SPECIFICATIONS

PXI-5691

RF Amplifier

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Definitions

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

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.
- *Nominal* specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are *Typical* unless otherwise noted.

Conditions

Specifications are valid under the following conditions unless otherwise noted.

- 10 minutes warm-up time before operation
- Calibration cycle maintained
- Chassis fan speed set to High
- NI-5690 instrument driver used
- NI-5690 instrument driver self-calibration performed after instrument temperature is stable

Frequency Range

Frequency range	50 MHz to 8.0 GHz

Channels

Number of channels	2
Gain	
Channel 0	Fixed
Channel 1	Programmable

Channel 0 (CH 0) Performance

Level calibration accuracy[1]	±0.9 dB
Absolute maximum input power (no damage)	+30 dBm, typical (7.1 V_{rms}, 10 V_{pk} at 50 Ω)
Maximum reverse power (no damage)	+20 dBm
Maximum output power	+25 dBm

[1] Valid for T_{ref} ± 5 °C. For temperatures other than T_{ref}, the level calibration accuracy is valid after applying the gain correction factor for ΔT.

DC voltage at input	±10 V, typical
Gain variation by temperature	$(-1.18 \times 10^{-12} \times F)$ - 0.01 in dB/°C [2]

Table 1. PXI-5691 Channel 0: Gain Warranted Specification

	10 MHz	**250 MHz**	**2 GHz**	**8 GHz**
Gain (Upper Bound) (dB)	33.26	33.22	32.23	30.34
Gain (Lower Bound) (dB)	22.50	22.70	24.10	21.44
The warranted specification is valid only between 10 MHz and 8 GHz. Intermediate bounds can be determined by linearly interpolating the provided data.				

[2] Calculate the correction factor using the following equation:
Δ Gain = (Gain Variation by temperature) * ΔT, where

- $\Delta T = T_{sensor} - T_{ref}$
- T_{sensor} = the temperature reading of the onboard temperature sensor in °C, as reported by the ni5690 Get Temperature VI
- F = frequency, in Hz
- T_{ref} = 34 °C

Figure 1. Measured Noise Figure (NF)

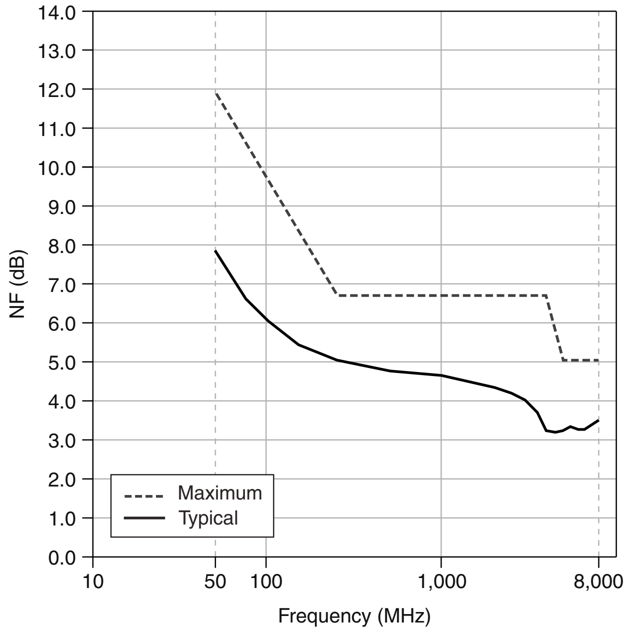


Figure 2. Measured Output Intercept Point (OIP_3)

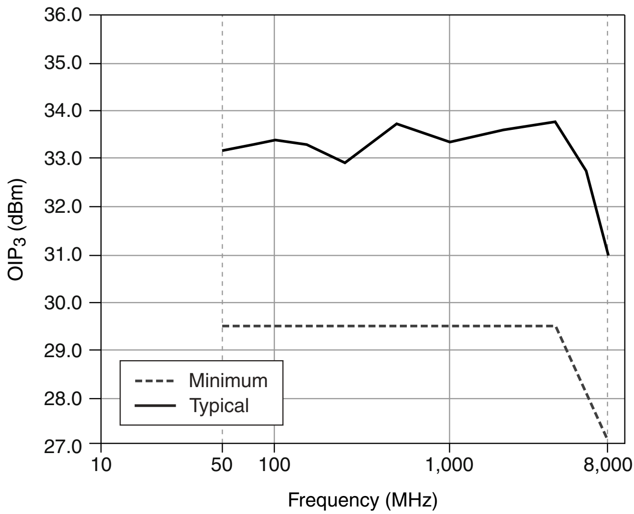


Figure 3. Measured Reverse Gain (S12)

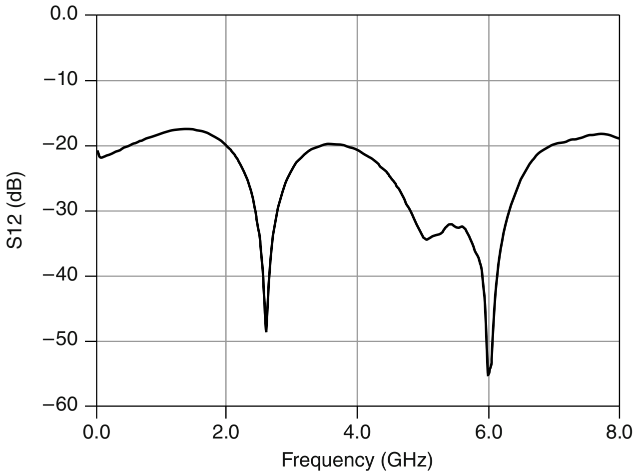


Figure 4. Measured 1 dB Gain Compression

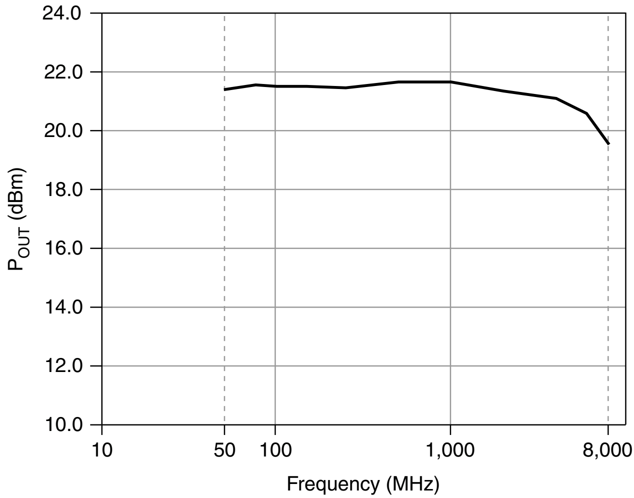


Figure 5. Measured P_{IN} at 1 dB Gain Compression

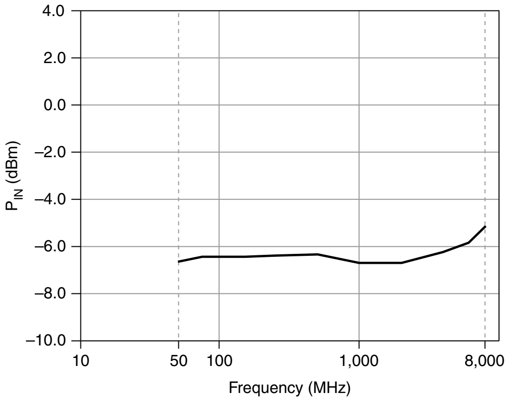


Figure 6. Measured 2nd Harmonic (P_{OUT} = 4 dBm)

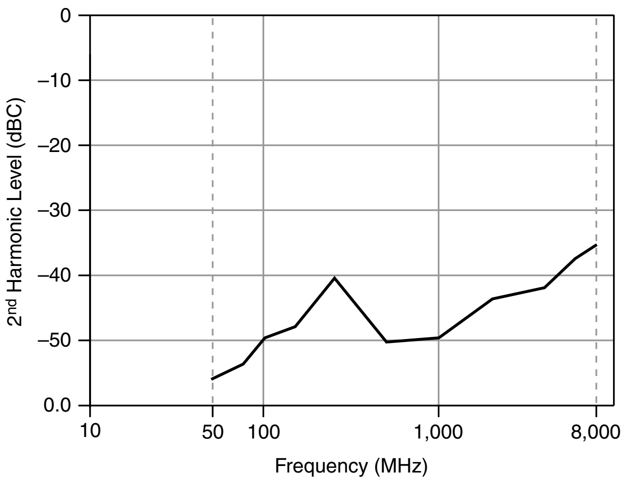
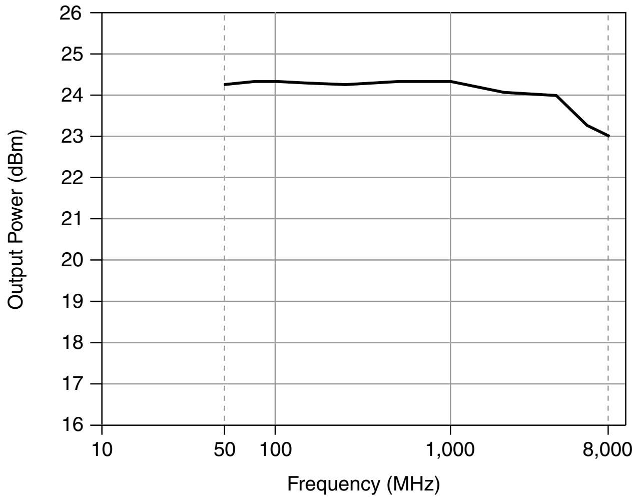


Figure 7. Measured Saturated Output Power



Channel 1 (CH 1)

Main Path

Gain range	+31.5 dB, typical
Gain step size	+0.5 dB, typical
Level setting time	+4 µs, maximum[3]
Level calibration accuracy	±0.9 dB[4]
Absolute maximum input power (no damage)	+30 dBm, typical (7.1 V_{rms}, 10 V_{pk} at 50 Ω)
Maximum reverse power (no damage)	+20 dBm
Maximum output power	+25 dBm

3 The level settling time is measured to 0.5 dB of final value when switching from minimum to maximum gain. Achieving settling times closer to the final attenuation value may take substantially longer.

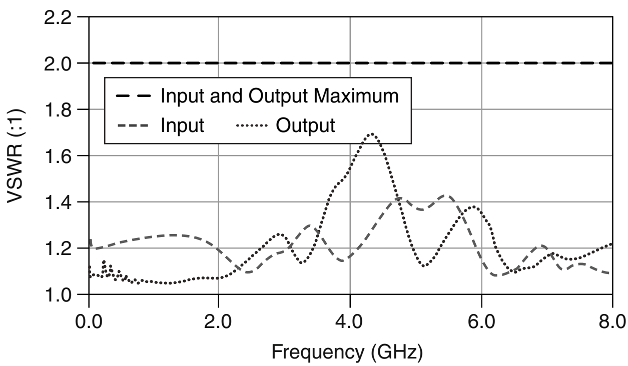
4 Valid for T_{ref} ± 5 °C. For temperatures other than T_{ref}, the level calibration accuracy is valid after applying the gain correction factor for ΔT.

DC voltage at input	±10 V, typical
Gain variation by temperature	$(-1.34 \times 10^{-12} \times F)$ - 0.01 in dB/°C [5]

Table 2. Channel 1: Programmable Gain Warranted Specification

	10 MHz	3.25 GHz	4 GHz	8 GHz
Maximum Gain (Upper Bound) (dB)	34.10	27.57	27.15	24.27
Maximum Gain (Lower Bound) (dB)	23.60	18.85	18.71	15.40
Minimum Gain (Upper Bound) (dB)	3.96	-2.96	-4.52	-6.14
Minimum Gain (Lower Bound) (dB)	-7.00	-11.90	-12.65	-16.53
The warranted specification is valid only between 10 MHz and 8 GHz. Intermediate bounds can be determined by linearly interpolating the provided data.				

Figure 8. Average Measured Input and Output VSWR at Maximum Gain Setting



[5] Calculate the correction factor using the following equation:
Δ Gain = (Gain Variation by temperature) * ΔT, where

- $\Delta T = T_{sensor} - T_{ref}$
- T_{sensor} = the temperature reading of the onboard temperature sensor in °C, as reported by the ni5690 Get Temperature VI
- T_{ref} = 34 °C
- F = frequency, in Hz

Figure 9. Average Measured Input and Output VSWR at Minimum Gain Setting

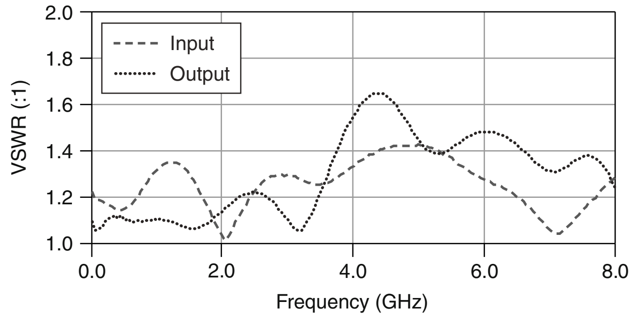


Figure 10. Measured Noise Figure (NF)

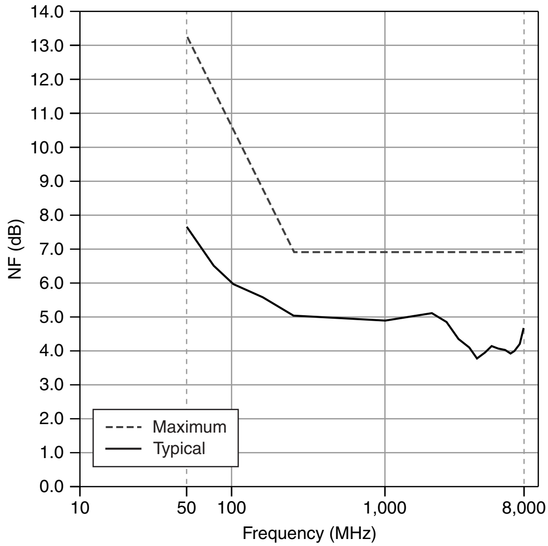


Figure 11. Measured Output Intercept Point (OIP_3)

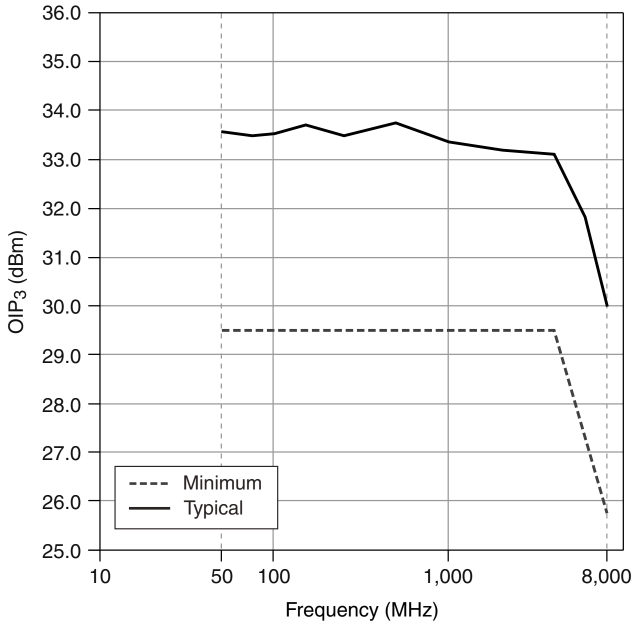


Figure 12. Measured Saturated Output Power (P_{SAT} at Maximum Gain Setting)

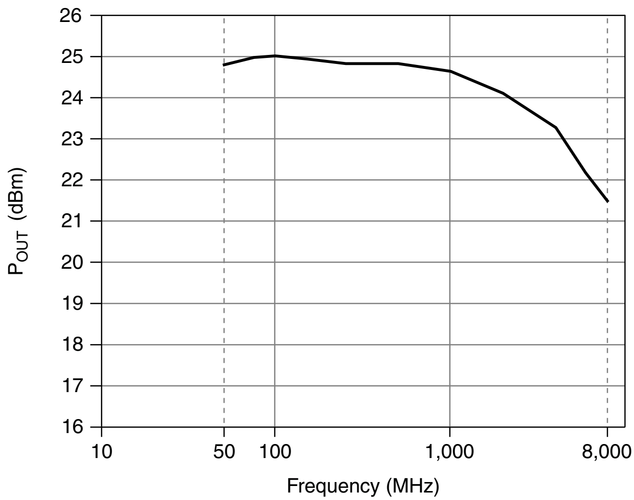


Figure 13. Measured Reverse Gain (S12) at Maximum Gain Setting

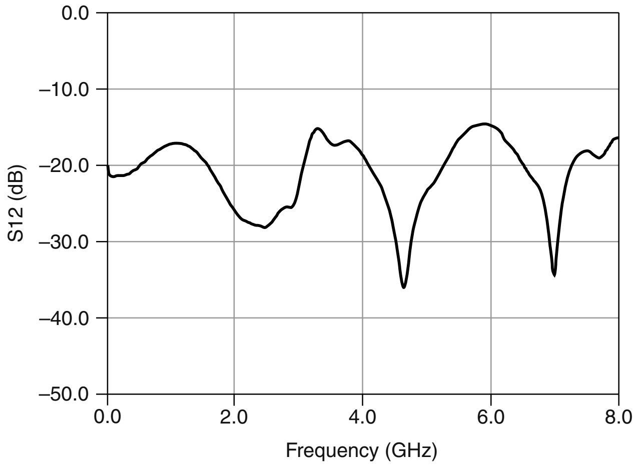


Figure 14. Measured 1 dB Gain Compression

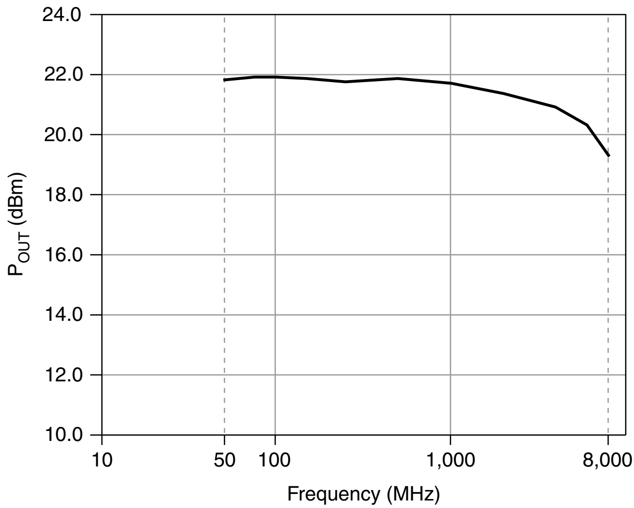


Figure 15. Measured P_{IN} at 1 dB Gain Compression

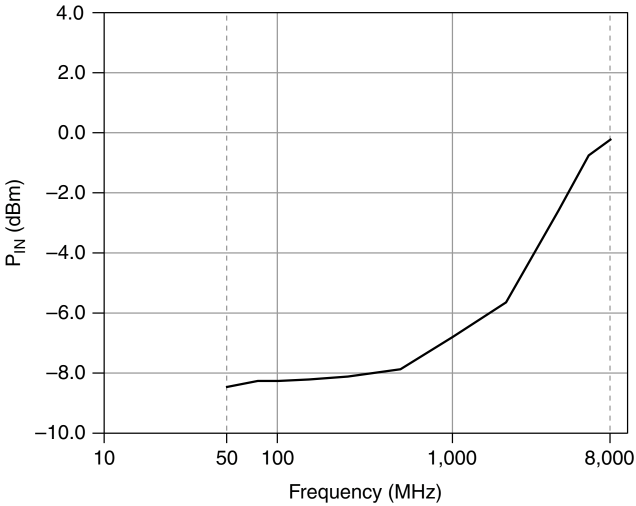
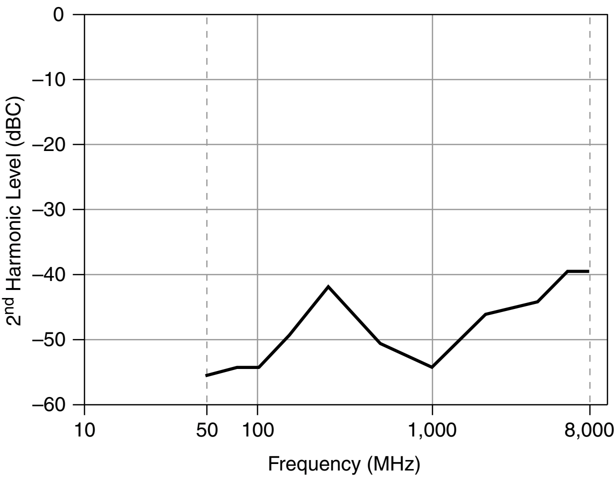


Figure 16. Measured 2nd Harmonic (P_{OUT} = 4 dBm, Maximum Gain Setting)



Direct Path

Level calibration accuracy	±0.9 dB[6]
Maximum input power (no damage)	+30 dBm, typical (7.1 V_{rms}, 10 V_{pk} at 50 Ω)

[6] Valid for T_{ref} ± 5° C. For temperatures other than T_{ref}, the level calibration accuracy is valid after applying the gain correction factor for ΔT.

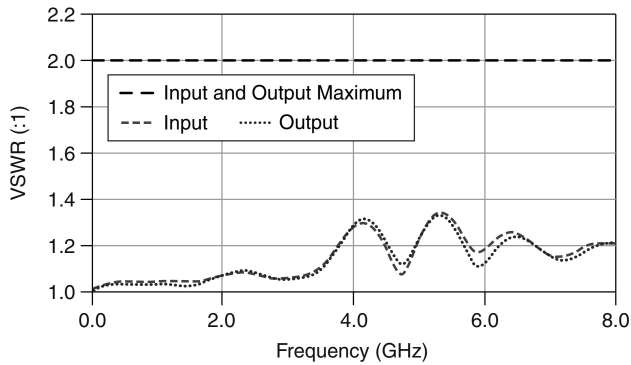
DC voltage at input	±10 V, typical[7]
Relay switch time	5 ms, maximum
Gain variation by temperature	$(-1.34 \times 10^{-12} \times F) - 0.01$ in dB/°C [8]

Direct Path Performance

Table 3. PXI-5691 Channel 1: Direct Path Gain

Frequency	10 MHz	8 GHz
Gain (Upper Bound) (dB)	0.40	-0.60
Gain (Lower Bound) (dB)	-0.60	-3.40

Figure 17. Average Measured Input and Output VSWR

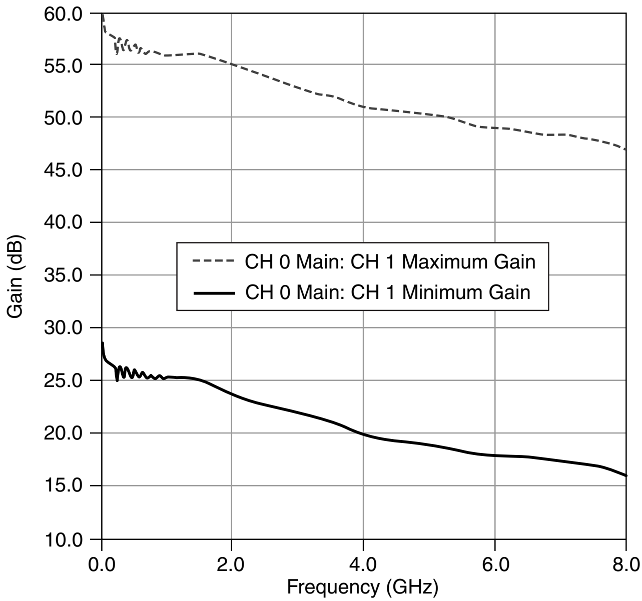


[7] DC coupled for input to output, but only calibrated from 50 MHz to 8 GHz.
[8] Calculate the correction factor using the following equation:
Δ Gain = (Gain Variation by temperature) * ΔT, where

- $\Delta T = T_{sensor} - T_{ref}$
- T_{sensor} = the temperature reading of the onboard temperature sensor in °C, as reported by the ni5690 Get Temperature VI.
- T_{ref} = 34°C
- F = frequency, in Hz

Channel 0/Channel 1 Cascaded Path Performance

Figure 18. Average Measured Cascaded Gain Response



Note When cascading Channel 0 and Channel 1, each channel is individually calibrated.

Power Requirements

Table 4. Power and Current

Power Rail (V_{DC})	Maximum Current (mA)	Typical Current (mA)	Maximum Power (W)
+3.3	643	234	2.1
+5	1,382	1,310	6.9
+12	240	99	2.9
-12	28	12	0.34

Calibration

Interval	1 year

Physical Characteristics

Front Panel Connectors

CH 0 IN	
Connector	SMA female
Impedance	50 Ω
Coupling	AC
Input amplitude	+30 dBm, maximum
CH 0 OUT	
Connector	SMA female
Impedance	50 Ω
Coupling	AC
Output amplitude	+25 dBm, maximum
CH 1 IN	
Connector	SMA female
Impedance	50 Ω
Coupling[9]	AC
Input amplitude	+30 dBm, maximum
CH 1 OUT	
Connector	SMA female
Impedance	50 Ω
Coupling	AC
Output amplitude	+25 dBm, maximum

Physical Dimensions

Dimensions	3U, One Slot, PXI/cPCI Module 21.6 cm × 2.0 cm × 13.0 cm (8.5 in. × 0.8 in. × 5.1 in.)
Weight	263 g (9.2 oz)

[9] Direct path passes input DC level to output.

Environment

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

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

Storage Environment

Ambient temperature range	-40 °C to 70 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)
Relative humidity range	5% to 95%, noncondensing (Tested in accordance with IEC-60068-2-56.)
Operational shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g_{rms}
Nonoperating	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.)

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.

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
- 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 generate radio frequency energy for the treament of material or inspection/analysis purposes.

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 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 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*.

电子信息产品污染控制管理办法（中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

375124G-01 February 27, 2018