

# Compact VNA - SC5090

## Extended Specifications



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Connectors IP10 to IP69

RF Microwave & Cables

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- **Frequency range:** 300 kHz - 9 GHz
- **Wide output power adjustment range:** -45 dBm to +15 dBm
- **Dynamic range:** 140 dB (10 Hz IF bandwidth) typ.
- **Measurement time per point:** 16  $\mu$ s per point, min typ.
- Up to **16 logical channels with 16 traces** each max
- **Time domain and gating** conversion included

- **Automation programming** in LabView, Python, MATLAB, .NET, etc.
- Models available in **50 Ohm**
- Up to **500,001 measurement points**
- Multiple **precision calibration** methods and automatic calibration

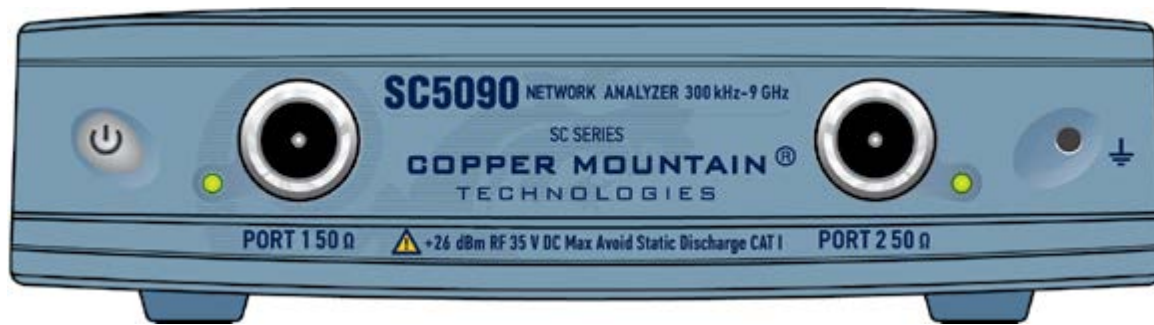
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# Specifications<sup>1</sup>



## Primary Specifications

Impedance	50 Ohm
Test port connector	type N, female
Number of test ports	2
Frequency range	300 kHz to 9 GHz
Full frequency accuracy	$\pm 5 \cdot 10^{-6}$
Frequency resolution	1 Hz
Number of measurement points	2 to 500,001
Measurement bandwidths (with 1/1.5/2/3/5/7 steps)	1 Hz to 1 MHz
Dynamic range <sup>2</sup>	
300 kHz to 1 MHz	125 dB
1 MHz to 5 MHz	135 dB (138 dB typ.)
5 MHz to 4 GHz	140 dB
4.0 GHz to 6.5 GHz	138 dB (140 dB typ.)
6.5 GHz to 8.0 GHz	133 dB (136 dB typ.)
8 GHz to 9 GHz	125 dB (130 dB typ.)

## Effective System Data

<b>300 kHz to 9 GHz</b>	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	$\pm 0.10$ dB
Transmission tracking	$\pm 0.08$ dB

## Uncorrected System Performance

<b>300 kHz to 6.5 GHz</b>	
Directivity	15 dB
Source match	15 dB
Load match	15 dB
<b>6.5 GHz to 9 GHz</b>	
Directivity	10 dB
Source match	15 dB
Load match	15 dB

## Measurement Accuracy

<b>Accuracy of transmission measurements<sup>4</sup></b>	Magnitude / Phase
<b>300 kHz to 1 MHz</b>	
0 dB to +15 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-40 dB to 0 dB	$\pm 0.1$ dB / $\pm 1^\circ$
-60 dB to -40 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-80 dB to -60 dB	$\pm 1.0$ dB / $\pm 6^\circ$
<b>1 MHz to 5 MHz</b>	
0 dB to +15 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-50 dB to 0 dB	$\pm 0.1$ dB / $\pm 1^\circ$
-70 dB to -50 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-90 dB to -70 dB	$\pm 1.0$ dB / $\pm 6^\circ$
<b>5.0 MHz to 4 GHz</b>	
0 dB to +15 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-55 dB to 0 dB	$\pm 0.1$ dB / $\pm 1^\circ$
-75 dB to -55 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-95 dB to -75 dB	$\pm 1.0$ dB / $\pm 6^\circ$
<b>4.0 GHz to 6.5 GHz</b>	
0 dB to +13 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-55 dB to 0 dB	$\pm 0.1$ dB / $\pm 1^\circ$
-75 dB to -55 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-95 dB to -75 dB	$\pm 1.0$ dB / $\pm 6^\circ$
<b>6.5 GHz to 8.0 GHz</b>	
0 dB to +10 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-50 dB to 0 dB	$\pm 0.1$ dB / $\pm 1^\circ$
-70 dB to -50 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-90 dB to -70 dB	$\pm 1.0$ dB / $\pm 6^\circ$
<b>8 GHz to 9 GHz</b>	
0 dB to +5 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-50 dB to 0 dB	$\pm 0.1$ dB / $\pm 1^\circ$
-70 dB to -50 dB	$\pm 0.2$ dB / $\pm 2^\circ$
-90 dB to -70 dB	$\pm 1.0$ dB / $\pm 6^\circ$
<b>Accuracy of reflection measurements<sup>5</sup></b>	Magnitude / Phase
-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 / $\pm 20^\circ$
<b>Trace noise magnitude (IF bandwidth 3 kHz)</b>	
300 kHz to 7 GHz	0.003 dB rms
7 GHz to 9 GHz	0.006 dB rms
<b>Temperature dependence</b>	
300 kHz to 7 GHz	0.02 dB/°C
7 GHz to 9 GHz	0.04 dB/°C

[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 10 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 10 Hz. [5] Reflection specifications are based on an isolating DUT. [6] Specification applies over entire frequency range, at output power of 0 dBm. © Copper Mountain Technologies - www.coppermountaintech.com - Rev. 2019Q4

# Specifications<sup>1</sup>

## Test Port Output

<b>Power range</b>	
300 kHz to 4 GHz	-45 dBm to +15 dBm
4.0 GHz to 6.5 GHz	-45 dBm to +13 dBm
6.5 GHz to 8.0 GHz	-45 dBm to +10 dBm
8 GHz to 9 GHz	-45 dBm to +5 dBm
<b>Power accuracy</b>	±2 dB
<b>Power resolution</b>	0.05 dB
<b>Harmonic distortion<sup>6</sup></b>	-8 dBc
<b>Non-harmonic spurious<sup>6</sup></b>	-15 dBc

## Test Port Input

<b>Noise floor</b>	
300 kHz to 1 MHz	-120 dBm/Hz
1 MHz to 5 MHz	-130 dBm/Hz
5 MHz to 6.5 GHz	-135 dBm/Hz
6.5 GHz to 8.0 GHz	-133 dBm/Hz
8.0 GHz to 9 GHz	-130 dBm/Hz
<b>Damage level</b>	+26 dBm
<b>Damage DC voltage</b>	35 V

## Measurement Speed

<b>Time per point</b>	16 µs typ.		
<b>Port switchover time</b>	200 µs		
<b>Typical cycle time vs number of measurement points</b>			
<b>Frequency range</b>	<b>Number of points</b>	<b>Uncorrected</b>	<b>2-port calibration</b>
from 300 kHz to 9 GHz IF bandwidth 1 MHz	51	1.6 ms	3.2 ms
	201	4.3 ms	8.6 ms
	401	7.5 ms	15.0 ms
	1601	26.7 ms	53.7 ms
from 4 GHz to 5 GHz IF bandwidth 1 MHz	51	1.2 ms	2.6 ms
	201	3.5 ms	7.4 ms
	401	6.6 ms	13.5 ms
	1601	23.0 ms	46.6 ms

## Frequency Reference Input

<b>Port</b>	Ref IN 10 MHz
<b>External reference frequency</b>	10 MHz
<b>Input level</b>	-3 dBm to 3 dBm
<b>Input impedance</b>	50 Ohm
<b>Connector type</b>	SMB, male

## Frequency Reference Output

<b>Port</b>	Ref OUT 10 MHz
<b>Internal reference frequency</b>	10 MHz
<b>Output reference signal level at 50 Ohm impedance</b>	-1 dBm to 3 dBm
<b>Connector type</b>	SMB, male

## Trigger Input

<b>Port</b>	Ext Trig In
<b>Input level</b>	
Low threshold voltage	1.1 V
High threshold voltage	2.6 V
<b>Input level range</b>	0 V to + 5 V
<b>Pulse width</b>	≥2 µs
<b>Polarity</b>	positive or negative
<b>Input impedance</b>	≥2 kOhm
<b>Connector type</b>	SMB, male

## Trigger Output

<b>Port</b>	Ext Trig Out
<b>Maximum output current</b>	20 mA
<b>Output level</b>	
Low level voltage	0.0 to 0.6 V
High level voltage	3.0 to 3.8 V
<b>Polarity</b>	positive or negative
<b>Connector type</b>	SMB, male

## 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>	12 W
<b>Input power</b>	9 V DC to 15 V DC
<b>Input power consumption DC</b>	18 W

## Factory Adjustment

<b>Recommended factory adjustment interval</b>	3 years
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## Environmental Specifications

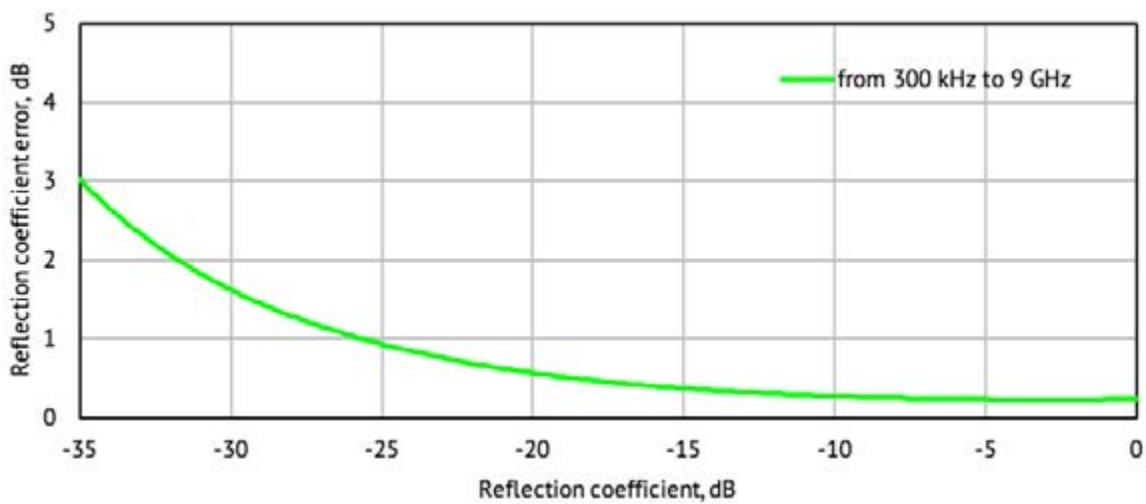
<b>Operating temperature</b>	+5 °C to +40 °C (41 °F to 104 °F)
<b>Storage temperature</b>	-50 °C to +70 °C (-58 °F to 158 °F)
<b>Humidity</b>	90 % at 25 °C (77 °F)
<b>Atmospheric pressure</b>	70.0 kPa to 106.7 kPa

# Reflection Accuracy Plots

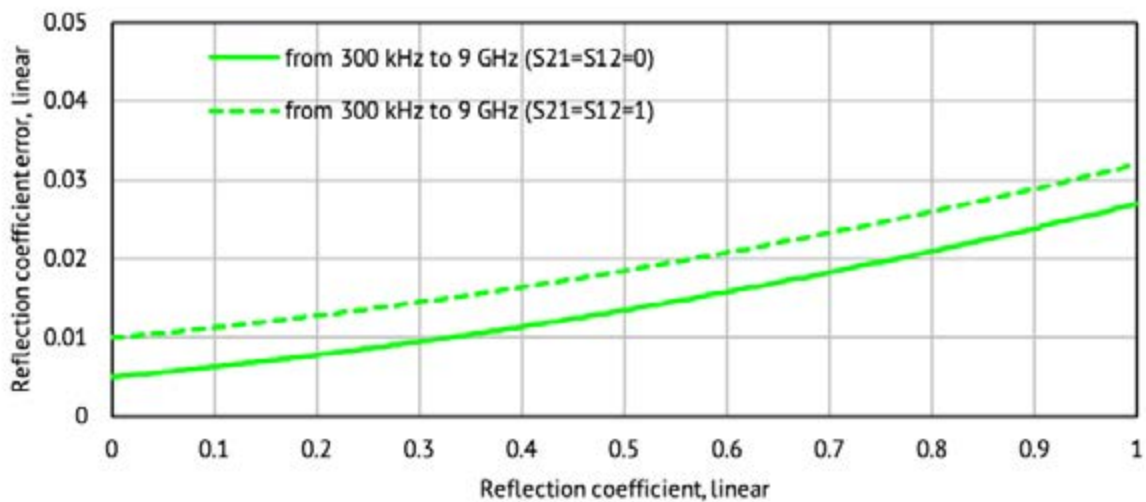
## Reflection Magnitude Errors



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

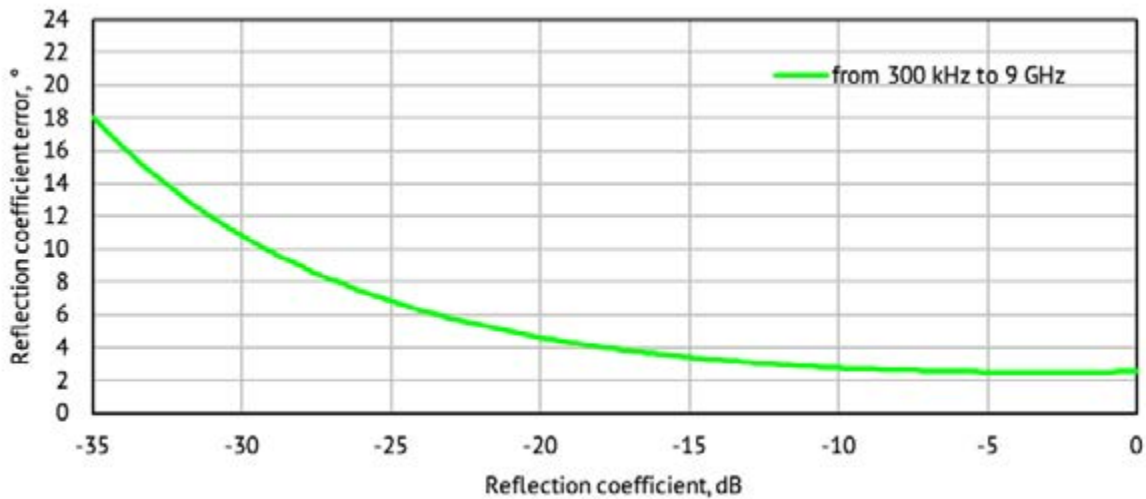


Specifications are based on isolating DUT ( $S_{21} = S_{12} = 0$ )

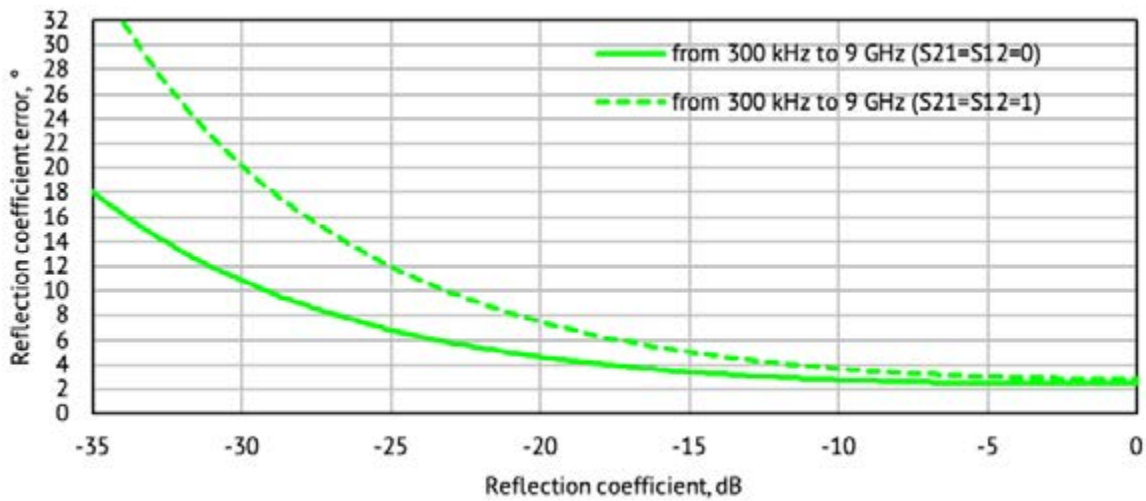


# Reflection/Transmission Accuracy Plots

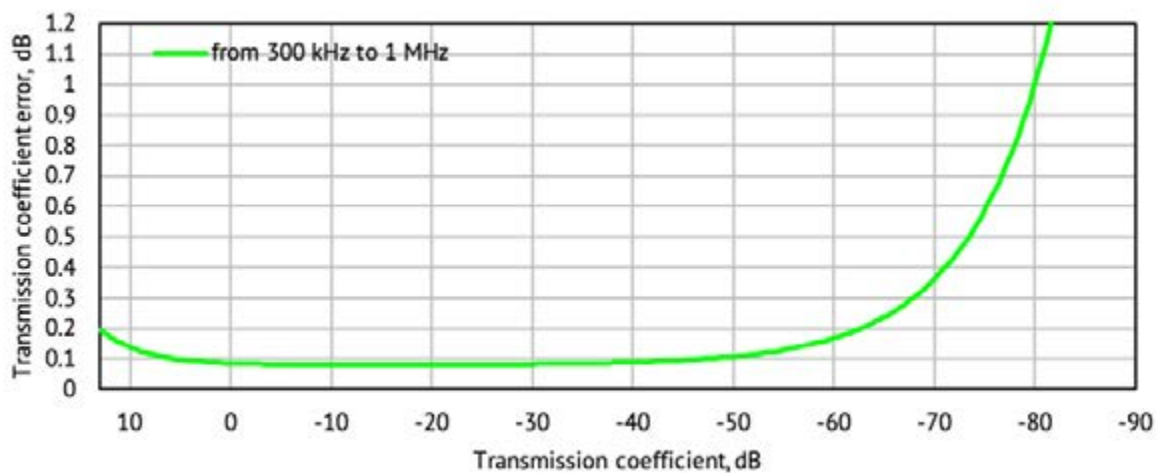
## Reflection Phase Errors



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



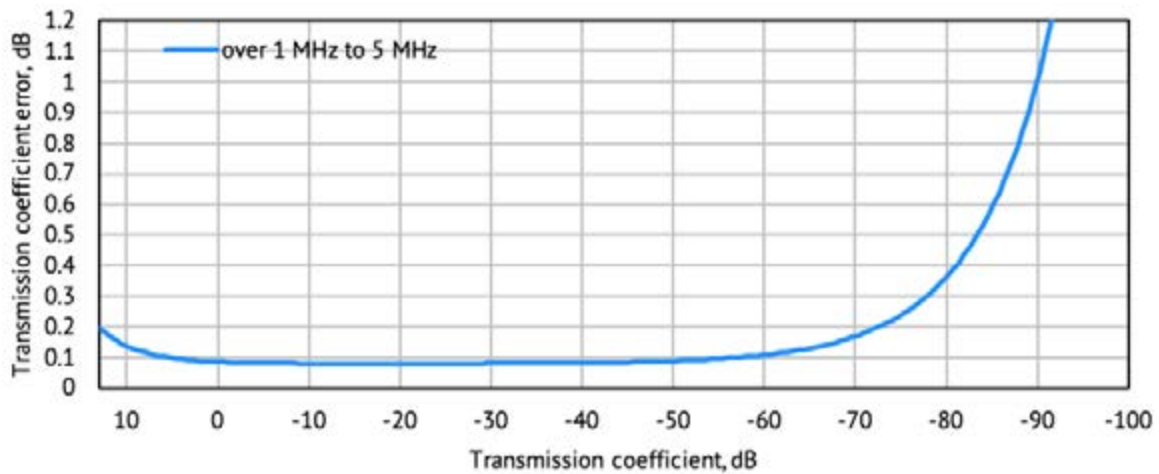
## Transmission Magnitude Errors



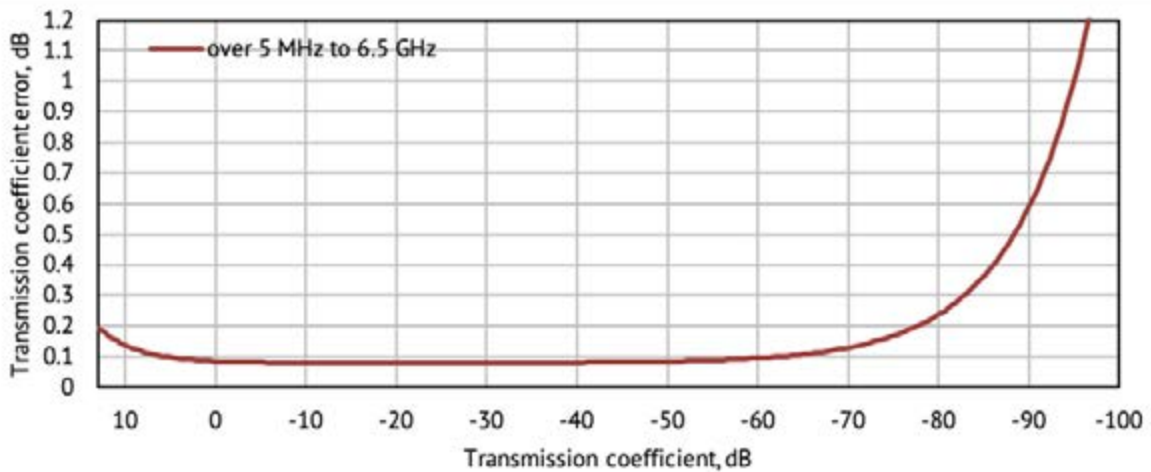
Specifications are based on matched DUT, and IF bandwidth of 10 Hz

# Transmission Accuracy Plots

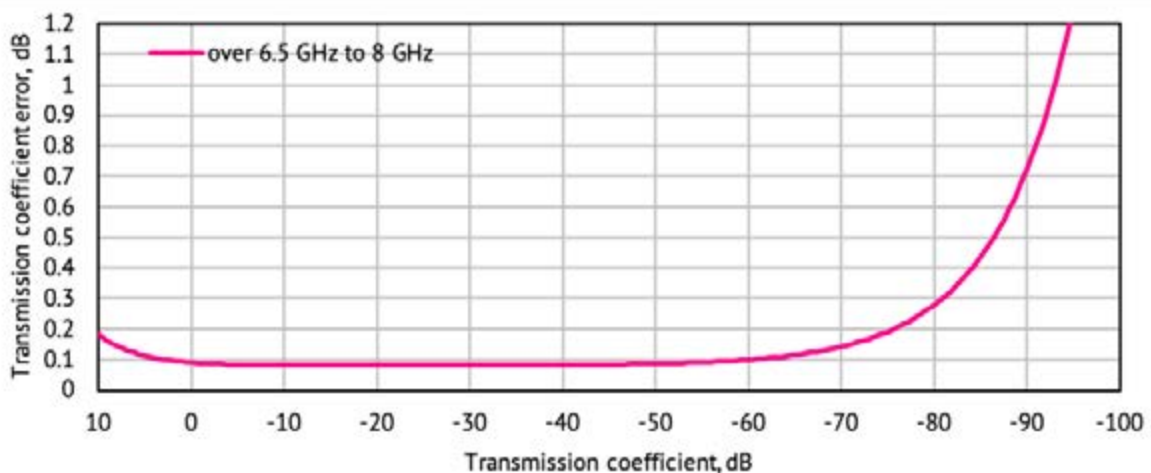
## Transmission Magnitude Errors



Specifications are based on matched DUT, and IF bandwidth of 10 Hz



Specifications are based on matched DUT, and IF bandwidth of 10 Hz

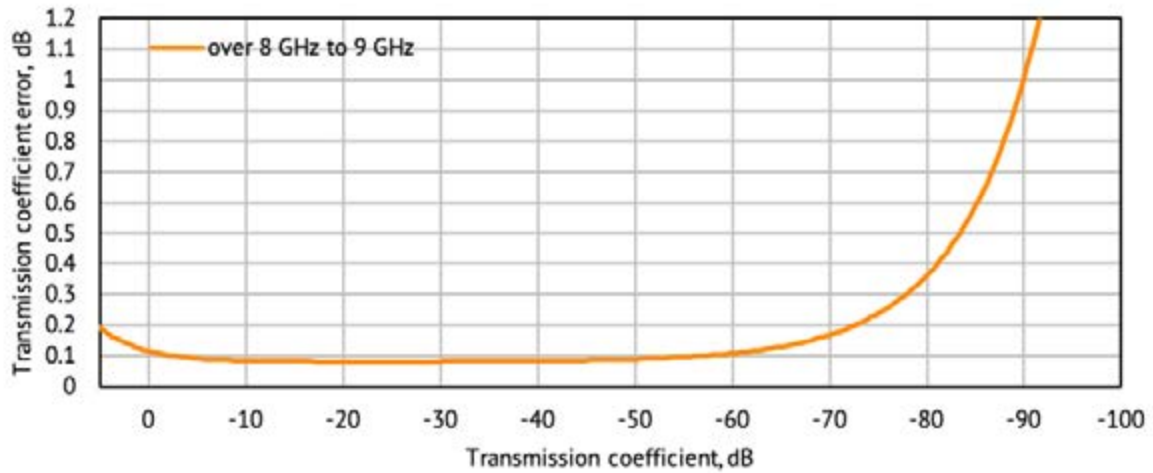


Specifications are based on matched DUT, and IF bandwidth of 10 Hz



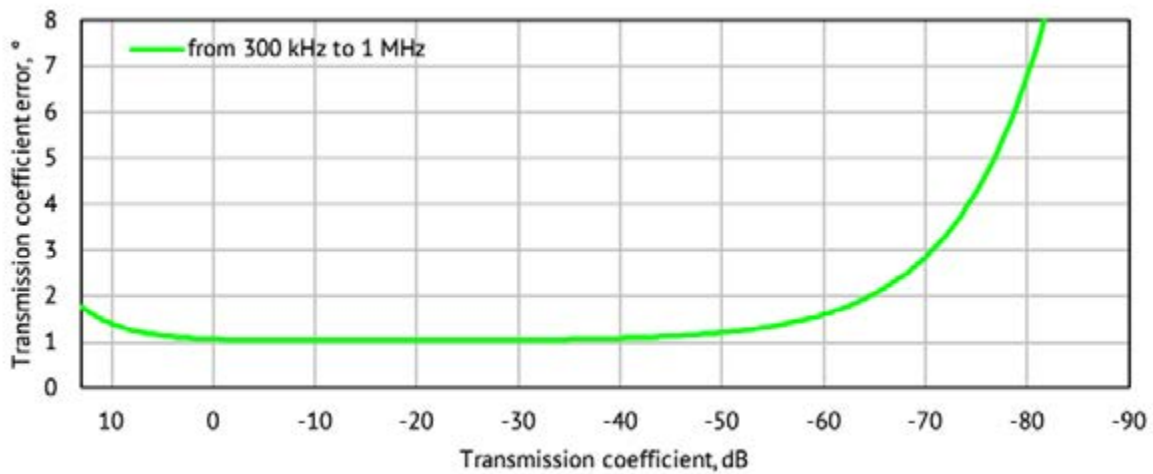
# Transmission Accuracy Plots

## Transmission Magnitude Errors

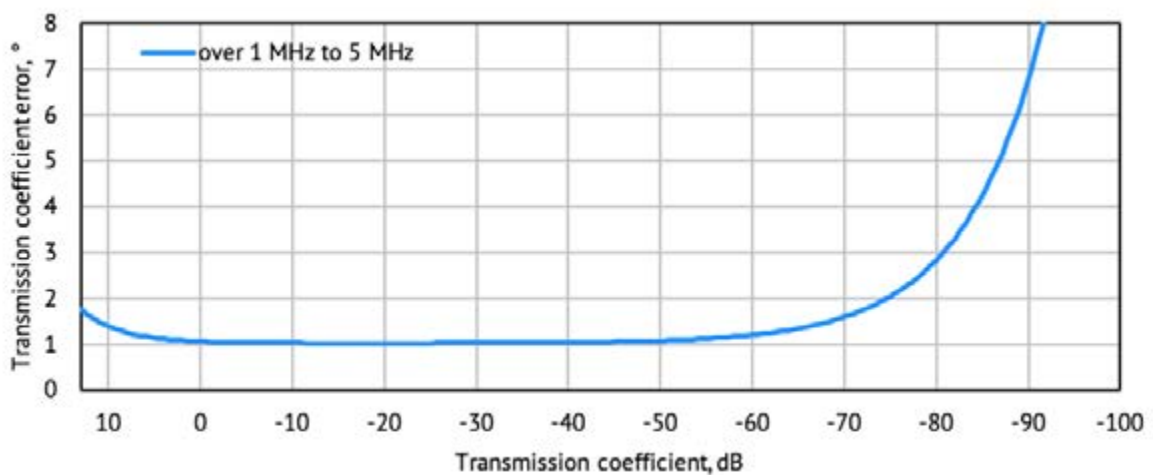


Specifications are based on matched DUT, and IF bandwidth of 10 Hz

## Transmission Phase Errors



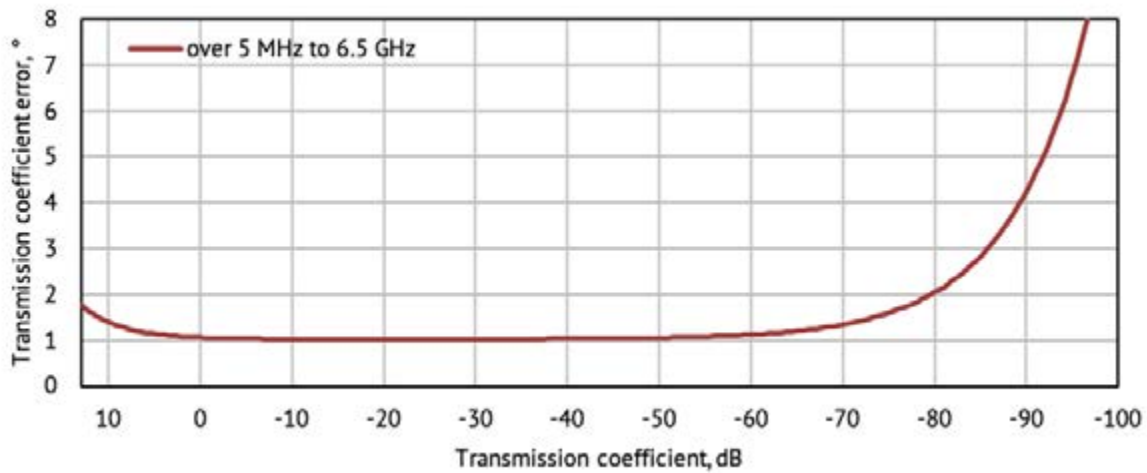
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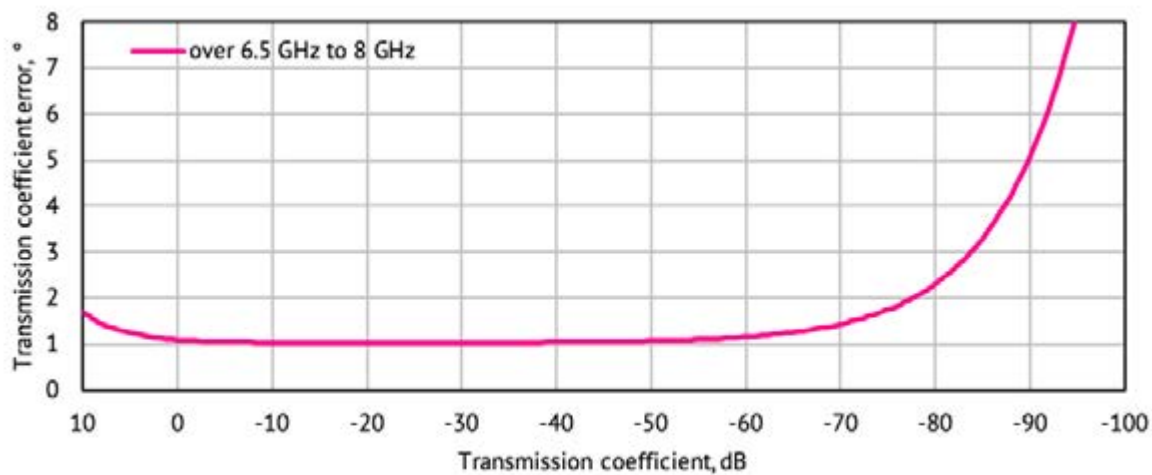
Specifications are based on matched DUT, and IF bandwidth of 10 Hz

# Transmission Accuracy Plots

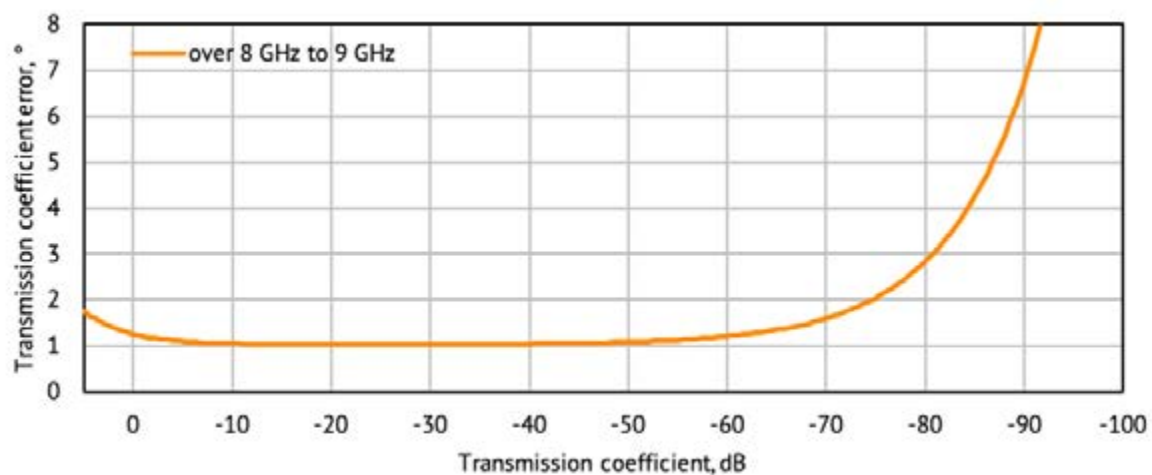
## Transmission Phase Errors



Specifications are based on matched DUT, and IF bandwidth of 10 Hz



Specifications are based on matched DUT, and IF bandwidth of 10 Hz



Specifications are based on matched DUT, and IF bandwidth of 10 Hz



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.



	SC5065	SC5090
Frequency Range	300 kHz to 6.5 GHz	300 kHz to 9 GHz
S-parameters	$S_{11}$ , $S_{21}$ , $S_{12}$ , $S_{22}$	$S_{11}$ , $S_{21}$ , $S_{12}$ , $S_{22}$
Dynamic Range	140 dB, typ.	140 dB, typ.

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