

User Guide

TNC

Coaxial Calibration Kit

DC to 18 GHz

**Models: 2950CK40/41
2950CK20/21**



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General Information 1

- Calibration Kit Description..... 1*
- Maintenance..... 1*
- Calibration 1*
- Supporting Test Port Adapters..... 1*
- Electrostatic Discharge Precautions 1*
- Connector Description..... 2*
- Connector Care..... 2*
- Connector Tightening..... 3*
- Calibration Kit Contents 4*

Standard Definitions 5

- Anritsu Network Analyzers..... 5*
- Keysight Network Analyzers 7*
- Rohde & Schwarz Network Analyzers 8*

Appendix..... 10

- Data Sheet Resources..... 10*

Contacts..... 11

Tables

Table 1. Male Standard Definitions for Anritsu.....	5
Table 2. Female Standard Definitions for Anritsu.....	5
Table 3. Standard Definitions for Keysight	7
Table 4. Standard Definitions for Rohde & Schwarz	8

Figures

Figure 1. Using the Torque Wrench	3
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Calibration Kit Description

This series of **TNC** 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

The Maury **TNC** connectors supplied in this kit fully comply with the interface requirements of MIL-C-348B. All connector bodies are fabricated from stainless steel for strength and wear resistance. These connectors were developed using optimized HFSS simulation to provide extremely low VSWR, up to 18 GHz. For interface specifications on these connectors, please see Maury data sheet [5E-056](#).

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 A012G 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-056](#) (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 **2698G1**) to final-tighten all connections. This will insure calibration accuracy and measurement repeatability.

When making connections, a **7/16 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.

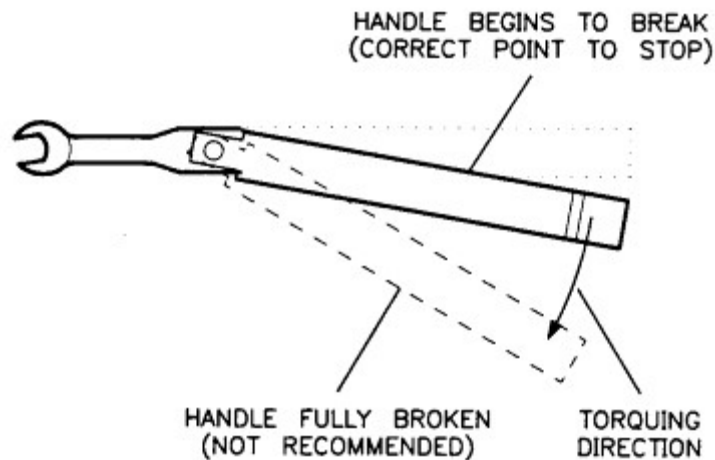


Figure 1. Using the Torque Wrench

Calibration Kit Contents**Standard Components – 2950CK40**

1 ea	Short, female	2946A
1 ea	Short, male	2947A
1 ea	Open, female	2948A
1 ea	Open, male	2948B
1 ea	Fixed Termination, female	2931A
1 ea	Fixed Termination, male	2931B
1 ea	Case Assembly	

Standard Components – 2950CK41

1 ea	Short, female	2946A
1 ea	Short, male	2947A
1 ea	Open, female	2948A
1 ea	Open, male	2948B
1 ea	Fixed Termination, female	2931A
1 ea	Fixed Termination, male	2931B
1 ea	Adapter, male to male	2921B
1 ea	Adapter, female to male	2921C
1 ea	Adapter, female to female	2921A
1 ea	Case Assembly	

Standard Components – 2950CK20

1 ea	Short, female	2946A
1 ea	Short, male	2947A
1 ea	Open, female	2948A
1 ea	Open, male	2948B
1 ea	Fixed Termination, female	2931A
1 ea	Fixed Termination, male	2931B
1 ea	Sliding Termination, female	2935A
1 ea	Sliding Termination, male	2935B
1 ea	9/16 Torque Wrench, 12in.lbs	2698G1
1 ea	Wrench, 7/16	8770Z7
1 ea	Case Assembly	

Standard Components – 2950CK21

1 ea	Short, female	2946A
1 ea	Short, male	2947A
1 ea	Open, female	2948A
1 ea	Open, male	2948B
1 ea	Fixed Termination, female	2931A
1 ea	Fixed Termination, male	2931B
1 ea	Adapter, male to male	2921B
1 ea	Adapter, female to male	2921C
1 ea	Adapter, female to female	2921A
1 ea	Sliding Termination, female	2935A
1 ea	Sliding Termination, male	2935B
1 ea	9/16 Torque Wrench, 12in.lbs	2698G1
1 ea	Wrench, 7/16	8770Z7
1 ea	Case Assembly	

Standard Definitions

Anritsu Network Analyzers

Table 1. Male Standard Definitions for Anritsu

Male Open Device		
	C0	102.000 e-15
	C1	-325.000 e-27
	C2	140.000 e-36
	C3	-2.500 e-45
	Offset Length	1.192 cm

Male Short Device		
	L0	-21.673 e-12
	L1	-9398.633 e-24
	L2	827.000 e-33
	L3	-20.600 e-42
	Offset Length	1.361 cm

Table 2. Female Standard Definitions for Anritsu

Female Open Device		
	C0	60.000 e-15
	C1	-3300.000 e-27
	C2	215.000 e-36
	C3	-4.900 e-45
	Offset Length	1.257 cm

Female Short Device		
	L0	-52.000 e-12
	L1	30043.000 e-24
	L2	-3195.000 e-33
	L3	95.500 e-42
	Offset Length	1.3190 cm

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

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Keysight Network Analyzers

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	Female Short	-52.0	30043	-3195	95.5		43.997	50	0.7	0.0	999.0	Coax	2946A
Open	Female Open	60.0	-3300	215.0	-4.9		41.91	50	0.7	0.0	999.0	Coax	2948A
Load	Broadband Female Load					Fixed	0.0	50	0.0	0.0	999.0	Coax	2931A BB
Thru	Thru						0.0	50	0.0	0.0	999.0	Coax	Thru ⁽⁵⁾
Load	Sliding Female Load					Sliding	0.0	50	0.0	1.999	999.0	Coax	2935A
Load	Lowband Female Load					Fixed	0.0	50	0.0	0.0	2.001	Coax	2931A LB
Short	Male Short	-21.6	-9398	827.0	-20.6		45.357	50	1.27	0.0	999.0	Coax	2947A
Open	Male Open	102.0	-325.0	140.0	-2.5		39.719	50	0.249	0.0	999.0	Coax	2948B
Load	Broadband Male Load					Fixed	0.0	50	0.0	0.0	999.0	Coax	2931B BB
Load	Sliding Male Load					Sliding	0.0	50	0.0	1.999	999.0	Coax	2935B
Load	Lowband Male Load					Fixed	0.0	50	0.0	0.0	2.001	Coax	2931B LB

⁽¹⁾ Open, short, load, delay/thru, or arbitrary impedance.

⁽²⁾ Load or arbitrary impedance only.

⁽³⁾ Z₀ 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

Short (M) Min Freq = 0 Hz Max Freq = 18.0 GHz Length = 13.61 mm Loss = 0.00535 dB/ $\sqrt{\text{GHz}}$ L0 = -21.6737 fH L1 = -9.39863 fH/GHz L2 = 0.81475 fH/GHz ² L3 = -0.02060 fH/GHz ³	Match (M) Min Freq = 0 Hz Max Freq = 18.0 GHz
Short (F) Min Freq = 0 Hz Max Freq = 18.0 GHz Length = 13.19 mm Loss = 0.00535 dB/ $\sqrt{\text{GHz}}$ L0 = -52.000 fH L1 = 30.043 fH/GHz L2 = -3.195 fH/GHz ² L3 = -0.095 fH/GHz ³	Match (F) Min Freq = 0 Hz Max Freq = 18.0 GHz
Open (M) Min Freq = 0 Hz Max Freq = 18.0 GHz Length = 11.92 mm Loss = 0.00509 dB/ $\sqrt{\text{GHz}}$ C0 = 102.0 fF C1 = -0.325 fF/GHz C2 = 0.104 fF/GHz ² C3 = -0.0025 fF/GHz ³	Sliding Match (M) Min Freq = 2.0 GHz Max Freq = 18.0 GHz
Open (F) Min Freq = 0 Hz Max Freq = 18.0 GHz Length = 12.57 mm Loss = 0.005 dB/ $\sqrt{\text{GHz}}$ C0 = 60.0 fF C1 = -3.300 fF/GHz C2 = 0.215 fF/GHz ² C3 = -0.0049 fF/GHz ³	Sliding Match (F) Min Freq = 2.0 GHz Max Freq = 18.0 GHz

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

Appendix

Data Sheet Resources

- 2Z-062A – AFTNC Calibration Kits
<http://maurymw.com/pdf/datasheets/2Z-062A.pdf>

- 5E-056 – Engineering Data, AFTNC Connectors
<http://maurymw.com/pdf/datasheets/5E-056.pdf>

- 5E-057A – TNC Compatibility Chart
<http://maurymw.com/pdf/datasheets/5E-057A.pdf>

- 2Y-028 – TNC MIL-SPEC and IEC Connector Gage Kit
<http://maurymw.com/pdf/datasheets/2Y-028.pdf>

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

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