

# Calibration Kits



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Copper Mountain Technologies offers calibration kits and Automatic Calibration Modules (ACMs) in multiple configurations from DC to 110 GHz, ensuring accurate testing with our VNAs.

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# CMT Automatic Calibration Modules

Copper Mountain Technologies' Automatic Calibration Modules (ACMs) are designed for n-port calibrations of vector network analyzers (VNA) produced by Copper Mountain Technologies.

Copper Mountain Technologies' VNAs have a built-in function of one-touch automatic calibration performed with these ACMs. The ACM calibrates the VNA in fully automatic mode through the built-in functions of the analyzer software. The ACM switches to the impedance states one by one in the process of calibration. The VNA calibration coefficients are calculated using the measured S-parameters of the ACM impedance states and the data stored in the ACM memory.

## Advantages of Automatic Calibration

The ACM calibration offers the following advantages over traditional mechanical SOLT calibration:

- reduced number of connections (for example, full two-port calibration requires only one connection of the ACM to a VNA instead of 7 connections of mechanical standards)
- faster calibration procedure
- reduced risk of human error
- higher accuracy
- reduced wear on test port connectors

## User-Defined Characterization

Besides factory characterization, the ACM memory can store up to three user characterizations. The user characterization allows use of the ACM with adapters and other fixtures connected.

## Attenuator state

The ACM features an additional attenuator state, which is not used in calibration. The attenuator is applied in confidence check of the performed calibration using a specific VNA function, which compares the measured S-parameters of the attenuator and the ACM memory data.

## Thermal Compensation

Thermal compensation is used to enhance ACM calibration accuracy in the entire range of the operating temperatures of 64°F to 82°F (18°C to 28°C). It is a software function of correcting the ACM characterization data for ambient temperature variations. Temperature dependence of S-parameters of each ACM is determined at the factory and saved into the device memory.

# ACM2708 Automatic Calibration Module<sup>1</sup>

## Measurement Range

Impedance	75 Ohm
Number of ports	2
Frequency range	20 kHz to 8 GHz
Number of characterization points	up to 1601

## Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2708 - 511	type N 75, female	type N 75, female
ACM2708 - 512	type N 75, male	type N 75, female

## Effective System Data<sup>2,3</sup>

20 kHz to 1 MHz		
Directivity		36 dB
Source match		32 dB
Load match		36 dB
Reflection tracking		0.15 dB
Transmission tracking		0.15 dB
1 MHz to 4 GHz		
Directivity		42 dB
Source match		39 dB
Load match		42 dB
Reflection tracking		0.10 dB
Transmission tracking		0.10 dB
4 GHz to 8 GHz		
Directivity		36 dB
Source match		30 dB
Load match		33 dB
Reflection tracking		0.10 dB
Transmission tracking		0.10 dB

## Port Input

Max power	0 dBm
Max DC voltage <sup>4</sup>	10 V
Damage level <sup>5</sup>	+18 dBm
Damage DC voltage <sup>5</sup>	35 V



## Interface & Power

Interface	USB 2.0
Connector type	Mini USB B
Support standard	USBTMC-USB488
Power consumption	0.2 W

## Dimensions

Length		
	without protective housing	115 mm
	with protective housing	115 mm
Width		
	without protective housing	40 mm
	with protective housing	95 mm
Height		
	without protective housing	25 mm
	with protective housing	28 mm
Weight		0.35 kg (12 oz)
Weight of protective housing		0.14 kg (5 oz)

## Environmental Specifications

Operating temperature	+5 °C to +40 °C (41 °F to 104 °F)
Storage temperature	-50 °C to +70 °C (-58 °F to 158 °F)
Humidity	90 % at 25 °C (77 °F)
Atmospheric pressure	70.0 kPa to 106.7 kPa

[1] All specifications subject to change without notice. [2] VNA maximum effective parameters after calibration. [3] All parameters are determined in the temperature range of 23±5 °C with the temperature variation after calibration of no more than ±1 °C and output power of -5 dBm output. [4] Exceeding max values reduces VNA measurement accuracy. [5] Exceeding limit values results in ACM failure. © Copper Mountain Technologies - www.coppermountaintech.com - Rev. 2021Q3

# ACM2506 Automatic Calibration Module<sup>1</sup>

The ACM contains two RF connectors for connection to VNA test ports, Mini-USB B control port, several different transmission and reflection impedance states and electronic changeover switches. ACM2506 has six reflection states (three for each port) and a Thru. The precise S-parameters of the calibration impedance states are stored in the ACM memory (factory characterization data).

## Measurement Range

<b>Impedance</b>	50 Ohm
<b>Number of ports</b>	2
<b>Frequency range</b>	20 kHz to 6.5 GHz
<b>Number of characterization points</b>	up to 1601

## Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2506 - 011	type N, female	type N, female
ACM2506 - 012	type N, male	type N, female
ACM2506 - 111	3.5 mm, female	3.5 mm, female
ACM2506 - 112	3.5 mm, male	3.5 mm, female

## Effective System Data<sup>2,3</sup>

20 kHz to 1 MHz	
Directivity	36 dB
Source match	32 dB
Load match	36 dB
Reflection tracking	0.15 dB
Transmission tracking	0.15 dB
1 MHz to 6.5 GHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	0.04 dB
Transmission tracking	0.06 dB

## Port Input

<b>Max power</b>	0 dBm
<b>Max DC voltage<sup>4</sup></b>	10 V
<b>Damage level<sup>5</sup></b>	+18 dBm
<b>Damage DC voltage<sup>5</sup></b>	35 V



## Interface & Power

<b>Interface</b>	USB 2.0
<b>Connector type</b>	Mini USB B
<b>Support standard</b>	USBTMC-USB488
<b>Power consumption</b>	0.2 W

## Dimensions

Length	
without protective housing	115 mm
with protective housing	115 mm
Width	
without protective housing	40 mm
with protective housing	95 mm
Height	
without protective housing	25 mm
with protective housing	28 mm
<b>Weight</b>	0.35 kg (12 oz)
<b>Weight of protective housing</b>	0.14 kg (5 oz)

## Environmental Specifications

<b>Operating temperature</b>	+5 °C to +40 °C (41 °F to 104 °F)
<b>Storage temperature</b>	-50 °C to +70 °C (-58 °F to 158 °F)
<b>Humidity</b>	90 % at 25 °C (77 °F)
<b>Atmospheric pressure</b>	70.0 kPa to 106.7 kPa

[1] All specifications subject to change without notice. [2] VNA maximum effective parameters after calibration. [3] All parameters are determined in the temperature range of 23±5 °C with the temperature variation after calibration of no more than ±1 °C and output power of -5 dBm output. [4] Exceeding max values reduces VNA measurement accuracy. [5] Exceeding limit values results in ACM failure. Rev. 2021Q2

# ACM2509 Automatic Calibration Module<sup>1</sup>

The ACM contains two RF connectors for connection to VNA test ports, Mini-USB control port, several different transmission and reflection impedance states and electronic changeover switches. ACM2509 has six reflection states (three for each port) and a Thru. The precise S-parameters of the calibration impedance states are stored in the ACM memory (factory characterization data).

## Measurement Range

<b>Impedance</b>	50 Ohm
<b>Number of ports</b>	2
<b>Frequency range</b>	20 kHz to 9 GHz
<b>Number of characterization points</b>	up to 1601

## Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2509 - 011	type N, female	type N, female
ACM2509 - 012	type N, male	type N, female
ACM2509 - 111	3.5 mm, female	3.5 mm, female
ACM2509 - 112	3.5 mm, male	3.5 mm, female

## Effective System Data<sup>2,3</sup>

20 kHz to 1 MHz	
Directivity	36 dB
Source match	32 dB
Load match	36 dB
Reflection tracking	0.15 dB
Transmission tracking	0.15 dB
1 MHz to 9 GHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	0.04 dB
Transmission tracking	0.06 dB

## Port Input

<b>Max power</b>	0 dBm
<b>Max DC voltage<sup>4</sup></b>	10 V
<b>Damage level<sup>5</sup></b>	+18 dBm
<b>Damage DC voltage<sup>5</sup></b>	35 V



## Interface & Power

<b>Interface</b>	USB 2.0
<b>Connector type</b>	Mini USB
<b>Support standard</b>	USBTMC-USB488
<b>Power consumption</b>	0.2 W

## Dimensions

Length	
without protective housing	115 mm
with protective housing	115 mm
Width	
without protective housing	40 mm
with protective housing	95 mm
Height	
without protective housing	25 mm
with protective housing	28 mm
<b>Weight</b>	0.35 kg (12 oz)
<b>Weight of protective housing</b>	0.14 kg (5 oz)

## Environmental Specifications

<b>Operating temperature</b>	+5 °C to +40 °C (41 °F to 104 °F)
<b>Storage temperature</b>	-50 °C to +70 °C (-58 °F to 158 °F)
<b>Humidity</b>	90 % at 25 °C (77 °F)
<b>Atmospheric pressure</b>	70.0 kPa to 106.7 kPa

[1] All specifications subject to change without notice. [2] VNA maximum effective parameters after calibration. [3] All parameters are determined in the temperature range of 23±5 °C with the temperature variation after calibration of no more than ±1 °C and output power of -5 dBm output. [4] Exceeding max values reduces VNA measurement accuracy. [5] Exceeding limit values results in ACM failure. Rev. 2021Q2

# ACM2520 Automatic Calibration Module<sup>1</sup>

The ACM contains two RF connectors for connection to VNA test ports, USB Type B (female) control port, several different transmission and reflection impedance states and electronic changeover switches. ACM2520 has eight reflection states (four for each port) and a Thru. The precise S-parameters of the calibration impedance states are stored in the ACM memory (factory characterization data).



## Measurement Range

<b>Impedance</b>	50 Ohm
<b>Number of ports</b>	2
<b>Frequency range</b>	100 kHz to 20 GHz*
<b>Number of characterization points</b>	up to 1601

## Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2520 - 011	type N, female	type N, female
ACM2520 - 012	type N, male	type N, female
ACM2520 - 111	3.5 mm, female	3.5 mm, female
ACM2520 - 112	3.5 mm, male	3.5 mm, female

## Effective System Data<sup>2,3</sup>

100 kHz to 1 MHz	
Directivity	36 dB
Source match	32 dB
Load match	36 dB
Reflection tracking	0.15 dB
Transmission tracking	0.15 dB
1 MHz to 10 GHz	
Directivity	47 dB
Source match	40 dB
Load match	47 dB
Reflection tracking	0.04 dB
Transmission tracking	0.06 dB
10 GHz to 20 GHz	
Directivity	40 dB
Source match	36 dB
Load match	40 dB
Reflection tracking	0.10 dB
Transmission tracking	0.10 dB

## Port Input

<b>Max power</b>	0 dBm
<b>Max DC voltage<sup>4</sup></b>	10 V
<b>Damage level<sup>5</sup></b>	+18 dBm
<b>Damage DC voltage<sup>5</sup></b>	35 V

## Interface & Power

<b>Interface</b>	USB 2.0
<b>Connector type</b>	USB B
<b>Support standard</b>	USBTMC-USB488
<b>Power consumption</b>	0.25 W

## Dimensions

Length	
without protective housing	107 mm
with protective housing	107 mm
Width	
without protective housing	55 mm
with protective housing	130 mm
Height	
without protective housing	27 mm
with protective housing	28 mm
<b>Weight</b>	0.435 kg (15 oz)
<b>Weight of protective housing</b>	0.14 kg (5 oz)

## Environmental Specifications

<b>Operating temperature</b>	+5 °C to +40 °C (41 °F to 104 °F)
<b>Storage temperature</b>	-50 °C to +70 °C (-58 °F to 158 °F)
<b>Humidity</b>	90 % at 25 °C (77 °F)
<b>Atmospheric pressure</b>	70.0 kPa to 106.7 kPa

\*All N-type models are only operational up to 18 GHz instead of 20 GHz. [1] All specifications subject to change without notice. [2] VNA maximum effective parameters after calibration. [3] All parameters are determined in the temperature range of 23±5 °C with the temperature variation after calibration of no more than ±1 °C and output power of -5 dBm output. [4] Exceeding max values reduces VNA measurement accuracy. [5] Exceeding limit values results in ACM failure. Rev. 2021Q2

# ACM2543 Automatic Calibration Module<sup>1</sup>

## Measurement Range

Impedance	50 Ohm
Number of ports	2
Frequency range	10 MHz to 44 GHz*
Number of characterization points	up to 1601

## Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2543 - 711	2.4 mm, female	2.4 mm, female
ACM2543 - 712	2.4 mm, male	2.4 mm, female

## Effective System Data<sup>2,3</sup>

10 MHz to 18 GHz		
Directivity		42 dB
Source match		38 dB
Load match		38 dB
Reflection tracking		0.10 dB
Transmission tracking		0.10 dB
18 GHz to 26.5 GHz		
Directivity		40 dB
Source match		34 dB
Load match		34 dB
Reflection tracking		0.15 dB
Transmission tracking		0.15 dB
26.5 GHz to 40 GHz		
Directivity		38 dB
Source match		32 dB
Load match		32 dB
Reflection tracking		0.15 dB
Transmission tracking		0.15 dB
40 GHz to 44 GHz		
Directivity		34 dB
Source match		30 dB
Load match		30 dB
Reflection tracking		0.20 dB
Transmission tracking		0.20 dB

## Port Input

Max power	0 dBm
Max DC voltage <sup>4</sup>	10 V
Damage level <sup>5</sup>	+18 dBm
Damage DC voltage <sup>5</sup>	35 V



## Interface & Power

Interface	USB 2.0
Connector type	Mini USB B
Support standard	USBTMC-USB488
Power consumption	0.40 W

## Dimensions

Length	87 mm
Width	65 mm
Height	22 mm
Weight	0.200 kg (7 oz)

## Environmental Specifications

Operating temperature	+5 °C to +40 °C (41 °F to 104 °F)
Storage temperature	-50 °C to +70 °C (-58 °F to 158 °F)
Humidity	90 % at 25 °C (77 °F)
Atmospheric pressure	70.0 kPa to 106.7 kPa

[1] All specifications subject to change without notice. [\*] All 2.92 mm models are only operational up to 40 GHz instead of 44 GHz. [2] VNA maximum effective parameters after calibration. [3] All parameters are determined in the temperature range of 23±5 °C with the temperature variation after calibration of no more than ±1 °C and output power of -10 dBm output. [4] Exceeding max values reduces VNA measurement accuracy. [5] Exceeding limit values results in ACM failure. © Copper Mountain Technologies - www.coppermountaintech.com - Rev. 2021Q4

# ACM4509 Automatic Calibration Module<sup>1</sup>

The ACM contains four RF connectors for connection to VNA test ports, Mini-USB control port, several different transmission and reflection impedance states and electronic changeover switches. ACM4509 has 16 reflection states (four for each port) and Thru. The precise S-parameters of the calibration impedance states are stored in the ACM memory (factory characterization data).

## Measurement Range

<b>Impedance</b>	50 Ohm
<b>Number of ports</b>	4
<b>Frequency range</b>	100 kHz to 9 GHz
<b>Number of characterization points</b>	up to 1601

## Hardware Configurations

Model	Connector	type
	Port A/C	Port B/D
ACM4509 - 01111	type N, female	type N, female
ACM4509 - 01212	type N, male	type N, female
ACM4509 - 11111	3.5 mm, female	3.5 mm, female
ACM4509 - 11212	3.5 mm, male	3.5 mm, female

## Effective System Data<sup>2,3</sup>

100 kHz to 1 MHz	
Directivity	36 dB
Source match	32 dB
Load match	36 dB
Reflection tracking	0.15 dB
Transmission tracking	0.15 dB
1 MHz to 9 GHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	0.04 dB
Transmission tracking	0.06 dB

## Port Input

<b>Max power</b>	-5 dBm
<b>Max DC voltage<sup>4</sup></b>	10 V
<b>Damage level<sup>5</sup></b>	+18 dBm
<b>Damage DC voltage<sup>5</sup></b>	35 V



## Interface & Power

<b>Interface</b>	USB 2.0
<b>Connector type</b>	Mini USB
<b>Support standard</b>	USBTMC-USB488
<b>Power consumption</b>	0.6 W

## Dimensions

Length	
without protective housing	115 mm
with protective housing	115 mm
Width	
without protective housing	74 mm
with protective housing	125 mm
Height	
without protective housing	25 mm
with protective housing	32 mm
<b>Weight</b>	0.55 kg (19 oz)
<b>Weight of protective housing</b>	0.14 kg (5 oz)

## Environmental Specifications

<b>Operating temperature</b>	+5 °C to +40 °C (41 °F to 104 °F)
<b>Storage temperature</b>	-50 °C to +70 °C (-58 °F to 158 °F)
<b>Humidity</b>	90 % at 25 °C (77 °F)
<b>Atmospheric pressure</b>	70.0 kPa to 106.7 kPa

[1] All specifications subject to change without notice. [2] VNA maximum effective parameters after calibration. [3] All parameters are determined in the temperature range of 23±5 °C with the temperature variation after calibration of no more than ±1 °C and output power of -5 dBm output. [4] Exceeding max values reduces VNA measurement accuracy. [5] Exceeding limit values results in ACM failure. Rev. 2021Q2



# ACM4520 Automatic Calibration Module

The ACM contains four RF connectors for connection to VNA test ports, USB Type B control port, several different transmission and reflection impedance states and electronic changeover switches. ACM4520 has 12 reflection states (three for each port) and a Thru. The precise S-parameters of the calibration impedance states are stored in the ACM memory (factory characterization data).

## Measurement Range

<b>Impedance</b>	50 Ohm
<b>Number of ports</b>	4
<b>Frequency range</b>	100 kHz to 20 GHz*
<b>Number of characterization points</b>	up to 1601

## Hardware Specifications

Model	Connector type	
	Port A/C	Port B/D
ACM4520 - 01111	type N, female	type N, female
ACM4520 - 01212	type N, male	type N, female
ACM4520 - 11111	3.5 mm, female	3.5 mm, female
ACM4520 - 11212	3.5 mm, male	3.5 mm, female

## Effective System Data<sup>2,3</sup>

100 kHz to 10 MHz	
Directivity	36 dB
Source match	32 dB
Load match	36 dB
Reflection tracking	0.15 dB
Transmission tracking	0.15 dB
10 MHz to 10 GHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	0.04 dB
Transmission tracking	0.06 dB
10 GHz to 20 GHz	
Directivity	40 dB
Source match	36 dB
Load match	40 dB
Reflection tracking	0.10 dB
Transmission tracking	0.10 dB

## Port Input

<b>Max power</b>	0 dBm
<b>Max DC voltage<sup>4</sup></b>	10 V
<b>Damage level<sup>5</sup></b>	+18 dBm
<b>Damage DC voltage<sup>5</sup></b>	16 V

## Environmental Specification

<b>Operating temperature</b>	+5 °C to +40 °C (41 °F to 104 °F)
<b>Storage temperature</b>	-50 °C to +70 °C (-58 °F to 158 °F)
<b>Humidity</b>	90 % at 25 °C (77 °F)
<b>Atmospheric pressure</b>	70.0 kPa to 106.7 kPa

Exceeding max values reduces VNA measurement accuracy. [5] Exceeding limit values results in ACM failure. Rev. 2021Q2



## Interface and Power

<b>Interface</b>	USB 2.0
<b>Connector type</b>	USB B
<b>Support standard</b>	USBTMC-USB488
<b>Power consumption</b>	0.4 W

## Dimensions

ACM4520 - 01111, ACM4520 - 01212	
<b>Length</b>	
without protective housing	110 mm
with protective housing	110 mm
<b>Width</b>	
without protective housing	89 mm
with protective housing	160 mm
<b>Height</b>	
without protective housing	27 mm
with protective housing	32 mm
<b>Weight</b>	0.9 kg (31.7 oz)
ACM4520 - 11111, ACM4520 - 11212	
<b>Length</b>	
without protective housing	98 mm
with protective housing	98 mm
<b>Width</b>	
without protective housing	89 mm
with protective housing	160 mm
<b>Height</b>	
without protective housing	27 mm
with protective housing	32 mm
<b>Weight</b>	0.8 kg (28.2 oz)
<b>Weight of protective housing</b>	0.14 kg (5 oz)

\*All N-type models are only operational up to 18 GHz instead of 20 GHz. [1] All specifications subject to change without notice. [2] VNA maximum effective parameters after calibration. [3] All parameters are determined in the temperature range of 23±5 °C with the temperature variation after calibration of no more than ±1 °C and output power of -5 dBm output. [4]

# N3.5 Calibration Kit

The N3.5 type N calibration kit is used to calibrate vector network analyzers up to 3.5 GHz for measurements of components with 50 Ω type N connectors.

## Electrical Data

<b>Impedance</b>	50Ω
<b>Frequency range</b>	DC to 3.5 GHz

## Electrical Specifications\*

<b>Load</b>	DC - 3.5 GHz
<b>VSWR</b>	$\leq 1.035$
<b>Return loss</b>	$\geq 35.3$ dB

<b>Open</b>	DC - 3.5 GHz
<b>Phase Deviation</b>	$\leq \pm 1^\circ$

<b>Short</b>	DC - 3.5 GHz
<b>Phase Deviation</b>	$\leq \pm 1^\circ$

\*Phase deviation: relative tolerance from standard phase

## Coefficients

	Male	Female
<b>Open</b>	$C_0 = 62.14 \times 10^{-15}$ F	$C_0 = 119.09 \times 10^{-15}$ F
	$C_1 = -143.07 \times 10^{-27}$ F/Hz	$C_1 = -36.955 \times 10^{-27}$ F/Hz
	$C_2 = 82.92 \times 10^{-36}$ F/Hz <sup>2</sup>	$C_2 = 26.258 \times 10^{-36}$ F/Hz <sup>2</sup>
	$C_3 = 0.76 \times 10^{-45}$ F/Hz <sup>3</sup>	$C_3 = 5.5136 \times 10^{-45}$ F/Hz <sup>3</sup>
Offset delay	17.411 ps	0 ps
Offset Z0	50	50
Offset loss	700 MΩ/s	700 MΩ/s
<b>Short</b>		
Offset delay	17.817 ps	93 fs
Offset Z0	50.209	49.992Ω
Offset loss	2.1002GΩ/s	700 MΩ/s
<b>Female-Female Thru</b>		
Offset delay	60.5 ps	
Offset loss	700 MΩ/s	
<b>Male-Male Thru</b>		
Offset delay	128.64 ps	
Offset loss	700 MΩ/s	



# N1801 Calibration Kit

## Electrical Data

Impedance	50Ω
Frequency range	DC to 18 GHz
Connector type	N-type

Mating cycles	≥ 500
Maximum torque	1.70 Nm
Recommended torque	1.10 Nm
Gauge	5.22 mm to 5.26 mm

<b>Short</b>	Phase Error <sup>2</sup>
DC - 6 GHz	≤ 1.5°
6 GHz - 9 GHz	≤ 2°
9 GHz - 18 GHz	≤ 3.5°

<b>Load</b>	
Resistance	50Ω ± 0.5Ω
<b>Return Loss</b>	
DC - 6 GHz	≥ 42 dB
6 GHz - 9 GHz	≥ 36 dB
9 GHz - 18 GHz	≥ 30 dB
<b>Power Handling</b>	≤ 1.0 W

<b>Thru</b>	
Electrical (Offset) delay	152.105 ps
<b>Return loss</b>	
DC - 6 GHz	≥ 40 dB
6 GHz - 9 GHz	≥ 36 dB
9 GHz - 18 GHz	≥ 32 dB

## Mechanical Data

Mating cycles	≥ 500
Maximum torque	1.70 Nm
Recommended torque	1.10 Nm
Gauge	5.22 mm to 5.26 mm

## Environmental Data

Operating temperature <sup>3</sup>	20°C to 26°C
Storage temperature	-40°C to +85°C



## Coefficients

<b>Open</b>	$C_0 = 37.1 \times 10^{-15} \text{ F}$	
	$C_1 = 1200 \times 10^{-27} \text{ F/Hz}$	
	$C_2 = -30 \times 10^{-36} \text{ F/Hz}^2$	
	$C_3 = 0.0 \times 10^{-45} \text{ F/Hz}^3$	
	Electrical (Offset) delay	40.028 ps
	Electrical (Offset) loss	0.80 GΩ/s
<b>Short</b>	$L_0 = 95 \times 10^{-12} \text{ H}$	
	$L_1 = -9900 \times 10^{-24} \text{ H/Hz}$	
	$L_2 = 980 \times 10^{-33} \text{ H/Hz}^2$	
	$L_3 = -29 \times 10^{-42} \text{ H/Hz}^3$	
	Electrical (Offset) delay	40.028 ps
	Electrical (Offset) loss	0.80 GΩ/s
<b>Load</b>	Electrical (Offset) delay	0.0 ps
	Electrical (Offset) loss	0.0 GΩ/s
<b>Thru</b>	Electrical (Offset) delay	152.105 ps
	Electrical (Offset) loss	2.2 GΩ/s

<sup>1</sup> The nominal phase is defined by the Offset Delay, the Offset Loss, and the Fringing Capacitances

<sup>2</sup> The nominal phase is defined by the Offset Delay, the Offset Loss, and the Short Inductant

<sup>3</sup> Temperature range over which these specifications are valid

# N1802 Calibration Kit

## Electrical Data

<b>Impedance</b>	50Ω
<b>Frequency range</b>	DC to 18 GHz
<b>Connector type</b>	N-type

<b>Mating cycles</b>	≥ 500
<b>Maximum torque</b>	1.70 Nm
<b>Recommended torque</b>	1.10 Nm
<b>Gauge</b>	5.28 mm to 5.32 mm

<b>Open</b>	Phase Error <sup>1</sup>
DC - 6 GHz	≤ 2°
6 GHz - 9 GHz	≤ 3°
9 GHz - 18 GHz	≤ 4°

<b>Short</b>	Phase Error <sup>2</sup>
DC - 6 GHz	≤ 1.5°
6 GHz - 9 GHz	≤ 2°
9 GHz - 18 GHz	≤ 2.5°

<b>Load</b>	
<b>Resistance</b>	50Ω ± 0.5Ω
<b>Return Loss</b>	
DC - 6 GHz	≥ 42 dB
6 GHz - 9 GHz	≥ 36 dB
9 GHz - 18 GHz	≥ 30 dB
<b>Power Handling</b>	≤ 1.0 W, derate by 0.01 W/K

<b>Thru</b>	
<b>Return loss</b>	
DC - 6 GHz	≥ 40 dB
6 GHz - 9 GHz	≥ 36 dB
9 GHz - 18 GHz	≥ 32 dB

## Mechanical Data

<b>Mating cycles</b>	≥ 500
<b>Maximum torque</b>	1.70 Nm
<b>Recommended torque</b>	1.10 Nm
<b>Gauge</b>	5.28 mm to 5.32 mm

## Environmental Data

<b>Operating temperature</b> <sup>3</sup>	20°C to 26°C
<b>Storage temperature</b>	-40°C to +85°C

<sup>1</sup> The nominal phase is defined by the Offset Delay, the Offset Loss, and the Fringing Capacitances

<sup>2</sup> The nominal phase is defined by the Offset Delay, the Offset Loss, and the Short Inductant

<sup>3</sup> Temperature range over which these specifications are valid



## Coefficients

<b>Open</b>	$C_0 = -14.2000 \times 10^{-15} \text{ F}$	-14.2000 fF
	$C_1 = 400.000 \times 10^{-27} \text{ F/Hz}$	0.40000 fF/GHz
	$C_2 = -16.0000 \times 10^{-36} \text{ F/Hz}^2$	-0.01600 fF/GHz <sup>2</sup>
	$C_3 = 1.00000 \times 10^{-45} \text{ F/Hz}^3$	0.00100 fF/GHz <sup>3</sup>
	Electrical (Offset) delay	73.384 ps
	Electrical (Offset) loss	0.80 GΩ/s
<b>Short</b>	$L_0 = -27.0000 \times 10^{-12} \text{ H}$	-27.0000 pH
	$L_1 = 7200.00 \times 10^{-24} \text{ H/Hz}$	7.20000 pH/GHz
	$L_2 = -800 \times 10^{-33} \text{ H/Hz}^2$	-0.80000 pH/GHz <sup>2</sup>
	$L_3 = 26.0000 \times 10^{-42} \text{ H/Hz}^3$	0.02600 pH/GHz <sup>3</sup>
	Electrical (Offset) delay	73.384 ps
	Electrical (Offset) loss	0.80 GΩ/s
<b>Load</b>	Electrical (Offset) delay	0.0 ps
	Electrical (Offset) loss	0.0 GΩ/s
<b>Thru</b>	Electrical (Offset) delay	212.814 ps
	Electrical (Offset) loss	2.20 GΩ/s

# N611 Calibration Kit

6 GHz N-type female calibration kit

## Electrical Data

<b>Impedance</b>	50Ω
<b>Average Power</b>	≤1W

## Electrical Specifications\*

<b>Load</b>	DC - 6 GHz
<b>Return Loss</b>	≤ -36 dB (VSWR ≤ 1.032)

<b>Open</b>	DC - 6 GHz
<b>Phase Deviation</b>	≤ ± 0.6°

<b>Short</b>	DC - 6 GHz
<b>Phase Deviation</b>	≤ ± 0.6°

## Mechanical Data

<b>Mating Cycles</b>	> 3000 times
<b>Coupling torque</b>	1.3 ~ 1.7 Nm
<b>Open-end wrench size</b>	19 mm

## Environmental Data

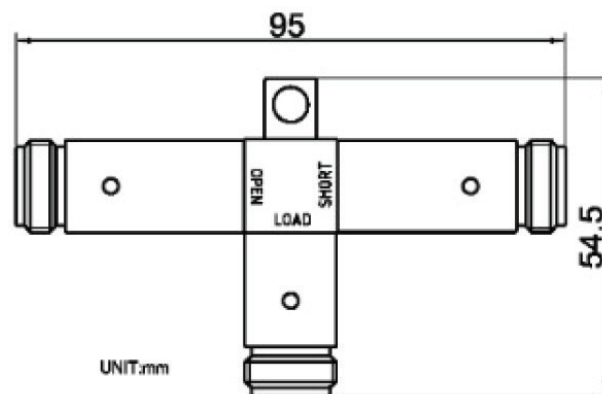
<b>Operating temperature</b>	15°C to 35°C
<b>Storage temperature</b>	-40°C to 75°C

\*Phase deviation: relative tolerance from standard phase



## Coefficients

<b>Open</b>	$C_0 = 89.939 \times 10^{-15} \text{ F}$	
	$C_1 = 2536.8 \times 10^{-27} \text{ F/Hz}$	
	$C_2 = -264.99 \times 10^{-36} \text{ F/Hz}^2$	
	$C_3 = 13.4 \times 10^{-45} \text{ F/Hz}^3$	
	Offset delay	41.17 ps
	Offset Z0	50 Ω
	Offset loss	0.93 GΩ/s
<b>Short</b>	$L_0 = 3.3998 \times 10^{-12} \text{ F}$	
	$L_1 = -496.481 \times 10^{-24} \text{ F/Hz}$	
	$L_2 = 34.8314 \times 10^{-33} \text{ F/Hz}^2$	
	$L_3 = -0.7847 \times 10^{-42} \text{ F/Hz}^3$	
	Offset delay	45.955 ps
	Offset Z0	49.992 Ω
	Offset loss	1.087 GΩ/s



# N612 Calibration Kit

6 GHz N-type male calibration kit

## Electrical Data

<b>Impedance</b>	50Ω
<b>Average power</b>	≤1W

## Electrical Specifications\*

<b>Load</b>	DC - 6 GHz
<b>Return loss</b>	≤ -36 dB (VSWR ≤ 1.032)
<b>Open</b>	DC - 6 GHz
<b>Phase Deviation</b>	≤ ±0.6°
<b>Short</b>	DC - 6 GHz
<b>Phase Deviation</b>	≤ ±0.6°

## Mechanical Data

<b>Mating cycles</b>	>3000 times
<b>Coupling torque</b>	1.3 ~ 1.7 Nm
<b>Open-end wrench size</b>	19 mm

## Environmental Data

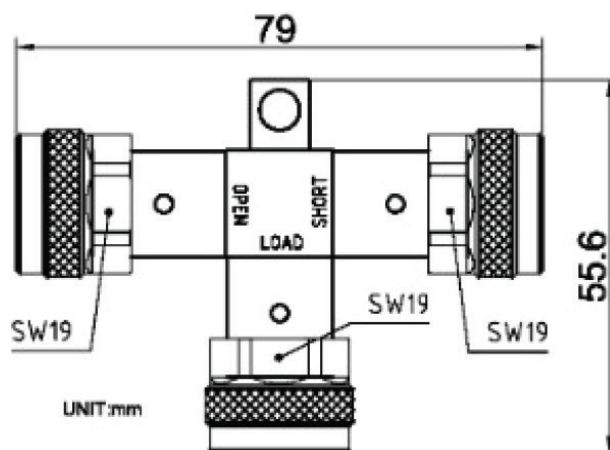
<b>Operating temperature</b>	15°C to 35°C
<b>Storage temperature</b>	-40°C to +75°C



## Coefficients

<b>Open</b>	$C_0 = 89.939 \times 10^{-15} \text{ F}$	
	$C_1 = 2536.8 \times 10^{-27} \text{ F/Hz}$	
	$C_2 = -264.99 \times 10^{-36} \text{ F/Hz}^2$	
	$C_3 = 13.4 \times 10^{-45} \text{ F/Hz}^3$	
	<b>Offset delay</b>	40.869 ps
	<b>Offset Z0</b>	50 Ω
	<b>Offset loss</b>	0.93 GΩ/s
<b>Short</b>	$L_0 = 3.3998 \times 10^{-12} \text{ F}$	
	$L_1 = -496.481 \times 10^{-24} \text{ F/Hz}$	
	$L_2 = 34.8314 \times 10^{-33} \text{ F/Hz}^2$	
	$L_3 = -0.7847 \times 10^{-42} \text{ F/Hz}^3$	
	<b>Offset delay</b>	45.955 ps
	<b>Offset Z0</b>	49.99 Ω
	<b>Offset loss</b>	1.087 GΩ/s

\*Phase deviation: relative tolerance from standard phase



# N911 Calibration Kit

9 GHz N-type female calibration kit

## Electrical Data

<b>Impedance</b>	50Ω
<b>Average Power</b>	≤1W

## Electrical Specifications\*

<b>Load</b>	DC - 9 GHz
<b>Return Loss</b>	≤ -36 dB (VSWR ≤ 1.032)

<b>Open</b>	DC - 9 GHz
<b>Phase Deviation</b>	≤ ± 0.8°

<b>Short</b>	DC - 9 GHz
<b>Phase Deviation</b>	≤ ± 0.8°

## Mechanical Data

<b>Mating Cycles</b>	> 3000 times
<b>Coupling torque</b>	1.3 ~ 1.7 Nm
<b>Open-end wrench size</b>	19 mm

## Environmental Data

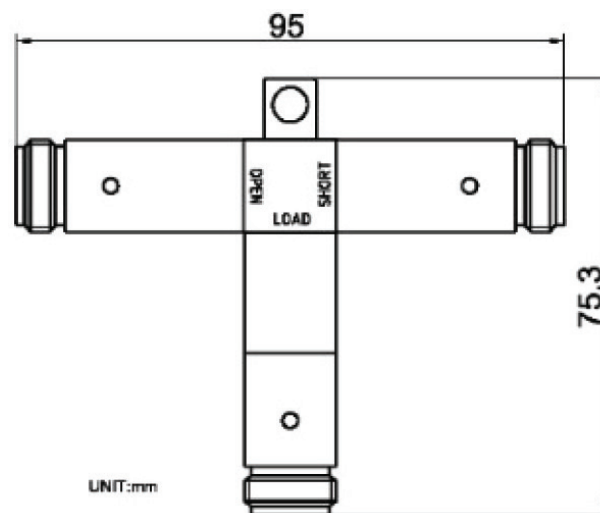
<b>Operating temperature</b>	15°C to 35°C
<b>Storage temperature</b>	-40°C to 75°C

\*Phase deviation: relative tolerance from standard phase



## Coefficients

<b>Open</b>	$C_0 = 89.939 \times 10^{-15} \text{ F}$	
	$C_1 = 2536.8 \times 10^{-27} \text{ F/Hz}$	
	$C_2 = -264.99 \times 10^{-36} \text{ F/Hz}^2$	
	$C_3 = 13.4 \times 10^{-45} \text{ F/Hz}^3$	
	Offset delay	41.17 ps
	Offset Z0	50 Ω
	Offset loss	0.93 GΩ/s
<b>Short</b>	$L_0 = 3.3998 \times 10^{-12} \text{ F}$	
	$L_1 = -496.481 \times 10^{-24} \text{ F/Hz}$	
	$L_2 = 34.8314 \times 10^{-33} \text{ F/Hz}^2$	
	$L_3 = -0.7847 \times 10^{-42} \text{ F/Hz}^3$	
	Offset delay	45.955 ps
	Offset Z0	49.992 Ω
	Offset loss	1.087 GΩ/s



# N912 Calibration Kit

9 GHz N-type male calibration kit

## Electrical Data

<b>Impedance</b>	50Ω
<b>Average power</b>	≤1W

## Electrical Specifications\*

<b>Load</b>	DC - 9 GHz
<b>Return loss</b>	≤ -36 dB (VSWR ≤ 1.032)

<b>Open</b>	DC - 9 GHz
<b>Phase Deviation</b>	≤ ±0.8°

<b>Short</b>	DC - 9 GHz
<b>Phase Deviation</b>	≤ ±0.8°

## Mechanical Data

<b>Mating cycles</b>	>3000 times
<b>Coupling torque</b>	1.3 ~ 1.7 Nm
<b>Open-end wrench size</b>	19 mm

## Environmental Data

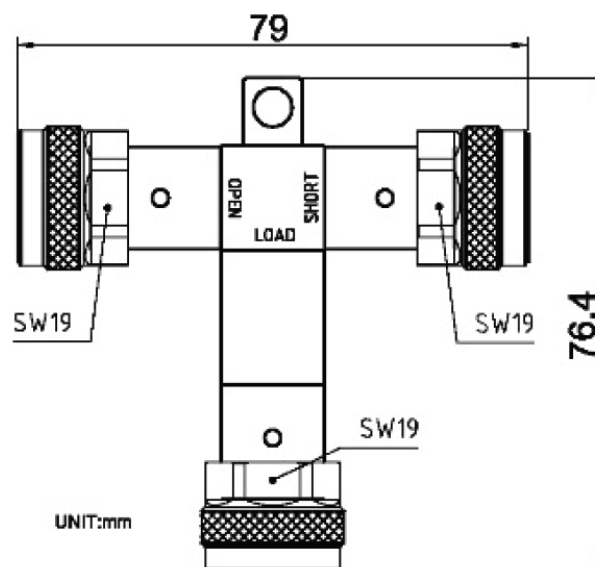
<b>Operating temperature</b>	15°C to 35°C
<b>Storage temperature</b>	-40°C to +75°C



## Coefficients

<b>Open</b>	$C_0 = 89.939 \times 10^{-15} \text{ F}$	
	$C_1 = 2536.8 \times 10^{-27} \text{ F/Hz}$	
	$C_2 = -264.99 \times 10^{-36} \text{ F/Hz}^2$	
	$C_3 = 13.4 \times 10^{-45} \text{ F/Hz}^3$	
	Offset delay	40.869 ps
	Offset Z0	50 Ω
	Offset loss	0.93 GΩ/s
<b>Short</b>	$L_0 = 3.3998 \times 10^{-12} \text{ F}$	
	$L_1 = -496.481 \times 10^{-24} \text{ F/Hz}$	
	$L_2 = 34.8314 \times 10^{-33} \text{ F/Hz}^2$	
	$L_3 = -0.7847 \times 10^{-42} \text{ F/Hz}^3$	
	Offset delay	45.955 ps
	Offset Z0	49.99 Ω
	Offset loss	1.087 GΩ/s

\*Phase deviation: relative tolerance from standard phase





# S911T Calibration Module

## Electrical Data

<b>Impedance</b>	50Ω
<b>Frequency range</b>	DC to 9 GHz
<b>Connector type</b>	3.5 mm female

<b>Open</b>	Phase deviation, max.
DC - 4 GHz	$\leq 1.5^\circ$
4 GHz - 9 GHz	$\leq 3^\circ$

<b>Short</b>	Phase deviation, max.
DC - 4 GHz	$\leq 1^\circ$
4 GHz - 9 GHz	$\leq 2^\circ$

<b>Load</b>	
<b>Resistance</b>	$50\Omega \pm 0.5\Omega$
<b>Return Loss</b>	
DC - 4 GHz	$\geq 37$ dB
4 GHz - 9 GHz	$\geq 34$ dB
<b>Power rating, max.</b>	0.5 W

<b>Thru</b>	
<b>Electrical (Offset) delay</b>	127.588 ps
<b>Return loss</b>	
DC - 4 GHz	$\geq 34$ dB
4 GHz - 9 GHz	$\geq 28$ dB
<b>Insertion loss</b>	
DC - 9 GHz	0.11 dB

## Environmental Data

<b>Operating temperature</b>	5°C to 40°C
<b>Storage temperature</b>	-40°C to +70°C



## Coefficients

<b>Open</b>	$C_0 = -7.425 \times 10^{-15}$ F	
	$C_1 = 2470 \times 10^{-27}$ F/Hz	
	$C_2 = -226 \times 10^{-36}$ F/Hz <sup>2</sup>	
	$C_3 = 6.18 \times 10^{-45}$ F/Hz <sup>3</sup>	
	Offset delay	30.821 ps
	Offset length	9.24 mm
<b>Short</b>	$L_0 = 27.98 \times 10^{-12}$ H	
	$L_1 = -5010 \times 10^{-24}$ H/Hz	
	$L_2 = 303.8 \times 10^{-33}$ H/Hz <sup>2</sup>	
	$L_3 = -6.13 \times 10^{-42}$ H/Hz <sup>3</sup>	
	Offset delay	30.688 ps
	Offset length	9.2 mm
<b>Thru</b>	Electrical delay	127.588 ps
	Electrical length	38.25 mm

# S2611 4-in-1 Calibration Kit\*

## Electrical Data

<b>Impedance</b>	50Ω
<b>Frequency range</b>	DC to 26.5 GHz
<b>Connector type</b>	3.5 mm female

## Effective Parameters

<b>Mating cycles</b>	≥ 500
<b>Maximum torque</b>	1.70 Nm
<b>Recommended torque</b>	0.90 Nm
<b>Gauge</b>	0.00 mm to 0.08 mm

## Electrical Specifications

Open	Phase Error <sup>1</sup>
DC - 4 GHz	≤ 1°
4 GHz - 8 GHz	≤ 2°
8 GHz - 26.5 GHz	≤ 3°

Short	Phase Error <sup>2</sup>
DC - 4 GHz	≤ 1°
4 GHz - 8 GHz	≤ 2°
8 GHz - 26.5 GHz	≤ 3°

Load	
<b>Resistance</b>	50Ω ± 0.5Ω
<b>Return Loss</b>	
DC - 4 GHz	≥ 40 dB
4 GHz - 8 GHz	≥ 35 dB
8 GHz - 26.5 GHz	≥ 30 dB
<b>Power Handling</b>	≤ 0.5 W

Thru	
<b>Electrical (Offset) delay</b>	84.058 ps
<b>Return loss</b>	
DC - 4 GHz	≥ 34 dB
4 GHz - 8 GHz	≥ 32 dB
8 GHz - 26.5 GHz	≥ 30 dB



## Coefficients

<b>Open</b>	$C_0 = -17.5 \times 10^{-15} \text{ F}$	
	$C_1 = -2000 \times 10^{-27} \text{ F/Hz}$	
	$C_2 = 140 \times 10^{-36} \text{ F/Hz}^2$	
	$C_3 = -2.7 \times 10^{-45} \text{ F/Hz}^3$	
	Electrical (Offset) delay	33.356 ps
	Electrical (Offset) loss	2.2 GΩ/s
<b>Short</b>	$L_0 = -44 \times 10^{-12} \text{ H}$	
	$L_1 = 3700 \times 10^{-24} \text{ H/Hz}$	
	$L_2 = -250 \times 10^{-33} \text{ H/Hz}^2$	
	$L_3 = 5 \times 10^{-42} \text{ H/Hz}^3$	
	Electrical (Offset) delay	33.356 ps
	Electrical (Offset) loss	2.36 GΩ/s
<b>Load</b>	Electrical (Offset) delay	0.0 ps
	Electrical (Offset) loss	0.0 GΩ/s
<b>Thru</b>	Electrical (Offset) delay	84.058 ps
	Electrical (Offset) loss	2.51 GΩ/s

## Environmental Data

<b>Operating temperature<sup>3</sup></b>	20°C to 26°C
<b>Storage temperature<sup>4</sup></b>	-40°C to +85°C

<sup>1</sup> The nominal phase is defined by the Offset Delay, the Offset Loss and the Fringing Capacitances. <sup>2</sup> The nominal phase is defined by the Offset Delay, the Offset Loss and the Short Inductance. <sup>3</sup> Temperature range over which these specifications are valid. <sup>4</sup> This range is underneath and above the operating temperature range, within the calibration kit is fully functional and could be used without damage.

\*Specifications are subject to change without notice.

# F7511 Calibration Kit

The F7511 is a 75Ω, 3 GHz, F-type calibration kit containing F-male and F-female open, short, load and an F-female adapter.

## Electrical Data

Impedance	75Ω
Frequency range	DC to 3 GHz

## Electrical Specifications\*

Load	DC - 1 GHz	1 GHz to 3 GHz
Return loss	≥ 38 dB	≥ 36 dB
Open	DC - 1 GHz	1 GHz to 3 GHz
Phase Deviation	≤ ± 1°	≤ ± 2°
Short	DC - 1 GHz	1 GHz to 3 GHz
Phase Deviation	≤ ± 1°	≤ ± 2°
Thru	DC - 1 GHz	1 GHz to 3 GHz
Offset Loss	1.13 GΩ/s	1.13 GΩ/s
Electrical Delay	136.6 ps	136.6 ps
Return Loss	≥ 40 dB	≥ 30 dB

## Coefficients

Open	$C_0 = 42.945 \times 10^{-15} \text{ F}$
	$C_1 = 98.367 \times 10^{-27} \text{ F/Hz}$
	$C_2 = 706.93 \times 10^{-36} \text{ F/Hz}^2$
	$C_3 = -114.957 \times 10^{-45} \text{ F/Hz}^3$
Offset delay	53.6 ps
Offset Z0	75
Offset loss	1.64 GΩ/s
Short	
Offset delay	57 ps
Offset Z0	75
Offset loss	1.8 GΩ/s
Thru	
Offset delay	136.6 ps
Offset loss	1.13 GΩ/s



# T4311 Calibration Kit

## Electrical Data

<b>Impedance</b>	50Ω
<b>Frequency range</b>	DC to 40 GHz
<b>Connector type</b>	2.92 mm female

<b>Mating cycles</b>	≥ 500
<b>Maximum torque</b>	1.70 Nm
<b>Recommended torque</b>	0.90 Nm
<b>Gauge</b>	0.00 mm to 0.08 mm

<b>Short</b>	Phase Error <sup>2</sup>
DC - 4 GHz	≤ 1.5°
4 GHz - 26.5 GHz	≤ 4°
26.5 GHz - 40 GHz	≤ 5°

<b>Load</b>	
<b>Resistance</b>	50Ω ± 0.5Ω
<b>Return Loss</b>	
DC - 4 GHz	≥ 40 dB
4 GHz - 26.5 GHz	≥ 28 dB
26.5 GHz - 40 GHz	≥ 25 dB
<b>Power Handling</b>	≤ 0.5 W

<b>Thru</b>	
<b>Electrical (Offset) delay</b>	65.712 ps
<b>Return loss</b>	
DC - 4 GHz	≥ 32 dB
4 GHz - 26.5 GHz	≥ 30 dB
26.5 GHz - 40 GHz	≥ 28 dB

## Mechanical Data

<b>Mating cycles</b>	≥ 500
<b>Maximum torque</b>	1.70 Nm
<b>Recommended torque</b>	0.90 Nm
<b>Gauge</b>	0.00 mm to 0.08 mm

## Environmental Data

<b>Operating temperature<sup>3</sup></b>	20°C to 26°C
<b>Storage temperature</b>	-40°C to +85°C



## Coefficients

<b>Open</b>	$C_0 = -4.3 \times 10^{-15} \text{ F}$	
	$C_1 = 431 \times 10^{-27} \text{ F/Hz}$	
	$C_2 = -11.5 \times 10^{-36} \text{ F/Hz}^2$	
	$C_3 = 0.12 \times 10^{-45} \text{ F/Hz}^3$	
	Electrical (Offset) delay	28.353 ps
	Electrical (Offset) loss	2.4 GΩ/s
<b>Short</b>	$L_0 = 0 \times 10^{-12} \text{ H}$	
	$L_1 = 0 \times 10^{-24} \text{ H/Hz}$	
	$L_2 = 0 \times 10^{-33} \text{ H/Hz}^2$	
	$L_3 = 0 \times 10^{-42} \text{ H/Hz}^3$	
	Electrical (Offset) delay	28.353 ps
	Electrical (Offset) loss	2.4 GΩ/s
<b>Load</b>	Electrical (Offset) delay	0.0 ps
	Electrical (Offset) loss	0.0 GΩ/s
<b>Thru</b>	Electrical (Offset) delay	65.712 ps
	Electrical (Offset) loss	2.7 GΩ/s

<sup>1</sup> The nominal phase is defined by the Offset Delay, the Offset Loss, and the Fringing Capacitances

<sup>2</sup> The nominal phase is defined by the Offset Delay, the Offset Loss, and the Short Inductant

<sup>3</sup> Temperature range over which these specifications are valid

# Z5411 Calibration Kit

The Z5411 is a 50Ω, 50 GHz, 2.4 mm calibration kit.

## Electrical Data

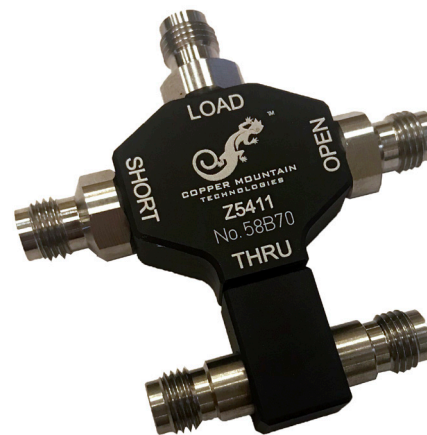
<b>Impedance</b>	50Ω
<b>Frequency range</b>	DC to 50 GHz
<b>Connector Type</b>	2.4 mm
<b>Mating cycles</b>	≥ 500
<b>Maximum torque</b>	1.65 Nm
<b>Recommended torque</b>	0.90 Nm
<b>Short</b>	Phase Error <sup>2</sup>
DC - 4 GHz	≤ 1.5°
4 GHz - 26.5 GHz	≤ 3°
26.5 GHz - 50 GHz	≤ 4.5°
<b>Load</b>	
<b>Resistance</b>	50Ω ± 0.5Ω
<b>Return Loss</b>	
DC - 4 GHz	≥ 36 dB
4 GHz - 26.5 GHz	≥ 30 dB
26.5 GHz - 50 GHz	≥ 22 dB
<b>Power Handling</b>	≤ 0.5 W
<b>Thru</b>	
<b>Electrical (Offset) delay</b>	87.394 ps
<b>Return loss</b>	
DC - 4 GHz	≥ 30 dB
4 GHz - 26.5 GHz	≥ 24 dB
26.5 GHz - 50 GHz	≥ 17 dB

## Environmental Data

<b>Operating temperature<sup>3</sup></b>	20°C to 26°C
<b>Storage temperature</b>	-40°C to +85°C

## Mechanical Data

<b>Connector Type</b>	2.4 mm
<b>Mating cycles</b>	≥ 500
<b>Maximum torque</b>	1.65 Nm
<b>Recommended torque</b>	0.90 Nm
<b>Gauge</b>	0.00 mm to 0.05 mm



## Coefficients

<b>Open</b>	$C_0 = 4.3 \times 10^{-15} \text{ F}$	
	$C_1 = -718 \times 10^{-27} \text{ F/Hz}$	
	$C_2 = 28.7 \times 10^{-36} \text{ F/Hz}^2$	
	$C_3 = -0.3 \times 10^{-45} \text{ F/Hz}^3$	
	Electrical (Offset) delay	23.350 ps
<b>Short</b>	Electrical (Offset) loss	4.0 GΩ/s
	$L_0 = 4 \times 10^{-12} \text{ H}$	
	$L_1 = 0 \times 10^{-24} \text{ H/Hz}$	
	$L_2 = 0 \times 10^{-33} \text{ H/Hz}^2$	
	$L_3 = 0 \times 10^{-42} \text{ H/Hz}^3$	
<b>Load</b>	Electrical (Offset) delay	23.350 ps
	Electrical (Offset) loss	3.5 GΩ/s
	Electrical (Offset) delay	0.0 ps
<b>Thru</b>	Electrical (Offset) loss	0.0 GΩ/s
	Electrical (Offset) delay	87.394 ps
	Electrical (Offset) loss	4.0 GΩ/s

[1] The nominal phase is defined by the Offset Delay, the Offset Loss, and the Fringing Capacitances. [2] The nominal phase is defined by the Offset Delay, the Offset Loss, and the Short Inductant. [3] Temperature range over which these specifications are valid. © Copper Mountain Technologies - www.coppermountaintech.com - Rev. 2018Q2

# Waveguide Calibration Kits

	WR-15 Calibration Kit	WR-12 Calibration Kit	WR-10 Calibration Kit
<b>Operating Frequency Range</b>	50 GHz to 75 GHz	60 GHz to 90 GHz	75 GHz to 110 GHz
<b>Fixed Load VSWR</b>	1.06:1 (Max)	1.06:1 (Max)	1.065:1 (Max)
<b>Fixed Load Power Handling</b>	0.2 Watts (Max)	0.2 Watts (Max)	0.2 Watts (Max)
<b>Included Hardware Quantity</b>	11	11	11
<b>Waveguide Material</b>	Beryllium Copper (BeCu)	Beryllium Copper (BeCu)	Beryllium Copper (BeCu)
<b>Waveguide Finish</b>	Gold Plated, MIL-G-45204 or ASTM B488	Gold Plated, MIL-G-45204 or ASTM B488	Gold Plated, MIL-G-45204 or ASTM B488
<b>Size</b>	214 mm x 172 mm x 98 mm	214 mm x 172 mm x 98 mm	214 mm x 172 mm x 98 mm
<b>Metrology Fixed Short</b>	1 Piece	1 Piece	1 Piece
<b>Metrology Fixed Waveguide Load</b>	1 Piece	1 Piece	1 Piece
<b>Metrology 1/8 Wavelength Offset</b>	1 Piece	1 Piece	1 Piece
<b>Metrology 1/4 Wavelength Offset</b>	1 Piece	1 Piece	1 Piece
<b>Metrology 3/8 Wavelength Offset</b>	1 Piece	1 Piece	1 Piece
<b>Waveguide Quick Connect, 0.75" Diameter Flange</b>	2 Pieces	2 Pieces	2 Pieces
<b>Waveguide Screws, 3/32 Hex Head</b>	1 Bag (10 Pieces)	1 Bag (10 Pieces)	1 Bag (10 Pieces)
<b>Extended Waveguide Screws, 3/32 Hex Head</b>	6 Pieces	6 Pieces	6 Pieces
<b>Alignment Dowel Pin</b>	4 Pieces	4 Pieces	4 Pieces
<b>Waveguide Screwdriver, 3/32 Hex Head</b>	1 Piece	1 Piece	1 Piece
<b>Calibration Data, USB Driver</b>	1 Piece	1 Piece	1 Piece



# Compatibility Comparison Chart

## ACM Calibration Kits:

	ACM2708	ACM2506 <sup>1</sup>	ACM2509 <sup>1</sup>	ACM2520 <sup>1</sup>	ACM2543	ACM4509 <sup>2</sup>
<b>1-Port USB VNAs</b>						
R60						
R140B						
R180						
<b>Compact USB VNAs</b>						
M5045						
M5065						
M5090						
M5180						
S5045						
S7530						
S5065						
S5085						
S5180B						
S5243						
TR1300/1						
SC5065						
SC5090						
SC7540						
<b>Multiport USB VNAs</b>						
SN5090-XX						
<b>Cobalt USB VNAs</b>						
C1209						
C2209						
C4209						
C1409						
C2409						
C4409						
C1220						
C2220						
C4220						
C1420						
C2420						
C4420						

<sup>1</sup> Except below the lower limit of 20 kHz (for ACM2506, ACM2509, ACM2520)

<sup>2</sup> Except below the lower limit of 100 kHz (for ACM4509, ACM4520)

# Compatibility Comparison Chart

## Mechanical Calibration Kits:

	N3.5	N1801	N1802	N611	N612	N911	N912	S911T	S2611	F7511	T4311	Z5411	WR-15	WR-12	WR-10	
<b>1-Port USB VNAs</b>																
R60																
R140B																
R180																
<b>Compact USB VNAs</b>																
M5045																
M5065																
M5090																
M5180																
S5045																
S7530																
S5065																
S5085																
S5180B																
S5243																
TR1300/1																
SC5065																
SC5090																
SC7540																
<b>Multiport USB VNAs</b>																
SN5090-XX																
<b>Cobalt USB VNAs</b>																
C1209																
C2209																
C4209																
C1409																
C2409																
C4409																
C1220																
C2220																
C4220																
C1420																
C2420																
C4420																
<b>CobaltFx Frequency Extension Modules</b>																
FET1854																
FET-WR15																
FET-WR15-HP																
FET-WR12																
FET-WR12-HP																
FET-WR10																
FET-WR10-HP																



Technology is supposed to move. It's supposed to change and update and progress. It's not meant to sit stagnant year after year simply because that's how things have always been done.

The engineers at Copper Mountain Technologies are creative problem solvers. They know the people using VNAs don't just need one giant machine in a lab. They know that VNAs are needed in the field, requiring portability and flexibility. Data needs to be quickly transferred, and a test setup needs to be easily automated and recalled for various applications. The engineers at Copper Mountain Technologies are rethinking the way VNAs are developed and used.

Copper Mountain Technologies' VNAs are designed to work with the Windows or Linux PC you already use via USB interface. After installing the test software, you have a top-quality VNA at a fraction of the cost of a traditional analyzer. The result is a faster, more effective test process that fits into the modern workspace. This is the creativity that makes Copper Mountain Technologies stand out above the crowd.

We're creative. We're problem solvers.



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