

# PXI Modules

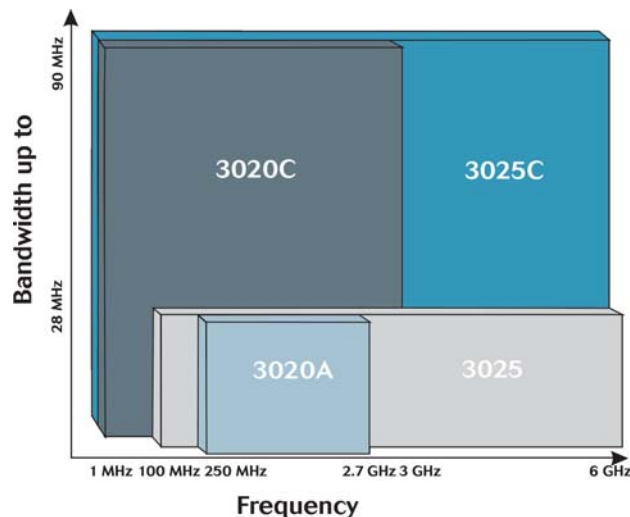
## 3020 Series Digital RF Signal Generators



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

- Frequency ranges spanning 1 MHz to 6 GHz
- Level ranges -120 dBm up to +6 dBm max.
- Level accuracy  $\pm 0.3$  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

The 3020 Series support applications in the frequency range 1 MHz to 6 GHz, provide output power control ranging from -120 dBm to +6 dBm and support modulation bandwidths of up to 90 MHz.



*The 3020 Series Family*

**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.

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. Modulation 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.



## Advantages of 3020 Series and PXI

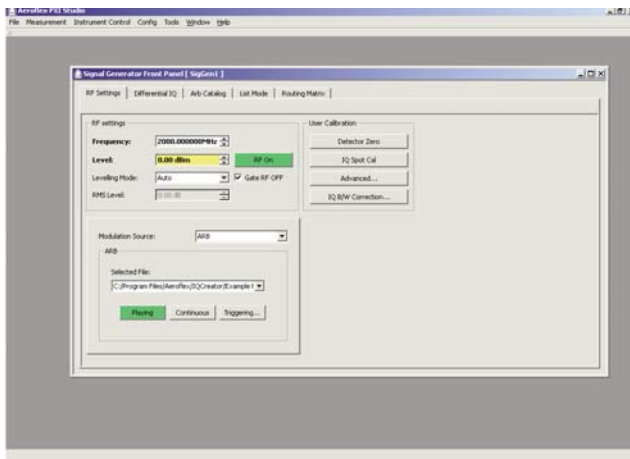
The 3020 Series digital RF signal generators offer significant economies compared to other general purpose rack and stack instruments while maintaining high performance and broad functionality. In part this is achieved by exploiting the benefits of the PXI specification, an industry standard open architecture 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 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 or without a touch screen LCD colour panel display and an embedded system controller with all software pre-installed.

## 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	WMAN	Generic	FSK, PSK, QAM
GSM	3GPP FDD	802.11a	802.16D	Cordless	DECT
EDGE	cdma2000	802.11b	802.16E	Trunked	TETRA
IS95	TD-SCDMA	802.11g		Avionics	VDL
	1xEVDO				



## Performance Highlights

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

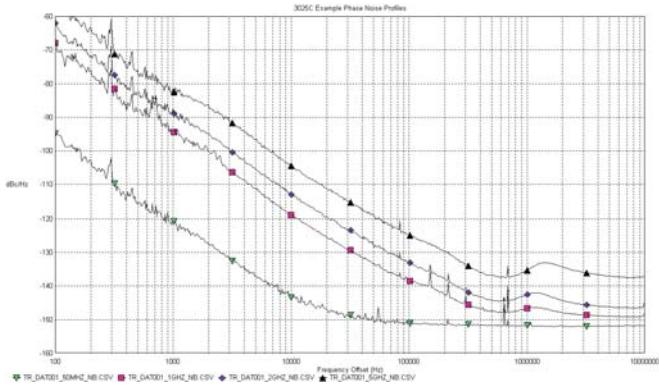
3020A: 250 MHz to 2.7 GHz

3020C: 1 MHz to 3 GHz (Useable to 100 kHz)

3025: 100 MHz to 6 GHz (Useable to 76 MHz)

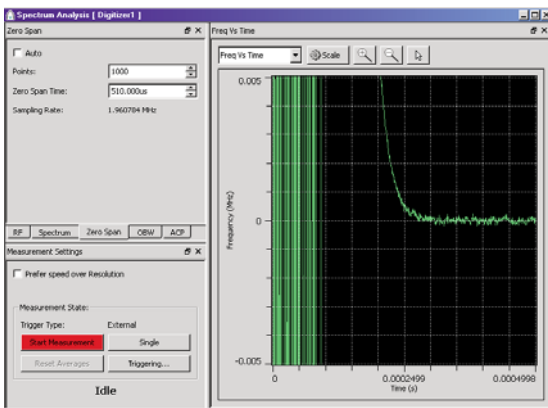
3025C: 1 MHz to 6 GHz (Useable to 100 kHz)

**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.



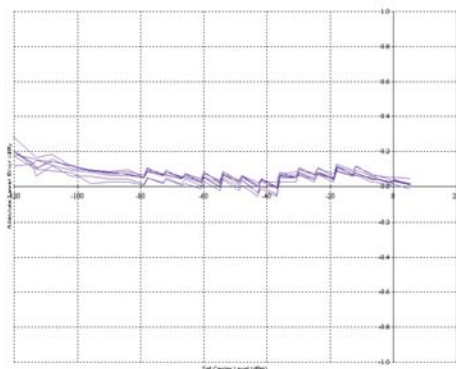
Typical 3020 Series Phase Noise Profiles

**Frequency Agile:** For frequencies 85 MHz and below, direct digital synthesis, (DDS) is used achieving frequency switching times of typically 25  $\mu$ s (3020 option 02 fitted). Above 85 MHz frequency switching in typically 250  $\mu$ s is achieved (3010 opt 01 fitted), making 3025C 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. 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.



Typical Level Accuracy at 2 GHz

**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  $\pm$ 45 MHz producing 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 Hz to 50 kHz.

**Optional Analog I & Q Outputs and Analog I & Q Inputs:** With this option 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  $\pm$ 3 V and differential offset voltage control to  $\leq \pm$  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  $\pm$  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.

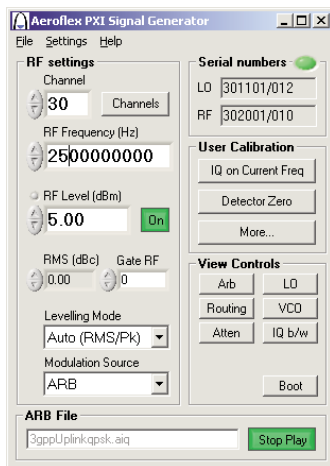
List mode supports up to 128 addresses. At each address the file can be played a user defined fixed number of times or continuously until triggered to the next sequence step. AWG sequencing is highly flexible, an AWG file play sequence can also be constructed to include periods of unmodulated or no signal 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

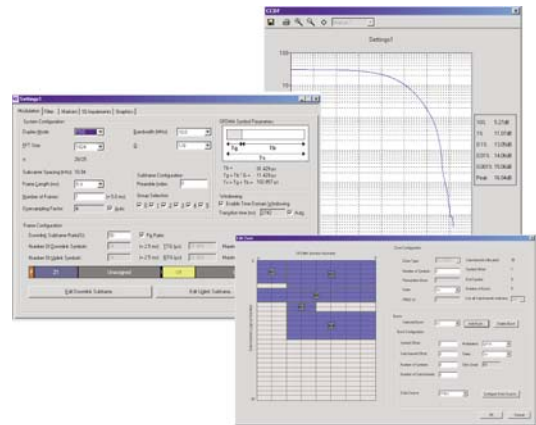
All 3020 Series module are supplied with multi layered software APIs and GUIs starting with a low level vxi pnp module driver and a a single high level signal generator driver for the combination of a 3020 Series and a 3010 Series module. Each driver is supplied with a .dll interface and is supported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



SIGGEN soft front panel

### IQCreator, Windows™ 9x, 2000, XP application

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 and 3G TDMA and CDMA 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. 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 3020A, 3020C, 3025 and 3025C.

### FREQUENCY

#### Range

3020A	250 MHz to 2.7 GHz
3020C	1 MHz to 3 GHz useable to 100 kHz
3025	100 MHz to 6 GHz useable to 76 MHz
3025C	1 MHz to 6 GHz useable to 100 kHz

#### Resolution

≤ 3 GHz; 1 Hz  
> 3 GHz; 2 Hz

#### Accuracy

As per frequency reference ( $\pm 58$  mHz for carriers  $\leq 85$  MHz)

#### Settling Time<sup>1</sup>

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<sup>2,3</sup> 250  $\mu$ s (25  $\mu$ s  $\leq$  85 MHz)

301x loop BW Normal 1.1 ms

301x loop BW Narrow 10 ms

<sup>(1)</sup> 3025C DDS clock mode=fast

<sup>(2)</sup> 3010 option 01 fitted, 301x loop BW normal and 3020 option 02 fitted

<sup>(3)</sup> 3020C/3025C Not applicable when crossing 85 MHz

### LEVEL

#### Output Power Range (peak)

	≤ 3 GHz	> 3 GHz
3020A	-120 to +5 dBm	NA
3020C	-120 to +5 dBm	NA
3025	-120 to +5 dBm	-120 to 0 dBm
3025C	-120 to +6 dBm	-120 to +1 dBm

#### Resolution

$\pm 0.01$  dB

#### Accuracy ( $\pm$ dB for CW signals @ 23°C $\pm 5^\circ$ C)

##### 3020A

≤ 2.25 GHz	> -78 dBm, < 0.6 dB (typ 0.3 dB)
	> -93 dBm, < 0.75 dB (typ 0.5 dB)
	> -113 dBm, < 0.8 dB (typ 0.5 dB)
	< -113 dBm, < 1.0 dB
> 2.25 GHz	> -63 dBm, < 0.6 dB (typ 0.3 dB)
	> -78 dBm, < 0.75 dB (typ 0.5 dB)
	< -78 dBm, < 1.0 dB

##### 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)

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

#### Switching Time (within 0.3 dB of final value)

List mode hardware triggered:

3020A:

< 250  $\mu$ s or typically 250  $\mu$ s to within 0.1 dB of final value when associated with a frequency change

3025/3025C:

≤ 4.5 GHz, < 3 ms to within 0.3 dB of final value (23°C  $\pm 5^\circ$ C)

> 4.5 GHz, < 4 ms to within 0.3 dB of final value (23°C  $\pm 5^\circ$ C)

#### Temperature Stability

$\pm 0.01$  dB/ $^\circ$ C

#### Repeatability (23°C $\pm 5^\circ$ C)

3020A:

After warm-up following a return from a change of frequency or level. Valid for at least 2 hours

Better than  $\pm 0.05$  dB above -100 dBm, otherwise better than  $\pm 0.1$  dB

#### Output Impedance

50  $\Omega$

#### Output VSWR

3020A:

< 1.35:1 for output levels below -3 dBm

3020C:

< 1.5:1 for output levels below -1 dBm

3025/3025C:

≤ 3 GHz < 1.5:1 for output levels < -1 dBm

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

#### Reverse Power Handling

3020A

Not to exceed +20 dBm

3020C/3025/3025C:

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  $\mu$ s to 10 seconds with resolution 10  $\mu$ s

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

3020C/3025C  $\leq$  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 ( $\leq$ 0 dBm output)

	3020A/3025	3020C/3025C
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)

<  $\pm$ 4% of set depth  $\pm$ 1%

#### Total Harmonic Distortion

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

<1.5% for depths of  $\leq$  30%

<2% for depths  $\leq$  80%

### 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)

<  $\pm$ 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 ( $\pm$ 3 dB) at RF output

3020A/3025:

Digital Modulation  $\pm$ 14 MHz for carrier frequencies >375 MHz

## 3020C/3025C:

Internal digital: Bandwidth versus carrier frequency

- > 500 MHz,  $\pm 45$  MHz
- > 375 MHz, typically  $\pm 45$  MHz
- > 200 MHz, typically  $\pm 30$  MHz
- > 85 MHz, typically  $\pm 20$  MHz
- $\leq 85$  MHz, up to  $\pm 45$  MHz<sup>1</sup>

<sup>(1)</sup> Limited by LF breakpoint at approx. 500 kHz

External Digital:

As internal, but limited to  $\pm F_s/4$  by the digital interpolation filter, where  $F_s$  is the IQ sample rate.

### Residual Carrier Leak<sup>(1)</sup>

Typically -50 dBc above 85 MHz

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

### IQ Image Suppression<sup>(1)</sup>

#### 3020A/3025:

Tone frequency	Typical image suppression level
10 kHz	-50 dBc

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

#### 3020C/3025C:

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

### Third Order Intermodulation Distortion

#### 3020A/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

#### 3020C/3025C:

Carrier Frequency	Tone spacing	Tone spacing
	25 kHz - 50 MHz	50 MHz - 100 MHz
< 5 GHz	typ -55 dBc	typ -50 dBc
> 5 GHz	typ -50 dBc	typ -46 dBc

### 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

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### Memory

#### 3020A/3025:

32 Msamples I Q \* 14 bit + 4 markers

#### 3020C/3025C:

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 3025 compatible format

### Sample Rates

#### 3020A/3025:

14.323 kHz to 66 MHz

#### 3020C/3025C:

10 kHz to 200 MHz

## AWG SEQUENCER

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### Number of Segments

128

### Segment Type

AWG file, CW (Mod Off)<sup>1</sup>, RF Off<sup>2</sup>

<sup>(1)</sup>When used in conjunction with list mode

### Number of AWG Files

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

#### 3020A/3025:

1 to 64

#### 3020C/3025C:

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

	3020A/3025	3020C/3025C
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

	3020A/3025	3020C/3025C <sup>(1)</sup>
Max I and Q bandwidth	±14 MHz at 66 MS/s	±22.5 MHz at 90 MS/s
Max RF bandwidth	±28 MHz	±45 MHz

<sup>(1)</sup>The 0.1 dB bandwidth of 3020C/3025C is Fs/4.

## 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

	3020A/3025	3020C/3025C
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<sup>(1)</sup>

<±0.75% of set Bias, ±15 mV

<sup>(1)</sup> After warmup and self calibration

### Differential Offset Range

±600 mV, differential into 100 Ω load

### Differential Offset Resolution

100 μV

### Differential Offset Accuracy<sup>(2)</sup>

<±2% ±3.3 mV max, ±1% ±0.7 mV typical

<sup>(2)</sup> After warmup and self calibration

### Differential Signal Balance

Typically 0.15 dB @ 10 MHz

### Frequency Response

3 dB bandwidth at maximum output level

3020A/3025:

15 MHz

3020C/3025C:

45 MHz

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

2<sup>nd</sup> harmonic <-60 dBc

3<sup>rd</sup> 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

3020A/3025:

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

3020C/3025C:

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)

	3010/3011	3020A	3025	3020C/3025C
+3.3 V	50 mA <sup>(1)</sup>	2.2 A	1.9 A	3.8 A
+5 V	650 mA	650 mA	2.3 A	2.3 A
+12 V	50 mA <sup>(2)</sup>	120 mA	400 mA	300 mA
-12 V	30 mA	150 mA	600 mA	600 mA
total power	4.5 W	14 W	30 W	40 W

<sup>(1)</sup> 250 mA transiently during power up

<sup>(2)</sup> -3011 OCXO requires 300 mA startup reducing to 150 mA after 5 minutes

## DIMENSIONS AND WEIGHT

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### Dimensions

3010/11	Single width 3U PXI module
3020 Series	Double width 3U PXI module

### Weight

3010	375 g (0.8 lbs)
3011	390 g (0.86 lbs)
3020A	675 g (inc option 01) (1.5 lbs)
3020C/3025/3025C	675 g (inc option 01) (1.5 lbs)

## FREQUENCY REFERENCE IN

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### 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  $\pm$ 100 Hz

## GENERAL

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

### RF Leakage (for carrier frequencies <3 GHz)

<5  $\mu$ V 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 61326-1:1997, Emissions Class A, Immunity Table 1 – Performance Criteria B

### Safety

EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1, General requirements

### Driver Software

VXI pnp compliant software driver

## RATED RANGE OF USE

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### 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

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### 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

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PXI Hardware Specification, Revision 2.2, ECN 1 Revision 1.0 ( 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

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

## LOCAL OSCILLATOR OUT

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### 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  $\Omega$  Nominal

### VSWR

<2:1

## FREQUENCY REFERENCE OUT (3011 ONLY)

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### Level

2 V pk-pk nominal square wave into 50  $\Omega$

### Frequency

10 MHz

### Ageing Rate

1 in 10<sup>9</sup> per day 1 in 10<sup>7</sup> per year

### Temperature Stability (0 to 50°C)

Typically better than  $\pm 1 \times 10^{-8}$

### Warm-Up Time

<5 minutes

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## VERSIONS, OPTIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

### Ordering Numbers

Ordering Numbers	Versions
3020A	PXI digital RF signal generator (250 MHz - 2.7 GHz)
3020C	PXI digital RF signal generator (1 MHz - 3 GHz)
3025	PXI digital RF signal generator (100 MHz - 6 GHz)
3025C	PXI digital 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/3025C only)
3020 Opt 03	1 Gb AWG Memory
3020 Opt 04	2 Gb AWG Memory
3010/11 Opt 01	High speed frequency switching

### Waveform Creation Application Software

3020 Opt 100	Enable IQCreator™ <sup>(1)</sup>
3020 Opt 101	Enable IQCreator 2G CDMA <sup>(2)</sup>
3020 Opt 102	Enable IQCreator 2G CDMA + 3G CDMA <sup>(2)</sup>

When purchased as an upgrade, then order as:

RTROPT100/3020	Enable IQCreator
RTROPT101/3020	Enable IQCreator 2G CDMA
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

3000	8 Slot PXI Chassis with 350 W power supply
3000A	8 Slot PXI Chassis with 8.4" touch panel display and 3001A PXI system controller
3001A	PXI system controller, Intel Pentium M 1.8 GHz, 2G RAM, 80G HDD with Windows XP
23435/698	68 way VHDCI to SCSI-3 cable assembly 1.8 m
23435/699	68 way VHDCI to VHDCI cable assembly 1.8 m
43139/709	SMA Link cable assembly (180 mm)
43139/590	SMA link cable (130 mm)
46885/224	SMA connector saver
46662/767	PXI hard carry case (for use with 82536, 82544)
82536	PXI assy, 8 slot chassis with 2.2 GHz P4 embedded controller (Windows XP)
82544	PXI assy, 8 slot chassis with MXI-4 PCI-PXI interface
82538	PXI assy, 18 slot chassis with 2.2 GHz P4 embedded controller (Windows XP)
82545	PXI assy, 18 slot chassis with MXI-4 PCI-PXI interface

### Notes

<sup>(1)</sup> Supplied with CD ROM containing IQCreator Windows application

<sup>(2)</sup> Requires option 100

For the very latest specifications visit [www.aeroflex.com](http://www.aeroflex.com)

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