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# NI PXIe-5630 Specifications

## RF Vector Network Analyzer

This document lists specifications for the NI PXIe-5630 RF vector network analyzer (NI 5630).

Specifications are warranted under the following conditions:

- Minimum of 30 minutes warm-up time
- No averaging applied to the data
- Environmental ambient temperature of 23 °C ± 5 °C
- Less than 1 °C ambient temperature deviation after user calibration
- Calibration cycle maintained
- Type-K, 50 Ω connectors used
- Chassis fan speed set to High
- Onboard Reference clock applied
- NI-VNA version 1.0 or later used

*Specifications* describe the warranted, traceable product performance over ambient temperature ranges of 23 °C ± 5 °C, unless otherwise noted.

*Typical* values describe useful product performance beyond specifications that are not covered by warranty and do not include guardbands for measurement uncertainty or drift. Typical values may not be verified on all units shipped from the factory. Unless otherwise noted, typical values cover the expected performance of units over ambient temperature ranges of 23 °C ± 5 °C with a 90% confidence level, based on measurements taken during development or production.

*Nominal* values (or supplemental information) describe additional information about the product that may be useful, including expected performance that is not covered under *Specifications* or *Typical* values. Nominal values are not covered by warranty.

Specifications are subject to change without notice. For the most recent NI 5630 specifications, visit `ni.com/manuals`.

To access NI 5630 documentation, navigate to **Start»All Programs» National Instruments»NI-VNA»Documentation**.

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**Hot Surface** If the NI 5630 has been in use, component modules or their shields may exceed safe handling temperatures and may cause burns. Allow the NI 5630 to cool before touching shields on component modules or removing modules from the chassis.

## Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) as stated in the product specifications. These requirements and limits are designed to provide reasonable protection against harmful interference when the product is operated in its intended operational electromagnetic environment.

This product is intended for use in industrial locations. There is no guarantee that harmful interference will not occur in a particular installation, when the product is connected to a test object, or if the product is used in residential areas. To minimize the potential for the product to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

**Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

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# General Information

Measurand ..... S11, S21

IF bandwidth (IFBW) ..... 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, and 30 kHz

Sweep capability

- Maximum frequency ..... 6 GHz
- Minimum frequency ..... 10 MHz
- Resolution ..... 10 Hz
- Minimum number of points ..... 1
- Maximum number of points ..... 3,201
- Frequency spacing ..... Linear, shown in the following equation:

$$\frac{Stop\ Freq - Start\ Freq}{\#\ of\ Points}$$

- NI-VNA soft front panel (SFP) sweep modes ..... Single sweep and hold, continuous, and continuous wave (CW)

Data formats ..... Magnitude (log), magnitude (linear), phase, group delay, VSWR, impedance, reflection/transmission coefficient, real, imaginary

NI-VNA SFP display types ..... Value vs. frequency plot, Smith chart

Number of averages ..... 4,096 maximum



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Smoothing.....25% maximum

User calibration

Methods .....AutoCal, manual

Types .....1-port SOL, 1-path 2-port SOLT, transmission response, and reflection response

# Port 1 Source Characteristics

Frequency range .....10 MHz to 6 GHz

Frequency resolution .....10 Hz

Frequency accuracy .....2.5 ppm + Internal or External Timebase Aging + Internal or External Timebase Temperature Stability

Internal timebase

Aging .....±1 ppm

Temperature stability.....±2.5 ppm/°C

Power range .....+5 dBm to –30 dBm

Power accuracy

At +5 dBm test port power .....±2 dB

At any test port power .....±4 dB, typical

Power step resolution.....0.5 dB

Harmonics (measured at +5 dBm source power)

| Frequency | Harmonic | Typical |
|---|---|---|
| 10 MHz to <250 MHz | <–6 dBc | <–8 dBc |
| 250 MHz to <1.7 GHz | <–9 dBc | <–12 dBc |
| 1.7 GHz to <2.5 GHz | <–16 dBc | <–20 dBc |
| 2.5 GHz to 6.0 GHz | <–22 dBc | <–28 dBc |

Nonharmonic spurs
(at +5 dBm source power) .....<–14 dBc, <–17 dBc, typical



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# Port 2 Receiver Characteristics

0.1 dB compression point..... >+5 dBm, typical

Noise floor[1]

| Frequency | Range | Typical |
|---|---|---|
| 10 MHz to <3 GHz | <–113 dBm/Hz | <–115 dBm/Hz |
| 3 GHz to 6 GHz | <–105 dBm/Hz | <–110 dBm/Hz |

Raw input match ..... 18 dB

Dynamic range[2]

| Frequency | Range | Typical |
|---|---|---|
| 10 MHz to <3 GHz | >108 dB | >110 dB |
| 3 GHz to 6 GHz | >100 dB | >105 dB |

Trace noise (measured at +5 dBm with 100 Hz IF bandwidth)

| Frequency | Noise | Typical |
|---|---|---|
| 10 MHz to <3.0 GHz | <6 mdB rms | <3 mdB rms |
| 3.0 GHz to 6.0 GHz | <9 mdB rms | <5 mdB rms |

Damage input level ..... 23 dBm

[1] Calculated from maximum port power and dynamic range.

[2] Measured at +5 dBm with 10 Hz IF bandwidth in high-sensitivity mode and an RF calibration with isolation using the NI manual calibration kit into 50 Ω terminations.



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# Measurement Speed[1]

| Span | IFBW | Number of Points | | |
|---|---|---|---|---|
| | | 201 | 801 | 3201 |
| Zero Span (Continuous Wave Mode) | 30 kHz | 28 ms | 93 ms | 350 ms |
| | 1 kHz | 230 ms | 874 ms | 3,452 ms |
| Small Span: 1 GHz to 2 GHz | 30 kHz | 79 ms | 262 ms | 958 ms |
| | 1 kHz | 273 ms | 1,036 ms | 4,054 ms |
| Full Span: 10 MHz to 6 GHz | 30 kHz | 79 ms | 283 ms | 1,057 ms |
| | 1 kHz | 272 ms | 1,057 ms | 4,161 ms |
| All values typical. Time Domain operations add 0.5 ms per 100 points. | | | | |

# Corrected System Performance

## Corrected System Performance with K-Type Connectors with NI Manual Calibration Kit and Precision Cables

| Specification | Frequency | |
|---|---|---|
| | 10 MHz to <5 GHz | 5 GHz to 6 GHz |
| Directivity | 42 dB | 36 dB |
| Source Match | 35 dB | 35 dB |
| Load Match | 18 dB | 18 dB |

[1] Indicates the amount of time it takes after hardware configuration has been committed to the device to initiate a sweep, perform the measurement, and then fetch the data from the device. Measurements taken using an NI PXIe-8133 controller and an NI PXIe-1065 chassis. Benchmarks run on a single device at a time.



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## Transmission Uncertainty

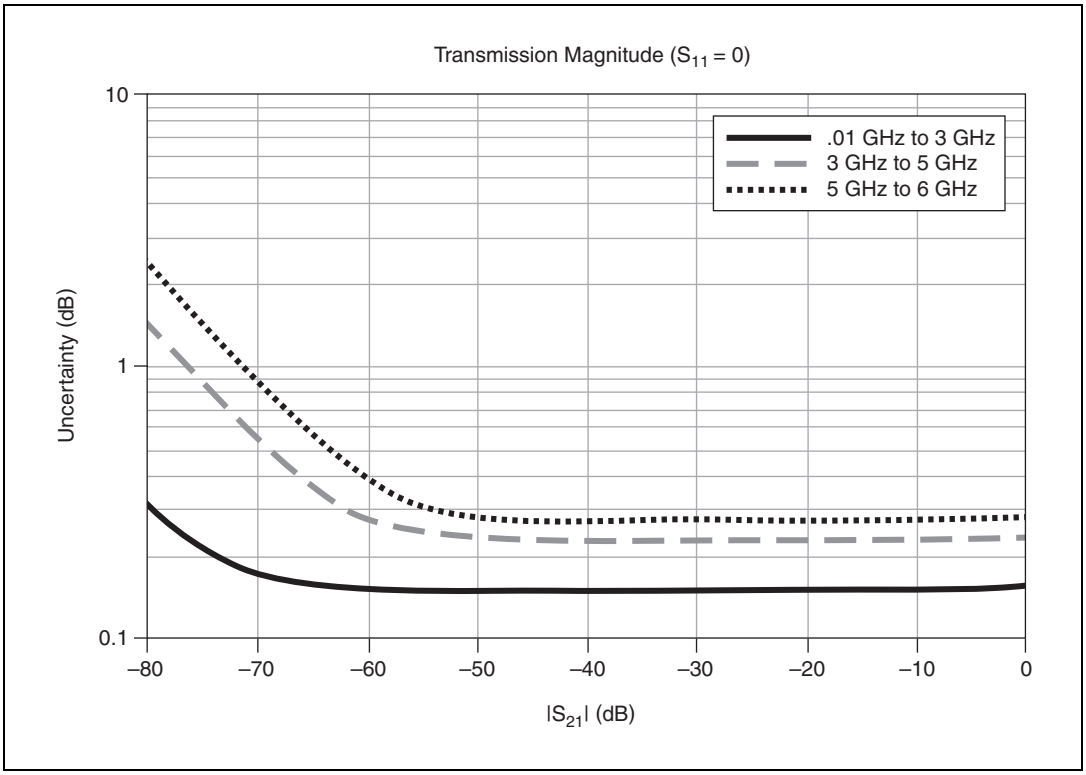



**Figure 1.** Magnitude Uncertainty



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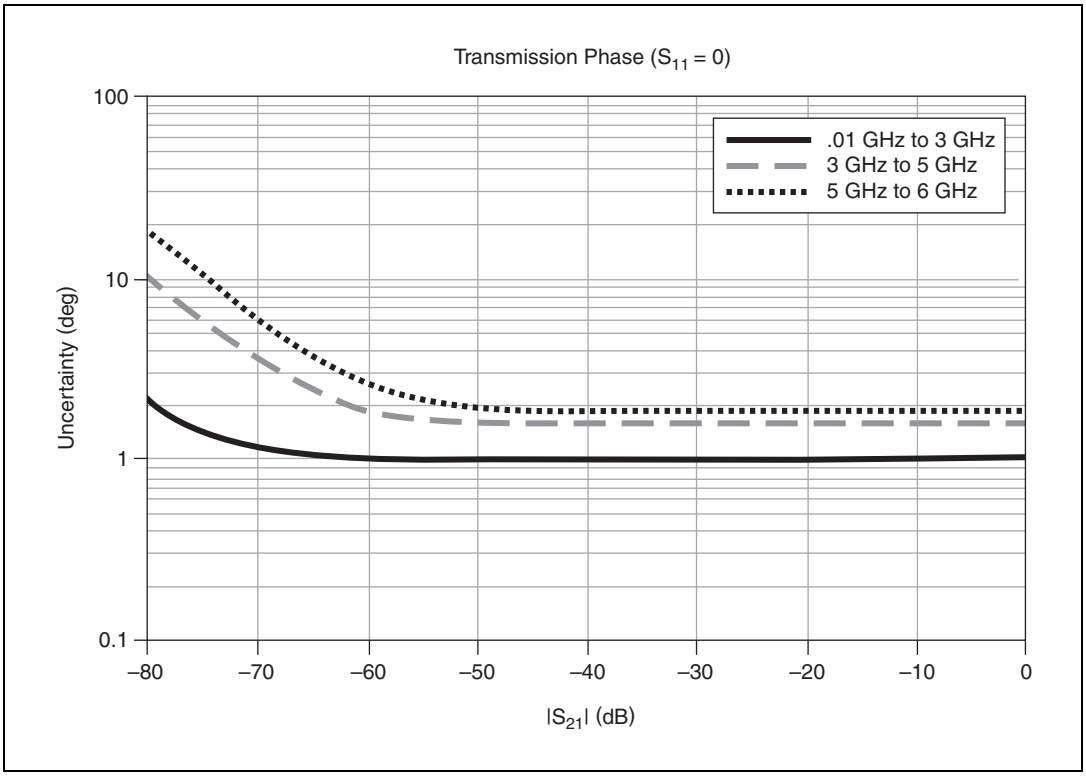



**Figure 2.** Phase Uncertainty



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## Reflection Uncertainty

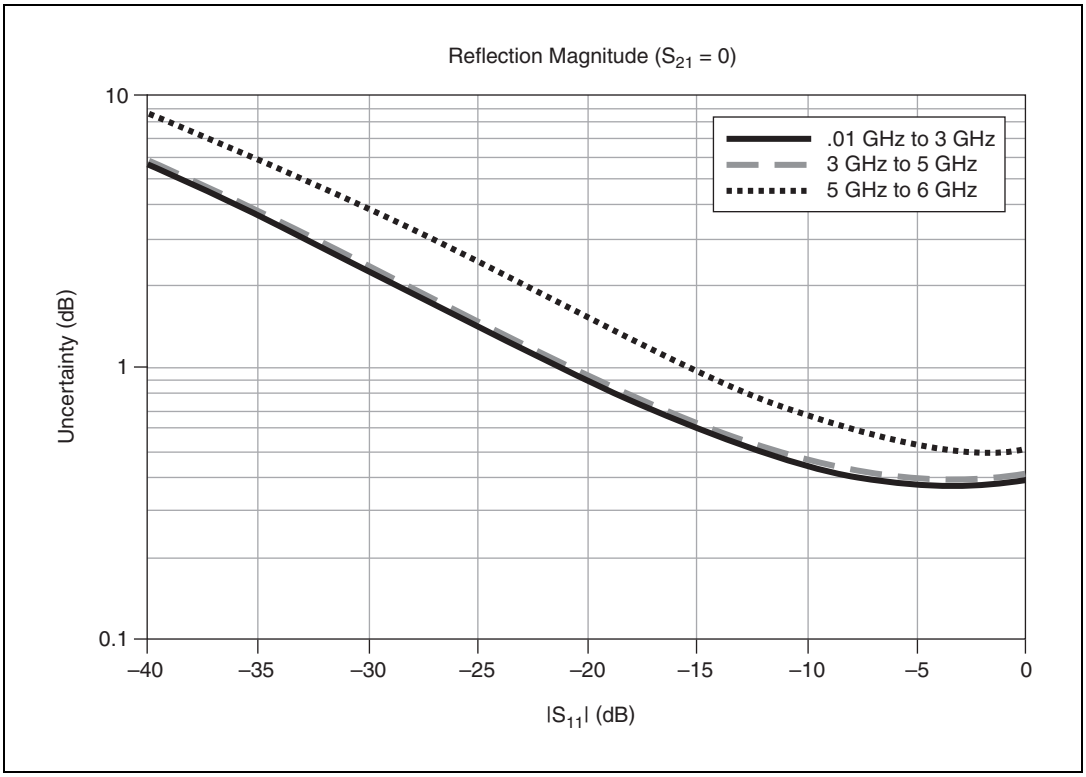



**Figure 3.** Magnitude Uncertainty



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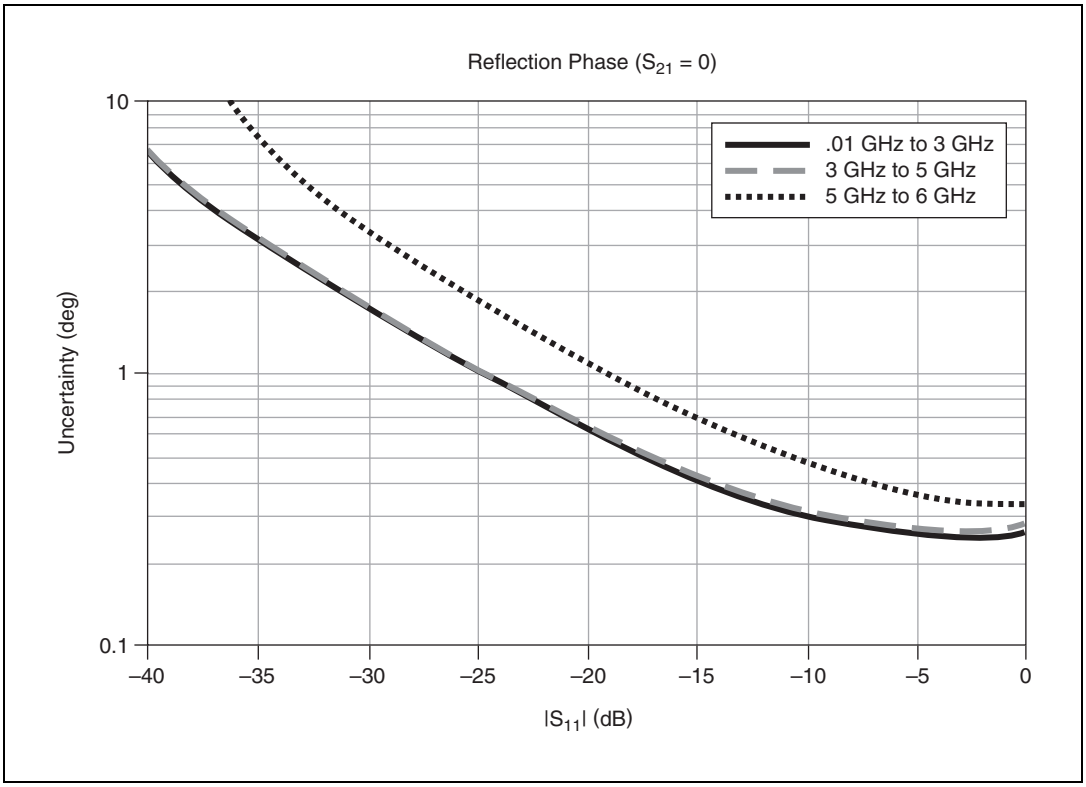



**Figure 4.** Phase Uncertainty

## Corrected System Performance with N-Type Connectors with NI Manual Calibration Kit and Precision Cables

| Specification | Frequency | |
|---|---|---|
| | 10 MHz to <5 GHz | 5 GHz to 6 GHz |
| Directivity | 42 dB | 36 dB |
| Source Match | 35 dB | 35 dB |
| Load Match | 18 dB | 18 dB |



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## Transmission Uncertainty

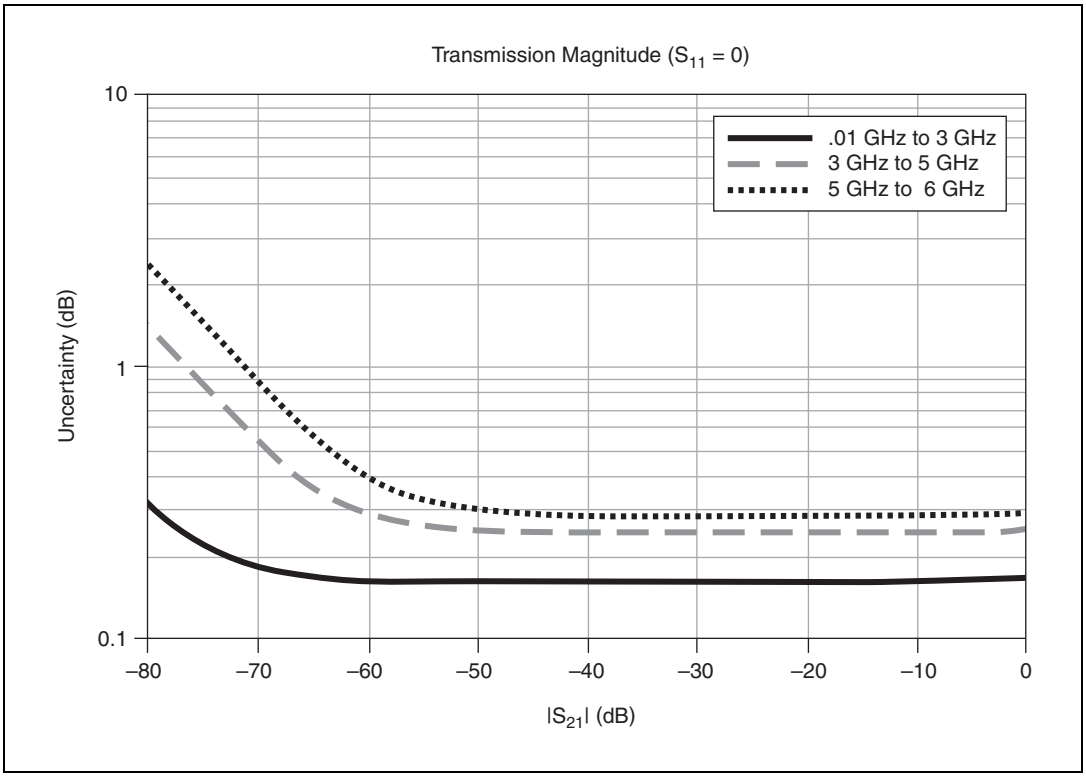



**Figure 5.** Magnitude Uncertainty



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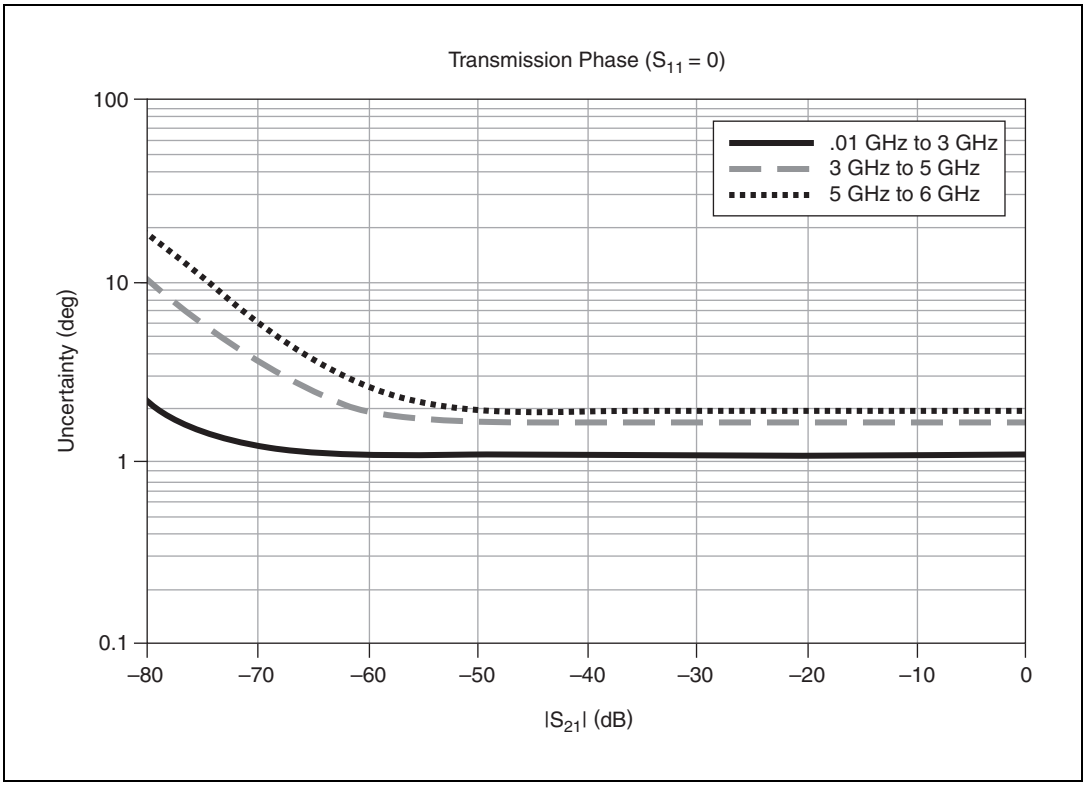



**Figure 6.** Phase Uncertainty



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## Reflection Uncertainty

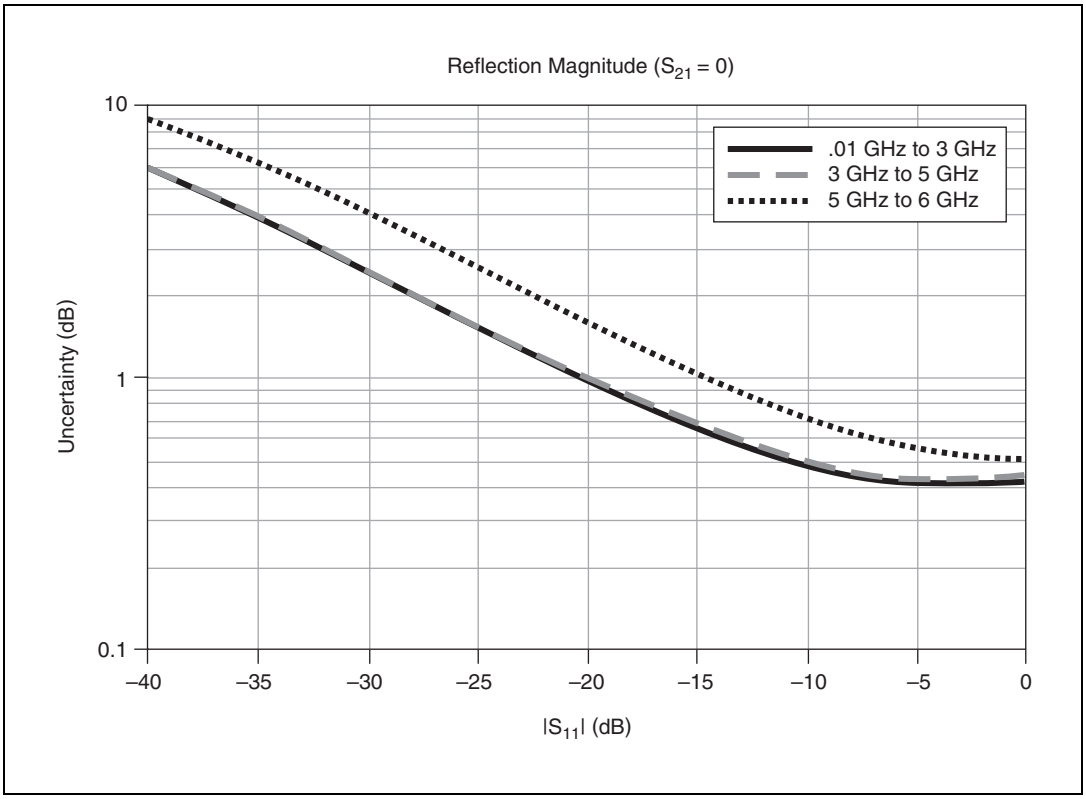



**Figure 7.** Magnitude Uncertainty



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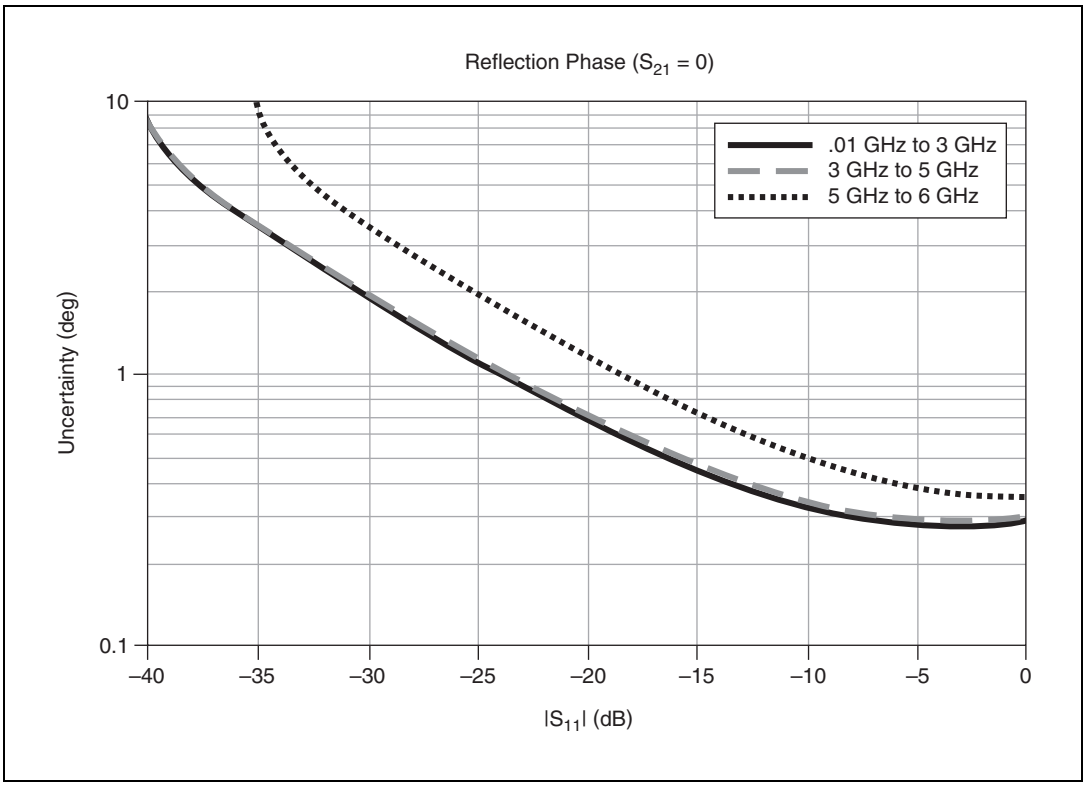



**Figure 8.** Phase Uncertainty

## Corrected System Performance with K-Type Connectors and NI AutoCal Kit and Precision Cables

| Specification | Frequency | |
|---|---|---|
| | 10 MHz to <5 GHz | 5 GHz to 6 GHz |
| Directivity | 42 dB | 36 dB |
| Source Match | 35 dB | 35 dB |
| Load Match | 18 dB | 18 dB |



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## Transmission Uncertainty

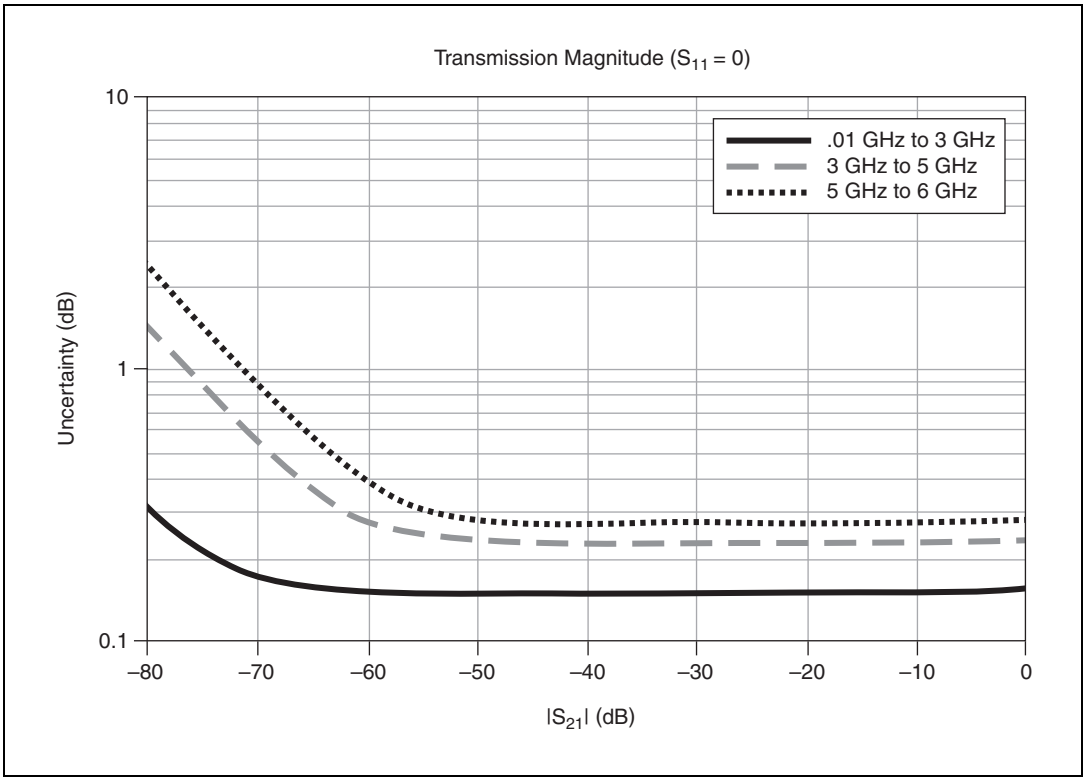



**Figure 9.** Magnitude Uncertainty



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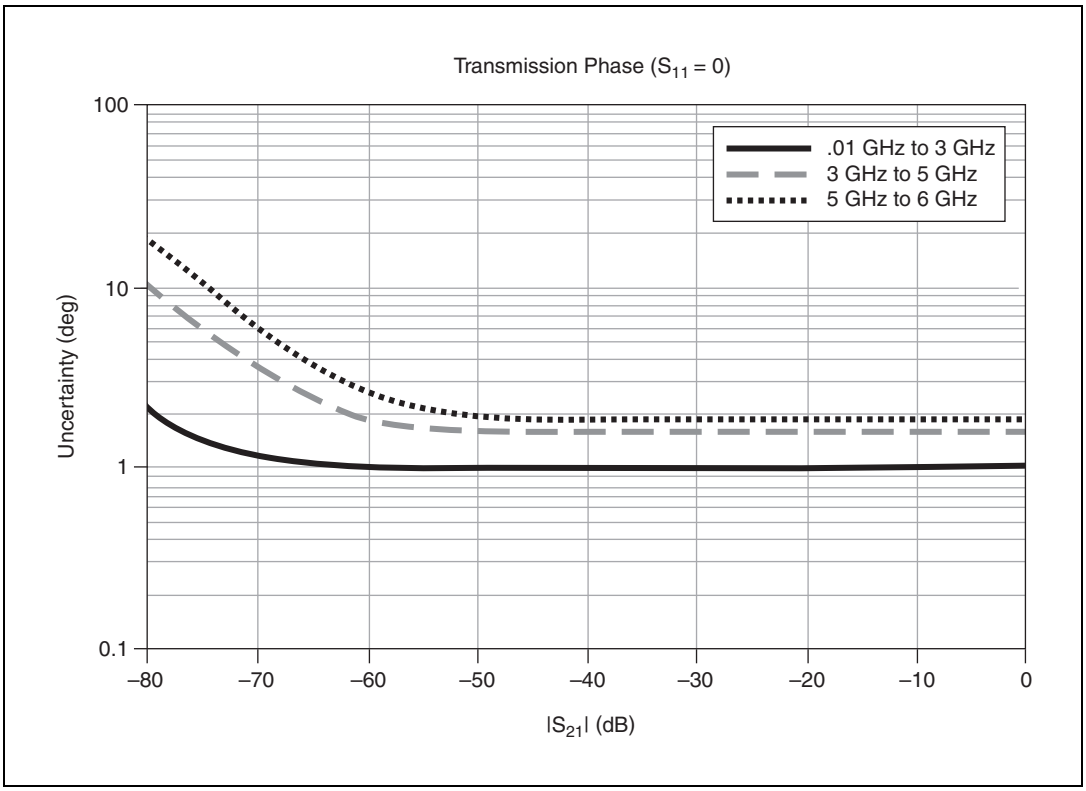



**Figure 10.** Phase Uncertainty



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## Reflection Uncertainty

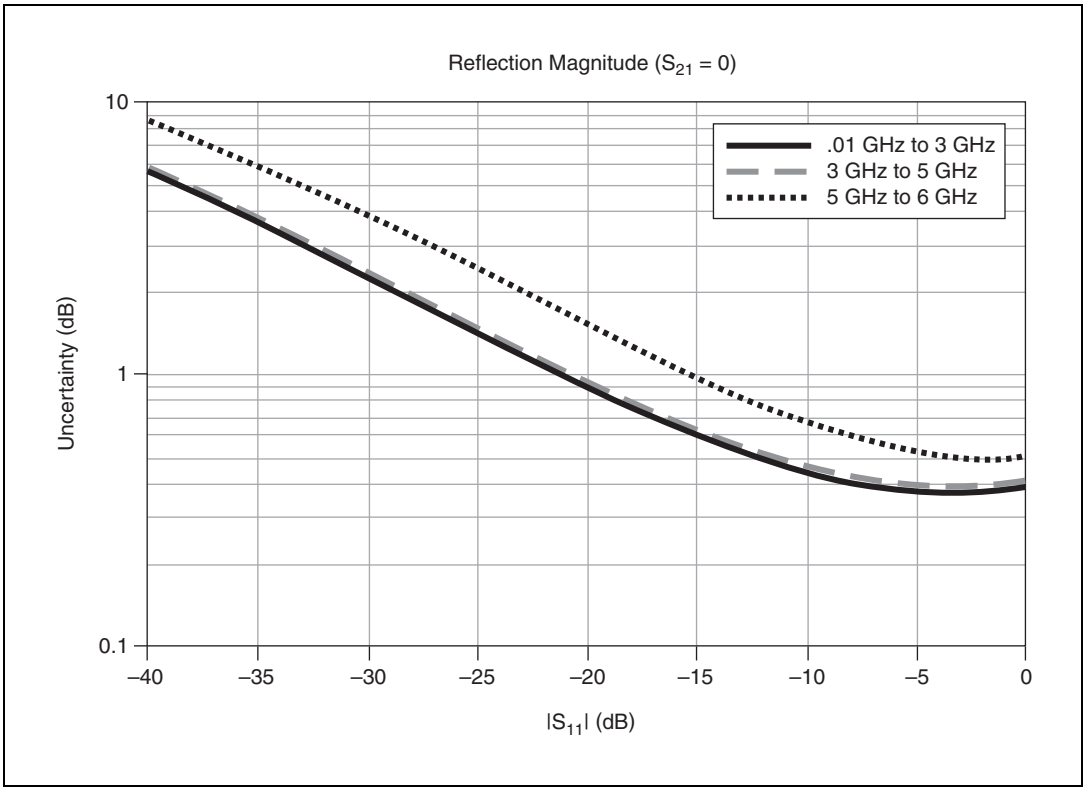



**Figure 11.** Magnitude Uncertainty



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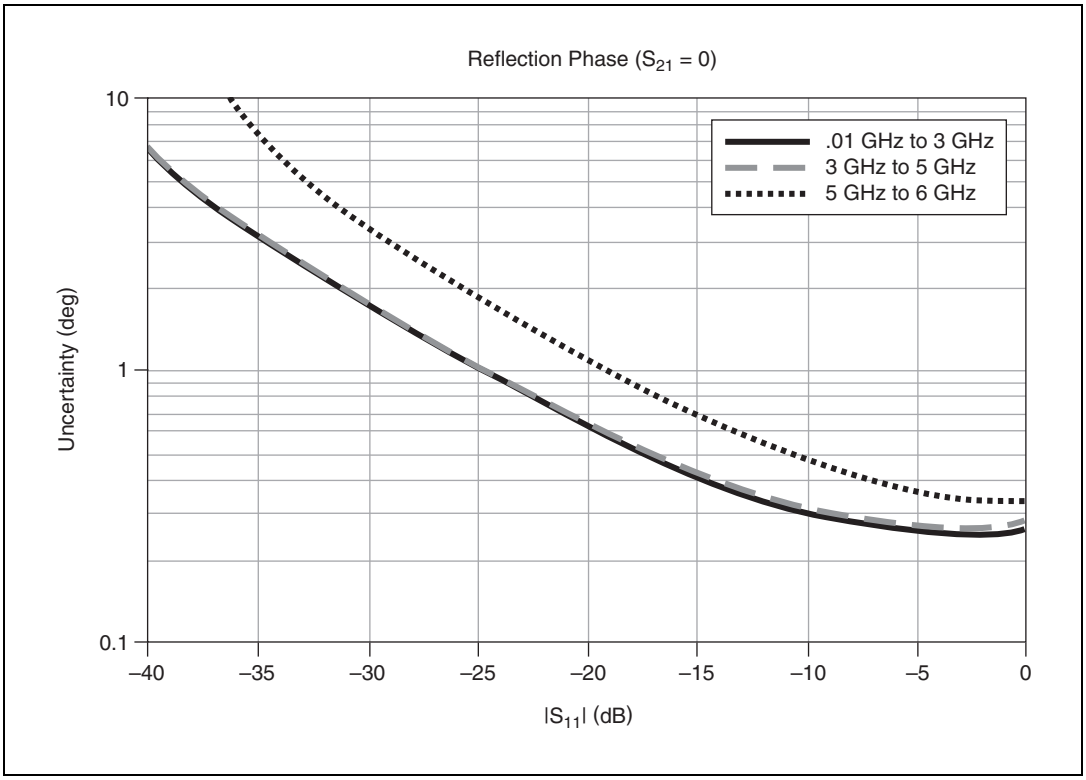



**Figure 12.** Phase Uncertainty

# Trigger

Start trigger types.....Immediate, software, digital edge

Digital edge Start trigger sources .....PFI 0, PXI_Trig<0..7>

Input range.....+3.3 V logic (+5 V tolerant)

Minimum trigger width

PFI 0 .....50 ns

PXI_Trig<0..7> .....50 ns



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## Reference Frequency

| | |
|---|---|
| Frequency sources | Onboard, REF IN |
| Input impedance | 50 Ω |
| Input range | +3 dBm to –10 dBm sine wave |
| Frequency range | 10 MHz ± 10 ppm |

## Calibration

| | |
|---|---|
| Interval | 1 year (from first device use after external calibration) |

## Power

| | |
|---|---|
| 3.3 VDC | 640 mA, typical |
| 12 VDC | 950 mA, typical |



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# Hardware Front Panels and Connectors

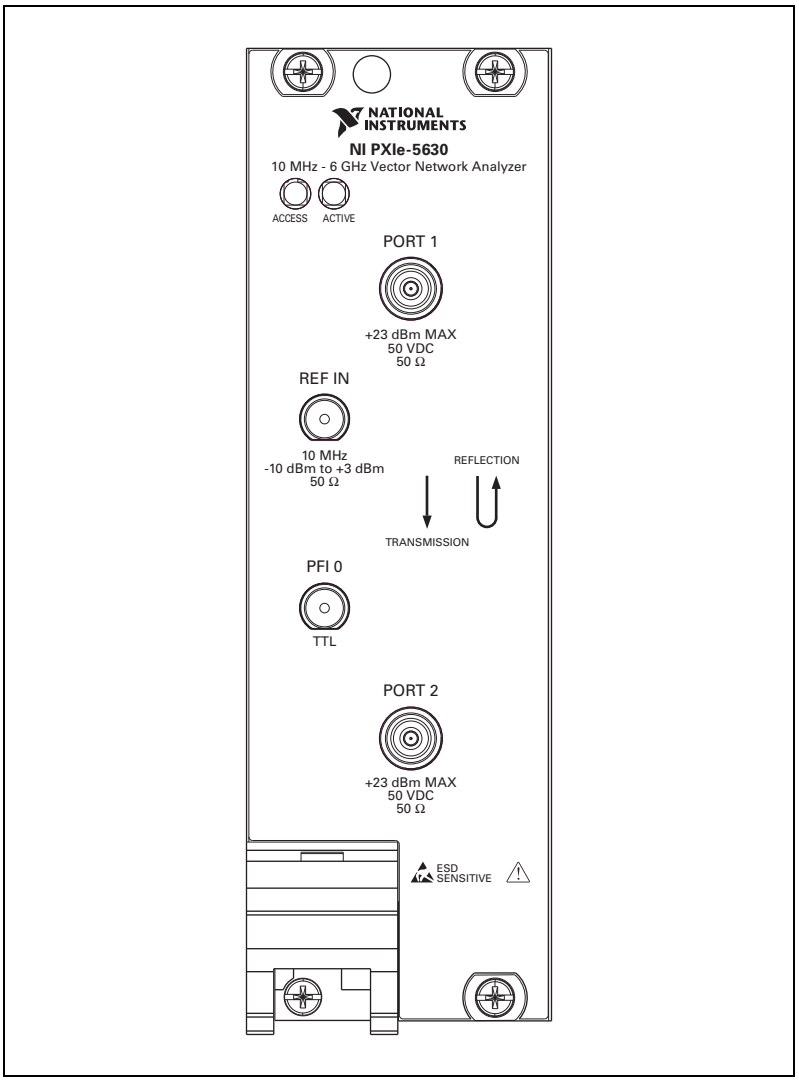



**Figure 13.** NI 5630 Front Panels



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The following table provides more information about the connectors located on the NI 5630 front panel.

**Table 1.** NI 5630 Front Panel Connectors

| Connector | Type | Function |
|---|---|---|
| PORT 1 | Type-K | Input/output terminal for NI 5630 measurements. Refer to the *Port 1 Source Characteristics* section for more information about this connector. |
| REF IN | SMA | Input terminal for an external reference signal for the NI 5630. Refer to the *Reference Frequency* section for more information about this connector. |
| PFI 0 | SMA | Input terminal for an external trigger signal. This connector is 3.3 V TTL logic (+5 V tolerant). Refer to the *Trigger* section for more information about this connector. |
| PORT 2 | Type-K | Input terminal for NI 5630 measurements. Refer to the *Port 2 Receiver Characteristics* section for more information about this connector. |

The following table provides LED and indication information for the LEDs located on the NI 5630 front panel.

**Table 2.** NI 5630 Front Panel LEDs

| LED | Indication |
|---|---|
| ACCESS | Indicates the basic hardware status of the NI 5630 module.<br>OFF—The module is not yet functional.<br>AMBER—The module is being accessed. Accessed means that the device is being communicated with over the PXI Express bus.<br>GREEN—The module is ready to be programmed by NI-VNA.<br>RED—The module has detected a hardware error, such as a hardware failure. The LED remains red until the error condition is removed. |
| ACTIVE | Indicates the state of the NI 5630 module.<br>OFF—The module is not yet functional.<br>AMBER—The module is armed and waiting for a trigger.<br>GREEN—The module has received a Start trigger. This state also indicates that the module is making a measurement.<br>RED—The module has detected a spurious error, such as when the PLL becomes unlocked. The LED remains red until the error condition is removed. |



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# Dimensions and Weight

Dimensions .....3U, two slot,
PXI Express module,
21.6 cm × 4.0 cm × 13.0 cm
(8.5 in. × 1.6 in. × 5.1 in.)

Weight .....680 g (24.0 oz)

# Environmental

Specifications in this document are guaranteed under the following specified environmental conditions unless otherwise stated.

Altitude .....0 m to 2,000 m

Pollution Degree .....2

Indoor use only.

## Operating Environment

Warm-up time.....30 minutes

Ambient temperature range .....0 °C to 55 °C
(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL PRF-28800F Class 3 low temperature limit and MIL PRF-28800F Class 2 high temperature limit.)

Relative humidity range.....10% to 90%, noncondensing
(Tested in accordance with IEC 60068-2-56.)

## Storage Environment

Ambient temperature range .....–41 °C to +71 °C
(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL PRF-28800F Class 3 limits.)

Relative humidity range.....5% to 95%, noncondensing
(Tested in accordance with IEC 60068-2-56.)



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## Shock and Vibration

Operating Shock..... 30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Meets MIL PRF-28800F Class 2 limits.)

Random Vibration

Operating ..... 5 Hz to 500 Hz, 0.3 $g_{rms}$

Non-operating ..... 5 Hz to 500 Hz, 2.4 $g_{rms}$ (Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL PRF-28800F, Class 3.)

## Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

**Note** For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

## Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity 1
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

**Note** In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

**Note** Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generates radio frequency energy for the treatment of material or inspection/analysis purposes.



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**Note** For EMC declarations and certifications, refer to the *Online Product Certification* section.

## CE Compliance CE

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

## Online Product Certification

To obtain product certifications and the Declaration of Conformity (DoC) for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

## Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

### Waste Electrical and Electronic Equipment (WEEE)

**EU Customers** At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit `ni.com/environment/weee`.

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