
PXle-5820

Specifications

2025-07-23



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Definitions

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

Characteristics 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% ($\approx 2\sigma$) 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 range of 0 °C to 45 °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.
- Calibration IP is used properly during the creation of custom FPGA bitfiles.

Typical specifications do not include measurement uncertainty and are measured immediately after a device self-calibration is performed.

Unless otherwise noted, specifications assume the PXle-5820 is configured in the following default mode of operation:

- I/Q IN voltage range: 2.0 V_{pk-pk} differential
- I/Q IN common-mode voltage: 0 V
- I/Q OUT voltage range: 1.0 V_{pk-pk} differential
- I/Q OUT common-mode voltage: 0 V
- I/Q OUT load impedance: 100 Ω differential



Note Within the specifications, ***self-calibration °C*** refers to the recorded device temperature of the last successful self-calibration. You can read the self-calibration temperature from the device using the appropriate software functions.

PXle-5820 Pinout

Use the pinout to connect to terminals on the PXle-5820 .

Figure 1. PXle-5820 Digital I/O Connector Pinout

Reserved	A1	B1	5.0 V
GND	A2	B2	GND
MGT Rx+ 0	A3	B3	MGT Tx+ 0
MGT Rx– 0	A4	B4	MGT Tx– 0
GND	A5	B5	GND
MGT Rx+ 1	A6	B6	MGT Tx+ 1
MGT Rx– 1	A7	B7	MGT Tx– 1
GND	A8	B8	GND
DIO 4	A9	B9	DIO 6
DIO 5	A10	B10	DIO 7
GND	A11	B11	GND
MGT REF+ / DIO 0	A12	B12	DIO 2
MGT REF– / DIO 1	A13	B13	DIO 3
GND	A14	B14	GND
MGT Rx+ 2	A15	B15	MGT Tx+ 2
MGT Rx– 2	A16	B16	MGT Tx– 2
GND	A17	B17	GND
MGT Rx+ 3	A18	B18	MGT Tx+ 3
MGT Rx– 3	A19	B19	MGT Tx– 3
GND	A20	B20	GND
5.0 V	A21	B21	Reserved

Table 1. PXle-5820 Digital I/O Signal Descriptions

Signal	Type	Direction
MGT Tx± <3..0>	Xilinx Virtex-7 GTH	Output
MGT Rx± <3..0>	Xilinx Virtex-7 GTH	Input
MGT REF±	Differential	Input
DIO <1..0>	Single-ended	Bidirectional
DIO <7..2>	Single-ended	Bidirectional
5.0 V	DC	Output
GND	Ground	—



Note DIO <1..0> pins are multiplexed with MGT REF±.

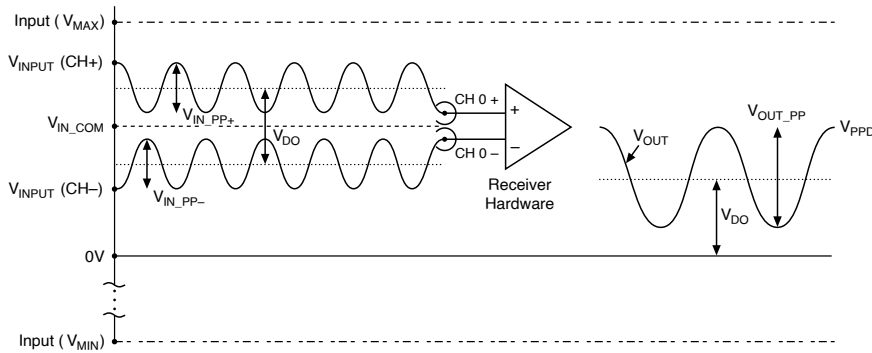
Differential Operation

The I/Q inputs and outputs of the PXle-5820 support differential operation. This section explains some of the fundamental analog signal processing that occurs in the first stages of the I/Q receiver.

A differential signal system has a positive component ($V_{\text{INPUT}}(\text{CH}+)$) and a negative component ($V_{\text{INPUT}}(\text{CH}-)$). The differential signal can have a common-mode offset ($V_{\text{IN_COM}}$) shared by both $V_{\text{INPUT}}(\text{CH}+)$ and $V_{\text{INPUT}}(\text{CH}-)$. The differential input signal is superimposed on the common-mode offset. The input circuitry rejects the input common-mode offset signal.

In a differential system, any noise present on both $V_{\text{INPUT}}(\text{CH}+)$ and $V_{\text{INPUT}}(\text{CH}-)$ gets rejected. Differential systems also double the dynamic range compared to a single-ended system with the same voltage swing. The following figure illustrates the key concepts of differential offset and common-mode offset associated with a differential system.

Figure 2. Definition of Common-Mode Offset and Differential Offset



where

- $V_{\text{IN_PP}+}$ represents the peak-to-peak amplitude of the positive AC input signal
- $V_{\text{IN_PP}-}$ represents the peak-to-peak amplitude of the negative AC input signal
- V_{DO} represents the differential offset voltage
- $V_{\text{IN_COM}}$ represents the common-mode offset voltage
- $V_{\text{OUT_PP}}$ represents the peak-to-peak amplitude of the output signal

In the previous figure, the input common-mode voltage is not present after the first stage of the receiver system. The signal remaining at the output of the receiver circuitry is the signal of interest.



Note The differential signal can have an offset between $V_{\text{INPUT}}(\text{CH}+)$ and $V_{\text{INPUT}}(\text{CH}-)$. This is known as the **differential offset** and is retained by the receiver circuitry.

In an I/Q analyzer, a differential offset can occur because of LO leakage or harmonics. In the case of I/Q generation, a differential offset can cause spurs and magnitude error.

In a phase-balanced differential system, the peak-to-peak amplitude of the positive AC input signal ($V_{\text{IN_PP}+}$) is equal to the peak-to-peak amplitude of the negative AC input signal ($V_{\text{IN_PP}-}$). The AC peak-to-peak amplitude of the output signal is the sum of $V_{\text{IN_PP}+}$ and $V_{\text{IN_PP}-}$. A more general definition for the output voltage regardless of phase is the difference between $V_{\text{IN_PP}+}$ and $V_{\text{IN_PP}-}$ described by the following equation:

$$V_{\text{OUT}} = (V_{\text{INPUT}}(\text{CH}+)) - (V_{\text{INPUT}}(\text{CH}-))$$

The common-mode offset, which represents the rejected component common to both signals, is described by the following equation:

$$V_{IN_COM} = [(V_{INPUT}(CH+)) + (V_{INPUT}(CH-))]/2$$

Frequency

Complex I/Q equalized bandwidth ¹	1 GHz
Frequency Range	DC-500 MHz



Note To operate the device in complex baseband mode, configure each channel with identical ranges and termination. Complex baseband mode requires two input signals that are 90° out of phase.

Internal Frequency Reference

Initial adjustment accuracy	$\pm 200 \times 10^{-9}$
Temperature stability	$\pm 1 \times 10^{-6}$, maximum
Aging	$\pm 1 \times 10^{-6}$ per year, maximum
Accuracy	<i>Initial adjustment accuracy $\pm$ Aging $\pm$ Temperature stability</i>

1. Complex equalized bandwidth is the combined bandwidth of I and Q channels. Valid only when using identical gain and termination settings for each I/Q channel.

I/Q Input

I/Q Input Common-Mode Accuracy

Table 2. I/Q Input Common-Mode Accuracy, Typical

Common-Mode (V)	Accuracy (mV) at 23 °C
-0.25 to 1.50	±2.5
Conditions: Measured with a DMM. Common-mode offset is not adjusted during self-calibration. Valid for vertical ranges between 0.1 V _{pp} and 2.0 V _{pp} , differential. Measured with both input terminals terminated to ground through a high impedance >1 MΩ.	

I/Q Input DC Offset

Table 3. I/Q Input Differential DC Offset Error, Typical

Reference Location	DC Offset at 23 °C ± 5 °C
At ADC	<-57 dBFS
At connector	<10 mV
Conditions: Terminated with 100 Ω differential impedance.	

I/Q Input Absolute AC Gain Accuracy

Table 4. I/Q Input Absolute AC Gain Accuracy (dB)

Input Vertical Range (V _{pp} , Differential)	23 °C ± 5 °C	0 °C to 45 °C
0.5 to 4.0	±0.57	±0.71
	±0.15, typical	±0.28, typical
1.0 to 4.0	±0.44	±0.57
Conditions: Valid for all common-mode voltages. Measured with 10 MHz CW tone from a 100 Ω differential source.		

Input Vertical Range (V_{pp}, Differential)	23 °C ± 5 °C	0 °C to 45 °C
This specification is valid only when the module is operating within the specified ambient temperature range and within ±5 °C from the last self-calibration temperature, as indicated by the niRFSA Device Temperature property or NIRFSA_ATTR_DEVICE_TEMPERATURE attribute.		

I/Q Input Frequency Response

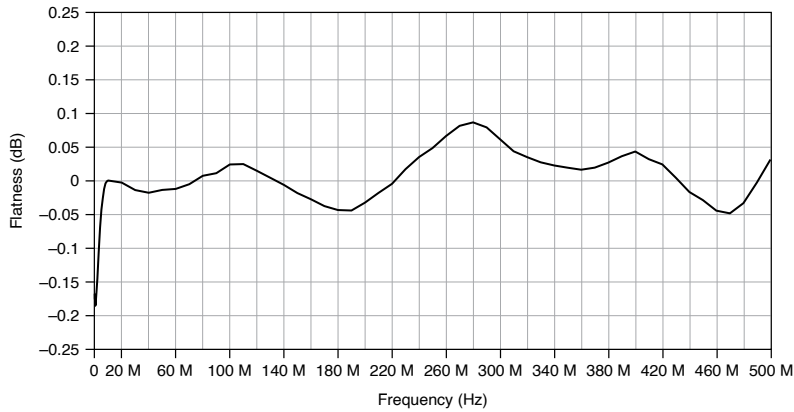
Table 5. I/Q Input Frequency Response² (dB)

Frequency	Input Vertical Range (V_{pp} , Differential)	23 °C ± 5 °C	0 °C to 45 °C
100 kHz to 100 MHz	0.5 to 4.0	±0.31, typical	±0.36, typical
		±0.82	±0.92
	1.0 to 4.0	±0.67	±0.77
100 kHz to 250 MHz	0.5 to 4.0	±0.31, typical	±0.36, typical
		±0.82	±0.97
	1.0 to 4.0	±0.67	±0.83
100 kHz to 500 MHz	0.5 to 4.0	±0.31, typical	±0.62, typical
		±0.82	±1.22
	1.0 to 4.0	±0.68	±1.10
10 MHz to 250 MHz	0.5 to 4.0	±0.10, typical	±0.28, typical
10 MHz to 500 MHz		±0.25, typical	±0.62, typical

Conditions: Valid for all common-mode voltages. Referenced to 10 MHz.

This specification is the individual I or Q channel flatness and is valid only when the module is operating within the specified ambient temperature range and within ±5 °C from the last self-calibration temperature, as indicated by the niRFSA Device Temperature property or the NIRFSA_ATTR_DEVICE_TEMPERATURE attribute.

- Referenced to 10 MHz. Digital equalization enabled. Valid only when using identical gain and termination settings for each I/Q channel.

Figure 3. I/Q Input Frequency Response, Nominal³

I/Q Input Settling Time

Table 6. I/Q Input Amplitude Settling Times, Nominal

Proximity to Final Settled Value (dB)	Settling Time (μ s)
0.5	9
0.1	100
0.05	100
0.01	100

Nominal common-mode voltage settling time (0.01 dB) ⁴	1.2 ms
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I/Q Input Average Noise Density

Table 7. I/Q Average Input Noise Density, Typical

Input Vertical Range (V_{pp} , Differential)	dBm/Hz	dBFs/Hz
0.5	-152	-149
1	-143	-146
2	-141	-149
3	-140	-150

3. Measured at 23 °C with 0 V common-mode and 1 V_{pp} vertical range, differential.

4. Nominal settling time is for max common-mode change.

Input Vertical Range (V_{pp} , Differential)	dBm/Hz	dBFS/Hz
Conditions: Terminated with a 100 Ω differential impedance.		

Figure 4. Input Average Noise Density vs. Linear Frequency (dBFS/Hz), Nominal ⁵

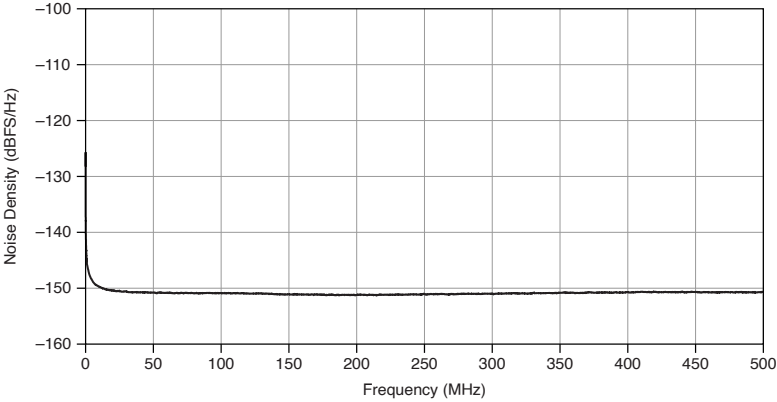
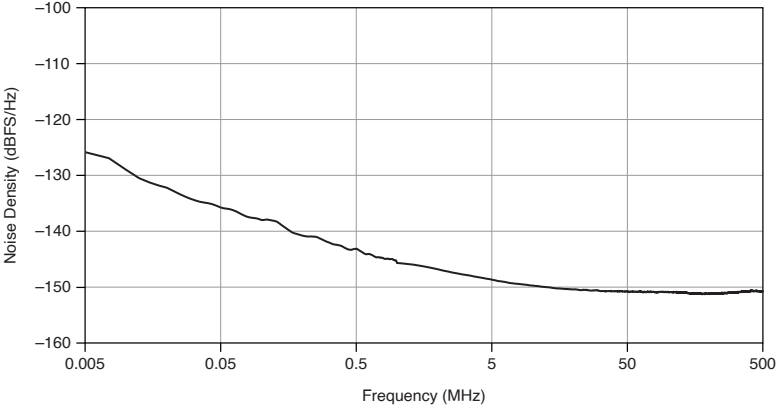


Figure 5. Input Average Noise Density vs. Log Frequency (dBFS/Hz), Nominal ⁶



I/Q Input Spectral Characteristics

Harmonics⁷

Table 8. I/Q Input I Channel Highest Harmonic Spur Level (dBc)

Input Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-74	-78	-76	-80
1	-75	-80	-76	-83

5. Terminated with a 100 Ω differential impedance. Linear scale used for frequency axis.
6. Terminated with a 100 Ω differential impedance. Log scale used for frequency axis.
7. Conditions: Measured with a -2 dBFS CW tone.

Input Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
2	-76	-81	-73	-80
3	-78	-80	-73	-79

Table 9. I/Q Input Q Channel Highest Harmonic Spur Level (dBc)

Input Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-78	-81	-78	-81
1	-80	-85	-82	-86
2	-79	-82	-80	-85
3	-77	-80	-79	-84

Table 10. I/Q Input I Channel THD (dBc)

Input Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-74	-77	-75	-79
1	-75	-80	-75	-82
2	-76	-80	-73	-79
3	-77	-79	-73	-79

Table 11. I/Q Input Q Channel THD (dBc)

Input Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-76	-79	-77	-81
1	-80	-84	-81	-85
2	-79	-81	-79	-84
3	-76	-79	-78	-83

Table 12. I/Q Input Second Harmonic (dBc), Nominal

Input Vertical Range (V _{pp} , Differential)	10 MHz	100 MHz
0.5	-89	-89
1	-89	-88
2	-89	-89
3	-89	-88

Table 13. I/Q Input Third Harmonic (dBc), Nominal

Input Vertical Range (V _{pp} , Differential)	10 MHz	100 MHz
0.5	-88	-91
1	-89	-89
2	-86	-85
3	-86	-84

Nonharmonics⁸

Table 14. I/Q Input Nonharmonics (dBc)

Input Vertical Range (V _{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-80	-82	-79	-81
1	-79	-81	-79	-81
2	-80	-81	-79	-81
3	-80	-81	-80	-82

8. Conditions: Measured with a -2 dBFS CW tone.

I/Q Output

I/Q Output Common-Mode Accuracy

Table 15. I/Q Output Common-Mode Accuracy, Typical

Common-Mode (V)	Accuracy (mV) at 23 °C
-0.25 to 1.50	±2
Conditions: Measured with a DMM. Common-mode offset is not adjusted during self-calibration. Valid for vertical ranges between 0.1 V _{pp} and 2.0 V _{pp} , differential. Measured with both output terminals terminated to ground through a high impedance >1 MΩ.	

I/Q Output DC Offset

Table 16. I/Q Output Differential DC Offset Error⁹ (dBr), Typical

Temperature Range	I/Q Output DC Offset Error
23 °C ± 5 °C	-60
dBr is dB relative to the peak to peak output voltage setting (V _{pp} , differential).	

I/Q Output Absolute AC Gain Accuracy

Table 17. I/Q Output Absolute AC Gain Accuracy (dB)

Output Vertical Range (V _{pp} , Differential)	23 °C ± 5 °C	0 °C ± 45 °C
0.25 to 2.0	±0.43	±0.68
	±0.10, typical	±0.35, typical
Conditions: Valid for all common-mode voltages. 10 MHz CW tone into a 100 Ω differential load. This specification is valid only when the module is operating within the specified ambient temperature range and within ±5 °C from the last self-calibration temperature, as indicated by the niRFSG Device Temperature property or the NIRFSA_ATTR_DEVICE_TEMPERATURE attribute.		

9. Conditions: 100 Ω differential load.

I/Q Output Frequency Response

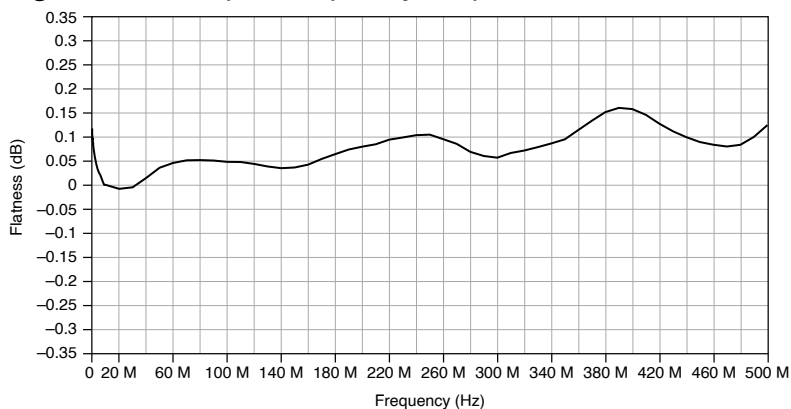
Table 18. I/Q Output Frequency Response (dB)

Frequency Range	Output Vertical Range (V_{pp} , Differential)	23 °C $\pm$ 5 °C	0 °C to 45 °C
100 kHz to 100 MHz	0.25 to 2.0	± 0.17 , typical	± 0.24 , typical
		± 0.51	± 0.61
	0.50 to 2.0	± 0.44	± 0.54
100 kHz to 250 MHz	0.25 to 2.0	± 0.17 , typical	± 0.25 , typical
		± 0.57	± 0.69
	0.50 to 2.0	± 0.55	± 0.68
100 kHz to 500 MHz	0.25 to 2.0	± 0.18 , typical	± 0.36 , typical
		± 0.65	± 0.83
	0.50 to 2.0	± 0.59	± 0.80

Conditions: Valid for all common-mode voltages. Referenced to 10 MHz.

This specification is the individual I or Q channel flatness and is valid only when the module is operating within the specified ambient temperature range and within ± 5 °C from the last self-calibration temperature, as indicated by the niRFSG Device Temperature property or the NIRFSA_ATTR_DEVICE_TEMPERATURE attribute.

Figure 6. I/Q Output Frequency Response, Nominal¹⁰



10. Measured at 23 °C with 0 V common-mode and 1 V_{pp} vertical range, differential.

I/Q Output Settling Time

Table 19. I/Q Output Nominal Amplitude Settling Times

Proximity to Final Settled Value (dB)	Settling Time (us)
0.5	9
0.1	100
0.05	100
0.01	100

Nominal common-mode settling time (0.01 dB) ¹¹	1.2 ms
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I/Q Output Average Noise Density

Table 20. I/Q Average Output Noise Density, Typical

Output Vertical Range (V _{pp} , Differential)	dBm/Hz	dBFS/Hz
0.5	-152	-147
1	-154	-155
2	-156	-162
Conditions: Terminated with a 100 Ω differential impedance.		

I/Q Output Spectral Characteristics

Harmonics¹²

Table 21. I/Q Output I or Q Channel Highest Harmonic Spur Level (dBc)

Output Vertical Range (V _{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-77	-80	-70	-74

11. Nominal settling time is for max common-mode voltage change.

12. Conditions: Measured with a -1 dBFS CW tone.

Output Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
1	-78	-80	-69	-74
2	-69	-71	-66	-68

Table 22. I/Q Output I or Q Channel THD (dBc)

Output Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-75	-78	-69	-73
1	-77	-78	-69	-73
2	-69	-70	-65	-67

Table 23. I/Q Output I or Q Channel Second Harmonic (dBc)

Output Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-72	-82	-67	-77
1	-73	-81	-68	-77
2	-74	-82	-66	-76

Table 24. I/Q Output I or Q Channel Third Harmonic (dBc)

Output Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-73	-81	-69	-78
1	-79	-85	-73	-80
2	-72	-75	-65	-71

Nonharmonics¹³

Table 25. I/Q Loopback Nonharmonics

Output Vertical Range (V_{pp} , Differential)	10 MHz		100 MHz	
	Typical	Nominal	Typical	Nominal
0.5	-76	-77	-75	-77
1	-79	-81	-79	-81
2	-80	-82	-79	-81

Additional Performance Information

Image Suppression

Table 26. I/Q Loopback Image Suppression¹⁴ (dBc), Nominal

Complex Bandwidth	Image Suppression
200 MHz	-69
1 GHz	-61
Image suppression is equivalent to or better than the specification at all frequency offsets within the specified bandwidth.	

SINAD and ENOB

Table 27. Input SINAD and ENOB

Real Bandwidth (MHz)	Real SINAD	Real ENOB	Complex SINAD	Complex ENOB
0.5	80.1	13.0	80.5	13.1
1	79.9	13.0	80.4	13.1

13. Conditions: Measured in loopback with a -1 dBFS CW tone. The I/Q input vertical range is set to twice the I/Q output vertical range.
14. Measured at 23 °C. Digital equalization enabled. Valid only when using identical gain and termination settings for each I/Q channel. Measured using short phase matched loopback cables <1 ps.

Real Bandwidth (MHz)	Real SINAD	Real ENOB	Complex SINAD	Complex ENOB
2.5	79.7	13.0	80.3	13.1
5	78.8	12.8	79.4	12.9
10	77.9	12.6	78.4	12.7
20	77.7	12.6	78.3	12.7
100	76.3	12.4	77.4	12.6
500	69.5	11.3	70.6	11.4

Complex equalized bandwidth is the combined bandwidth of I and Q channels.

Table 28. Output SINAD and ENOB

Real Bandwidth (MHz)	Real SINAD	Real ENOB	Complex SINAD	Complex ENOB
0.5	79.3	12.9	80.5	13.1
1	78.7	12.8	80.1	13.0
2.5	75.8	12.3	77.9	12.6
5	76.8	12.5	78.7	12.8
10	75.8	12.3	77.9	12.6
20	74.3	12.0	76.8	12.5
100	69.7	11.3	72.5	11.8
500	63.6	10.3	66.6	10.8

Complex equalized bandwidth is the combined bandwidth of I and Q channels.

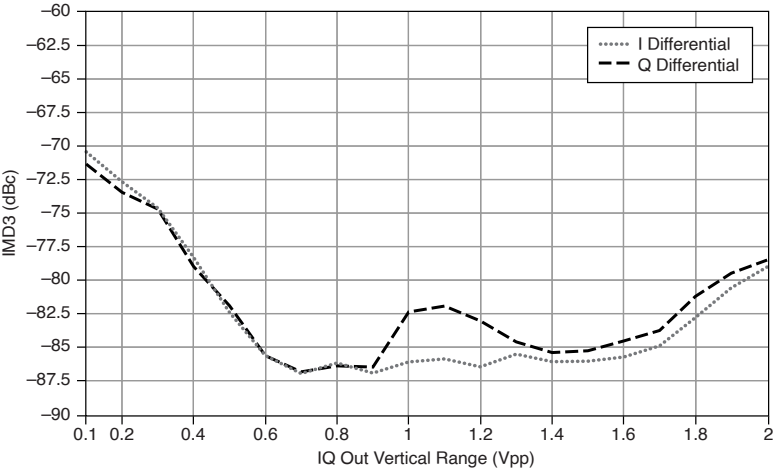
I/Q Loopback Third-Order Intermodulation (IMD3)

Table 29. I/Q Loopback IMD3 (dBc), Typical

Vertical Range (V _{pp} , Differential)	0 °C to 45 °C	
	Center Frequency (MHz)	
	10 MHz	100 MHz
0.25	-77	-77
0.50	-77	-77
1.00	-78	-76
2.00	-73	-72

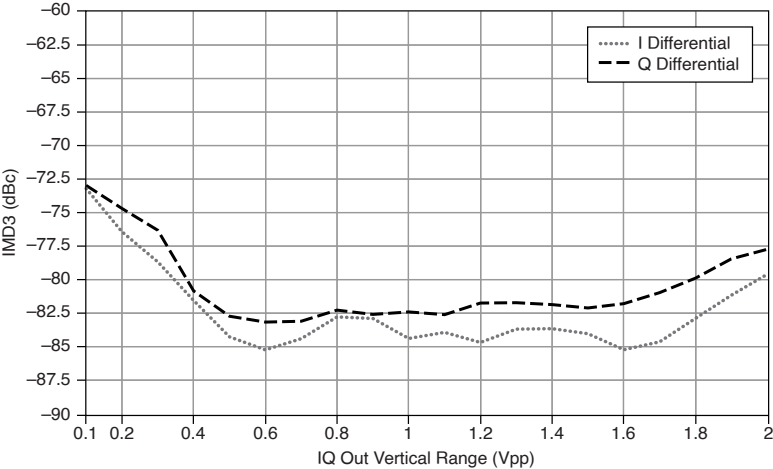
Conditions: Measured in loopback with two-tone stimulus, each tone is -8 dBFS with a 700 kHz spacing between the tones (equally spaced from the center frequency). IQ In and IQ Out ports are configured with the same Vertical Range and with 0 V common-mode.

Figure 7. 10 MHz IMD3, Nominal¹⁵



15. Measured at 23 °C with both I/Q In and I/Q Out common-mode voltage set to 0 V and with I/Q In vertical range set to 2.0 V_{pp}, differential.

Figure 8. 100 MHz IMD3, Nominal¹⁶



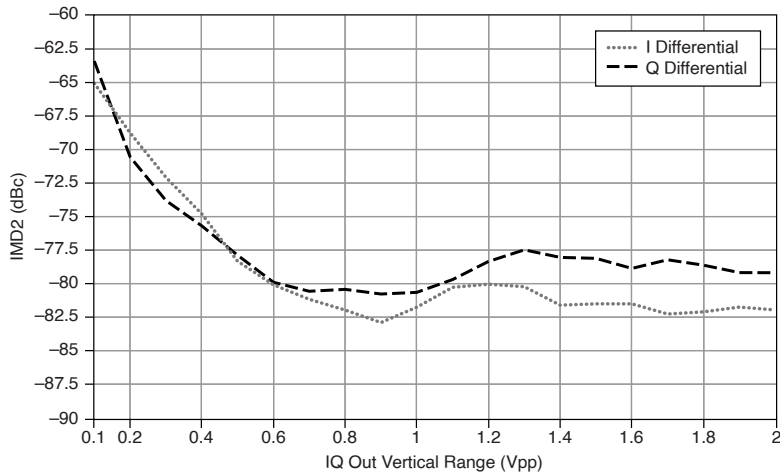
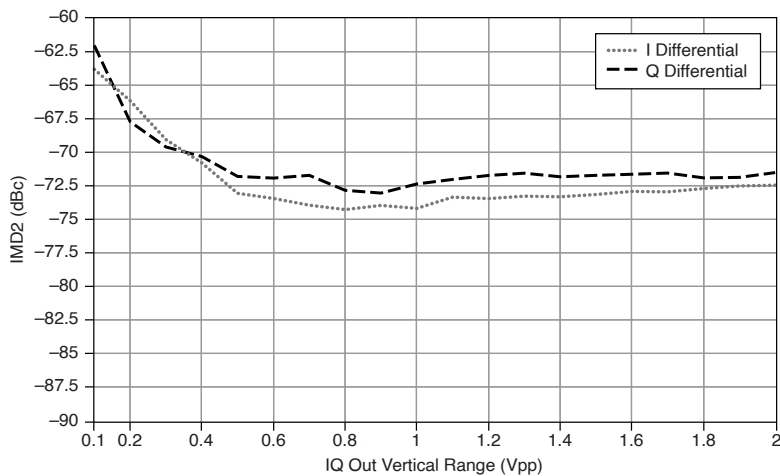
I/Q Loopback Second-Order Intermodulation (IMD2)

Table 30. I/Q Loopback IMD2 (dBc), Typical

Vertical Range (V _{pp} , Differential)	0 °C to 45 °C	
	Center Frequency (MHz)	
	10 MHz	100 MHz
0.25	-74	-68
0.50	-73	-67
1.00	-73	-68
2.00	-73	-67

Conditions: Measured in loopback with two-tone stimulus, each tone is -8 dBFS with a 700 kHz spacing between the tones (equally spaced from the center frequency). IQ In and IQ Out ports are configured with the same Vertical Range and with 0 V common-mode.

16. Measured at 23 °C with both I/Q In and I/Q Out common-mode voltage set to 0 V and with I/Q In vertical range set to 2.0 V_{pp}, differential.

Figure 9. 10 MHz IMD2, Nominal¹⁷Figure 10. 100 MHz IMD2, Nominal¹⁸

Application-Specific Modulation Quality

WLAN 802.11ax

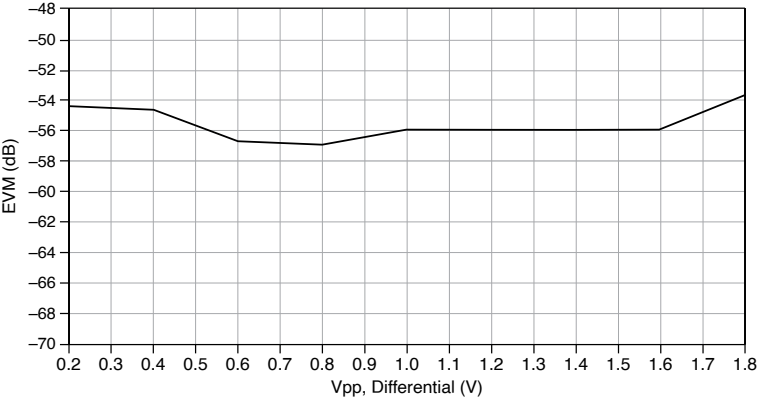
EVM (Bandwidth: 80 MHz) ¹⁹	-50 dB, typical
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17. Measured at 23 °C with both I/Q In and I/Q Out common-mode voltage set to 0 V and with I/Q In vertical range set to 2.0 V_{pp}, differential.

18. Measured at 23 °C with both I/Q In and I/Q Out common-mode voltage set to 0 V and with I/Q In vertical range set to 2.0 V_{pp}, differential.

19. Loopback with phase matched cables <1 ps; transmit power auto-leveled based on real-time average power measurements; MCS=11.

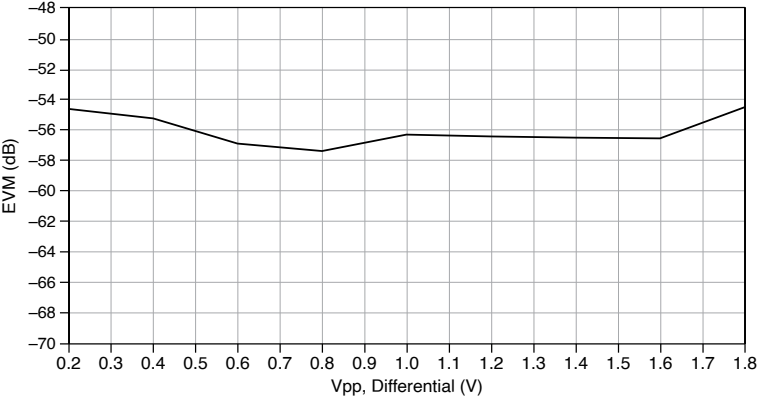
Figure 11. 802.11ax Measured EVM (80 MHz)



WLAN 802.11ac

EVM (Bandwidth: 80 MHz) ²⁰	-50 dB, typical
EVM (Bandwidth: 160 MHz) ²¹	-50 dB, typical

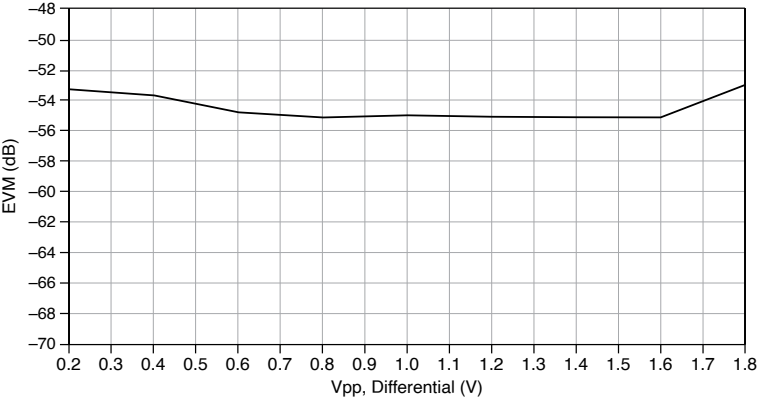
Figure 12. 802.11ac Measured EVM (80 MHz)



20. Loopback with phase matched cables <1 ps; transmit power auto-leveled based on real-time average power measurements; MCS=11.

21. Loopback with phase matched cables <1 ps; transmit power auto-leveled based on real-time average power measurements; MCS=11.

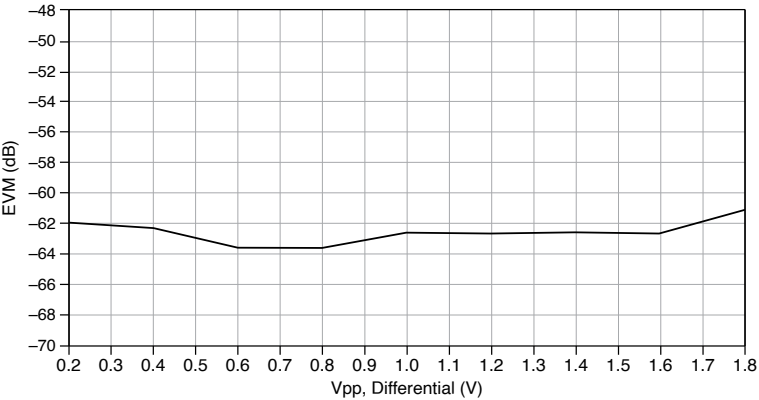
Figure 13. 802.11ac Measured EVM (160 MHz)



LTE

EVM (Bandwidth: 20 MHz) ²²	-58 dB, typical
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Figure 14. LTE Measured EVM (20 MHz)



Baseband Characteristics

Analog-to-digital converters (ADCs)	
I/Q data rate ²³	19 kS/s to 1.25 GS/s
Digital-to-analog converters (DACs)	

22. Loopback with phase matched cables <1 ps; transmit power auto-leveled based on real-time average power measurements.

23. I/Q data rates lower than 1.25 GS/s are achieved using fractional decimation.

I/Q data rate ²⁴	19 kS/s to 1.25 GS/s
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Onboard FPGA

FPGA	Xilinx Virtex-7 X690T
LUTs	433,200
Flip-flops	866,400
DSP48 slices	3,600
Embedded block RAM	52.9 Mbits
Data transfers	DMA, interrupts, programmed I/O
Number of DMA channels	56

Onboard DRAM

Memory size	2 banks, 2 GB per bank
Theoretical maximum data rate	12 GB/s per bank

24. I/Q data rates lower than 1.25 GS/s are achieved using fractional interpolation.

Onboard SRAM

Memory size	2 MB
Maximum data rate (read)	31 MB/s
Maximum data rate (write)	29 MB/s

Front Panel I/O

I/Q IN 0

Connectors	MMPX (female)
Input coupling, per terminal	DC
Input type	Differential
Number of channels	2

Vertical Range

Input voltage range per I/Q input pin ²⁵ (no damage)	-3 V to 5 V
Common-mode range ²⁶	-0.25 V to 1.5 V

25. Common-mode voltage plus peak AC voltage.

26. Valid for all Vpp differential levels with a 100 Ω differential source.

Maximum vertical range	4 V _{pp} , differential
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Impedance

DC differential input impedance	100 ± 10 Ω, typical
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Figure 15. I/Q Input Impedance, Nominal

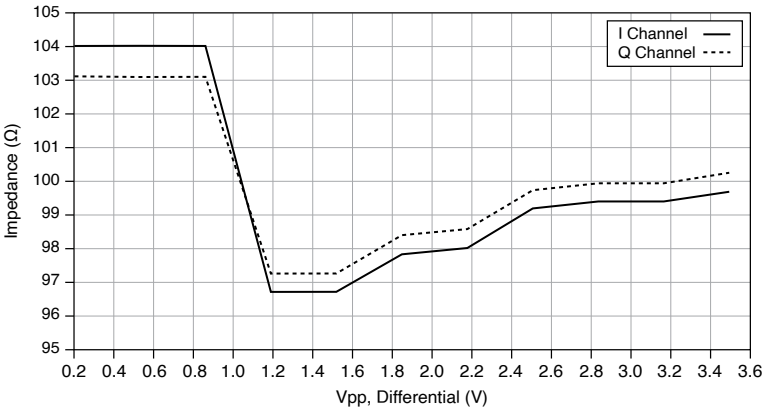
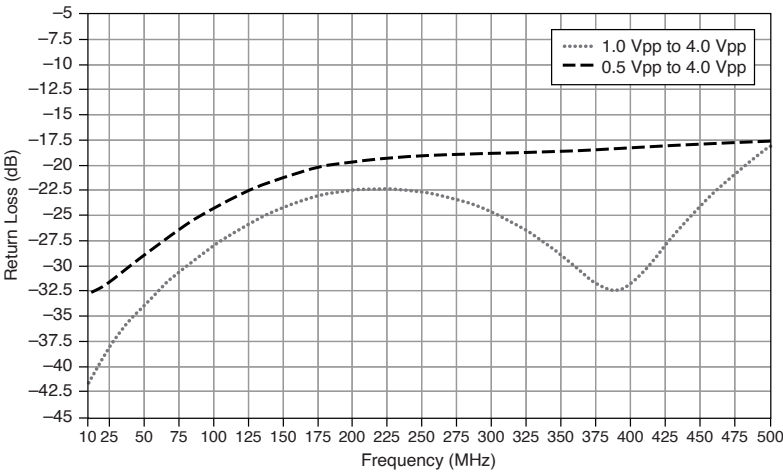


Figure 16. I/Q Input Differential Return Loss, Nominal



I/Q OUT 0

Connectors	MMPX (female)
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Output coupling, per terminal	DC
Output type	differential
Number of channels	2

Vertical Range

Maximum voltage range per I/Q output pin (no damage)	$V_{com} \pm 3.5 \text{ V}$
Common-mode range ²⁷	-0.25 V to 1.5 V

Table 31. I/Q Output Vertical Range (V_{pp} , Differential)

NI-RFSG Signal Bandwidth Setting (Complex)	Maximum Vertical Range
$\leq 160 \text{ MHz}$	3.4, nominal
$\leq 1 \text{ GHz}$	2, typical
Conditions: Into a 100Ω differential load.	

Impedance

DC differential output impedance	$100 \pm 10 \Omega$, typical
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27. Valid for all V_{pp} , differential levels.

Figure 17. I/Q Output Impedance, Nominal

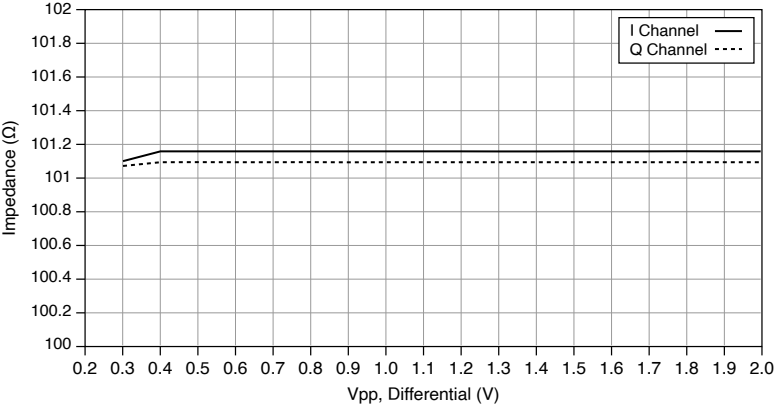
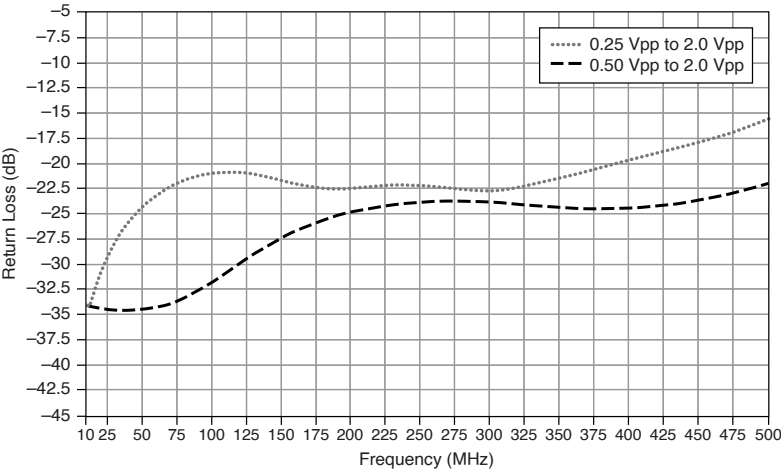


Figure 18. I/Q Output Differential Return Loss, Nominal



REF IN

 **Note** *Frequency Accuracy = Tolerance × Reference Frequency*

Connector	MMPX (female)
Frequency	10 MHz
Tolerance	$\pm 10 \times 10^{-6}$
Amplitude	0.7 V _{pk-pk} to 3.3 V _{pk-pk} into 50 Ω, typical.

Input impedance	50 Ω , nominal
Coupling	AC



Note Jitter performance improves with increased slew rate of input signal.

REF OUT

Connector	MMPX (female)
Frequency	10 MHz, nominal
Amplitude	1.65 V _{pk-pk} into 50 Ω , nominal
Output impedance	50 Ω , nominal
Coupling	AC

PFI 0

Connector	MMPX (female)
Input impedance	10 k Ω , nominal
Output impedance	50 Ω , nominal

Maximum DC drive strength	24 mA
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Note Voltage levels are guaranteed by design through the digital buffer specifications.

Table 32. Voltage Levels

Absolute maximum input range	-0.5 V to 5.5 V
V_{IL} , maximum	0.8 V
V_{IH} , minimum	2.0 V
V_{OL} , maximum	0.2 V with 100 μ A load
V_{OH} , minimum	2.9 V with 100 μ A load

DIGITAL I/O

Connector	Molex Nano-Pitch I/O
5.0 V Power	$\pm 5\%$, 50 mA maximum, nominal

Table 33. DIGITAL I/O Signal Characteristics

Signal	Type	Direction
MGT Tx $\pm$ <3..0>	Xilinx Virtex-7 GTH	Output
MGT Rx $\pm$ <3..0>	Xilinx Virtex-7 GTH	Input
MGT REF $\pm$	Differential	Input
DIO <1..0>	Single-ended	Bidirectional
DIO <7..2>	Single-ended	Bidirectional
5.0 V	DC	Output
GND	Ground	—



Note DIO <1..0> pins are multiplexed with MGT REF±.

Digital I/O High Speed Serial MGT



Note For detailed FPGA and High Speed Serial Link specifications, refer to Xilinx documentation.

Data rate	500 Mbps to 12 Gbps, nominal
Number of Tx channels	4
Number of Rx channels	4
I/O AC coupling capacitor	100 nF

MGT Tx± <3..0> Channels

Minimum differential output voltage	800 mV _{pk-pk} into 100 Ω, nominal
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Conditions: transmitter output swing at maximum setting.

MGT Rx± <3..0> Channels

Table 34. Differential Input Voltage Range

≤6.6 GB/s	150 mV _{pk-pk} to 2,000 mV _{pk-pk} , nominal
>6.6 GB/s	150 mV _{pk-pk} to 1,250 mV _{pk-pk} , nominal

Differential input resistance	100 Ω , nominal
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MGT Reference Clock



Note Internal MGT Reference is derived from the Sample Clock PLL. Available frequencies are 2.5 GHz / N, where $4 \leq N \leq 32$. Set via MGT component level IP (CLIP).

Table 35. Clocking Resources

Data Clock	156.25 MHz
MGT REF $\pm$ Input	60 MHz to 820 MHz, nominal

MGT REF $\pm$ Input

AC coupling capacitors	100 nF
Differential input resistance	100 Ω , nominal
Differential input V_{pk-pk} range	350 mV to 2000 mV, nominal
Absolute maximum input range	-1.25 V to 4.5 V



Note Absolute maximum levels measured at input, prior to AC coupling capacitors.

Figure 19. DIGITAL I/O Nano-Pitch Connector

Reserved	A1	B1	5.0 V
GND	A2	B2	GND
MGT Rx+ 0	A3	B3	MGT Tx+ 0
MGT Rx– 0	A4	B4	MGT Tx– 0
GND	A5	B5	GND
MGT Rx+ 1	A6	B6	MGT Tx+ 1
MGT Rx– 1	A7	B7	MGT Tx– 1
GND	A8	B8	GND
DIO 4	A9	B9	DIO 6
DIO 5	A10	B10	DIO 7
GND	A11	B11	GND
MGT REF+ / DIO 0	A12	B12	DIO 2
MGT REF– / DIO 1	A13	B13	DIO 3
GND	A14	B14	GND
MGT Rx+ 2	A15	B15	MGT Tx+ 2
MGT Rx– 2	A16	B16	MGT Tx– 2
GND	A17	B17	GND
MGT Rx+ 3	A18	B18	MGT Tx+ 3
MGT Rx– 3	A19	B19	MGT Tx– 3
GND	A20	B20	GND
5.0 V	A21	B21	Reserved

Power Requirements

Table 36. Power Requirements

Voltage (V _{DC})	Typical Current (A)
+3.3	3.3
+12	6.0
Power is 83 W, typical. Consumption is from both PXI Express backplane power connectors. Conditions: Simultaneous generation and acquisition using NI-RFSG and NI-RFSA at 1.25 GS/s I/Q rate, 45 °C ambient temperature. Power consumption depends on FPGA image being used.	

Calibration

Interval	1 year
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Physical Characteristics

PXIe-5820 module	3U, two slot, PXI Express module 4.1 cm × 13.0 cm × 21.6 cm 1.6 in. × 5.1 in. × 8.5 in.
Weight	795 g (28.0 oz)

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 45 °C
Relative humidity range	10% to 90%, noncondensing

Storage Environment

Ambient temperature range	-40 °C to 71 °C
Relative humidity range	5% to 95%, noncondensing

Shock and Vibration

Operating shock	30 g peak, half-sine, 11 ms pulse
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 grms
Nonoperating	5 Hz to 500 Hz, 2.4 grms

Compliance and Certifications

Safety Compliance Standards

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 safety certifications, refer to the product label or the [Product Certifications and Declarations](#) 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, certifications, and additional information, refer to the [Product Certifications and Declarations](#) section.

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

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 ***Engineering a Healthy Planet*** 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.

EU and UK Customers

-  **Waste Electrical and Electronic Equipment (WEEE)**—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RoHS**—NI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NI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.)