DEVICE SPECIFICATIONS

NI PXI-5695

RF Attenuator

This document lists the specifications of the NI PXI-5695 (NI 5695) RF attenuator. Specifications are warranted by design and under the following conditions unless otherwise noted:

- 10 minutes warm-up time
- Calibration cycle maintained
- Chassis fan speed set to High

Specifications indicated as *maximum* or *minimum* values describe the warranted traceable product performance over ambient temperature ranges of 0 °C to 55 °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 25 ± 10°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 *maximum*, *minimum*, or *typical* values. *Nominal* values are not covered by warranty.

Specifications are subject to change without notice. Visit *ni.com/manuals* for the most current specifications and product documentation.

Caution You can impair the protection provided by the NI 5695 if you use it in a manner not described in this document.

Contents

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, Main Path

Table 1. Channel 0 (CH 0) Performance, Main Path

Main Path Specifications	Value
Level calibration accuracy[1]	±0.7 dB
Maximum input power (operation)	+33 dBm maximum (10 Vrms, 14 Vpk)
Absolute maximum input power (no damage)	+33 dBm maximum
Maximum reverse power (no damage)	+33 dBm maximum
DC voltage at input[2]	±10 V maximum
Gain variation by temperature[3]	$-(4.66 * 10^{-13})$ * (*Frequency in Hz*) in dB/°C

[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.
[2] DC-coupled from input to output, but calibrated only from 50 MHz to 8 GHz.

Figure 1. Average Measured Attenuation (Fixed Attenuator)

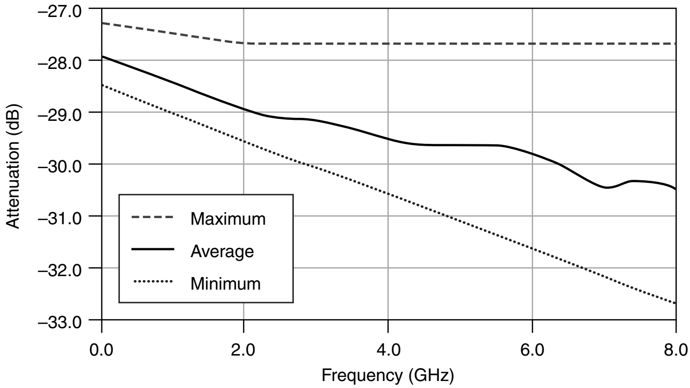
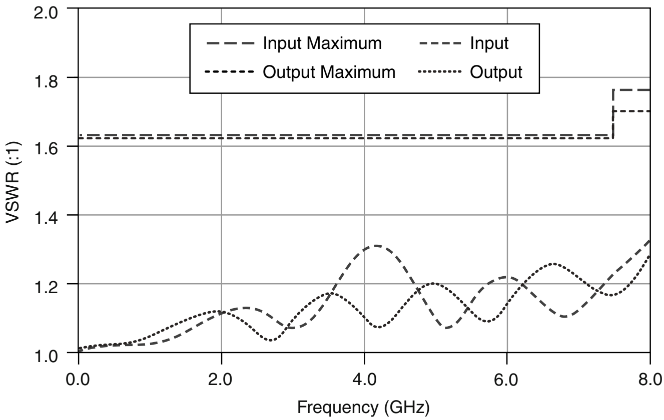


Figure 2. Average Measured Input and Output Voltage Standing Wave Ratio (VSWR)



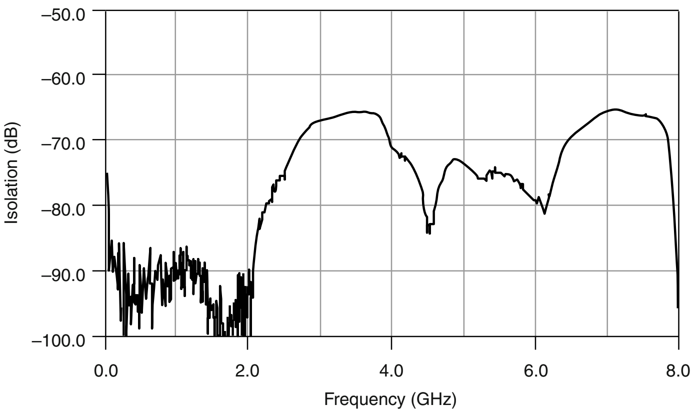
[3] Calculate the correction factor using the following equation:
ΔGain = (*Gain variation by temperature*) * ΔT
where

$\Delta T = T_{sensor} - T_{ref}$

T_{sensor} = the temperature reading of the onboard temperature sensor in °C, as reported by the ni5690 Get Temperature VI or the `ni5690_getTemperature` function

T_{ref} = 26 °C

Figure 3. Measured Input to Output Leakage



Channel 0 (CH 0) Performance, Direct Path

Table 2. Channel 0 (CH 0) Performance, Direct Path

Direct Path Specifications	Value
Level calibration accuracy[4]	±0.7 dB
Maximum input power (operation)	+33 dBm maximum (10 Vrms, 14 Vpk)
Absolute maximum input power (no damage)	+33 dBm maximum
DC voltage at input[5]	±10 V maximum
Relay switch time	5 ms maximum
Gain variation by temperature[6]	$-(3.09 * 10^{-13})$ * (*Frequency in Hz*) in dB/°C

[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.

[5] DC-coupled from input to output, but only calibrated from 50 MHz to 8 GHz.

[6] Calculate the correction factor using the following equation:
ΔGain = (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 or the `ni5690_getTemperature` function

T_{ref} = 26 °C

Figure 4. Average Measured Attenuation

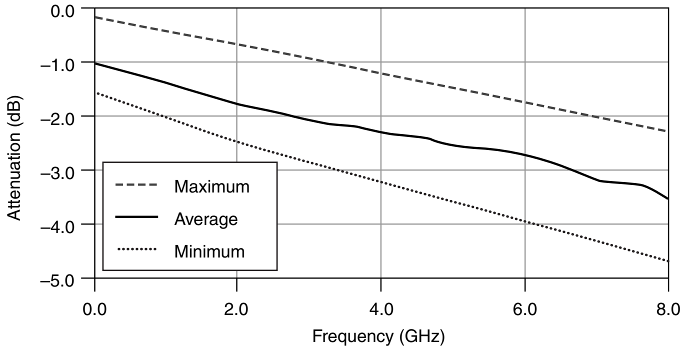
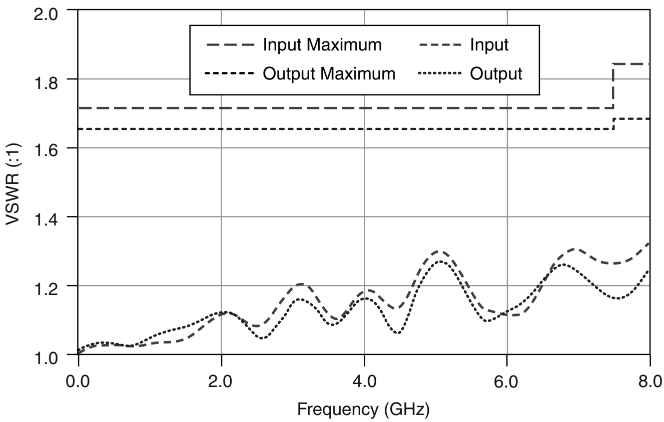


Figure 5. Average Measured Input and Output VSWR



Channel 1 (CH 1) Performance

Table 3. Channel 1 (CH 1) Performance

Programmable Path Specifications	Value
Attenuation resolution	+0.5 dB typical
Level calibration accuracy[7]	±0.7 dB
Attenuation settling time[8]	+4 μs maximum

[7] 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.

Table 3. Channel 1 (CH 1) Performance (Continued)

Programmable Path Specifications	Value
Maximum input power (operation)	+27 dBm maximum (5 Vrms, 7 Vpk)
Absolute maximum input power (no damage)	+27 dBm maximum
Maximum reverse power (no damage)	+26 dBm maximum
Gain variation by temperature[9]	$-(2.69 * 10^{-13}) * (\textit{Frequency in Hz})$ in dB/°C

Table 4. NI 5695 Channel 1 Variable Attenuation Warranted Specification (dB)

	10 MHz[10]	8 GHz
Minimum Attenuation (Upper Bound)	10.7	13.6
Minimum Attenuation (Lower Bound)	12.3	16.5
Maximum Attenuation (Upper Bound)	41.6	44.3
Maximum Attenuation (Lower Bound)	44.0	47.4

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

9 Calculate the correction factor using the following equation:
ΔGain = (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 or the `ni5690_getTemperature` function

T_{ref} = 26 °C

10 The warranted specification is valid only between 10 MHz and 8 GHz. Determine intermediate bounds by linearly interpolating the provided data.

Figure 6. Average Measured Programmable Attenuation Range

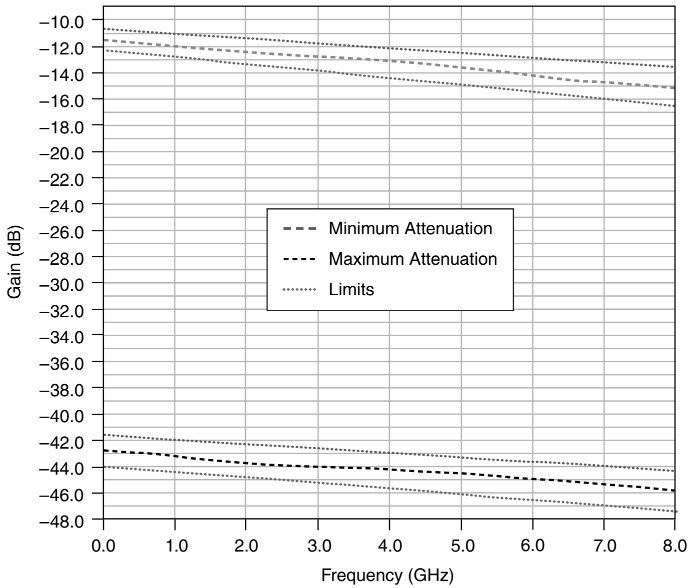


Figure 7. Average Measured Input and Output VSWR at 0 dB Attenuation Setting

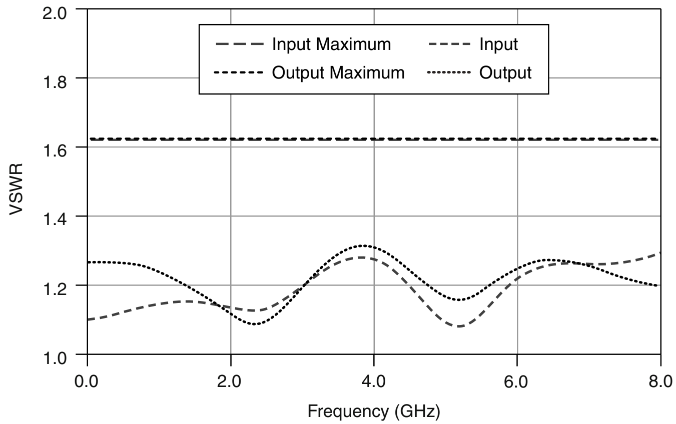


Figure 8. Measured Input and Output VSWR at 31.5 dB Attenuation Setting

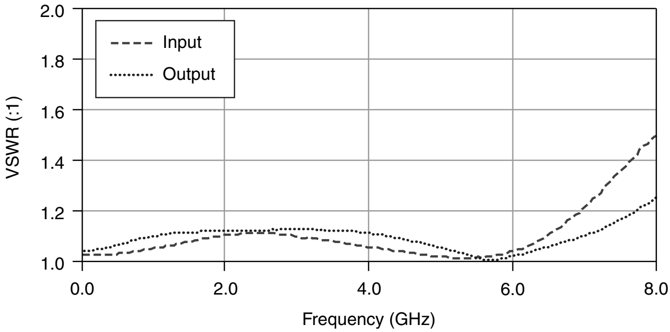


Figure 9. Measured Input Intercept Point (IIP3)

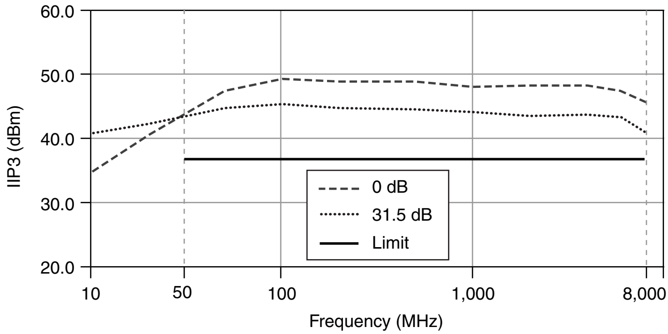


Figure 10. Measured Input/Output Leakage

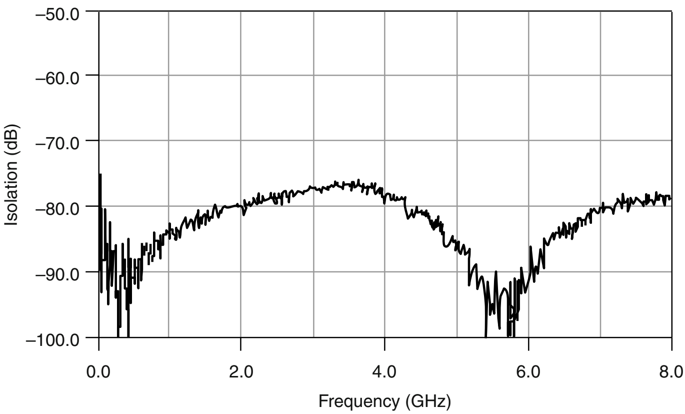
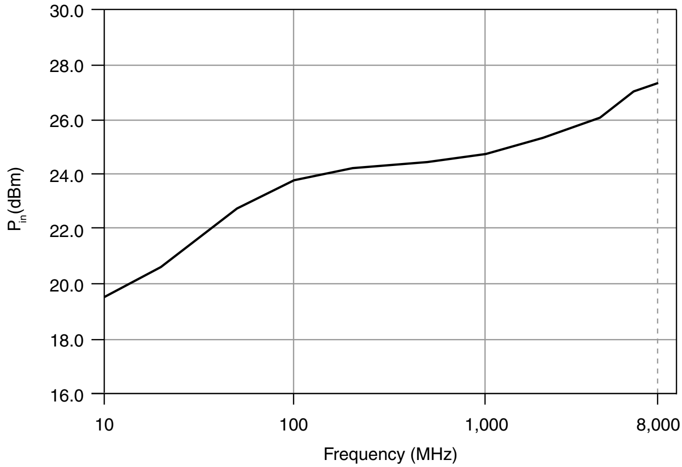
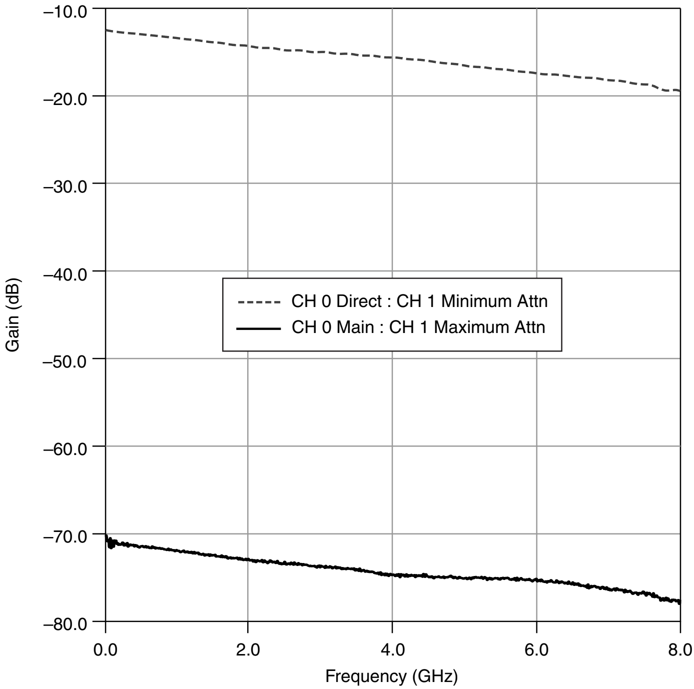


Figure 11. Measured Power (0.1 dB)



Channel 0/Channel 1 Cascaded Path Performance

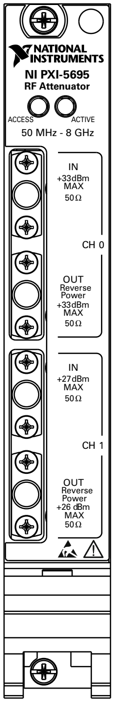
Figure 12. Cascaded Response



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

Hardware Front Panel

Figure 13. NI 5695 RF Attenuator Front Panel



CH 0 IN	
Connector	SMA female
Impedance	50 Ω
Coupling	DC[11]
CH 0 OUT	
Connector	SMA female
Impedance	50 Ω

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

CH 1 IN	
Connector	SMA female
Impedance	50 Ω
Main path coupling	AC
CH 1 OUT	
Connector	SMA female
Impedance	50 Ω

Power Requirements

Table 5. Power Requirements

Power Rail (V_{DC})	Maximum Current (mA)	Typical Current (mA)	Maximum Power (W)
+3.3	660	250	2.2
+5	—	—	—
+12	528	0	7.0
-12	508	12	6.1

Calibration

Interval	1 year

Physical Characteristics

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)

Environment

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

Indoor use only.

Storage Environment

Ambient temperature range	-40 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.)

Operating Environment

Ambient temperature range	0 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.)

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}
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 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 treatment 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`.)

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