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SPECIFICATIONS

PXIe-5668

14 GHz and 26.5 GHz Vector Signal Analyzer

These specifications apply to the PXIe-5668 (14 GHz) Vector Signal Analyzer and the PXIe-5668 (26.5 GHz) Vector Signal Analyzer with 320/765 MHz bandwidth, 200 MHz bandwidth, or 80 MHz bandwidth.

When not otherwise specified, the specifications for the PXIe-5668 in this document refer to both the PXIe-5668 (14 GHz) and the PXIe-5668 (26.5 GHz).

The PXIe-5668 comprises the following modules:

- PXIe-5606 RF Signal Downconverter
- PXIe-5624 IF Digitizer
- PXIe-5653 RF Analog Signal Generator

There is no physical device named "PXIe-5668."

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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.
- *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

Warranted specifications are valid under the following conditions unless otherwise noted.

- Over ambient temperature ranges of 0 °C to 55 °C.
- 30 minutes warm-up time.
- Calibration cycle is maintained.
- Chassis fan speed is set to high. In addition, NI recommends using slot blockers and EMC filler panels in empty module slots to minimize temperature drift and reduce emissions.
- The PXIe-5606, PXIe-5624, and PXIe-5653 are used as the downconverter, digitizer, and LO source, respectively.
- The PXIe-5653 onboard 4 GHz LO2 OUTPUT is used, after dividing by 2, as the Sample Clock for the PXIe-5624.
- Modules are connected with NI cables as shown in the *NI PXIe-5668R Getting Started Guide*.
- NI-RFSA instrument driver is used.
- Self-calibration is performed after the specified warm-up period has completed.
- For the PXIe-5606, the **Channel Coupling** property is set to DC Coupled for RF tuned frequencies less than 16 kHz and is set to AC Coupled for downconverter center frequencies greater than or equal to 16 kHz. For center frequencies less than 16 kHz,

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remove the DC block accessory from the PXIe-5606 RF IN connector to measure as low as 20 Hz.

Note The PXIe-5606 has an external DC block. Components in the PXIe-5606 can be damaged when DC signals are applied directly to the RF IN connector. The PXIe-5606 ships with a 2.92 mm DC block attached to the RF IN connector to prevent damage to the device when a DC input signal is present. The DC block must be removed to make measurements at frequencies less than 16 kHz. NI recommends that you keep the DC block attached to the RF IN connector for all measurements at frequencies greater than or equal to 16 kHz to maximize the accuracy of the device. Refer to the *PXIe-5668 Theory of Operation* topic in the *NI RF Vector Signal Analyzers Help* for more information about reinstalling the DC block for the PXIe-5606.

Typical specifications are valid under the following condition unless otherwise noted.

- Over ambient temperature ranges of 23 °C ± 5 °C

Frequency

Frequency range	
PXIe-5668 14 GHz VSA	20 Hz to 14 GHz
PXIe-5668 26.5 GHz VSA	20 Hz to 26.5 GHz
Tuning resolution[2]	533 nHz

Bandwidth

Equalized Bandwidth

Table 1. PXIe-5668 Equalized Bandwidth

Frequency Range[3]	RF VSA Bandwidth Configuration	Equalized Bandwidth
>10 MHz to 3.41 GHz	80 MHz (Standard)	80 MHz
	200 MHz (Optional)	200 MHz
	320 MHz (Optional)	320 MHz

[1] The PXIe-5668 maximum center frequency is either 14 GHz or 26.5 GHz depending on the hardware option you purchased.
[2] *Tuning resolution* refers to the digital downconversion (DDC) tuning resolution.
[3] The PXIe-5668 maximum center frequency is either 14 GHz or 26.5 GHz depending on the hardware option purchased.

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Table 1. PXIe-5668 Equalized Bandwidth (Continued)

Frequency Range[3]	RF VSA Bandwidth Configuration	Equalized Bandwidth
>3.41 GHz to 14 GHz	80 MHz (Standard)	80 MHz
	200 MHz (Optional)	200 MHz
	320 MHz (Optional)	320 MHz
>3.6 GHz to 14 GHz	765 MHz (Optional)	765 MHz
>14 GHz to 26.5 GHz	80 MHz (Standard)	80 MHz
	200 MHz (Optional)	200 MHz
	320 MHz (Optional)	320 MHz
	765 MHz (Optional)	765 MHz

Note Equalization is performed by digital filters in the digitizer. The IF through path is limited to either 80 MHz, 200 MHz, 320 MHz, or 765 MHz, depending on the option purchased. IF response self-calibration is performed with the preselector disabled. When using the preselector on the PXIe-5606, the signal is not equalized.

Resolution Bandwidth

Bandwidth range	
Standard	<1 Hz to 80 MHz (typical)
Optional	<1 Hz to 200 MHz (typical) or <1 Hz to 320 MHz (typical)[4]
Selectivity, 60 dB : 3 dB ratio	
Flat Top window	2.5 (typical)
7-term Blackman-Harris window	4.1 (typical)

Note These additional window types are supported: Uniform, Hanning, Hamming, Blackman-Harris, Exact Blackman, Blackman, Flat Top, 4-term Blackman-Harris, Low Side Lobe, Gaussian, and Kaiser-Bessel.

Dither

Dithering adds band-limited noise in the analog signal path to help reduce the quantization effects of the ADC and improve spectral performance. When you enable dithering, the

[3] The PXIe-5668 maximum center frequency is either 14 GHz or 26.5 GHz depending on the hardware option purchased.

[4] Available bandwidth range depends on hardware option purchased.

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maximum signal level that can be present at the IF port on the PXIe-5624 is reduced up to 2 dB. The maximum IF input power with dither disabled is 8 dBm, and the maximum IF input power level with dither enabled is 6 dBm. When dithering is enabled, the I/Q data is dithered even if the dither signal is not visible within the displayed spectrum. The dither signal on the device may appear in the I/Q data for large I/Q rates, as shown in the following table.

Table 2. PXIe-5668 Dither Signal Conditions

IF Filter	Minimum I/Q Rate with 25 MHz Dither Cutoff Frequency	Minimum I/Q Rate with 50 MHz Dither Cutoff Frequency
300 kHz	>348 MS/s	>298 MS/s
5 MHz	>330 MS/s	>280 MS/s
100 MHz	>325 MS/s	>275 MS/s
320 MHz	Not present	Not present
765 MHz	500 MS/s for 800 MHz FPGA image[5]	500 MS/s for 800 MHz FPGA image[5]

Note The dither signal is filtered out by NI-RFSA when calling the niRFSA Read Power Spectrum VI, but it may still be present when performing an I/Q acquisition measurement. This can affect the data displayed when using zero span measurements and when processing I/Q data over sampled signals. The dither signal can also cause an I/Q power edge trigger error.

Frequency Reference

Internal Frequency Reference[6]

Frequency	10 MHz
Initial calibration accuracy	$\pm 50 \times 10^{-9}$ over a temperature range from 15 °C to 35 °C
Temperature stability	
15 °C to 35 °C	$\pm 10 \times 10^{-9}$ (maximum)
0 °C to 55 °C	$\pm 50 \times 10^{-9}$

[5] Dither signal not present for 400 MHz FPGA image.

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Aging after 30 days of continuous operation	
Per day	$\pm 0.5 \times 10^{-9}$ (maximum)
Per year	$\pm 100 \times 10^{-9}$ (maximum)
Accuracy	*Initial Calibration Accuracy* ± *Aging* ± *Temperature Stability*

External Frequency Reference Input[8]

Frequency	5 MHz to 100 MHz in 1 MHz steps
Lock range	$\pm 0.2 \times 10^{-6}$
Peak-to-peak amplitude (Vpk-pk)	0.5 V to 2.0 V into 50 Ω (≥1 V recommended)
Peak-to-peak absolute maximum amplitude (Vpk-pk)	5 V
Input impedance	50 Ω, nominal, AC coupled
Connector	SMA
REF OUT 10 MHz reference output[7]	
Accuracy	10 MHz * *Frequency Reference Accuracy*
Peak-to-peak amplitude (Vpk-pk)	
Maximum	2 V into 50 Ω
Typical	1.2 V into 50 Ω
Minimum	0.71 V into 50 Ω
Coupling	AC coupled
Connector	SMA
REF OUT 100 MHz reference output[8]	
Accuracy	100 MHz * *Frequency Reference Accuracy*
Peak-to-peak amplitude (Vpk-pk)	
Maximum	2 V into 50 Ω
Typical	1.0 V into 50 Ω
Minimum	0.71 V into 50 Ω
Coupling	AC coupled
Connector	SMA

6 The PXIe-5653 reference oscillator determines this specification.

7 The PXIe-5653 10 MHz reference oscillator output determines this specification. System frequency accuracy error is equal to $Y * (f/10\ \text{MHz})$, where Y is equal to the 10 MHz frequency error and f is equal to the frequency. For example, a frequency accuracy error at 20 MHz equals twice the 10 MHz frequency accuracy error.

8 The PXIe-5653 reference oscillator determines this specification.

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Spectral Purity

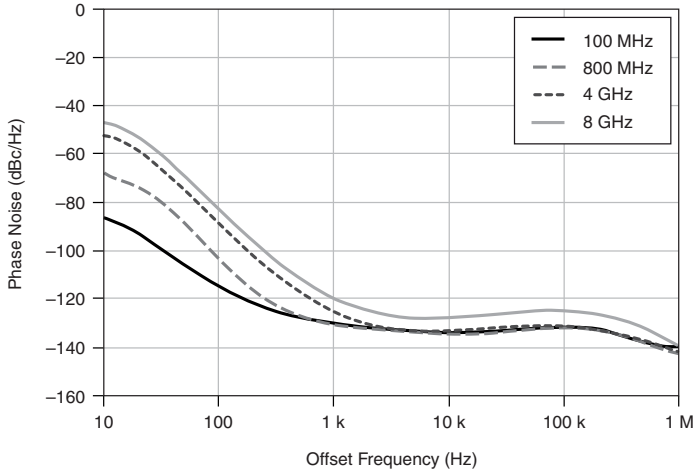
Single Sideband (SSB) Phase Noise at 800 MHz

Table 3. SSB Phase Noise (dBc/Hz, Typical)

Offset	Phase Noise (dBc/Hz)	
	23 °C ± 5 °C	0 °C to 55 °C
10 Hz	—	-87 (nominal)
100 Hz	-106	-105
1 kHz	-129	-127
10 kHz	-129	-128
100 kHz	-128	-127
1 MHz	-140	-140

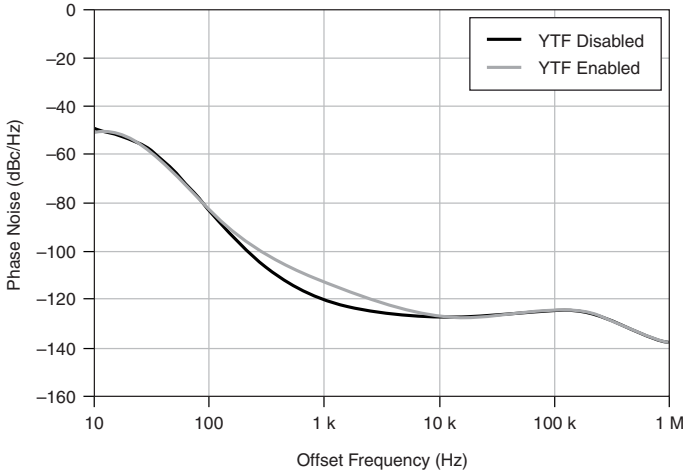
Note Phase noise values use PXIe-5653 internal frequency reference, PXIe-5624 digitizer directly clocked, dithering enabled and the **LO YIG Main Coil Drive** property set to Normal. Refer to the following figures for phase noise performance at additional offsets, frequencies, and with the preselector enabled.

Figure 1. Phase Noise at 100 MHz, 800 MHz, 4 GHz, and 8 GHz (Nominal, Direct Clocking, Dithering Enabled, Preselector Disabled, and Spurs Not Shown)



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Figure 2. Phase Noise at 8 GHz
(Nominal, Direct Clocking, Dithering Enabled, and Spurs Not Shown)

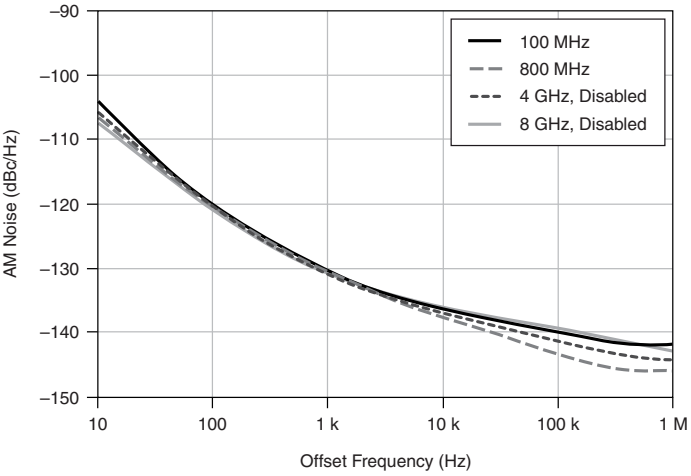


Residual FM (RMS) at 800 MHz

10 Hz to 10 kHz	<0.5 Hz, typical

AM Noise

Figure 3. AM Noise for Carrier Frequencies of 100 MHz, 800 MHz, 4 GHz, and 8 GHz
(Nominal, Spurs Not Shown)



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Amplitude

Amplitude Range

Amplitude range	*Average Noise Level* to +30 dBm (nominal)[9]
RF input attenuation	
Electronic	0 dB to 30 dB in 1 dB steps (20 Hz to 3.6 GHz)
Mechanical	0 dB to 75 dB in 5 dB steps (20 Hz to 26.5 GHz)

Display Average Noise Level

Table 4. PXIe-5668 Display Average Noise Level, Preamplifier Disabled and Preselector Disabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm/Hz)	Typical (dBm/Hz)	Specification (dBm/Hz)	Typical (dBm/Hz)
20 Hz to 200 kHz	—	—	—	-92
>200 kHz to 10 MHz	-151	-153	-150	-152
>10 MHz to 100 MHz	-154	-155	-153	-155
>100 MHz to 300 MHz	-155	-157	-153	-157
>300 MHz to 1.7 GHz	-154	-157	-152	-156
>1.7 GHz to 2.8 GHz	-151	-154	-149	-153
>2.8 GHz to 3.6 GHz	-149	-151	-149	-150
>3.6 GHz to 5 GHz	-153	-158	-152	-157

[9] Refer to the *Maximum Safe Continuous RF Power* section for the lower amplitude range limit under specific conditions.

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Table 4. PXIe-5668 Display Average Noise Level, Preamplifier Disabled and Preselector Disabled (Continued)

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm/Hz)	Typical (dBm/Hz)	Specification (dBm/Hz)	Typical (dBm/Hz)
>5 GHz to 14 GHz	-153	-156	-151	-156
>14 GHz to 17 GHz	-147	-150	-145	-148
>17 GHz to 24 GHz	-151	-154	-150	-152
>24 GHz to 26.5 GHz	-148	-150	-146	-149

Note Values are based on input-terminated, 0 dB RF attenuation for center frequency ≥ 10 MHz, 300 kHz, 5 MHz, 100 MHz, and 320 MHz IF filter, ≤-50 dBm reference level, and >10 averages. Log average noise level is normalized to a 1 Hz noise bandwidth.

Table 5. PXIe-5668 Display Average Noise Level, Preamplifier Present and Enabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm/Hz)	Typical (dBm/Hz)	Specification (dBm/Hz)	Typical (dBm/Hz)
10 MHz to 30 MHz	-164	-167	-163	-166
>30 MHz to 100 MHz	-165	-168	-164	-166
>100 MHz to 300 MHz	-167	-169	-166	-168
>300 MHz to 1.7 GHz	-165	-168	-165	-167
>1.7 GHz to 2.8 GHz	-164	-166	-163	-165

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Table 5. PXIe-5668 Display Average Noise Level, Preamplifier Present and Enabled (Continued)

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm/Hz)	Typical (dBm/Hz)	Specification (dBm/Hz)	Typical (dBm/Hz)
>2.8 GHz to 3.6 GHz	-163	-165	-162	-164

Note Values are based on input-terminated, 0 dB RF attenuation, 300 kHz, 5 MHz, 100 MHz, and 320 MHz IF filter, ≤-50 dBm reference level, and >10 averages. Log average noise level normalized to a 1 Hz noise bandwidth.

Table 6. PXIe-5668 Display Average Noise Level, Preselector Present and Enabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm/Hz)	Typical (dBm/Hz)	Specification (dBm/Hz)	Typical (dBm/Hz)
>3.6 GHz to 5 GHz	-149	-152	-148	-152
>5 GHz to 14 GHz	-150	-154	-149	-153
>14 GHz to 17 GHz	-143	-147	-141	-147
>17 GHz to 22 GHz	-147	-150	-146	-149
>22 GHz to 24 GHz	-145	-148	-144	-147
>24 GHz to 26.5 GHz	-143	-148	-142	-147

Note Values are based on input-terminated, 0 dB RF attenuation, 300 kHz, 5 MHz, 100 MHz, and 320 MHz IF filter, ≤-50 dBm reference level, and >10 averages. Log average noise level normalized to a 1 Hz noise bandwidth.

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Table 7. PXIe-5668 Display Average Noise Level, 765 MHz Bandwidth

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm/Hz)	Typical (dBm/Hz)	Specification (dBm/Hz)	Typical (dBm/Hz)
>3.6 GHz to 5 GHz	-154	-157	-153	-156
>5 GHz to 14 GHz	-153	-156	-152	-156
>14 GHz to 17 GHz	-146	-150	-145	-150
>17 GHz to 24 GHz	-148	-154	-148	-154
>24 GHz to 26.5 GHz	-147	-150	-146	-150

Note Values are based on input-terminated, 0 dB RF attenuation, 765 MHz filter, ≤-50 dBm reference level, and >10 averages. Log average noise level normalized to a 1 Hz noise bandwidth.

Amplitude Accuracy

Frequency Response

Table 8. PXIe-5668 Frequency Response, Preamplifier Disabled and Preselector Disabled

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
10 MHz to 100 MHz	±0.09	±0.07	±0.06	±0.10	±0.09
>100 MHz to 300 MHz	±0.11	±0.10	±0.09	±0.12	±0.11
>300 MHz to 1.7 GHz	±0.15	±0.14	±0.13	±0.20	±0.18
>1.7 GHz to 2.8 GHz	±0.12	±0.14	±0.13	±0.20	±0.20

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Table 8. PXIe-5668 Frequency Response, Preamplifier Disabled and Preselector Disabled (Continued)

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
>2.8 GHz to 3.6 GHz	±0.16	±0.14	±0.12	±0.54	±0.38

Note Frequency response is measured relative to the 612.5 MHz calibration tone frequency. Values are based on 100 MHz IF filter for center frequency ≥100 MHz, 300 kHz IF filter for center frequency <100 MHz, signal-to-noise ratio >20 dB, and using the automatic calibration correction of the NI-RFSA instrument driver within ±5 °C of the temperature at the last calibration. RF attenuation is 20 dB for frequencies <10 MHz and is 10 dB for frequencies >10 MHz.

Table 9. PXIe-5668 Frequency Response, Preamplifier Present and Enabled

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
10 MHz to 100 MHz	±0.20	±0.18	±0.15	±0.20	±0.15
>100 MHz to 300 MHz	±0.12	±0.11	±0.10	±0.12	±0.10
>300 MHz to 1.7 GHz	±0.04	±0.03	±0.02	±0.11	±0.10
>1.7 GHz to 2.8 GHz	±0.19	±0.16	±0.13	±0.10	±0.08
>2.8 GHz to 3.6 GHz	±0.20	±0.17	±0.14	±0.31	±0.26

Note Frequency response is measured relative to the 612.5 MHz calibration tone frequency. Values are based on a 100 MHz filter for center frequency ≥100 MHz, 300 kHz IF filter for center frequency <100 MHz, signal-to-noise ratio >20 dB, and using automatic calibration correction of the NI-RFSA instrument driver within ±5 °C of the temperature at the last calibration. RF attenuation is 10 dB for frequencies >10 MHz.

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Absolute Amplitude Accuracy

Table 10. PXIe-5668 Absolute Amplitude Accuracy, Preamplifier Disabled and Preselector Disabled

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
612.5 MHz	±0.57	±0.28	±0.21	±0.75	±0.37
>10 MHz to 100 MHz	±0.57 + *Frequency response*[10]	±0.35	±0.27	±0.85	±0.46
>100 MHz to 300 MHz	±0.57 + *Frequency response*[10]	±0.38	±0.30	±0.87	±0.44
>300 MHz to 1.7 GHz	±0.57 + *Frequency response*[10]	±0.35	±0.34	±0.96	±0.55
>1.7 GHz to 2.8 GHz	±0.57 + *Frequency response*[10]	±0.33	±0.25	±0.87	±0.44
>2.8 GHz to 3.6 GHz	±0.57 + *Frequency response*[10]	±0.42	±0.33	±1.29	±0.75
>3.6 GHz to 8.5 GHz	±0.82	±0.47	±0.40	±1.70	±1.07
>8.5 GHz to 14 GHz	±0.91	±0.56	±0.48	±2.08	±1.35
>14 GHz to 17 GHz	±0.94	±0.58	±0.48	±1.98	±1.27
>17 GHz to 20 GHz	±1.19	±0.76	±0.64	±2.32	±1.52

[10] Refer to the *Frequency Response* section for more information about this specification.

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Table 10. PXIe-5668 Absolute Amplitude Accuracy, Preamplifier Disabled and Preselector Disabled (Continued)

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
>20 GHz to 26.5 GHz	±1.50	±1.00	±0.83	±2.99	±1.98

Values are based on -10 dBm to -50 dBm reference level, 100 MHz IF filter for center frequency ≥100 MHz, 300 kHz IF filter for center frequency <100 MHz, and using automatic calibration correction of the NI-RFSA instrument driver within ±5 °C of the temperature at the last calibration. RF attenuation is 20 dB for frequencies <10 MHz and is 10 dB for frequencies >10 MHz.

The absolute amplitude accuracy is measured at the center frequency. The absolute amplitude accuracy measurements are made after the hardware has settled. The high band to low band signal path transitions can take up to 200 ms for hardware to settle to within 0.1 dB of the final amplitude.

Table 11. PXIe-5668 Absolute Amplitude Accuracy, Preamplifier Enabled

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
612.5 MHz	±0.96	±0.61	±0.47	±1.51	±0.89
>10 MHz to 100 MHz	±0.96 + *Frequency response*	±0.43	±0.32	±1.45	±0.83
>100 MHz to 300 MHz	±0.96 + *Frequency response*	±0.50	±0.37	±1.56	±0.92
>300 MHz to 1.7 GHz	±0.96 + *Frequency response*	±0.64	±0.49	±1.63	±0.99
>1.7 GHz to 2.8 GHz	±0.96 + *Frequency response*	±0.77	±0.60	±1.62	±0.97

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Table 11. PXIe-5668 Absolute Amplitude Accuracy, Preamplifier Enabled (Continued)

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
>2.8 GHz to 3.6 GHz	±0.96 + *Frequency response*	±0.78	±0.61	±1.82	±1.15

Values are based on -20 dBm to -50 dBm reference level, 100 MHz IF filter for center frequency ≥100 MHz, 300 kHz IF filter for center frequency <100 MHz, and using automatic calibration correction of the NI-RFSA instrument driver within ±5 °C of the temperature at the last calibration. RF attenuation is 20 dB for frequencies <10 MHz and is 10 dB for frequencies >10 MHz.

The absolute amplitude accuracy is measured at the center frequency. The absolute amplitude accuracy measurements are made after the hardware has settled. The high band to low band signal path transitions can take up to 200 ms for hardware to settle to within 0.1 dB of the final amplitude.

Table 12. PXIe-5668 Absolute Amplitude Accuracy, Preselector Enabled

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
>3.6 GHz to 8.5 GHz	±1.60	±1.08	±0.84	±2.80	±1.69
>8.5 GHz to 14 GHz	±1.51	±0.98	±0.73	±2.48	±1.50
>14 GHz to 17 GHz	±1.60	±1.09	±0.85	±2.45	±1.54
>17 GHz to 20 GHz	±2.11	±1.42	±1.08	±3.24	±2.01

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Table 12. PXIe-5668 Absolute Amplitude Accuracy, Preselector Enabled (Continued)

Center Frequency	23 °C ± 5 °C			0 °C to 55 °C	
	Specification (dB)	2σ (dB)	Typical (dB)	Specification (dB)	Typical (dB)
>20 GHz to 26.5 GHz	±2.31	±1.61	±1.26	±3.02	±1.99

Values are based on -10 dBm to -50 dBm reference level, 10 dB RF attenuation, 100 MHz IF filter, and using the automatic calibration correction of the NI-RFSA instrument driver within ±5 °C of a self-calibration.

The absolute amplitude accuracy is measured at the center frequency. The absolute amplitude accuracy measurements are made after the hardware has settled. The high band to low band signal path transitions can take up to 200 ms for hardware to settle to within 0.1 dB of the final amplitude.

Spurious Responses

Non-Input-Related (Residual) Spurs[11]

Table 13. PXIe-5668 Non-Input-Related (Residual) Spurs, Preselector Disabled (23 °C ± 5 °C)

Frequency	Specification (dBm)	Typical (dBm)
100 MHz to 3.6 GHz	-110	-115
>3.6 GHz to 11 GHz	-110	-115
>11 GHz to 26.5 GHz	-97	-105

Table 14. PXIe-5668 Non-Input-Related (Residual) Spurs, Preselector Disabled (23 °C ± 5 °C), 100 MHz Instantaneous Bandwidth (BW) Path

Frequency	Specification (dBm)	Typical (dBm)
100 MHz to 3.6 GHz	-99	-102
>3.6 GHz to 11 GHz	-102	-105

[11] Non-input-related spurs (residual spurs) are the responses observed when no input signal is present. The non-input-related spur values are based on ambient temperature of 23 °C ± 5 °C, RF input terminated, 0 dB RF attenuation, and -60 dBm reference level using 300 kHz and 5 MHz IF bandwidth.

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Table 14. PXIe-5668 Non-Input-Related (Residual) Spurs, Preselector Disabled (23 °C ± 5 °C), 100 MHz Instantaneous Bandwidth (BW) Path (Continued)

Frequency	Specification (dBm)	Typical (dBm)
>11 GHz to 24 GHz	-92	-98
>24 GHz to 26.5 GHz	-91	-95

Higher-Order RF Responses[12]

Table 15. PXIe-5668 Higher-Order RF Responses (23 °C ± 5 °C, Typical)

Center Frequency	Higher-Order RF Responses (dBc)
100 MHz to 3.6 GHz	-47
>3.6 GHz to 14 GHz	-92
>14 GHz to 26.5 GHz	-92

Note The higher-order RF responses ($n > 1$) are measured greater than 10 MHz offset from the carrier signal at a mixer level of -10 dBm for center frequencies less than or equal to 3.6 GHz and a mixer level of -40 dBm for center frequencies greater than 3.6 GHz. The preamplifier is disabled. The preselector is enabled for center frequencies greater than 3.6 GHz.

Image Rejection

Table 16. RF Image Rejection

Center Frequency	23 °C ± 5 °C		0 °C ± 55 °C	
	Specification (dBc)	Typical (dBc)	Specification (dBc)	Typical (dBc)
100 MHz to 3.6 GHz	-98	-102	-96	-100
>3.6 GHz to 14 GHz	-81	-85	-80	-84

[12] Higher-order RF responses are responses resulting from RF second-order and higher-order harmonic-related spurs.

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Table 16. RF Image Rejection (Continued)

Center Frequency	23 °C ± 5 °C		0 °C ± 55 °C	
	Specification (dBc)	Typical (dBc)	Specification (dBc)	Typical (dBc)
>14 GHz to 26.5 GHz	-74	-78	-73	-77

Note Values are based on 0 dBm input signal, 10 dB RF attenuation, and 0 dBm reference level. For frequencies less than 3.6 GHz, the IF filter is 100 MHz or 320 MHz and the preamplifier is disabled. For frequencies greater than 3.6 GHz, the preselector is enabled and the IF filter is 100 MHz.

Table 17. IF Image Rejection, Center Frequency <3.6 GHz

	23 °C ± 5 °C (dBc, Typical)	0 °C ± 55 °C (dBc, Typical)
Second IF (Direct)	-65	-63
Second IF (Translated)	-53	-53
Third IF (Direct)	-95	-95
Third IF (Translated)	-95	-95

Note IF image rejection describes the rejection of a signal incident on the signal analyzer at the second or third mixer image frequency or at the second or third mixer image frequency, translated to the RF input frequency by the first mixer relative to the level of a signal incident at other tuned frequencies.

Note Values are based on 0 dBm input signal, 10 dB RF attenuation, 0 dBm reference level, 100 MHz or 320 MHz IF filter, and preamplifier disabled.

Table 18. Second IF Image Rejection, Center Frequency >3.6 GHz

Preselector	23 °C ± 5 °C (dBc, Typical)	0 °C ± 55 °C (dBc, Typical)
Enabled	-93	-93
Disabled	-84	-84

Note Second IF image rejection describes the rejection of a signal incident on the signal analyzer at the second mixer image frequency or at the second mixer image frequency, translated to the RF input frequency by the first mixer relative to the level of a signal incident at other tuned frequencies.

Note Values are based on 0 dBm input signal, 10 dB RF attenuation, 0 dBm reference level, and 100 MHz IF filter.

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IF Rejection[13]

Table 19. IF Rejection, Center Frequency <3.6 GHz[14]

	23 °C ± 5 °C (dBc, Typical)	0 °C ± 55 °C (dBc, Typical)
Half IF	-60	-59
First IF	-72	-70
Second IF	-74	-74
Third IF	-63	-63

Note Values are based on 0 dBm input signal, 10 dB RF attenuation, 0 dBm reference level, 100 MHz or 320 MHz IF filter, and preamplifier disabled.

Table 20. IF Rejection, Center Frequency >3.6 GHz, 100 MHz IF Filter[14]

	23 °C ± 5 °C (dBc, Typical)	0 °C ± 55 °C (dBc, Typical)
Half IF	-91	-91
First IF (3.6 GHz to 14 GHz)	-83	-82
First IF (14 GHz to 26.5 GHz)	-80	-79
Second IF	-83	-83

Note Values are based on 0 dBm input signal, 10 dB RF attenuation, and 0 dBm reference level.

Table 21. IF Rejection, Center Frequency >3.6 GHz, 320 MHz IF Filter[14]

	23 °C ± 5 °C (dBc, Typical)	0 °C ± 55 °C (dBc, Typical)
First IF	-60	-59

Note Values are based on 0 dBm input signal, 10 dB RF attenuation, 0 dBm reference level, and preselector disabled.

[13] Refer to the *IF Frequencies* section for the IF1, IF2, and IF3 frequency definitions.

[14] IF rejection describes the rejection of a signal incident on the signal analyzer at a multiple or sub-multiple of the IF frequency relative to the level of a signal incident at other tuned frequencies.

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Linearity

Third-Order Intermodulation Distortion

Table 22. PXIe-5668 Input Third-Order Intercept Point (IP_3), Preamplifier Disabled and YTF Disabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
10 MHz to 100 MHz	+16.0	+19.0	+15.0	+17.0
>100 MHz to 1 GHz	+21.0	+24.0	+20.0	+23.0
>1 GHz to 2 GHz	+23.0	+26.0	+22.0	+25.0
>2 GHz to 2.8 GHz	+23.0	+26.0	+22.0	+25.0
>2.8 GHz to 3.6 GHz	+25.0	+28.0	+24.0	+27.0
>3.6 GHz to 5 GHz	+6.0	+13.0	+5.0	+12.0
>5 GHz to 7.5 GHz	+6.0	+14.0	+5.0	+13.0
>7.5 GHz to 14 GHz	+14.0	+22.0	+13.0	+21.0
>14 GHz to 17 GHz	+14.0	+17.0	+13.0	+16.0
>17 GHz to 26.5 GHz	+19.5	+22.0	+19.0	+21.0

Note Values are based on two -10 dBm input tones (-10 dBm equivalent mixer level) at 700 kHz apart, 0 dB RF attenuation, preamplifier disabled, -10 dBm reference level, and the 300 kHz IF filter. Specifications for frequencies greater than 3.6 GHz apply when the preselector is disabled. Mixer level is equivalent to input signal level minus RF attenuation.

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Table 23. PXIe-5668 Input Third-Order Intercept Point (IP_3), Preamplifier Disabled and YTF Enabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
>3.6 GHz to 5 GHz	+11.0	+20.0	+10.0	+18.0
>5 GHz to 7.5 GHz	+15.0	+20.0	+15.0	+18.0
>7.5 GHz to 14 GHz	+18.0	+27.0	+17.0	+25.0
>14 GHz to 17 GHz	+18.0	+21.0	+17.0	+19.0
>17 GHz to 26.5 GHz	+20.0	+25.0	+19.5	+24.0

Note Values are based on two -10 dBm input tones (-10 dBm equivalent mixer level) at 700 kHz apart, 0 dB RF attenuation, preamplifier disabled, -10 dBm reference level, and the 300 kHz IF filter. Mixer level is equivalent to input signal level minus RF attenuation.

Table 24. PXIe-5668 Input Third-Order Intercept Point (IP_3), Preamplifier Enabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
10 MHz to 500 MHz	-16	-12	-15	-14
>500 MHz to 2 GHz	-14	-11	-15	-13
>2 GHz to 3 GHz	-12	-10	-13	-12

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Table 24. PXIe-5668 Input Third-Order Intercept Point (IP_3), Preamplifier Enabled (Continued)

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
>3 GHz to 3.6 GHz	-9	-8	-10	-9

Note Values are based on two -30 dBm tones (-30 dBm equivalent mixer level) spaced at 700 kHz apart, 0 dB RF attenuation, preamplifier enabled, -30 dBm reference level, and the 300 kHz filter. Mixer level is equivalent to input signal level minus RF attenuation plus preamplifier gain.

Second Harmonic Distortion (Input SHI)

Table 25. PXIe-5668 Input SHI, Preamplifier Disabled, Signal Conditioning High Pass Filter (HPF) Enabled, and Preselector Enabled

Source Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
50 MHz to 700 MHz	—	+40	—	+35
>700 MHz to 1 GHz	+70	+75	+69	+74
>1 GHz to 1.8 GHz	+71	+74	+70	+72
>1.8 GHz to 7 GHz	+62	+68	+61	+66
>7 GHz to 8.5 GHz	+58	+68	+57	+66
>8.5 GHz to 11 GHz	+58	+70	+57	+68

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Table 25. PXIe-5668 Input SHI, Preamplifier Disabled, Signal Conditioning High Pass Filter (HPF) Enabled, and Preselector Enabled (Continued)

Source Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
>11 GHz to 13.25 GHz	+58	+70	+57	+68

Note Values are based on a -10 dBm mixer level and 300 kHz IF filter. Mixer level is equivalent to input signal level minus RF attenuation. For center frequencies greater than 3.6 GHz, the preselector is enabled.

Table 26. PXIe-5668 Input SHI, Preamplifier Enabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
50 MHz to 100 MHz	-7	-5	-8	-6
>100 MHz to 300 MHz	-5	-3	-6	-4
>300 MHz to 1 GHz	-5	-2	-6	-3
>1 GHz to 1.8 GHz	-2	0	-2	-1

Note Values are based on a -40 dBm mixer level and 300 kHz IF filter. Mixer level is equivalent to input signal level minus RF attenuation plus preamplifier gain.

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Table 27. PXIe-5668 Input SHI, Preselector Disabled and Signal Conditioning HPF Disabled

Source Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
>300 MHz to 1 GHz	+63.0	+67.0	+61.0	+66.0
>1 GHz to 1.8 GHz	+49.0	+53.0	+48.0	+52.0
>1.8 GHz to 5 GHz	+28.2	+34.0	+27.0	+33.0
>5 GHz to 7 GHz	+27.0	+30.0	+27.0	+29.0
>7 GHz to 9 GHz	+25.7	+35.0	+24.0	+34.0
>9 GHz to 13.25 GHz	+26.2	+32.0	+25.5	+31.0

Note Values are based on a -10 dBm mixer level and 300 kHz IF filter. Mixer level is equivalent to input signal level minus RF attenuation.

Gain Compression[15]

Table 28. PXIe-5668 1 dB Gain Compression Level, Preamplifier Disabled and Preselector Disabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
10 MHz to 100 MHz	-1	+1	-2	0
>100 MHz to 1.8 GHz	+4	+7	+3	+6
>1.8 GHz to 3.6 GHz	+4	+7	+3	+6
>3.6 GHz to 20 GHz	+3	+6	+3	+5
>20 GHz to 24 GHz	+6	+9	+5	+8

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Table 28. PXIe-5668 1 dB Gain Compression Level, Preamplifier Disabled and Preselector Disabled (Continued)

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
>24 GHz to 26.5 GHz	+8	+10	+7	+9

Note Values are based on a two-tone technique, tone separation greater than 1.5 times the instantaneous bandwidth, 0 dB RF attenuation, 0 dBm reference level, and 300 kHz IF filter.

Table 29. PXIe-5668 1 dB Gain Compression Level, Preamplifier Enabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
10 MHz to 100 MHz	-30	-25	-27	-25
>100 MHz to 800 MHz	-27	-24	-26	-24
>800 MHz to 2 GHz	-27	-24	-26	-24
>2 GHz to 3 GHz	-26	-23	-26	-24
>3 GHz to 3.6 GHz	-24	-20	-25	-21

Note Values are based on a two-tone technique, tone separation greater than 1.5 times the instantaneous bandwidth, 0 dB RF attenuation, -30 dBm reference level, and 300 kHz IF filter.

Table 30. PXIe-5668 1 dB Gain Compression Level, Preselector Enabled

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
>3.6 GHz to 7.5 GHz	+6	+9	+5	+8
>7.5 GHz to 11 GHz	+7	+8	+6	+8

[15] Compression of an in-band signal by an out-of-band interfering signal, referenced to the RF input.

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Table 30. PXIe-5668 1 dB Gain Compression Level, Preselector Enabled (Continued)

Center Frequency	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBm)	Typical (dBm)	Specification (dBm)	Typical (dBm)
>11 GHz to 14 GHz	+8	+11	+10	+11
>14 GHz to 20 GHz	+9	+11	+10	+11
>20 GHz to 26.5 GHz	+9	+12	+11	+12

Note Values are based on a two-tone technique, tone separation greater than 1.5 times the instantaneous bandwidth, 0 dB RF attenuation, -30 dBm reference level, and 300 kHz IF filter.

Clipping (ADC Overrange)[16]

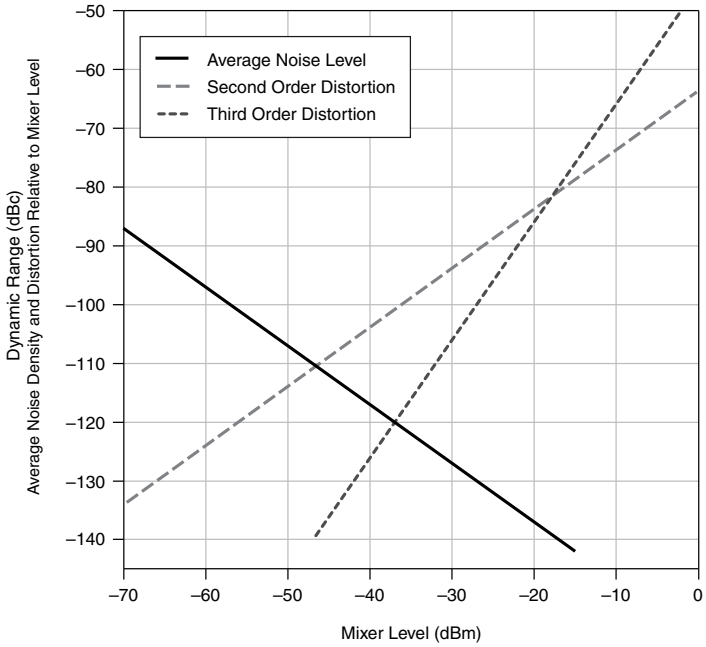
Single tone, relative to the reference level	10 dB (nominal)

[16] The IF power offset defaults to 0 dB.

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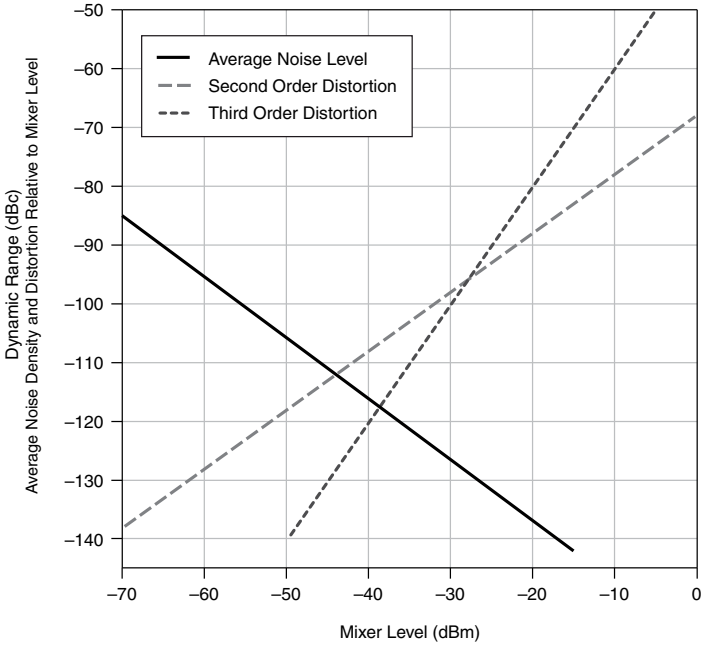
Dynamic Range

Figure 4. PXIe-5668 RF Downconverter Dynamic Range at 1 GHz, Preamplifier Disabled (Nominal)



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Figure 5. PXIe-5668 Downconverter Dynamic Range at 20 GHz, YTF Enabled (Nominal)



Modulation

IF Amplitude Response

Table 31. Typical PXIe-5668 IF Amplitude Response (23 °C ± 5 °C, 100 MHz Path)

IF Passband (MHz)	Center Frequency ≤ 3.41 GHz (dB)	Center Frequency ≤ 3.6 GHz (dB)	Preamplifier Enabled, Center Frequency ≤ 3.6 GHz (dB)	Center Frequency > 3.6 GHz (dB)
≤5	±0.03	±0.04	±0.03	±0.03
≤10	±0.05	±0.07	±0.05	±0.06
≤25	±0.09	±0.15	±0.08	±0.12
≤40	±0.12	±0.22	±0.10	±0.14
≤50	±0.14	±0.25	±0.12	±0.14

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Table 31. Typical PXIe-5668 IF Amplitude Response (23 °C ± 5 °C, 100 MHz Path) (Continued)

IF Passband (MHz)	Center Frequency ≤ 3.41 GHz (dB)	Center Frequency ≤ 3.6 GHz (dB)	Preamplifier Enabled, Center Frequency ≤ 3.6 GHz (dB)	Center Frequency > 3.6 GHz (dB)
≤100	±0.27	±0.58	±0.30	±0.24

Note IF passband response is relative to IF center frequency. The specification applies when RF center frequency is ≥200 MHz, 10 dB RF attenuation, 100 MHz signal path, IF equalization is enabled, and self-calibration is performed. The standard 80 MHz bandwidth option for the PXIe-5668 provides IF bandwidth up to 80 MHz.

Table 32. Typical PXIe-5668 IF Amplitude Response (23 °C ± 5 °C, 320 MHz Path)

IF Passband (MHz)	Center Frequency ≤ 3.41 GHz (dB)	Preamplifier Enabled, Center Frequency ≤ 3.41 GHz (dB)	Center Frequency > 3.41 GHz (dB)
≤5	±0.04	±0.03	±0.03
≤10	±0.08	±0.06	±0.05
≤25	±0.20	±0.14	±0.10
≤40	±0.28	±0.20	±0.15
≤50	±0.30	±0.22	±0.18
≤100	±0.50	±0.45	±0.38
≤320	±1.35	±1.30	±0.86

Note IF passband response is relative to IF center frequency. The specification applies when RF center frequency is ≥320 MHz, 10 dB RF attenuation, 320 MHz signal path, IF equalization is enabled, and self-calibration is performed. The standard 80 MHz bandwidth option for the PXIe-5668 provides IF bandwidth up to 80 MHz.

Table 33. Typical PXIe-5668 IF Amplitude Response (23 °C ± 5 °C, 765 MHz Path)

IF Passband (MHz)	Center Frequency > 3.6 GHz (dB)
≤5	±0.03
≤10	±0.05
≤25	±0.12

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Table 33. Typical PXIe-5668 IF Amplitude Response (23 °C ± 5 °C, 765 MHz Path) (Continued)

IF Passband (MHz)	Center Frequency > 3.6 GHz (dB)
≤40	±0.18
≤50	±0.25
≤100	±0.50
≤320	±0.75
≤765	±1.27

Note IF passband response is relative to IF center frequency. The specification applies when RF center frequency is >3.6 GHz, 10 dB RF attenuation, 765 MHz signal path, IF equalization is enabled, and self-calibration is performed. The standard 80 MHz bandwidth option for the PXIe-5668 provides IF bandwidth up to 80 MHz.

IF Phase Linearity (Deviation from Linear Phase)

Table 34. Typical PXIe-5668 Deviation from Linear Phase (Degrees) (23 °C, 100 MHz Path)

IF Passband	Center Frequency ≤ 3.6 GHz	Preamplifier Enabled, Center Frequency ≤ 3.6 GHz	Center Frequency > 3.6 GHz
≤5 MHz	±0.03	±0.03	±0.03
≤10 MHz	±0.08	±0.09	±0.10
≤25 MHz	±0.45	±0.45	±0.50
≤40 MHz	±0.90	±1.00	±0.90
≤50 MHz	±1.30	±1.45	±1.10
≤100 MHz	±3.50	±4.00	±1.80

Note IF passband response is relative to IF center frequency. The specification applies when RF center frequency is ≥200 MHz, 10 dB RF attenuation, 100 MHz signal path, IF equalization is enabled, and self-calibration is performed. The standard 80 MHz bandwidth option for the PXIe-5668 provides IF bandwidth up to 80 MHz.

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Table 35. Typical PXIe-5668 Deviation from Linear Phase (Degrees) (23 °C, 320 MHz Path)

IF Passband	Center Frequency ≤ 3.41 GHz	Preamplifier Enabled, Center Frequency ≤ 3.41 GHz	Center Frequency > 3.41 GHz
≤5 MHz	±0.03	±0.04	±0.04
≤10 MHz	±0.06	±0.06	±0.07
≤25 MHz	±0.32	±0.30	±0.35
≤40 MHz	±0.85	±0.70	±0.75
≤50 MHz	±1.30	±1.10	±1.00
≤100 MHz	±4.10	±4.00	±2.45
≤320 MHz	±12.5	±13.0	±8.00

Note IF passband response is relative to IF center frequency. The specification applies when RF center frequency is ≥320 MHz, 10 dB RF attenuation, 320 MHz signal path, IF equalization is enabled, and self-calibration is performed. The standard 80 MHz bandwidth option for the PXIe-5668 provides IF bandwidth up to 80 MHz.

Table 36. Nominal PXIe-5668 Deviation from Linear Phase (Degrees) (23 °C, 765 MHz Path)

IF Passband	Center Frequency > 3.6 GHz (Nominal)	Center Frequency > 9 GHz (Nominal)
≤5 MHz	±0.04	±0.04
≤10 MHz	±0.06	±0.06
≤25 MHz	±0.25	±0.25
≤40 MHz	±0.60	±0.60
≤50 MHz	±0.90	±0.90
≤100 MHz	±2.25	±2.25
≤320 MHz	±6.00	±6.00

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Table 36. Nominal PXIe-5668 Deviation from Linear Phase (Degrees) (23 °C, 765 MHz Path) (Continued)

IF Passband	Center Frequency > 3.6 GHz (Nominal)	Center Frequency > 9 GHz (Nominal)
≤765 MHz	±10.00	±16.00

Note IF passband response is relative to IF center frequency. The specification applies when RF center frequency is >3.6 GHz, 10 dB RF attenuation, 765 MHz signal path, IF equalization is enabled, and self-calibration is performed. The standard 80 MHz bandwidth option for the PXIe-5668 provides IF bandwidth up to 80 MHz.

Error Vector Magnitude (EVM) and Modulation Error Ratio (MER)

Data length in the following two tables is a 1,250 symbol pseudorandom bit sequence (PRBS) at a -10 dBm power level. These results were obtained using the independent onboard clock for the PXIe-5668 with the independent Reference Clock for the PXIe-5646 Vector Signal Transceiver. The results do not include software equalization using the Modulation Toolkit. Results are the composite effect of both the PXIe-5668 and the PXIe-5646.

Table 37. 825 MHz Carrier Frequency (Nominal)[17]

QAM Order	Symbol Rate (kS/s)	α_{RRC}	EVM (% RMS)	MER (dB)
4	160	0.25	0.11	59.00
	800	0.21	0.11	59.35
	4,090	0.22	0.12	58.58
16	17,600	0.25	0.21	51.26
	32,000	0.25	0.48	43.93
64	5,360	0.15	0.09	57.28
	6,952	0.15	0.10	56.45
	40,990	0.22	0.60	40.92
256	6,952	0.15	0.09	56.71

[17] NI-RFSA reference level = -7 dBm, RF attenuation = 10 dB, IF filter = 320 MHz

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Table 38. 2.4 GHz Carrier Frequency (Nominal)[17]

QAM Order	Symbol Rate (kS/s)	α_{RRC}	EVM (% RMS)	MER (dB)
4	160	0.25	0.28	51.19
	800	0.25	0.23	52.66
	4,090	0.22	0.20	53.97
16	17,600	0.25	0.22	50.77
	32,000	0.25	0.48	43.90
64	5,360	0.15	0.14	53.43
	6,952	0.15	0.15	53.19
	40,990	0.22	0.62	40.79
256	6,952	0.15	0.13	53.50

Table 39. 5.8 GHz Carrier Frequency (Nominal)[17]

QAM Order	Symbol Rate (kS/s)	α_{RRC}	EVM (% RMS)	MER (dB)
4	160	0.25	0.63	44.12
	800	0.25	0.52	45.77
	4,090	0.22	0.45	46.97
16	17,600	0.25	0.34	46.82
	32,000	0.25	0.39	45.65
64	5,360	0.15	0.30	46.96
	6,952	0.15	0.30	46.87
	40,990	0.22	0.42	43.98
256	6,952	0.15	0.27	47.01

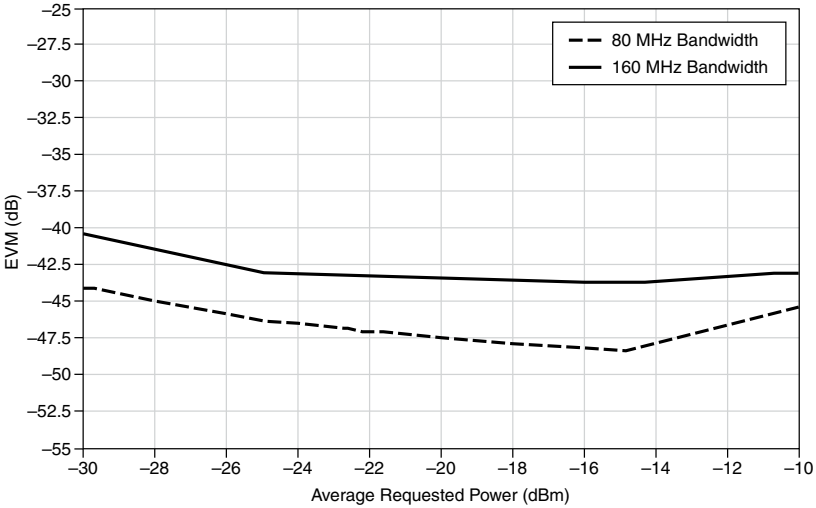
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Application-Specific Modulation Quality

WLAN 802.11ac

OFDM EVM	
80 MHz bandwidth	-49 dB (RMS) (nominal)[18]
80 MHz bandwidth with channel tracking enabled (preamble and data)	-52 dB[18]
160 MHz bandwidth	-44 dB (RMS) (nominal)[18]
160 MHz bandwidth with channel tracking enabled (preamble and data)	-47[18]

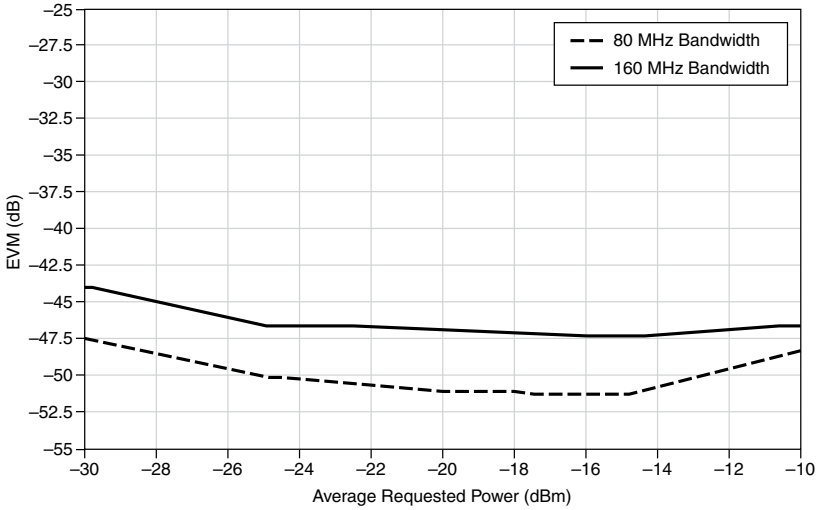
Figure 6. WLAN 802.11ac RMS EVM (dB) Versus Measured Average Power (dBm)



[18] Conditions: RF IN = 5,800 MHz; RF attenuation = 0 dB; average input power = -30 dBm to -10 dBm; IF filter = 320 MHz; reference level = auto-level based on real-time average power measurement with optimized offset, optimized IF power offset, 20 packets, 16 OFDM data symbols; MCS = 9, 256 QAM.

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Figure 7. WLAN 802.11ac RMS EVM (dB) Versus Measured Average Power (dBm), Channel Tracking Enabled



WLAN 802.11n

Table 40. 802.11n OFDM EVM (RMS) (dB), Nominal

Frequency	20 MHz Bandwidth		40 MHz Bandwidth	
	Channel Tracking Disabled	Channel Tracking Enabled, Preamble and Data	Channel Tracking Enabled	Channel Tracking Enabled, Preamble and Data
2.412 GHz	-53	-56	-51	-54
5.000 GHz	-51	-53	-50	-52
Conditions: RF attenuation = 10 dB; average input power = -10 dBm; IF filter = 320 MHz; reference level = auto-level based on real-time average power measurement with -10 dB offset, 20 packets, 3/4 coding rate, 64 QAM.				

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WLAN 802.11a/g/j/p

Table 41. 802.11a/g/j/p OFDM EVM (RMS) (dB) (Nominal)

Frequency	20 MHz Bandwidth	
	Channel Tracking Disabled	Channel Tracking Enabled, Preamble and Data
2.412 GHz	-55	-57
5.000 GHz	-51	-54
Conditions: RF attenuation = 10 dB; average input power = -10 dBm; IF filter = 320 MHz; reference level = auto-level based on real-time average power measurement with -10 dB offset, 20 packets, 3/4 coding rate, 64 QAM.		

WLAN 802.11g

Table 42. 802.11g DSSS-OFDM EVM (RMS) (dB) (Nominal)

Frequency	20 MHz Bandwidth	
	Channel Tracking Disabled	Channel Tracking Enabled, Preamble and Data
2.412 GHz	-54	-56
5.000 GHz	-51	-53
Conditions: RF attenuation = 10 dB; average input power = -10 dBm; IF filter = 320 MHz; reference level = auto-level based on real-time average power measurement with -10 dB offset, 20 packets, 3/4 coding rate, 64 QAM.		

LTE

Table 43. SC-FDMA (Uplink FDD) EVM (RMS) (dB) (Nominal)

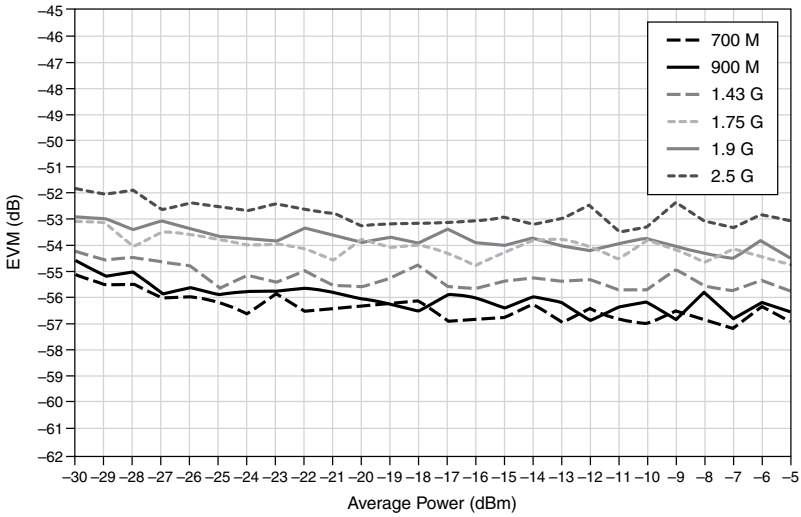
Frequency	5 MHz Bandwidth	10 MHz Bandwidth	20 MHz Bandwidth
700 MHz	-55	-55	-52
900 MHz	-55	-55	-52
1.430 GHz	-54	-54	-51
1.750 GHz	-53	-53	-51
1.900 GHz	-52	-52	-51

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Table 43. SC-FDMA (Uplink FDD) EVM (RMS) (dB) (Nominal) (Continued)

Frequency	5 MHz Bandwidth	10 MHz Bandwidth	20 MHz Bandwidth
2.500 GHz	-51	-51	-50
Conditions: single channel uplink only, RF attenuation = 0 dB; average input power = -30 dBm to -5 dBm; IF filter = 320 MHz; reference level = auto-level based on real-time average power measurement with -5 dB offset.			

Figure 8. LTE RMS EVM (dB) Versus Measured Average Power (dBm), 5 MHz Bandwidth



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Figure 9. LTE RMS EVM (dB) Versus Measured Average Power (dBm), 10 MHz Bandwidth

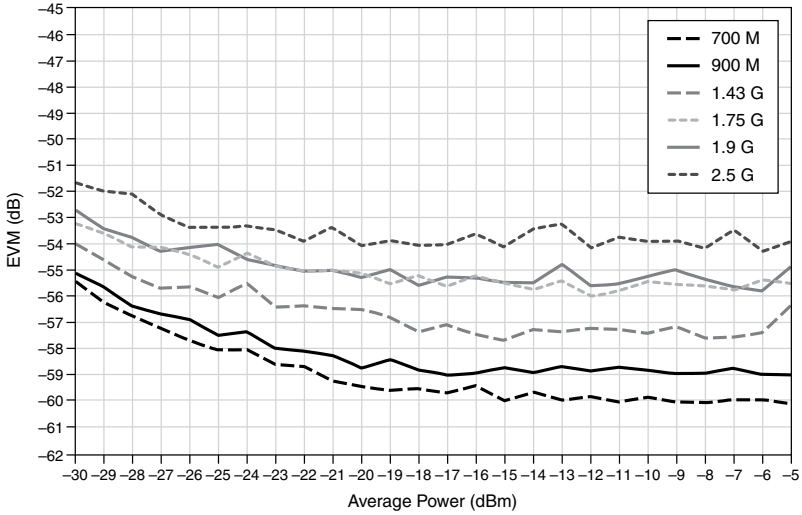
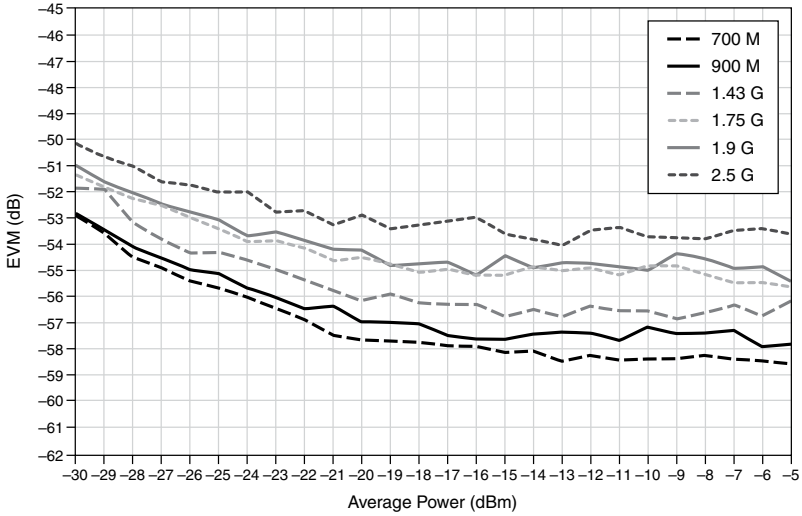


Figure 10. LTE RMS EVM (dB) Versus Measured Average Power (dBm), 20 MHz Bandwidth



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Measurement Speed

Measurement duration is made up of tuning time plus analysis time. The tuning benchmark includes programming time, frequency settling time, and amplitude settling time. Programming time partially overlaps frequency settling time and amplitude settling time. Measurement duration is dependent on the specific measurement settings used.

Amplitude Settling Time[19]

Table 44. PXIe-5668 Amplitude Settling Time (Nominal)

Center Frequency	Mechanical Attenuator Stationary (µs)	Mechanical Attenuator State Changed (ms)
>100 MHz to ≤ 3.6 GHz	25	40
>3.6 GHz to ≤26.5 GHz	25	40

Tuning Time

Table 45. PXIe-5668 Tuning Time (ms, Nominal)[20]

Step Size	Fast Configuration[21]	Normal Configuration[22]
50 MHz	1.8	5.6
75 MHz	1.9	7.7
250 MHz	2.3	9.3
1.0 GHz	6.6	15.0
3.5 GHz	14.5	19.6

19 Amplitude settling is within 0.1 dB.

20 Tuning times refer to tuning with a single band, for example, tuning within 0 Hz to 3.6 GHz or within 3.6 GHz to 7.5 GHz. The tuning times for tuning within the 7.5 GHz to 14 GHz band are lower than if the frequency spans multiple frequency bands. If your application uses the PXIe-5668 26.5 GHz VSA with the preselector enabled, add the preselector tuning times to the tuning times listed in this table.

21 Fast Configuration refers to setting the **LO YIG Main Coil Drive** property to Fast at an accuracy of 1.0×10^{-6} of final frequency.

22 Normal Configuration refers to setting the **LO YIG Main Coil Drive** property to Normal at an accuracy of 0.1×10^{-6} of final frequency.

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Preselector Tuning Time

Table 46. PXIe-5668 Preselector Tuning Time (Nominal)

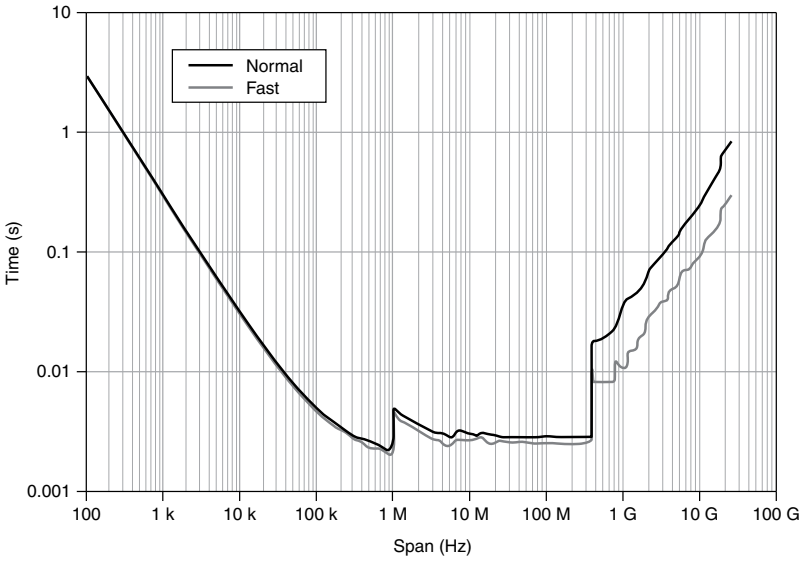
Center Frequency Step Size	Preselector Tuning Time (ms)[23]
≤100 MHz	10.5
500 MHz	12.8
1.0 GHz	14.1
2.0 GHz	15.2
3.0 GHz	16.4
3.5 GHz	16.9
4.0 GHz	17.5
6.0 GHz	19.7
13.0 GHz	27.6
22.9 GHz	38.8

[23] Tuning time refers to the time required to tune the preselector upwards in frequency range from 3.6 GHz to 26.5 GHz of preselector path. The time required to tune downwards in frequency can be 16 ms to 26 ms for RF center frequencies from 3.6 GHz to 7.5 GHz, 25 ms to 39 ms for RF center frequencies from 7.5 GHz to 14 GHz, and 38 ms to 62 ms for RF center frequencies from 14 GHz to 26.5 GHz.

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Analysis Time Versus Span[24]

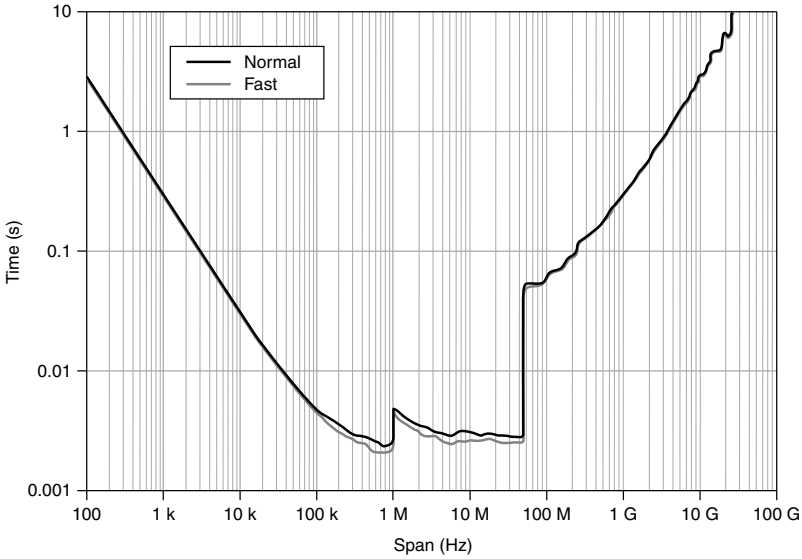
Figure 11. PXIe-5668 Analysis Time, Preselector Disabled (Nominal)



[24] Analysis time versus span was measured with a tuned frequency > 10 MHz. For spans smaller than 1 MHz, 100 frequency points were measured; above 1 MHz span, 1,000 frequency points were measured. Analysis time includes acquisition, FFT analysis, and data transfer time. For spans larger than 320 MHz, analysis time also includes tuning time. Tuning Mode refers to the setting of the **LO YIG Main Coil Drive** property to either Fast or Normal .

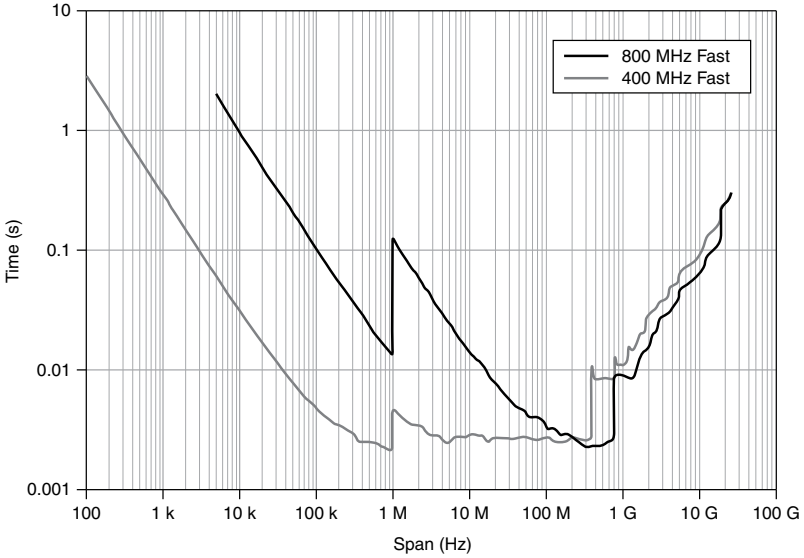
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Figure 12. PXIe-5668 Analysis Time, Preselector Enabled (Nominal)



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Figure 13. PXIe-5668 Analysis Time with 320 MHz and 765 MHz Bandwidth Setting for High Band (Nominal)[25]



Input and Output Characteristics

RF IN Front Panel Connector (PXIe-5606)

Connector	2.92 mm female
Impedance	50 Ω (nominal)
Coupling	AC and DC
Maximum safe DC input voltage, DC coupled	±40 VDC[26]

[25] Plots measured using 800 MHz and 400 MHz acquisition mode FPGA images for the PXIe-5624 digitizer. Refer to *NI RF Vector Signal Analyzers Help* for more information about using NI-RFSA instrument driver FPGA extensions.

[26] Ensure that the DC voltage at the RF IN connector of the PXIe-5606 is limited to ±40 V even with the DC block attached to the RF IN connector. With the DC block removed, the maximum safe DC input voltage for the RF IN connector is 0 V.

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NOISE SOURCE Front Panel Connector (PXIe-5606)

Connector	HD BNC
Noise source On	+28 VDC
Noise source Off	0 VDC

Maximum Safe Continuous RF Power

PXIe-5606 with 0 dB mechanical attenuation	+30 dBm

Voltage Standing Wave Ratio (VSWR) of RF Input

Table 47. PXIe-5606 VSWR (Nominal)

Attenuation[27]	Preselector (Enabled/ Disabled)	Center Frequency (MHz)	MAX VSWR (1 : 1)
0 dB	N/A	>10 MHz to ≤3.6 GHz	2.35 : 1
	Disabled	>3.6 GHz to ≤14 GHz	2.20 : 1
		>14 GHz to ≤26.5 GHz	2.45 : 1
	Enabled	>3.6 GHz to ≤14 GHz	2.50 : 1
		>14 GHz to ≤26.5 GHz	2.60 : 1
≥10 dB	N/A	>10 MHz to ≤3.6 GHz	1.25 : 1
	Disabled	>3.6 GHz to ≤14 GHz	1.30 : 1
		>14 GHz to ≤26.5 GHz	1.58 : 1
	Enabled	>3.6 GHz to ≤14 GHz	1.33 : 1
		>14 GHz to ≤26.5 GHz	1.58 : 1

IF OUT Front Panel Connector (PXIe-5606)

Connector	SMA female
Impedance	50 Ω (nominal)
Return loss	15 dB (nominal)

[27] Attenuation available in 1 dB steps for frequencies less than 3.6 GHz. Attenuation is available in 5 dB steps for frequencies from 20 Hz to 26.5 GHz. Based on a 90% tolerance interval and 90% confidence with k factor 2.59.

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Nominal IF output level	+7 dBm
Output voltage	0 V DC

LO IN and LO OUT Front Panel Connectors (PXIe-5606)

Connector	SMA female
Impedance	50 Ω (nominal)
Coupling	AC
Maximum safe power level	
LO1 IN	+13 dBm
LO2 IN	+13 dBm
LO3 IN	+15 dBm
LO1 OUT	+21 dBm
LO2 OUT	+17 dBm
LO3 OUT	+20 dBm
Maximum safe voltage	
LO1 IN	25 VDC
LO2 IN	12 VDC
LO3 IN	24 VDC
LO1 OUT	0 VDC
LO2 OUT	0 VDC
LO3 OUT	0 VDC
LO frequency	
LO1	4.6 GHz to 8.3 GHz
LO2	4.0 GHz
LO3	800 MHz
LO output level	
LO1	+7 dBm to +8 dBm (typical, varies with frequency)
LO2	+9 dBm to +10 dBm (typical)
LO3	+9 dBm to +10 dBm (typical)

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LO Output (PXIe-5653)

Table 48. LO Output Level

LO	Minimum	Nominal	Maximum
LO1 (from 3.2 GHz to 8.2 GHz)	*Nominal Value* - 2.5 dB	Varies by frequency according to the following equation: $10.5 - 3\left(\frac{Frequency(GHz) - 3.2GHz}{5.0GHz}\right)(dBm)$	*Nominal Value* + 2.5 dB
LO1 (at 8.3 GHz)	+4 dBm	+6.5 dBm	+9 dBm
LO2	+6.5 dBm	+9 dBm	+13 dBm
LO3	+7 dBm	+9 dBm	+13 dBm

Power Requirements

Table 49. PXIe-5668 Power Requirements (Voltages ± 5%)

Module	From +3.3 VDC	From +12 VDC	Total Power (W)
PXIe-5606	1.60 A (5.28 W)	5.00 A (60.00 W)	65.28
PXIe-5624	2.45 A (8.09 W)	1.95 A (23.40 W)	31.49
PXIe-5653	1.10 A (3.63 W)	4.00 A (48.00 W)	51.63
PXIe-5668 (combined VSA)	—	—	148.40

Calibration

Interval	2 years

PXIe-5653 LO Specifications

LO frequency	
LO1	3.2 GHz to 8.3 GHz (nominal)
LO2	4.0 GHz (nominal)
LO3	800 MHz (nominal)

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Single Sideband (SSB) Phase Noise (LO1)

LO1 (5.4125 GHz)

Table 50. Phase Noise (dBc/Hz), PXIe-5668 Center Frequency = 800 MHz

Offset	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBc/Hz)	Typical (dBc/Hz)	Nominal (dBc/Hz)	Typical (dBc/Hz)
10 Hz	—	—	<-73	—
100 Hz	<-89	<-94	—	<-89
1 kHz	<-118	<-122	—	<-119
10 kHz	<-128	<-131	—	<-130
100 kHz	<-125	<-128	—	<-127
1 MHz	<-141	<-144	—	<-143
5 MHz	<-155	<-157	—	<-155
Conditions: **LO YIG Main Coil Drive** property set to Normal.				

LO1 (7.8125 GHz)

Table 51. Phase Noise (dBc/Hz), PXIe-5668 Center Frequency = 3.2 GHz

Offset	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBc/Hz)	Typical (dBc/Hz)	Nominal (dBc/Hz)	Typical (dBc/Hz)
10 Hz	—	—	<-70	—
100 Hz	<-86	<-92	—	<-86
1 kHz	<-115	<-119	—	<-116
10 kHz	<-127	<-130	—	<-129
100 kHz	<-125	<-128	—	<-127
1 MHz	<-141	<-144	—	<-143
5 MHz	<-155	<-157	—	<-155
Conditions: **LO YIG Main Coil Drive** property set to Normal.				

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Figure 14. LO1 Phase and Amplitude Noise (AM, Nominal)[28]

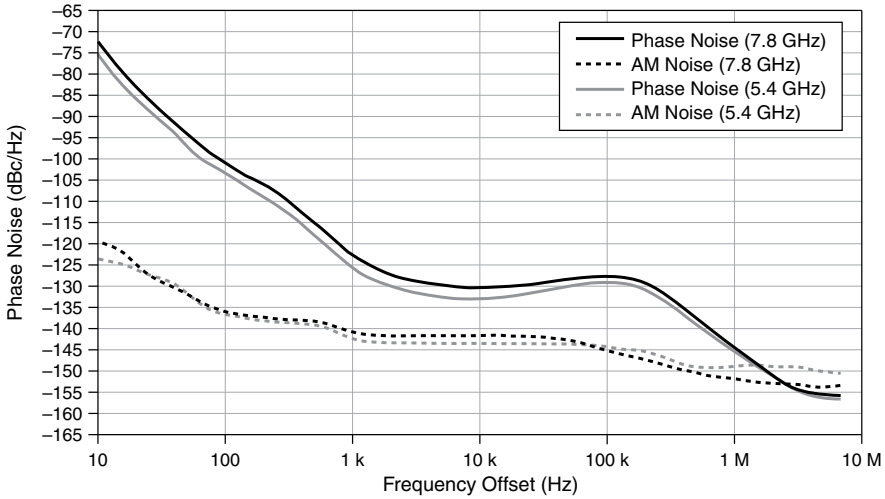
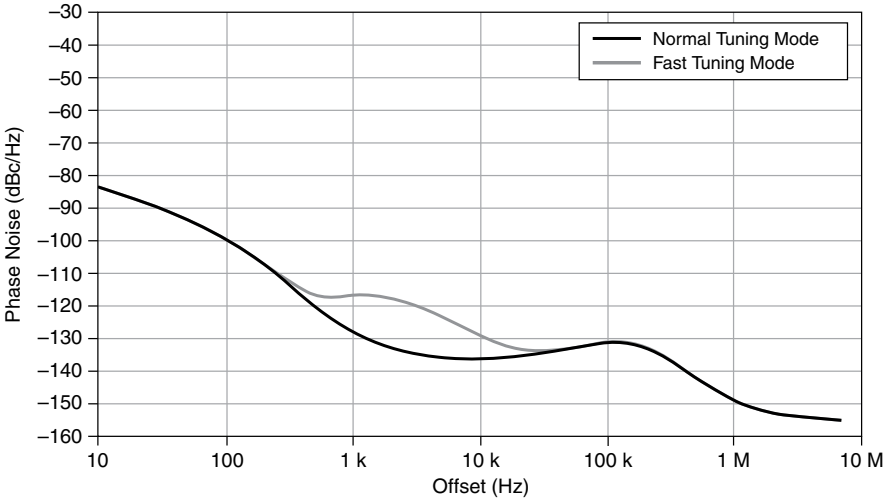


Figure 15. LO1 Phase Noise Measured Performance Comparison, Normal Tuning Versus Fast Tuning Speed[29]



[28] LO1 Noise Sidebands: LO1 = 5.4125 GHz, 7.8125 GHz. Plots of measured LO1 performance (Phase Noise and AM Noise) shown without spurs.

[29] LO1 frequency is 5 GHz. Representative of nominal performance difference across the entire frequency range of LO1 (shown without spurs). Tuning Mode refers to the setting of the **LO YIG Main Coil Drive** property to Fast or Normal.

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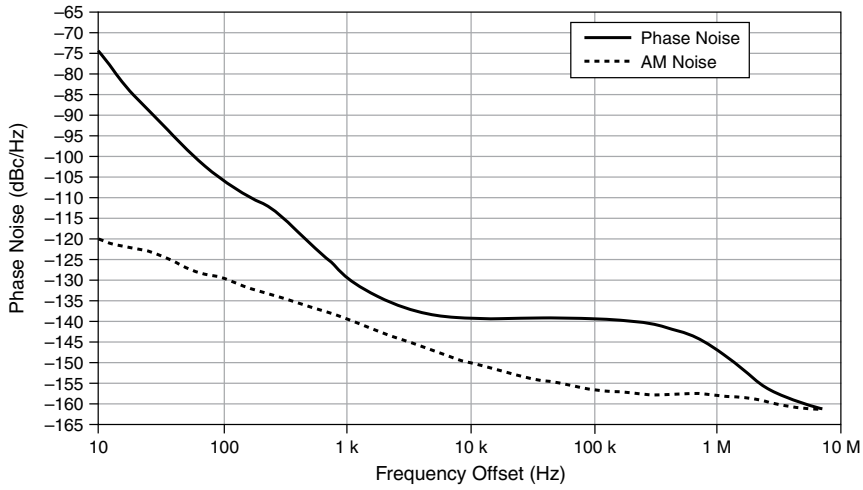
Single Sideband (SSB) Phase Noise (LO2)

LO2 (4 GHz)

Table 52. Noise Density, PXIe-5668 Center Frequencies > 3.6 GHz

Offset	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBc/Hz)	Typical (dBc/Hz)	Nominal (dBc/Hz)	Typical (dBc/Hz)
10 Hz	—	—	<-76	—
100 Hz	<-92	<-97	—	<-92
1 kHz	<-121	<-125	—	<-122
10 kHz	<-134	<-137	—	<-135
100 kHz	<-134	<-137	—	<-135
1 MHz	<-143	<-146	—	<-145
5 MHz	<-155	<-157	—	<-155

Figure 16. LO2 Phase and Amplitude Noise (Nominal)[30]



[30] LO2 = 4.0 GHz. Plots of measured LO2 performance (*Phase Noise* and *AM Noise*) shown without spurs.

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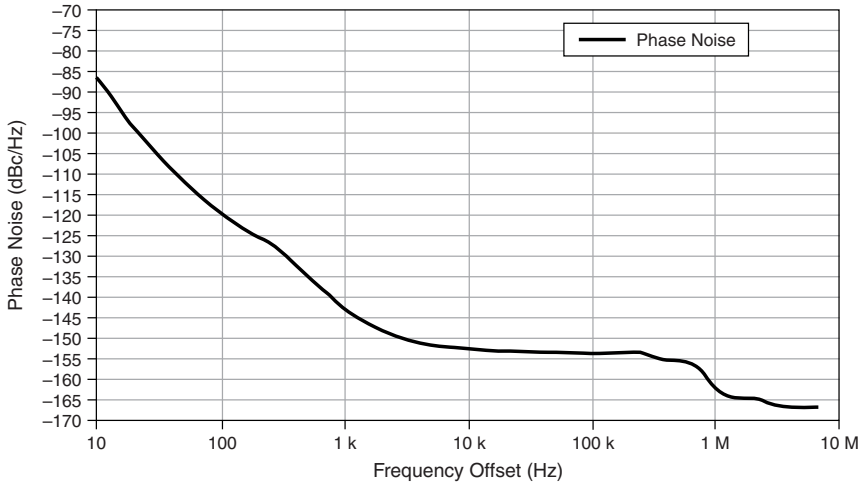
Single Sideband (SSB) Phase Noise (LO3)

LO3 (800 MHz)

Table 53. Noise Density, PXIe-5668 Center Frequencies >3.6 GHz

Offset	23 °C ± 5 °C		0 °C to 55 °C	
	Specification (dBc/Hz)	Typical (dBc/Hz)	Nominal[31] (dBc/Hz)	Typical (dBc/Hz)
10 Hz	—	—	<-90	—
100 Hz	<-104	-111	—	<-106
1 kHz	<-135	-139	—	<-134
10 kHz	<-148	-152	—	<-149
100 kHz	<-149	-153	—	<-150
1 MHz	<-158	-160	—	<-156
5 MHz	<-160	-163	—	<-159

Figure 17. LO3 Phase Noise[32]



[31] When used in a VSA system, the nominal specification for the VSA improves significantly from this value because the VSA uses all the LOs instead of a single LO. The phase noise of other LOs is correlated to the phase noise on LO1 at low offsets, which improves performance of the VSA system.

[32] LO3 = 800 MHz. *Phase Noise* plot of measured LO3 performance shown without spurs.

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PXIe-5653 Frequency Lock Time[33]

Table 54. PXIe-5653 Maximum Lock Time (0 °C to 55 °C)

Frequency Step Size	Fast Tuning Mode[34] (ms)	Normal Tuning Mode[35] (ms)
≤25 MHz	0.85	3
≤50 MHz	1.10	6
≤75 MHz	1.35	7
≤80 MHz	1.35	7
≤90 MHz	1.35	7
≤100 MHz	1.35	7
≤250 MHz	1.80	10
≤500 MHz	6	12
≤1.0 GHz	10	14
≤2.0 GHz	13	17
≤3.0 GHz	15	18
≤5.1 GHz	17	20

PXIe-5653 Frequency Settling Time[36]

[33] PXIe-5653 Frequency Tuning Time consists of *Lock Time + Settling Time to Required Accuracy*. For example, in Fast Configuration mode, a 50 MHz step requires 1.1 ms (the frequency lock time) + 0.75 (the frequency settling time), or 1.85 ms to lock and settle to 0.1 ppm accuracy.

[34] Fast Tuning Mode refers to setting the **LO YIG Main Coil Drive** property to Fast at an accuracy of 1.0×10^{-6} of the final frequency.

[35] Normal Tuning Mode refers to setting the **LO YIG Main Coil Drive** property to Normal at an accuracy of 1.0×10^{-6} of the final frequency.

[36] PXIe-5653 Frequency Tuning Time consists of *Lock Time + Settling Time to Required Accuracy*. For example, in Fast Configuration mode, a 50 MHz step requires 1.1 ms (the frequency lock time) + 0.75 (the frequency settling time), or 1.85 ms to lock and settle to 0.1 ppm accuracy.

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Table 55. PXIe-5668 Maximum Settling Time (0 °C to 55 °C)

Settling Accuracy (Relative to Final Frequency)	Fast Tuning Mode[37] (ms)	Normal Tuning Mode[38] (ms)
1.0×10^{-6}	0.00	0.00
0.1×10^{-6}	0.75	1.00
0.01×10^{-6}	1.60	6.00
0.001×10^{-6}	5	20

PXIe-5606 Downconverter Specifications

Instantaneous Bandwidth

IF passband bandwidth	
IF through path (≥100 MHz)	3 dB (23 °C ± 5 °C, typical)
≥5 MHz	3 dB (23 °C ± 5 °C, typical)
≥300 kHz	3 dB (23 °C ± 5 °C, typical)
RF preselector[39] passband bandwidth	
Preselector enabled (≤65 MHz)	6 dB (23 °C ± 5 °C, typical)

IF Frequencies

Table 56. Nominal PXIe-5668 Downconverter IF Frequencies

RF Center Frequency	IF Signal Path	IF1	IF2	IF3
20 Hz to 3.6 GHz	80 MHz[40]/100 MHz[41]	4.6125 GHz	612.5 MHz	187.5 MHz
	5 MHz	4.6100 GHz	610.0 MHz	190.0 MHz
	300 kHz	4.6010 GHz	601.0 MHz	199.0 MHz
	200 MHz and 320 MHz (device option)	4.730 GHz	730 MHz	—

[37] Fast Tuning Mode refers to setting the **LO YIG Main Coil Drive** property to Fast at an accuracy of 1.0×10^{-6} of the final frequency.
[38] Normal Tuning Mode refers to setting the **LO YIG Main Coil Drive** property to Normal at an accuracy of 1.0×10^{-6} of the final frequency.
[39] Preselector ripple may affect the bandwidth due to passband ripple and modes.
[40] 80 MHz BW option
[41] 200 MHz or 320 MHz BW option

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Table 56. Nominal PXIe-5668 Downconverter IF Frequencies (Continued)

RF Center Frequency	IF Signal Path	IF1	IF2	IF3
>3.6 GHz	80 MHz[40]/100 MHz[41]	612.5 MHz	187.5 MHz	—
	5 MHz	610.0 MHz	190.0 MHz	—
	300 kHz	601.0 MHz	199.0 MHz	—
	200 MHz and 320 MHz (device option)	730 MHz	—	—
	400 MHz and 765 MHz (device option and image selection)	507.5 MHz	—	—

Amplitude Range

The PXIe-5606 amplitude range is the same as the amplitude range specified for the PXIe-5668.

Display Average Noise Level

Preamplifier Disabled

Table 57. PXIe-5606 Downconverter Display Average Noise Level, Preamplifier Disabled (Typical)

Center Frequency	23 °C ± 5 °C (dBm/Hz)	0 °C to 55 °C (dBm/Hz)
20 Hz to 200 kHz	—	-92
>200 kHz to 10 MHz	-153	-152
>10 MHz to 100 MHz	-155	-155
>100 MHz to 300 MHz	-157	-157
>300 MHz to 1.7 GHz	-157	-156
>1.7 GHz to 2.8 GHz	-154	-153
>2.8 GHz to 3.6 GHz	-151	-150
>3.6 GHz to 5 GHz	-158	-157
>5 GHz to 14 GHz	-156	-156
>14 GHz to 17 GHz	-150	-148
>17 GHz to 24 GHz	-154	-152

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Table 57. PXIe-5606 Downconverter Display Average Noise Level, Preamplifier Disabled (Typical) (Continued)

Center Frequency	23 °C ± 5 °C (dBm/Hz)	0 °C to 55 °C (dBm/Hz)
>24 GHz to 26.5 GHz	-150	-149

Note Values based on input terminated, no input signal, 0 dB RF attenuation for center frequency ≥10 MHz, 100 MHz IF filter for center frequency ≥100 MHz, 300 kHz IF filter for center frequency <100 MHz, ≤-50 dBm reference level, and >10 averages. Log average noise level normalized to a 1 Hz noise bandwidth.

Preamplifier Enabled

Table 58. PXIe-5606 Downconverter Display Average Noise Level, Preamplifier Enabled (Typical)

Center Frequency	23 °C ± 5 °C (dBm/Hz)	0 °C to 55 °C (dBm/Hz)
10 MHz to 30 MHz	-167	-166
>30 MHz to 100 MHz	-168	-166
>100 MHz to 300 MHz	-169	-168
>300 MHz to 1.7 GHz	-168	-167
>1.7 GHz to 2.5 GHz	-166	-165
>2.8 GHz to 3.6 GHz	-165	-164

Note Values based on input terminated, no input signal, 0 dB RF attenuation, 100 MHz IF filter for center frequency ≥100 MHz, 300 kHz IF filter for center frequency <100 MHz, ≤-50 dBm reference level, IF through path, and >10 averages. Log average noise level measured in a 1 Hz noise bandwidth using NI-RFSA I/Q acquisition mode.

Preselector (YIG-Tuned Filter) Present and Enabled

Table 59. PXIe-5606 Downconverter Display Average Noise Level, Preselector (YIG-Tuned Filter) Present and Enabled (Typical)

Center Frequency	23 °C ± 5 °C (dBm/Hz)	0 °C to 55 °C (dBm/Hz)
>3.6 GHz to 5 GHz	-152	-152
>5 GHz to 14 GHz	-154	-153
>14 GHz to 17 GHz	-147	-147
>17 GHz to 22 GHz	-150	-149

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Table 59. PXIe-5606 Downconverter Display Average Noise Level, Preselector (YIG-Tuned Filter) Present and Enabled (Typical) (Continued)

Center Frequency	23 °C ± 5 °C (dBm/Hz)	0 °C to 55 °C (dBm/Hz)
>22 GHz to 24 GHz	-148	-147
>24 GHz to 26.5 GHz	-148	-147

Note Values based on input terminated, 0 dB RF attenuation, ≤-50 dBm reference level, 100 MHz IF filter, and >10 averages. Log average noise level normalized to a 1 Hz noise bandwidth.

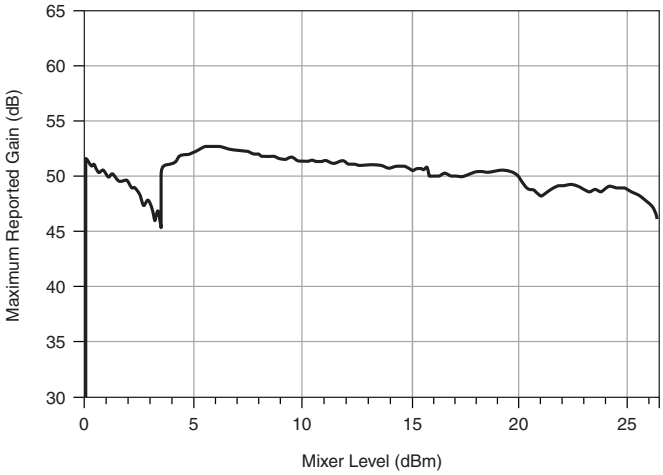
Downconverter Gain Accuracy

(Typical)

The PXIe-5606 gain accuracy after use of the internal self-calibration factor is the same as the amplitude accuracy specification. The receiver that is used with the PXIe-5606 downconverter should have resolution and temperature stability equal to or better than that of the PXIe-5624 digitizer.

Downconverter Conversion Gain

Figure 18. PXIe-5606 Conversion Gain at 100 MHz BW



Spurious Response Level

The PXIe-5606 spurious response level is the same as or better than the PXIe-5668 spurious responses specification when the PXIe-5653 is used as the LO and the PXIe-5624 is used as the digitizer.

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Image and IF Rejection

The PXIe-5606 image and IF rejection are the same as those specified for the PXIe-5668.

Linearity and Dynamic Range Specifications

The PXIe-5606 linearity (TOI, SHI, two tone compression) and dynamic range specifications are the same as or better than the PXIe-5668 linearity and dynamic range specifications.

Measurement Configuration Speed

The PXIe-5606 measurement configuration speed specification is the same as or better than the PXIe-5668 measurement speed specification when the PXIe-5653 is used as the LO.

PXIe-5624 IF Digitizer Module Specifications

IF IN

Connector	SMA female
Input impedance	50 Ω, nominal
Coupling	AC
Absolute maximum input power	20 dBm, continuous wave (CW) RMS
Input return loss/VSWR	>15 dB/1.43:1[42], typical

PFI 0 (Programmable Function Interface)

Connector	SMA female
Voltage levels	
Absolute maximum input range	-0.5 V to 5.5 V
V_{IL}	0.8 V
V_{IH}	2.0 V
V_{OL}	0.2 V with 100 µA load
V_{OH}	2.9 V with 100 µA load
Recommended operating voltage	0 V to 3.3 V
Input impedance	10 kΩ, nominal
Output impedance	50 Ω, nominal

[42] 5 MHz to 2 GHz.

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Maximum DC drive strength	24 mA
Minimum required direction change latency	60 ns + 1 clock cycle[43]

CLK IN

Connector	SMA female
Frequency	
Sample Clock	4 GHz, 2 GHz
Reference Clock	100 MHz, 10 MHz
Tolerance	±50 ppm
Amplitude	
10 MHz and 100 MHz Reference Clocks	-3 dBm to 15 dBm[44]
2 GHz and 4 GHz Sample Clocks	-5 dBm to 10 dBm
Input impedance	50 Ω, nominal
Coupling	AC

CLK OUT

Connector	SMA female
Frequency	
Sample Clock	2 GHz
Reference Clock	100 MHz, 10 MHz[45]
Tolerance	Same as Reference Clock or Sample Clock source[46]
Amplitude, typical	
Reference Clock (CLK IN)	CLK IN input power + 3 dB, nominal
Reference Clock (PXIe_CLK100)	7.5 dBm
Sample Clock	5 dBm
Output impedance	50 Ω, nominal
Coupling	AC

[43] *Clock cycle* refers to the FPGA clock domain used for direction control.
[44] Optimal performance for a 10 MHz Reference Clock is greater than 4 dBm.
[45] 100 MHz available when locking to CLK IN or PXIe_CLK100. 10 MHz available when locking to external front panel CLK IN.
[46] Refer to the *Internal Frequency Reference* section for more information about internal frequency reference accuracy specifications.

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Environment

Maximum altitude	2,000 m (800 mbar) (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. 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.)

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.)[47]
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.)

[47] Internal mechanical attenuator may change states during shock application. Use instrument preset or reset attenuator to return to normal operating state.

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Physical Characteristics

Table 60. PXIe-5668 Module Characteristics

Module	Dimensions	Weight	
		Grams	Ounces
PXIe-5606 RF Signal Downconverter	3U, 4 slots	1,880.0	63.3
PXIe-5624 IF Digitizer	3U, 1 slot	490.0	17.3
PXIe-5653 RF Analog Signal Generator	3U, 2 slots	1,270.0	44.8
PXIe-5668 Vector Signal Analyzer	3U, 7 slots	3,640.0	128.4

Caution Clean the hardware with a soft, nonmetallic brush. Make sure that the hardware is completely dry and free from contaminants before returning it to service.

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
- 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

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- 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 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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