NI PXIe-5673E Specifications

RF Vector Signal Generator

This document lists specifications for the NI PXIe-5673E (NI 5673E) RF vector signal generator. The NI PXIe-5673E RF vector signal generator is comprised of the NI PXIe-5611 I/Q modulator, the NI PXIe-5450/5451 arbitrary waveform generator, and the NI PXIe-5650/5651/5652 RF signal generator (used as an LO source). There is no single device labeled "NI 5673E."

Specifications are warranted under the following conditions:

- 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
- NI 5650/5651/5652 onboard reference clock used as NI 5673E reference clock
- NI 5650/5651/5652 in narrow loop bandwidth mode unless otherwise noted
- Most current product revision

Specifications describe the warranted, traceable product performance over ambient temperature ranges of 0 °C to 55 °C, unless otherwise noted.

Typical values describe useful product performance beyond specifications that are not covered by warranty and do not include guardbands for measurement uncertainty or drift. Typical values may not be verified on all units shipped from the factory. Unless otherwise noted, typical values cover the expected performance of units over ambient temperature ranges of 23 ±5 °C with a 90% confidence level, based on measurements taken during development or production.

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Nominal values (or supplemental information) describe additional information about the product that may be useful, including expected performance that is not covered under *Specifications* or *Typical* values. Nominal values are not covered by warranty.

Specifications are subject to change without notice. For the most recent NI 5673E specifications, visit `ni.com/manuals`.

After installing NI-RFSG instrument driver software, you can access all NI PXIe-5673E documentation, including the *NI RF Signal Generators Getting Started Guide*, by navigating to **Start»All Programs» National Instruments»NI-RFSG»Documentation**.

Caution The inputs and outputs of this device are not protected against electromagnetic interference for functional reasons. This product may experience reduced accuracy or other temporary performance degradation when cables are attached in an environment where electromagnetic interference is present.

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Frequency Characteristics

Frequency Range	NI PXIe-5673E Part Number
85 MHz to 1.3 GHz	781261-0*X*
85 MHz to 3.3 GHz	781262-0*X*
85 MHz to 6.6 GHz	781263-0*X*
Note: NI PXIe-5673E part numbers vary according to memory size.	

Bandwidth

Modulation bandwidth
(3 dB double sideband).....>100 MHz

The modulation bandwidth specification assumes the frequency range is between 85 MHz and 6.6 GHz. For example, 100 MHz bandwidth can be achieved at a frequency of 135 MHz but not 85 MHz.

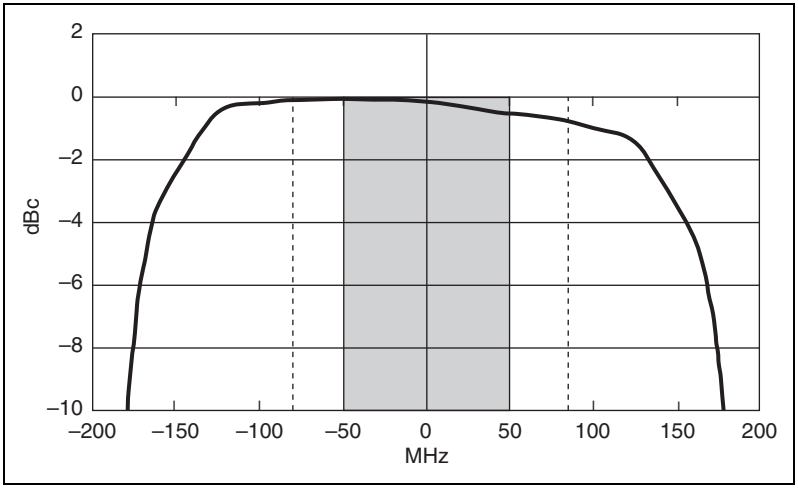

Figure 1. Measured Modulation Bandwidth at 1 GHz Carrier Frequency

In Figures 1 through 3, measured modulation bandwidths show the actual baseband response. The usable bandwidth is limited by the NI 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.

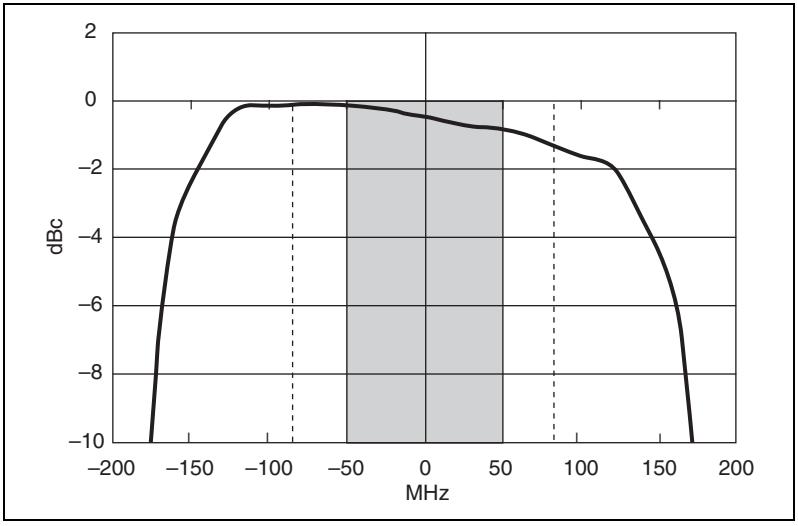

Figure 2. Measured Modulation Bandwidth at 2.4 GHz Carrier Frequency

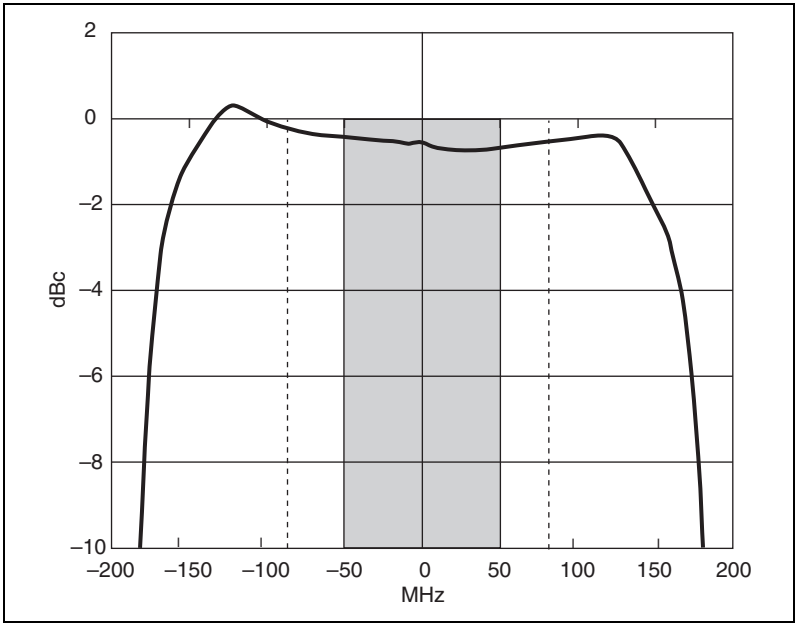

Figure 3. Measured Modulation Bandwidth at 5.8 GHz Carrier Frequency

Data streaming continuous
transfer rate ..... 500 MB/s, nominal

Tuning Resolution (NI 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

Narrow Loop Bandwidth		
Frequency Settling Time	**Median Tuning Speed (ms)**	**Maximum Tuning Speed (ms)**
$\leq 0.1 \times 10^{-6}$ of final frequency	1.5	6.5*
$\leq 0.01 \times 10^{-6}$ of final frequency	6.5	13

* Frequency steps that span the full range of a voltage-controlled oscillator (VCO) require more settling time than steps that remain close together within one VCO or steps that switch between VCO's. The maximum specification covers this worst case frequency's settling time.

Wide Loop Bandwidth		
Frequency Settling Time	**Median Tuning Speed (ms)**	**Maximum Tuning Speed (ms)**
$\leq 1.0 \times 10^{-6}$ of final frequency	0.2	1.0
$\leq 0.1 \times 10^{-6}$ of final frequency	0.3	2.0
$\leq 0.01 \times 10^{-6}$ of final frequency	1.0	10.0

The frequency settling time specification only includes frequency settling, and it excludes any residual amplitude settling that may occur as a result of large frequency changes. Driver and operating system timing can affect transition times. This specification applies when using RF list mode.

RF List Mode

Maximum number of configuration steps 250

The preceding maximum assumes power, frequency, and upconverter center frequency are all changing. More steps can be achieved if fewer parameters change.

Internal Frequency Reference (NI 5650/5651/5652)

Frequency ..... 10 MHz

Initial accuracy ..... $\pm 3 \times 10^{-6}$

Temperature stability (15 °C to 35 °C) ..... $\pm 1 \times 10^{-6}$, maximum

Aging

Per year ..... $\pm 5 \times 10^{-6}$, maximum

Internal Reference Output (NI 5650/5651/5652 REF OUT and REF OUT 2 Connectors)

Frequency ..... 10 MHz

Amplitude ..... 1 $V_{pk\text{-}pk}$ into 50 Ω

Ouput impedance ..... 50 Ω

Coupling ..... AC

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

Frequency ..... 10 MHz ±10 ppm

Amplitude ..... 0.2 $V_{pk\text{-}pk}$ to 1.5 $V_{pk\text{-}pk}$ into 50 Ω

Input impedance ..... 50 Ω

Lock time to external reference ..... < 1 s

External Reference Input (NI 5450/5451)

Frequency .....10 MHz

Amplitude .....1.0 V_{pk-pk} to 5.0 V_{pk-pk} into 50 Ω

Input impedance .....50 Ω

Coupling .....AC

External Reference Output (NI 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 1. Single Sideband Phase Noise at 10 kHz Offset

Frequency	Phase Noise (dBc/Hz)
100 MHz	<–125, typical
500 MHz	<–111
1 GHz	<–105
2 GHz	<–98
3 GHz	<–95
4 GHz	<–93
5 GHz	<–90
6.6 GHz	<–90

Wide loop bandwidth has very 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.

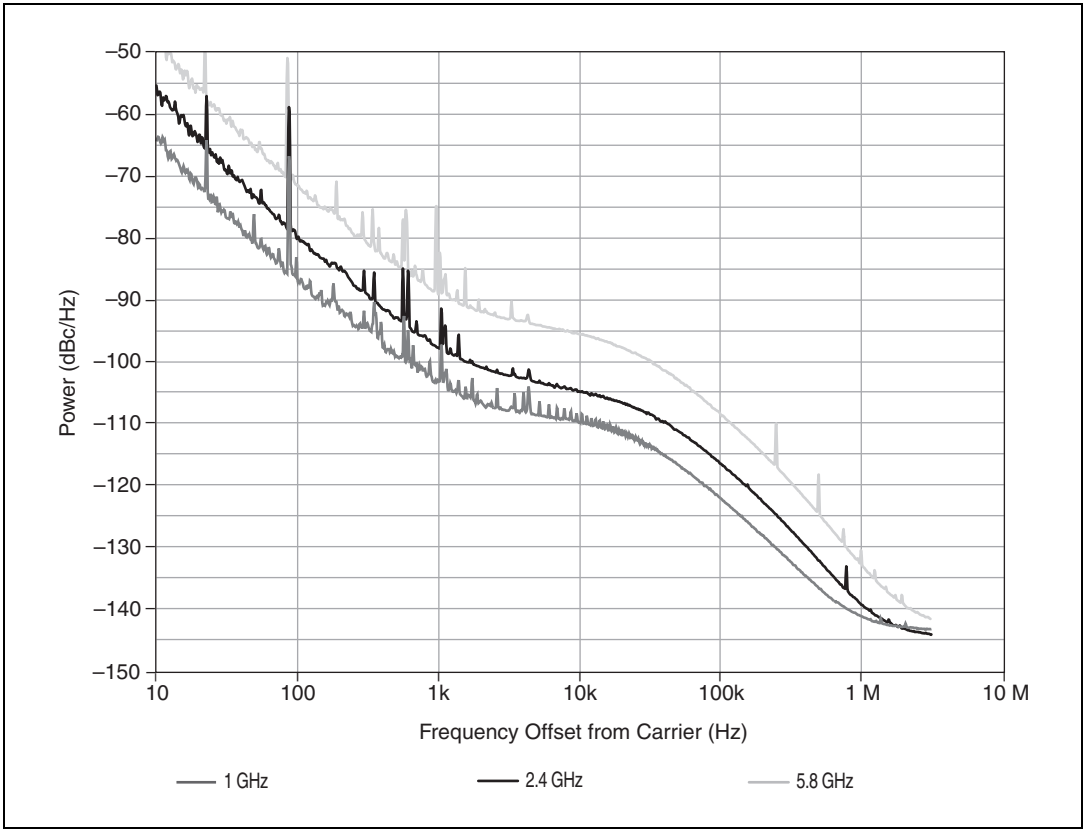

Figure 4. Measured Phase Noise at 1 GHz, 2.4 GHz, and 5.8 GHz Using Internal 10 MHz Reference Clock

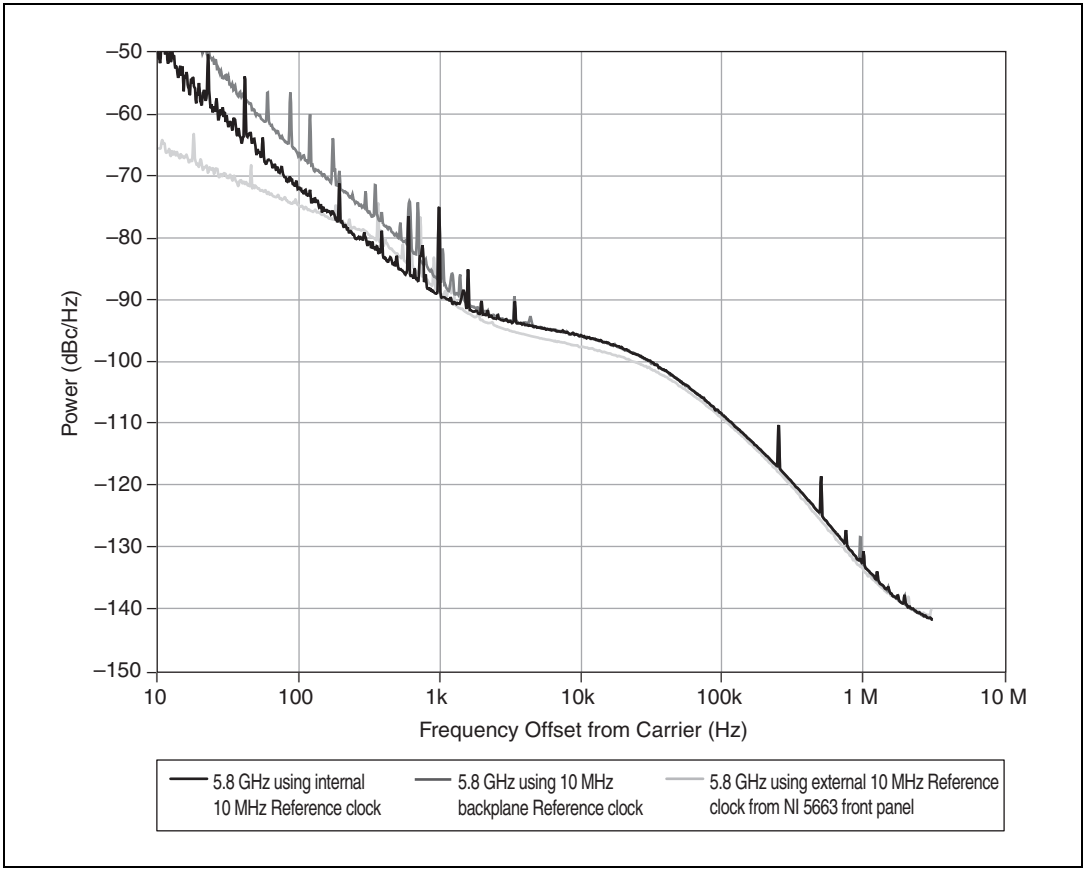

Figure 5. Measured Phase Noise at 5.8 GHz

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

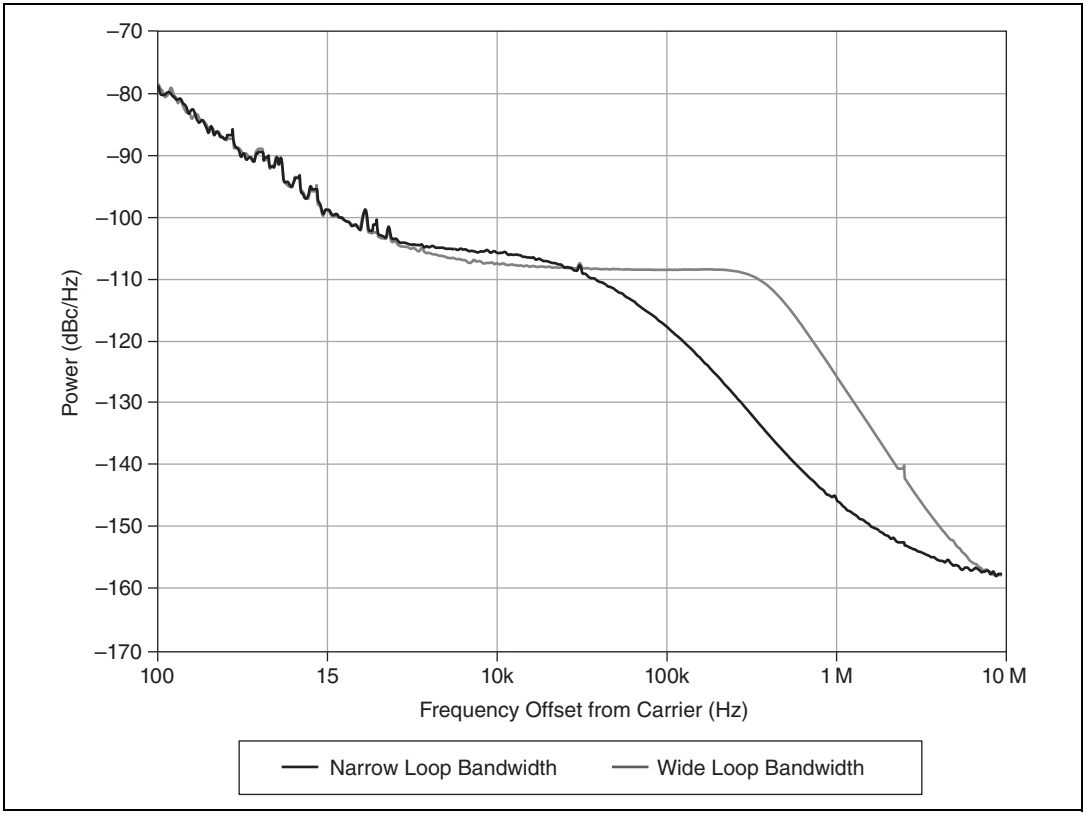

Figure 6. Phase Noise at 2.4 GHz in Narrow and High Loop Bandwidths

Spurious Responses

Harmonics

Harmonics	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

Note: Harmonics were measured using a 1 MHz baseband signal. This specification includes all harmonic levels. Below 100 MHz, harmonic levels are nominally –11 dBc.

RF OUT Subharmonics	Specification		Typical	
	3.3 GHz to 3.5 GHz	3.5 GHz to 6.6 GHz	3.3 GHz to 3.5 GHz	3.5 GHz to 6.6 GHz
0.5 harmonic	–34 dBc	–34 dBc	–41 dBc	–41 dBc
1.5 harmonic	–41 dBc	–46 dBc	–47 dBc	–52 dBc

Baseband Feedthrough

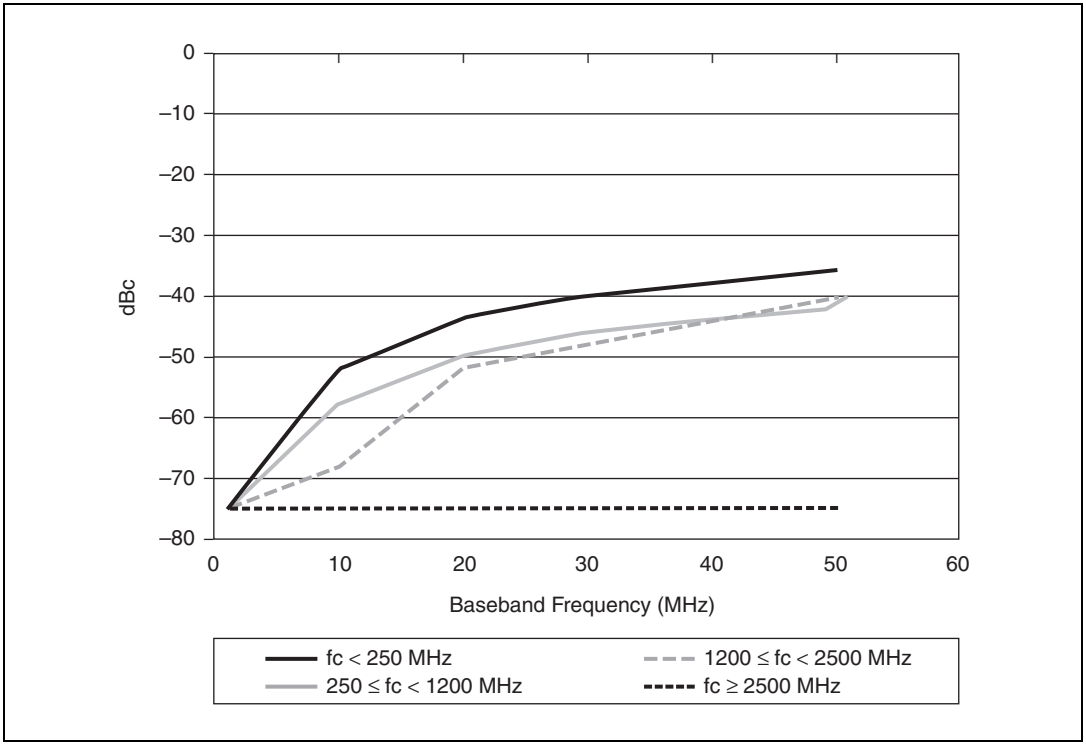

Figure 7. Measured Baseband Feedthrough

The measurement noise floor in Figure 7 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.

Typical Baseband Image Feedthrough[1]

I/Q Sample Rate	RF Bandwidth, 1 Sample per Symbol	Total Interpolation	Interpolated Sample Rate (MS/s)*	Image Feedthrough, in dB, 20 MHz Bandwidth Signal	Image Feedthrough†, in dB, Maximum I/Q Bandwidth
200 MS/s	108 MHz to 160 MHz	2	400	–82	–28
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

Assumptions: Internal sample clock, High Resolution onboard Sample clock mode. Desired sample rate ranges do not include the first point (a desired sample rate of 50 MS/s yields 8x total interpolation).

* If your interpolated sample rate falls within an undesirable band, use the Modulation Toolkit to provide fractional resampling that adjusts the sample rate to achieve better rejection.

† Calculated from sync response and typical filter rejection for the NI 5450/5451. Refer to the *NI PXIe-5450 Specifications* or *NI PXIe-5451 Specifications* for more information about the expected performance of the NI 5450/5451.

[1] *Baseband image* refers to the image frequency generated around the digital-to-analog converter (DAC) update frequency. For example, at 400 MS/s, the DAC update rate of a 10 MHz baseband I signal has a baseband image at 400 MHz, ±10 MHz = 390 MHz and 410 MHz. At a carrier frequency of 1 GHz, these images appear at ±390 MHz and ±410 MHz from the 1 GHz carrier.

Typical Modulation Spectrum

Figures 8 through 11 indicate the performance that can be achieved by reducing the baseband power using prefilter gain.

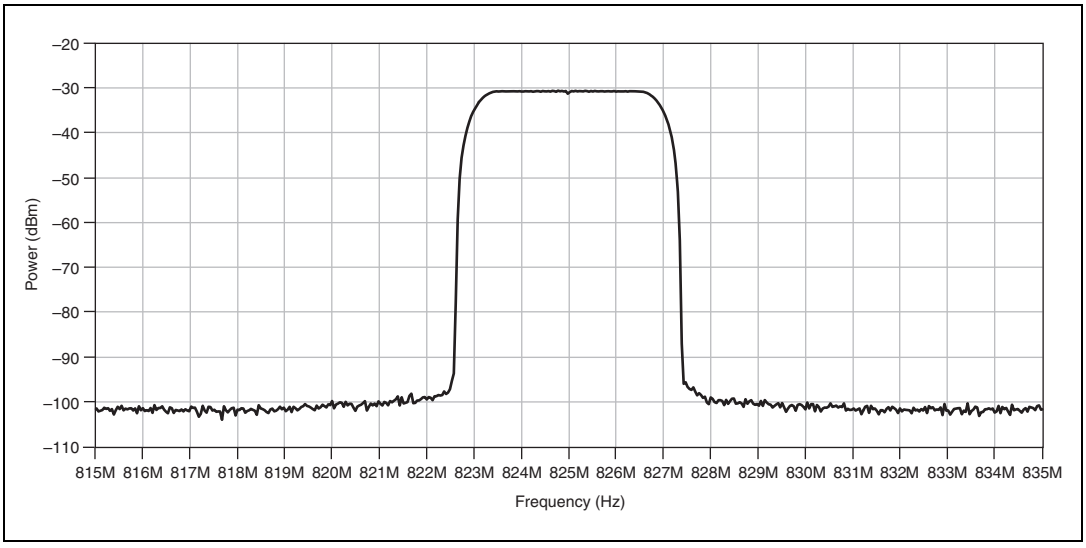

Figure 8. Measured Spectrum at 825 MHz

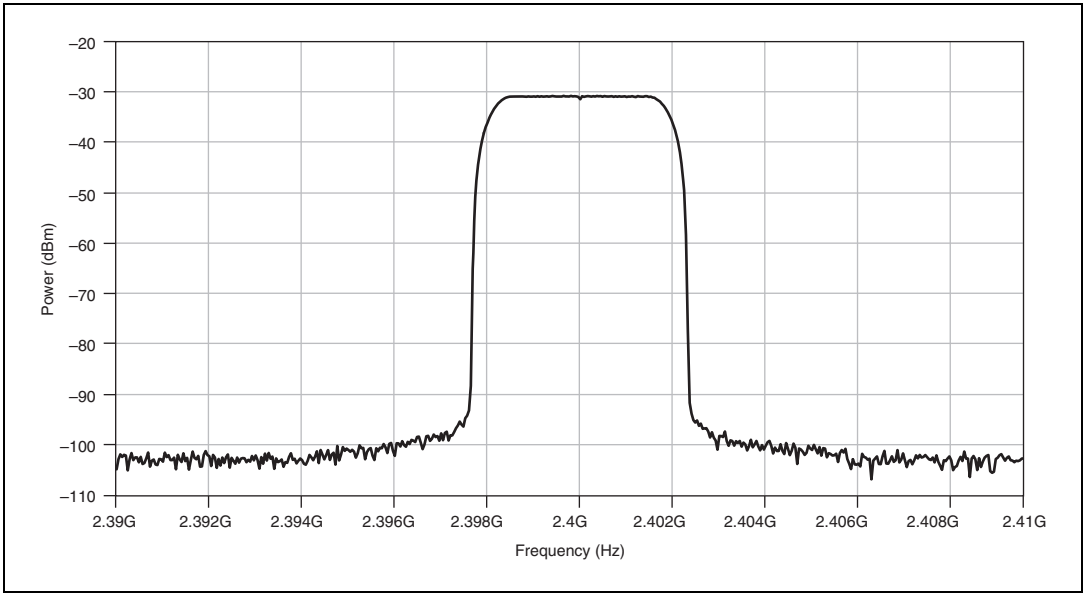

Figure 9. Measured Spectrum at 2.4 GHz

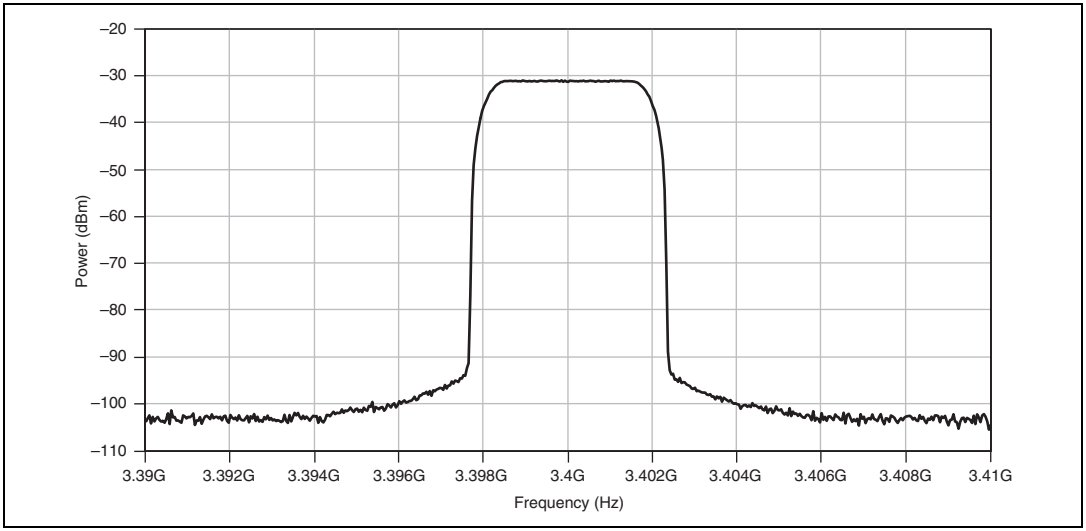

Figure 10. Measured Spectrum at 3.4 GHz

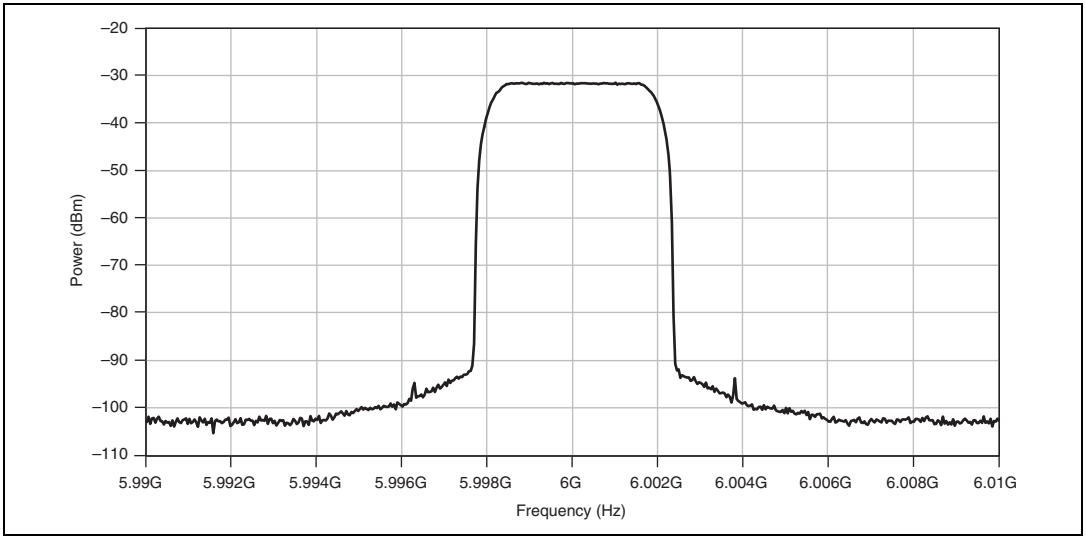

Figure 11. Measured Spectrum at 5.8 GHz

The specifications in Figures 8 through 11 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

Output Intermodulation Distortion (IMD_3) Products

LO Frequency (two tones, 300 kHz apart, at –6 dBm per tone)	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

LO Frequency (two tones, 300 kHz apart, at –36 dBm per tone)	Specification (dBc)	Typical (dBc)	Typical (dBc) –6 dB Prefilter Gain
85 MHz to 250 MHz	–51	–56	–62
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. IMD_3 performance can be improved by reducing the baseband level as shown in Figures 8 through 11. When prefilter gain is reduced from full scale, the gain of the NI 5673E is adjusted to maintain the specified output power.

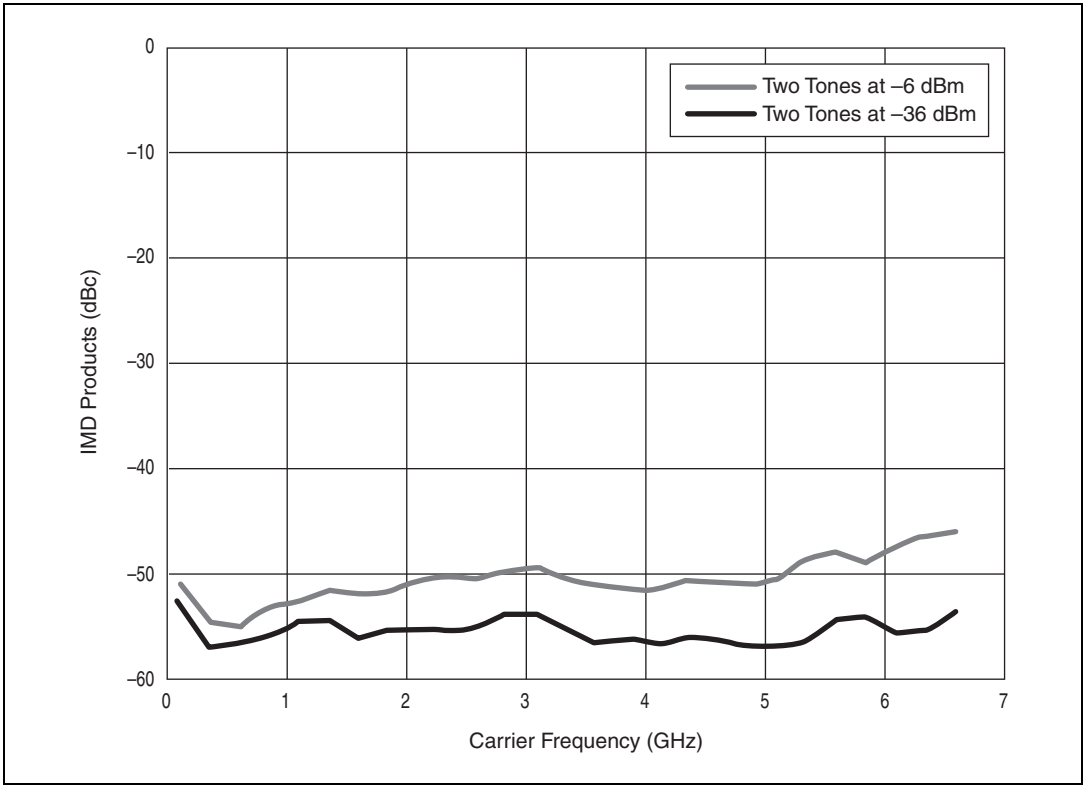

Figure 12. Measured NI 5673 IMD_3 Products

Sideband Image Suppression

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

Note: Measured with a test signal at a baseband frequency of 1 MHz. In order to achieve optimum performance, add a typical wait period of 1 s when crossing a carrier frequency of 3.5 GHz that is increasing or decreasing in frequency.

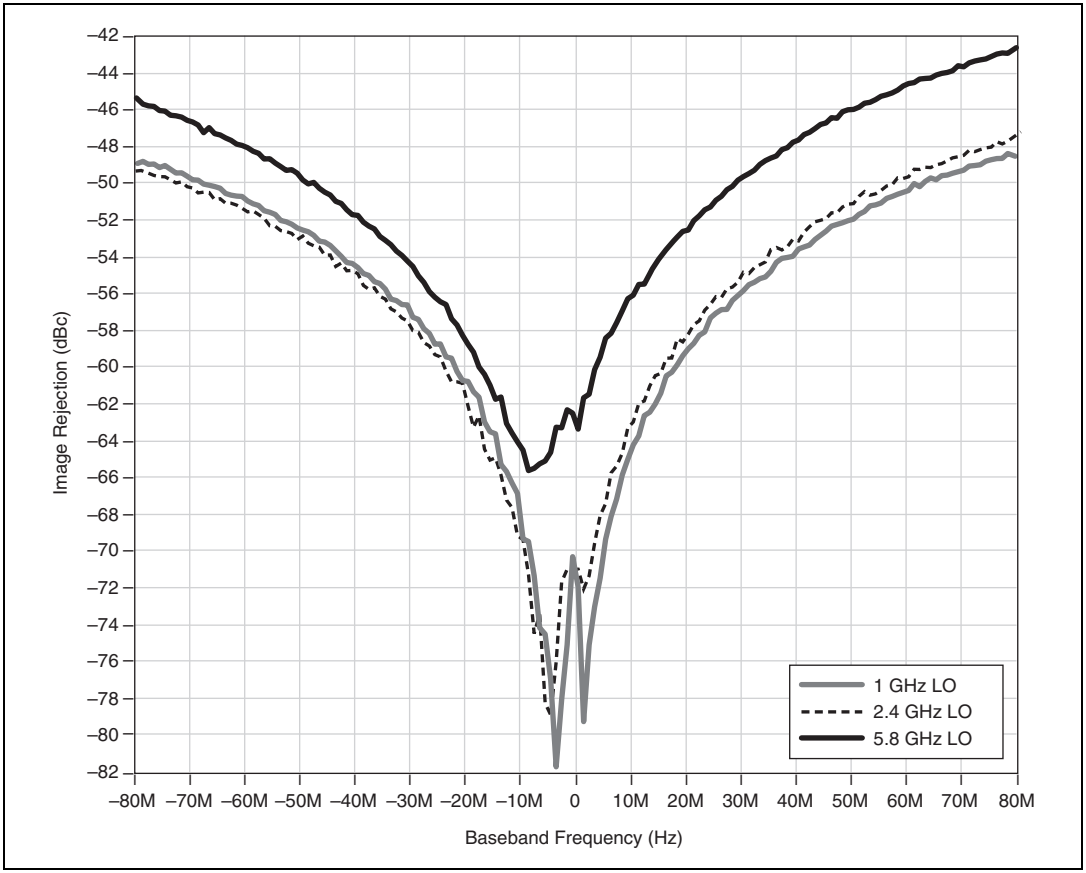

Figure 13. Measured Image Rejection Versus Baseband Frequency

Carrier Suppression

LO Frequency	Carrier Suppression (dBc)
85 MHz to 5.5 GHz	–44
5.5 GHz to 6.6 GHz	–41

Note: In order to achieve optimum performance, add a typical wait period of 1 s when crossing a carrier frequency of 3.5 GHz that is increasing or decreasing in frequency.

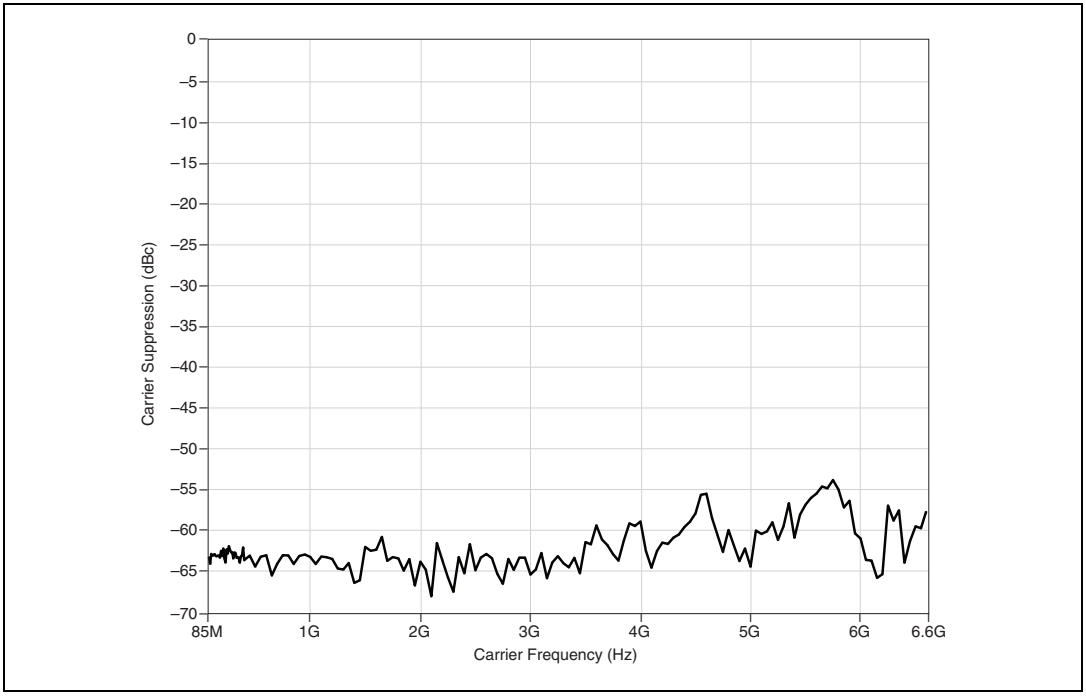

Figure 14. Measured Carrier Suppression

Local oscillator feedthrough
(uncompensated).....–100 dBm

Baseband Linearity-Related Spurs (0 dBm RF OUT)

LO Frequency	Specification (dBc)
85 MHz to 250 MHz	–51
250 MHz to 6.6 GHz	–56

RF Output Characteristics

Power Range

Output..... Noise floor to +10 dBm[1], maximum

NI 5673E resolution..... 0.1 dB, minimum

NI 5611..... 1 dB, typical

NI 5673E
amplitude settling time..... <0.5 dB within 10 ms, typical[2]

Output Power Level Accuracy

Output Frequency	+5 dBm to –90 dBm	
	Temperature (15 °C to 35 °C)	Temperature (0 °C to 55 °C)
85 MHz to 6.6 GHz	±0.75 dB	±1.0 dB
Note: *Power level accuracy* is specified as a CW tone at 1 MHz offset from the carrier frequency. Specifications apply if the device temperature is within 5 °C of the temperature when self-calibration is applied.		

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
+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.				

[1] Represents saturated CW power.

[2] The NI-RFSG instrument driver waits long enough for a typical device to settle within 0.5 dB.

Voltage Standing Wave Ratio (VSWR)

Output Amplitude* (dBm)	VSWR, Maximum
<–10	1.92:1
+10	2.2:1
* Represents saturated CW power.	

Phase Linearity

Carrier Frequency	Modulation Bandwidth	Phase Linearity (°), Nominal
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 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, typical

On/Off ratio

<1 GHz .....>50 dBc, typical

≤ 3 GHz .....>43 dBc, typical

≤ 6.6 GHz .....>30 dBc, typical

Overload Protection on NI 5611 RF OUT Front Panel Connector

Maximum reverse RF power .....1 W, maximum ≥4 GHz
2 W, maximum <4 GHz

DC input .....±5 VDC, maximum

LO OUT on NI 5611 Front Panel Connector

Frequency range ..... 85 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 ..... 2:1, maximum

Amplitude settling time[1] ..... <0.5 dB in less than 10 ms, typical

Output Frequency (GHz)	Noise Figure (dB, typical)
2	26
4	23
6	19
Note: The noise figure specifications are for a calibrated output gain of 0 dB.	

Maximum reverse power[2] ..... +18 dBm

Maximum saturated output power ..... +18 dBm

Maximum DC voltage..... ±5 VDC

LO OUT Isolation (State: Disabled)[3]

1 GHz ..... –50 dBc, typical

6.6 GHz ..... –30 dBc, typical

[1] The LO input has filters that must achieve optimum settling to meet specifications. The LO power must be settled to within 0.5 dB to meet specifications.

[2] The limit on the LO output relay is 13 dBm when LO OUT is enabled.

[3] The NI 5673E is calibrated for a 0 dBm LO output level. Connect a 50 Ω terminator to the NI 5611 LO OUT front panel connector when the LO OUT front panel connector is not in use.

LO IN on NI 5611 Front Panel Connector

Frequency range .....85 MHz to 6.6 GHz

Nominal input power .....0 dBm

Input impedance .....50 Ω, nominal

Input VSWR .....2:1, maximum

Absolute maximum power.....+18 dBm

Maximum DC power .....±5 VDC

Digital Modulation[1]

(Nominal)

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	0.22	0.4	0.7	1.0	48	42	40
4.09	4.98 MHz	0.25	0.6	0.8	1.2	45	42	38

[1] All measurements were made with an NI 5673E and NI 5663E not phase-locked together.
Number of symbols = 1,250 pseudorandom bit sequence (PRBS) at –30 dBm for all measurements. No equalization in receiver demodulation.

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
0.80	1.00 MHz	0.22	0.9	1.3	1.7	41	38	36
4.09	4.98 MHz	0.25	1.1	1.3	1.5	39	38	36

16-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

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

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
40.99	50.00 MHz	0.22	1.3	2.8	2.6	34	27	28

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

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

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

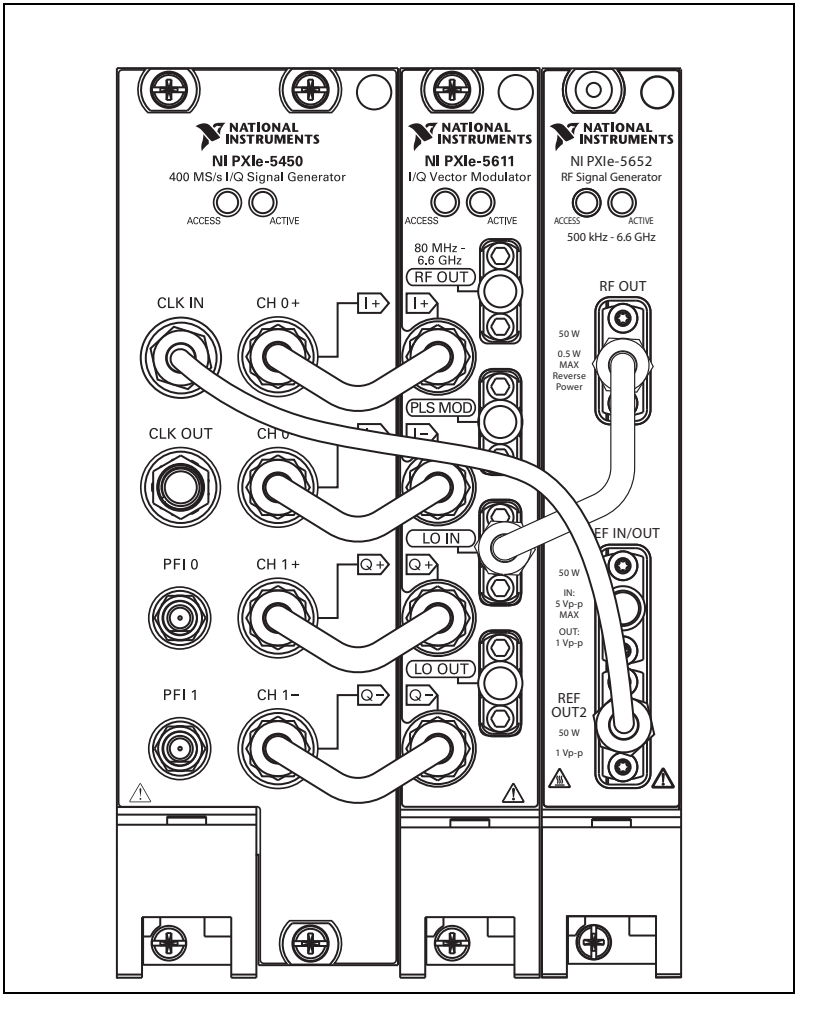

Figure 15. NI PXIe-5673 Front Panel

Front Panel Connector Types

NI 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

NI 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

NI 5650/5651/5652 LO source module
RF OUT ..... SMA female
REF IN/OUT ..... SMA female
REF OUT 2 ..... SMA female

Physical Dimensions

NI PXIe-5611 ..... 3U, One Slot,
PXI Express module
21.6 × 2.0 × 13.0 cm
(8.5 × 0.8 × 5.1 in.)

NI PXIe-5450/5451 ..... 3U, Two Slot,
PXI Express module
21.6 × 4.0 × 13.0 cm
(8.5 × 1.6 × 5.1 in.)

NI PXIe-5650/5651/5652 ..... 3U, One Slot,
PXI Express module
21.6 × 2.0 × 13.0 cm
(8.5 × 0.8 × 5.1 in.)

Weight (combined unit) ..... 1,458 g (52 oz)
NI 5611 ..... 567 g (20 oz)
NI 5450/5451 ..... 476 g (17 oz)
NI 5650/5651/5652 ..... 415 g (15 oz)

DC Power

NI 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.		

NI PXIe-5450/5451 AWG Module[1]

Voltage (V_{DC})	Maximum Current (A)	Typical Current(A)
+3.3	2.3	2.2
+12.0	2.2	1.9
Note: Power is 28.5 W, typical.		

NI PXIe-5650/5651/5652 LO Source Module

Voltage (V_{DC})	Maximum Current (A)	Typical Current (A)
+3.3	1.00	0.90
+12.0	1.00	0.80
Note: Power is 10 W, typical.		

[1] Refer to the printed specifications in your AWG hardware module kit, or visit `ni.com/manuals` to search for the most recent version of the specifications document for your AWG module.

Environmental

Specifications in this document are guaranteed under the environmental conditions specified below.

Operating Environment

Ambient temperature range

NI PXIe-5611 I/Q Modulator ..... 0 °C to 55 °C
(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)

NI PXIe-5450/5451 AWG ..... 0 °C to 55 °C operating in all PXI Express chassis produced by NI.

NI PXIe-5650/5651/5652 LO Source ..... 0 °C to 55 °C
(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)

Relative humidity range ..... 10% to 90%, noncondensing
(Tested in accordance with IEC 60068-2-56.)

Altitude..... 0 m to 2,000 m
(at 25 °C ambient temperature.)

Pollution degree 2

Indoor use only

Storage Environment

Ambient temperature range..... –40 °C to 70 °C
(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)

Relative humidity range ..... 5% to 95%, noncondensing
(Tested in accordance with IEC 60068-2-56.)

Shock and Vibration

Nonoperational shock ..... 30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)

Random vibration
nonoperating ..... 5 Hz to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Calibration

Interval

- NI PXIe-5611 ..... 1 year
- NI PXIe-5450/5451 ..... 2 years
- NI PXIe-5650/5651/5652 ..... 1 year

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN-61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 (IEC 61326): 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 15 B: Class A
- ICES-001; Class A emissions

Note For the standards applied to asses the EMC of this product, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this product according to the documentation.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain 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 *NI and the Environment* 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 products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit `ni.com/environment/weee`.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。
关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。
(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

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