Maury Microwave

User Guide

7mm Coaxial Calibration Kit

DC to 18 GHz

Models: 2650CK10
2650CK20

2650-511 (A) 3/15

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2650CK20

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Warranty

Maury Microwave hardware products are warranted against defects in materials and workmanship for a period of one year from date of shipment. During the warranty period, Maury Microwave will, at its option, either repair or replace products which prove to be defective.

Maury Microwave software products are warranted against defects in material and workmanship of the media on which the product is supplied for a period of ninety (90) days from date of shipment. Maury also warrants that the product shall operate substantially in accordance with published specifications during the same warranty period. During the warranty period, Maury Microwave will, at its option, either repair or replace products which prove to be defective. Maury does not warrant that the operation of the product shall be uninterrupted or error-free.

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General Information

Calibration Kit Description

This series of **7mm** coaxial calibration kits is designed to provide accurate calibrations of network analyzers in the **DC to 18.0 GHz** range. Each of these kits includes all the necessary calibration standards and associated hardware needed for the accurate calibration of most network analyzers.

Refer to the ***Calibration Kits*** *Contents* section (see Appendix, Date Sheet Resources) for information on included components and available kit options.

NOTE: This document, calibration constants software, and data sheet can be downloaded from our website: ***maurymw.com***

NOTE: Legacy analyzer software is not on our website but is available for purchase.

Maintenance

This calibration kit is relatively maintenance free if the components are handled with the same care that is appropriate to all precision equipment. As with any precision component, proper care should be taken to assure clean mating surfaces, correct alignment when mating, and proper torquing of connectors or waveguide coupling screws. To help maintain the integrity of the components in this kit, routine visual inspection and cleaning of mating surfaces is recommended. Failure to do so may result in degraded repeatability and accuracy, as well as damage any mated devices.

Calibration

To maintain verification that a calibration kit is performing to traceable specifications, we recommend that all kits be periodically returned to Maury Microwave for calibration. The typical calibration cycle is one year, although actual need may vary depending on usage.

Supporting Test Port Adapters

When configuring a test setup, be sure that damaging stresses are not applied to the connectors on the test set. This is particularly critical when the attached components are heavy or long. Always properly support the test port adapters being used.

Electrostatic Discharge Precautions

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

When handling the connectors on the test set, be aware that you are coming in contact with exposed center conductors that are connected directly to the static-sensitive internal circuits of the network analyzer. Make sure that you and your equipment are well-grounded before inspecting, cleaning, or making connections to test set ports. Standard ESD precautions, such as the use of grounded wrist straps and grounded antistatic mats, are recommended.

Connector Description

All calibration standards and adapters in the 2650 series kits utilize the Maury Microwave Precision 7mm Connector, which is compliant with IEEE standard 287 for instrument-grade general precision connectors (GPC7).

Connector Care

Precision connectors must be handled carefully if accurate calibrations and measurements are to be obtained. All connectors should be inspected prior to each use. For optimum measurement results, all interfaces should be visually inspected under magnification and cleaned on a regular basis. Proper connector contact pin depths should also be verified through regular inspections using a connector gage, such as the Maury Microwave A028D connector gage kit, to insure that the connectors on both calibration devices and devices under test (DUTs) have contact pin depths within recommended tolerances. Refer to Maury data sheet ***5E-060*** (available on our website) for proper pin depth specifications.

Care should be used whenever aligning connectors. Tighten connector coupling nuts using an appropriate torque wrench while holding the opposing connector with an open-end wrench.

When disconnecting devices, take care not to rock or bend any of the connections. Disconnect devices by disengaging the coupling nuts and gently pulling the connectors apart in a straight line.

Always use protective covers on all connectors when devices are not in use.

Should a connector become damaged, it should be repaired before it is used any further or replaced immediately. A damaged connector can damage other mated connectors.

Connector Tightening

Damage to a calibration device or attaching connector can occur if the device is turned instead of the connector nut. ALWAYS turn the nut when making connections. Never turn the device itself.

Always use a torque wrench (Maury model **2698C2**) to final-tighten all connections. This will insure calibration accuracy and measurement repeatability.

When making connections, a **3/4 inch** open-end wrench may be required to hold the body of one device stationary while torquing the nut on the other device or cable. This open-end wrench is supplied with this calibration kit for this purpose.

Using the torque wrench, hand-tighten the connection to be torqued by holding the calibration device steady and turning only the nut.

- Hold the torque wrench with your thumb and index finger, behind the groove in the handle (see **Figure 1**).
- Tighten the connection until the ball in the handle crests on the cam (as the handle begins to break). Do not "fully break" the handle of the torque wrench to reach the specified torque.
- Reverse the previous procedure to disconnect the connection.

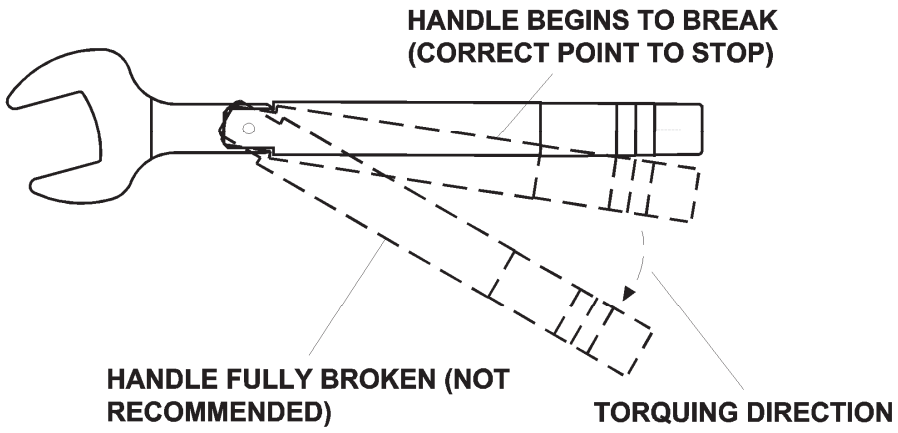

Figure 1. Using the Torque Wrench

Description of Sliding Termination

The model 2517H precision 7mm sliding termination is used as a 50 ohm impedance standard and is included in the 2650CK20 series cal kits. It covers the frequency range of 2 to 18 GHz and travels λ/2 wave at 2 GHz.

Connecting the Sliding Termination

NOTE: The model 2517H should be properly supported when connected to the device to be tested to avoid stress at the connector joint.

The sliding load should first be connected to the 7mm short circuit calibration device to establish a precise physical alignment of the center and outer conductors (flush set technique). The center conductor is then locked in place using the rear lock nut. The short is then removed and the sliding load is connected directly to the test port. Use a torque wrench to tighten the coupling nut.

Traditionally, the sliding load is connected directly to the test port with the center conductor fully compressing the collet of the test port connector. This is not the condition of the test port collet during device measurements and the difference in conditions produces a systematic error (which is large enough to compromise the performance specifications of the VNA). Therefore, always use the flush set technique. The short is the best device to use in the procedure because it provides a completely flat reference plane and results in a pin depth between 0.0000 and -0.0003.

CAUTION: Do not exert excessive axial pressure or bowing of the center conductor may result.

Using the Sliding Termination

The sliding termination has radial rings for the sliding ring to ride over. The sliding ring is set using these rings as detents. The sliding ring is moved from mark to mark during calibration using the detents as set points.

Move the sliding ring forward as far as possible toward the connector end of the sliding termination.

Move the sliding ring back until you feel it detent at the first set mark. This is the first calibration position.

Continue to set the sliding ring to all of the seven positions. This completes the calibration sequence.

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Calibration Kit Contents

Standard Components – 2650CK10

1 ea	Short, fixed	2615D3
1 ea	Open, fixed	2616D3
1 ea	Fixed Termination	2610F
1 ea	Case Assembly	

Standard Components – 2650CK20

1 ea	Short, fixed	2615D3
1 ea	Open, fixed	2616D3
1 ea	Fixed Termination	2610F
1 ea	Sliding Termination	2517H
1 ea	3/4 Torque Wrench, 12in.lbs	2698C2
1 ea	Case Assembly	

Anritsu Network Analyzers

Table 1. Male Standard Definitions for Anritsu

Male Open Device	
C0	92.85 e-15
C1	0.0 e-27
C2	7.20 e-36
C3	4.30 e-45
Offset Length	0.000 cm
Serial Number	00000

Male Short Device	
Offset Length	0.000 cm
Serial Number	00000

Table 2. Female Standard Definitions for Anritsu

Female Open Device	
C0	92.85 e-15
C1	0.0 e-27
C2	7.20 e-36
C3	4.30 e-45
Offset Length	0.000 cm
Serial Number	00000

Female Short Device	
Offset Length	0.000 cm
Serial Number	00000

For specific loading instructions, see ***Anritsu loading instructions,*** which can be downloaded from our website: ***maurymw.com***.

Table 3. Standard Definitions for Keysight

Standard (1)			C0 x10^{-15} F	C1 x10^{-27} F/Hz	C2 x10^{-36} F/Hz^2	C3 x10^{-45} F/Hz^3	Fixed or Sliding (2)	Offset			Frequency GHz		Coax or W/G	Standard Label
	Type	Description	L0 x10^{-12} H	L1 x10^{-24} H/Hz	L2 x10^{-33} H/Hz^2	L3 x10^{-42} H/Hz^3		Delay ps	Z_0 (3) Ω	Loss (4) GΩ/s	Min	Max		
	Short	2615D3 Short						0.0	50	0.0	0.0	999.0	Coax	2615D3
	Open	2616D3 Open	92.85	0.0	7.2	4.3		0.0	50	0.0	0.0	999.0	Coax	2616D3
	Load	2610( ) Broadband Load					Fixed	0.0	50	0.0	0.0	999.0	Coax	2610( ) BB
	Load	2517H Sliding Load					Sliding	0.0	50	0.0	1.999	999.0	Coax	2517H Sliding
	Thru	Thru (0 cm)						0.0	50	0.0	0.0	999.0	Coax	Thru(5)
	Load	2610( ) Lowband Load					Fixed	0.0	50	0.0	0.0	2.001	Coax	2610( ) LB

(1) Open, short, load, delay/thru, or arbitrary impedance.
(2) Load or arbitrary impedance only.
(3) Z_0 normalized.
(4) Skin loss factor, normalized at 1 GHz.
(5) Test ports connected directly.

For specific loading instructions, see ***Keysight loading instructions***, which can be downloaded from our website: ***maurymw.com***

Rohde & Schwarz Network Analyzers

Table 4. Standard Definitions for Rohde & Schwarz

Through	
Label	= Thru (0cm)
Min Freq	= 0 Hz
Max Freq	= 18.0 GHz
Length	= 0.0 mm
Loss	= 0.0 dB/$\sqrt{GHz}$
Short	
Label	= 2615D3
Min Freq	= 0 Hz
Max Freq	= 18.0 GHz
Length	= 0.0 mm
Loss	= 0.0 dB/$\sqrt{GHz}$
Open	
Label	= 2616D3
Min Freq	= 0 Hz
Max Freq	= 18.0 GHz
Length	= 0.0 mm
Loss	= 0.0 dB/$\sqrt{GHz}$
C0	= 92.85 fF
C1	= 0.0 fF/GHz
C2	= 0.0072 fF/GHz^2
C3	= 0.0043 fF/GHz^3
Match	
Label	= 2610F
Min Freq	= 0 Hz
Max Freq	= 18.0 GHz
Sliding Match	
Label	= 2517H
Min Freq	= 1.999 GHz
Max Freq	= 18.0 GHz

For specific loading instructions, see ***Rohde & Schwarz loading instructions***, which can be downloaded from our website: ***maurymw.com***.

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Appendix

Data Sheet Resources

2Z-060 – 7mm Calibration Kits
http://maurymw.com/pdf/datasheets/2Z-060.pdf

2Y-001 – Connector Gages and Connector Gage Kits
http://maurymw.com/pdf/datasheets/2Y-001.pdf

2Y-005 – Metrology Grade 7mm Connector Gage Kit
http://maurymw.com/pdf/datasheets/2Y-005.pdf

2Y-050A – Torque Wrenches
http://maurymw.com/pdf/datasheets/2Y-050A.pdf

5E-060 – Precision 7mm Coaxial Connectors
http://maurymw.com/pdf/datasheets/5E-060.pdf

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Web Resources

Maury Calibration Kits
http://maurymw.com/Precision/VNA_Cal_Kits.php

Maury Precision Coaxial and Waveguide-to-Coaxial Adapters
http://maurymw.com/Finder/Adapter_Finder.php

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