# M5180 Extended Data Sheet

M5180 NETWORK ANALYZER 300 kHz-18 GHz
M SERIES
COPPER MOUNTAIN® TECHNOLOGIES

PORT 1 50 Ω  ⚠ +23 dBm RF 35 V DC Max Avoid Static Discharge CAT I  PORT 2 50 Ω

- **Frequency range:** 300 kHz - 18 GHz

- **Wide output power range:** -40 dBm to +10 dBm

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

- **Measurement time per point:** 30 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

# M5180 Specifications[1]

## Primary Specifications[3]

| | |
|---|---|
| Impedance | 50 Ohm |
| Test port connector | type N, female |
| Number of test ports | 2 |
| Frequency range | 300 kHz to 18 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 300 kHz |
| Dynamic range[2] | |
| 300 kHz to 1 MHz | 100 dB |
| 1 MHz to 6.5 GHz | 130 dB |
| 6.5 GHz to 12 GHz | 125 dB |
| 12 GHz to 16 GHz | 122 dB |
| 16 GHz to 18 GHz | 118 dB |
| Crosstalk[2a] | |
| 300 kHz to 5 GHz | - |
| 5 GHz to 7.5 GHz | -120 dB typ. |
| 7.5 GHz to 8.5 GHz | -110 dB typ. |
| 8.5 GHz to 15 GHz | -120 dB typ. |
| 15 GHz to 18 GHz | -100 dB typ. |

## Effective System Data

| | |
|---|---|
| **300 kHz to 10 GHz** | |
| Directivity | 46 dB |
| Source match | 40 dB |
| Load match | 46 dB |
| Reflection tracking | ±0.10 dB |
| Transmission tracking | ±0.08 dB |
| **10 GHz to 18 GHz** | |
| Directivity | 42 dB |
| Source match | 38 dB |
| Load match | 42 dB |
| Reflection tracking | ±0.10 dB |
| Transmission tracking | ±0.08 dB |

## Uncorrected System Performance

| | |
|---|---|
| **300 kHz to 1 MHz** | |
| Directivity | 10 dB |
| Source match | 8 dB |
| Load match | 12 dB |
| **1 MHz to 6.5 GHz** | |
| Directivity | 15 dB |
| Source match | 12 dB |
| Load match | 15 dB |
| **6.5 GHz to 12 GHz** | |
| Directivity | 10 dB |
| Source match | 8 dB |
| Load match | 10 dB |
| **12 GHz to 18 GHz** | |
| Directivity | 10 dB |
| Source match | 8 dB |
| Load match | 10 dB |

## Measurement Accuracy

| Accuracy of transmission measurements[4] | Magnitude / Phase |
|---|---|
| 300 kHz to 1 MHz | |
| 0 dB to +10 dB | ±0.2 dB / ±2° |
| -30 dB to 0 dB | ±0.1 dB / ±1° |
| -50 dB to -30 dB | ±0.2 dB / ±2° |
| -70 dB to -50 dB | ±1.0 dB / ±6° |
| 1 MHz to 6.5 GHz | |
| 0 dB to +10 dB | ±0.2 dB / ±2° |
| -60 dB to 0 dB | ±0.1 dB / ±1° |
| -80 dB to -60 dB | ±0.2 dB / ±2° |
| -100 dB to -80 dB | ±1.0 dB / ±6° |
| 6.5 GHz to 12 GHz | |
| 0 dB to +10 dB | ±0.2 dB / ±2° |
| -55 dB to 0 dB | ±0.1 dB / ±1° |
| -75 dB to -55 dB | ±0.2 dB / ±2° |
| -95 dB to -75 dB | ±1.0 dB / ±6° |
| 12 GHz to 16 GHz | |
| 0 dB to +10 dB | ±0.2 dB / ±2° |
| -50 dB to 0 dB | ±0.1 dB / ±1° |
| -70 dB to -50 dB | ±0.2 dB / ±2° |
| -92 dB to -70 dB | ±1.0 dB / ±6° |
| 16 GHz to 18 GHz | |
| 0 dB to +6 dB | ±0.2 dB / ±2° |
| -50 dB to 0 dB | ±0.1 dB / ±1° |
| -70 dB to -50 dB | ±0.2 dB / ±2° |
| -92 dB to -70 dB | ±1.0 dB / ±6° |
| **Accuracy of reflection measurements[5]** | Magnitude / Phase |
| 300 kHz to 10 GHz | |
| -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° |
| 10 GHz to 18 GHz | |
| -15 dB to 0 dB | ±0.5 dB / ±4° |
| -25 dB to -15 dB | ±1.5 dB / ±10° |
| -35 dB to -25 dB | ±5.5 dB / ±30° |
| **Trace noise magnitude (IF bandwidth 3 kHz)** | |
| 300 kHz to 1 MHz | 0.010 dB rms |
| 1 MHz to 6.5 GHz | 0.002 dB rms |
| 6.5 GHz to 12 GHz | 0.003 dB rms |
| 12 GHz to 18 GHz | 0.004 dB rms |
| **Temperature dependence** | |
| 300 kHz to 6.5 GHz | 0.02 dB/°C |
| 6.5 GHz to 18 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. [2a] Uncorrected crosstalk is defined at maximum specified output power level. Dynamic range of the analyzer may be limited on the lower end by either crosstalk or noise floor. [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 - 2022Q1

# M5180 Specifications[1]



65 mm
2.5 inches

200 mm/7.9 inches
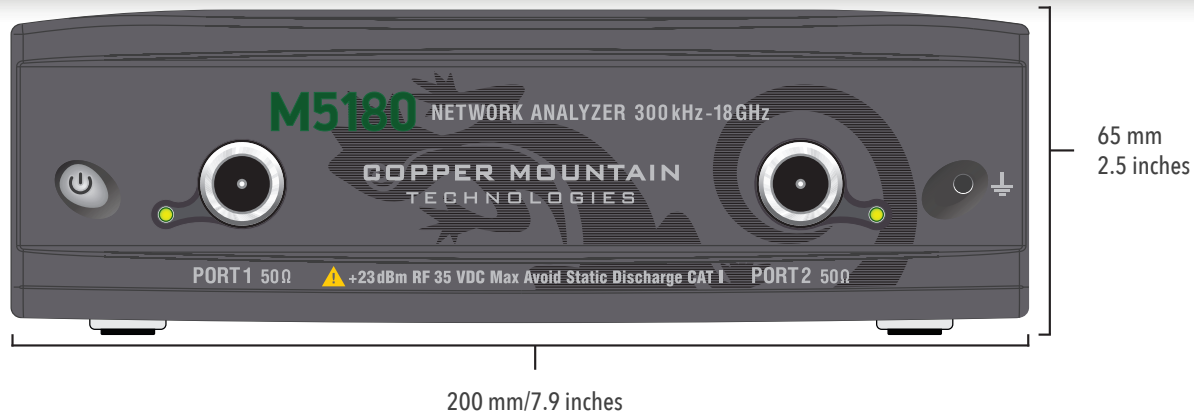
## Test Port Output

| Power range | |
|---|---|
| 300 kHz to 16 GHz | -40 dBm to +10 dBm |
| 16 GHz to 18 GHz | -40 dBm to +6 dBm |
| Power accuracy | ±2 dB |
| Power resolution | 0.05 dB |
| Harmonic distortion[6] | -15 dBc |
| Non-harmonic spurious[6] | |
| 300 kHz to 16 GHz | -20 dBc |
| 16 GHz to 18 GHz | -15 dBc |

## Test Port Input

| Noise floor | |
|---|---|
| 300 kHz to 1 MHz | -100 dBm/Hz |
| 1 MHz to 6.5 GHz | -130 dBm/Hz |
| 6.5 GHz to 12 GHz | -125 dBm/Hz |
| 12 GHz to 18 GHz | -122 dBm/Hz |
| Damage level | +23 dBm |
| Damage DC voltage | 35 V |

## Measurement Speed

| Time per point | 30 µs typ. |
|---|---|
| Port switchover time | 0.2 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 |

## Factory Adjustment

| Recommended factory adjustment interval | 3 years |
|---|---|

## 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) | 11 V DC to 15 V DC |
| Input power consumption (VNA) | 35 W |
| Power supply (Main Outlet) | 110-240 V, 50/60 Hz |
| Power consumption (Main Outlet) | 40 W |

## 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 |

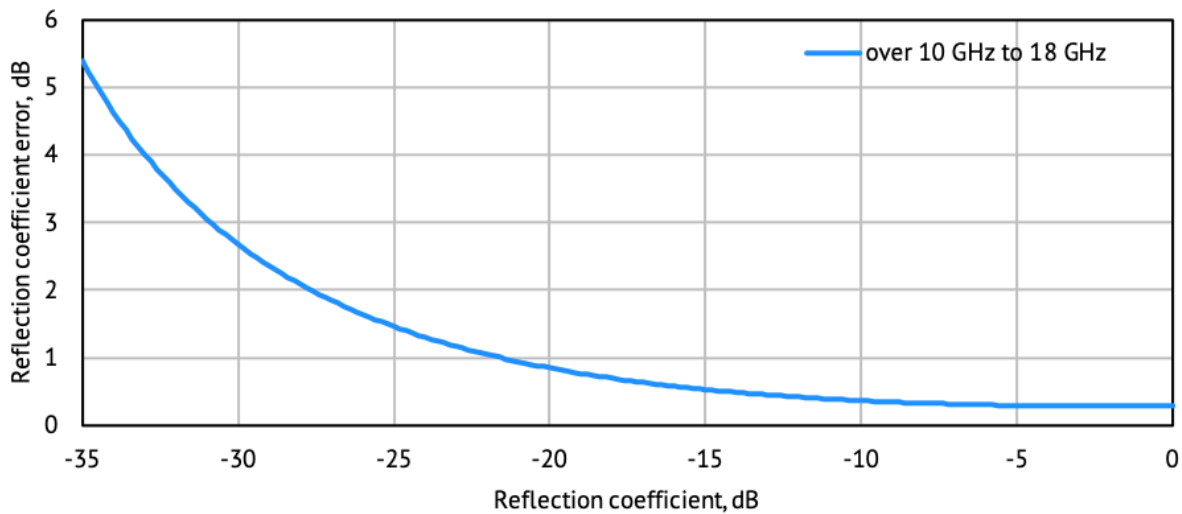# Reflection Accuracy Plots
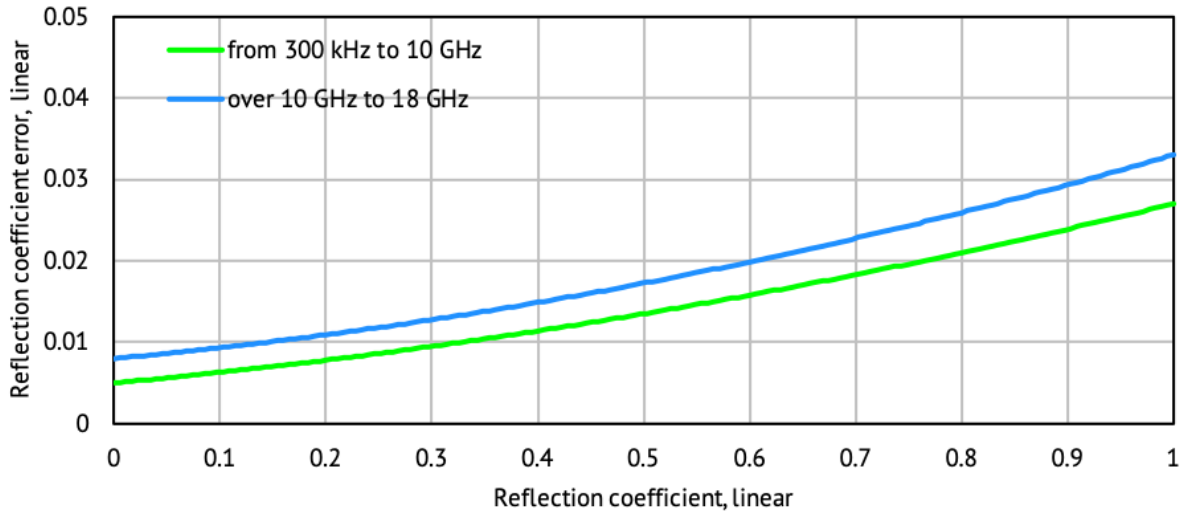
**Reflection Magnitude Errors**



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



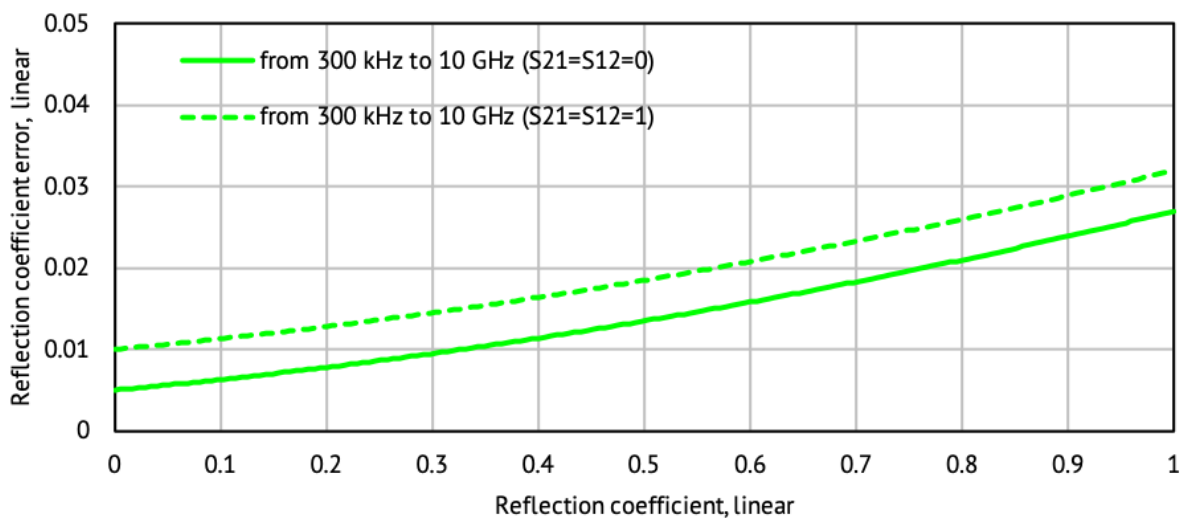Specifications are based on isolating DUT ($S_{21} = S_{12} = 0$)
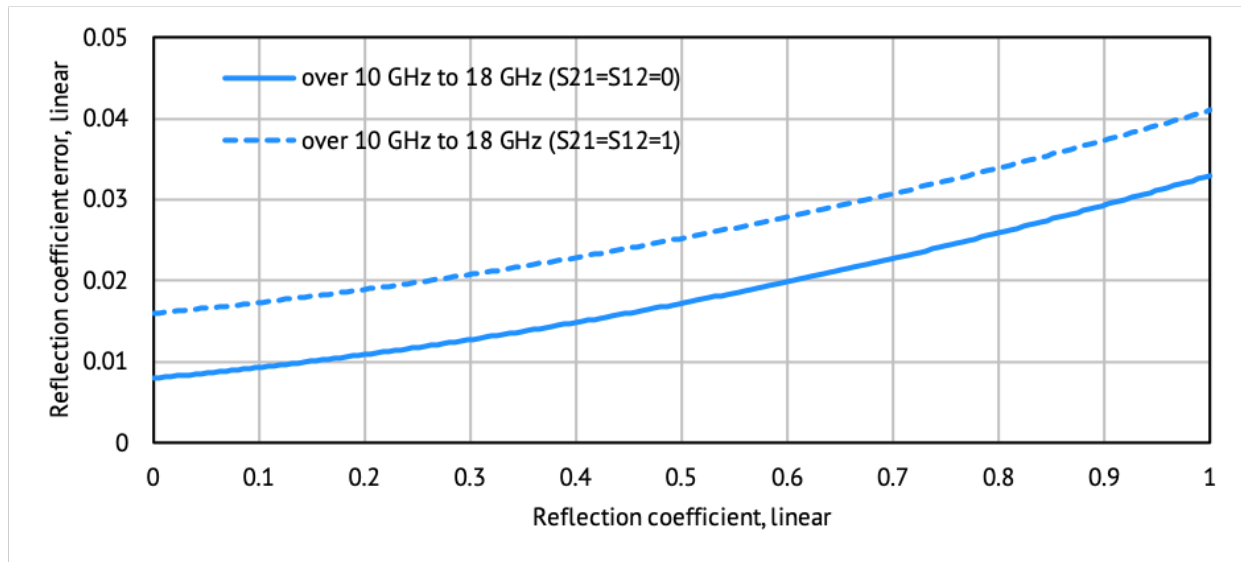
# Reflection Accuracy Plots

**Reflection Magnitude Errors**



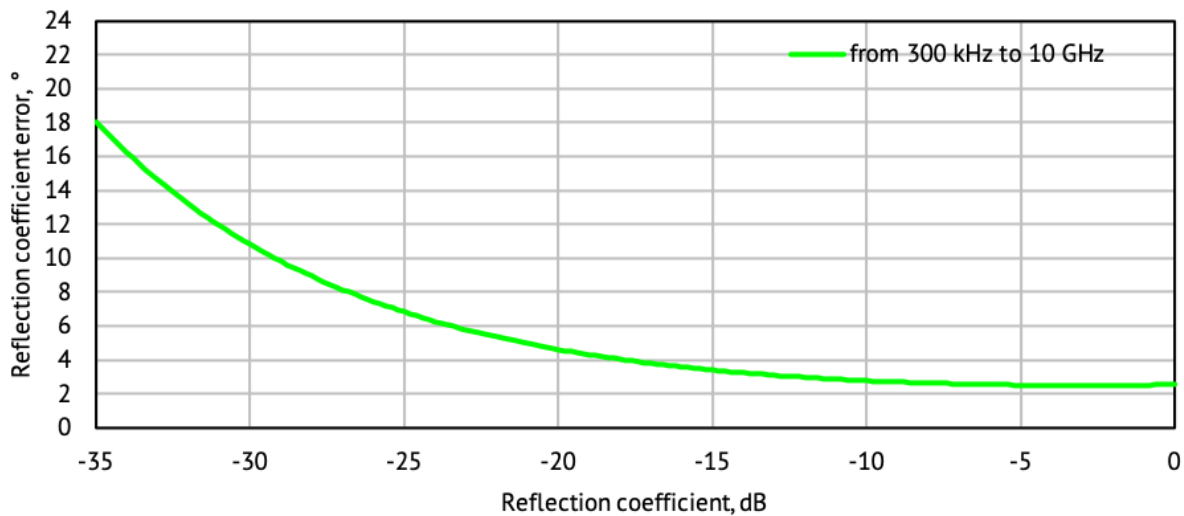Specifications are based on isolating DUT ($S_{21} = S_{12} = 0$)
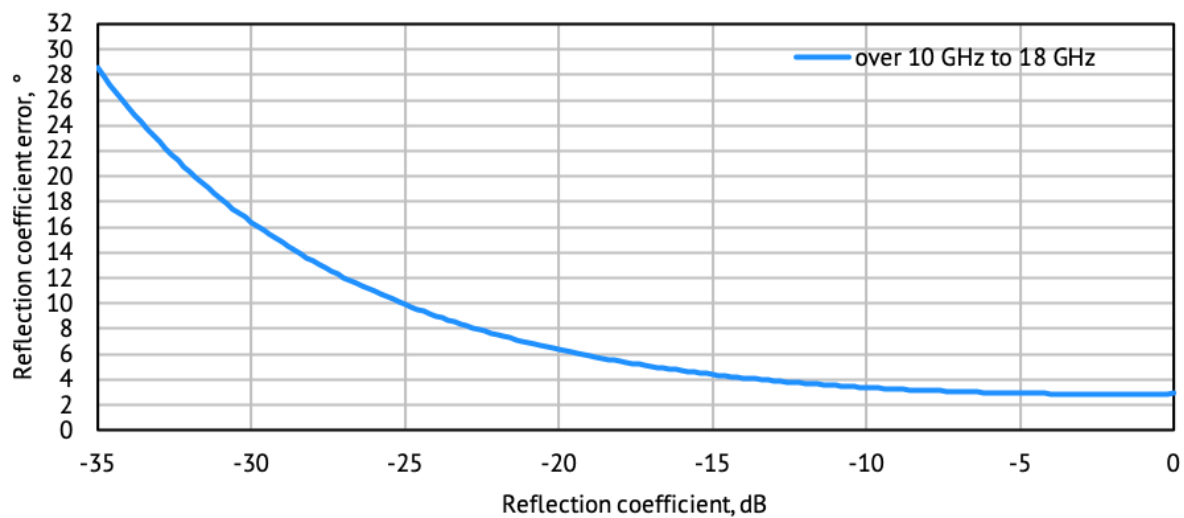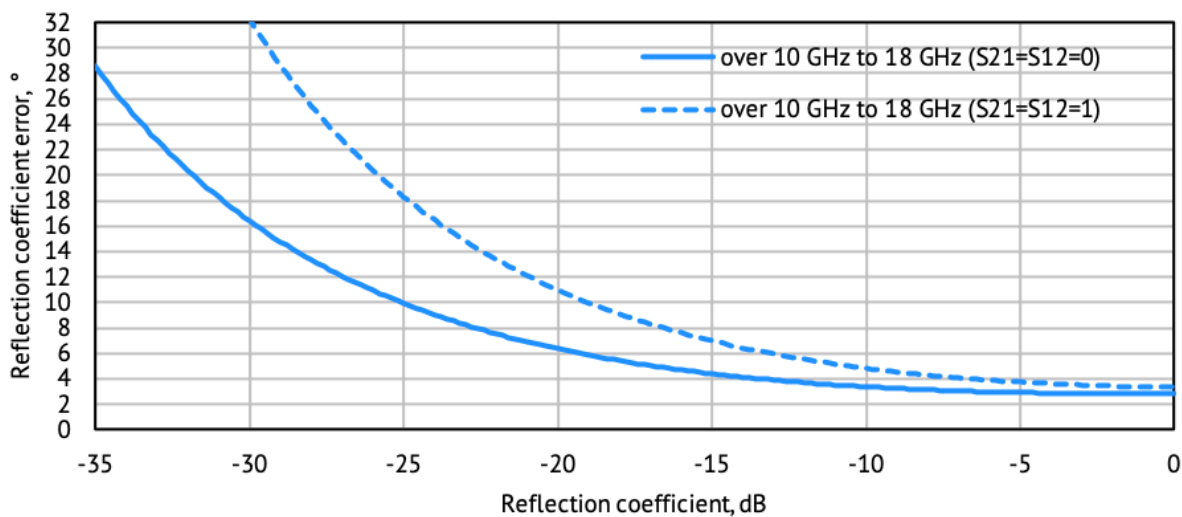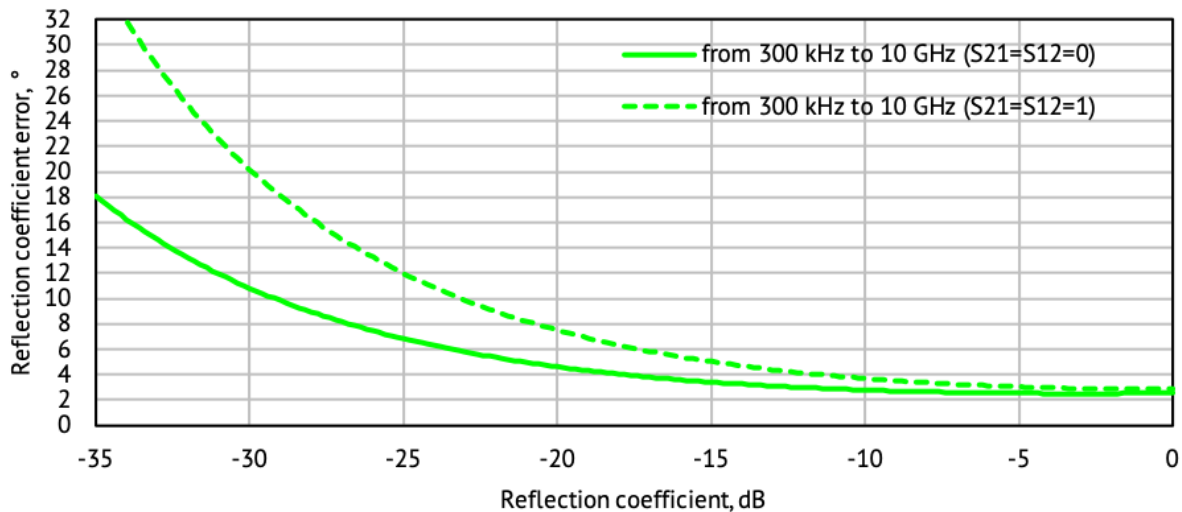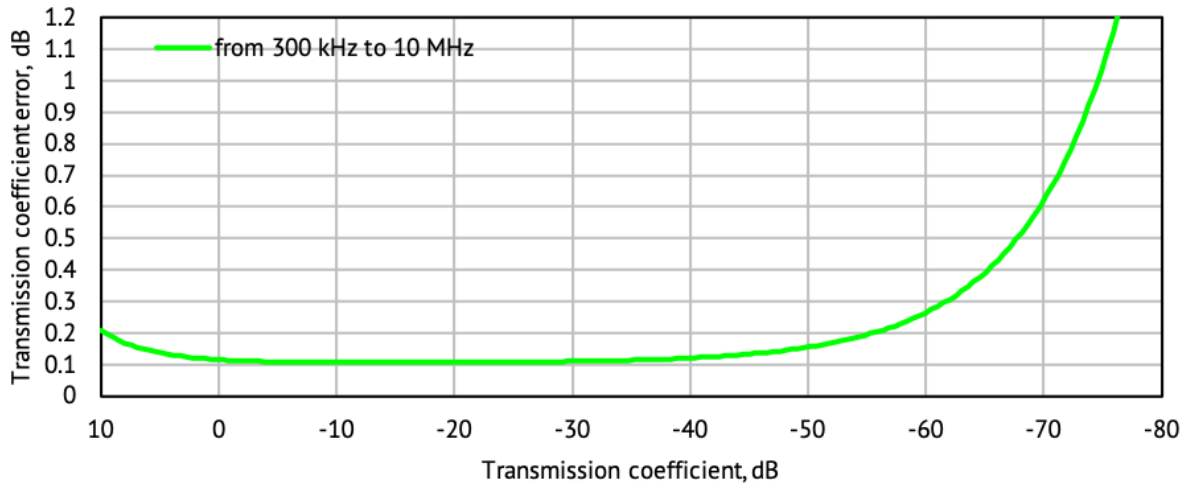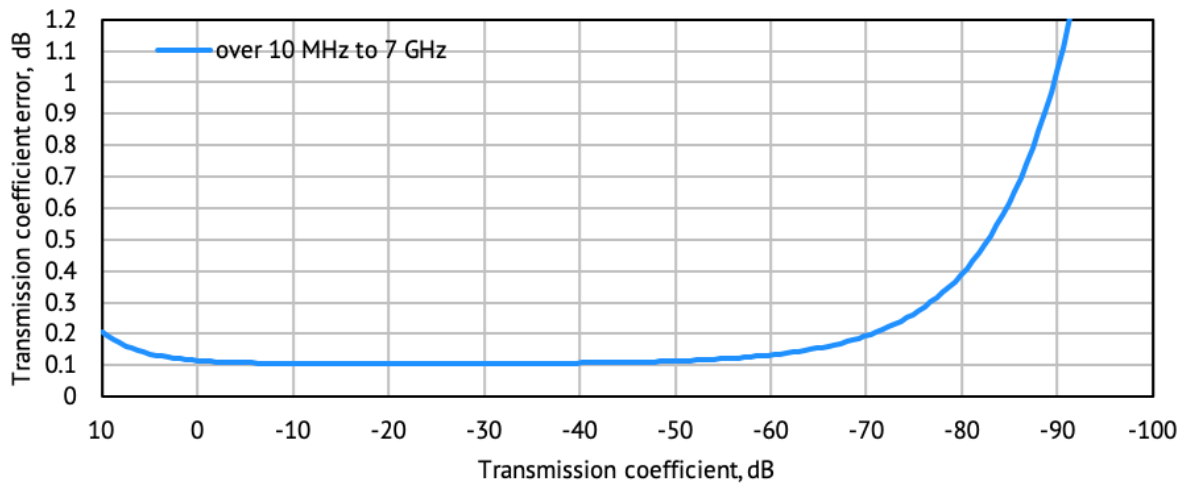
# Reflection Accuracy Plots

**Reflection Magnitude Errors**

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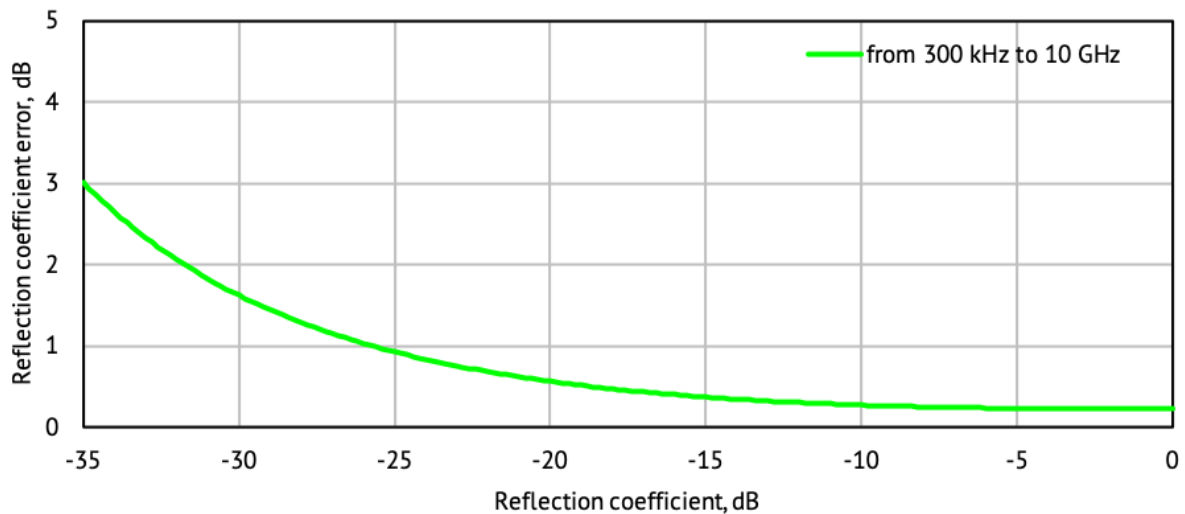
**Reflection Phase Errors**



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



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# Reflection Accuracy Plots

**Reflection Phase Errors**

# Transmission Accuracy Plots

**Transmission Magnitude Errors**



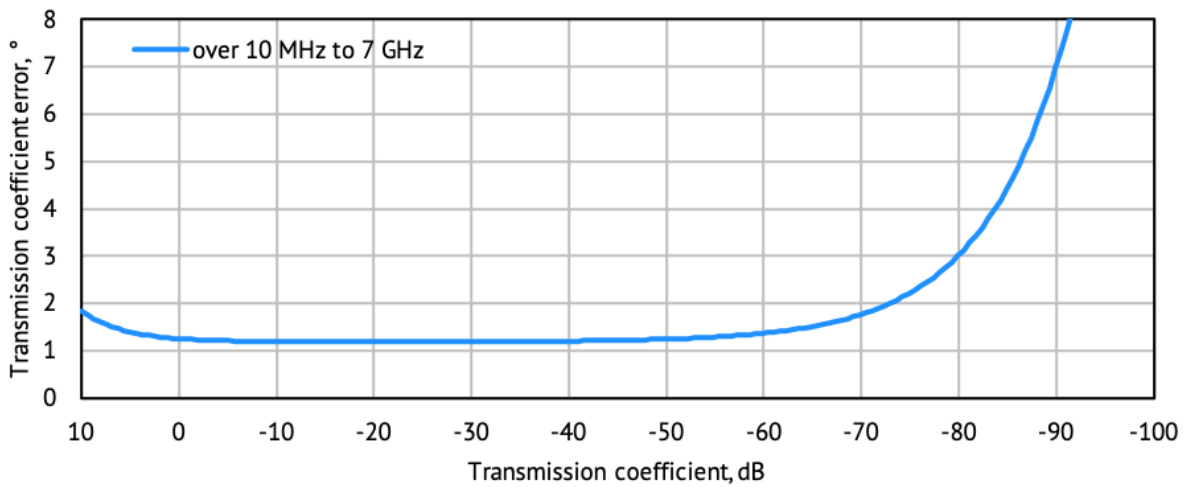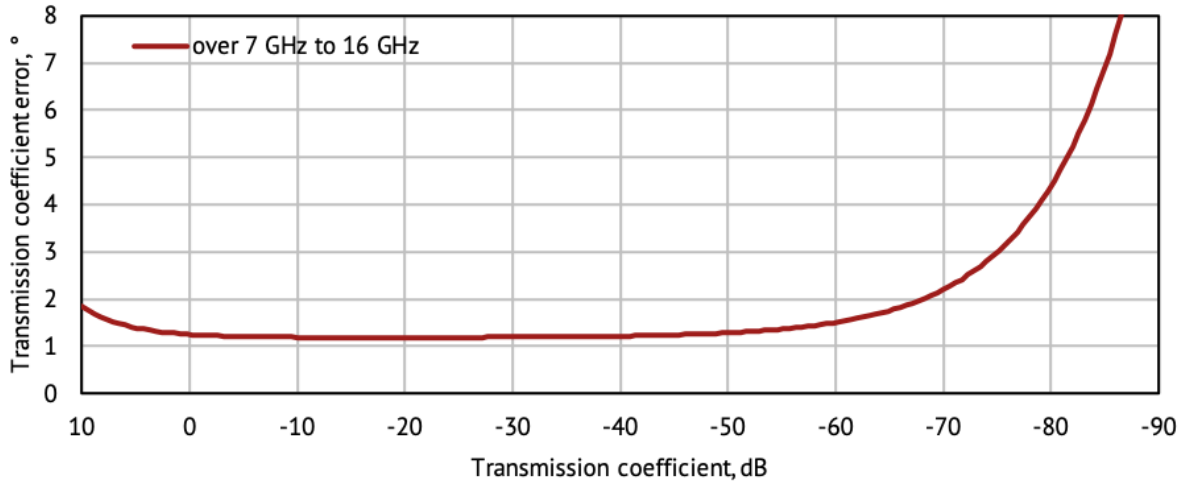Specifications are based on matched DUT, and IF bandwidth of 10 Hz
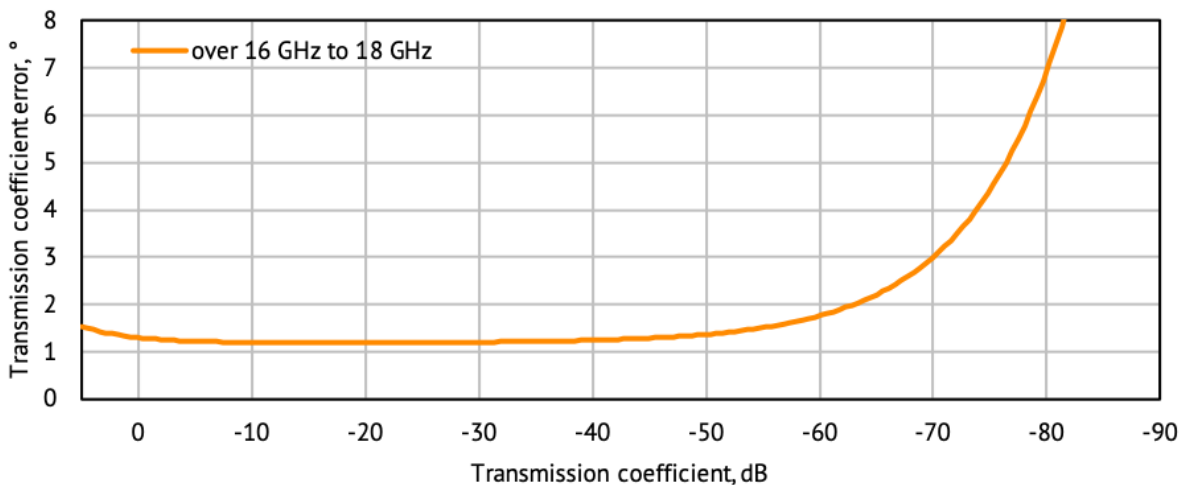


Specifications are based on matched DUT, and IF bandwidth of 10 Hz

# Transmission Accuracy Plots
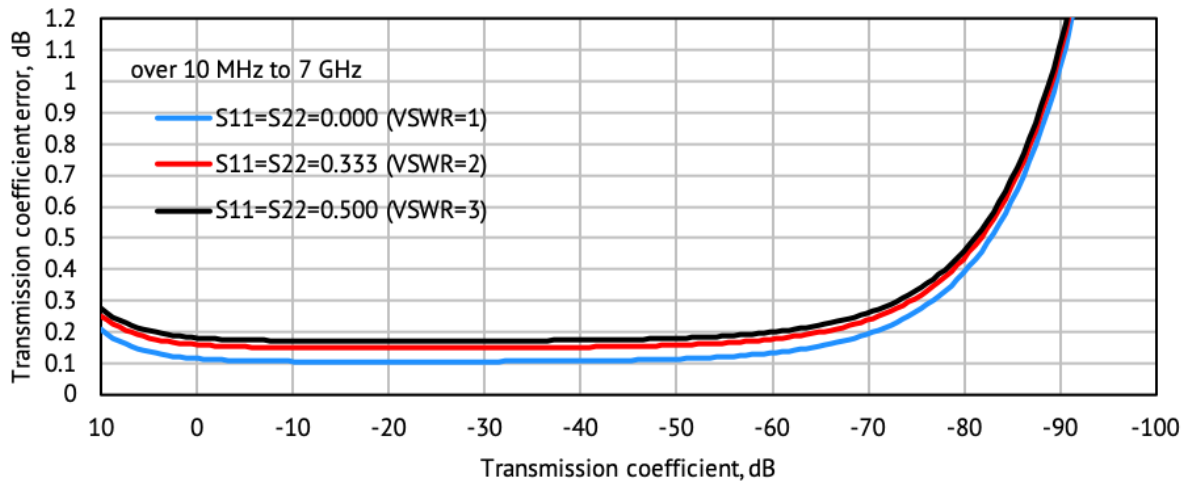
**Transmission Magnitude Errors**



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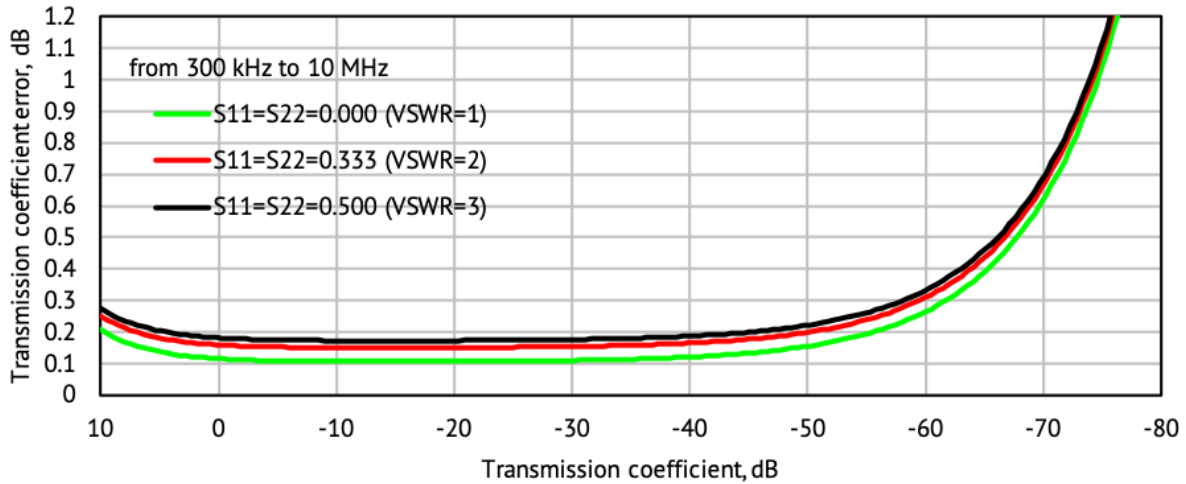
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**Transmission Phase Errors**



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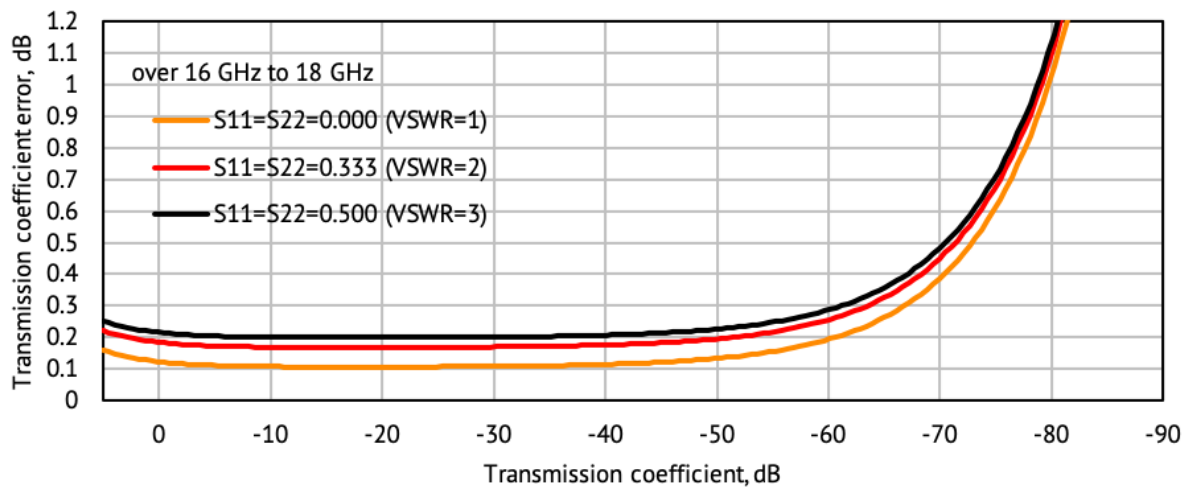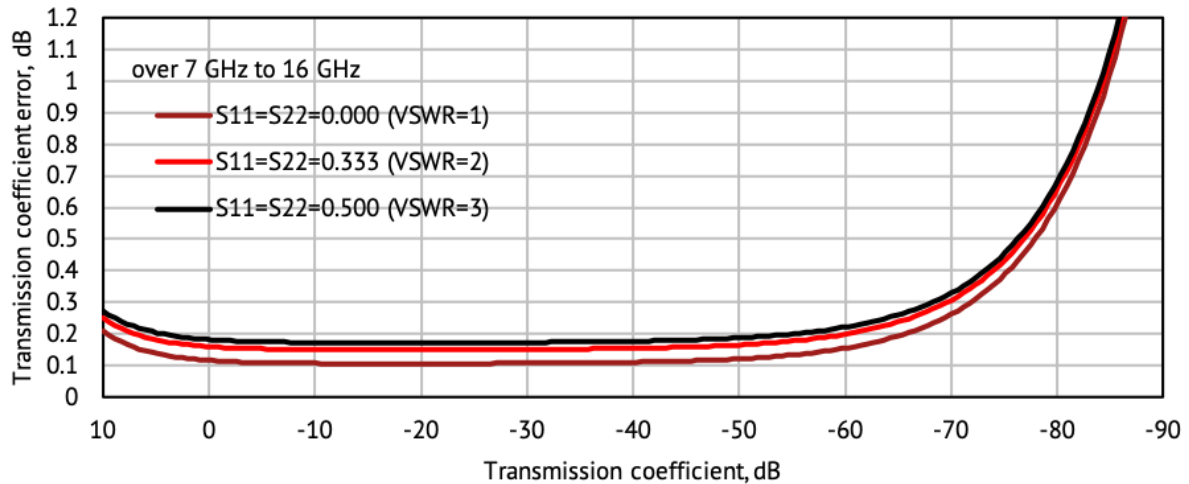
**Transmission magnitude errors for unmatched devices**

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# Transmission Accuracy Plots
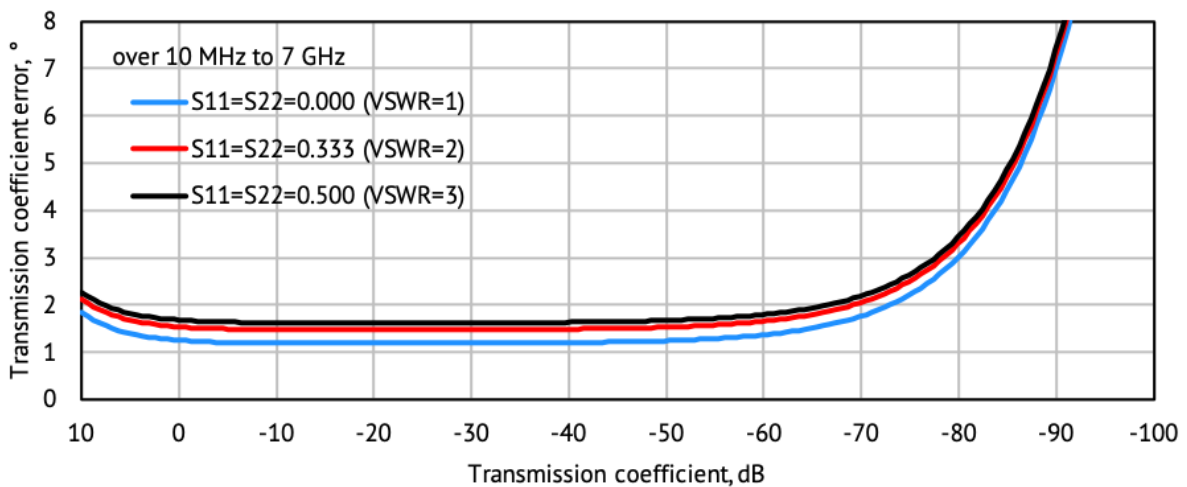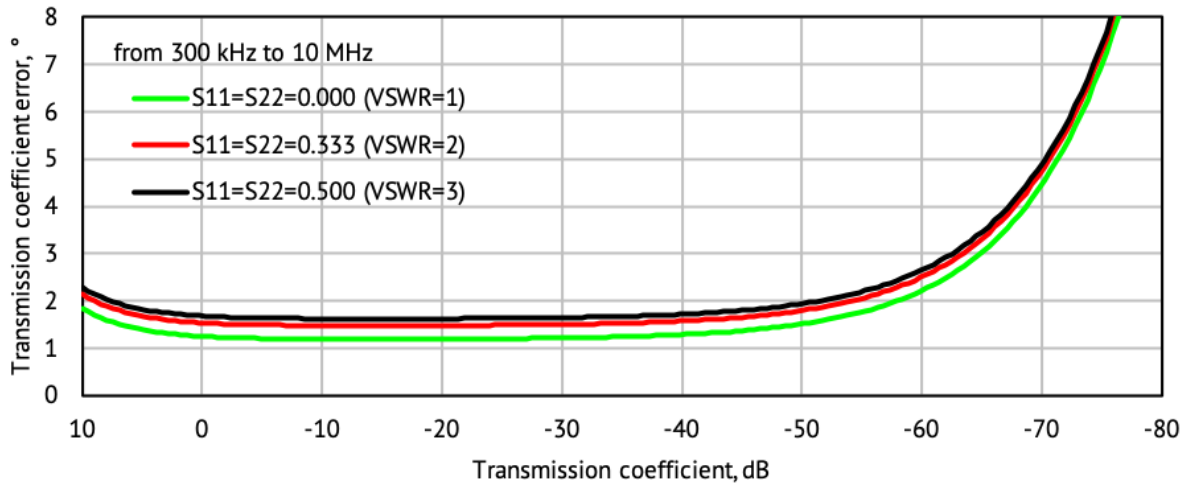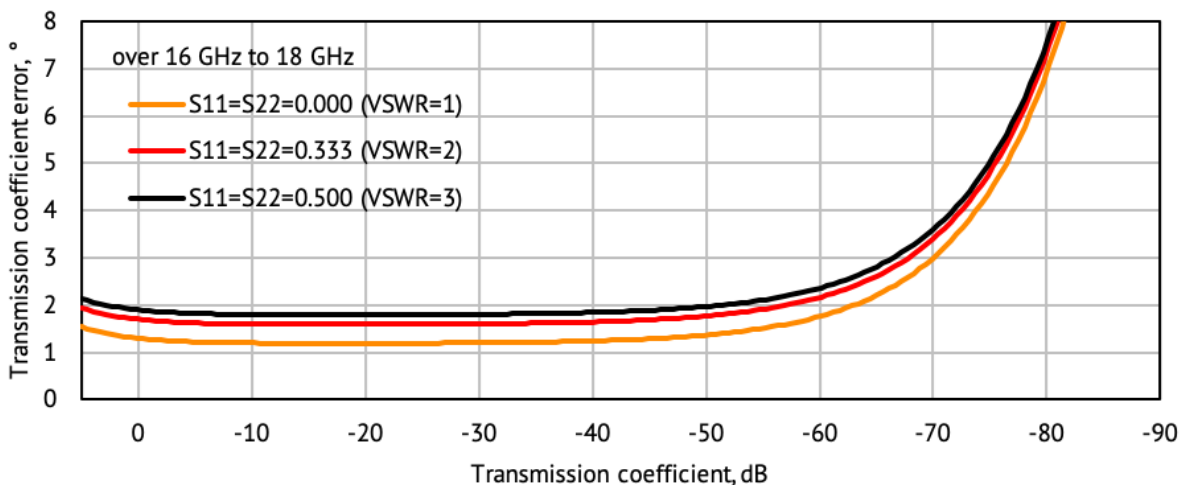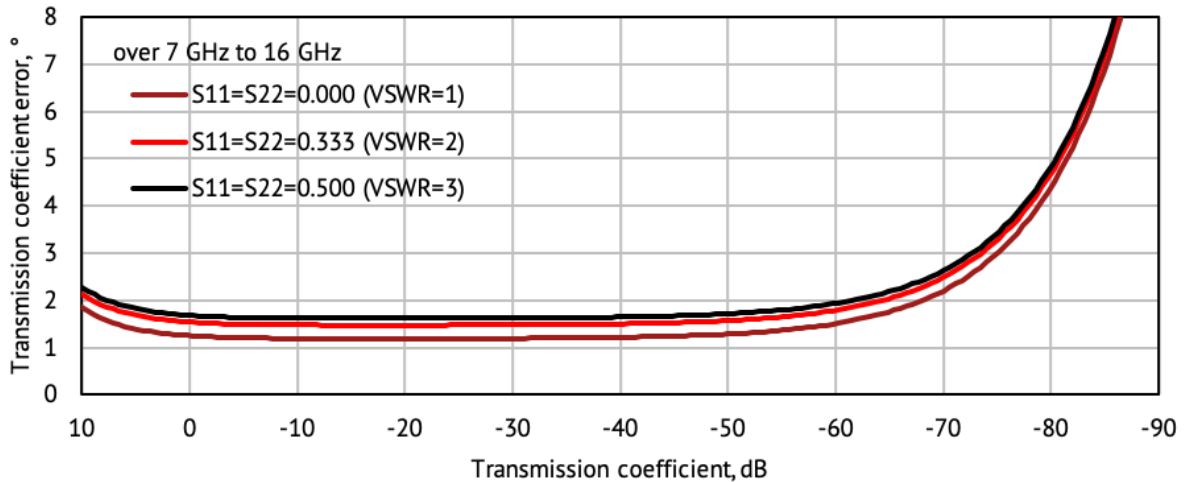
**Transmission phase errors for unmatched devices**
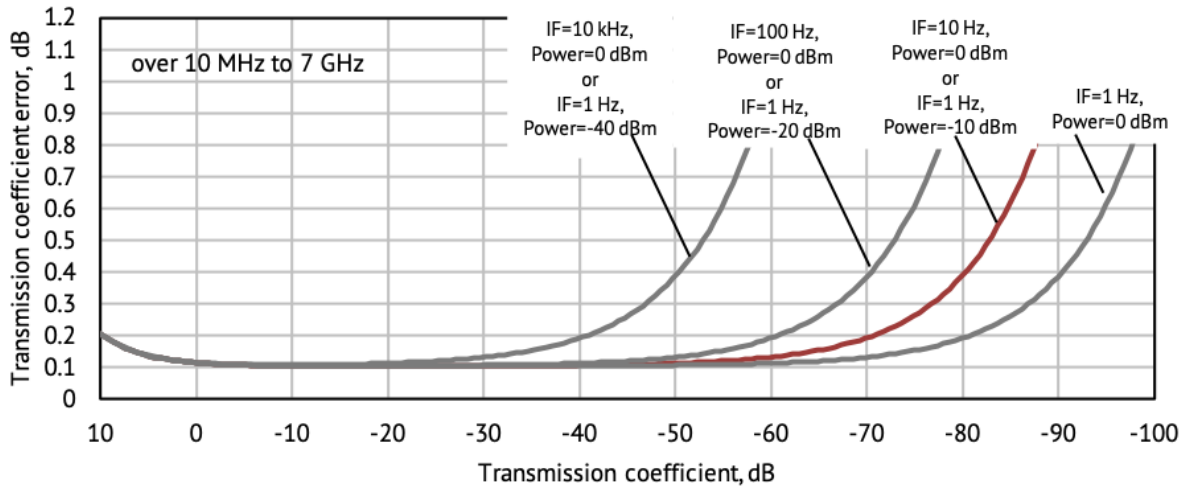
# Transmission Accuracy Plots

**Transmission phase errors for unmatched devices**

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**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.*

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2015

GLOBAL VECTOR NETWORK ANALYZER COMPETITIVE STRATEGY INNOVATION AND LEADERSHIP AWARD

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BEST PRACTICES AWARD

2017

GLOBAL UNIVERSAL SERIAL BUS (USB) VECTOR NETWORK ANALYZER (VNA) PRODUCT LEADERSHIP AWARD

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BEST PRACTICES AWARD

2020

GLOBAL VECTOR NETWORK ANALYZERS CUSTOMER VALUE LEADERSHIP AWARD

## 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. |