

# Cobalt Series

## 20 GHz



- **Frequency range:** 100 kHz - 20 GHz
- **Wide output power range:** -60 dBm to +10 dBm
- **Dynamic range:** 135 dB (10 Hz IF bandwidth) typ.
- **Measurement time per point:** 10  $\mu$ s per point, min typ.
- **16 logical channels with 16 traces** each max
- **Automation programming** in LabView, Python, MATLAB, .NET, etc.
- 2- and 4-port models with **Direct Receiver Access** and **Frequency Extension** as available options
- **Time domain and gating** conversion included
- **Fixture simulation**
- **Frequency offset mode**, including vector mixer calibration measurements
- Up to **500,001 measurement points**
- Multiple **precision calibration** methods and automatic calibration

EXTEND YOUR REACH™

USA: +1.317.222.5400  
info@coppermountaintech.com

631 E. New York St | Indianapolis, IN | 46202  
www.coppermountaintech.com

Singapore: +65.6323.6546  
Latin America: +1.954.706.5920

# Specifications<sup>1</sup>

## Measurement Range

<b>Impedance</b>	50 Ohm
<b>Test port connector</b>	NMD 3.5 mm, male
<b>Number of test ports</b>	
C1220, C2220, C4220	2 ports
C1420, C2420, C4420	4 ports
<b>Direct Access (Source, Ref, and Meas)</b>	C2220, C2420
<b>Frequency extender compatible</b>	C4220, C4420
<b>Frequency range</b>	100 kHz to 20.0 GHz
<b>Full frequency accuracy</b>	$\pm 2 \cdot 10^{-6}$
<b>Frequency resolution</b>	1 Hz
<b>Number of measurement points</b>	2 to 500,001
<b>Measurement bandwidths (with 1/1.5/2/3/5/7 steps)</b>	1 Hz to 2 MHz
<b>Dynamic range<sup>2</sup></b>	
C1220, C4220, C1420, C4420	
100 kHz to 1 MHz	120 dB
1 MHz to 20 GHz	143 dB (145 dB typ.)
C2220, C2420	
100 kHz to 1 MHz	110 dB
1 MHz to 20 GHz	130 dB (135 dB typ.)

## Measurement Accuracy<sup>3</sup>

<b>Accuracy of transmission measurements<sup>4</sup></b>	Magnitude / Phase
100 kHz to 1 MHz	
-40 dB to 0 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-60 dB to -40 dB	$\pm 0.3$ dB / $\pm 3^\circ$
-80 dB to -60 dB	$\pm 1.1$ dB / $\pm 7^\circ$
1 MHz to 20 GHz	
0 dB to 10 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-60 dB to 0 dB	$\pm 0.1$ dB / $\pm 1^\circ$
-80 dB to -60 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-100 dB to -80 dB	$\pm 1.0$ dB / $\pm 6^\circ$
<b>Accuracy of reflection measurements<sup>5</sup></b>	Magnitude / Phase
100 kHz to 10 GHz	
-15 dB to 0 dB	$\pm 0.4$ dB / $\pm 3^\circ$
-25 dB to -15 dB	$\pm 1.0$ dB / $\pm 6^\circ$
-35 dB to -25 dB	$\pm 3.0$ dB / $\pm 20^\circ$
10 GHz to 20 GHz	
-15 dB to 0 dB	$\pm 0.5$ dB / $\pm 4^\circ$
-25 dB to -15 dB	$\pm 1.5$ dB / $\pm 10^\circ$
-35 dB to -25 dB	$\pm 5.5$ dB / $\pm 30^\circ$
<b>Trace noise magnitude (IF bandwidth 3 kHz)</b>	
100 kHz to 1 MHz	0.020 dB rms
1 MHz to 20 GHz	0.001 dB rms
<b>Temperature dependence</b>	0.02 dB/°C (0.01 dB/°C typ.)

[1] All specifications subject to change without notice. [2] The dynamic range is defined as the difference between the specified maximum power level and the specified noise floor. The specification applies at 1 Hz IF bandwidth. [3] Reflection and transmission measurement accuracy applies over the temperature range of (73 ± 9) °F or (23 ± 5) °C after 40 minutes of warming-up, with less than 1 °C deviation from the full two-port calibration temperature, at output power of 0 dBm. Frequency points have to be identical for measurement and calibration (no interpolation allowed). [4] Transmission specifications are based on a matched DUT, and IF bandwidth of 1 Hz. [5] Reflection specifications are based on an isolating DUT. © Copper Mountain Technologies - www.coppermountaintech.com - Rev. 2018Q4

# Specifications<sup>1</sup>

## Effective System Data

100 kHz to 1 MHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	±0.05 dB
Transmission tracking	±0.20 dB
1 MHz to 10 GHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	±0.05 dB
Transmission tracking	±0.05 dB
10 GHz to 20 GHz	
Directivity	42 dB
Source match	38 dB
Load match	42 dB
Reflection tracking	±0.10 dB
Transmission tracking	±0.05 dB

## Uncorrected System Performance

100 kHz to 1 MHz	
Directivity	10 dB
Source match	10 dB
Load match	10 dB
1 MHz to 10 GHz	
Directivity	20 dB
Source match	15 dB
Load match	15 dB
10 GHz to 20 GHz	
Directivity	15 dB
Source match	15 dB
Load match	15 dB

## Test Port Output

Power range	-60 dBm to +10 dBm
Power accuracy	±1.5 dB
Power resolution	0.05 dB
Harmonic distortion <sup>6</sup>	-25 dBc
Non-harmonic spurious <sup>6</sup>	-30 dBc

# Specifications<sup>1</sup>

## Test Port Input

<b>Noise floor</b>		
C1220, C4220, C1420, C4420		
	100 kHz to 1 MHz	-110 dBm/Hz
	1 MHz to 20 GHz	-133 dBm/Hz
C2220, C2420		
	100 kHz to 1 MHz	-110 dBm/Hz
	1 MHz to 20 GHz	-130 dBm/Hz
<b>Damage level</b>		+26 dBm
<b>Damage DC voltage</b>		35 V
<b>Direct receiver access ports</b>		C2220, C2420
<b>Maximum operating input power level</b>		
	Ref	-5 dBm
	Source	10 dBm
	Meas	-5 dBm
<b>Damage level</b>		
	Ref	13 dBm
	Source	26 dBm
	Meas	13 dBm
<b>Damage DC voltage</b>		
	Ref	0 V
	Source	35 V
	Meas	0 V

## Measurement Speed

<b>Time per point</b>	12 $\mu$ s typ.	
<b>Port switchover time</b>	0.2 ms typ.	
<b>Typical cycle time vs number of measurement points<sup>7</sup></b>		
<b>Number of points (IF bandwidth 1 MHz)</b>	Uncorrected	2-port calibration
51	2.3 ms	4.4 ms
201	4.2 ms	8.2 ms
401	6.5 ms	12.8 ms
1601	20.5 ms	40.8 ms

## Frequency Reference Input

<b>Port</b>	10 MHz Ref In
<b>External reference frequency</b>	10 MHz
<b>Input level</b>	-2 dBm to 4 dBm
<b>Input impedance</b>	50 Ohm
<b>Connector type</b>	BNC, female

## Frequency Reference Output

<b>Port</b>	10 MHz Ref Out
<b>Internal reference frequency</b>	10 MHz
<b>Output reference signal level at 50 Ohm impedance</b>	0 dBm to 2 dBm
<b>Connector type</b>	BNC, female

# Specifications<sup>1</sup>

## Trigger Input

<b>Port</b>	Ext Trig In
<b>Input level</b>	
Low threshold voltage	0.8 V
High threshold voltage	2.7 V
<b>Input level range</b>	0 to + 5 V
<b>Pulse width</b>	≥2 μs
<b>Polarity</b>	positive or negative
<b>Input impedance</b>	≥10 kOhm
<b>Connector type</b>	BNC, female

## Trigger Output

<b>Port</b>	Ext Trig Out
<b>Maximum output current</b>	20 mA
<b>Output level</b>	
Low level voltage	0.4 V
High level voltage	3.0 V
<b>Polarity</b>	positive or negative
<b>Connector type</b>	BNC, female

## Aux Inputs (Optional)

<b>Port</b>	AUX In1, AUX In2
<b>DC voltage range</b>	±1 V, or ±10 V selectable
<b>Measurement accuracy</b>	
±1 V input	1 % ± 1 mV
±10 V input	1 % ± 10 mV
<b>Input impedance</b>	≥10 kOhm
<b>Damage voltage</b>	30 V
<b>Number of ports</b>	2
<b>Connector type</b>	BNC, female

## System & Power

<b>Operating system</b>	Windows 7 and above
<b>CPU frequency</b>	1.5 GHz
<b>RAM</b>	1 GB
<b>Interface</b>	USB 2.0
<b>Connector type</b>	USB B
<b>Power supply</b>	110-240 V, 50/60 Hz
<b>Power consumption</b>	
110W	C1220, C2220
145W	C4220
200W	C1420, C2420
270W	C4420

# Specifications<sup>1</sup>

## Calibration

Recommended Factory Adjustment Interval	3 Years
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## Dimensions

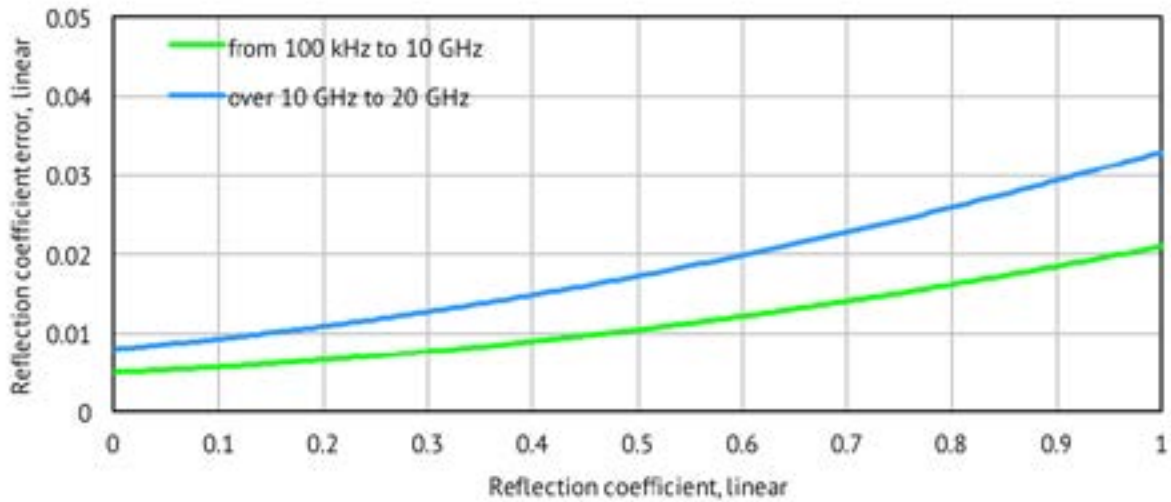
C1220, C2220, C4220	
Length	430 mm
Width	440 mm
Height	140 mm
Weight	14 kg (494 oz)
C1420, C2420, C4420	
Length	600 mm
Width	440 mm
Height	140 mm
Weight	22 kg (776 oz)

## Environmental Specifications

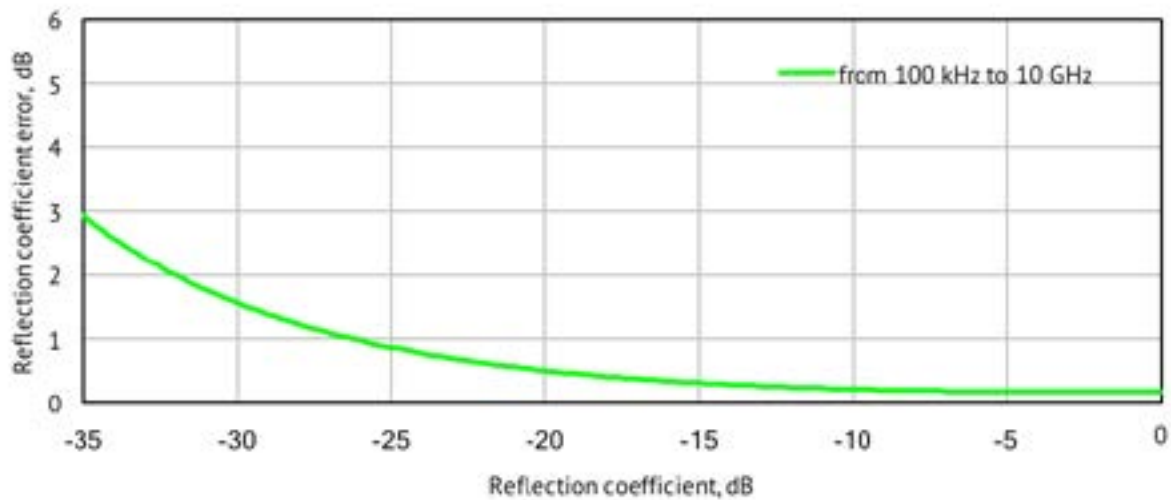
Operating temperature	+5 °C to +40 °C (41 °F to 104 °F)
Storage temperature	-50 °C to +70 °C (-58 °F to 158 °F)
Humidity	90 % at 25 °C (77 °F)
Atmospheric pressure	70.0 kPa to 106.7 kPa

# Reflection Accuracy Plots

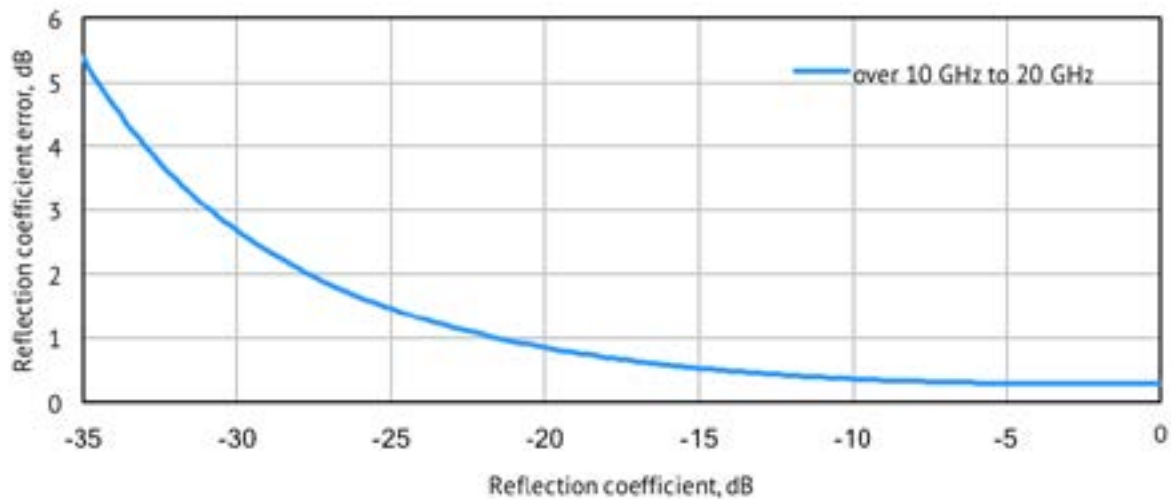
## Reflection Magnitude Errors



Specifications are based on isolating DUT ( $S_{21} = S_{12} = 0$ )

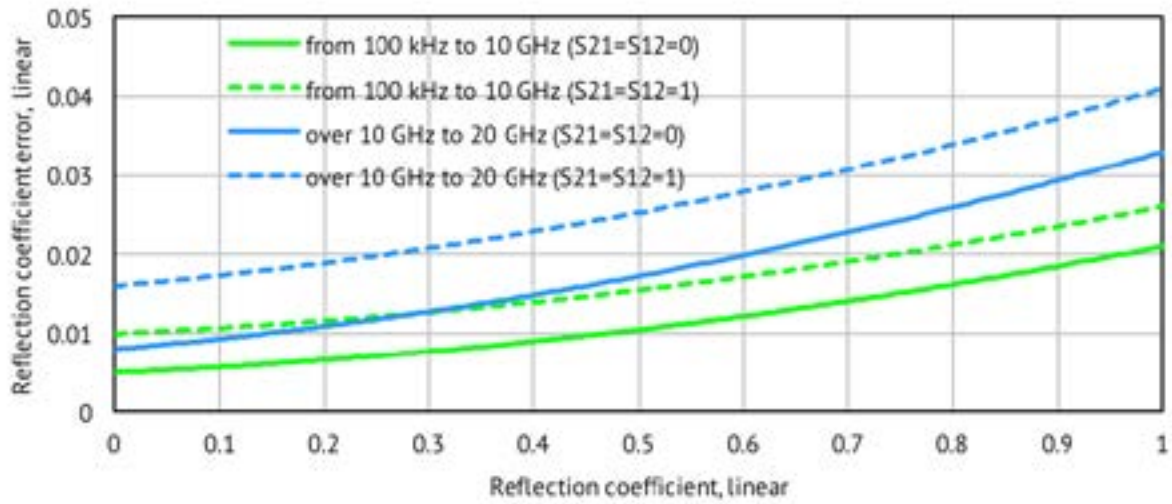


Specifications are based on isolating DUT ( $S_{21} = S_{12} = 0$ )

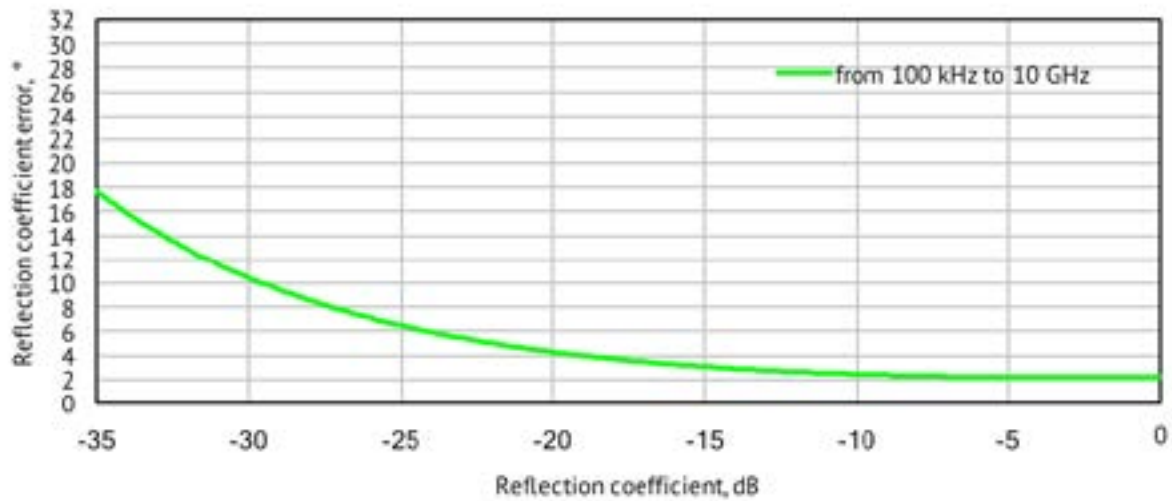


Specifications are based on isolating DUT ( $S_{21} = S_{12} = 0$ )

# Reflection Accuracy Plots



## Reflection Phase Errors

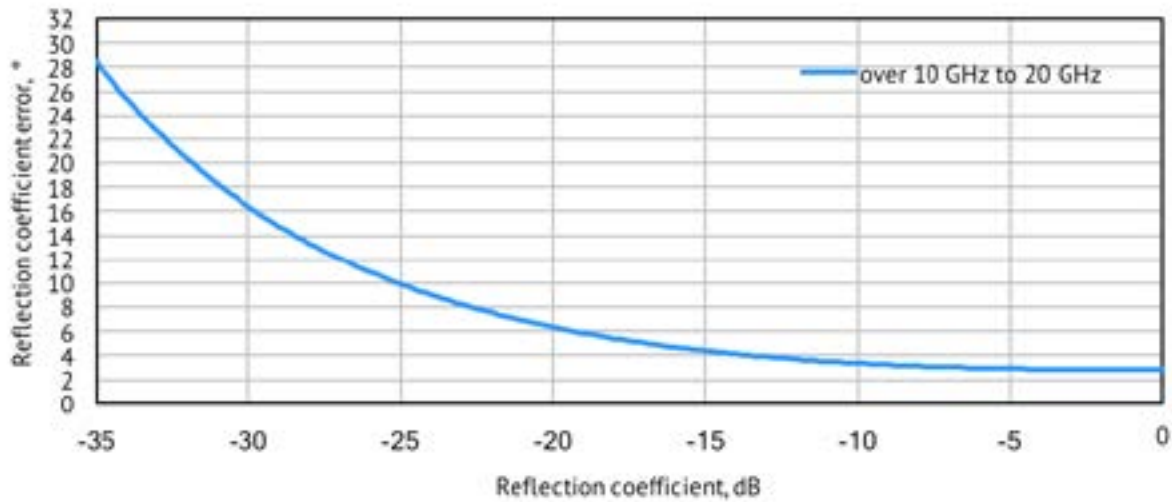


Specifications are based on isolating DUT ( $S_{21} = S_{12} = 0$ )

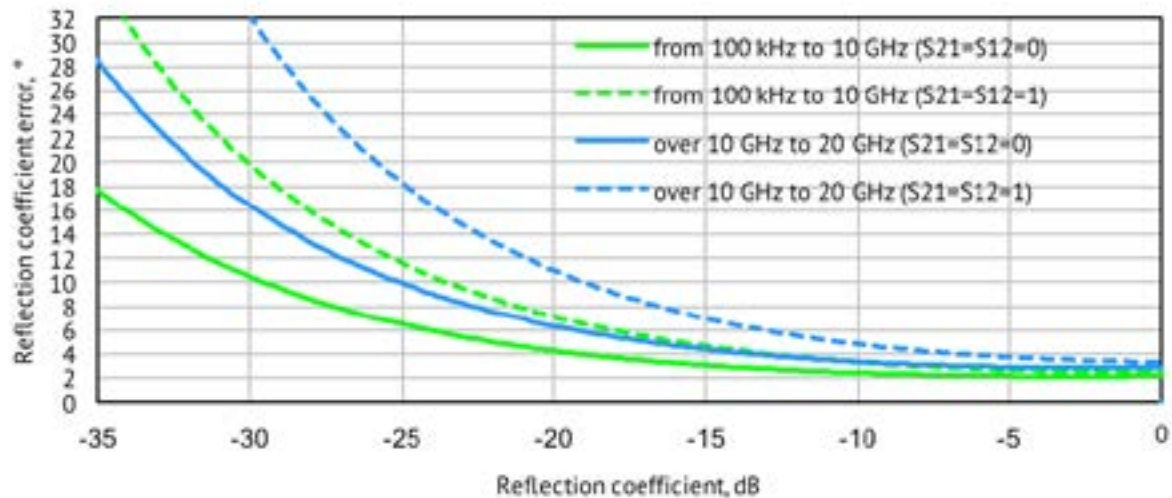


# Reflection/Transmission Accuracy Plots

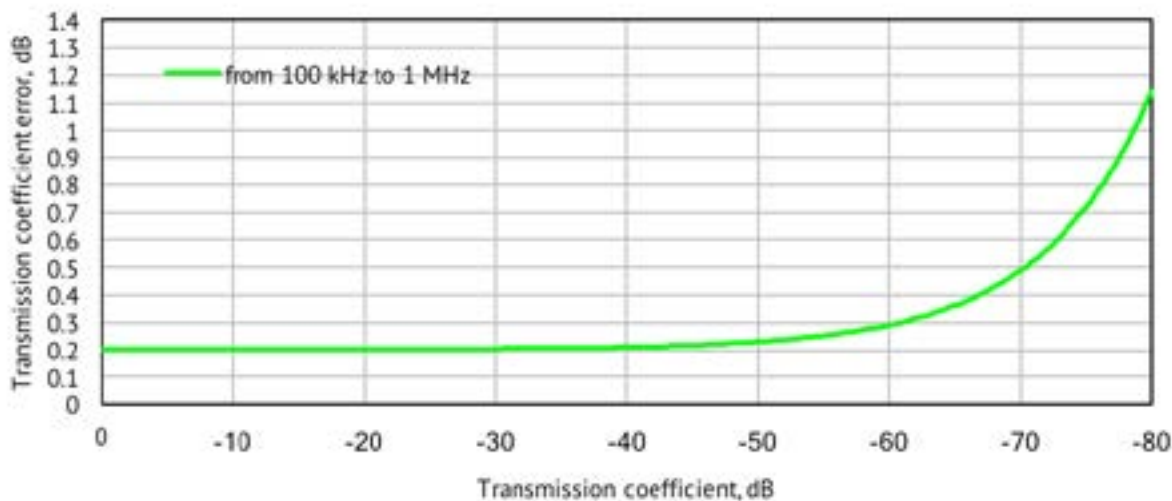
## Reflection Phase Errors



Specifications are based on isolating DUT ( $S_{21} = S_{12} = 0$ )



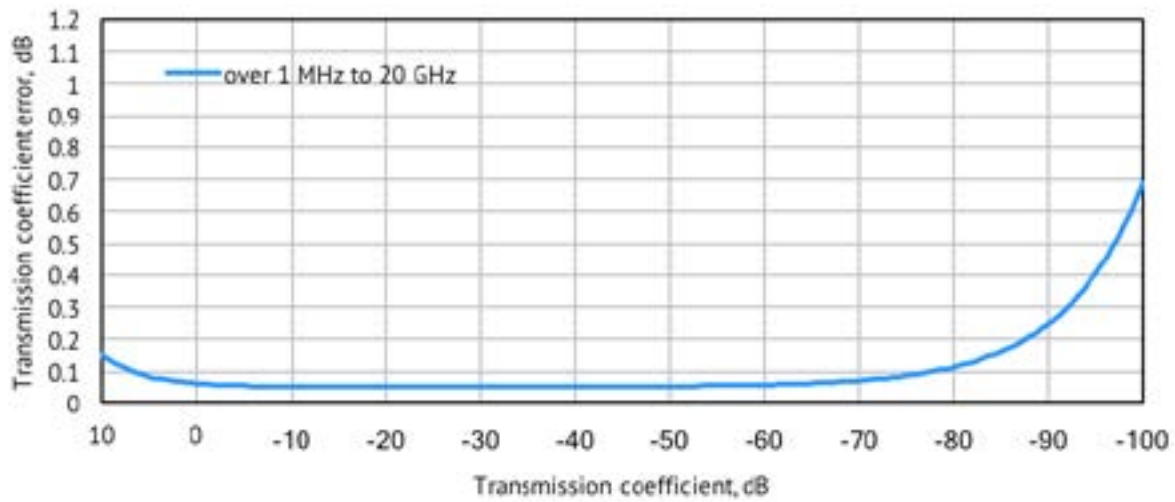
## Transmission Magnitude Errors



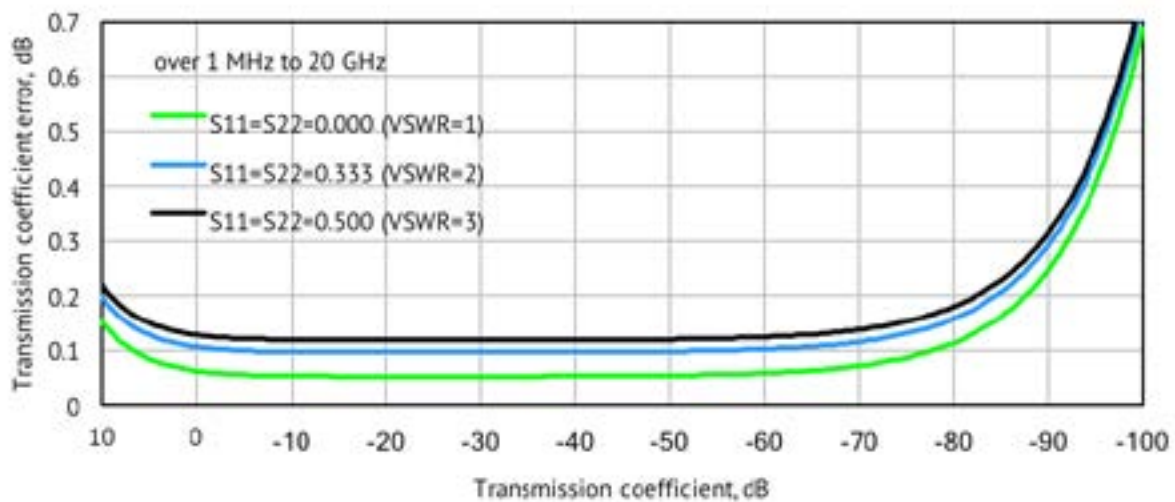
Specifications are based on matched DUT, and IF bandwidth of 1 Hz

# Transmission Accuracy Plots

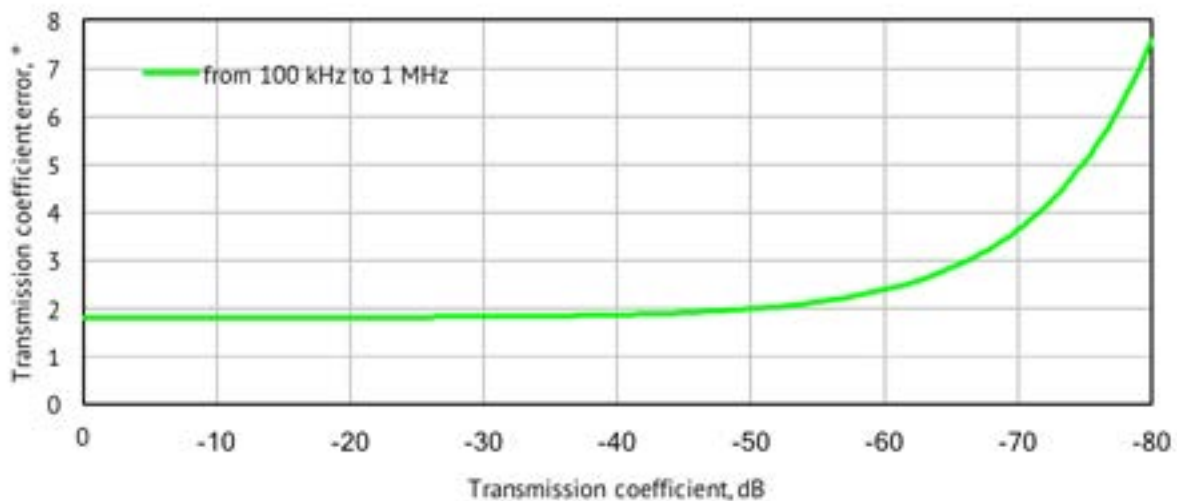
## Transmission Magnitude Errors



Specifications are based on matched DUT, and IF bandwidth of 1 Hz



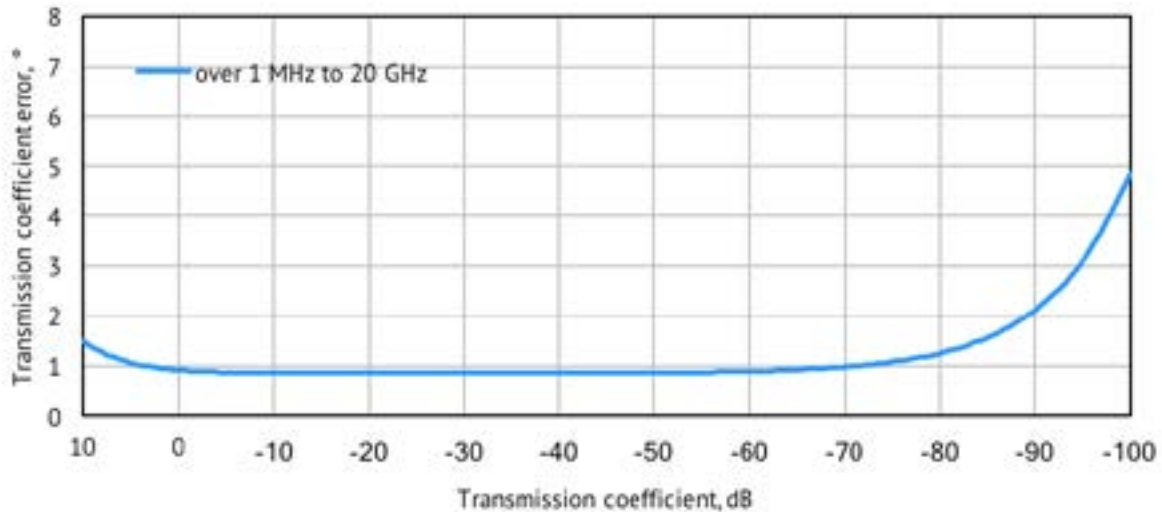
## Transmission Phase Errors



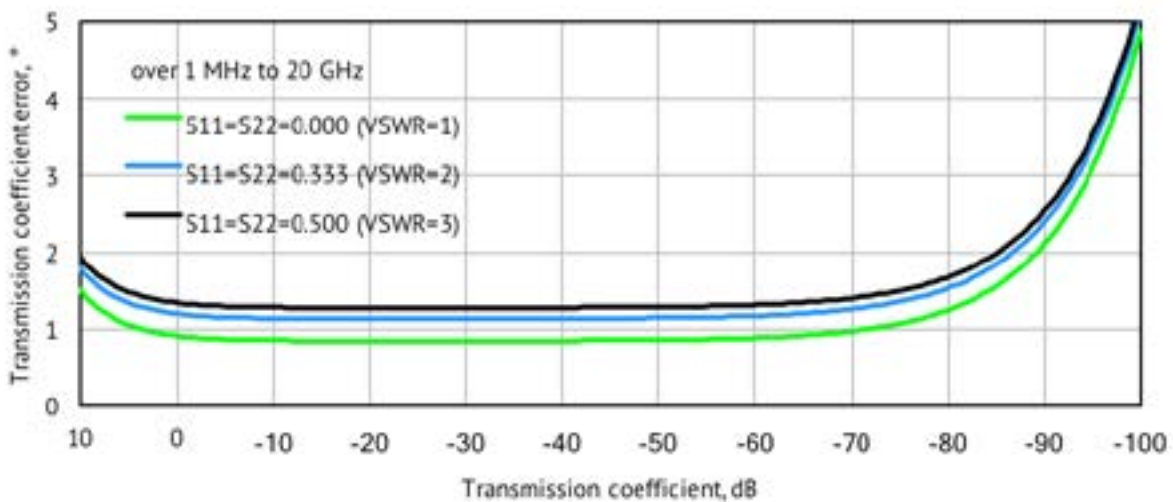
Specifications are based on matched DUT, and IF bandwidth of 1 Hz

# Transmission Accuracy Plots

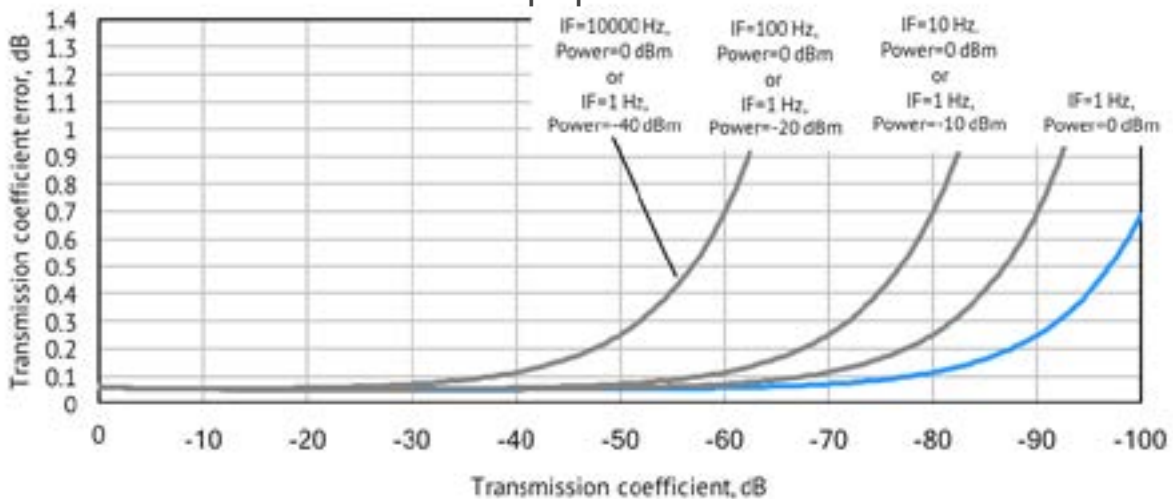
## Transmission Phase Errors



Specifications are based on matched DUT, and IF bandwidth of 1 Hz



## Transmission errors for matched devices vs. output power and IF Bandwidth



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 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.



	C1220	C2220	C4220	C1420	C2420	C4420
Frequency Range	100 kHz to 20 GHz	100 kHz to 20 GHz	100 kHz to 20 GHz	100 kHz to 20 GHz	100 kHz to 20 GHz	100 kHz to 20 GHz
Number of Ports	2	2	2	4	4	4
Additional Features		Direct Receiver Access	Frequency Extension		Direct Receiver Access	Frequency Extension

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 Latin America: +1.954.706.5920