PXIe-5673E Specifications

2023-08-04

Contents

PXIe-5673E Specifications

These specifications apply to the PXIe-5673E with up to 6.6 GHz frequency and up to 512 MB onboard memory.

The PXIe-5673E comprises the following modules:

- PXIe-5611 IQ Modulator
- PXIe-5450/5451 Waveform Generator
- PXIe-5650/5651/5652 RF Analog Signal Generator (LO source)

There is no physical device named "PXIe-5673E."

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.
- **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 adjustment cycle maintained
- Chassis fan speed set to High
- NI-RFSG instrument driver self-calibration performed after instrument temperature is stable
- 50 Ω terminator connected to the LO OUT front panel connector
- PXIe-5650/5651/5652 onboard Reference Clock used as the PXIe-5673E Reference Clock
- PXIe-5650/5651/5652 in low loop bandwidth mode unless otherwise noted
- Most current product revision

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

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

Frequency Characteristics

Table 1. Device Frequency Range

Frequency Range	PXIe-5673E Part Number
50 MHz to 1.3 GHz	781261-0x
50 MHz to 3.3 GHz	781262-0x
50 MHz to 6.6 GHz	781263-0x

Note PXIe-5673E part numbers vary according to memory size.

Bandwidth

Modulation bandwidth(3 dB double sideband)	>100 MHz

In the following three figures, measured modulation bandwidths show the actual baseband response. The usable bandwidth is limited by the PXIe-5450/5451 I/Q

generator sample rate from -80 MHz to 80 MHz. The shaded area between the solid lines indicates the frequency range covered by this specification.

Figure 1. Measured Modulation Bandwidth at 1 GHz Carrier Frequency

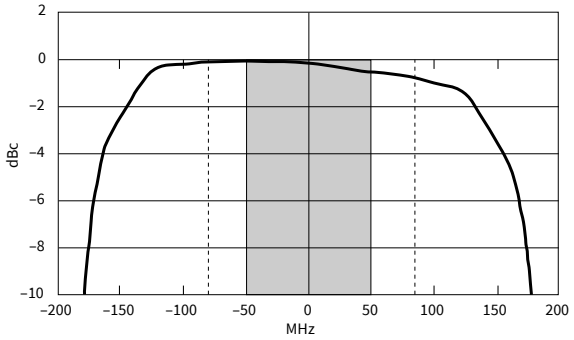


Figure 2. Measured Modulation Bandwidth at 2.4 GHz Carrier Frequency

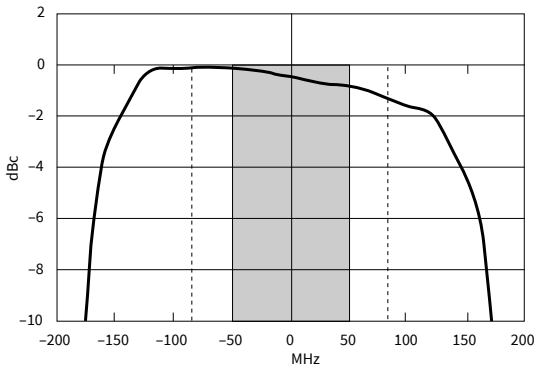
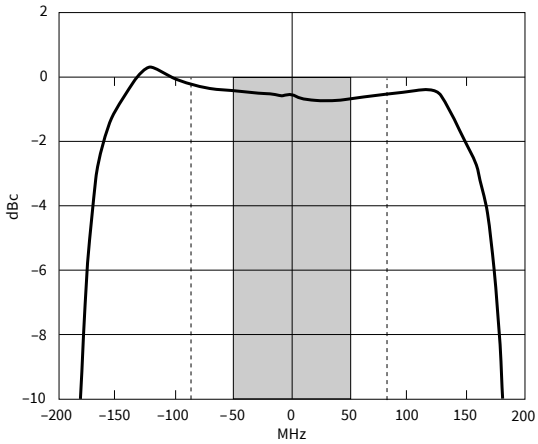


Figure 3. Measured Modulation Bandwidth at 5.8 GHz Carrier Frequency



Data streaming continuous transfer rate	500 MB/s, nominal

Tuning Resolution (PXIe-5650/5651/5652)

≤1.3 GHz	<1 Hz
>1.3 GHz to 3.3 GHz	<2 Hz
>3.3 GHz to 6.6 GHz	<4 Hz

Frequency Settling Time

Table 2. Low Loop Bandwidth

Frequency Settling Time	Median Tuning Speed (ms)	Maximum Tuning Speed (ms)
≤0.1 × 10 of final frequency	1.5	6.5
≤0.01 × 10 of final frequency	6.5	13

Table 3. High Loop Bandwidth

Frequency Settling Time	Median Tuning Speed (ms)	Maximum Tuning Speed (ms)
≤1.0 × 10 of final frequency	0.2	1.0
≤0.1 × 10 of final frequency	0.3	2.0
≤0.01 × 10 of final frequency	1.0	10.0

Internal Frequency Reference (PXIe-5650/5651/5652)

Frequency	10 MHz
Initial accuracy	±3 × 10
Temperature stability (15 °C to 35 °C)	±1 × 10, maximum
Aging per year	±5 × 10, maximum

Internal Reference Output (PXIe-5650/5651/5652REF IN/OUT and REF OUT2 Connectors)

Frequency	10 MHz
Amplitude	1 V_{pk-pk} into 50 Ω
Output impedance	50 Ω
Coupling	AC

External Reference Input (PXIe-5650/5651/5652 REF IN Connector)

Frequency	10 MHz ± 10 ppm
Amplitude	0.2 V_{pk-pk} to 1.5 V_{pk-pk} into 50 Ω
Input impedance	50 Ω
Lock time to external reference	<1 s

External Reference Input (PXIe-5450/5451)

Frequency	10 MHz
Amplitude	1.0 V_{pk-pk} to 5.0 V_{pk-pk} into 50 Ω, nominal
Input impedance	50 Ω

Coupling	AC

External Reference Output (PXIe-5450/5451)

Frequency	10 MHz
10 MHz Reference Clock out	0.7 V_{pk-pk} into 50 Ω, nominal
Output impedance	50 Ω
Coupling	AC

Spectral Purity

Table 4. Single Sideband Phase Noise at 10 kHz Offset

Frequency	Phase Noise (dBc/Hz)
100 MHz	<-111, typical
500 MHz	<-107
1 GHz	<-105
2 GHz	<-98
3 GHz	<-95
4 GHz	<-93
5 GHz	<-90
6.6 GHz	<-84

High loop bandwidth has similar phase noise performance at 10 kHz offset, but this noise level extends to approximately 300 kHz offset before it starts rolling down at approximately 30 dB per decade until it reaches the far-out noise density.

Figure 4. Measured Phase Noise at 1 GHz, 2.4 GHz, and 5.8 GHz Using Internal 10 MHz Reference Clock

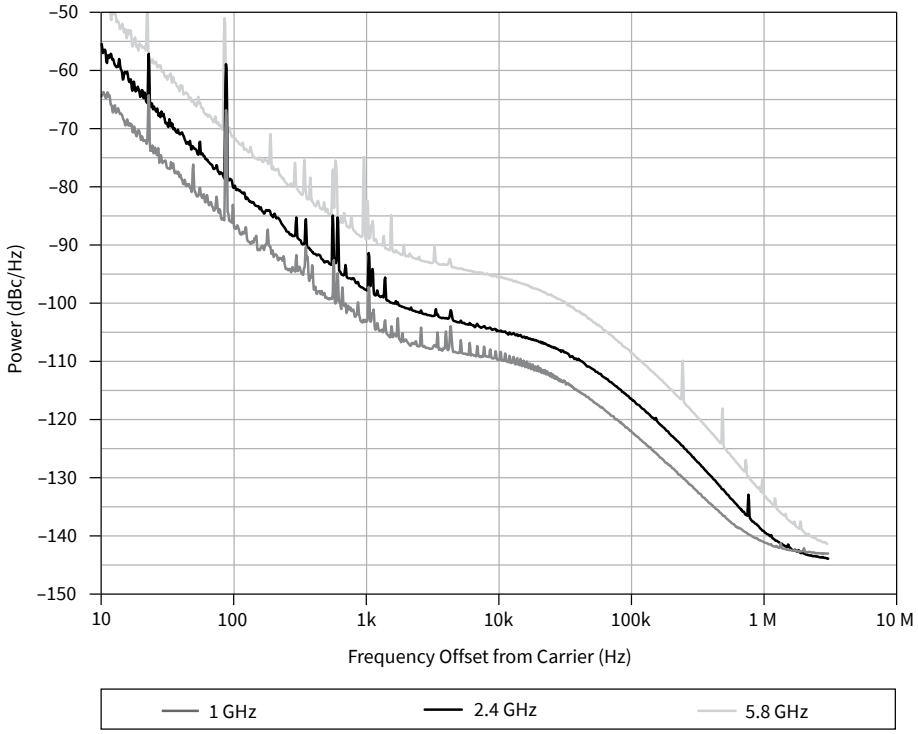
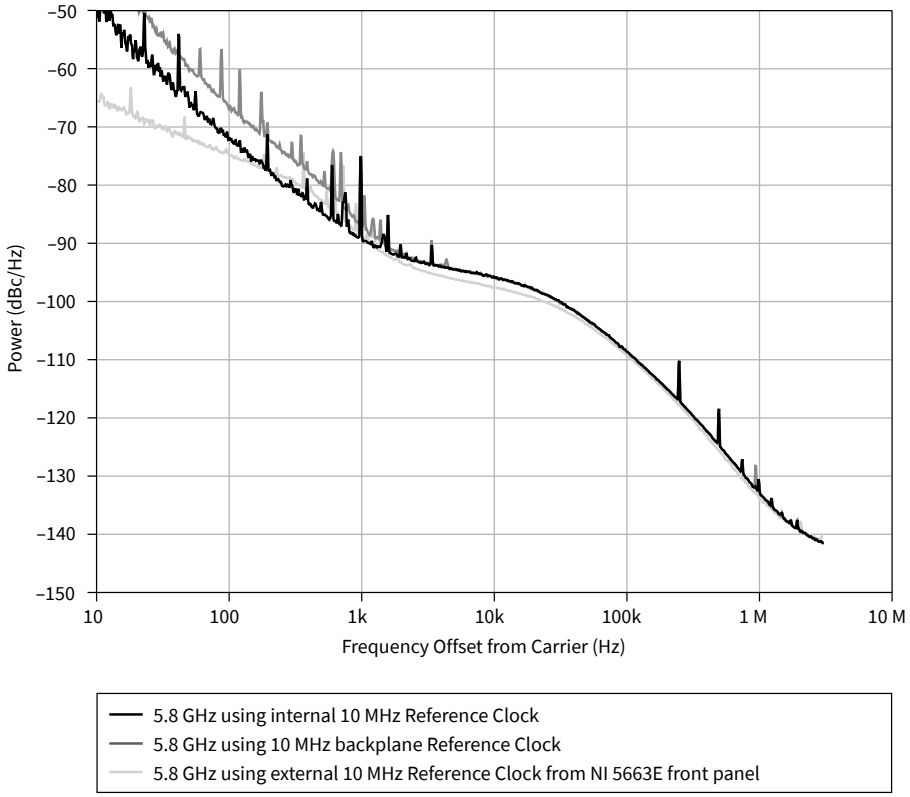
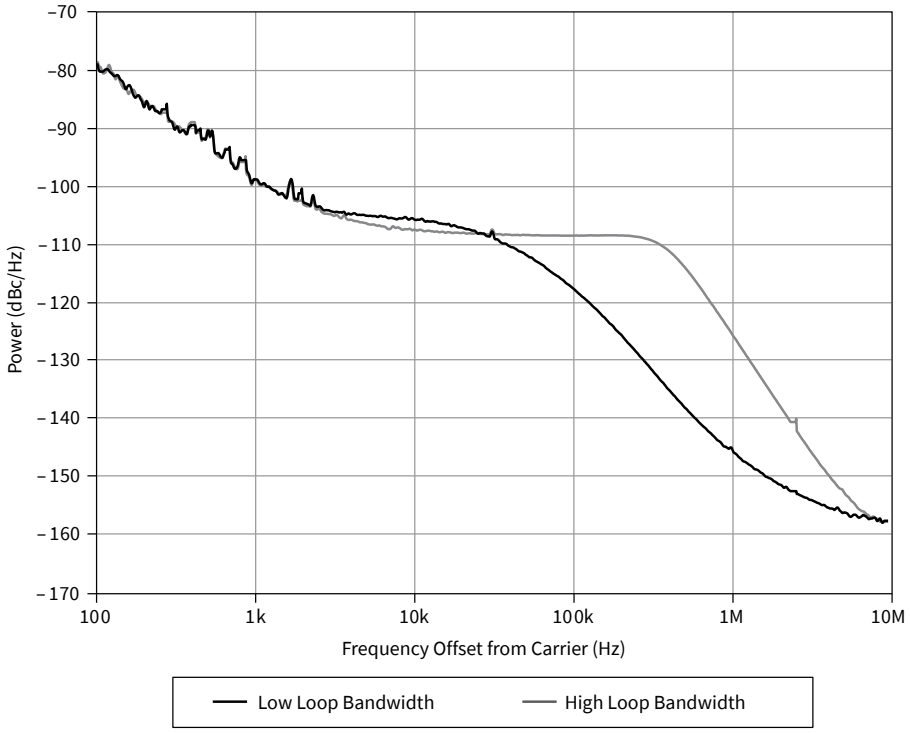


Figure 5. Measured Phase Noise at 5.8 GHz



Residual FM, 1 GHz (continuous wave, 300 Hz to 3 kHz integration bandwidth)	0.8 Hz RMS, typical

Figure 6. Phase Noise at 2.4 GHz in Low and High Loop Bandwidths



Spurious Responses

Harmonics

Harmonics in the following table were measured using a 1 MHz baseband signal. The following specification includes all harmonic levels. Below 100 MHz, harmonic levels are nominally -11 dBc.

Table 5. Harmonics

Carrier Frequency	Specification (dBc)	Typical (dBc)
100 MHz to 250 MHz	-23	-30
>250 MHz to 1.3 GHz	-28	-35
>1.3 GHz to 3.3 GHz	-23	-30
>3.3 GHz to 6.6 GHz	-23	-28

Carrier Frequency	Specification (dBc)	Typical (dBc)

Note Harmonic levels outside the device frequency range are typical.

Table 6. Subharmonics and Non-Integer Harmonics

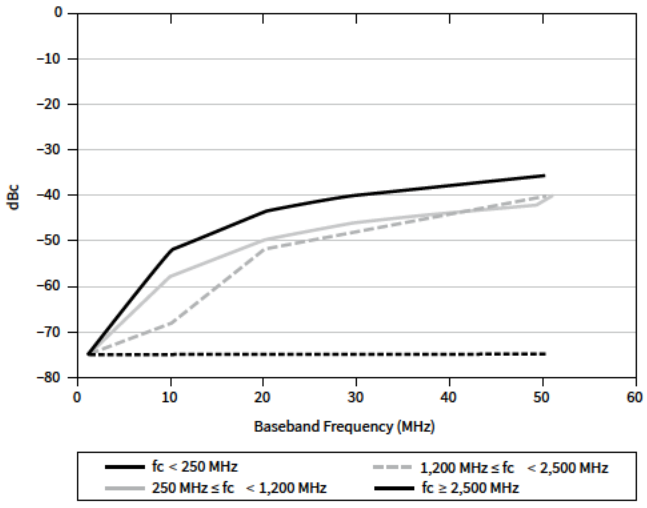
Carrier Frequency	Subharmonics		Non-Integer Harmonics	
	Specification (dBc)	Typical (dBc)	Specification (dBc)	Typical (dBc)
>3.3 GHz to 3.5 GHz	<-34	-41	<-41	-47
>3.5 GHz to 6.6 GHz	<-34	-41	<-46	-52

Note Subharmonic and non-integer harmonic levels outside the device frequency range are typical.

Baseband Feedthrough

The measurement noise floor in the following figure is at -75 dBc. For example, with a baseband frequency of 10 MHz at an RF carrier frequency of 2 GHz, a 10 MHz signal is also present at the RF output at a level of -69 dBc.

Figure 7. Measured Baseband Feedthrough



Baseband Image Feedthrough

Table 7. Typical Baseband Image Feedthrough

I/Q Sample Rate	RF Bandwidth, 1 Sample per Symbol	Total Interpolation	Interpolated Sample Rate (MS/s)	Image Feedthrough (dB), 20 MHz Bandwidth Signal	Image Feedthrough (dB), Maximum I/Q Bandwidth
12 kS/s to 16.66 MS/s	9.6 kHz to 13.328 MHz	12 to 32,768 in steps of 8, 16, and 32	310 to 400	N/A	≤-100
16.66 MS/s to 33.33 MS/s	13.328 MHz to 26.664 MHz	12 to 24 in steps of 8	300 to 400	N/A	-88
33.33 MS/s to 50 MS/s	26.664 MHz to 40 MHz	8	267 to 400	N/A	-61
50 MS/s to 67.5 MS/s	40 MHz to 54 MHz	4	200 to 270	-31	-23
67.5 MS/s to 100 MS/s	54 MHz to 80 MHz	4	270 to 400	-62	-45
100 MS/s to 135 MS/s	80 MHz to 108 MHz	2	200 to 270	-31	-31
135 MS/s to 200 MS/s	108 MHz to 160 MHz	2	270 to 400	-62	-28
200 MS/s	108 MHz to 160 MHz	2	400	-82	-28

Typical Modulation Spectrum

The following four figures indicate the achievable performance when you reduce the baseband power using prefilter gain.

The specifications in the following four figures were measured under the following conditions:

- Modulation: QPSK
- Symbol rate: 3.84 MS/s

- Filter: root raised cosine with alpha value of 0.22
- Filter length: 128 symbols
- RF power: set to -10 dBm
- Prefilter gain: set to -5 dB
- Number of averages by receiver: 100
- Noise cancellation: On

Figure 8. Measured Spectrum at 825 MHz

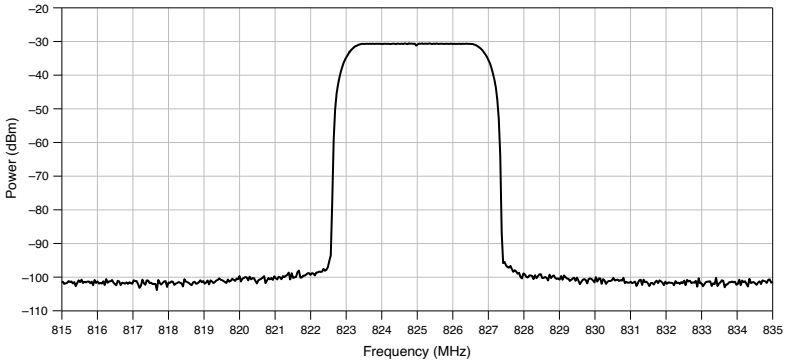


Figure 9. Measured Spectrum at 2.4 GHz

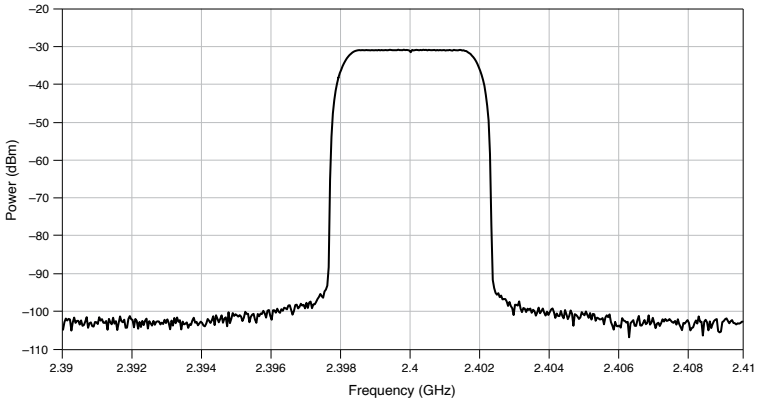


Figure 10. Measured Spectrum at 3.4 GHz

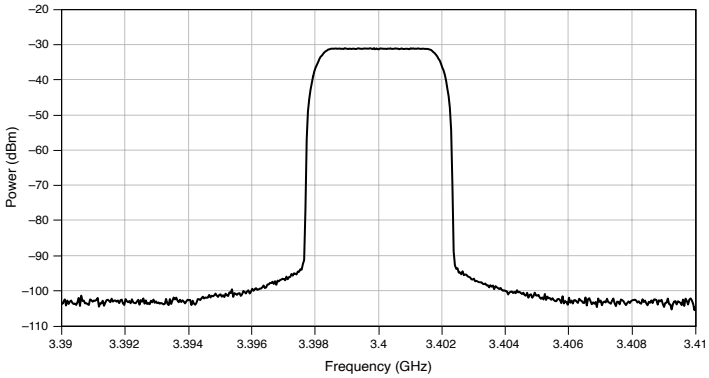
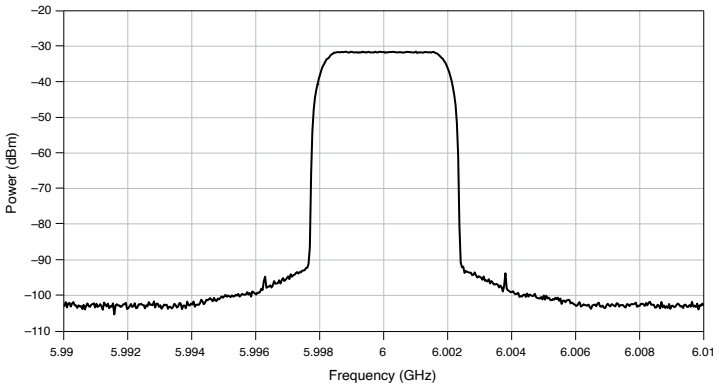


Figure 11. Measured Spectrum at 5.8 GHz



Output Intermodulation Distortion (IMD_3) Products

Table 8. Two Tones, 300 kHz Apart at -6 dBm per Tone

LO Frequency	Specification (dBc)	Typical (dBc)	Typical (dBc) -6 dB Prefilter Gain
85 MHz to 250 MHz	-49	-54	-62
>250 MHz to 1.3 GHz	-53	-57	-61
>1.3 GHz to 3.3 GHz	-48	-52	-56
>3.3 GHz to 6.6 GHz	-47	-50	-53

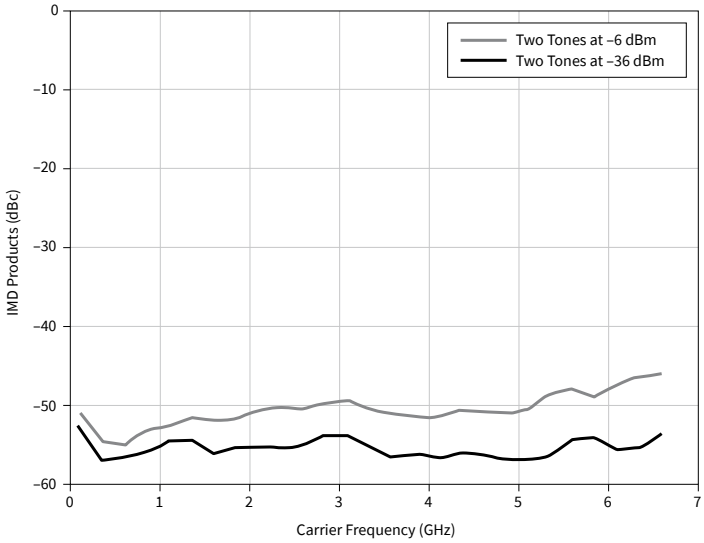
Table 9. Two Tones, 300 kHz Apart at -36 dBm per Tone

LO Frequency	Specification (dBc)	Typical (dBc)	Typical (dBc) -6 dB Prefilter Gain
85 MHz to 250 MHz	-51	-56	-62

LO Frequency	Specification (dBc)	Typical (dBc)	Typical (dBc) -6 dB Prefilter Gain
>250 MHz to 1.3 GHz	-54	-59	-66
>1.3 GHz to 3.3 GHz	-50	-57	-62
>3.3 GHz to 6.6 GHz	-50	-57	-62

The IMD_3 specification is at full baseband power. You can improve the IMD_3 performance by reducing the baseband level as shown in the previous four figures. When you reduce prefilter gain from full scale, the gain of the PXIe-5673E adjusts to maintain the specified output power.

Figure 12. Measured PXIe-5673E IMD_3 Products

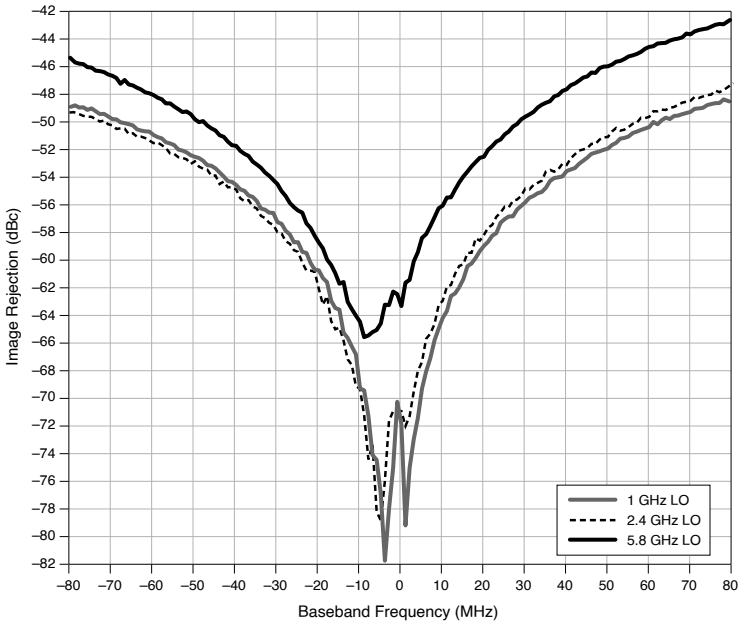


Sideband Image Suppression

Table 10. Sideband Image Suppression

Frequency	2 MHz Modulation Bandwidth (dBc)	20 MHz Modulation Bandwidth (dBc)
85 MHz to 400 MHz	-43	-41
>400 MHz to 2.5 GHz	-50	-48
>2.5 GHz to 5.5 GHz	-46	-45
>5.5 GHz to 6.6 GHz	-43	-41

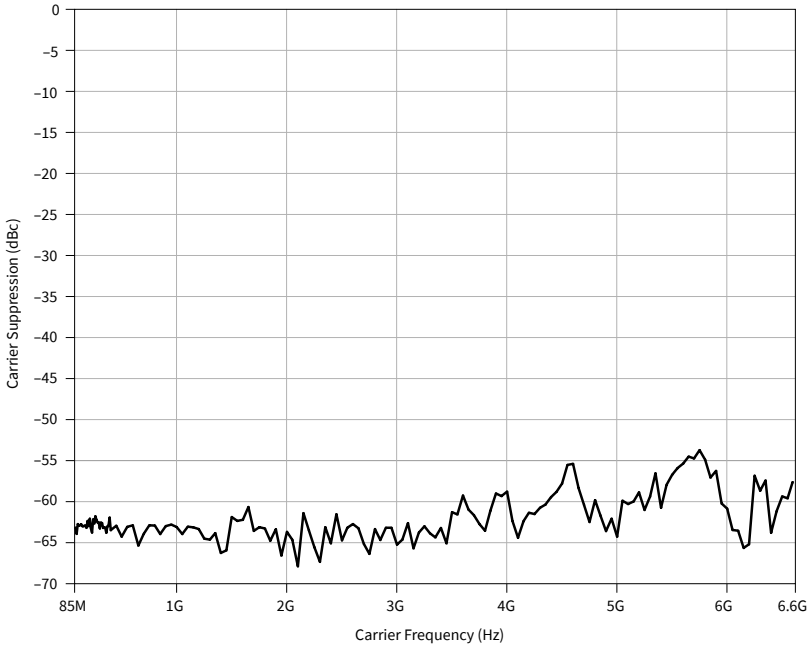
Figure 13. Measured Image Rejection Versus Baseband Frequency



Carrier Suppression

85 MHz to 5.5 GHz	-44 dBc
>5.5 GHz to 6.6 GHz	-41 dBc

Figure 14. Measured Carrier Suppression



Local Oscillator Feedthrough (Uncompensated)

<3.3 GHz	-100 dBm, typical
≥3.3 GHz	-90 dBm, typical

Baseband Linearity-Related Spurs (0 dBm RF OUT)

85 MHz to 250 MHz	-51 dBc
>250 MHz to 6.6 GHz	-56 dBc

RF Output Characteristics

Power Range

Output	Noise floor to +10 dBm, maximum
PXIe-5673E resolution	0.1 dB, minimum
PXIe-5611	1 dB, typical
PXIe-5673E amplitude settling time	<0.5 dB within 10 ms, typical

Output Power Level Accuracy

Table 11. Output Power Level Accuracy

Output Frequency	+5 dBm to -90 dBm	
85 MHz to 6.6 GHz	±0.75 dB (23 °C ± 5 °C)	±1.0 dB (0 °C to 55 °C)

Table 12. Nominal Output Power Level Accuracy at 23 °C ± 5 °C

Output Frequency	-10 dBm to +5 dBm	-50 dBm to -10 dBm
50 MHz to 85 MHz	±1.5 dB	±0.75 dB
>85 MHz to 100 MHz	±0.75 dB	±0.75 dB
>100 MHz to 5 GHz	±0.3 dB	±0.6 dB
>5 GHz to 6.6 GHz	±0.6 dB	±0.6 dB

Output Noise Floor

Table 13. Specified and Typical RF Output Noise Floor

RF Output Power (dBm)	Specification ≤250 MHz	Specification >250 MHz	Typical ≤250 MHz	Typical >250 MHz
-30	-152 dBm/Hz	-152 dBm/Hz	-154 dBm/Hz	-154 dBm/Hz
-10	-145 dBm/Hz	-145 dBm/Hz	-148 dBm/Hz	-148 dBm/Hz
0	-140 dBm/Hz	-141 dBm/Hz	-142 dBm/Hz	-144 dBm/Hz

RF Output Power (dBm)	Specification ≤250 MHz	Specification >250 MHz	Typical ≤250 MHz	Typical >250 MHz
+10	-133 dBm/Hz	-134 dBm/Hz	-135 dBm/Hz	-136 dBm/Hz

Note Nominally, the noise floor drops 1 dB per dB of reduction in output power range.

Voltage Standing Wave Ratio (VSWR)

<-10 dBm output amplitude	<1.92:1, nominal
+10 dBm output amplitude	<2.2:1, nominal

Phase Linearity

Table 14. Nominal Phase Linearity

Carrier Frequency	Modulation Bandwidth	Phase Linearity (°)
85 MHz to 400 MHz	±10 MHz (20 MHz bandwidth)	±1.0
>400 MHz to 6.6 GHz	±40 MHz (80 MHz bandwidth)	±3.0

Pulse Modulation

Rise time	<5 ns, typical
Fall time	<5 ns, typical

Note Rise time and fall time is defined as 10% to 90%.

Pulse repetition frequency	50 MHz, maximum
Pulse delay (PLS MOD to RF OUT Connector)	10 ns, typical

Logic level	3.3 VTTL, nominal
PLS MOD input impedance	1 kΩ, nominal
On/Off Ratio	
<1 GHz	>50 dBc, typical
≤3 GHz	>43 dBc, typical
≤6.6 GHz	>30 dBc, typical

PXIe-5611 Front Panel Overload Protection

Maximum reverse RF power	
≥4 GHz	1 W, maximum
<4 GHz	2 W, maximum
DC input	±5 VDC, maximum

LO OUT on PXIe-5611 Front Panel Connector

Frequency range	50 MHz to 6.6 GHz
Power	0 dBm, ±1.0 dB, typical
Output power resolution	0.5 dB
Output impedance	50 Ω, nominal
Output VSWR	

50 MHz to 3.3 GHz	1.671:1, nominal
3.3 GHz to 4.8 GHz	2.100:1, nominal
4.8 GHz to 6.6 GHz	1.925:1, nominal
Amplitude settling time	<0.5 dB in less than 10 ms, typical
I/Q inputs maximum RF power (each)	+19 dBm

Table 15. Typical Noise Figure

Output Frequency (GHz)	Noise Figure (dB)
2	26
4	23
6	19

Maximum reverse power	+18 dBm
Maximum saturated output power	+18 dBm
Maximum DC voltage	±5 VDC

LO OUT Isolation (State: Disabled)

1 GHz	-50 dBc, typical
6.6 GHz	-30 dBc, typical

LO IN on PXIe-5611 Front Panel Connector

Frequency range	50 MHz to 6.6 GHz

Input power	0 dBm, nominal
Input impedance	50 Ω, nominal
Input VSWR	<2:1, nominal
Absolute maximum power	+18 dBm
Maximum DC power	±5 VDC

Digital Modulation

(Nominal)

Table 23. Quadrature Phase-Shift Keying (QPSK), Onboard Reference Clock Source

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
0.16	200.00 kHz	0.25	0.3	0.7	1.0	51	43	40
0.80	1.00 MHz	0.25	0.4	0.7	1.0	48	42	40
4.09	4.98 MHz	0.22	0.6	0.8	1.2	45	42	38

Table 23. QPSK, External Reference Clock Source (PXI Express Backplane Clock)

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
0.16	200.00 kHz	0.25	0.7	2	2.9	43	34	30

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
0.80	1.00 MHz	0.25	0.9	1.3	1.7	41	38	36
4.09	4.98 MHz	0.22	1.1	1.3	1.5	39	38	36

Table 18. 16-Quadrature Amplitude Modulation (QAM), Onboard Reference Clock Source

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
17.6	22 MHz	0.25	0.7	1.4	1.8	41	35	32
32.0	40 MHz	0.25	1.1	2.4	2.5	36	29	29

Table 23. 16-QAM, External Reference Clock Source (PXI Express Backplane Clock)

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
17.6	22 MHz	0.25	1	1.5	1.9	37	34	32
32.0	40 MHz	0.25	1.4	2.5	2.6	35	29	29

Table 23. 64-QAM, Onboard Reference Clock Source

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
5.36	6.16 MHz	0.15	0.4	0.6	1	44	40	37
6.95	7.99 MHz	0.15	0.5	0.7	1	43	39	36

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
40.99	50.00 MHz	0.22	1.3	2.8	2.6	34	27	28

Table 23. 64-QAM, External Reference Clock Source (PXI Express Backplane Clock)

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
5.36	6.16 MHz	0.15	0.9	1	1.2	38	36	35
6.95	7.99 MHz	0.15	0.9	1.1	1.2	38	36	35
40.99	50.00 MHz	0.22	1.5	2.8	2.7	33	27	28

Table 23. 256-QAM, Onboard Reference Clock Source

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
6.95	7.99 MHz	0.15	0.5	0.8	1.8	43	38	32

Table 23. 256-QAM, External Reference Clock Source (PXI Express Backplane Clock)

Symbol Rate (MS/s)	Bandwidth	Root Raised Cosine Filter Alpha Value	EVM (%)			MER (dB)		
			825 MHz	3,400 MHz	5,800 MHz	825 MHz	3,400 MHz	5,800 MHz
6.95	7.99 MHz	0.15	0.8	2	2.3	37	32	29

Physical Characteristics

Front Panel Connector Types

PXIe-5611 I/Q modulator module	
I+	SMA female
I-	SMA female
Q+	SMA female
Q-	SMA female
RF OUT	SMA female
PLS MOD	SMA female
LO IN	SMA female
LO OUT	SMA female
PXIe-5450/5451 AWG module	
CLK IN	SMA female
CLK OUT	SMA female
PFI 0	SMB
PFI 1	SMB
CH 0+/I+	SMA female
CH 0-/I-	SMA female

CH 1+/Q+	SMA female
CH 1-/Q-	SMA female
PXIe-5650/5651/5652 LO source module	
RF OUT	SMA female
REF IN/OUT	SMA female
REF OUT2	SMA female

Dimensions and Weight

Dimensions	
PXIe-5611	3U, One Slot, PXI Express module, 21.6 cm × 2.0 cm × 13.0 cm (8.5 in. × 0.8 in. × 5.1 in.)
PXIe-5450/5451	3U, Two Slot, PXI Express module, 21.6 cm × 4.0 cm × 13.0 cm (8.5 in. × 1.6 in. × 5.1 in.)
PXIe-5650/5651/5652	3U, One Slot, PXI Express module, 21.6 cm × 2.0 cm × 13.0 cm (8.5 in. × 0.8 in. × 5.1 in.)
Weight	
PXIe-5611	567 g (20 oz)
PXIe-5450/5451	476 g (17 oz)
PXIe-5650/5651/5652	415 g (15 oz)

PXIe-5673E (combined unit)	1,458 g (52 oz)

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.

DC Power

Table 26. PXIe-5611 I/Q Modulator Module

Voltage (V_{DC})	Maximum Current (A)	Typical Current (A)
+3.3	0.6	0.6
+12.0	0.8	0.7

Note Power is 10.5 W, typical.

Table 26. PXIe-5450/5451 AWG Module

Voltage (V_{DC})	Maximum Current (A)	Typical Current (A)
+3.3	2.0	1.9
+12.0	PXIe-5450: 2.5	PXIe-5450: 2.2
	PXIe-5451: 2.9	PXIe-5451: 2.6

Note Power is 32.7 W, typical (PXIe-5450); 37.5 W, typical (PXIe-5451).

Table 26. PXIe-5650/5651/5652 LO Source Module

Voltage (V_{DC})	Maximum Current (A)	Typical Current (A)
+3.3	1.0	0.9
+12.0	1.0	0.8

Note Power is 12.6 W, typical.

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
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 g_{rms}
Nonoperating	5 Hz to 500 Hz, 2.4 g_{rms}

Calibration

Recommended calibration interval	
PXIe-5611	1 year
PXIe-5450/5451	1 year
PXIe-5650/5651/5652	1 year

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
- 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

- 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.)