

PXI Modules

3030 PXI RF Digitizer

AEROFLEX
A passion for performance.



Fully featured PXI RF Digitizer module for complex signal analysis applications in communications system test

- Frequency range 330 MHz to 3 GHz
- Wide 20 MHz digitized corrected bandwidth
- 14 bit A/D resolution with 61.44 MHz sample rate
- Typical 75 dB spurious free dynamic range
- Typical 75 dB intermodulation free dynamic range
- Noise spectral density <-140 dBm/Hz
- Excellent Level accuracy of typically 0.3 dB
- List Mode for fast frequency settling
- Digital IQ or digital IF output
- 128 M samples digital IF memory
- Real time digital IF/IQ output via LVDS interface
- IF In and IF Out
- FFT Spectrum Analyzer Measurement Library

The combination of PXI modules 3030 and 3010 form a compact 3U high precision RF Digitizer occupying just 3 slots. Together with measurement application software they provide first class vector signal analysis of RF signals. Their functionality and performance are ideally matched to the needs of RF test systems for manufacturing or design verification.

The 2 slot wide 3030 frequency down converts and digitizes RF signals in the range 330 MHz to 3 GHz providing an instantaneous analysis bandwidth of up to 20 MHz. The single slot wide 3010 / 3011 RF Synthesizer module provides the low phase noise, frequency agile local oscillator input to the digitizer.

The 3030 offers high linearity, low noise and excellent level accuracy performance making it especially well suited for the analysis of radio signals such as GSM/EDGE and 3G WCDMA. The 3030 outputs amplitude and phase corrected digital IF or IQ data samples with amplitude accuracy of typically 0.3 dB. Correction ensures amplitude flatness is maintained better than 0.25 dB across the entire digitizer bandwidth with phase flatness typically 0.03 radians pk-pk. Supporting the RF digitizer are a variety of measurement applications providing spectrum and vector signal analysis of common system personalities. As standard, the 3030 is supplied with a FFT Spectrum Analyzer Measurement Library, ideal for general purpose testing and alignment of radio communications transmitters and components. Measurement functions include; Channel Power, Adjacent Channel Power, Occupied Bandwidth, marker functions and time domain power, and frequency analysis.

Advantages of PXI

The 3030 RF digitizer offers significant economies compared to general purpose rack and stack instruments without compromising performance. 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 easier system integration and future system evolution.

For the very latest specifications visit

Applications

The 3030 RF digitizer forms an essential component within any development or manufacturing PXI based RF test system. Whether the application is for measurement or system emulation, the 3030 delivers the functionality and performance required. The 3030 is designed around the needs of today's advanced digital communications standards as used in cellular communications, i.e. GSM, EDGE, UMTS, cdma2000 as well as applications in satellite and terrestrial TV broadcasting, military communications and WLAN as well as general purpose RF test. Used in conjunction with other Aeroflex PXI RF modules, complete RF test systems can be designed. The 3030 RF digitizer is complimentary to the 3020 series digital RF signal generator which provides wideband linear modulated RF signal generation up to 2.7 GHz with integrated AWG.

Performance Highlights

Wide Frequency Range: The 3030 provides continuous frequency coverage from 330 MHz to 3 GHz. Frequency conversion to an IF is performed using a highly linear single stage down converter which offers a TOI of +30 dBm and low conversion loss. When used in conjunction with the 3010 RF synthesizer, the phase noise at 2 GHz is typically -115 dBc/Hz at 20 kHz offset.

Level Range: Signal powers up to +10 dBm peak can be input directly. RF Input level control is provided using reliable, fast electronic switched attenuation selectable in 4 dB steps to help maximize the useable dynamic range.

Level Accuracy: 0.3 dB total measurement uncertainty is achieved making the 3030 ideal for making accurate power measurements on radio transmitters. Equally important is level repeatability. The 3030 offers <0.05 dB measurement repeatability making it especially suited for use in high volume manufacturing.

High Dynamic Range: The 3030 is ideal for making difficult transmitter measurements such as burst power and ORFS (Output Radio Frequency Spectrum) parameters on cellular terminals. The digitizer typically provides 75 dB of spurious free dynamic range and 75 dB intermodulation free dynamic range. This together with excellent phase noise performance makes it possible to measure an ACLR of typically 68 dB on 3G terminals.

Wide Bandwidth: The 3030 provides a phase and amplitude corrected digital IF bandwidth of 20 MHz sufficient to capture up to 4 channels of 3GPP WCDMA for ACLR measurement.

Low Phase Noise: The module is designed to be used with the PXI 3010 or 3011 RF synthesizer modules, which provide a low noise agile local oscillator signal.

IF input: The 3030 will accept a direct IF input signal at 46 MHz between -15 dBm and +5 dBm.

Flexible ADC: Full rate digital IF or decimated IQ data can be output via a LVDS data interface on the front panel. This is especially useful for realtime system emulation applications. Data can also be captured to internal memory then read over the PCI bus. Internal memory provides storage for up to 128 M x 16 bit samples of IF data sampled at 61.44 Msamples per second, equivalent to just over 2 seconds. The sample rate is user defined and independent of the sam-

pling clock over the range 3.75 ks/s and 30.72 Ms/s. Lowering the sample rate improves data transfer rates and allows much longer events to be captured.

Small Size: The module occupies just 2 slots in a 3U PXI rack. An additional slot is required to accommodate the 3010 RF synthesizer making a total of just 3 slot widths required for a complete RF digitizer.

Acquisition, Data Transfer and Measurement Speed: Data acquisition, data transfer and measurement processing can be performed serially or overlapped. New data acquisition can be initiated in parallel to processing a previous capture sample thus leading to faster measurement time. Data transfer time to the CPU is performed at a rate of up to 20 MSamples/s (IF data) or 10 Million IQ pairs per second while measurement processing time varies according to CPU speed and the application.

Triggering and Synchronization: The 3030 module can frequency lock to a 10 MHz reference signal supplied by the 3010.

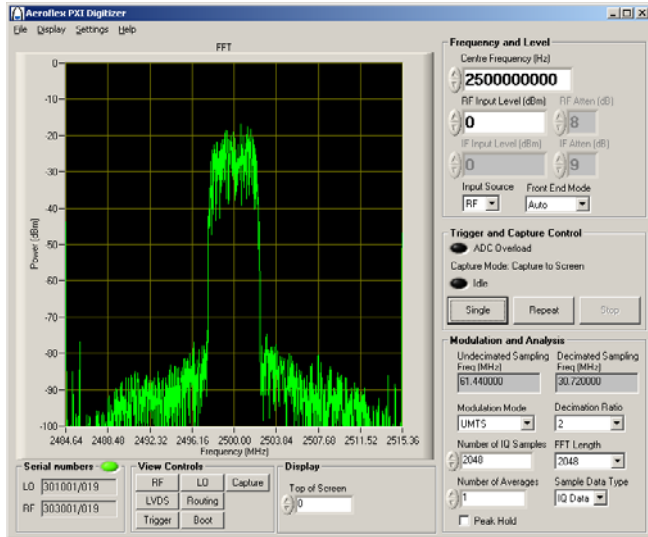
The 3030 supports external trigger sources. Triggers can be applied either from the PXI backplane or directly through the front panel LVDS interface.

The 3030 is able to initiate data capture based on an internal IF trigger derived from sample data. IF triggering can be set as absolute, with a user defined threshold level, or relative in which case a power change results in trigger activation. Both trigger modes have settable time constants for noise filtering making it possible to avoid triggering on transients. All trigger modes are supported by user definable pre- and post trigger delays. The 3030 data acquisition is also able to be gated. The sample length is then defined by the duration of the externally applied gate.

List Mode: This feature enables the 3030 to be preloaded with up to 128 combinations of different frequency and level settings. A list address is used to point to one of the 128 combinations. The list address can be sourced from the application driving the 3030. All of the 3030 internal hardware settings are pre-calculated making selection of a new frequency faster while still maintaining level accuracy. This feature is ideally suited for fast mobile phone transmitter alignment applications and is complimented by similar features in the 3020A RF Signal Generator in support of the corresponding fast mobile phone receiver alignment.

Software

The 3030 is supplied with a variety of software including; drivers, soft front panels and measurement applications.



3030 Soft Front Panel

Driver Software The 3030 is supplied with a VXI PNP compatible .dll driver and a soft front panel to enable automated or manual hardware control. An Active X Control combining the functions of both the 3030 and 3010 is supplied together with its own soft front panel treating the 3030+3010 modules as a single combined instrument.

Measurement Applications

Measurement software is supplied as ActiveX controls for use in application software development environments such as LabVIEW, LabWindows/CVI, Visual C/C++ and Visual Basic.

The 3030 is supplied as standard with the FFT Spectrum Analyzer Measurement Library. This allows precision frequency and time domain analysis of any 20 MHz wide span between 330 MHz and 3 GHz - ideal for general purpose measurements in a wide variety of communication applications. Example applications featuring the ActiveX control are supplied to help familiarize the user. Supplied as source code, these may be used as supplied or modified by the user.

FFT Spectrum Analyzer Measurement Library Highlights

FFT analysis of signals can be performed across any 20 MHz span with a minimum resolution of 1 kHz. Using 3030 hardware decimation permits finer frequency resolution down to 2 Hz for a frequency span of 30 kHz. The resolution bandwidth can be defined in three ways: 3 dB point, Noise Equivalent Bandwidth and a fixed Blackman Harris window.

Channel Power and Adjacent Channel Power Measurement

The user defines the channel configuration to be measured (i.e. channel width; channel spacing; center frequency; etc). The measurement then computes the central channel rms power as an absolute and the adjacent channel powers relative to this. Four adjacent channels are examined (two either side of the central channel).

Occupied Bandwidth is calculated by a function that returns the bandwidth in which a user defined percentage of the total signal power is occupied.

The FFT can be configured as either RMS averaged or peak hold in which case the control will accumulate trace results or retain peak values if repeatedly called. The number of averages is user defined.

A marker power function is provided together with a marker peak find and a next peak search function. These enable measurement of discrete signals.

Time domain analysis functions are also included that enable measurement of average power plus power and frequency versus time. The time window for analysis can be the entire IQ sample array or any user defined subset.

This group of FFT Spectrum and measurement functions permits fast characterization and alignment of radio transmitters.

Optional signal analysis application suites are available for use in the measurement of GSM/EDGE, UMTS uplink and cdma2000 uplink transmissions. (See separate datasheets) Each application library is supplied with example code to help familiarize the user. These provide measurement of power, modulation quality and spectrum measurement in accordance with the relevant standards for mobile terminal testing, ideal for both production line and development laboratory use.

Customer Support

Users can elect to purchase PXI modules with optional warranty extensions. Standard Extended Warranty provides either a 36 month or 60 month 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 3030 specifications are defined when used in conjunction with the 3010/11 RF Synthesizer PXI module.

FREQUENCY

Frequency Range

RF input: 330 MHz to 3.0 GHz
IF input: Centered on 46.08 MHz

Resolution

1 Hz

Frequency Accuracy

As per frequency reference

Frequency Settling Time

Time taken to be within 1 kHz of final demanded frequency

3010 in Normal Loop Bandwidth:

As standard: Typically 1.1 ms

With 3010 option 01 fitted:

List Mode: (requires PXI local bus left connection to 3010/3011)

hardware triggered; <250 μs

3010 in Narrow Loop Bandwidth:

Typically <10 ms

LIST MODE

List Addresses

128 frequency, amplitude combinations

Trigger Sources

PXI Trigger Bus, Star Trigger, PXI Local Bus, LVDS Aux 1 to 5, TTL, software commanded

SPECTRAL PURITY

SSB Phase Noise (typical)

3010 set to narrow loop BW at 2 GHz and at ambient room temperature

Loop Bandwidth	Narrow	Wide (normal)
Offset	dBc/Hz	dBc/Hz
100 Hz	-55	-85
1 kHz	-85	-103
10 kHz	-114	-103
20 kHz	-116	-110
100 kHz	-133	-130
1 MHz	-136	-136
10 MHz	-138	-138

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

LEVEL

Input Coupling

AC Coupled

Input Power

RF input: Max. +10 dBm single tone or peak

IF input: -15 dBm to +5 dBm for full scale on digitizer

Maximum Safe Input

RF input +16 dBm continuous (with 0 dB input attenuation)

IF input +10 dBm (with 0 dB IF attenuation)

RF Input Attenuator

0 to 28 dB in 4 dB steps

Level Accuracy (RF input, 23°C ±5°C)

Within any GSM, DSC1800, PCS1900, UMTS and CDMA bands, valid for signals with <5 MHz occupied bandwidth at the tuned frequency with S/N ratio >40 dB

Better than ± 0.6 dB

Typically 0.3 dB

Level Temperature Stability

±/-0.01 dB/°C

Level Repeatability

Better than ± 0.05 dB after warm up following a return from a change in frequency or level. Valid for at least 2 hours and excluding temperature influence.

LINEARITY AND NOISE

(Specifications apply to RF input)

Intermodulation

Typically 75 dB intermodulation free dynamic range (2 tone input with maximum 0 dBm input power for each tone) Manual mode

Adjacent Channel Leakage Ratio (ACLR)

63 dB ACLR on 3GPP (downlink test model 1)

Typically 68 dB ACLR on 3GPP uplink

Spurious

Typically -75 dBc excluding IF image frequencies and harmonic

responses

Residual Responses (no signal input)

-100 dBm with RF input terminated into 50 ohms and minimum RF and IF attenuation

Noise Spectral Density (no signal input)

<-140 dBm/Hz with RF input terminated in 50 ohms and minimum RF and IF attenuation

RF Input Return Loss

16 dB with 8 dB or more RF attenuation

IF OUTPUT

Frequency

Center 46.08 MHz

Level

Typically -3 dB relative to RF input at 2 GHz (0 dB input attenuation selected) 3 dB Bandwidth Typically >100 MHz

A/D CONVERSION

Resolution

14 bits

ADC clock

Fixed 61.44 MHz

Sample Rate Control

IF: Fixed, 61.44 MHz (UMTS x 16)

IQ: Variable 3.75 ks/s to 30.72 Ms/s

Sample Rate resolution

0.1 Hz

When the sample rate is entered as a fraction, resolution is given by 32 bit denominator and numerator.

Sample Rate Accuracy

As per 10 MHz reference

Amplitude Flatness

Flatness correction on:

0.25 dB to 20 MHz

0.1 dB across center 5 MHz

Phase Flatness (typical)

0.03 radians pk-pk to 20 MHz

Data Output

A Sample data block (equal to the data capture length) can be stored to the memory internal to the 3030 and then transferred to the controller via the PCI bus. Sample data can be continuously streamed out of the LVDS connector.

IF data samples have 16 bit resolution.

IQ data samples can be 16 or 32 bit resolution.

Data Transfer Rate

10 Mwords/s (a word is 32 bits long)

IQ and IF block data transfer when using 2.2 GHz embedded CPU running windows XP

Sample Memory

128 M x 16 bit samples

TRIGGERING

Trigger Mode

Single, Repeat

Trigger Type

Edge, Gated, NONE (software triggered)

Hardware Trigger Sources

Internal (IF, derived from IQ data with user defined level control)

External (LVDS, LBL, Trig Bus, Star Trigger)

Trigger Functions

Pre-trigger

0 to sample length

Delayed Trigger

-10 to + 2G samples

Trigger Polarity

+ve or -ve (Edge trigger)

Gate High, Gate Low (Gated trigger)

FFT SPECTRUM ANALYZER MEASUREMENT LIBRARY

FFT Length

2ⁿ for n = 7 to 16

Measurement Bandwidth

2 Hz up to 10 MHz

Window Type

NEBW: Gaussian

3 dB: Gaussian

Fixed: Blackman Harris 5 term

Channel Power and Adjacent Channel Power

Adjacent Channels: 2 upper and 2 lower subject to 20 MHz bandwidth limitation

Channel filter alpha: 0 to 1

Channel spacing: up to 10 MHz

Channel width: up to 15 MHz

Occupied Bandwidth (OBW)

Percentage range: 1% to 99.99%

Marker Functions

Marker Power, Peak Search, Next Peak

Time Domain Functions

(Computed for the entire IQ sample record or any subset)

Average Power, Power versus Time, Frequency versus Time

INTERFACES

3010/11	LO output, (SMA) 10 MHz reference I/O (SMA x 2) PCI bus interface including PXI triggering functions
3030	RF input, +10 dBm max (SMA); Local oscillator input (SMA); IF output (SMA); IF input (SMA); 10 MHz reference input for sampling clock (SMA); 10 MHz reference link through (SMA); IF or IQ 16 bit LVDS data (SCSI3) PCI bus interface including PXI triggering functions

POWER CONSUMPTION (TYPICAL)

3010/3011	+3.3 V	50 mA (250 mA transiently during power up)
	+5 V	650 mA
	+12 V	50 mA*
	-12 V	30 mA

* 3011 OCXO requires 300 mA startup reducing to 150 mA after 5 minutes

3030	+3.3 V	2.5 A
	+5 V	1.3 A
	+12 V	300 mA
	-12 V	100 mA

DIMENSIONS AND WEIGHT

Dimensions

3010/11 Single width 3U PXI module

3030 Double width 3U PXI module

Weight

3010	375 g
3011	390 g
3030	750 g

FREQUENCY REFERENCE

Mode

External, Free Running (3030)

External Source

SMA

Frequency

10 MHz

Level

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

GENERAL

The following general specifications are common to 3010, 3011 and 3030.

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

VXlpnp compliant software driver

LOCAL OSCILATOR

LO Frequency

1500 MHz to 3000 MHz

Level

3010 LO output: -4 dBm to +3 dBm

3030 LO input: Nominally 0 dBm

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 Specification, Revision 2.1

VXIplug&play Specifications (VPP-2, VPP-3.x, VPP-4.x and VPP-7)

3010/3011 SPECIFIC SPECIFICATIONS

Specifications are common to 3010 and 3011 unless otherwise stated.

LO OUTPUT

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

Output (3011 only)

2 V pk-pk nominal square wave into 50 ohms

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 $\pm 1 \times 10^{-8}$

Warm-Up Time

<5 Minutes

VERSIONS, OPTIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers

Ordering Numbers	Versions
3010	PXI RF Synthesizer
3020	PXI RF Synthesizer (including OCXO 10 MHz reference)
3010/11	Option 01 High Speed Frequency settling
3030	PXI RF digitizer

Note: For use in conjunction with the 3010 or 3011, supplied separately

Supplied with

CDROM containing VXI PNP Driver with soft front panel and user documentation

2 x SMA-SMA links (for IF link and 10 MHz reference link)

SMA connector saver

Service Options

W3010/103	3010 Standard Extended Warranty 36 months
W3030/103	3030 Standard Extended Warranty 36 months
W3010/103C	3010 Standard Extended Warranty 36 months with scheduled calibration
W3030/103C	3030 Standard Extended Warranty 36 months with scheduled calibration
W3010/105	3010 Standard Extended Warranty 60 months
W3030/105	3030 Standard Extended Warranty 60 months
W3010/105C	3010 Standard Extended Warranty 60 months with scheduled calibration
W3030/105C	3030 Standard Extended Warranty 60 months with scheduled calibration

Optional Accessories

43138/421	SMA link cable
23435/696	SCSI Cable Assembly, 1.8 m
46885/224	SMA connector saver
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
46662/767	PXI hard carry case (for use with 82536, 82544)

Optional Application Libraries See separate data sheets

Option 100	GSM/EDGE measurement library
Option 101	UMTS FDD uplink measurement library
Option 102	cdma2000 reverse link measurement library

When purchased as an upgrade, order as:

RTROPT100/3030	GSM/EDGE enable
RTROPT101/3030	UMTS uplink enable
RTROPT102/3030	cdma2000 reverse link enable



根网通讯设备(北京)有限公司
 邮件: enquiry@rootscomm.com.cn
 网址: www.rootscomm.com.cn
 ROOTS Communication Equipment (Beijing) Co.,Ltd.
 北京市朝阳区芳园西路5号 丽园中心508室 100015
 电话: +86-10-64382686
 传真: +86-10-64382703