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SPECIFICATIONS

PXIe-5632

8.5 GHz Vector Network Analyzer

Contents

Definitions....1
Conditions....2
General Information....2
Source Characteristics....3
Receiver Characteristics....5
Measurement Speed....6
Corrected System Performance....7
- K-Type Connectors with NI Manual Calibration Kit and Precision Cables....7
- N-Type Connectors with NI Manual Calibration Kit and Precision Cables....10
- K-Type Connectors with NI Automatic Calibration Kit and Precision Cables....12

Trigger....14
Reference Frequency....15
Calibration....15
Power....15
Physical Characteristics....15
Environment....15
- Operating Environment....16
- Storage Environment....16

Shock and Vibration....16
Compliance and Certifications....16
- Safety....16
- Electromagnetic Compatibility....17
- CE Compliance....17
- Online Product Certification....17
- Environmental Management....17

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

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The following characteristic specifications describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- *Typical* specifications describe the performance met by a majority of models.
- *Typical-95* specifications describe the performance met by 95% (≈2σ) of models with a 95% confidence.
- *Nominal* specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are *Warranted* unless otherwise noted.

Conditions

Specifications are valid under the following conditions unless otherwise noted.

- Minimum of 45 minutes warm-up time
- No averaging or smoothing applied to the data unless otherwise noted
- Less than 1 °C ambient temperature deviation after user calibration
- Calibration cycle maintained
- Type-K or Type-N, 50 Ω connectors used
- Chassis fan speed set to High
- Onboard Reference Clock applied
- NI-VNA version 2.0 or later used

General Information

Measurements	S11, S21, S12, S22, user-defined
IF bandwidth (IFBW)	10 Hz to 500 kHz in 1, 3, 5, 7, and 10 steps
Sweep capability	
Maximum frequency	8.5 GHz
Minimum frequency[1]	300 kHz
Resolution	1 Hz
Minimum number of points	1
Maximum number of points	20,001
Frequency spacing	Linear, shown in the following equation: (*Stop Freq* - *Start Freq*) / (*Number of Points* - 1)

[1] Operational to 50 kHz.

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NI-VNA soft front panel (SFP) sweep modes	Single sweep and hold, continuous, and continuous wave (CW)
Types	Linear, segmented sweep, and power sweep
Data formats	Magnitude (log), magnitude (linear), phase, group delay, VSWR, impedance, reflection/ transmission coefficient, real, and imaginary
NI-VNA SFP display types	Value versus frequency plot, Smith chart, and value versus power plot
Maximum number of averages	4,096
Maximum smoothing	25%[2]
User calibration	
Methods	Automatic, manual
Types	1-port SOL, 2-port SOLT (full, 1-path forward, 1-path reverse), 2-port SOLR, LRL (TRL), LRM, transmission response, reflection response, source power calibration, and receiver power calibration

Source Characteristics[3]

Frequency range[4]	300 kHz to 8.5 GHz
Frequency resolution	1 Hz
Frequency accuracy	Equal to timebase accuracy (internal or external)
Power range (leveled)	
Minimum leveled power	-30 dBm
Maximum leveled power	Refer to the *Source Maximum Leveled Power* table.

[2] You can use the NI-VNA SFP to achieve 100% smoothing.
[3] Specifications are valid for both PORT 1 and PORT 2 as source terminals unless otherwise noted.
[4] Operational to 50 kHz.

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Table 1. Source Maximum Leveled Power

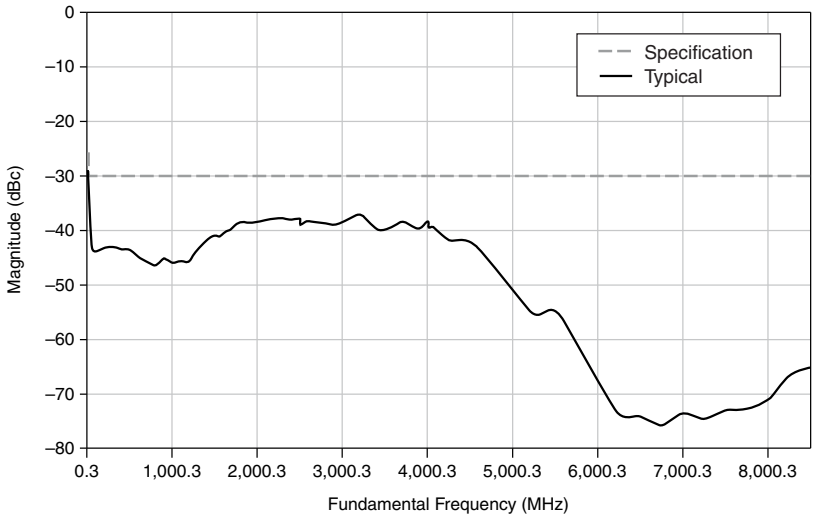
Frequency	Specification (dBm)
300 kHz to <6 GHz	+15
6 GHz to 8 GHz	+12
>8 GHz	+10

Power accuracy	
At +0 dBm test port power	±1 dB
At any test port power	±2 dB, typical
Power step resolution	0.01 dB

Table 2. Second Harmonics (Measured at 0 dBm Source Power)

Frequency	Harmonic (dBc)
300 kHz to <50 MHz	-20
50 MHz to <2.5 GHz	-30
2.5 GHz to 2.7 GHz	-27
>2.7 GHz to 8.5 GHz	-30

Figure 1. PXIe-5632 Source Second Harmonics

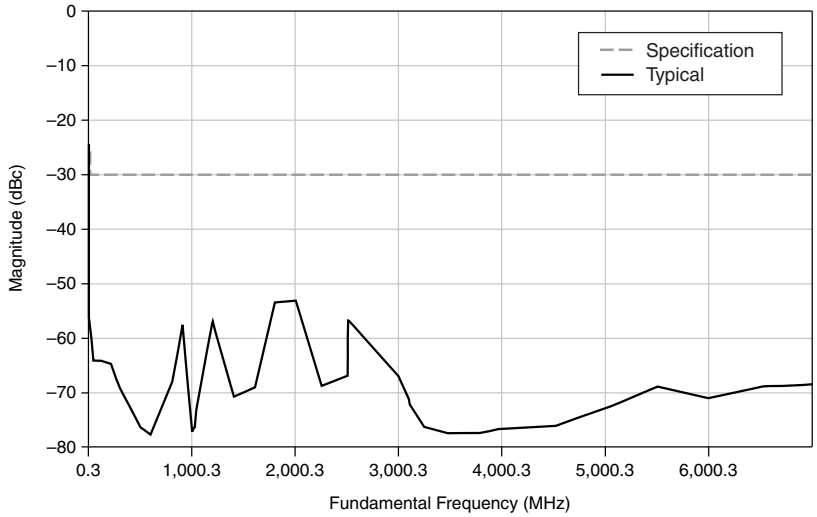


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Table 3. Third Harmonics (Measured at 0 dBm Source Power)

Frequency	Harmonic (dBc)
300 kHz to <50 MHz	-20
50 MHz to <8.5 GHz	-30

Figure 2. PXIe-5632 Source Third Harmonics



Nonharmonic spurs (at 0 dBm source power)	<-30 dBc
LO OUT	
Output power[5]	-10 dBm, nominal
Frequency range	10 MHz to 8.5 GHz, nominal

Receiver Characteristics[6]

Receiver variation	±0.1 dB across full power range, typical

[5] Must be terminated to 50 Ω.
[6] Specifications are valid for both PORT 1 and PORT 2 as receiver terminals unless otherwise noted.

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Table 4. System Dynamic Range[7]

Frequency	Specification (dB)	Typical (dB)
500 kHz[8] to <3 MHz	95	100
3 MHz to <1.5 GHz	100	105
1.5 GHz to <6 GHz	110	115
6 GHz to <8 GHz	105	110
8 GHz to 8.5 GHz	—	90

Table 5. Trace Noise[9]

Frequency	Specification (mdB_{RMS})	Typical (mdB_{RMS})
300 kHz to <8 GHz	6	3
8 GHz to 8.5 GHz	—	4

Damage input level +27 dBm

Measurement Speed[10]

Table 6. PXIe-5632 Measurement Speed (Typical)[11,12]

Span	IF Bandwidth (kHz)	Number of Points (ms)				
		201	401	801	1,601	3,201
Zero span[13]	500	15	28	52	102	203
	1	439	870	1,733	3,460	6,912

7 Measured at maximum leveled power in 10 Hz IF bandwidth.
8 Degrades by 10 dB (typical) below 500 kHz.
9 Measured at +10 dBm with 100 Hz IF bandwidth.
10 Indicates the amount of time it takes after hardware configuration has been committed to the device to initiate a sweep, perform the measurement, then fetch the data from the device. Measurements taken using a PXIe-8135 controller and a PXIe-1075 chassis. Benchmarks run on a single device at a time.
11 Time-domain operations add 0.5 ms per 100 points.
12 Times include a full forward and reverse sweep and data transfer of all four S-parameters with correction applied.
13 Measured in continuous wave mode.

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Table 6. PXIe-5632 Measurement Speed (Typical)[11,12] (Continued)

Span	IF Bandwidth (kHz)	Number of Points (ms)				
		201	401	801	1,601	3,201
Small span: 1 GHz to 2 GHz	500	22	41	77	152	300
	1	475	915	1,795	3,557	7,079
Full span: 300 kHz to 8.5 GHz	500	28	47	85	161	306
	1	648	1,129	2,016	3,782	7,302

Corrected System Performance

K-Type Connectors with NI Manual Calibration Kit and Precision Cables

Table 7. PXIe-5632 Corrected System Performance

Specification	Frequency (dB)	
	300 kHz to <5 GHz	5 GHz to 8.5 GHz
Directivity	>42	>36
Source match	>35	>35
Load match	>42	>36

[11] Time-domain operations add 0.5 ms per 100 points.

[12] Times include a full forward and reverse sweep and data transfer of all four S-parameters with correction applied.

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Transmission Uncertainty[14]

Figure 3. PXIe-5632 Magnitude Uncertainty (Typical)

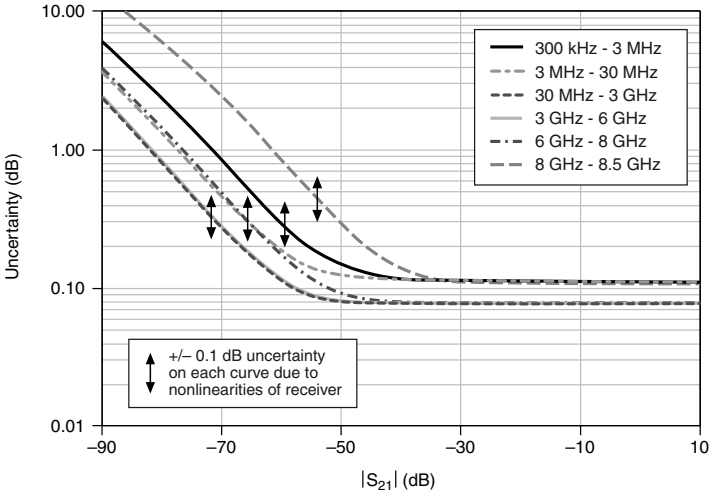
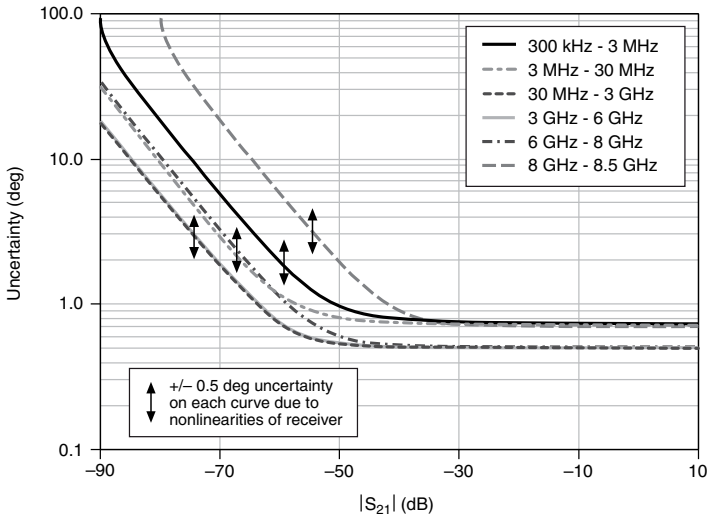


Figure 4. PXIe-5632 Phase Uncertainty (Typical)



[14] Assumes $S_{11} = S_{22} = 0$; 10 Hz IF bandwidth; 0 dBm power; cable flex and drift not included.

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Reflection Uncertainty[15]

Figure 5. PXIe-5632 Magnitude Uncertainty (Typical)

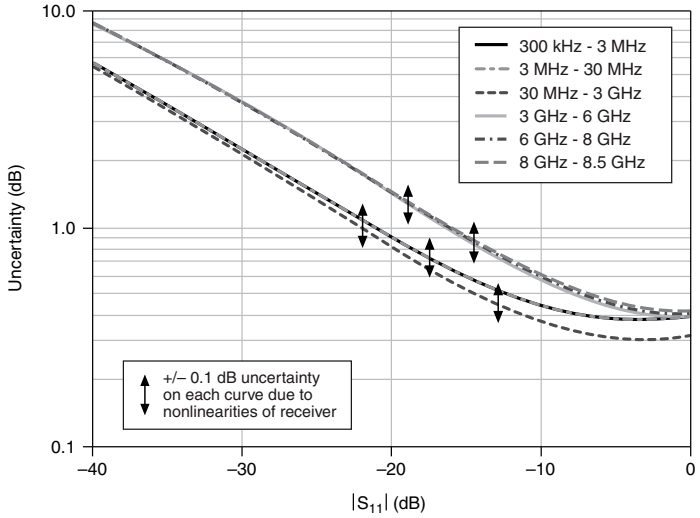
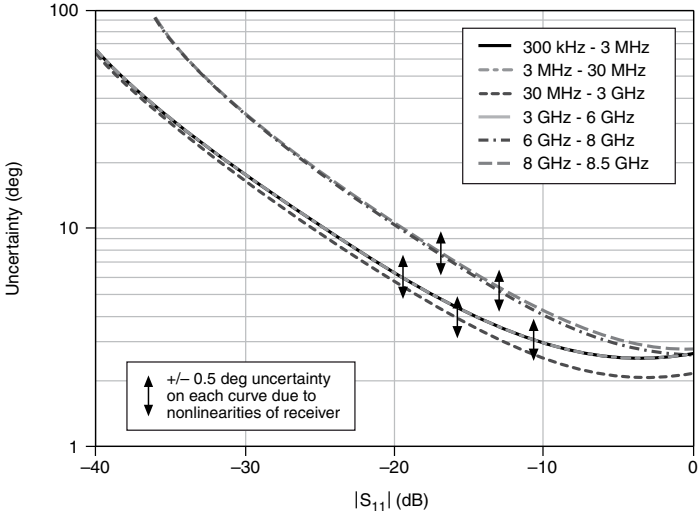


Figure 6. PXIe-5632 Phase Uncertainty (Typical)



[15] Assumes $S_{21} = S_{12} = 0$; 10 Hz IF bandwidth; 0 dBm power; cable flex and drift not included.

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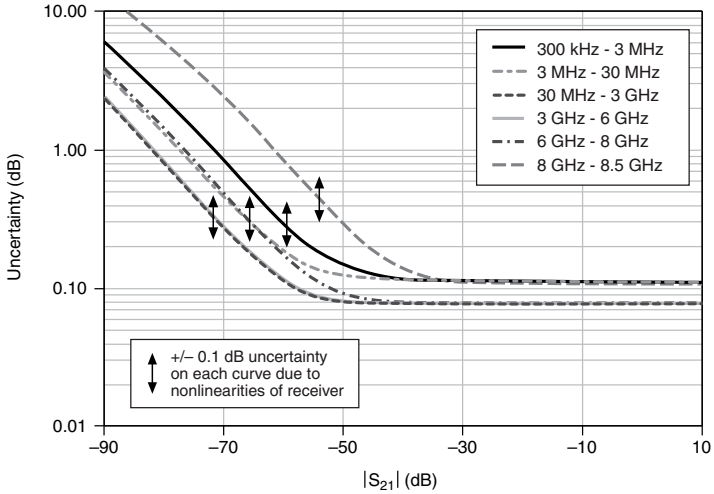
N-Type Connectors with NI Manual Calibration Kit and Precision Cables

Table 8. PXIe-5632 Corrected System Performance

Specification	Frequency (dB)	
	300 kHz to <5 GHz	5 GHz to 8.5 GHz
Directivity	>42	>36
Source match	>35	>35
Load match	>42	>36

Transmission Uncertainty[16]

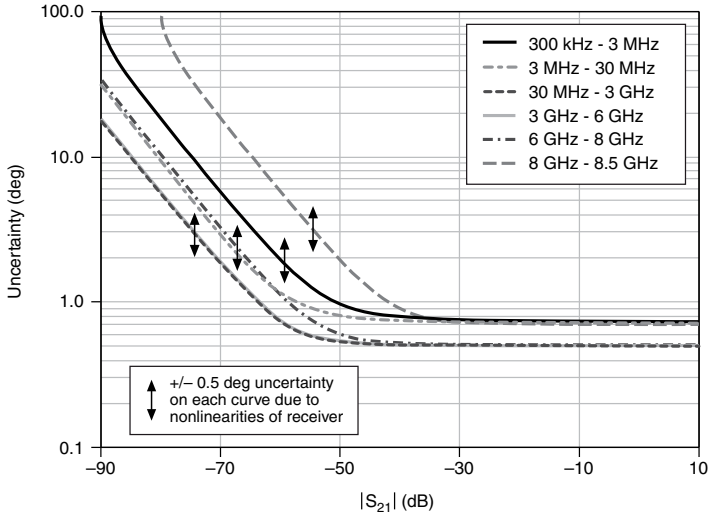
Figure 7. PXIe-5632 Magnitude Uncertainty (Typical)



[16] Assumes $S_{11} = S_{22} = 0$; 10 Hz IF bandwidth; 0 dBm power; cable flex and drift not included.

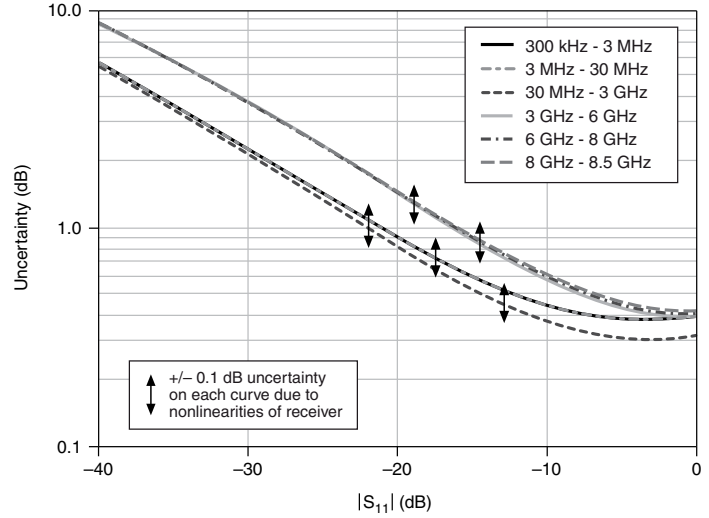
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Figure 8. PXIe-5632 Phase Uncertainty (Typical)



Reflection Uncertainty[17]

Figure 9. PXIe-5632 Magnitude Uncertainty (Typical)



[17] Assumes $S_{21} = S_{12} = 0$; 10 Hz IF bandwidth; 0 dBm power; cable flex and drift not included.

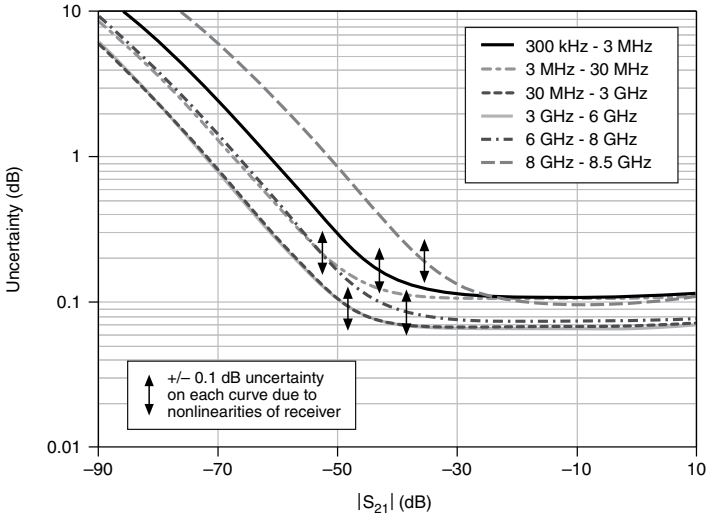
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Table 9. PXIe-5632 Corrected System Performance

Specification	Frequency (dB)	
	300 kHz to <5 GHz	5 GHz to 8.5 GHz
Directivity	>42	>36
Source match	>35	>35
Load match	>42	>36

Transmission Uncertainty[18]

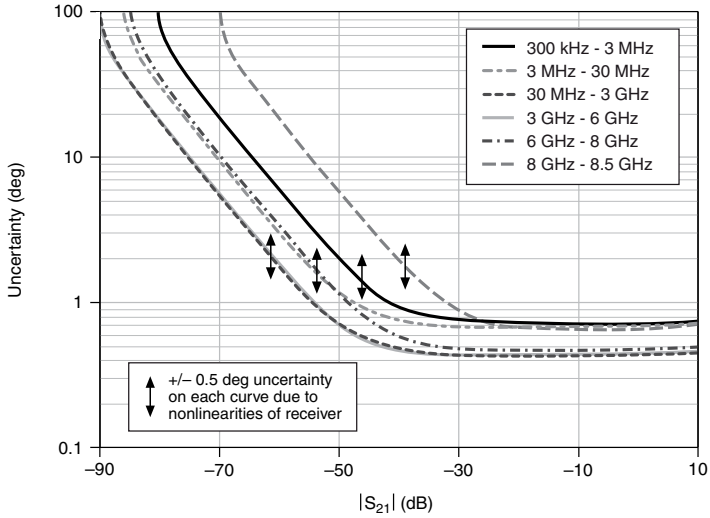
Figure 10. PXIe-5632 Magnitude Uncertainty (Typical)



[18] Assumes $S_{11} = S_{22} = 0$; 10 Hz IF bandwidth; -10 dBm power; cable flex and drift not included.

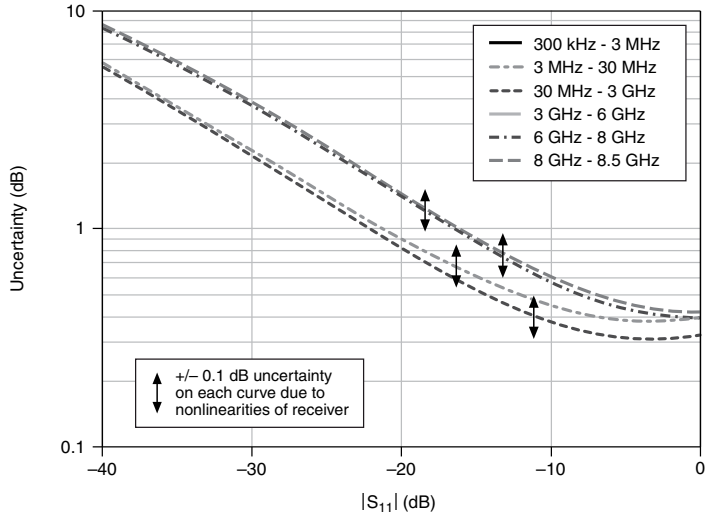
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Figure 11. PXIe-5632 Phase Uncertainty (Typical)



Reflection Uncertainty[19]

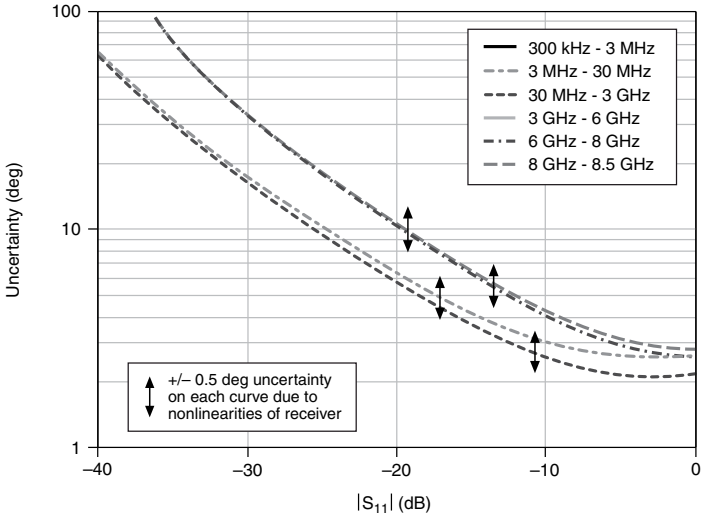
Figure 12. PXIe-5632 Magnitude Uncertainty (Typical)



[19] Assumes $S_{21} = S_{12} = 0$; 10 Hz IF bandwidth; -10 dBm power; cable flex and drift not included.

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Figure 13. PXIe-5632 Phase Uncertainty (Typical)



Trigger

Start Trigger	
Types	Immediate, software, digital edge
Digital edge sources	PFI 0, PXI_TRIG<0..7>
Step Trigger	
Types	Immediate, digital edge
Digital edge sources	PFI 0, PXI_TRIG<0..7>
Input range	+3.3 V logic (+5 V tolerant)
Minimum trigger width (typical)	
PFI 0	50 ns
PXI_TRIG<0..7>	50 ns
Trigger delay	6 µs, typical
Trigger jitter, PFI 0	<3 µs, typical

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Reference Frequency

Frequency sources	REF IN, backplane (PXIe_CLK100), and internal
REF IN	
Frequency range	10 MHz ± 5 ppm
Input impedance	50 Ω, nominal
Input range	+3 dBm to -10 dBm, typical, sine wave
Backplane (PXIe_CLK100)	100 MHz ± 25 ppm
Internal timebase	
Initial accuracy	±2.5 ppm
Aging	<12 ppm per year
Temperature stability	<10 ppm over full operating temperature range

Calibration

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

Power

3.3 VDC	6.2 A, typical
12 VDC	3.3 A, typical

Physical Characteristics

Dimensions	3U, three slot, PXI Express module, 21.6 cm × 6.0 cm × 13.0 cm (8.5 in. × 2.4 in. × 5.1 in.), nominal
Weight	1,290 g (45.0 oz), nominal

Environment

Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
Pollution Degree	2

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Indoor use only.

Operating Environment

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	-40 °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.)

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

Compliance and Certifications

Safety

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

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 61010-1

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

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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
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: 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 generate radio frequency energy for the treatment of material or inspection/analysis purposes.

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

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the 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 *Minimize Our Environmental Impact* web page at *ni.com/environment*. This page contains the environmental regulations and

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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 NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

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