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Find the *National Instruments PXI-5610* at our website: *Click HERE*

NI PXI-567*X* Specifications

2.7 GHz RF Vector Signal Generator

This document lists specifications for
NI PXI-567*X* 2.7 GHz RF Vector Signal Generators.

Minimum or maximum specifications are guaranteed under the following conditions:

- 30 minutes warm-up time at ambient temperature
- calibration cycle maintained

Typical values are used to define an average unit measured at ambient temperatures of 15 °C to 35 °C. Maximum and minimum values are specified over temperature ranges of 0 °C to 55 °C unless otherwise noted.

Values that do not list a tolerance are typical numbers unless otherwise specified. Tolerance values represent the maximum variation that will be observed. These numbers are guaranteed over temperature ranges of 0 °C to 55 °C unless otherwise noted.



Hot Surface If the NI 567*X* has been in use, it may exceed safe handling temperatures and cause burns. Allow the NI 567*X* to cool before removing it from the chassis.

NATIONAL INSTRUMENTS

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Frequency Characteristics

Frequency range ..... 250 kHz to 2.7 GHz

Bandwidth

Realtime bandwidth	20 MHz
Signal bandwidth, digital upconverter (DUC) enabled	6.6 MHz maximum

Frequency Tolerance, CW (Continuous-Wave) Mode

Memory Option (MB)	Frequency Tolerance	
	NI 5670	NI 5671[1]
8	25 Hz	—
32	6 Hz	355 nHz
≥256	1 Hz	355 nHz

[1]With DUC enabled. Refer to NI 5670 section for times with DUC disabled.

Note The NI PXI-567*X* tuning speed and resolution depend on resampling performed by the PC. Therefore, fine resolution tuning speed is dependent on the speed and memory of the computer. Specifications below are the result of using an NI PXI-8186 Pentium 4 controller 2.2 GHz with 1 GB RAM with the Windows XP operating system.

Tuning Speed

NI 5670		
Waveform	**Digital IF Equalization**	**Maximum Time**
CW[1]	—	45 msec
CW[2]	—	950 msec
Arb waveform[3,4]	off	1315 msec
	on	8.2 sec
NI 5671		
Waveform	**Digital IF Equalization**	**Maximum Time**
CW[5]	—	45 msec
Arb waveform[3,6]	off	45 msec
	on	7.2 sec

[1] Frequency tolerance = 50 Hz
[2] Frequency tolerance = 1 Hz
[3] 10 million samples waveform
[4] Phase continuity disabled
[5] For all frequency tolerances
[6] With DUC enabled. Refer to NI 5670 section for times with DUC disabled.

Typical Arb Waveform System-Level Performance[1,2]

Symbol Rate (Symbols/sec)	Time (sec)		
	NI 5671		NI 5670[3]
	Without Resampling[4]	With Resampling	With Resampling
100 k	0.5	5	70
200 k	0.5	5	35
500 k	0.5	5	12
1 M	0.5	5	7
4.16 M	0.5	5	5
> 4.17 M	—	5	5

[1] 32-QAM arb waveform, 2 samples per symbol, 65535 symbols
[2] Times include initialization, resampling and writing the arb waveform, and initiation of signal generation
[3] Resampling is always required
[4] Resampling is not needed when the IQ rate for the application is an IQ supported by the DUC. Refer to the *NI-RFSG VI Reference Help* for more information about supported IQ rates.

Internal Frequency Reference

Frequency ..... 10 MHz

Temperature stability ..... ± 20 ppb maximum

Aging

Per year ..... ± 100 ppb maximum

Per day ..... ± 1 ppb after 72 hours

Initial achievable accuracy ..... ± 50 ppb maximum

Locking range ..... ±0.5 ppm minimum

Lock time for the NI 5610 (to external reference) ..... 5 sec maximum

10 MHz reference out ..... 1 ± 0.1 V_{pk-pk} (6.7 dBm into 50 Ω load, fundamental frequency)

Spectral Purity

Phase Noise

Real-time bandwidth ≤ 10 MHz		
	Maximum Phase Noise (dBc/Hz)	
Offset Frequency	Carrier Frequency = 1 GHz	Carrier Frequency = 2 GHz
100 Hz	–82	–79
1 kHz	–85	–83
10 kHz	–93	–92
100 kHz	–110	–110
Real-time bandwidth > 10 MHz		
	Maximum Phase Noise (dBc/Hz)	
Offset Frequency	Carrier Frequency = 1 GHz	Carrier Frequency = 2 GHz
100 Hz	–72	–70
1 kHz	–75	–72
10 kHz	–98	–96
100 kHz	–116	–116

Residual FM .....4.5 Hz rms maximum
(Continuous wave, 300 Hz to 3 kHz integration bandwidth)

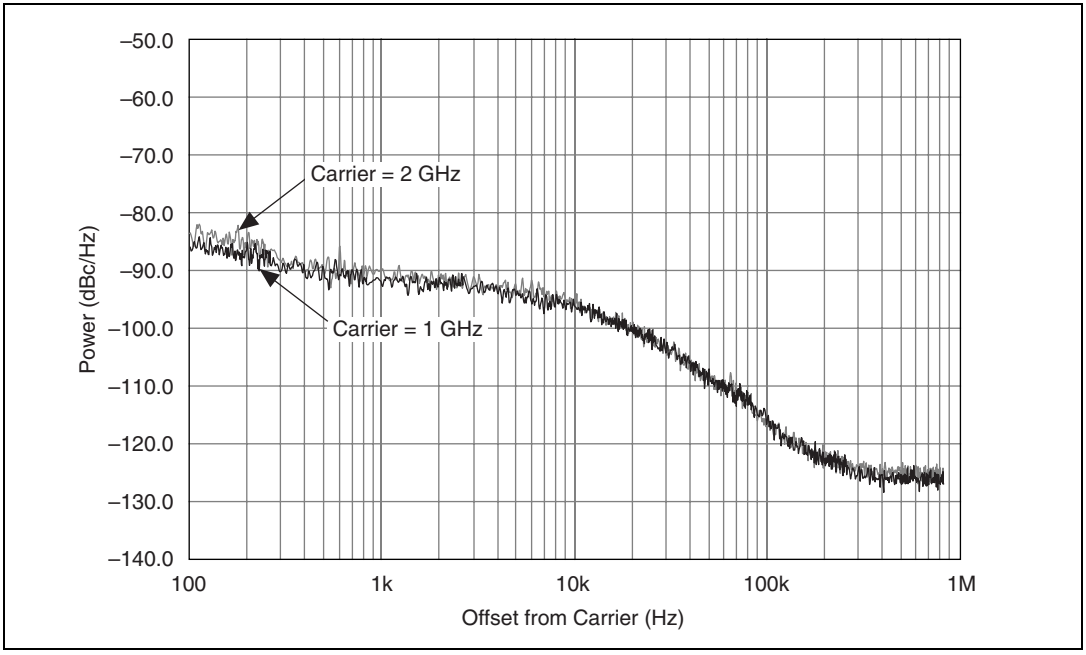


Figure 1. Typical Phase Noise at 1 GHz, Real-Time Bandwidth ≤10 MHz

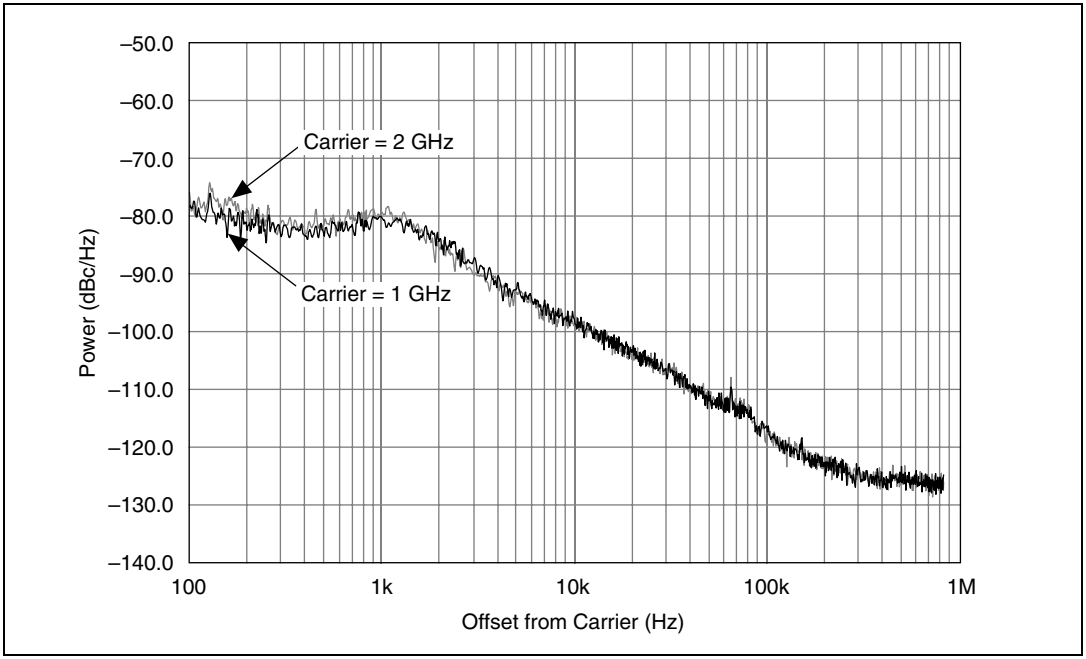


Figure 2. Typical Phase Noise at 1 GHz and 2 GHz, Real-Time Bandwidth >10 MHz

Spurious Responses

Harmonic (0 dBm RF Output Power)

Second harmonic (> 10 MHz)

0 °C to 55 °C ..... –40 dBc maximum

Output third-order distortion (IMD)
(two –3 dBm tones, >200 kHz apart) ....–75 dBc typical

Nonharmonic (0 dBm RF Output Power)

IF[1] – RF output frequency .....–64 dBc typical,
–58 dBc maximum

IF[1] leakage .....–70 dBc typical,
–63 dBc maximum

Others.....–80 dBc

LO Leakage

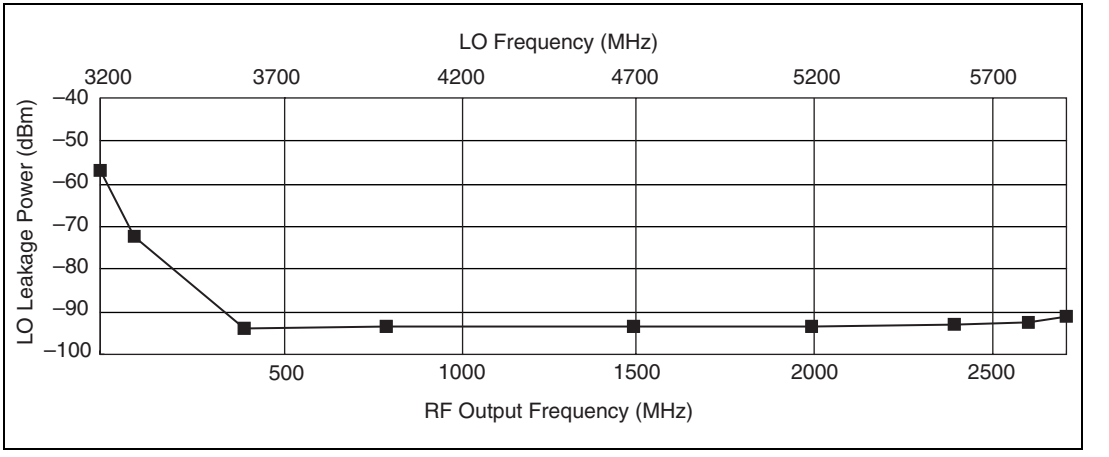


Figure 3. LO Leakage at RF OUTPUT, 0 dBm Output Power

[1] IF is at 3.2 GHz.

AWG Module System Clock

Rate ..... 100 MHz, typical

Harmonic and spurious response ..... –105 dBm, typical

RF Output Characteristics

Power Range

Output..... –145 dBm to +10 dBm

Resolution

NI 567*X*..... 0.02 dB, minimum

NI 5610 ..... 1 dB, typical

Amplitude settling time

NI 5610 ..... 0.1 dB within 5 msec, typical

NI 5421 ..... 0.1 dB within 30 msec, typical

Voltage Standing Wave Ratio (VSWR) (output)

Output Frequency	Maximum VSWR
10 MHz to 2.3 GHz	1.6:1
2.3 GHz to 2.7 GHz	1.7:1

Output 1 dB Gain Compression Point

	Minimum 1 dB Gain Compression Point (dBm)	
Output Frequency	15 °C to 35 °C	0 °C to 55 °C
Up to 2.0 GHz	16	14.5
2.0 GHz to 2.5 GHz	14	12.5
2.5 GHz to 2.7 GHz	13	11.5

Output Power Level Accuracy

Output Frequency	Typical Output Power Level Accuracy (dB)			
	+7 dBm to –30 dBm	–30 dBm to –80 dBm	–80 dBm to –127 dBm	< –127 dBm (typical)
10 MHz to 2.7 GHz	±0.7	±0.8	±1	±1.5
250 kHz to 10 MHz	±1.2	±1.3	±1.5	±2

25 °C ±10 °C.
Accuracy degrades by < 0.03 dB per °C over full temperature range.
Accuracy degrades by 0.1 dB per dB above +7 dBm power levels, and by 0.15 dB per dB above +10 dBm power levels.
At non-system spur frequencies. Refer to the *Spurious Responses* section for more information.
The environmental temperature must be stable to maintain specified power level accuracy. The device temperature is taken into account every time the signal generation is initiated. If generating one signal for a long period of time in a temperature-fluctuating environment, call niRFSG Perform Thermal Correction periodically as needed.

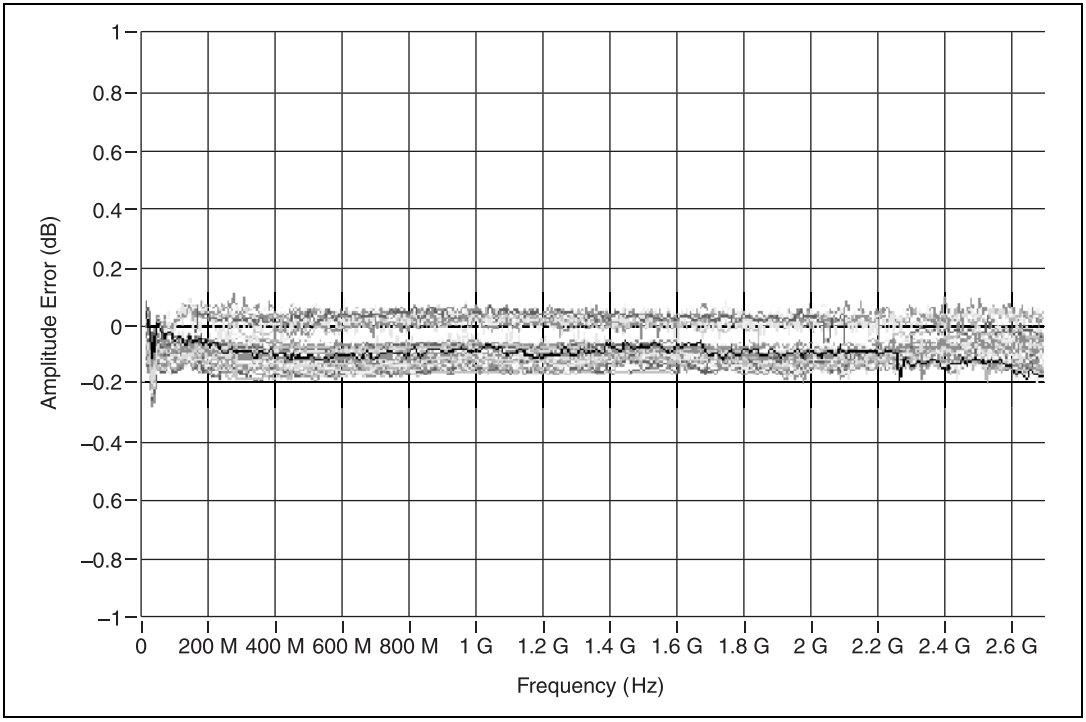


Figure 4. Typical Output Power Level Accuracy, –45 dBm to +10 dBm[1]

[1] 1 dB increments,10 MHz to 2.7 GHz; 5 MHz increments (RF frequency multiple of 5 MHz). Measurement and calibration performed using the same power meter at 25 °C ambient. For random RF frequencies, typical sine wave amplitude accuracy is ±0.3 dB.

Output Noise Density

Output Power Level (dBm)	Typical Noise Density, 15 °C to 35 °C (dBm/Hz)	Typical Noise Density, 0 °C to 55 °C (dBm/Hz)
0	–120	–115
–20	–140	–135

Noise Floor at 2 GHz

Output Power Level (dBm)	Typical Noise Floor (dBm/Hz)
–57	–158
–50	–157
–40	–154
–30	–147
–20	–140
–10	–130
0	–120
10	–110

Vector modulation
bandwidth flatness..... ±0.5 dB, typical[1]

Group delay deviation (within
the vector modulation bandwidth) ..... ±20 ns, typical

Group delay

NI 54*XX* AWG module..... 750 nsec, typical[2]

NI 5610 upconverter module ..... 1,200 nsec, typical

Overload protection on RF output

Maximum reverse RF power ..... 4 W

Maximum DC input..... ±50 VDC

[1] Equalization enabled. ±1.8 dB maximum with equalization disabled.

[2] For the NI PXI-5421, group delay is the time between receipt of start trigger to commencement of waveform output.

Local Osc Out 0

Frequency range .....3.2 GHz to 5.9 GHz typical

Power .....–22 dBm typical

VSWR.....1.5:1 maximum

Phase Noise—Local Osc Out 0

Offset Frequency (kHz)	Typical Phase Noise		
	Carrier Frequency 3.2 GHz (dBc/Hz)	Carrier Frequency 4.2 GHz (dBc/Hz)	Carrier Frequency 5.2 GHz (dBc/Hz)
1	–89	–88	–85
10	–98	–98	–95
100	–120	–120	–120

Close-In Spurious Responses (carrier-modulated)

Real-Time Bandwidth	Spurious Response	
	Offset from Carrier	Typical Power (dBc)
≤10 MHz	<100 Hz	–50 maximum
	100 Hz to 10 kHz	–60 maximum
>10 MHz	<400 Hz	–40 maximum
	100 Hz to 2 kHz	–50 maximum

10 MHz Inputs/Ouputs Front Panel

Frequency reference input ..... 50 Ω, SMA female
- Input amplitude ..... –5 to +16 dBm
- Input frequency range ..... 10 MHz ± 0.5 ppm

10 MHz outputs ..... 50 Ω, SMA female
- Signal ..... Square wave
- Amplitude ..... Refer to the *Frequency Characteristics* section
- Accuracy ..... Refer to the *Frequency Characteristics* section

FM Modulation

FM distortion[1] ..... < 1% typical

Digital Modulation

QPSK, 16-QAM, 64-QAM

Symbol Rate	Typical EVM (%)	Typical MER (dB)
200 kS/s	1.0	37.0
1 MS/s	1.0	37.0
2.56 MS/s	1.0	37.0
5.12 MS/s	1.0	37.0
10 MS/s	1.2	36.0

Root Raised Cosine Filter.
alpha = 0.25; carrier frequency = 1 GHz; 2,000 symbol pseudorandom bit stream (PRBS).
equalization: on.

[1] Modulation frequency 1 kHz, carrier frequency 1 GHz, FM deviation 100 kHz, filter bandwidth 2 MHz.

Typical Digital Modulation Spectra

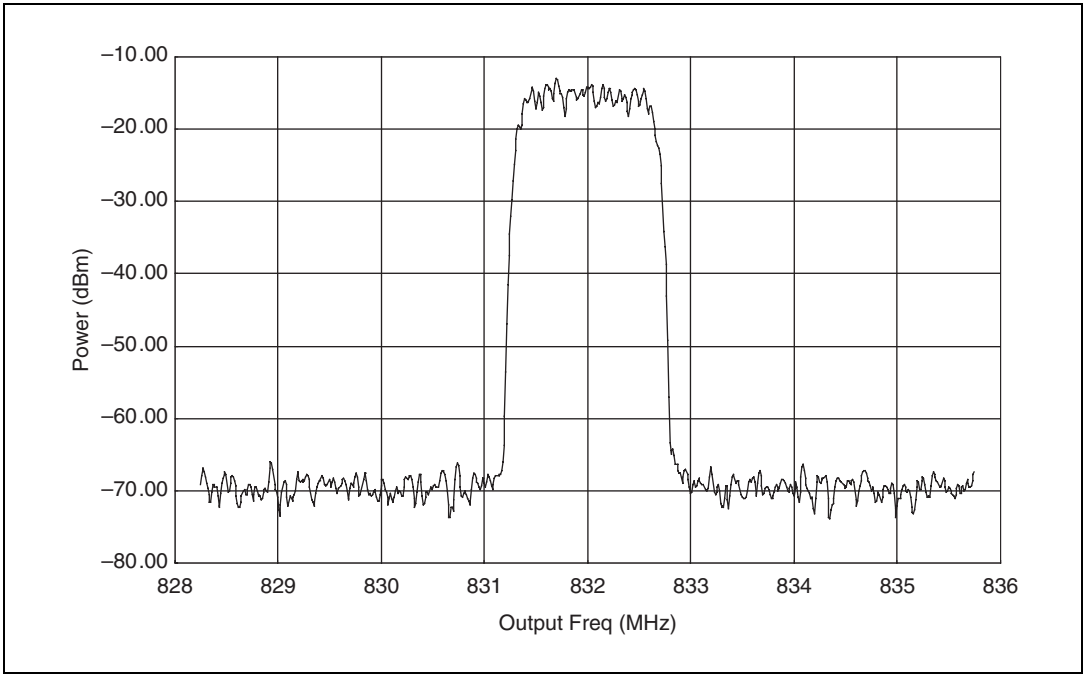


Figure 5. Typical Power Spectrum for a QPSK Signal, Symbol Rate = 1.2288 MS/s with Filter Rolloff Factor = 0.25 and Resolution Bandwidth = 100 kHz[1]

[1] Measurement performed using NI 567*X* and NI 5660 RF Signal Analyzer. NI 5660 reference level = 0 dBm, NI PXI-567*X* output setting = 0 dBm.

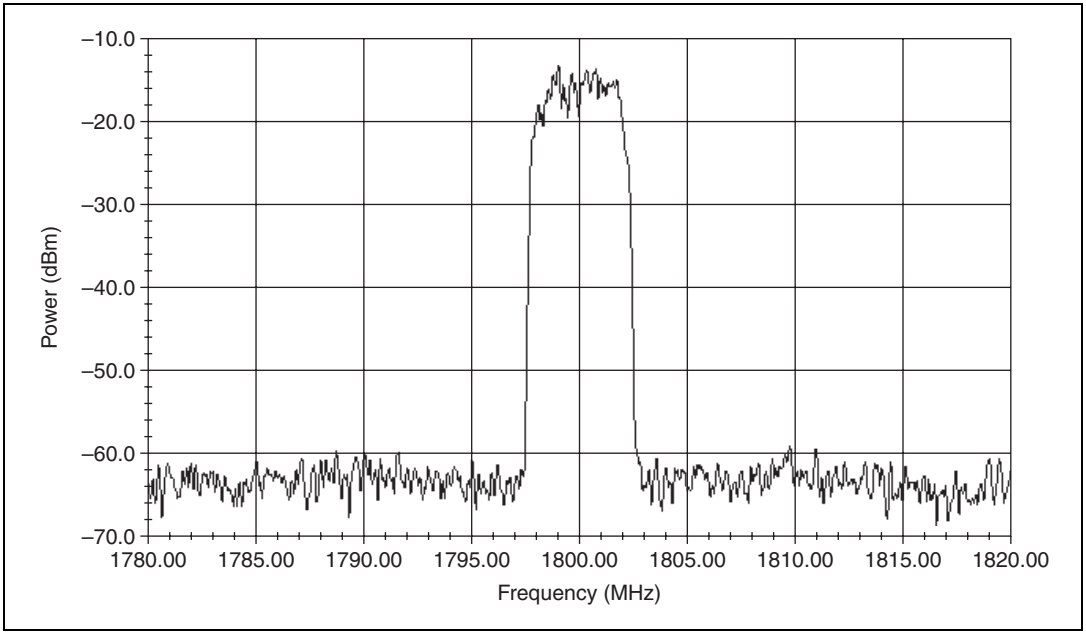


Figure 6. Typical Power Spectrum for a QPSK Signal, Symbol Rate = 3.9 MS/s with Filter Rolloff Factor = 0.25 and Resolution Bandwidth = 100 kHz[1]

[1] Measurement performed using NI 567*X* and NI 5660 RF Signal Analyzer. NI 5660 reference level = 0 dBm, NI PXI-567*X* output setting = 0 dBm.

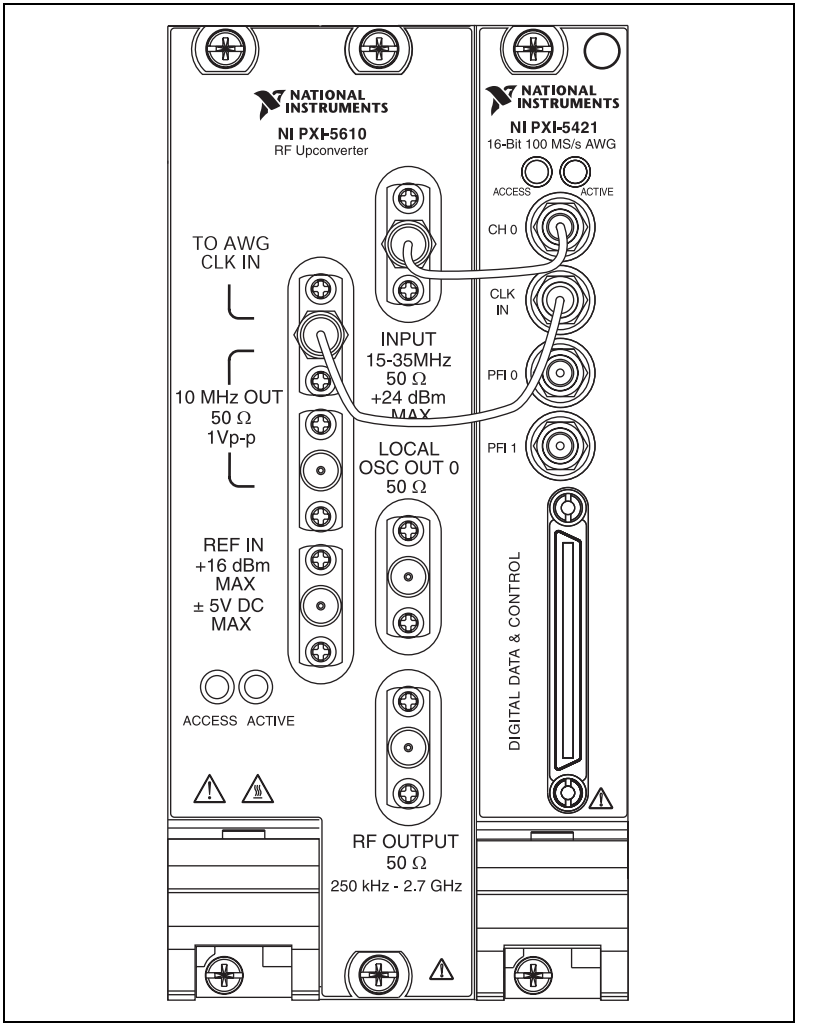


Figure 7. NI PXI-567*X* Front Panel

Front Panel Connectors

NI 5610 Upconverter Module

10 MHz OUT.....SMA

10 MHz OUT
(TO AWG CLK IN) .....SMA

REF IN.....SMA

INPUT .....SMA

LOCAL OSC OUT 0 ..... SMA
RF OUTPUT ..... SMA

NI 54*XX* AWG Module
CH 0 ..... SMB
CLK IN ..... SMB
PFI 0 ..... SMB
PFI 1 ..... SMB
Digital Data & Control ..... 68-pin male VHDCI

Dimensions ..... 3U, One Slot,
PXI/cPCI Module
4.0 cm × 13.0 cm × 21.6 cm
(1.6 in. × 5.1 in. × 8.5 in.)

Weight ..... 1,165 g (41.1 oz)

DC Power

NI PXI-5610 Upconverter Module (typical 25 W)

Voltage (V_{DC})	Maximum Current (A)	Typical Current (A)
+3.3	0.5	0.15
+5	3.75	2.6
+12	1.0	0.9
–12	0.08	0.06

NI PXI-5421 AWG Module (typical 22 W)[1]

Voltage (V_{DC})	Maximum Current (A)	Typical Current(A)
+3.3	2.7	1.9
+5	2.2	2.0
+12	0.5	0.46
–12	0.01	0.01

[1] Refer to the specifications document for your AWG module, located at **Start»Programs»National Instruments»NI-FGEN»Documentation»Specifications**, for complete AWG module specifications.

NI PXI-5441 AWG Module (typical 22 W)[1]

Voltage (V_{DC})	Maximum Current (A)	Typical Current (A)
+3.3	0.5	0.15
+5	3.75	2.6
+12	0.97	0.9
–12	0.08	0.06

Environmental

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

Operating Environment

Ambient temperature range

NI PXI-567*X* upconverter..... 0 °C to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

NI PXI-54*XX* AWG..... 0 °C to 45 °C (When installed in NI PXI-101*X* or PXI-1000B chassis.)

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

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

Storage Environment

Ambient temperature range .....–20 °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.)

[1] Refer to the specifications document for your AWG module, located at **Start»Programs»National Instruments»NI-FGEN»Documentation»Specifications**, for complete AWG module specifications.

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-2880F, Class B.)

Calibration

Interval

NI 5610 upconverter[1] ..... 1 year

NI 54*XX* AWG ..... 2 years

Compliance and Certifications

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
- CAN/CSA-C22.2 No. 61010-1

Note For UL and other safety certifications, refer to the product label, or visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

[1] Factory calibration is invalidated if the NI 5610 RF upconverter module enclosure is opened. To preserve guaranteed calibration, do not disassemble the NI 5610 RF upconverter module.

Electromagnetic Compatibility

Emissions.....EN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

Immunity .....EN 61326:1997 + A2:2001, Table 1

EMC/EMI .....CE, C-Tick, and FCC Part 15 (Class A) Compliant

Note For EMC compliance, operate this device with shielded cabling.

CE Compliance

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

Low-Voltage Directive (safety).....73/23/EEC

Electromagnetic Compatibility Directive (EMC).....89/336/EEC

Note Refer to the Declaration of Conformity (DoC) for this product for any 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.

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