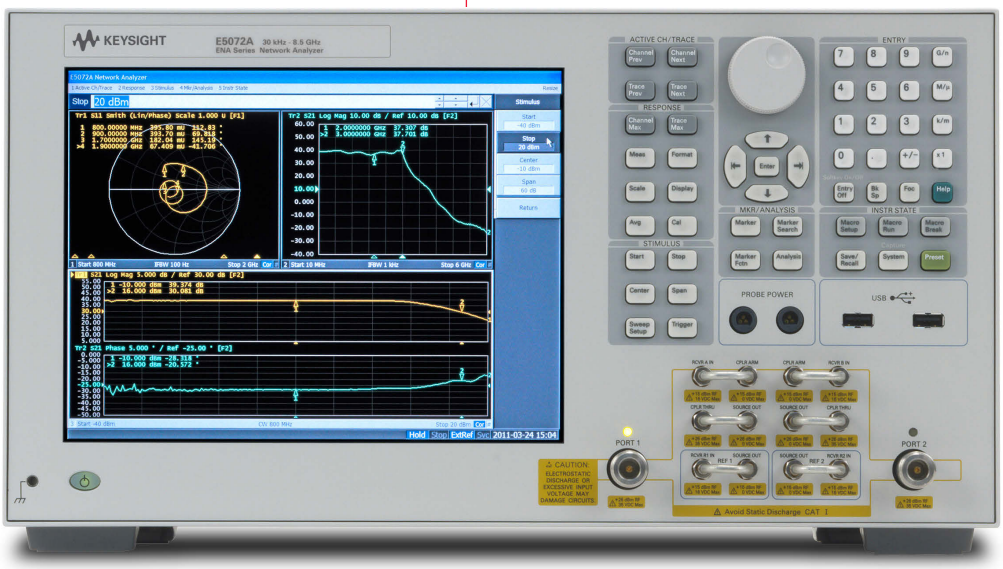
# Keysight Technologies

# E5072A ENA Series Network Analyzer 30 kHz to 4.5/8.5 GHz

## Data Sheet




KEYSIGHT TECHNOLOGIES

# Options

This document provides technical specifications for the E5072A ENA network analyzer.

| | |
|---|---|
| **E5072A-245** | 2-port with configurable test set, 30 kHz to 4.5 GHz |
| **E5072A-285** | 2-port with configurable test set, 30 kHz to 8.5 GHz |

# Calibration kits and ECal modules

This E5072A data sheet provides technical specifications for the following calibration kits and ECal modules.

| | |
|---|---|
| **85032F** | Calibration kit |
| **85033E** | Calibration kit |
| **85092C** | Electronic calibration (ECal) module |
| **85093C** | Electronic calibration (ECal) module |

# Definitions

## Specification (spec.):

Warranted performance. All specifications apply at 23 °C (± 5 °C), unless otherwise stated, and 90 minutes after the instrument has been turned on. Specifications include guard bands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

## Typical (typ.):

Describes performance that will be met by a minimum of 80% of all products. It is not guaranteed by the product warranty.

## Supplemental performance data (SPD):

Supplemental performance data represents the value of a parameter that is most likely to occur; the expected mean or average. It is not guaranteed by the product warranty.

## General characteristics:

A general, descriptive term that does not imply a level of performance.

# Boundary Conditions

In this data sheet, boundary conditions are given for the specifications. For example, system dynamic range is 98 dB with the following boundary conditions.

Frequency: 10 MHz, IF bandwidth: 3 kHz

If the same boundary conditions fall under more than one category in a table, apply the best value.

# Corrected System Performance

The specifications in this section apply to measurements made with the Keysight Technologies, Inc. E5072A network analyzer under the following conditions:

- No averaging applied to data
- Environmental temperature of 23 °C (± 5 °C) with less than 1 °C deviation from the calibration temperature
- Response and isolation calibration performed

| Description | Specification | SPD |
|---|---|---|
| **System dynamic range at test port [1, 2]** | | |
| (IF Bandwidth = 3 kHz) | | |
| 30 to 300 kHz | 65 dB (Typ.) | |
| 300 kHz to 10 MHz | 82 dB | |
| 10 MHz to 6 GHz | 98 dB | |
| 6 to 8.5 GHz | 92 dB | |
| (IF Bandwidth = 10 Hz) | | |
| 30 to 300 kHz | 90 dB (Typ.) | 100 dB |
| 300 kHz to 10 MHz | 107 dB | 115 dB |
| 10 MHz to 6 GHz | 123 dB | 130 dB |
| 6 to 8.5 GHz | 117 dB | 128 dB |
| **Extended dynamic range at direct receiver access input [3]** | | |
| (IF Bandwidth = 10 Hz) | | |
| 30 to 300 kHz | | 128 dB |
| 300 kHz to 10 MHz | | 134 dB |
| 10 MHz to 3 GHz | | 151 dB |
| 3 GHz to 6 GHz | | 147 dB |
| 6 to 8.5 GHz | | 145 dB |

1. The test port dynamic range is calculated as the difference between the test port rms noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainty and interfering signals into account.
2. Typical performance might not be met from 60 to 70 kHz.
3. The direct receiver access input system dynamic range is calculated as the difference between the direct receiver access input noise floor and the source maximum output power. The effective dynamic range must take measurement uncertainties and interfering signals into account.

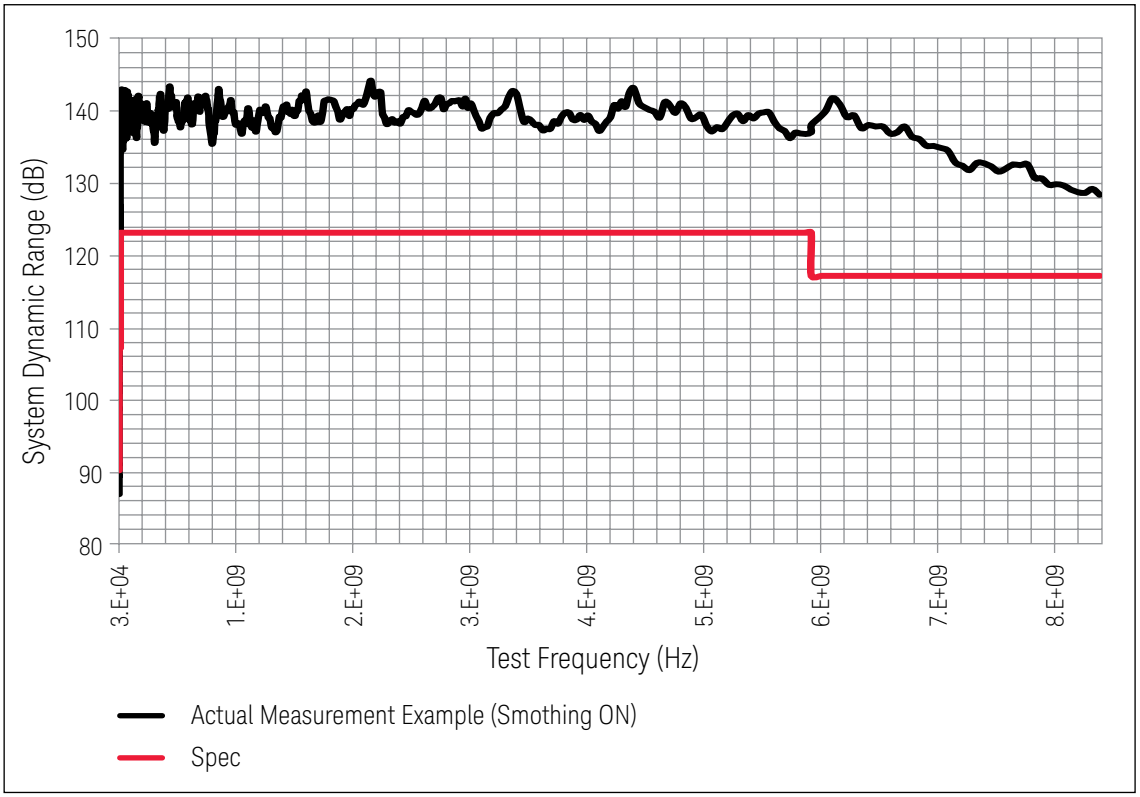


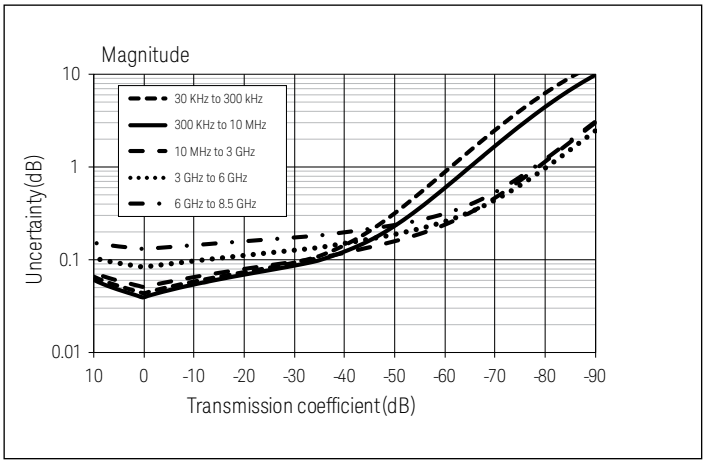

Figure 1. System dynamic range (specification and actual measurement data example, IF bandwidth 10 Hz)

# Corrected system performance with calibration kit

Corrected system performance with type-N device connectors, 85032F calibration kit
Network analyzer : E5072A
Calibration kit : 85032F (Type-N, 50 Ω)
Calibration : full 2-port

IF bandwidth = 10 Hz, no averaging applied to data, environmental temperature = 23 °C (± 5 °C ) with < 1 °C deviation from calibration temperature, isolation calibration performed.

| | Specification (dB) | | | | |
|---|---|---|---|---|---|
| **Description** | **30 to 300 kHz (Typ.)** | **300 kHz to 10 MHz** | **10 MHz to 3 GHz** | **3 to 6 GHz** | **6 to 8.5 GHz** |
| Directivity | 49 | 49 | 46 | 40 | 38 |
| Source match | 41 | 41 | 40 | 36 | 35 |
| Load match | 49 | 49 | 46 | 39 | 37 |
| Reflection tracking | ± 0.011 | ± 0.011 | ± 0.021 | ± 0.032 | ± 0.054 |
| Transmission tracking | ± 0.011 | ± 0.007 | ± 0.029 | ± 0.074 | ± 0.088 |



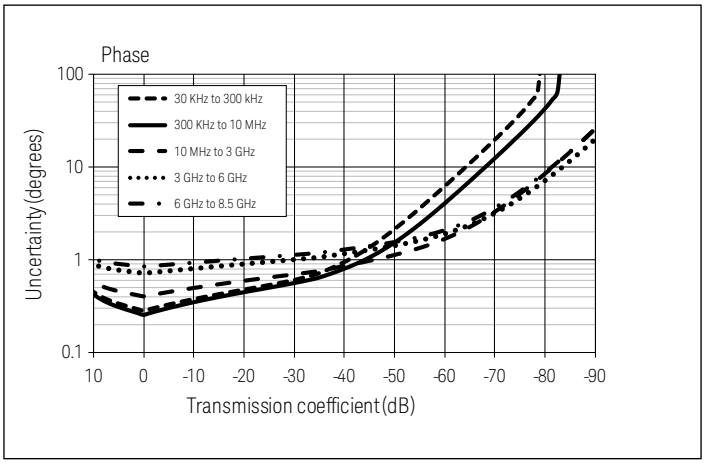
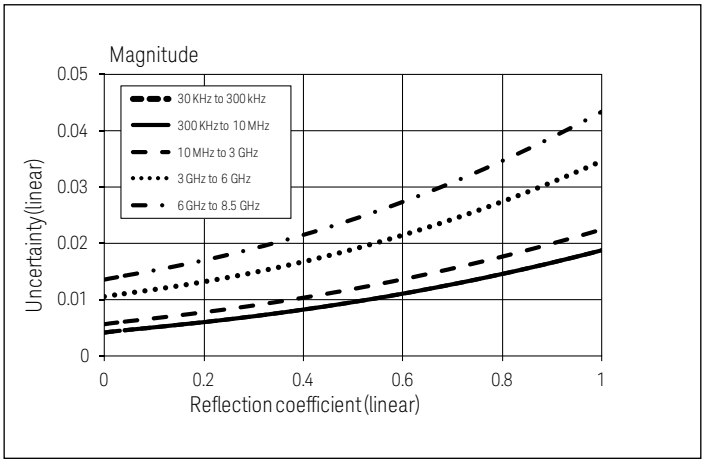




Figure 2. Transmission uncertainty (Specification)



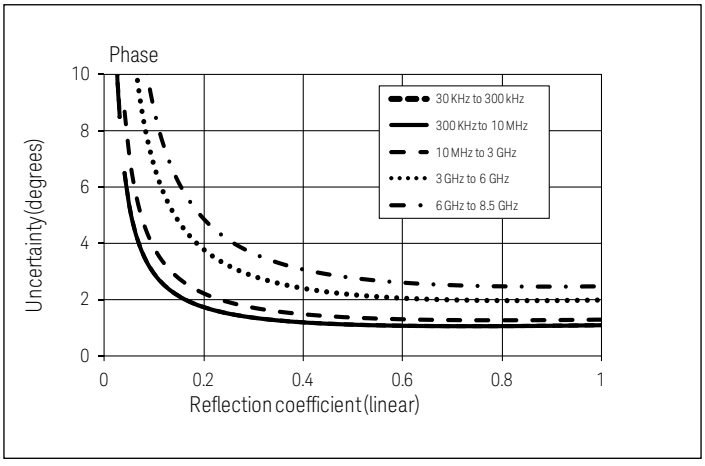



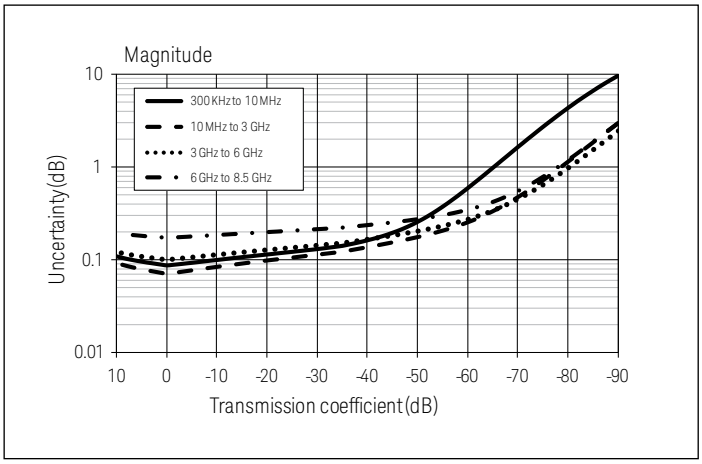

Figure 3. Reflection uncertainty (Specification)

# Corrected system performance with type-N device connectors, 85092C electronic calibration (ECal) module

Network analyzer : E5072A
Calibration kit : 85092C (Type-N, 50 Ω) Electronic calibration (ECal) module
Calibration : full 2-port

IF bandwidth = 10 Hz, no averaging applied to data, environmental temperature = 23 °C (± 5 °C ) with < 1 °C deviation from calibration temperature, isolation calibration is not performed.

| | Specification (dB) | | | |
|---|---|---|---|---|
| **Description** | **300 kHz to 10 MHz** | **10 MHz to 3 GHz** | **3 to 6 GHz** | **6 to 8.5 GHz** |
| Directivity | 45 | 54 | 52 | 47 |
| Source match | 36 | 44 | 41 | 36 |
| Load match | 41 | 47 | 44 | 39 |
| Reflection tracking | ± 0.100 | ± 0.040 | ± 0.060 | ± 0.070 |
| Transmission tracking | ± 0.053 | ± 0.040 | ± 0.069 | ± 0.136 |



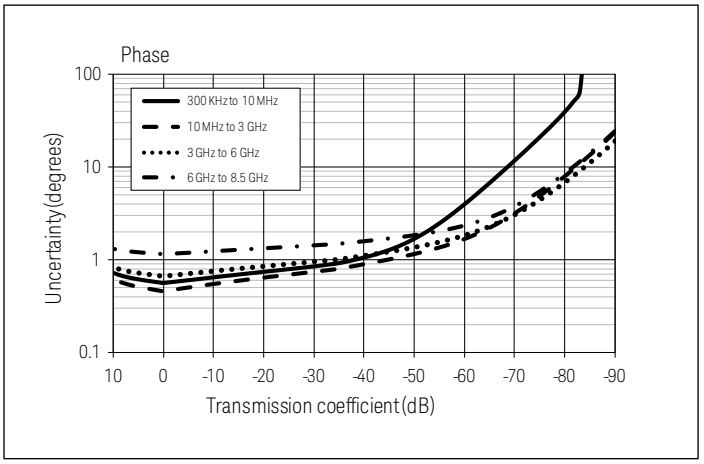
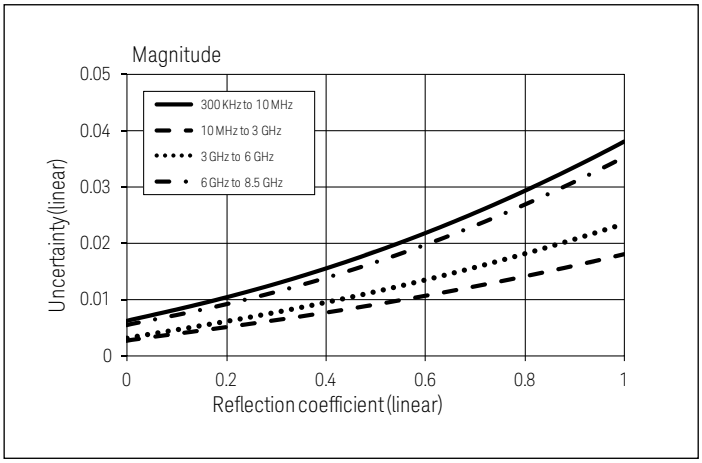




Figure 4. Transmission uncertainty (Specification)



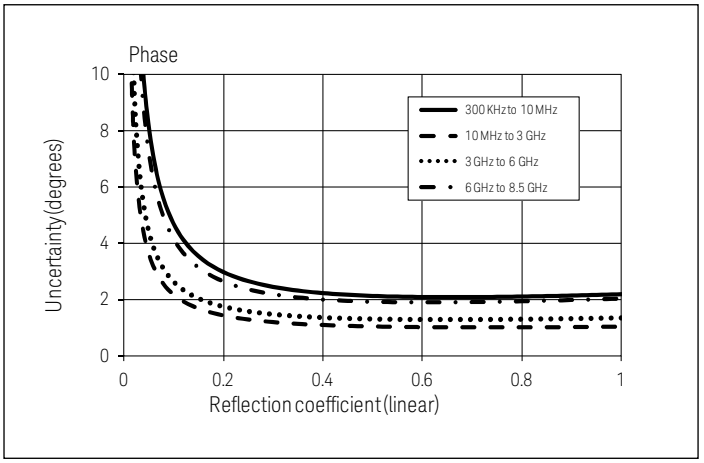



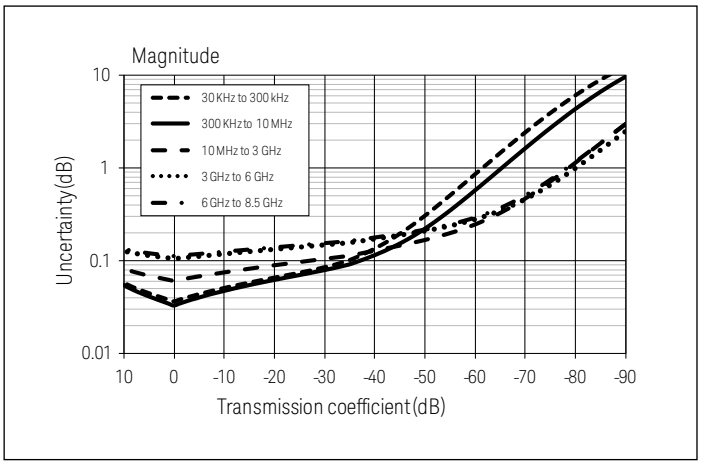

Figure 5. Reflection uncertainty (Specification)

# Corrected system performance with 3.5 mm device connector type, 85033E calibration kit

Network analyzer : E5072A
Calibration kit : 85033E (3.5 mm, 50 Ω)
Calibration : full 2-port

IF bandwidth = 10 Hz, no averaging applied to data, environmental temperature = 23 °C (± 5 °C ) with < 1 °C deviation from calibration temperature, isolation calibration performed.

| | Specification (dB) | | | | |
|---|---|---|---|---|---|
| **Description** | **30 to 300 kHz (Typ.)** | **300 kHz to 10 MHz** | **10 MHz to 3 GHz** | **3 to 6 GHz** | **6 to 8.5 GHz** |
| Directivity | 46 | 46 | 44 | 38 | 38 |
| Source match | 43 | 43 | 40 | 37 | 36 |
| Load match | 46 | 46 | 44 | 38 | 38 |
| Reflection tracking | ± 0.006 | ± 0.006 | ± 0.007 | ± 0.009 | ± 0.010 |
| Transmission tracking | ± 0.010 | ± 0.007 | ± 0.032 | ± 0.074 | ± 0.079 |



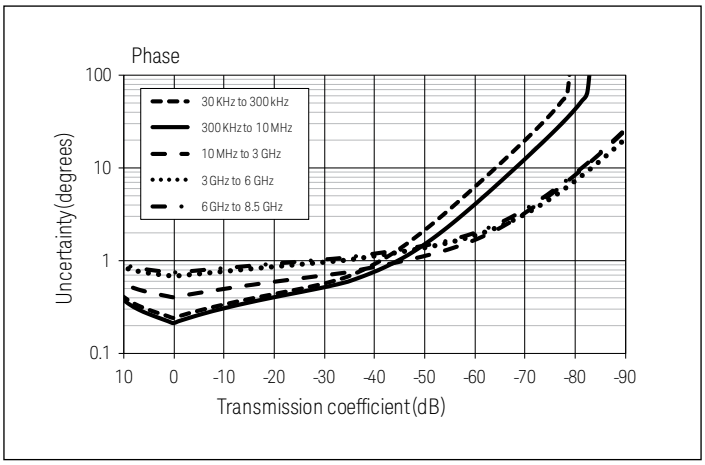
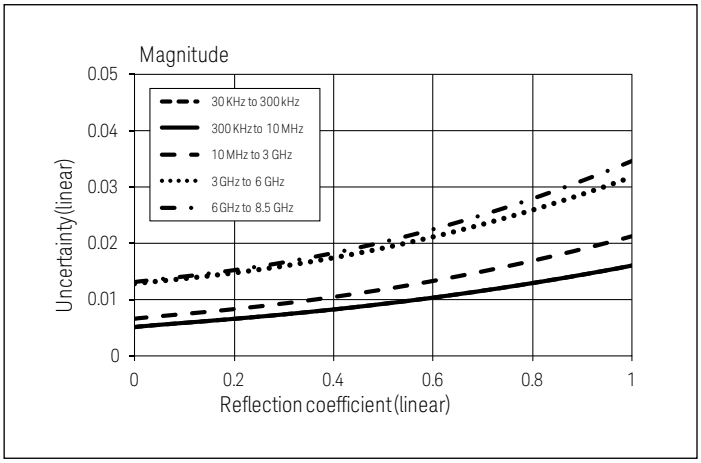




Figure 6. Transmission uncertainty (Specification)



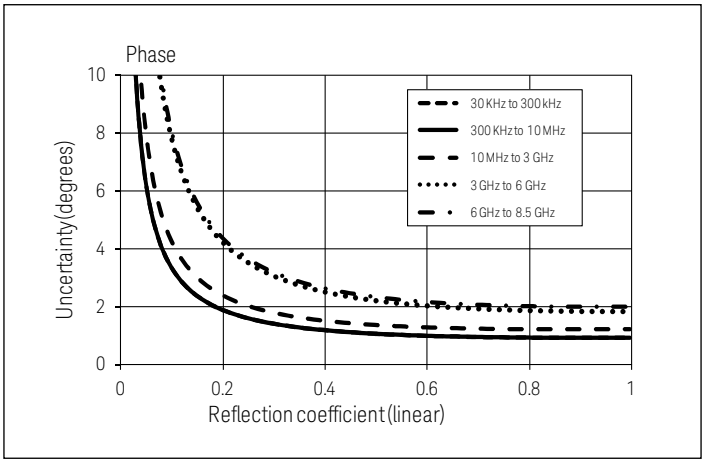



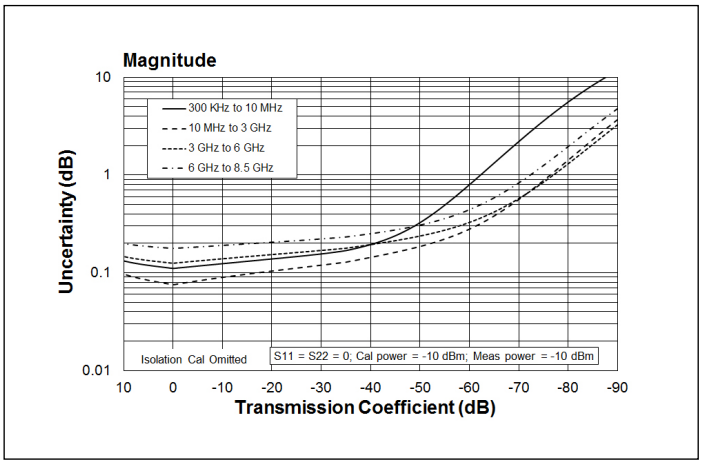

Figure 7. Reflection uncertainty (Specification)

# Corrected system performance with 3.5 mm device connector type, 85093C electronic calibration (ECal) module

Network analyzer : E5072A
Calibration kit : 85093C (3.5 mm, 50 Ω) Electronic calibration (ECal) module
Calibration : full 2-port

IF bandwidth = 10 Hz, no averaging applied to data, environmental temperature = 23 °C (± 5 °C ) with < 1 °C deviation from calibration temperature, isolation calibration is not performed.

| | Specification (dB) | | | |
|---|---|---|---|---|
| **Description** | **300 kHz to 10 MHz** | **10 MHz to 3 GHz** | **3 to 6 GHz** | **6 to 8.5 GHz** |
| Directivity | 45 | 52 | 50 | 47 |
| Source match | 36 | 44 | 39 | 34 |
| Load match | 37 | 45 | 42 | 39 |
| Reflection tracking | ± 0.100 | ± 0.040 | ± 0.050 | ± 0.070 |
| Transmission tracking | ± 0.084 | ± 0.047 | ± 0.097 | ± 0.145 |



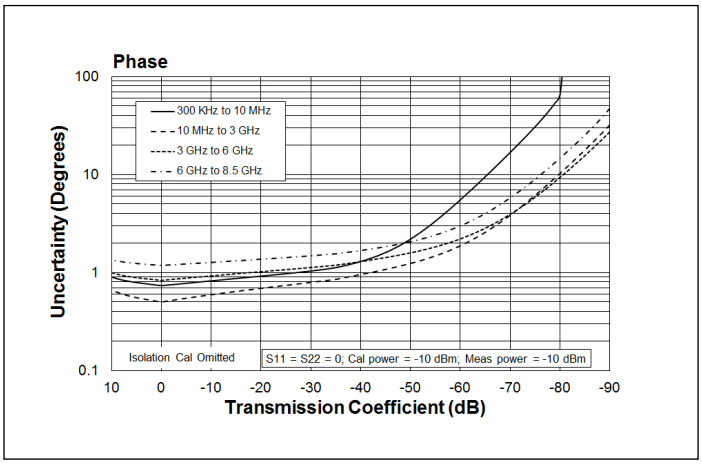
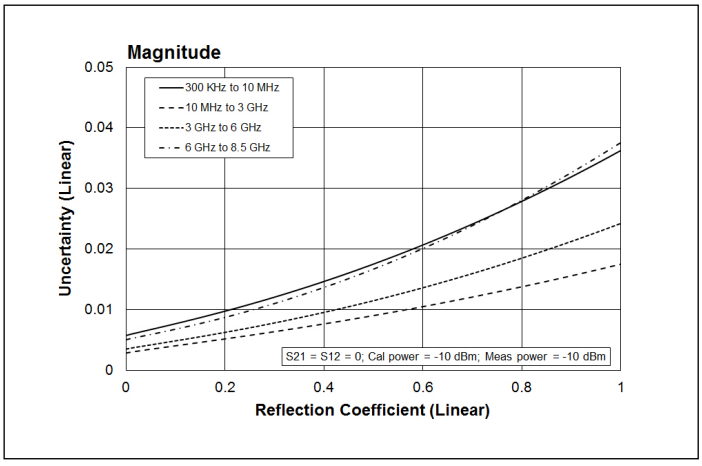




Figure 8. Transmission uncertainty (Specification)



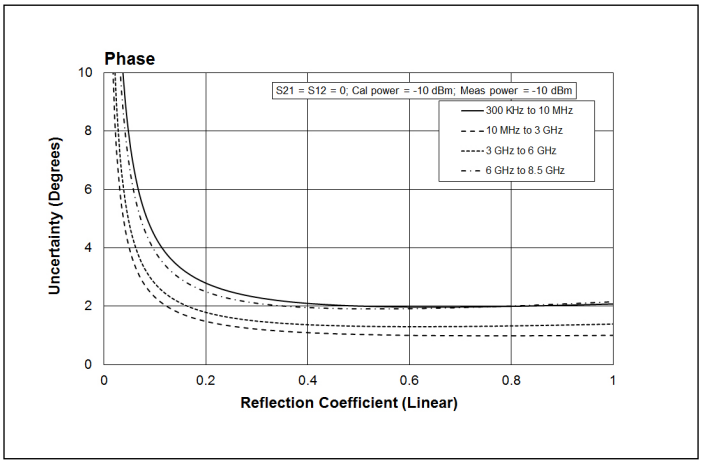




Figure 9. Reflection uncertainty (Specification)

# Uncorrected System Performance

User correction: OFF, System error correction: ON

| | Specification (dB) | | | |
|---|---|---|---|---|
| **Description** | **30 to 300 kHz** | **300 kHz to 3 GHz** | **3 to 6 GHz** | **6 to 8.5 GHz** |
| Directivity | 15 (Typ.) | 25 | 20 | 15 |
| Source match | 15 (Typ.) | 25 | 20 | 15 |
| Reflection tracking | ± 1.5 (Typ.) | ± 1.0 | ± 1.5 | ± 1.5 |
| Transmission tracking | ± 1.5 (Typ.) | ± 1.0 | ± 1.5 | ± 1.5 |

| | Specification (dB) | | | | |
|---|---|---|---|---|---|
| **Description** | **30 to 300 kHz** | **300 kHz to 100 MHz** | **100 MHz to 2 GHz** | **2 to 4.5 GHz** | **4.5 to 8.5 GHz** |
| Load match | 14 (Typ.) | 22 | 15 | 11 | 8 |

# Test Port Output (Source)

## Test port output frequency

| **Description** | **Specification** | **Typical** |
|---|---|---|
| Frequency range [1] | | |
| Option 245 | 30 kHz to 4.5 GHz | |
| Option 285 | 30 kHz to 8.5 GHz | |
| Resolution | 1 Hz | |
| Source Stability | | |
| Standard | | ± 7 ppm (5 to 40 °C) |
| Option 1E5 | | ± 1 ppm (5 to 40 °C)<br>± 0.5 ppm/year |
| CW accuracy | | |
| Standard | ± 7 ppm | |
| Option 1E5 | ± 1 ppm | |

## Test port output power [2]

| **Description** | **Specification** | **SPD** |
|---|---|---|
| Nominal Power (Preset Power) | 0 dBm | |
| Range [3] | | |
| 30 to 300 kHz | –85 to 10 dBm | |
| 300 kHz to 3 GHz | –85 to 16 dBm | |
| 3 to 6 GHz | –85 to 12 dBm | |
| 6 to 8.5 GHz | –85 to 10 dBm | |
| Max Leveled Power | | |
| 30 to 300 kHz | | 16 dBm |
| 300 kHz to 1 GHz | | 20 dBm |
| 1 to 3 GHz | | 18 dBm |
| 3 to 8.5 GHz | | Slope from 18 dBm (3 GHz) to 12 dBm (8.5 GHz) |

1. Frequency can be set down to 9 kHz
2. Source output performance on port 1 only. Port 2 output performance is typical.
3. Power can be set from –109 to 20 dBm

| Description | Specification | Typical |
|---|---|---|
| Resolution | 0.05 dB | |
| Level Accuracy [1] | | |
| At 50 MHz, 0 dBm, Absolute | ± 0.65 dB | |
| (Level Flatness) [2] | | |
| Stepped Sweep Mode | | |
| 30 to 300 kHz | – | ± 1.0 dB |
| 300 kHz to 8.5 GHz | ± 1.0 dB | – |
| Swept Sweep Mode | | |
| 30 kHz to 7 GHz | | ± 2.5 dB |
| 7 to 8.5 GHz | | ± 3.0 dB |
| Level Linearity [3] | | |
| (–15 dBm to Maximum Power) | | |
| Stepped Sweep Mode | | |
| 30 to 300 kHz | – | ± 0.75 dB |
| 300 kHz to 8.5 GHz | ± 0.75 dB | – |
| Swept Sweep Mode | | |
| All frequency | | ± 1.5 dB |
| Power Sweep Range [4] | 65 dB | |

## Test port output signal purity

| Description | Specification | Typical |
|---|---|---|
| Harmonics (2nd or 3rd) | | |
| (at 5 dBm) | | |
| 30 kHz to 2 GHz | | < –25 dBc |
| 2 to 8.5 GHz | | < –20 dBc |
| Non-harmonic spurious | | |
| (at 5 dBm) | | < –30 dBc |

1. Power calibration using an external power meter improves level accuracy of the test port output power.
2. Level accuracy of other frequency is taken at 0 dBm, relative to 50 MHz reference unless otherwise stated.
3. Level linearity given is relative to 0 dBm.
4. Stop power may be limited by maximum power.

## Test Port Input

| Description | Specification | SPD |
|---|---|---|
| Crosstalk [1] | | |
| 30 to 300 kHz | –90 dB (Typ.) | –95 dB |
| 300 kHz to 10 MHz | –110 dB | –120 dB |
| 10 MHz to 3 GHz | –120 dB | –140 dB |
| 3 to 6 GHz | –110 dB | –130 dB |
| 6 to 8.5 GHz | –100 dB | –120 dB |
| Test Port Noise Floor [1] | | |
| 30 to 300 kHz | –90 dBm/Hz (Typ.) | –100 dBm/Hz |
| 300 kHz to 10 MHz | –101 dBm/Hz | –109 dBm/Hz |
| 10 MHz to 3 GHz | –117 dBm/Hz | –124 dBm/Hz |
| 3 to 6 GHz | –121 dBm/Hz | –128 dBm/Hz |
| 6 to 8.5 GHz | –117 dBm/Hz | –128 dBm/Hz |
| (at 10Hz IFBW) | | |
| 30 to 300 kHz | –80 dBm (Typ.) | –90 dBm |
| 300 kHz to 10 MHz | –91 dBm | –99 dBm |
| 10 MHz to 3 GHz | –107 dBm | –114 dBm |
| 3 to 6 GHz | –111 dBm | –118 dBm |
| 6 to 8.5 GHz | –107 dBm | –118 dBm |
| Compression level (at +10dBm input) | | |
| Magnitude | | |
| 30 to 300 kHz | 0.3 dB (Typ.) | 0.15 dB |
| 300 kHz to 3 GHz | 0.2 dB | 0.08 dB |
| 3 to 8.5 GHz | 0.2 dB | 0.1 dB |
| Phase | | |
| 30 to 300 kHz | 7 deg (Typ.) | 0.7 deg |
| 300 kHz to 3 GHz | 5 deg | 0.3 deg |
| 3 to 6 GHz | 5 deg | 0.6 deg |
| 6 to 8.5 GHz | 5 deg | 1.0 deg |
| 0.1 dB Compression Input Level | | |
| 30 to 300 kHz | | 6 dBm |
| 300 kHz to 2 GHz | | 16 dBm |
| 2 to 6 GHz | | 14 dBm |
| 6 to 8.5 GHz | | 10 dBm |

## Trace Noise [2]

| Description | Specification | SPD |
|---|---|---|
| (test port input level = maximum power in Specification) | | |
| Magnitude | | |
| 30 to 300 kHz, 3 kHz IFBW | 0.015 dB rms (Typ.) | 0.007 dB rms |
| 300 kHz to 10 MHz, 3 kHz IFBW | 0.003 dB rms | 0.0005 dB rms |
| 10 MHz to 4.38 GHz, 70 kHz IFBW | 0.004 dB rms | 0.001 dB rms |
| 4.38 to 8.5 GHz, 70 kHz IFBW | 0.006 dB rms | 0.0012 dB rms |
| Phase | | |
| 30 to 300 kHz, 3 kHz IFBW | 0.1 deg rms (Typ.) | 0.05 deg rms |
| 300 kHz to 10 MHz, 3 kHz IFBW | 0.02 deg rms | 0.0025 deg rms |
| 10 MHz to 4.38 GHz, 70 kHz IFBW | 0.035 deg rms | 0.0075 deg rms |
| 4.38 to 8.5 GHz, 70 kHz IFBW | 0.05 deg rms | 0.015 deg rms |

1. Typical performance might not be met from 60 to 70 kHz.
2. The specification might not be met at the following frequencies: 333.333 kHz, 406.25 kHz, 857.143 kHz, and 928.571 kHz.

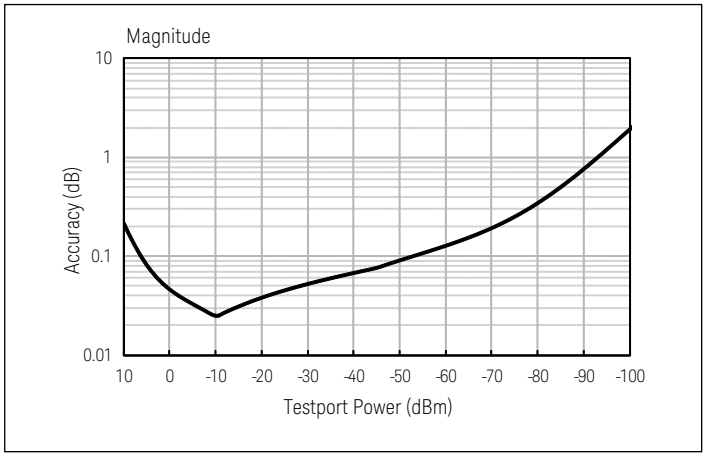
## Stability

| Description | Specification | SPD |
|---|---|---|
| Magnitude | | |
| 30 to 300 kHz | | ± 0.04 dB/°C |
| 300 kHz to 3 GHz | | ± 0.005 dB/°C |
| 3 to 6 GHz | | ± 0.03 dB/°C |
| 6 to 8.5 GHz | | ± 0.04 dB/°C |
| Phase | | |
| 30 to 300 kHz | | ± 0.8 deg/°C |
| 300 kHz to 3 GHz | | ± 0.1 deg/°C |
| 3 to 6 GHz | | ± 0.4 deg/°C |
| 6 to 8.5 GHz | | ± 0.8 deg/°C |

## Dynamic Accuracy [1]

| Description | Specification (dB) | Typical |
|---|---|---|
| Magnitude | | |
| 10 dBm | ± 0.21 dB | |
| –30 dBm | ± 0.045 dB | |
| –100 dBm | ± 2 dB | |
| –110 dBm | | ± 3.0 dB |
| Phase | | |
| 10 dBm | ± 5 deg | |
| –30 dBm | ± 0.3 deg | |
| –100 dBm | ± 15 deg | |

1. Accuracy of the test port input power reading is relative to –10 dBm reference input power level.



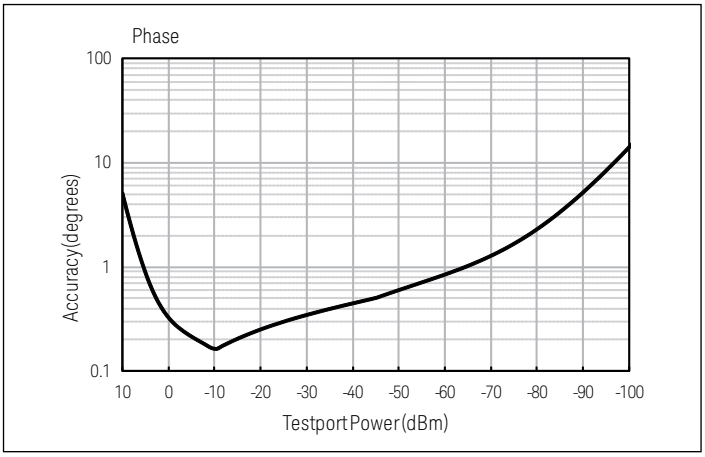




Figure 10. Dynamic Accuracy

## Group Delay [1]

| Description | Specification (dB) | Supplemental information |
|---|---|---|
| Aperture (selectable) | (frequency span)/(number of points - 1) | |
| Maximum aperture | 25% of frequency span | |
| Minimum delay | | Limited to measuring no more than 180° of phase change within the minimum aperture. |
| Accuracy | | See graph below (Typical) |

The following graph shows group delay accuracy with type-N connectors, full 2-port calibration and a 10 Hz IF bandwidth.

- Calibration kit (85032F).
- Insertion loss is assumed to be < 2 dB.

In general, the following formula can be used to determine the accuracy (in seconds) of a specific group delay measurement:
± phase accuracy (degrees)/[360 x aperture (Hz)]

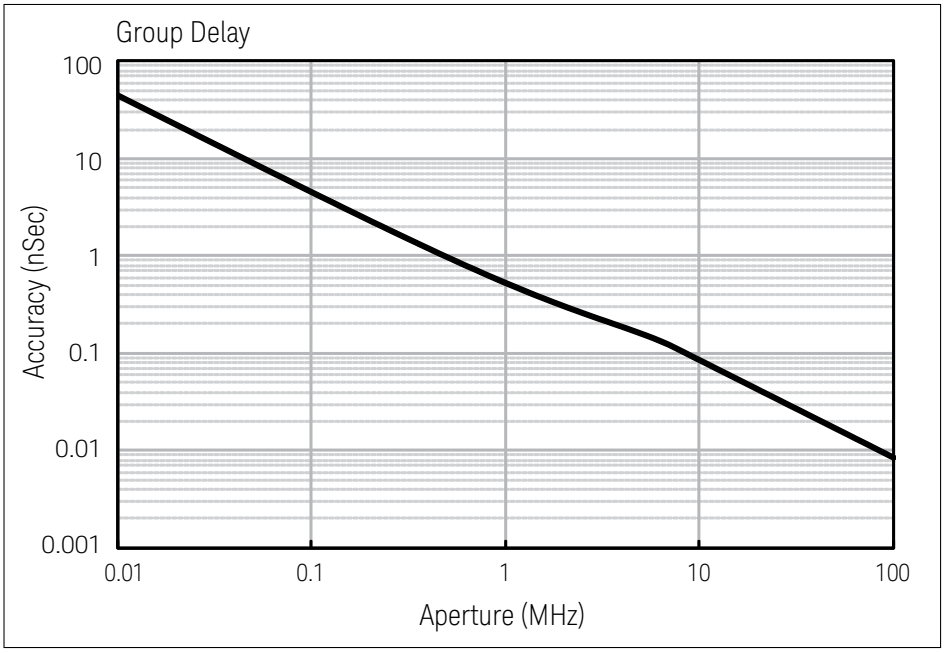



Figure 11. Group delay

1. Group delay is computed by measuring the phase change within a specified step (determined by the frequency span and the number of points per sweep).

# Front-Panel Jumpers

## Measurement Receiver Input (R1, R2, A, B)

| Description | SPD | Typical |
|---|---|---|
| Noise Floor | | |
| 30 kHz to 10 MHz | –128 dBm/Hz | |
| 10 MHz to 8.5 GHz | –145 dBm/Hz | |
| (10Hz IFBW ) | | |
| 30 kHz to 10 MHz | –118 dBm | |
| 10 MHz to 8.5 GHz | –135 dBm | |
| Maximum Input Level (Rcvr R1/R2/A or B IN at 0.1dB typical compression) | | |
| 30 to 300 kHz | –15 dBm | |
| 300 kHz to 8.5 GHz | –10 dBm | |

## Coupler through input

| Description | SPD | Typical |
|---|---|---|
| Insertion Loss from Coupler Thru to Test Port | Slope from 0.8 dB at 30 kHz to 3.5 dB at 8.5 GHz (0.32 x f [GHz] + 0.8) dB | |

## Source output

| Description | SPD | Typical |
|---|---|---|
| Maximum Leveled Power | | |
| 30 to 300 kHz | +18 dBm | |
| 300 kHz to 1 GHz | +20.5 dBm | |
| 1 to 3 GHz | +19 dBm | |
| 3 to 8.5 GHz | Slope from +19dBm at 3 GHz to +16 dBm at 8.5 GHz | |
| Maximum Input Level (at Max Specified Output Power) 30 kHz to 8.5 GHz | +20 dBm | |

# General Information

| Description | General characteristic |
|---|---|
| System band width | |
| Range | 10 Hz to 500 kHz<br>Nominal settings are:<br>10, 15, 20, 30, 40, 50, 70, 100, 150, 200, 300, 400, 500, 700, 1 k, 1.5 k, 2 k, 3 k, 4 k, 5 k, 7 k,<br>10 k, 15 k, 20 k, 30 k, 40 k, 50 k, 70 k, 100 k, 150 k, 200 k, 300 k, 400 k, 500 kHz |
| Number of points per traces | 2 to 20,001[1] |

## Front Panel

| Description | Typical | General characteristic |
|---|---|---|
| Test Ports | | Type –N, female, 50 Ω (nominal) |
| Damage Level | | +26 dBm or ±35 VDC (warranted) |
| Front Panel Jumpers | | SMA, female, 50 Ω (nominal) |
| Damage Level | | |
| Measurement Receiver Input (R1,R2,A,B) | +15 dBm or ±16 VDC | |
| Coupler Arm Output | +15 dBm or 0 VDC | |
| Coupler Through Input | +26 dBm or ±35 VDC | |
| Source Output | +26 dBm or 0 VDC | |
| Reference Source Output | +15 dBm or 0 VDC | |
| Probe Power | | |
| Connector | | 3 terminal connector x 2 |
| Voltage & Maximum current[2] | +15 V ± 5% (400 mA)<br>–12.6 V ± 5% (300 mA) | |
| Display | | |
| Type | | 10.4 inch TFT color LCD with touch screen |
| Resolution | | XGA (1024 x 768)[3] |
| USB host port | | Universal serial bus jack, Type A configuration; female; provides connection to mouse, keyboard, printer, ECal module, USB power sensor, or USB/GPIB interface |

## Rear Panel

| Description | Typical | General characteristic |
|---|---|---|
| External trigger input connector | | |
| Type | | BNC, female |
| Input level | | Low threshold voltage: 0.5 V<br>High threshold voltage: 2.1 V<br>Input level range: 0 to +5 V |
| Input impedance | | 50 Ω |
| Pulse width | | ≥ 2 µsec |
| Polarity | | Positive or negative |
| External trigger output connector | | |
| Type | | BNC, female |
| Maximum output current | | 50 mA |
| Output level | | Low level voltage: 0 V<br>High level voltage: 5 V |
| Pulse width | | 1 µsec |
| Polarity | | Positive or negative |
| External reference signal input connector | | |
| Type | | BNC, female |
| Input frequency | 10 MHz ± 10 ppm | |
| Input level | –3 to +10 dBm | |

1. The maximum number varies according to Channel/Trace Setup.
2. Combined load for both probe connections
3. Valid pixels are 99.99% and more. Below 0.01% (approx. 30 points) of fixed points of black, blue, green or red are not regarded as failure.

## Rear Panel

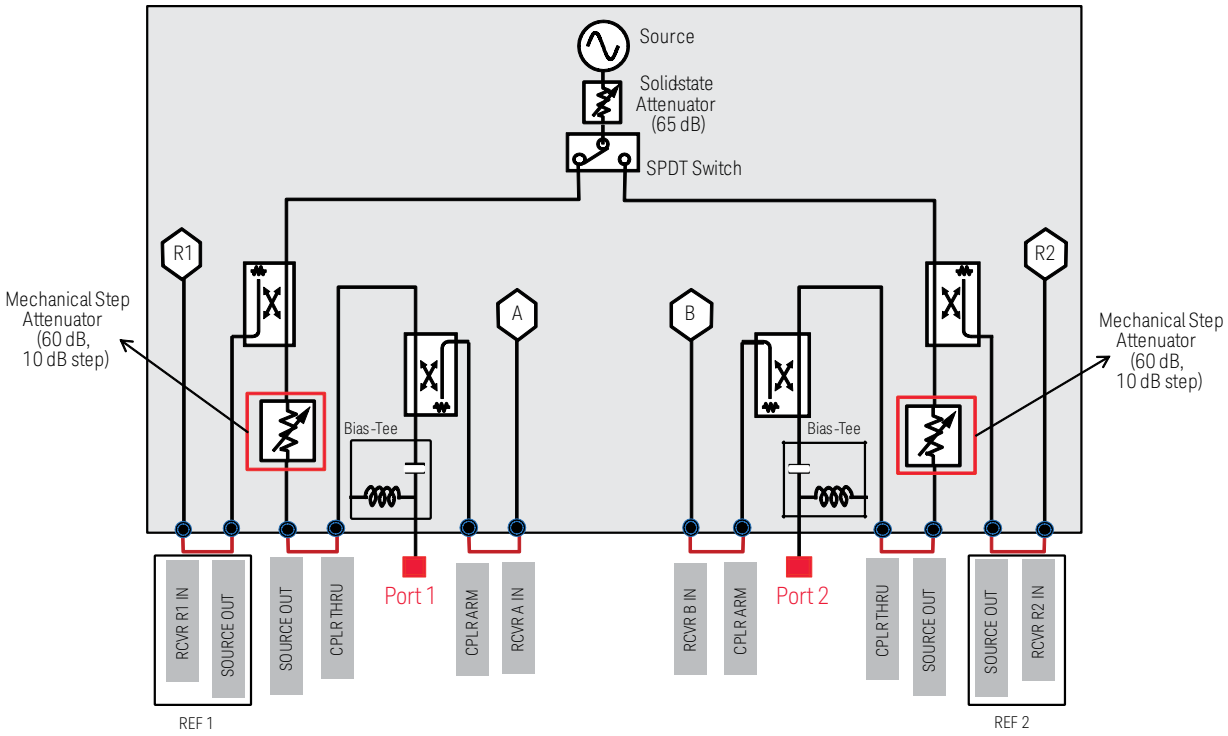
| Description | Typical | General characteristic |
|---|---|---|
| Internal reference signal output connector | | |
| Type | | BNC, female |
| Output frequency | 10 MHz ± 7 ppm | |
| Signal Type | Sinewave | |
| Output level | 0 dBm ± 3 dB into 50 Ω | |
| Output Impedance | | 50 Ω |
| Internal reference signal oven connector (Option 1E5) | | |
| Type | | BNC, female |
| Output frequency | 10 MHz ± 1 ppm | |
| Output level | 0 dBm minimum | |
| Bias tee input connector | | |
| Type | | BNC, female |
| Damage level | ± 35 V, 1A DC | |
| No RF spec degradation level | 300 mA | |
| Over current protection | 1A (Circuit Breaker) | |
| Video output | | 15-pin mini D-Sub; female; drives XGA compatible monitors |
| GPIB | | 24-pin D-Sub (Type D-24), female; compatible with IEEE-488 |
| USB host port | | Universal serial bus jack, Type A configuration; female; provides connection to mouse, key board, printer, ECal module, USB power sensor, or USB/GPIB interface |
| USB (USBTMC [1]) interface port | | Universal serial bus jack, Type B configuration (4 contacts inline); female; provides connection to an external PC; compatible with USBTMC-USB488 and USB 2.0.LA |
| LAN | | 10/100BaseT Ethernet, 8-pin configuration; auto selects between the two data rates |
| Handler I/O port | | 36-pin centronics, female; provides connection to handler system |
| Line Power [2] | | |
| Frequency | | 47 Hz to 63 Hz |
| Voltage | | 90-264 VAC (Vpeak ≥ 120V) |
| VA max | | 350 VA max. |
| Power consumption | | 135 W (SPD) |

## Rear panel

| Description | Specification | General characteristic |
|---|---|---|
| AUX input connector | | |
| Type | | BNC, female |
| Input Range | 1% + 1 mV for ± 1 V input | ± 1 V or ± 10 V selectable |
| Accuracy | 1% + 10 mV for ± 10 V input | |

1. USB Test and Measurement Class (TMC) interface that communicates over USB, complying with the IEEE 488.1 and IEEE 488.2 standards.
2. A third-wire ground is required.

## Block Diagram

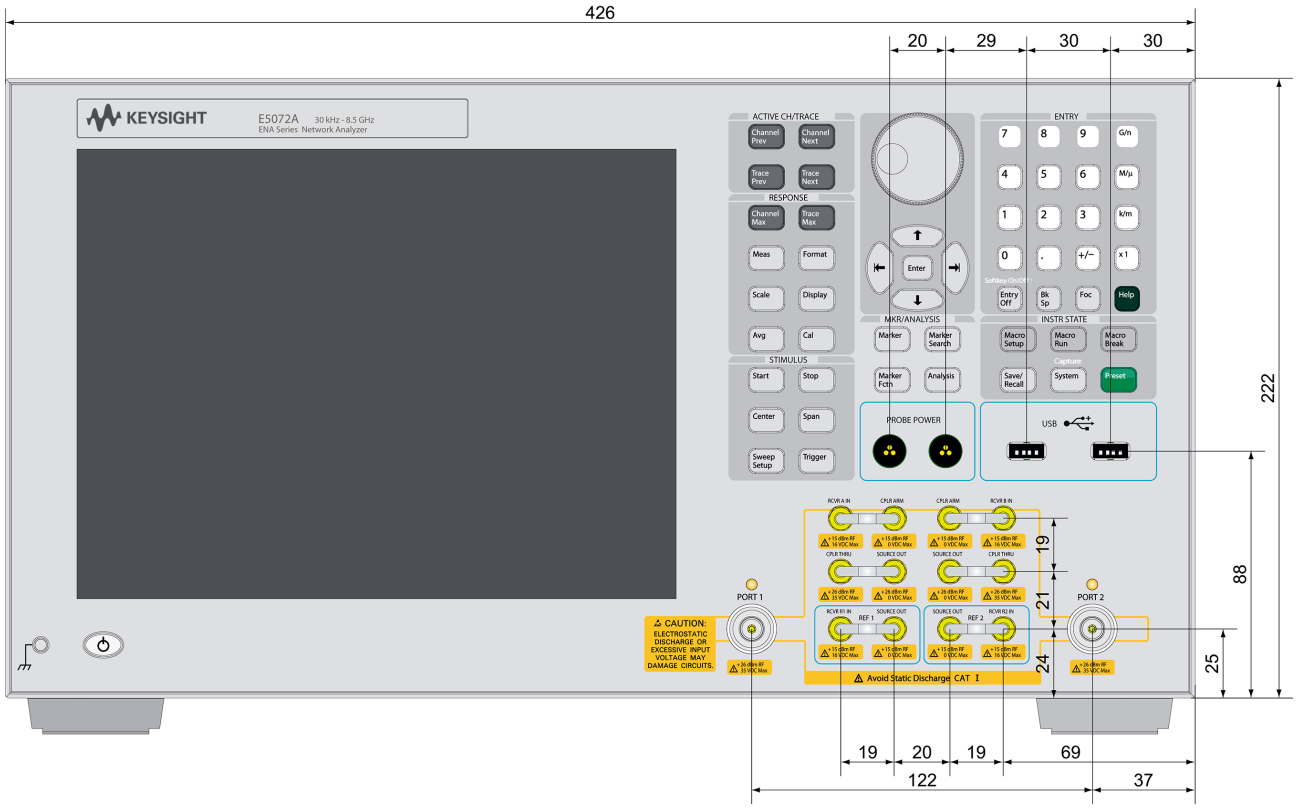


## EMC, safety, environment and compliance

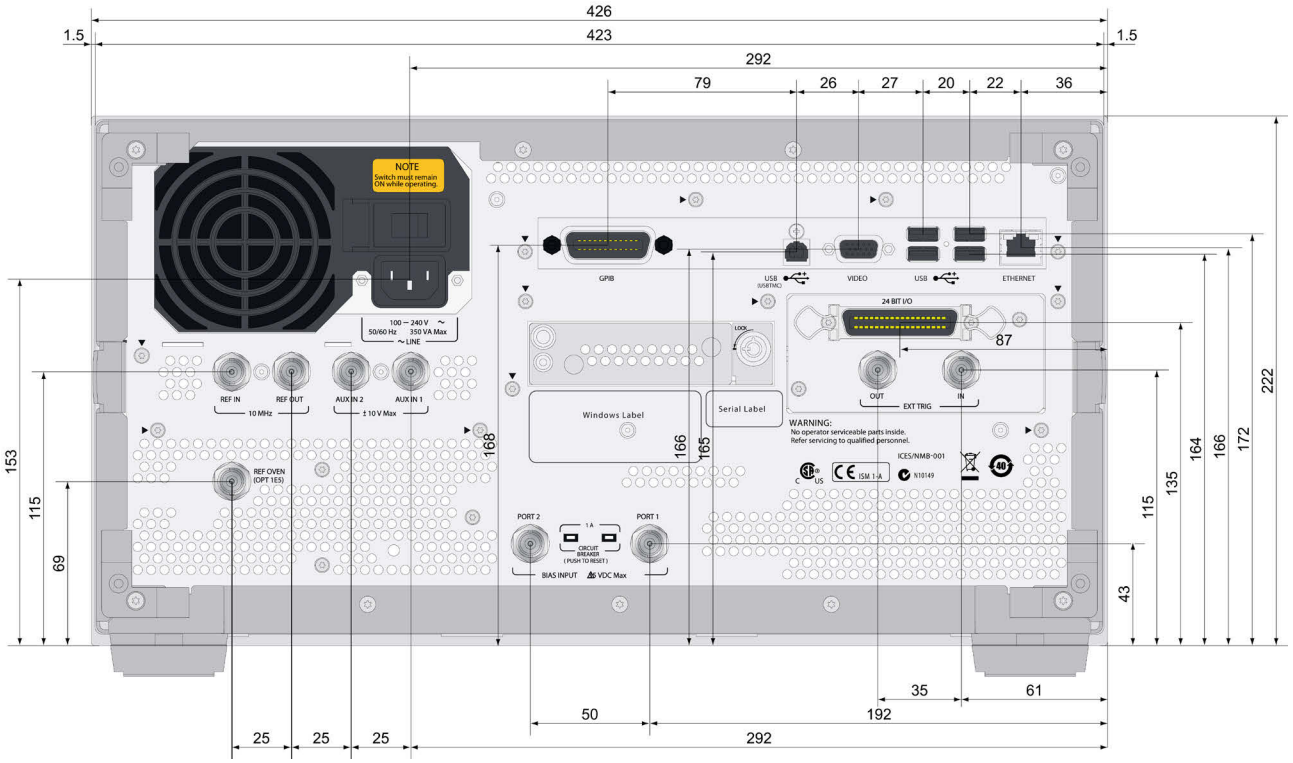
| Description | Specification |
|---|---|
| **EMC** | |
| CE<br>ISM 1-A | European Council Directive 2004/108/EC<br>IEC 61326-1:2012<br>EN 61326-1:2013<br>CISPR 11:2009 +A1:2010<br>EN 55011: 2009 +A1:2010<br>Group 1, Class A<br>IEC 61000-4-2:2008<br>EN 61000-4-2:2009<br>4 kV CD / 8 kV AD<br>IEC 61000-4-3:2006 +A1:2007 +A2:2010<br>EN 61000-4-3:2006 +A1:2008 +A2:2010<br>3 V/m, 80-1000 MHz, 1.4 - 2.0 GHz / 1V/m, 2.0 - 2.7 GHz, 80% AM<br>IEC 61000-4-4:2004 +A1:2010<br>EN 61000-4-4:2004 +A1:2010<br>1 kV power lines / 0.5 kV signal lines<br>IEC 61000-4-5:2005<br>EN 61000-4-5:2006<br>0.5 kV line-line / 1 kV line-ground<br>IEC 61000-4-6:2008<br>EN 61000-4-6:2009<br>3 V, 0.15-80 MHz, 80% AM<br>IEC 61000-4-8:2009<br>EN 61000-4-8:2010<br>30A/m, 50/60Hz<br>IEC 61000-4-11:2004<br>EN 61000-4-11:2004<br>0.5-300 cycle, 0% / 70% |
| ICES/NMB-001 | ICES-001:2006 Group 1, Class A |
| | AS/NZS CISPR11:2004<br>Group 1, Class A |
| MSIP-REM-Kst-WNMODSF36 | KN11, KN61000-6-1 and<br>KN61000-6-2<br>Group 1, Class A |
| **Safety** | |
| CE<br>ISM 1-A | European Council Directive 2006/95/EC<br>IEC 61010-1:2001/EN 61010-1:2001<br>Measurement Category I<br>Pollution Degree 2<br>Indoor Use |
| C US | CAN/CSA C22.2 No. 61010-1-04<br>Measurement Category I<br>Pollution Degree 2<br>Indoor Use |
| **Environment** | |
| | This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.<br>Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control instrumentation" product.<br>Do not dispose in domestic household waste. |
| **Compliance** | |
| LXI | Class C |

## Analyzer environmental specifications and dimensions

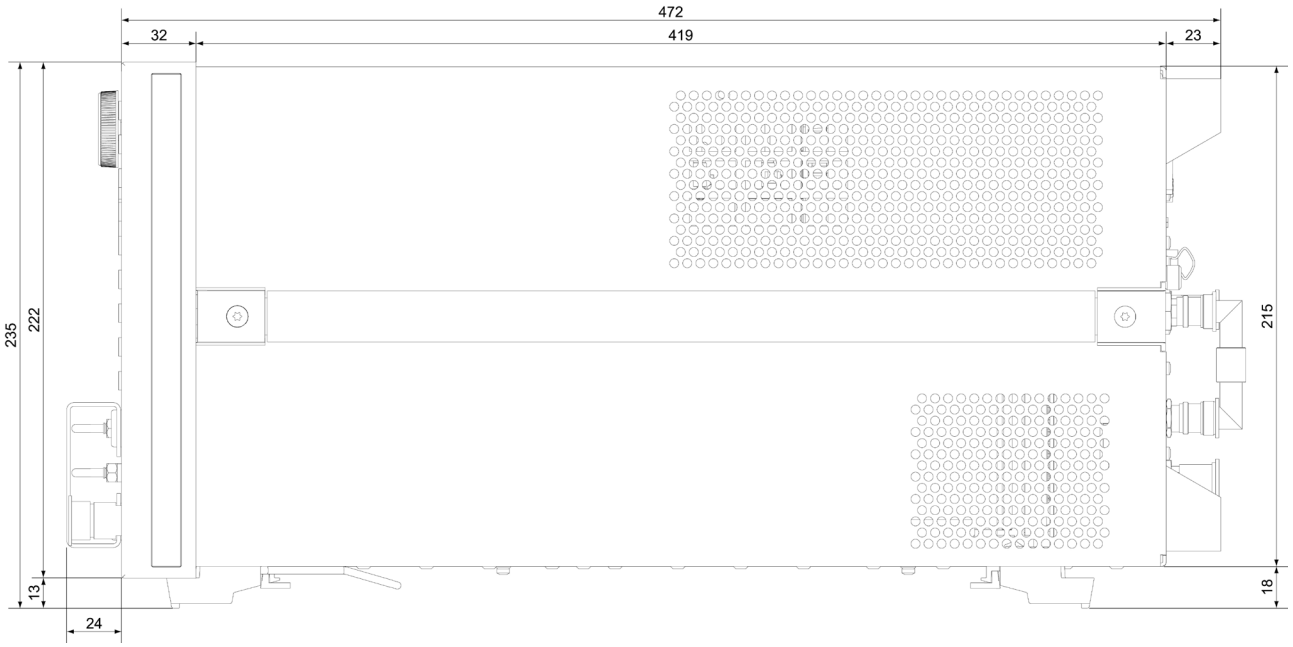
| Description | General characteristics |
|---|---|
| Operating environment | |
| Temperature | +5 °C to +40 °C |
| Error-corrected temperature range | 23 °C (± 5 °C) with < 1 °C deviation from calibration temperature |
| Humidity | 20% to 80% at wet bulb temperature < +29 °C (non-condensation) |
| Altitude | 0 to 2,000 m (0 to 6561 feet) |
| Vibration | 0.21 G maximum, 5 Hz to 500 Hz |
| Non-operating environment | |
| Temperature | –10 °C to +60 °C |
| Humidity | 20% to 90% at wet bulb temperature < +40 °C (non-condensation) |
| Altitude | 0 to 4,572 m (0 to 15,000 feet) |
| Vibration | 0.5 G maximum, 5 Hz to 500 Hz |
| Dimensions | See next page |
| Weight (net) | Option 017: 19.8 kg<br>Option 019: 19.0 kg |




Dimensions (front view)




Dimensions (rear view)




Dimensions (side view)

# Measurement Throughput Summary

Measurement throughput data is supplemental performance data.
Common condition for the measurement throughput data:

- Analyzer display turned off with: DISP : ENAB OFF
- Number of traces = 1
- Firmware version: A.01.00

## Cycle time for measurement completion

| | Sweep mode: Swept<br>System error correction: OFF | | | | Sweep mode: Step<br>System error correction: ON | | | |
|---|---|---|---|---|---|---|---|---|
| **Number of Points** | **51** | **201** | **401** | **1601** | **51** | **201** | **401** | **1601** |
| **Start 1 GHz, stop 1.2 GHz, 500 kHz IF bandwidth** | | | | | | | | |
| Uncorrected | 2 ms | 3 ms | 4 ms | 12 ms | 3 ms | 6 ms | 10 ms | 26 ms |
| 2-port cal | 2 ms | 4 ms | 7 ms | 23 ms | 4 ms | 11 ms | 18 ms | 51 ms |
| **Start 1 GHz, stop 1.2 GHz, 1 kHz IF bandwidth** | | | | | | | | |
| Uncorrected | 52 ms | 199 ms | 394 ms | 1560 ms | 52 ms | 199 ms | 394 ms | 1600 ms |
| 2-port cal | 102 ms | 396 ms | 786 ms | 3119 ms | 102 ms | 396 ms | 786 ms | 3119 ms |
| **Start 30 kHz, stop 4.5 GHz, 500 kHz IF bandwidth** | | | | | | | | |
| Uncorrected | 9 ms | 11 ms | 12 ms | 18 ms | 5 ms | 11 ms | 16 ms | 45 ms |
| 2-port cal | 16 ms | 21 ms | 23 ms | 35 ms | 10 ms | 20 ms | 32 ms | 90 ms |
| **Start 30 kHz, stop 4.5 GHz, 1 kHz IF bandwidth** | | | | | | | | |
| Uncorrected | 54 ms | 203 ms | 401 ms | 1579 ms | 54 ms | 203 ms | 401 ms | 1579 ms |
| 2-port cal | 107 ms | 405 ms | 800 ms | 3158 ms | 107 ms | 405 ms | 800 ms | 3157 ms |
| **Start 30 kHz, stop 8.5 GHz, 500 kHz IF bandwidth** | | | | | | | | |
| Uncorrected | 12 ms | 16 ms | 17 ms | 20 ms | 6 ms | 11 ms | 17 ms | 45 ms |
| 2-port cal | 24 ms | 31 ms | 33 ms | 38 ms | 10 ms | 21 ms | 32 ms | 90 ms |
| **Start 30 kHz, stop 8.5 GHz, 1 kHz IF bandwidth** | | | | | | | | |
| Uncorrected | 55 ms | 204 ms | 401 ms | 1579 ms | 55 ms | 204 ms | 401 ms | 1579 ms |
| 2-port cal | 108 ms | 406 ms | 801 ms | 3157 ms | 108 ms | 406 ms | 801 ms | 3157 ms |

## Cycle time vs. number of points

Condition: Start 1 GHz, stop 1.2 GHz, 500 kHz IF bandwidth

| Number of Points | Sweep mode: Swept<br>System error correction: OFF | Sweep mode: Step<br>System error correction: ON |
|---|---|---|
| 3 | 1 ms | 1 ms |
| 11 | 2 ms | 2 ms |
| 51 | 2 ms | 3 ms |
| 101 | 2 ms | 4 ms |
| 201 | 3 ms | 6 ms |
| 801 | 7 ms | 16 ms |
| 1601 | 12 ms | 27 ms |

## Cycle time vs. IF bandwidth

Condition: NOP=201, system error correction: OFF, Sweep mode: swep

| IF BW (Hz) | Cycle Time (ms) | IF BW (Hz) | Cycle Time (ms) | IF BW (Hz) | Cycle Time (ms) | IF BW (Hz) | Cycle Time (ms) | IF BW (Hz) | Cycle Time (ms) |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 19297 | 100 | 1931 | 1000 | 195 | 10000 | 20 | 100000 | 3 |
| 15 | 12865 | 150 | 1288 | 1500 | 130 | 15000 | 14 | 150000 | 3 |
| 20 | 9649 | 200 | 1091 | 2000 | 98 | 20000 | 11 | 200000 | 3 |
| 30 | 6433 | 300 | 645 | 3000 | 66 | 30000 | 8 | 300000 | 3 |
| 40 | 4825 | 400 | 484 | 4000 | 50 | 40000 | 6 | 400000 | 2 |
| 50 | 3861 | 500 | 388 | 5000 | 40 | 50000 | 5 | 500000 | 2 |
| 70 | 2735 | 700 | 276 | 7000 | 29 | 70000 | 4 | | |

## Data transfer time [1]

| Number of Points | 51 | 201 | 401 | 1601 |
|---|---|---|---|---|
| **SCPI over GPIB** | | | | |
| 64-bit floating point | 5 ms | 15 ms | 28 ms | 110 ms |
| 32-bit floating point | 3 ms | 8 ms | 15 ms | 56 ms |
| ASCII | 21 ms | 78 ms | 156 ms | 618 ms |
| **SCPI over 100 Mbps LAN (Socket) [2]** | | | | |
| REAL 64 | 1 ms | 1 ms | 2 ms | 3 ms |
| REAL 32 | 1 ms | 1 ms | 1 ms | 2 ms |
| ASCII | 13 ms | 47 ms | 93 ms | 363 ms |
| **SCPI over 100 Mbps LAN (SICL-LAN)** | | | | |
| REAL 64 | 3 ms | 3 ms | 4 ms | 6 ms |
| REAL 32 | 3 ms | 3 ms | 4 ms | 4 ms |
| ASCII | 3 ms | 7 ms | 11 ms | 37 ms |
| **SCPI over USB [2]** | | | | |
| REAL 64 | 2 ms | 2 ms | 2 ms | 3 ms |
| REAL 32 | 2 ms | 2 ms | 2 ms | 3 ms |
| ASCII | 3 ms | 9 ms | 17 ms | 66 ms |
| **SCPI over GPIB/USB (82357B)** | | | | |
| REAL 64 | 8 ms | 14 ms | 23 ms | 77 ms |
| REAL 32 | 7 ms | 10 ms | 14 ms | 41 ms |
| ASCII | 74 ms | 285 ms | 568 ms | 2268 ms |
| **COM [3]** | | | | |
| Variant Type | 1 ms | 1 ms | 1 ms | 1 ms |

1. Measured using a VEE Pro 7.0 program running on a 3.2 GHz Pentium 4 DELL Precision 370, Transferred complex S11 data, using : CALC{1-36} : DATA : FDAT?.
2. USB Test and Measurement Class (TMC) interface that communicates over USB, complying with the IEEE 488.1 and IEEE 488.2 standards.
3. Measured using an E5072A VBA macro running inside the analyzer. Transferred complex S11 data

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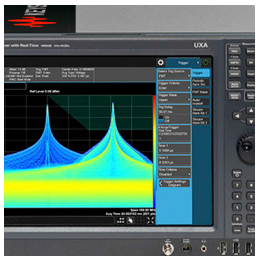

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