PXI Modules

3020 Series Digital RF Signal Generators

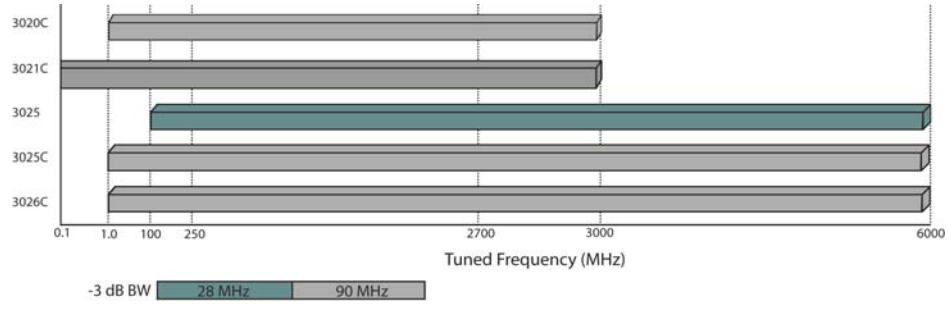
Fully featured PXI digital RF signal generator modules for applications in communications system test

- Frequency ranges spanning 100 kHz to 6 GHz
- Level ranges -120 dBm up to +17 dBm max.
- Level accuracy ±0.3 dB typical cw
- Analog, digital and vector modulation
- Up to 90 MHz RF modulation bandwidth
- List mode for fast switching and waveform sequencing
- Dual-channel AWG with up to 2 Gb memory
- IQCreator waveform creation software
- Data interface for digital IQ streaming
- Low phase noise typically -115 dBc/Hz at 20 kHz offset
- Versatile triggering
- Optional analog I & Q inputs and I & Q outputs
- PXI Studio Application Software

Creating high quality complex RF test signals has never been more flexible or cost effective.

The 3020 Series are compact 3U high precision PXI modular RF signal generators with integrated dual-channel arbitrary waveform generator, (AWG). Their functionality and performance are ideally matched to the needs of RF test systems for R&D manufacturing and design verification.The 3020 Series support applications in the frequency range 100 kHz to 6 GHz, provide output power control ranging from -120 dBm to +17 dBm and support modulation bandwidths of up to 90 MHz.

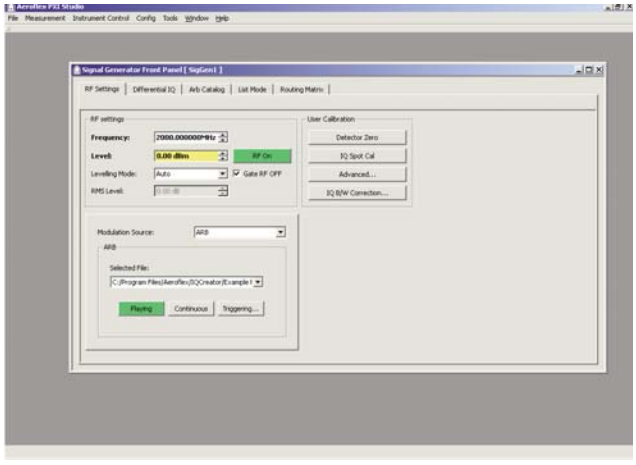
Comprehensive modulation capability is provided including internal analog AM/FM modulation, digital modulation and IQ vector modulation modes. Digital modulated signals are generated from either an integrated dual channel AWG or from external digital I & Q inputs. Analog I and Q vector modulation inputs are provided as an option. Modulated RF bandwidths of up to 90 MHz are supported ideal for multicarrier or wideband signal applications. The dual-channel AWG can optionally provide differential I and Q baseband outputs simultaneously with a CW RF signal, ideally suited for testing IQ modulators. Each 3020 Series module is used together with a single slot wide 3010/3011 RF synthesizer module to provide a low phase noise, frequency agile local oscillator input.



The 3020 Series Family

PXI Studio Application Software

PXI Studio is a software application for use with all Aeroflex 3000 Series PXI modules. This highly flexible application supports vector signal generation and vector signal analysis of complex modulated signals when used with appropriate modules. The graphical user interface simplifies operation, making the 3000 Series suitable for all manner of benchtop applications. PXI Studio can also be used to control a number of signal generator modules collectively from the one user interface, ideal for multiple signal test scenarios.



PXI Studio

Complex modulation waveforms can be designed using software application IQCreator, then loaded into the 3020 Series AWG and played using PXI Studio. IQCreator provides design templates for all common 2nd, 3rd and 4th generation digital radio standards as well as custom waveform templates for FSK, PSK and QAM based modulation types. IQCreator also provides tools to package external IQ vector files compatible for use with the AWG. This enables waveforms produced using design tools such as MatLab or MathCad to be supported.

Cellular		Wireless Data		Others	
2/2.5G	3G	WLAN	W/MAN	Generic	FSK, PSK, QAM
GSM EDGE IS95	3GPP FDD cdma2000 TD-SCDMA 1xEVDO LTE	802.11a 802.11b 802.11g	802.16D 802.16E	Cordless Trunked Avionics	DECT TETRA VDL

Advantages of 3020 Series and PXI

The 3020 Series digital RF signal generators offer significant economies compared to other general purpose rack and stack instruments while maintaining high performance and broad functionality. In part this is achieved by exploiting the benefits of the PXI specification, an industry standard open architecture for modular instrumentation. Using PXI enables faster measurement speed, smaller size and greater flexibility for integration and future system evolution.

Applications

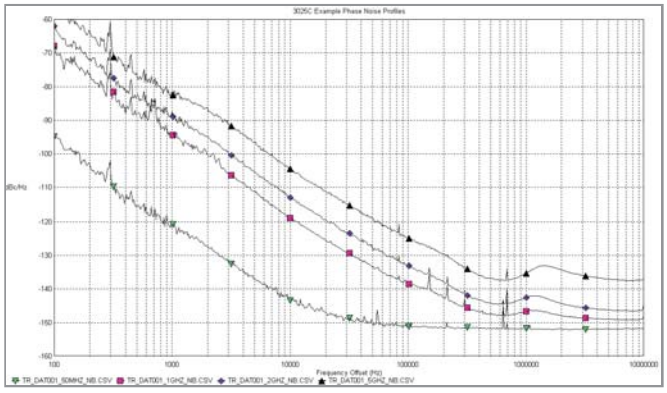
The 3020 Series are an essential component within any automated development or manufacturing RF test system designed around the needs of advanced digital communications standards as used in WLAN, WMAN and cellular communications, including LTE, as well as applications in satellite and terrestrial TV broadcasting and military communications. Whether the application is for measurement or system emulation, they deliver the functionality and performance required. When used in conjunction with other Aeroflex PXI RF modules, PXI chassis and system controller, complete RF test systems can be designed. The 3020 Series is complementary to the 3030 Series of RF digitizers which provide wideband high dynamic range A to D conversion of RF input signals up to 6 GHz. Aeroflex PXI modules can be supplied standalone or configured ready to go within an 8 slot PXI chassis with an embedded system controller with all software pre-installed.

Performance Highlights

Wide Frequency Range: The 3020 Series variants cover a variety of frequency ranges at different power levels with a frequency resolution as low as 1 Hz:

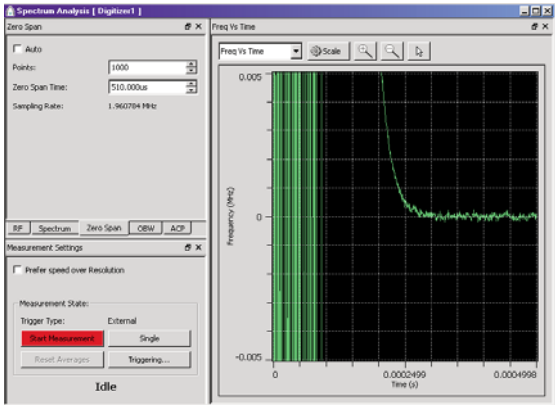
	Module	Frequency Range	Max Peak Power	
28 MHz Basic	3025	Up to 6 GHz	5 dBm	Low
90 MHz Enhanced	3020C	Up to 3 GHz	6 dBm	
	3025C	Up to 6 GHz	6 dBm	
	3021C	Up to 3 GHz	17 dBm	High
	3026C	Up to 6 GHz	17 dBm	

Low Noise: Each 3020 Series module is designed to be used with a 3010 Series RF synthesizer module with phase noise at 20 kHz offset from carrier typically -135 dBc/Hz at 50 MHz, -116 dBc/Hz at 2 GHz and -108 dBc/Hz at 5 GHz while the noise floor at 2 GHz is typically -135 dBc/Hz from 10 MHz offset.



Typical 3020 Series Phase Noise Profiles

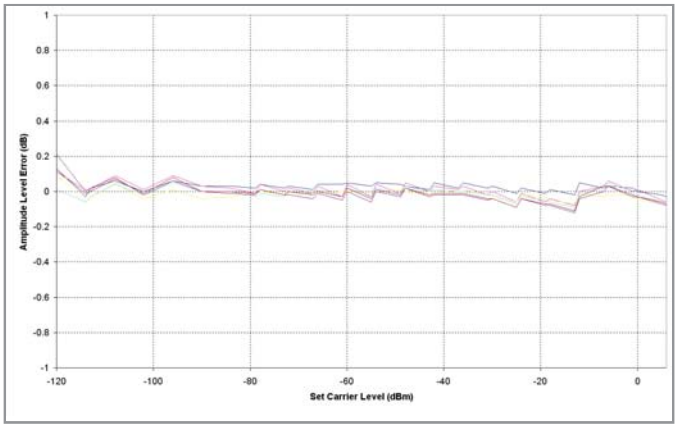
Frequency Agile: For frequencies 85 MHz and below, direct digital synthesis, (DDS) is used achieving frequency switching times of typically 25 μs (3020 option 02 fitted). Above 85 MHz frequency switching in typically 250 μs is achieved (3010 opt 01 fitted), making the 302xC ideal for high productivity RFIC testing or as a stimulus to frequency hopping radios.



Frequency Settling Time 930 MHz to 1800 MHz

Accurate RF Level: The output level is electronically variable in fine 0.01 dB increments from -120 dBm to a maximum level of up to +6 dBm (or 17 dBm with 3021C/3026C, see table below). An all digital levelling control loop ensures that even with complex bursty modulated signals the output signal is accurately set. Levelling control is combined with an electronic high speed RF attenuator for high reliability in volume manufacturing. High dynamic range modulated RF bursts can be generated to simulate TDMA signal characteristics as used in a variety of cellular and other wireless applications.

Max Peak Output Power					
	3020C	**3021C**	**3025**	**3025C**	**3026C**
<3 GHz	+6 dBm	+17 dBm	+5 dBm	+6 dBm	+17 dBm
>3 GHz	N/A	N/A	0 dBm	+1 dBm	+17 dBm



Typical Level Accuracy at 2 GHz (using 3025C)

Stability: Frequency and power settings remain stable across both time and temperature variation ensuring consistent measurement results time and time again. Using the 3011's internal OCXO 10 MHz reference, frequency stability is typically 0.01 ppm across 0 to 50 degrees C.

IQ Digital Modulation: High quality digital modulation is provided with I and Q bandwidths of up to ±45 MHz producting modulated RF carriers with bandwidths up to 90 MHz, ideal for testing multi channel amplifiers and applications in broadband wireless standards such as WiMAX. IQ calibration ensures that modulator carrier leakage and sideband suppression are typically <-50 dBc. Modulation linearity for UMTS W-CDMA (downlink test model 1) is better than 55 dB, more that suitable for testing mobile amplifiers. The source of modulation can be either from the internal dual-channel Arbitrary Waveform Generator (AWG), or from external digital I and Q data. The data interface can be used to stream in 14 bit digital I and Q data and associated control and timing signals.

Analog FM and AM Modulation: AM or FM modulation is generated from an internal sinusoidal modulation source with a frequency range 1 kHz to 50 kHz. FM deviations up to 500 kHz can be set with a 10 Hz resolution.

Optional Analog I & Q Outputs and Analog I & Q Inputs: When fitted, they can provide outputs at base band simultaneously with a CW output at RF making them ideal for testing RFIC modulators. Analog I & Q outputs from the dual-channel AWG can be set as single ended or differential. Differential output level can be set in the range 100 mV to 4 V pk with or without additional DC biasing control to ±3 V and differential offset voltage control to <±600 mV with a limit of 6 V total EMF.

IQ Vector Modulation: Vector modulation from external analog I & Q sources is supported on carrier frequencies above 85 MHz with I and Q bandwidths up to ±45 MHz.

Arbitrary Waveform Generator: The dual-channel AWG has up to 2 Gbytes (512 Msamples) sample memory, each 32 bit sample word consisting of 14 bit I, 14 bit Q and 4 bit marker data. The AWG memory can be used to store either a single long waveform or a number of smaller waveforms up to the limit of the sample memory. Transfer of waveforms between the controller and the AWG is fast by virtue of the wide bandwidth of the PXI backplane and once loaded switching between waveforms can be almost instantaneous when using list mode. Through innovative design, the dual-channel AWG can achieve a single file playback times by incorporating a real time interpolating filter. Extending playback time still further can be achieved by sequencing the AWG files in list mode.

Triggering and Synchronization: The 3020 Series is equipped with a variety of triggering facilities to maximize flexibility for synchronous measurements. Trigger scenarios can be configured making it possible for different trigger events to impact different hardware responses. These can be used for a variety of simple or complex switching/control applications including addressed selection or stepped increment of RF frequency, level, AWG file, marker/trigger routing from the front panel to PXI backplane or vice versa, control of modulation on/off, RF on/off status, and RF levelling loop. Trigger sources can be via the front panel or the PXI backplane. The front panel supports triggering from a TTL input or via the data interface. The data interface can be used to supply single line or addressed triggers as well as supporting marker inputs and outputs. Similarly the 3020 Series supports PXI backplane trigger sources. Trigger inputs may be routed to the 3010 using the PXI local bus.

The front panel data interface connector provides an interface for real time digital I and Q data streaming.

List Mode: In list mode all internal hardware settings are pre-calculated making it possible to change settings rapidly while maintaining RF output accuracy. This feature is ideally suited for component testing or fast receiver alignment applications. List mode supports 128 combinations of different frequency and level settings.

Using list mode it is also possible to construct a sequence of different AWG waveforms. This can be used to effectively extend the sample memory and thereby create very long waveform playback times.

AWG waveform selection can be combined with frequency and level selection in list mode thus permitting all RF parameters to be configured by a new list address. This allows reconfiguration of signal generator settings in the shortest possible time and thereby accelerate test speed.

List mode supports up to 128 addresses. At each address the file can be played a user defined fixed number of times or continuously until triggered to the next sequence step. AWG sequencing is highly flexible, an AWG file play sequence can also be constructed to include periods of unmodulated or no signal output. Stepping between list address can be triggered as an immediate event or set up to wait for the current waveform file to end before playing the next file. This configuration option ensures continuous baseband generation from the AWG when sequencing through List Mode and hence can avoid switching transients being generated.

SOFTWARE

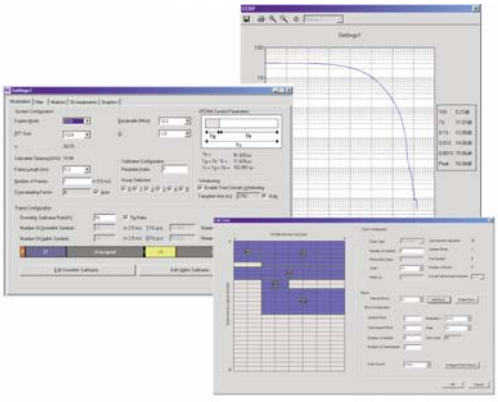
The 3020 Series modules are supplied with a variety of software including applications, instrument drivers and soft front panels.

Driver Software

All 3020 Series modules are supplied with multi layered software APIs and GUIs starting with a low level vxi pnp module driver and a single high level signal generator driver for the combination of a 3020 Series and a 3010 Series module. Each driver is supplied with a .dll interface and is supported with an associated soft front panel graphical user interface to aid manual operation and debugging during application development.

IQCreator Waveform Creation Software

IQCreator enables the design of a wide range of user defined or system specific complex digital modulation waveform files for use with the 3020 Series AWG. Generic capabilities include FSK, MSK, PSK and QAM modulation types with user defined symbol rates and a choice of filter characteristics. Data sources can be PRBS, fixed pattern or user defined. In addition, the user can enter deliberate IQ errors. Also included are standard waveforms and design templates for 2G, 2.5G, 3G and 4G, TDMA ,CDMA and OFDMA digital cellular standards together with WLAN, WMAN and cordless telephone standards. IQCreator also supports the development of multi-tone, multi-carrier and multi-standard waveforms. For testing 3G receivers with specific C/N input levels, IQCreator permits AWGN interference to be combined with the modulation waveform. IQCreator provides graphical illustration of waveform, spectrum and CCDF characteristics.



IQCreator WiMAX Waveform Templates

IQCreator is a "free to download" application from the Aeroflex web site at www.aeroflex.com/IQCreator. Loading waveforms created using IQCreator into the 3020 Series module requires the enable IQCreator option 100 fitted in the module. In the absence of the enable IQCreator option, the software may still be used to package custom ASCII or BIN files, e.g. convert from MATLAB or Mathcad into the correct format for use in the AWG.

Customer Support

Users can elect to purchase PXI modules with optional warranty extensions.

Standard extended warranty provides either 36 months or 60 months warranty period plus the benefits of guaranteed product repair times in the event of failure.

Standard extended warranty can also be provided inclusive of scheduled calibration.

On request Aeroflex can provide customized premium warranty support designed around your specific needs.

SPECIFICATION

All 3020 Series specifications are defined when used in conjunction with a 3010/11 RF synthesizer PXI module and driver software supplied with the module (or later version). Specifications are included for variants 3020C, 3021C, 3025 and 3025C and 3026C.

FREQUENCY

Range

3020C	1 MHz to 3 GHz useable to 100 kHz
3021C	100 kHz to 3 GHz
3025	100 MHz to 6 GHz useable to 76 MHz
3025C	1 MHz to 6 GHz useable to 100 kHz
3026C	1 MHz to 6 GHz

Resolution

≤ 3 GHz; 1 Hz
>3 GHz; 2 Hz

Accuracy

As per frequency reference (± 58 mHz for carriers ≤ 85 MHz)

Settling Time[1]

Below 3 GHz: typical setting time to within 0.7 ppm or 1 kHz of final frequency (whichever is the smaller)

Above 3 GHz: typical settling time to within 2 kHz of final frequency

List Mode[2, 3]	250 µs (25 µs ≤ 85 MHz)
301x loop BW Normal	1.1 ms
301x loop BW Narrow	10 ms

[1] 3020C/3021C/3025C DDS clock mode=fast

[2] 3010 option 01 fitted, 301x loop BW normal and 3020 option 02 fitted

[3] 3020C/3021C/3025C Not applicable when crossing 85 MHz

LEVEL

Output Power Range (peak)

	≤85 MHz	≤3 GHz	>3 GHz
3020C	-120 to +6 dBm	-120 to +6 dBm	NA
3021C	-121 to +14 dBm	-121 to +17 dBm	NA
3025	NA	-120 to +5 dBm	-120 to 0 dBm
3025C	-120 to +6 dBm	-120 to +6 dBm	-120 to +1 dBm
3026C	-121 to +14 dBm	-121 to +17 dBm	-121 to +17 dBm

Resolution[1]

±0.01 dB (Nominal)

[1] Settable resolution within ALC range. ALC range dependant upon: attenuator and output amplifier switch points; modulated waveform characteristics. Level accuracy specification takes precedence.

Accuracy (±dB for CW signals @ 23°C ±5°C)

3020C

>-78 dBm	<0.6 dB (typ 0.3 dB)
>-93 dBm	<0.75 dB (typ 0.5 dB)
>-100 dBm	<1.0 dB (typ 0.5 dB)
>-113 dBm	<1.0 dB (typ 0.5 dB)

3021C

> 12 dBm	<1.0 dB (typ 0.5 dB)
>-78 dBm	<0.6 dB (typ 0.3 dB)
>-93 dBm	<0.75 dB (typ 0.5 dB)
>-100 dBm	<1.0 dB (typ 0.5 dB)
>-113 dBm	<1.0 dB (typ 0.5 dB)
>-121 dBm	(typ 1 dB)

3025	**<3 GHz**	**>3 GHz**
>-78 dBm	< 0.6 dB (typ 0.3 dB)	<1.0 dB
>-93 dBm	<0.75 dB (typ 0.5 dB)	<1.0 dB
>-100 dBm	<1.0 dB (typ 0.5 dB)	<1.0 dB
>-113 dBm	<1.0 dB (typ 0.5 dB)	unspecified

3025C

>-78 dBm	<0.6 dB (typ 0.3 dB)	<1.0 dB (typ 0.6 dB)
>-93 dBm	<0.75 dB (typ 0.5 dB)	<1.0 dB (typ 0.6 dB)
>-100 dBm	<1.0 dB (typ 0.5 dB)	<1.0 dB (typ 0.6 dB)
>-113 dBm	<1.0 dB (typ 0.5 dB)	unspecified

3026C

> 12 dBm	<1.0 dB (typ 0.5 dB)	<1.0 dB (typ 0.6 dB)
>-78 dBm	<0.6 dB (typ 0.3 dB)	<1.0 dB (typ 0.6 dB)
>-93 dBm	<0.75 dB (typ 0.5 dB)	<1.0 dB (typ 0.6 dB)
>-100 dBm	<1.0 dB (typ 0.5 dB)	<1.0 dB (typ 0.6 dB)
>-113 dBm	<1.0 dB (typ 0.5 dB)	unspecified
>-121 dBm	typ 1 dB	

Switching Time (within 0.3 dB of final value)

List mode hardware triggered:

≤4.5 GHz, <3 ms to within 0.3 dB of final value (23°C ±5°C)

>4.5 GHz, <4 ms to within 0.3 dB of final value (23°C ±5°C)

Temperature Stability

3020C/3025/3025C

±0.01 dB/°C

3021C

±0.01 dB/°C	*≤12 dBm*
±0.02 dB/°C	*>12 dBm*

Output Impedance

50 Ω

3020C/3021C

<1.5:1 for output levels below -1 dBm
Typically 1.5:1 above -1 dBm

3025/3025C

≤ 3 GHz	*<1.5:1 for output levels <-1 dBm*
> 3 GHz	*<1.7:1 for output levels <-6 dBm*

3026C

≤ 3 GHz	*<1.5:1 for output levels <-1 dBm*
	Typically 1:5:1 above -1 dBm
> 3 GHz	*<1.7:1 for output levels <-6 dBm*
	Typically 1:7:1 above -6 dBm

Reverse Power Handling

Not to exceed +25 dBm

LIST MODE

List Mode Channel Parameters

RF frequency, RF level, RF levelling mode, RMS offset, RF out (on/off), modulation mode, AWG file selection

List Addresses

128 numbered 0 to 127

Settling Time

See frequency and level data

Address Sources

Manual (software commanded)
External (hardware triggered)
Internal (counter timer)

External Mode Trigger Sources

PXI Trigger bus, star trigger, LVDS Aux 1 to 5, TTL+ve, TTL-ve

Counter Mode (internal)

Dwell time 250 µs to 10 seconds with resolution 10 µs

Dwell time may be overridden depending upon AWG settings.

SPECTRAL PURITY

SSB Phase Noise

Typical at 50 MHz and at ambient room temperature (DDS clock mode = low noise)

3010/11 Loop Bandwidth	***Narrow***	***Wide (normal)***
Offset	*dBc/Hz*	*dBc/Hz*
100 Hz	*-86*	*-109*
1 kHz	*-116*	*-130*
10 kHz	*-140*	*-134*
20 kHz	*-143*	*-139*
100 kHz	*-149*	*-148*
1 MHz	*-149*	*-149*
10 MHz	*-150*	*-150*

Typical at 2 GHz and at ambient room temperature

3010/11 Loop Bandwidth	***Narrow***	***Wide (normal)***
Offset	*dBc/Hz*	*dBc/Hz*
100 Hz	*-54*	*-84*
1 kHz	*-84*	*-102*
10 kHz	*-113*	*-102*
20 kHz	*-115*	*-109*
100 kHz	*-132*	*-129*
1 MHz	*-140*	*-140*
10 MHz	*-144*	*-144*

Phase noise below 100 Hz offset is dependent upon reference phase noise.

Typical phase noise at 5 GHz -108 dBc/Hz 20 kHz offset

Noise Floor (10 MHz offset from 2 GHz)

Typically -140 dBc/Hz

Non-Harmonic Related Spurious *(DDS mode = low noise where applicable)*

Typically -60 dBc at >10 kHz offset

Typically -70 dBc at >10 kHz offset for C.W signals

302xC ≤ 85 MHz, typically -60 dBc at >10 kHz offset for C.W signals

Sub-Harmonics (up to 0 dBm output)

< -30 dBc, typically -55 dBc

Harmonics (≤ 0 dBm output)

	3025	*302xC*
2nd Harmonic	*<-28 dBc (typ -40 dBc)*	*<-28 dBc, (typ -40 dBc)*
3rd Harmonic	*<-30 dBc (typ -55 dBc)*	*<-30 dBc (typ -55 dBc)*

MODULATION

Modulation Modes:

Internal analog AM or FM
Internal digital IQ, (AWG)
External analog IQ (optional) above 86 MHz
External digital IQ (LVDS)

INTERNAL AMPLITUDE MODULATION

Modulation Generator

Single tone, sinusoid

Modulation Rate

1 kHz to 50 kHz

Resolution

1 Hz

Mod Depth Range

0% to 99%

Resolution

1%

Accuracy
(1 kHz mod rate, carrier frequency below 3 GHz)

<±4% of set depth ±1%

Total Harmonic Distortion
(1 kHz mod rate, carrier frequency below 3 GHz)

<1.5% for depths of ≤ 30%
<2% for depths ≤ 80% (up to +16 dBm peak)

INTERNAL FM MODULATION

Modulation Generator

Single tone, sinusoid

FM Modulation Rate

1 kHz to 50 kHz

Resolution

1 Hz

FM Deviation Range

10 Hz to 500 kHz

Resolution

1 Hz to 1 kHz, 10 Hz above

Accuracy *(1 kHz mod rate)*

<±3% of set deviation

Total Harmonic Distortion *(at 1 kHz mod rate and max deviation)*

<1.5% at max deviation

DIGITAL MODULATION

I and Q Bandwidth (±3 dB) at RF output

3025:

Digital Modulation ±14 MHz for carrier frequencies >375 MHz

302xC:

Internal digital: Bandwidth versus carrier frequency

> 500 MHz, ±45 MHz

> 375 MHz, typically ±45 MHz

> 200 MHz, typically ±30 MHz

> 85 MHz, typically ±20 MHz

≤ 85 MHz, up to ±45 MHz[1]

(1) Limited by LF breakpoint at approx. 500 kHz

External Digital:

As internal, but limited to ±Fs/4 by the digital interpolation filter, where Fs is the IQ sample rate.

Residual Carrier Leak[(1)]

Typically -50 dBc above 85 MHz

(1) After warm-up and self calibration valid for temp range 5°C

IQ Image Suppression[(1)]

3025:

Tone frequency	*Typical image suppression level*
10 kHz	*-50 dBc*

(1) After warm-up and self calibration valid for temp range 5°C

302xC:

Tone frequency	*Typical image suppression level*
10 kHz	*-50 dBc*
10 MHz	*-48 dBc*
30 MHz	*-38 dBc*
45 MHz	*-30 dBc*

Linearity

>55 dB ACPR on WCDMA signals (Downlink test model 1)

Meets IEEE 802.11a/g spectral mask with >10 dB standoff for output level <0 dBm rms

Third Order Intermodulation Distortion

3025:

(2 tones with spacing 25 kHz and level at -6 dBm per tone (<3 GHz) or -9 dBm per tone (>3 GHz)

<-50 dBc relative to each tone

302xC:

Carrier Frequency	*Tone spacing*	*Tone spacing [(1)]*
	25 kHz - 50 MHz	*50 MHz - 100 MHz*
<5 GHz	*typ -55 dBc*	*typ -50 dBc*
>5 GHz	*typ -50 dBc*	*typ -46 dBc*

(1) For output levels <0 dBm/tone below 3 GHz and <-5 dBm/tone above 3 GHz

Error Vector Magnitude

Below 3 GHz: typically 1.5% EVM on WCDMA signals
typically 0.5% EVM on GSM EDGE signals

Up to 6 GHz: typically 2% EVM on IEEE 802.11a, b, g signals

ARBITRARY WAVEFORM GENERATOR

Memory

3025:

*32 Msamples I Q * 14 bit + 4 markers*

302xC:

*Standard - 128 Msamples I Q * 14 bit + 4 markers*

*Opt3 - 256 Msamples I Q * 14 bit + 4 markers*

*Opt4 - 512 Msamples I Q * 14 bit + 4 markers*

AWG File Source Data

IQCreator (requires option 100)

*ASC11, 16/32 bit integer, 32 bit floating point**

**using IQCreator waveform packager to convert into a 302X*

compatible format

AWG Trigger Modes:

Internal: Continuous (start/stop) & Single shot

External: Single shot and Gated

Trigger edge +ve, -ve

AWG Trigger Sources:

302xC:

Internal; AWG marker, List address, List strobe out, sequence start, RF blank

External; PXI trigger bus[0-8], start trigger, Serial local bus, TTL (SMB), LVDS

3025:

As above excluding serial bus but including PXI local bus left [0-13]

302xC Enhanced Trigger Modes

Start only; start & stop; re-trigger

Termination selection; Immediate / End of file

Trigger Edge; +ve, -ve, ANY

AWG file play count 1 to 65,535 or continuous

Trigger delay; 0 to 68 seconds resolution 4 ns

Note: AWG trigger latency approx. 520ns + (9 Sample Clocks) where 1 Sample Clock is the period of the current ARB Sample rate.

Sample Rates

3025:

14.323 kHz to 66 MHz

302xC:

10 kHz to 200 MHz

AWG SEQUENCER

Number of Segments

128

Segment Type

AWG file, CW (Mod Off)[1], RF Off[1]

(1)When used in conjunction with list mode

Number of AWG Files

(hosted simultaneously up to the limit of available sample memory)

3025:

1 to 64

302xC:

up to 1 million, (limited to 128 when in List mode)

Length of Segment

128 samples up to limit of AWG memory

Number of Segment Repeats

1 to 4095

Sequence Trigger Modes

Stepped, Single, Continuous

Sequence Trigger Sources

PXI trigger bus, Star trigger, LVDS Aux 1 to 5, TTL+ve, TTL-ve, Software commanded

AWG File Selection Time

AWG completion On - Seamless

AWG completion Off - Defined by sample rate

REAL TIME IQ INTERFACE

Input Level

LVDS (Low voltage differential signalling ANSI/TIA/EIA-644)

Input Data

14 bit IQ data + 4 markers, 5 aux

Output Data

4 markers, 5 aux, clock, IQ select

LVDS Clock

External interleaved data clock required

LVDS clock to be phase locked to 302x 10 MHz reference

Sampling Rate

	3025	**302xC**
14 bit word rate (interleaved)	*28.626 kwords/s to 132 Mwords/s*	*20 kwords/s to 180 Mwords/s*
IQ sample rate	*14.323 kS/s to 66 MS/s*	*10 kS/s to 90 MS/s*

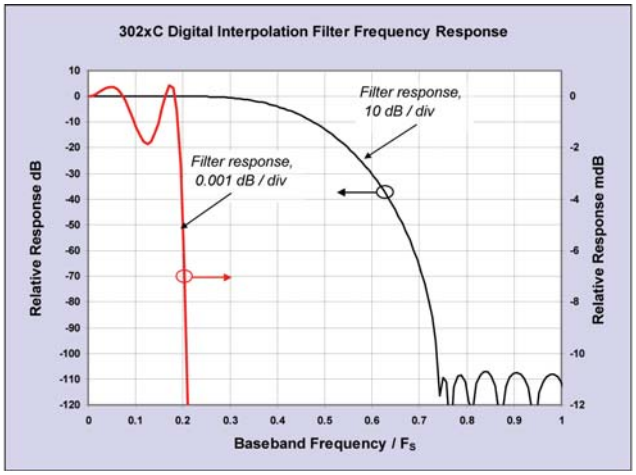
Bandwidth

	3025	**302xC[1]**
Max I and Q bandwidth	*±14 MHz at 66 MS/s*	*±27 MHz at 90 MS/s*
Max RF bandwidth	*28 MHz*	*54 MHz*

(1)The 0.1 dB bandwidth is Fs/4 (3021C/3026C).

The Input IQ data passes through a digital interpolation filter before being applied to the IQ modulator.

The response of this filter for 302xC Variants is shown below:



OPTION 01: ANALOG I & Q INPUTS AND I & Q OUTPUTS

I & Q ANALOG OUTPUTS

Single ended I & Q outputs, 50 ohms
Differential I & Q outputs, 100 ohms

I & Q Output Level Range

	3025	302xC
Single ended into 50 Ω load	100 mV to 4 V pk-pk	100 mV to 1 V pk-pk
Differential into 100 Ω load	200 mV to 8 V pk-pk	200 mV to 2 V pk-pk

I & Q Output Level Resolution

100 µV

I & Q Output Level Accuracy

<2% at 20 kHz, typ 1.5%, excludes termination errors

I/Q Level Imbalance Adjust

±4 dB nominal continuously variable

Output Bias Voltage Range

±3 V

Output Bias Voltage Resolution

1.5 mV

Output Bias Voltage Accuracy[1]

<±0.75% of set Bias, ±15 mV

[1] After warmup and self calibration

Differential Offset Range

±600 mV, differential into 100 Ω load

Differential Offset Resolution

100 µV

Differential Offset Accuracy[1]

<±2% ±3.3 mV max, ±1% ±0.7 mV typical

[1] After warmup and self calibration

Differential Signal Balance

Typically 0.15 dB @ 10 MHz

Frequency Response

3 dB bandwidth at maximum output level

3025:

15 MHz

302xC:

45 MHz

Spectral Purity (2 V pk-pk set voltage at 1 MHz)

2nd harmonic <–60 dBc
3rd harmonic <–65 dBc
IMD <–60 dBc (100 kHz tone spacing)

I & Q ANALOG INPUTS

Single ended I & Q inputs, selectable 50 Ω or 100 kΩ

Input Level (for nominal set RF level)

0.5 Vrms complex signal on I and Q
0.5 Vdc on I or Q

Bandwidth

3025:

>25 MHz (50 Ω only) for carrier frequencies above 375 MHz

302xC:

As for internal digital modulation. Available for carrier frequencies above 85 MHz

INTERFACES

3010/11:

LO output (SMA)
10 MHz reference I/O (SMAx 2)
PCI bus interface including PXI triggering functions

3020 Series:

RF output (SMA)
LO input 1.5 GHz to 3 GHz, nominally 0 dBm (SMA) 50 Ω
10 MHz reference input for sampling clock (SMA)
10 MHz reference link through (SMA)
Data IQ interface (VHDCI)
Ext. trigger In: LVDS, TTL (SMB) or PXI
Trigger out: LVDS or PXI
PCI bus interface including PXI triggering functions
I & Q In (SMB x 2) with 3020 option 01 fitted
–I, +I, –Q, +Q Out (SMB x 4) with 3020 option 01 fitted

POWER CONSUMPTION (TYPICAL)

Max Power is the peak power consumption achieved and does not coincide with max current on all power rails

	3010/3011	3025	3020C/3025C	3021C	3026C
+3.3 V	50 mA[1]	900 mA	3.9 A	3.8 A	3.8 A
+5 V	650 mA	2.6 A	3.1 A	3.9 A	3.9 A
+12 V	50 mA[2]	540 mA	310 mA	850 mA	850 mA
-12 V	30 mA	580 mA	540 mA	710 mA	710 mA
Max power	4.5 W	28 W	37 W	45 W	45 W

[1] 250 mA transiently during power up
[2] -3011 OCXO requires 300 mA startup reducing to 150 mA after 5 minutes

DIMENSIONS AND WEIGHT

Dimensions

3010/11	Single width 3U PXI module
3025	Double width 3U PXI module
3020C/3025C	Double width 3U PXIe Hybrid module
3021C/3026C	3 slot width 3U PXIe Hybrid module

Weight

3010	375 g (0.8 lbs)
3011	390 g (0.86 lbs)
3020C/3025/3025C	675 g (inc option 01) (1.5 lbs)
3021C/3026C	1030 g (inc option 01) (2.27 lbs)

FREQUENCY REFERENCE IN

Source

3010/11	External SMA
302x	External SMA and external PCI

Input

0.4 V to 4 V pk-pk into 50 ohms or looped through

Frequency

10 MHz ±100 Hz

GENERAL

The following general specifications are common to the 3010, 3011 and 302x.

RF Leakage (for carrier frequencies <3 GHz)

<5 µV PD at the carrier frequency into a single turn 25 mm loop, 25 mm or more from the front panel

Standard Warranty

24 months

Calibration Interval

Recommended 24 months

Electromagnetic Compatibility

EN 61326-1, Emissions Class A, Immunity Table 1

Safety

EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1, General requirements

Driver Software

VXIpnp compliant software driver

System Requirements

The recommended minimum system requirements are:

Intel Pentium IV – 1.3 GHz or better

512 MB RAM (for 8-slot chassis - larger PXI chassis may require more memory to be fitted)

200 MB free disk space

1024 x 768 display resolution

CD-ROM drive, network access, or USB memory stick for software installation

Microsoft Windows XP Professional with Service Pack 2

Microsoft Windows 7

NI-VISA - 3.1.0 or later

RATED RANGE OF USE

Operating Temperature

0 to 50°C. Meets IEC-60068-2-1 and 60068-2-2

Operating Humidity

10 to 90% non-condensing. Meets IEC-60068-2-56

CONDITIONS OF STORAGE AND TRANSPORT

Storage Temperature

-20 to +70°C. Meets IEC-60068-2-1 and 60068-2-2

Storage Humidity

5 to 93% non-condensing. Meets IEC-60068-2-56

Shock

30 g peak, half sine, 9 ms pulse. Tested in accordance with IEC-60068-2-27

Random vibration 5 Hz to 500 Hz, 2.46 g rms non-operating. Tested in accordance with IEC-60068-2-64

COMPLIANCE

PXI Hardware Specification, Revision 2.2, ECN 1 Revision1.0 (Hybrid Slot-Compatible PXI-1 Peripheral Module. PXI Software Specification Revision 2.1 VXI plug & play specifications (VPP-2, VPP-3.x, VPP-4.x and VPP-7)

3010/3011 SPECIFIC SPECIFICATIONS

Specifications are common to the 3010 and 3011 unless otherwise stated.

LOCAL OSCILLATOR OUT

Frequency Range

1.5 GHz to 3.0 GHz

Resolution

1 Hz

Accuracy

As frequency standard

Output Power

Fixed level in the range -4 dBm to +3 dBm

Output Impedance

50 Ω Nominal

VSWR

<2:1

FREQUENCY REFERENCE OUT (3011 ONLY)

Level

2 V pk-pk nominal square wave into 50 Ω

Frequency

10 MHz

Aging Rate

1 in 10^9 per day 1 in 10^7 per year

Temperature Stability (0 to 50°C)

Typically better than ±1 x 10^{-8}

Warm-Up Time

<5 minutes

VERSIONS, OPTIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers	Versions
3020C	PXI digital RF signal generator (1 MHz - 3 GHz)
3021C	PXI high power RF signal generator (100 kHz - 3 GHz)
3025	PXI digital RF signal generator (100 MHz - 6 GHz)
3025C	PXI digital RF signal generator (1 MHz - 6 GHz)
3026C	PXI high power RF signal generator (1 MHz – 6 GHz)
3010	PXI RF synthesizer
3011	PXI RF synthesizer (including OCXO 10 MHz reference)
	Supplied with
	The 302x and 3010/11 are each supplied with:
	CD ROM containing VXI PNP driver, soft front panel, PXI Studio and user documentation
	2 SMA link cables
	Options
3020 Opt 01	Analog I & Q inputs and I & Q outputs
3020 Opt 02	High speed frequency switching for frequencies below 85 MHz (available on 3020C/3021C/3025C only)
3020 Opt 03	1 Gb AWG Memory
3020 Opt 04	2 Gb AWG Memory
3010/11 Opt 01	High speed frequency switching
3010/11 Opt 02	PXI Hybrid Slot Compatible
	Waveform Creation Application Software
3020 Opt 100	Enable IQCreator™
3020 Opt 102	Enable IQCreator 2G CDMA + 3G CDMA [1]

When purchased as an upgrade, then order as:

RTROPT100/3020	Enable IQCreator
RTROPT102/3020	Enable IQCreator 2G CDMA + 3G CDMA

	Service Options
W3010/103	Standard extended warranty 36 months
W3020/103	Standard extended warranty 36 months
W3010/103C	Standard extended warranty 36 months with scheduled calibration
W3020/103C	Standard extended warranty 36 months with scheduled calibration
W3010/105	Standard extended warranty 60 months
W3020/105	Standard extended warranty 60 months
W3010/105C	Standard extended warranty 60 months with scheduled calibration
W3020/105C	Standard extended warranty 60 months with scheduled calibration
	Optional Accessories
43139/738	SMA link cable (130 mm)
43139/739	SMA link cable (180 mm)
46885/224	SMA connector saver
23435/698	68 way VHDCI to VHDCI cable assy 1.8 m
23435/699	68 way VHDCI to SCSI-3 cable assy 1.8 m

Notes

[1] Requires option 100

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