cause bad contact, resulting in measurement errors. Also, it may get stuck in the slotless female and it may cause permanent damage to it.

NOTE

Note the appearance of undamaged slotless female contact (3.5 mm has 6 fingers, and 2.4 mm has 4 fingers). Inspect them periodically to be sure they are clean, symetrical, and undamaged.

Recommendation

When the devices are first received, measure their S-parameters on a calibrated Keysight 8510 network analyzer. Keep a record of the results and periodically remeasure them. This will allow you to monitor their performance compared to the new condition.

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