

## User Manual

# 2.4mm Coaxial Calibration Kit

DC to 50 GHz

Models: FMCK1015  
FMCK1016



**FMCK1015**



**FMCK1016**

Fairview Microwave  
301 Leora Ln., Suite 100. Lewisville, TX 75056  
Tel: 1-800-715-4396 or (972) 649-6678  
Fax: (972) 649-6689  
[sales@fairviewmicrowave.com](mailto:sales@fairviewmicrowave.com) | [tech\\_support@fairviewmicrowave.com](mailto:tech_support@fairviewmicrowave.com)

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

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For warranty service or repair, all products must be returned to Fairview Microwave and must be issued a return authorization number by Fairview Microwave prior to shipment. Buyer shall prepay shipping charges to Fairview Microwave. Obligation is limited to the original Buyer.

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## General Information

### Calibration Kit Description

These Fairview Microwave 2.4mm coaxial calibration kits are designed to provide accurate calibrations of network analyzers in the DC to 50.0 GHz range. These kits include all the necessary calibration standards and associated hardware needed for the accurate calibration of most network analyzers. This manual applies to the following model numbers: FMCK1015 9-piece SOL (Short, Open, Load) calibration kit and FMCK1016 12-piece SOLT (Short, Open, Load, Through) calibration kit.

Refer to the [Calibration Kit Contents](#) section for information on included components and available kit options.

NOTE: This document, along with the kit data file and datasheet, can be downloaded from [fairviewmicrowave.com](http://fairviewmicrowave.com).

### 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 ensure clean mating surfaces, correct alignment when mating, and proper torqueing of connectors. To help maintain the integrity of the components in the 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 to any mated devices.

### Calibration

To maintain and certify the calibration kit's ongoing performance to specification, we recommend that all kits be periodically returned to Fairview Microwave for calibration. The typical calibration cycle is one year, although actual needs may vary depending on usage.

### Supporting Test Port Adapters

When configuring a test setup, ensure 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 into contact with exposed center conductors that are connected directly to the static-sensitive internal circuits of the network analyzer. Ensure 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

Precision 2.4mm connectors are miniature, instrument-grade, air-dielectric connectors that operate mode-free up to 50 GHz. They feature extremely low VSWR and insertion loss and are designed to non-destructively mate with standard 2.4mm connectors. These connectors generally have a high-performance support bead and comply with the proposed *IEEE Standard 287 for Precision Coaxial Connectors*.

## 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 optimal 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 kit to ensure that connectors on both calibration devices and devices under test (DUTs) have contact pin depths within recommended tolerances.

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 again or replaced immediately. A damaged connector can damage other mated connectors.

## Connector Tightening

Damage to a calibration standard or attaching connector can occur if the device is turned instead of the connector's coupling nut. ALWAYS turn the coupling nut when making connections. Never turn or spin the connectors.

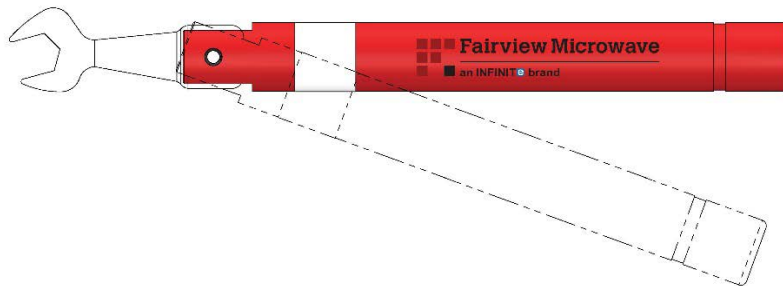
Always use a torque wrench (Fairview Microwave model ST-SMA-516-BO8A) to final-tighten all connections. This will ensure calibration accuracy and measurement repeatability.

When making connections, an open-end wrench is recommended 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 the calibration kit for this purpose.

### *Using the torque wrench:*

Hand-tighten the connection being torqued by holding the calibration device steady and turning only the coupling 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 over). Do not “fully break” the handle of the torque wrench to reach the specified torque.
- Reverse the previous procedure to disconnect.



Torque wrench handle will break over when preset torque is achieved.  
Take note of the wrench bit orientation relative to the direction of motion/rotation.

## Calibration Kit Contents

### Standard Components SOL – FMCK1015

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1 ea	Short, female	FMSC3010
1 ea	Short, male	FMSC3011
1 ea	Open, female	FMSC3025
1 ea	Open, male	FMSC3026
1 ea	Load, female	FMTR1055
1 ea	Load, male	FMTR1056
1 ea	1/4" X 5/16" Open-End Wrench	FMTL1001
1 ea	7/16" X 1/2" Wrench	FMTL1002
1 ea	5/16" Torque Wrench	ST-SMA-516-BO8A

### Standard Components SOLT – PECK1016

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1 ea	Short, female	FMSC3010
1 ea	Short, male	FMSC3011
1 ea	Open, female	FMSC3025
1 ea	Open, male	FMSC3026
1 ea	Load, female	FMTR1055
1 ea	Load, male	FMTR1056
1 ea	Thru, female to female	FMAD1123
1 ea	Thru, male to male	FMAD1124
1 ea	Thru, male to female	FMAD1125
1 ea	1/4" X 5/16" Open-End Wrench	FMTL1001
1 ea	7/16" X 1/2" Wrench	FMTL1002
1 ea	5/16" Torque Wrench	ST-SMA-516-BO8A

## Standard Definitions

Vector Network Analyzer hardware and test cables have a set of well understood systematic errors that affect the unprocessed measurements made by the instrument. The calibration standards in this kit have precisely-known electrical behavior, and during calibration the VNA software uses the raw measurement data and the known behavior of the standards to calculate the phase and magnitude of up to 12 complex error terms at each frequency point of the calibration. Once calibrated, the instrument applies Vector Error Correction to each data point measured.

Pasternack FMCK1015 and FMCK1016 2.4mm Calibration Kits Standards' Definitions				
Short (Male) FMSC3011				
	Rohde & Schwarz Units		Keysight & Anritsu Units	
Minimum Frequency	0	Hz		
Maximum Frequency	50	GHz		
Length	5.075	mm		
Delay			16.929	ps
Loss	0.00825	$dB/\sqrt{GHz}$	2.806	GΩ/s
Short (Female) FMSC3010				
Minimum Frequency	0	Hz		
Maximum Frequency	50	GHz		
Length	5.075	mm		
Delay			16.929	ps
Loss	0.00825	$dB/\sqrt{GHz}$	2.806	GΩ/s
Open (Male) FMSC3026				
Minimum Frequency	0	Hz		
Maximum Frequency	50	GHz		
Length	4.475	mm		
Delay			14.927	ps
Loss	0.00666	$dB/\sqrt{GHz}$	2.57	GΩ/s
C0	36	$fF$	36E-15	F
C1	0.05	$fF/GHz$	50E-17	F/Hz
C2	-0.00095	$fF/GHz^2$	-0.95E-36	F/Hz <sup>2</sup>
C3	0.00011	$fF/GHz^3$	0.11E-45	F/Hz <sup>3</sup>
Open (Female) FMSC3025				
Minimum Frequency	0	Hz		
Maximum Frequency	50	GHz		
Length	4.475	mm		
Delay			14.927	ps
Loss	0.00666	$dB/\sqrt{GHz}$	2.57	GΩ/s
C0	34	$fF$	34E-15	F
C1	0.06	$fF/GHz$	60E-27	F/Hz
C2	0.0087	$fF/GHz^2$	8.7E-36	F/Hz <sup>2</sup>
C3	0.00008	$fF/GHz^3$	-0.08E-45	F/Hz <sup>3</sup>



Through (Male/Female) Insertable Device, No Adapter		
Minimum Frequency	0	Hz
Maximum Frequency	50	GHz
Length	0	mm
Delay	0	ps
Loss	0	$dB/\sqrt{GHz}$
Through (Male/Male) FMAD1124 <sup>(1)</sup>		
Minimum Frequency	0	Hz
Maximum Frequency	50	GHz
Length	19.702	mm
Loss	0.01476	$dB/\sqrt{GHz}$
Through (Female/Female) FMAD1123 <sup>(1)</sup>		
Minimum Frequency	0	Hz
Maximum Frequency	50	GHz
Length	19.702	mm
Loss	0.01476	$dB/\sqrt{GHz}$
Through (Male/Female) FMAD1125 <sup>(1)</sup>		
Minimum Frequency	0	Hz
Maximum Frequency	50	GHz
Length	19.702	mm
Loss	0.01476	$dB/\sqrt{GHz}$
Match (Male) FMTR1056		
Minimum Frequency	0	Hz
Maximum Frequency	50	GHz
Match (Female) FMTR1055		
Minimum Frequency	0	Hz
Maximum Frequency	50	GHz

Footnote 1: Precision Through Standards are contained in kit FMCK1016 only. For all kits, perform TOSM or SOLT calibrations using the "Unknown Through" method for best results.

## Resources

### Datasheets:

2.4mm Calibration Kits:

<https://www.fairviewmicrowave.com/images/ProductPDF/FMCK1015.pdf>

<https://www.fairviewmicrowave.com/images/ProductPDF/FMCK1016.pdf>

Torque Wrenches:

<https://www.fairviewmicrowave.com/images/ProductPDF/st-sma-516-bo8a.pdf>

### Website:

Fairview Microwave Calibration Kits:

[https://www.fairviewmicrowave.com/nsearch.aspx?Category=Calibration+Kits+Portable^Calibration+Kits^Calibration+Kits+Components&keywords=calibration+ports+vna&sort=y&searchtype=1&view\\_type=grid](https://www.fairviewmicrowave.com/nsearch.aspx?Category=Calibration+Kits+Portable^Calibration+Kits^Calibration+Kits+Components&keywords=calibration+ports+vna&sort=y&searchtype=1&view_type=grid)

Fairview Microwave Test and Measurement Products:

[https://www.fairviewmicrowave.com/nsearch.aspx?Category=Calibration+Kits+Portable^Calibration+Kits^Calibration+Kits+Components^Adapters^Data+Cable+assemblies^Cable+assemblies^Connectors^VNA+Test+Cables&keywords=Banana+Alligator+Spade+Breakout+calibration+ports+vna+armored+test&searchtype=1&no\\_metaphones=0:1&sort=y&view\\_type=grid](https://www.fairviewmicrowave.com/nsearch.aspx?Category=Calibration+Kits+Portable^Calibration+Kits^Calibration+Kits+Components^Adapters^Data+Cable+assemblies^Cable+assemblies^Connectors^VNA+Test+Cables&keywords=Banana+Alligator+Spade+Breakout+calibration+ports+vna+armored+test&searchtype=1&no_metaphones=0:1&sort=y&view_type=grid)

## Contacts

### Customer Support & Sales

Fairview Microwave  
301 Leora Ln., Suite 100  
Lewisville, TX 75056  
USA

Phone: (800) 715-4396  
(972) 649-6678

Fax: (972) 649-6689

Sales Email: [sales@fairviewmicrowave.com](mailto:sales@fairviewmicrowave.com)

Customer Support Email: [tech\\_support@fairviewmicrowave.com](mailto:tech_support@fairviewmicrowave.com)

Website: <https://www.fairviewmicrowave.com>