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SPECIFICATIONS

# PXI-5695

RF Attenuator

## Contents



## 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.

NATIONAL INSTRUMENTS

Specifications are *Typical* unless otherwise noted.

# Conditions

Specifications are valid under the following conditions unless otherwise noted.

- Over ambient temperature ranges of 0 °C to 55 °C
- 10 minutes warm-up time
- Calibration cycle maintained
- Chassis fan speed set to High

# 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] | $-(4.66 * 10^{-13}) * (\textit{Frequency in Hz})$ 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.

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

**Figure 1.** Average Measured Attenuation (Fixed Attenuator)

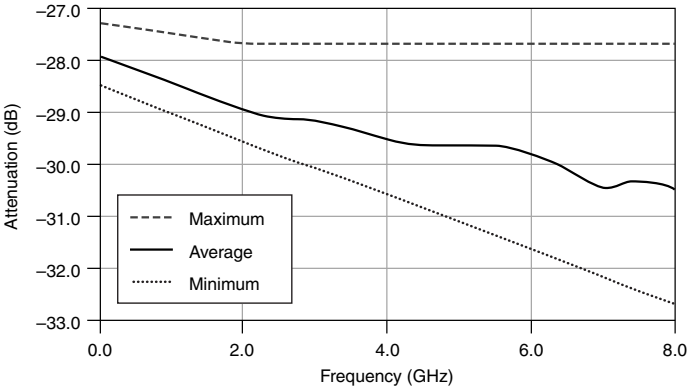
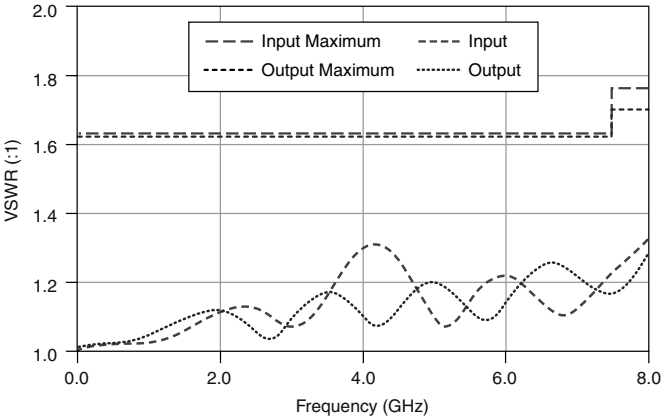



**Figure 2.** Average Measured Input and Output Voltage Standing Wave Ratio (VSWR)



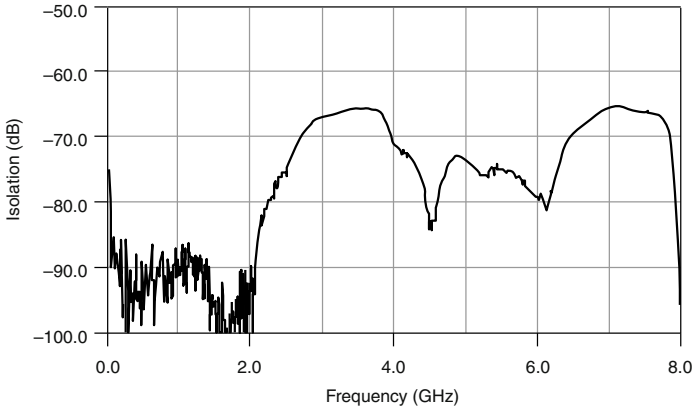

where

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

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

$T_{ref}$ = 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

$T_{ref}$ = 26 °C

**Figure 4.** Average Measured Attenuation

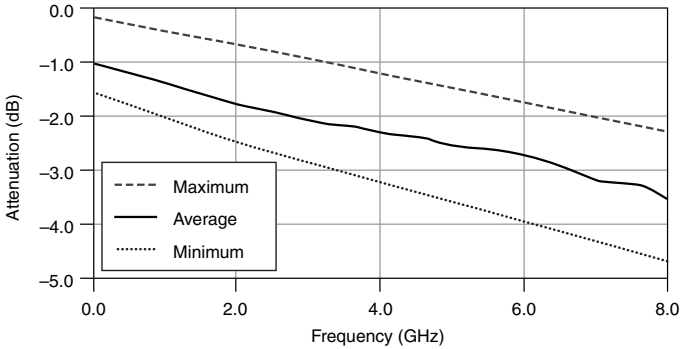
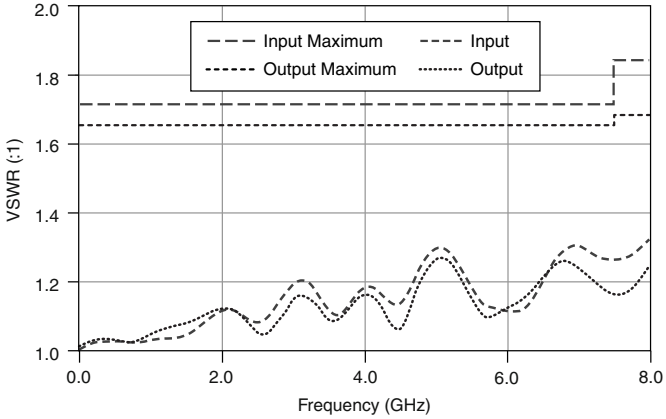



**Figure 5.** Average Measured Input and Output VSWR




# 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 |

[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 |
|---|---|
| Attenuation settling time[8] | +4 µs, maximum |
| 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] | $-(2.69 * 10^{-13}) *$ (*Frequency in Hz*) in dB/°C |

**Table 4.** PXI-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:
$\Delta Gain = (Gain\ variation\ by\ temperature) * \Delta T$
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
$T_{ref}$ = 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

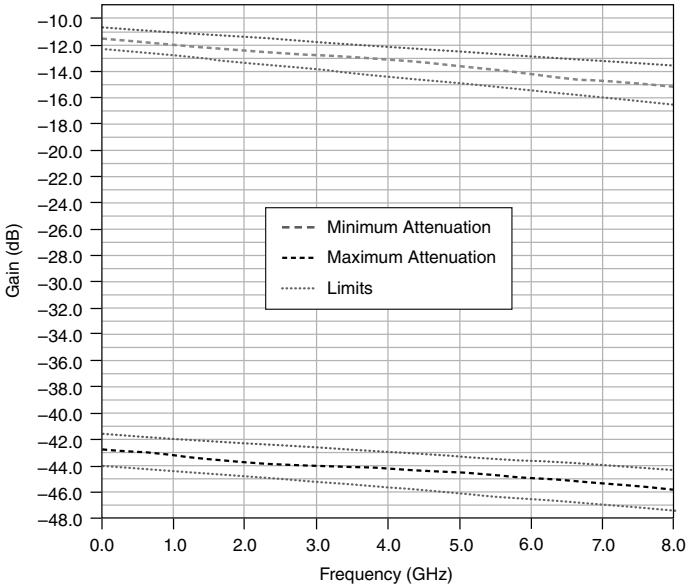



**Figure 7.** Average Measured Input and Output VSWR at 0 dB Attenuation Setting

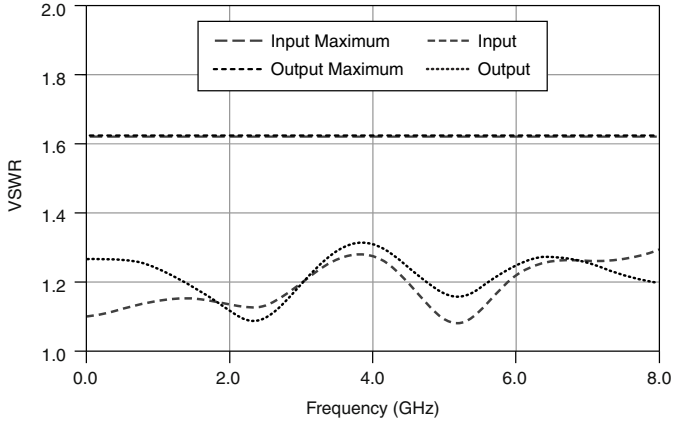


**Figure 8.** Measured Input and Output VSWR at 31.5 dB Attenuation Setting

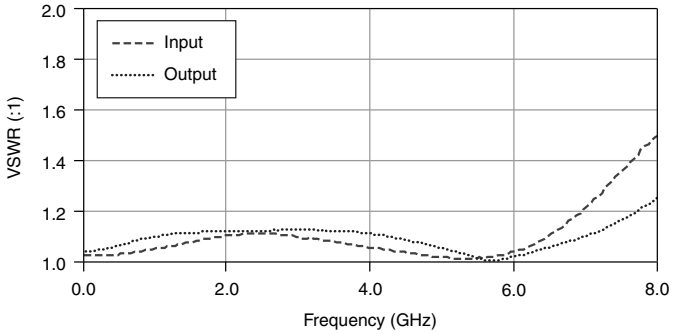



**Figure 9.** Measured Input Intercept Point (IIP3)

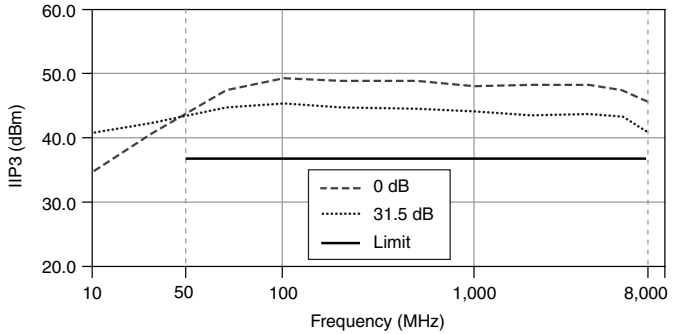



**Figure 10.** Measured Input/Output Leakage

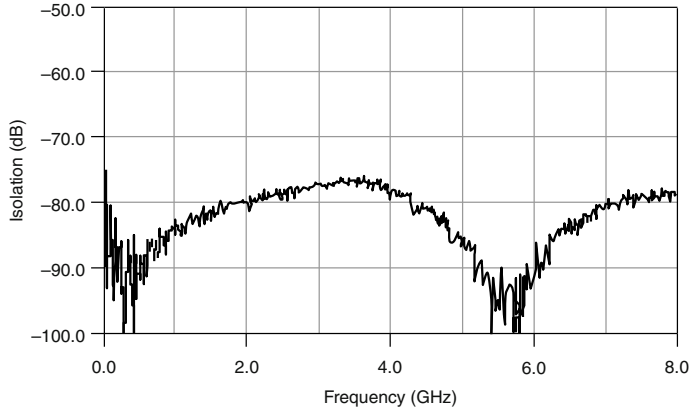
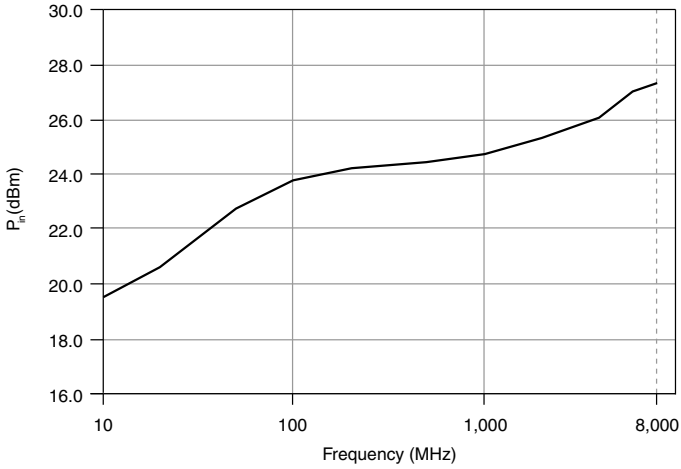
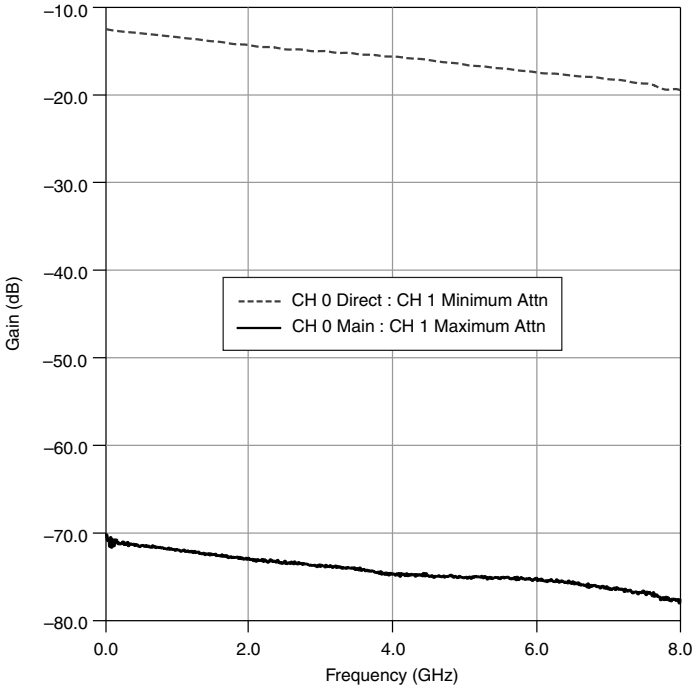


**Figure 11.** Measured Power (0.1 dB)



# Channel 0/Channel 1 Cascaded Path Performance

**Figure 12.** Cascaded Response




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

# 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 | — | — | — |

**Table 5.** Power Requirements (Continued)

| Power Rail ($V_{DC}$) | Maximum Current (mA) | Typical Current (mA) | Maximum Power (W) |
|---|---|---|---|
| +12 | 528 | 0 | 7.0 |
| -12 | 508 | 12 | 6.1 |

# Calibration

| | |
|---|---|
| Interval | 1 year |

# Physical Characteristics

## Front Panel Connectors

| | |
|---|---|
| CH 0 IN | |
| Connector | SMA female |
| Impedance | 50 Ω |
| Coupling | DC[11] |
| CH 0 OUT | |
| Connector | SMA female |
| Impedance | 50 Ω |
| CH 1 IN | |
| Connector | SMA female |
| Impedance | 50 Ω |
| Main path coupling | AC |
| CH 1 OUT | |
| Connector | SMA female |
| Impedance | 50 Ω |

## Physical Dimensions

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

[11] 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.

## 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 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.

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