# M5090 Extended Data Sheet

- **Frequency range:** 300 kHz - 9 GHz

- **Wide output power range:** -55 dBm to +5 dBm

- **Dynamic range:** 130 dB (10 Hz IF bandwidth) typ.

- **Measurement time per point:** 70 µs per point, min typ.

- **16 logical channels with 16 traces** each max.

- **Automation programming** in Python, LabVIEW, MATLAB, .NET, etc.

- Up to **200,001 measurement points**

- Multiple **precision calibration** methods and automatic calibration

M5090 Specifications[1]

75 mm

170 mm

Image shows actual size
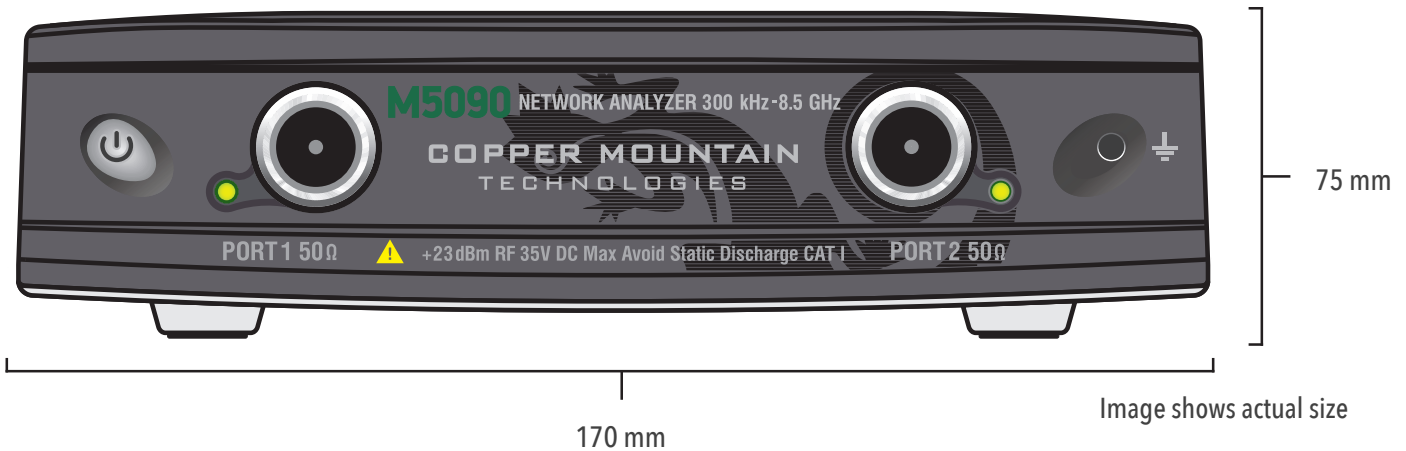
Primary Specifications[3]

Impedance	50 Ohm
Test port connector	type N, female
Number of test ports	2
Frequency range	300 kHz to 8.5 GHz
Full frequency accuracy	$\pm 5 \cdot 10^{-6}$
Frequency resolution	1 Hz
Number of measurement points	2 to 200,001
Measurement bandwidths (with 1/1.5/2/3/5/7 steps)	1 Hz to 100 kHz
Dynamic range[2]	
300 kHz to 6.5 GHz	125 dB (130 dB typ.)
6.5 GHz to 8.0 GHz	120 dB (125 dB typ.)
8.0 GHz to 8.5 GHz	115 dB (120 dB typ.)

Effective System Data

Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	±0.10 dB
Transmission tracking	±0.08 dB

Test Port Output

Power range	
300 kHz to 8.0 GHz	-55 dBm to +5 dBm
8.0 GHz to 8.5 GHz	-55 dBm to +3 dBm
Power accuracy	±1.5 dB
Power resolution	0.05 dB
Harmonic distortion[6]	-20 dBc
Non-harmonic spurious[6]	
300 kHz to 6.5 GHz	-20 dBc
6.5 GHz to 8.5 GHz	-15 dBc

Measurement Accuracy

Accuracy of transmission measurements[4]	Magnitude / Phase
300 kHz to 6.5 GHz	
0 dB to +10 dB	±0.2 dB / ±2°
-45 dB to 0 dB	±0.1 dB / ±1°
-65 dB to -45 dB	±0.2 dB / ±2°
-85 dB to -65 dB	±1.0 dB / ±6°
6.5 GHz to 8.0 GHz	
0 dB to +10 dB	±0.2 dB / ±2°
-40 dB to 0 dB	±0.1 dB / ±1°
-60 dB to -40 dB	±0.2 dB / ±2°
-80 dB to -60 dB	±1.0 dB / ±6°
8.0 GHz to 8.5 GHz	
0 dB to +10 dB	±0.2 dB / ±2°
-35 dB to 0 dB	±0.1 dB / ±1°
-55 dB to -35 dB	±0.2 dB / ±2°
-75 dB to -55 dB	±1.0 dB / ±6°
Accuracy of reflection measurements[5]	Magnitude / Phase
-15 dB to 0 dB	±0.4 dB / ±3°
-25 dB to -15 dB	±1.0 dB / ±6°
-35 dB to -25 dB	±3.0 dB / ±20°
Trace noise magnitude (IF bandwidth 3 kHz)	0.002 dB rms
Temperature dependence	0.02 dB/°C

Uncorrected System Performance

300 kHz to 6.5 GHz	
Directivity	15 dB
Source match	15 dB
Load match	15 dB
6.5 GHz to 8.5 GHz	
Directivity	12 dB
Source match	15 dB
Load match	15 dB

M5090 Specifications[1]
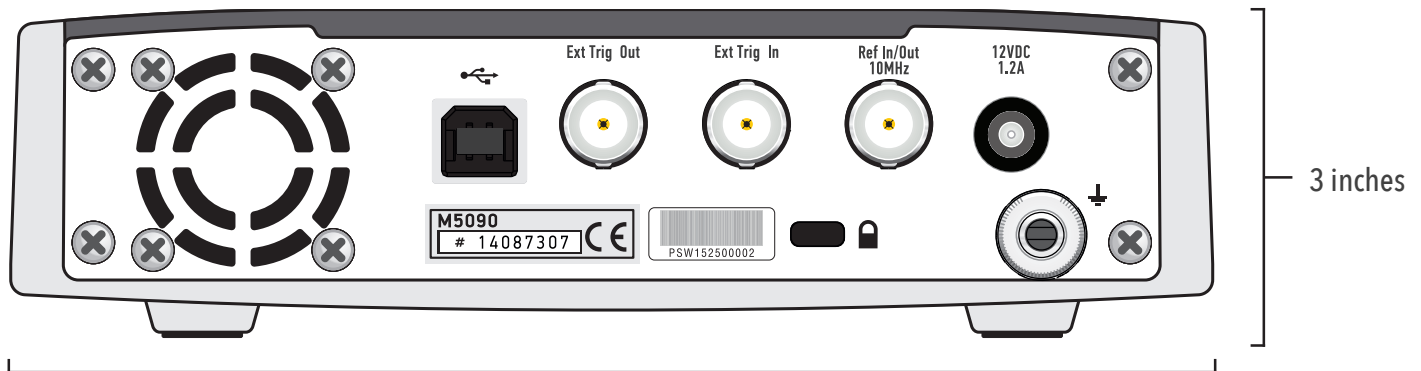
3 inches

6 3/4 inches

Image shows actual size

Test Port Input

Noise floor	
300 kHz to 6.5 GHz	-130 dBm/Hz
6.5 GHz to 8.0 GHz	-125 dBm/Hz
8.0 GHz to 8.5 GHz	-122 dBm/Hz
Damage level	+23 dBm
Damage DC voltage	35 V

Measurement Speed

Time per point	70 µs typ.
Port switchover time	1 ms

Frequency Reference Input

Port	10 MHz Ref In/Out
External reference frequency	10 MHz
Input level	-1 dBm to 5 dBm
Input impedance	50 Ohm
Connector type	BNC, female

Frequency Reference Output

Port	10 MHz Ref In/Out
Internal reference frequency	10 MHz
Output reference signal level at 50 Ohm impedance	1 dBm to 5 dBm
Connector type	BNC, female

Trigger Input

Port	Ext Trig In
Input level	
Low threshold voltage	0.5 V
High threshold voltage	2.7 V
Input level range	0 V to + 5 V
Pulse width	≥2 µs
Polarity	positive or negative
Input impedance	≥10 kOhm
Connector type	BNC, female

Trigger Output

Port	Ext Trig Out
Maximum output current	20 mA
Output level	
Low level voltage	0.0 V
High level voltage	3.5 V
Polarity	positive or negative
Connector type	BNC, female

System & Power

Operating system	Windows 7 and above
CPU frequency	1.5 GHz
RAM	1 GB
Interface	USB 2.0
Connector type	USB B
Input power (VNA)	9 V DC to 15 V DC
Input power consumption (VNA)	12 W
Power supply (Main Outlet)	110-240 V, 50/60 Hz
Power consumption (Main Outlet)	14 W

Factory Adjustment

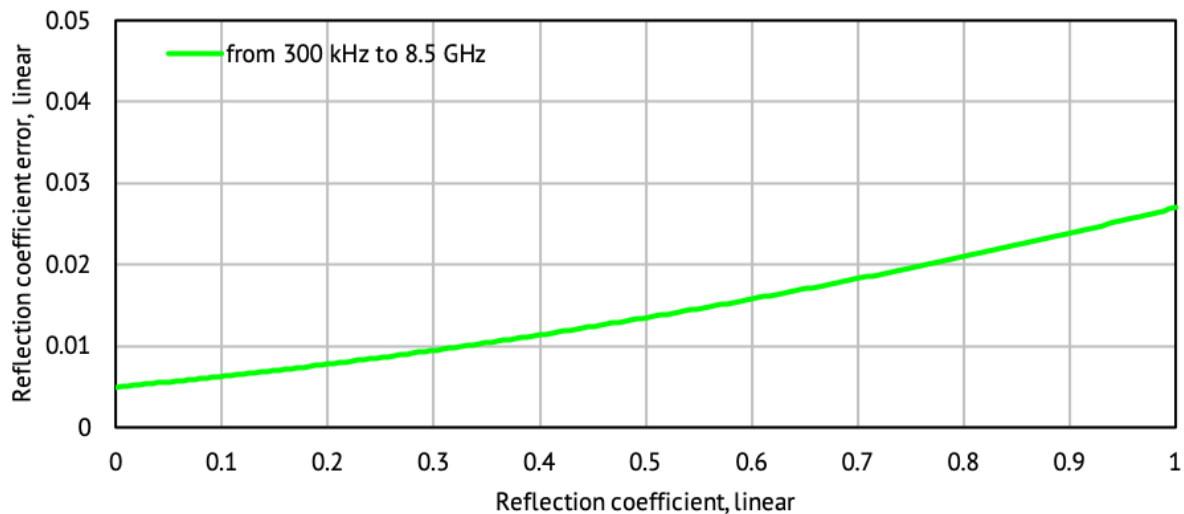| Recommended factory adjustment interval	3 years

Dimensions

Length	297 mm
Width	160 mm
Height	44 mm
Weight	1.7 kg (60 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

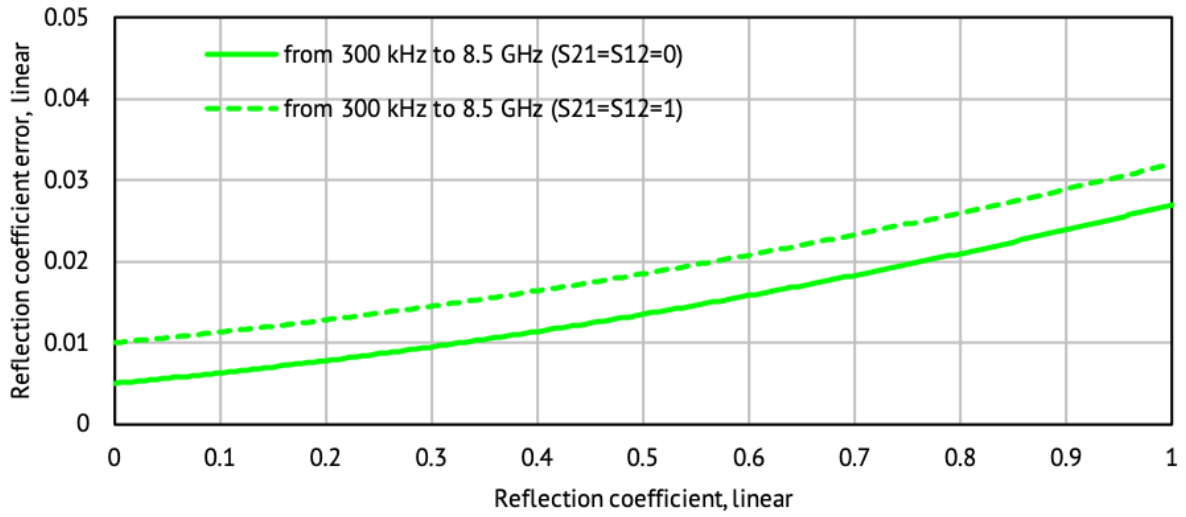# Reflection Accuracy Plots

Reflection Magnitude Errors

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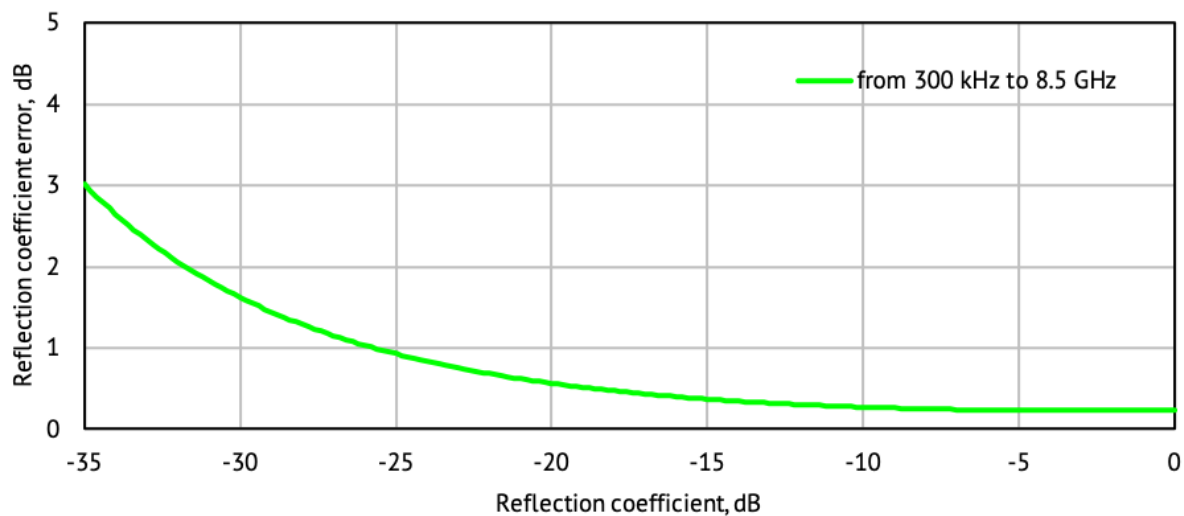
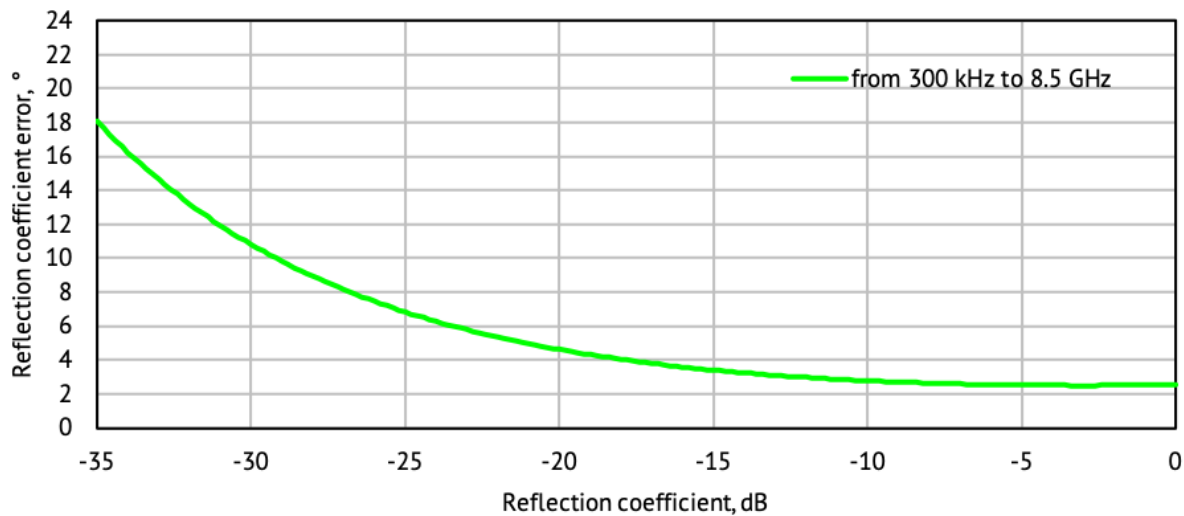Specifications are based on isolating DUT $(S_{21} = S_{12} = 0)$

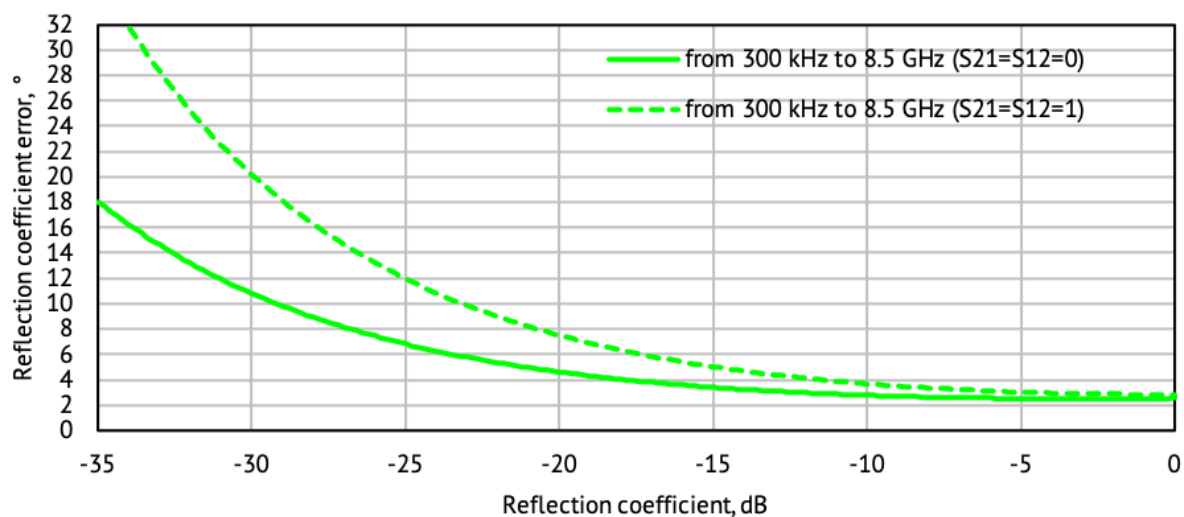**Reflection Magnitude Errors**

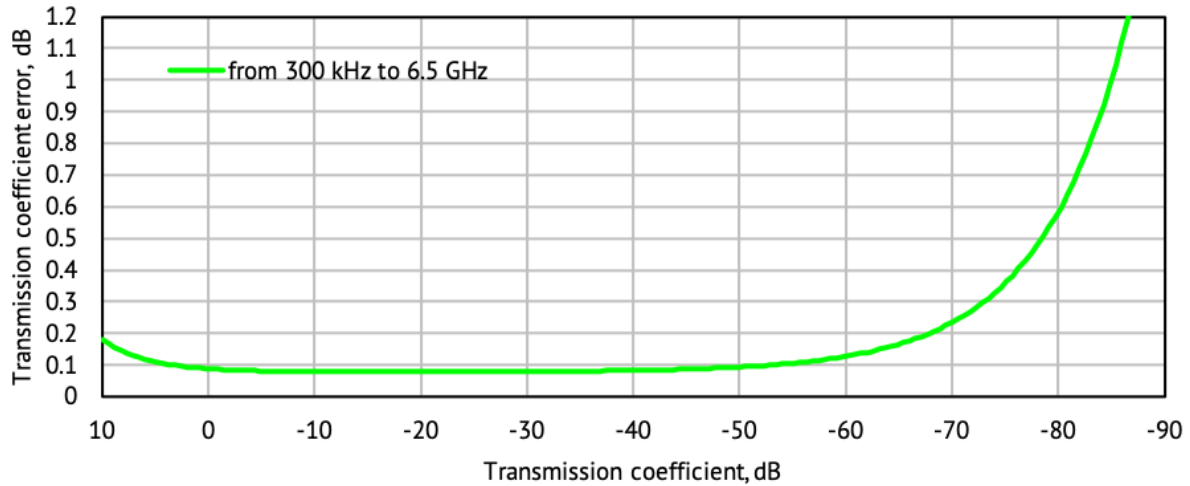# Reflection Accuracy Plots

Reflection Phase Errors

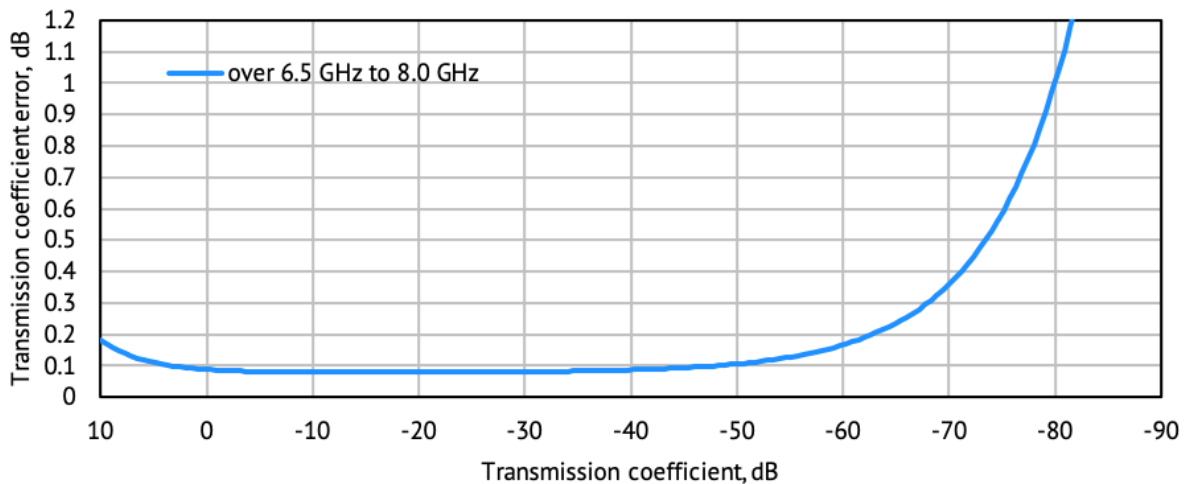Specifications are based on isolating DUT ($S_{21} = S_{12} = 0$)

Transmission Accuracy Plots
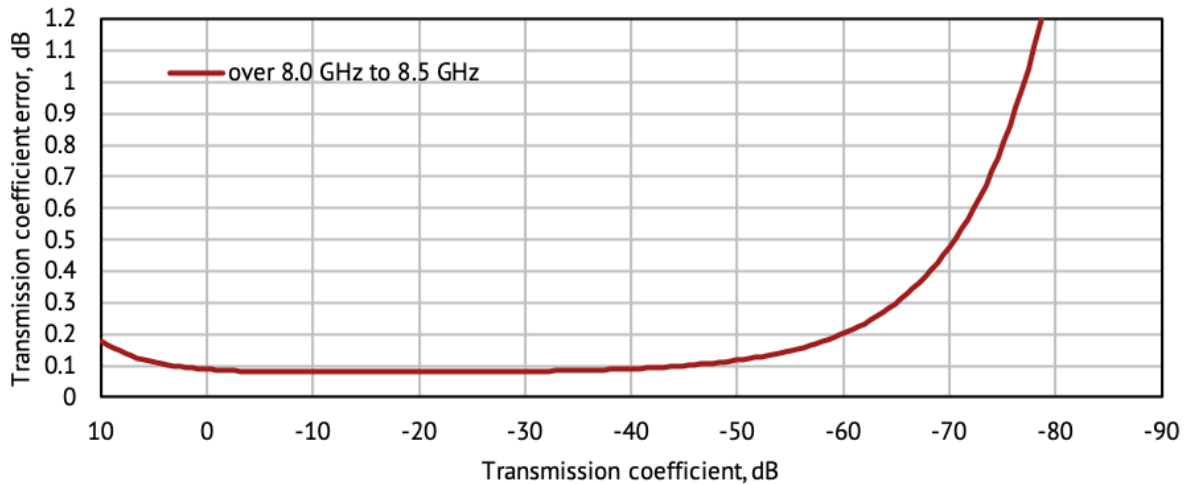
Transmission Magnitude Errors

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

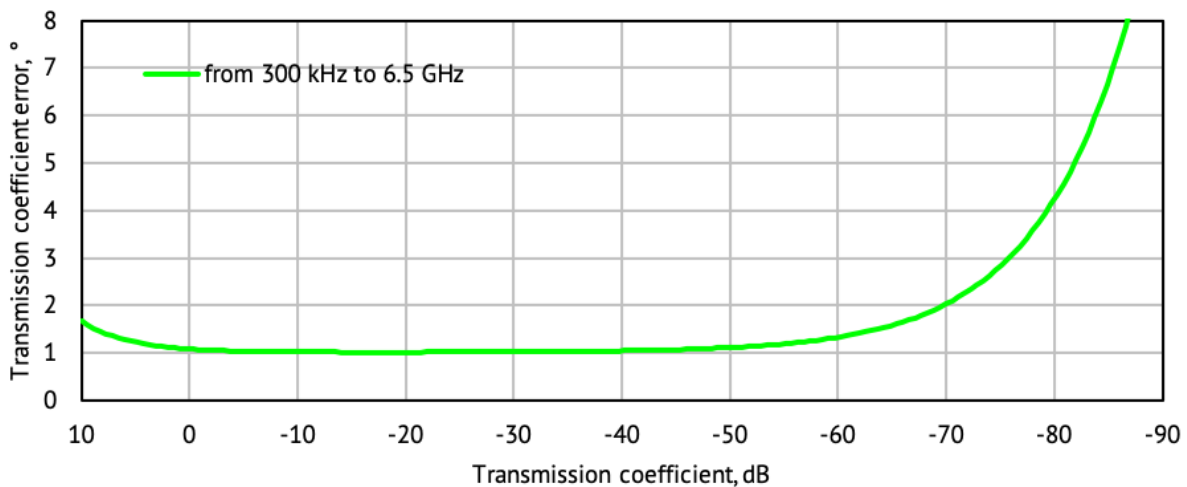Specifications are based on matched DUT, and IF bandwidth of 10 Hz

Transmission Accuracy Plots

Transmission Magnitude Errors

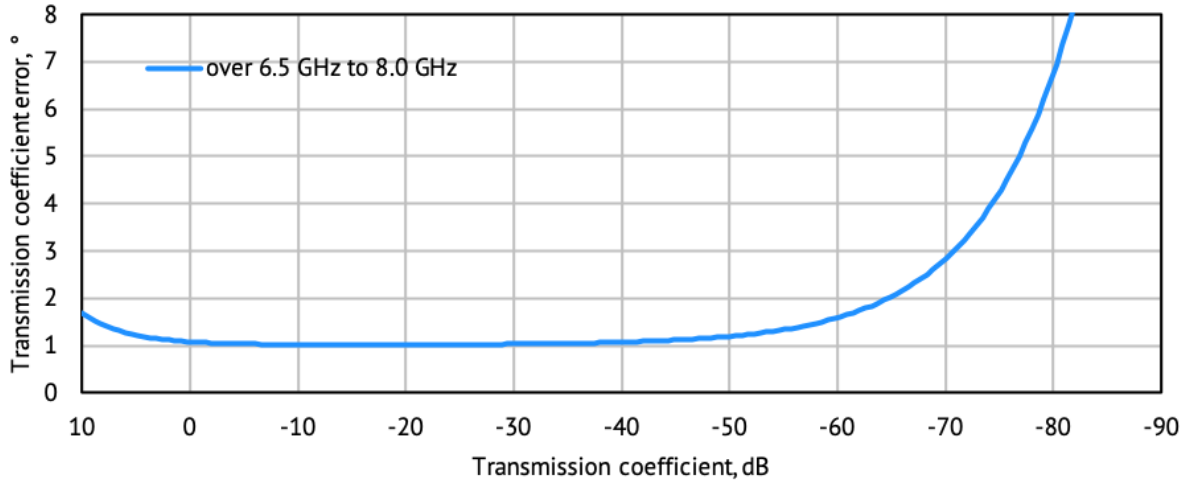Specifications are based on matched DUT, and IF bandwidth of 10 Hz
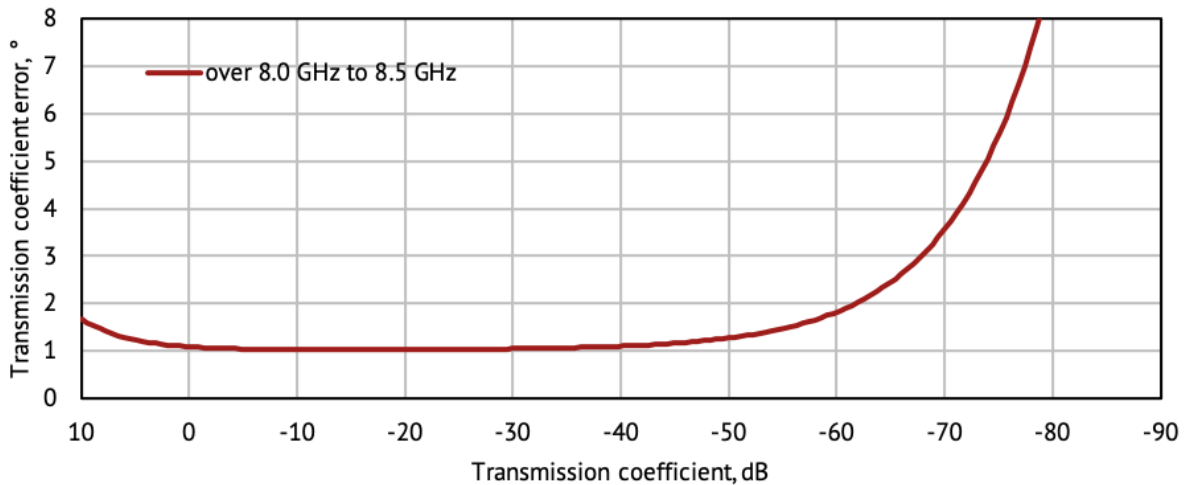
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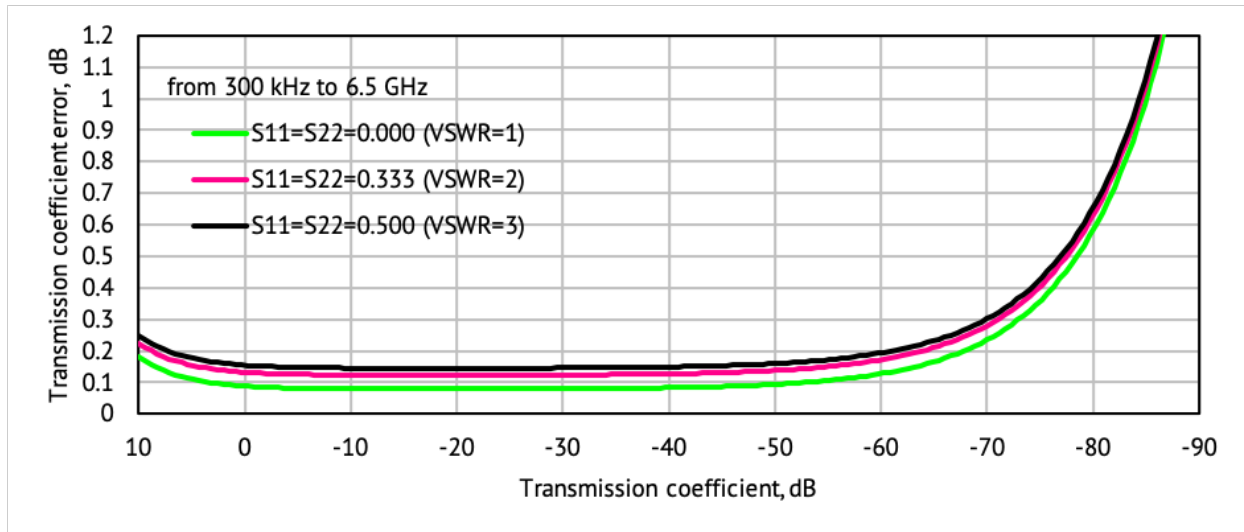
Transmission Phase Errors

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

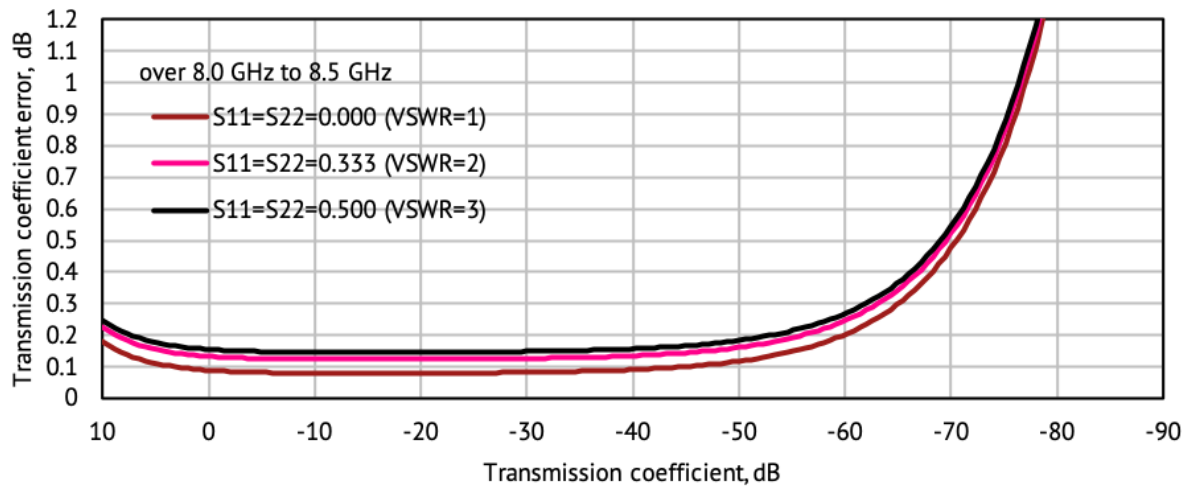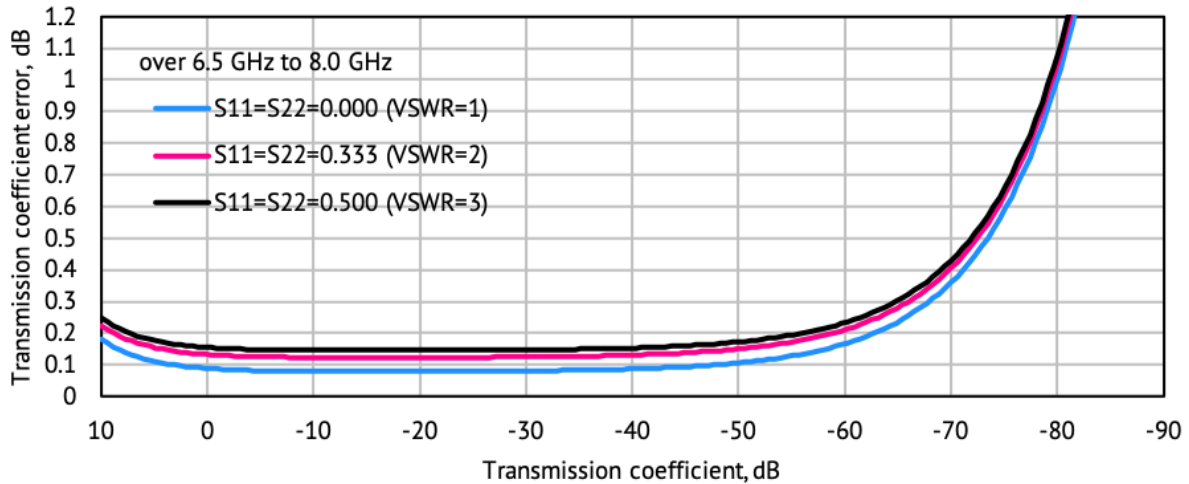Specifications are based on matched DUT, and IF bandwidth of 10 Hz

Transmission Accuracy Plots

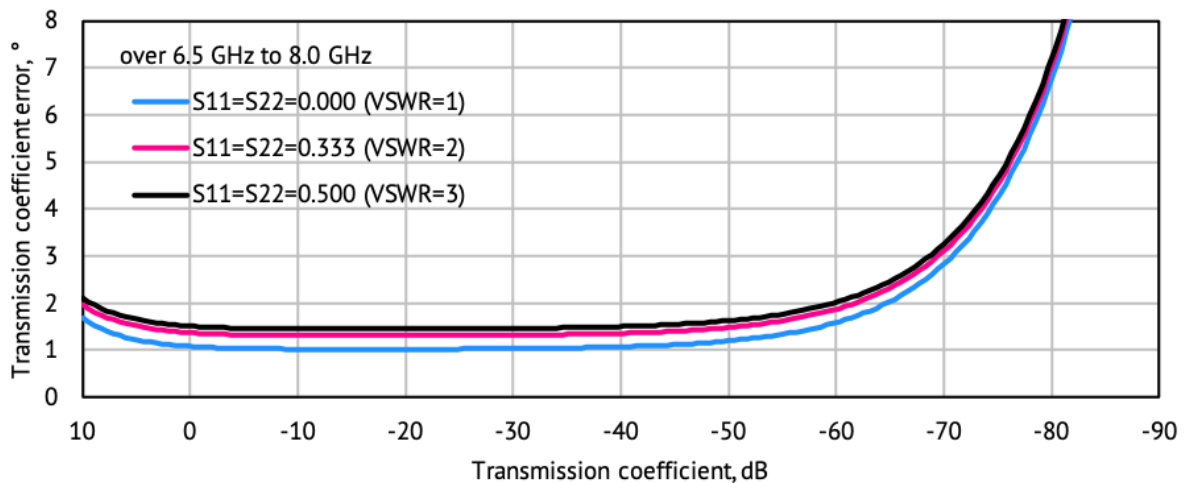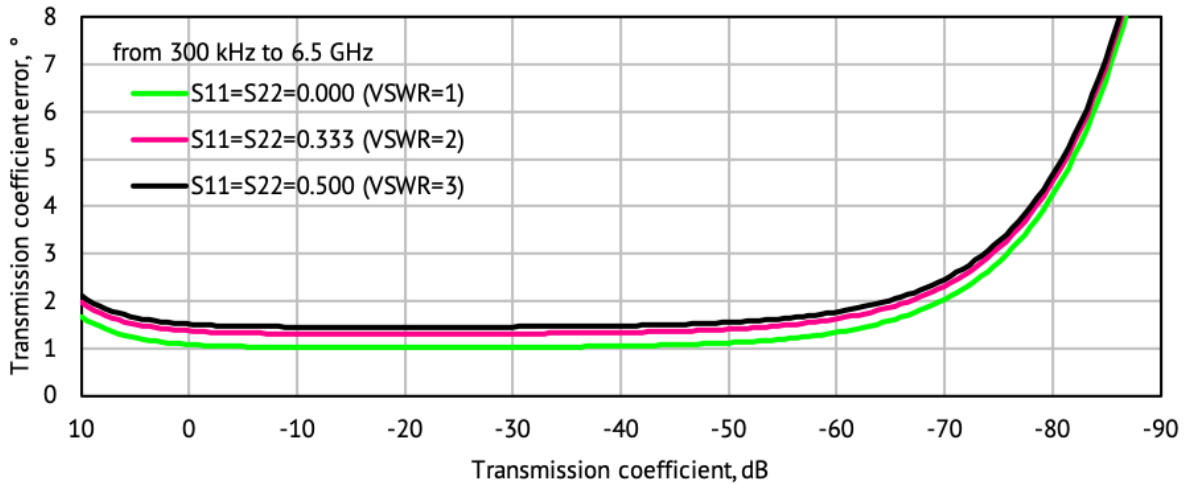**Transmission magnitude errors for unmatched devices**
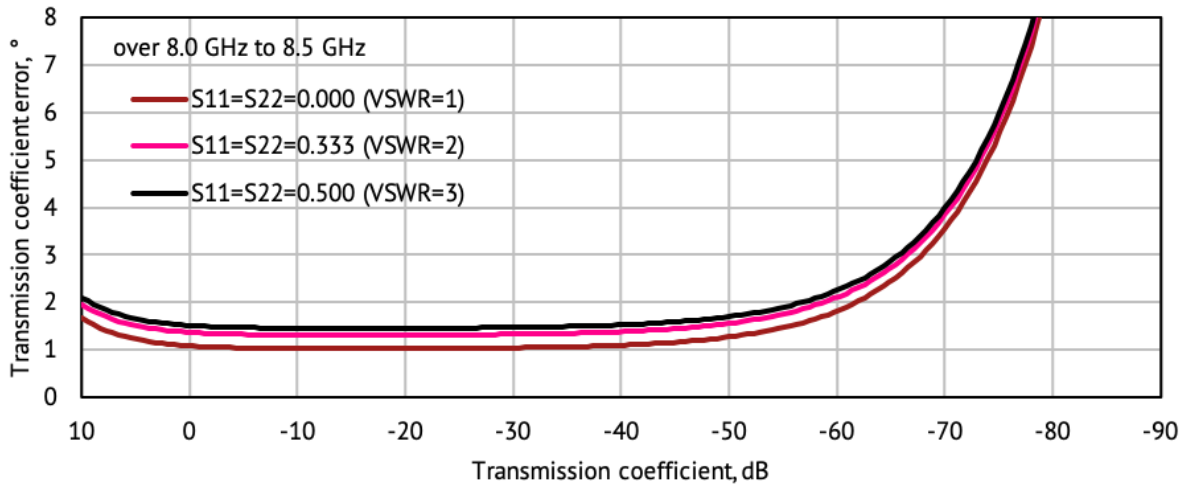
Transmission magnitude errors for unmatched devices

Transmission phase errors for unmatched devices
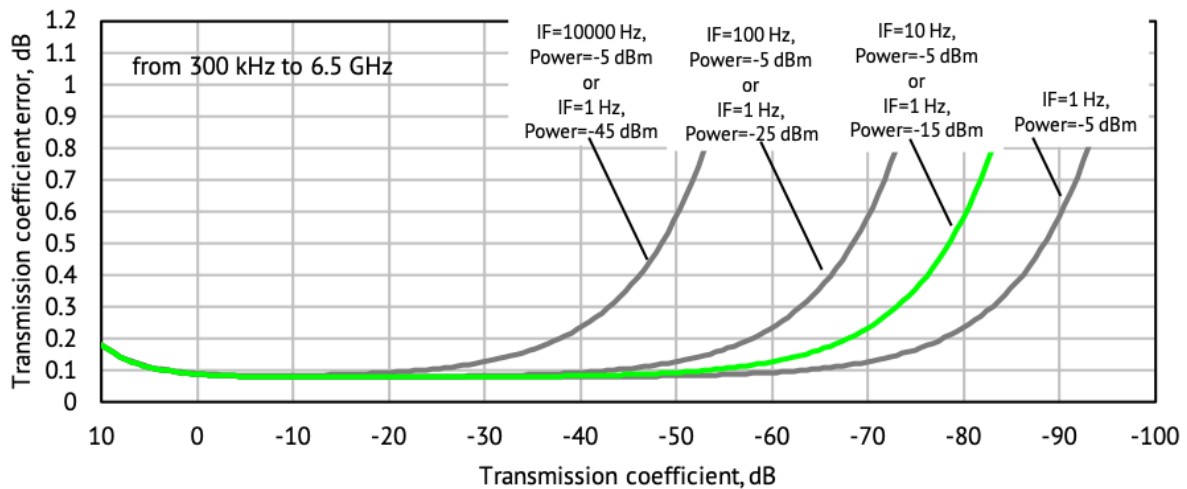
Transmission phase errors for unmatched devices

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 transfered, 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.

Compact Series M Models Overview

	M5045	M5065	M5090	M5180
Frequency Range	300 kHz to 4.5 GHz	300 kHz to 6.5 GHz	300 kHz to 9 GHz	300 kHz to 18 GHz
Dynamic Range	130 dB, typ.	130 dB, typ.	130 dB, typ.	135 dB, typ.

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