PXI Modules

3030 PXI RF Digitizer

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 bandwidth
- 14 bit A/D resolution with 61.44 MHz sample rate
- Typically 75 dB spurious free dynamic range
- Typically 75 dB intermodulation free dynamic range
- Noise spectral density <-140 dBm/Hz
- Level accuracy typically 0.3 dB
- Digital IQ or digital IF output
- 128 M samples digital IF memory
- Real time digital IF/IQ output via LVDS interface
- 46.08 MHz IF In and IF Out
- FFT Spectrum Analyzer Measurement Suite

Introduction

The 3030 is a precision broadband RF digitizer module in a compact 3U high, 2 slot wide PXI package. Used in conjunction with the 3010 or 3011 PXI RF synthesizer modules, the 3030 frequency down converts and digitizes RF signals of up to 20 MHz bandwidth in the frequency range of 330 MHz to 3 GHz. The 3030 offers high linearity and low noise performance making it especially suited for the analysis of radio signals such as GSM/EDGE and 3G WCDMA. The 3030 outputs a set of amplitude and phase corrected digital IF or IQ data samples with an excellent amplitude accuracy of typically 0.3 dB. The module is supported by a variety of signal analysis applications providing spectrum and vector signal analysis of common system personalities. As standard, the 3030 is supplied with a FFT Spectrum Analyzer Measurement Suite, ideal for general purpose testing 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 and without compromising upon performance. The 3030 fully exploits the benefits of PXI to achieve faster measurement speed, smaller size and greater flexibility for integration and onward evolution.

Applications

The 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 digital RF signal generator which provides wideband linear modulated RF signal generation up to 2.5 GHz.

Performance Highlights

Wide Frequency Range: The 3030 provides continuous frequency coverage from 330 MHz to 3 GHz. Frequency conversion to an IF of 46 MHz 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 typically achieved making the 3030 ideal for making accurate power measurements on radio transmitters. Equally important is level repeatability. The 3030 offers <0.1 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 2G and 3G 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 produces a 20 MHz wide digitized IF signal 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 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. For narrowband signal analysis, the 3030 provides internal digital downconversion and decimation. 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.

Signal Processing The 3030 features digital resampling filters appropriate to GSM/EDGE or UMTS or cdma2000. This ensures that IQ data is output at an integer multiple of the symbol rate, making it convenient for further signal processing.

Acquisition, Data Transfer and Measurement Speed Data acquisition, data transfer and measurement processing are performed serially. 3030 uses a maximum sample rate of 61.44 MHz (IF data) or 30.72 MHz (IQ data pairs) for data acquisition. Data transfer time to the CPU is performed at a rate of up to 10 MSamples/s (IF data) or 5 MSamples/s (IQ data pairs) while measurment processing time varies according to CPU speed and the application.

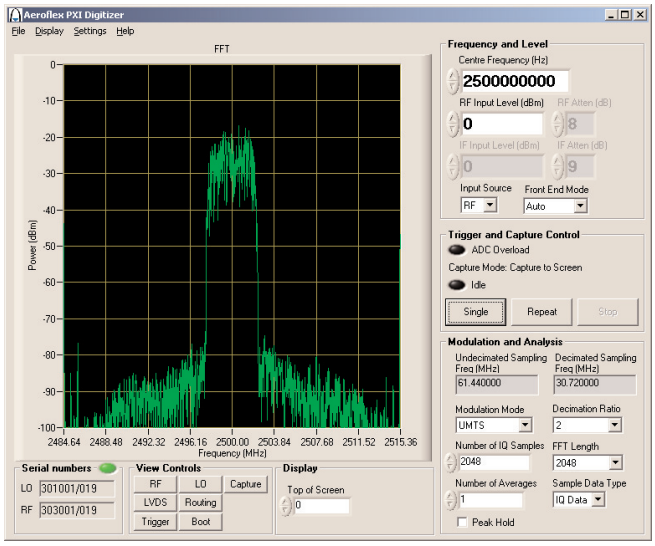
Consequently, the time required to capture 1024 IQ samples, transfer the data and compute 5 channels of adjacent channel power using the FFT Spectrum Analyzer Measurement Suite is typically 1.5 ms when using a 2.2 GHz CPU in conjunction with a PCI-PXI interface.

Digital decimating filters can additionally be applied to the data to improve data transfer times to the controller and hence accelerate test time.

Triggering and Synchronization The 3030 module can synchronize 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.

Software

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



3030 Soft Front Panel

Driver software 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 making it possible to treat 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 Analyser Measurement Suite. 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 familiarise the user. These may be used as supplied or modified by the user.

FFT Spectrum Analyzer Measurement Suite Highlights

FFT analysis of signals 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; centre 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 characterisation and alignment of radio transmitters.

Optional signal analysis application suites are available for use in the measurement of GSM/EDGE and UMTS transmissions. (see separate datasheets). Each application library is supplied with example code and help to familiarise 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. Enhanced Standard Warranty provides the benefit of guaranteed product repair times in the event of failure during the standard 12 month warranty period. Standard Extended Warranty provides either 36 months 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

FREQUENCY

Frequency Range

RF input: 330 MHz to 3.0 GHz

IF input: Centered on 46.08 MHz

Resolution

As per LO input, 1 Hz when using 3010

Frequency Accuracy

As per external reference standard (refer to 3010)

SPECTRAL PURITY

(Typical using 3010 set to narrow loop BW as the LO source measured at 2 GHz)

Phase Noise

Typically -115 dBc/Hz at 20 kHz offset

Noise Floor

Typically -138 dBc/Hz at 5 MHz offset and
Typically -136 dBc/Hz at 1 MHz offset

LEVEL

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)

<±0.6 dB, Typically ±0.3 dB

Level Temperature Stability

±/-0.01dB/°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 -5 dB relative to RF input (0 dB input attenuation selected)
3 dB Bandwidth Typically >100 MHz

A/D CONVERSION

Resolution

14 bits

Sample Rate

IF: 61.44 MHz (UMTS x 16)

IQ: 61.44 MHz / 2^n, for n = 1 to 10

13 MHz/48 x 1, 2, 4, 8, or 16 (GSM/EDGE)

1.2288 MHz x 1, 2, 4, 8 or 16 (cdma2000)

Bandwidth

20 MHz (phase and amplitude corrected to 19.2 MHz)

Output

16 bit digital IF or interleaved IQ at LVDS

32 bit digital I/Q or packed IF at PCI

Sample Memory

128 M x 16 bit samples

TRIGGERING

Trigger Source

External: PCI or LDVS interface

Trigger Offset Delay Range

-8 to 2 x 10^9 samples

Resolution

± 1 output sample

FFT SPECTRUM ANALYZER MEASUREMENT SUITE

FFT Length

2^n 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 bandwith 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

GENERAL

Standard Warranty

12 months

Calibration Interval

Recommended 2 year

Power Consumption (Typical)

+3.3 V 2.1 A
+5 V 1.3 A
+12 V 300 mA
-12 V 100 mA

Electromagnetic Compatibility

EN 61326-1:1997, Emissions Class A, Immunity Table 1 - Performance Critieria B

Safety

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

Driver Software

VXIpnp compliant software driver

LO INPUT (E.G. 3010)

Input Frequency

1500 MHz to 3000 MHz

LO = RF carrier frequency (Fc) ±46.08 MHz where 1500 MHz<Fc<3000 MHz

LO = 2 x (Fc ±46.08 MHz) where 750 MHz<Fc<1500 MHz

LO = 4 x (Fc ±46.08 MHz) where 330 MHz<Fc<750 MHz

Input Power

-4 dBm to +3 dBm

FREQUENCY REFERENCE

Mode

External, Free Running

External Source

SMA

Frequency

10 MHz

Level

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

INTERFACES

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 output at up to the ADC sample rate (SCSI3)

PCI bus interface including PXI triggering functions

DIMENSIONS AND WEIGHT

Dimensions

Double width 3U PXI module

Weight

0.75 kg

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)

VERSIONS, OPTIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers	Versions
3030	PXI RF digitizer
	Note: For use in conjunction with 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
W3000/101	Enhanced Standard Warranty
W3030/103	Standard Extended Warranty 36 months
W3030/103C	Standard Extended Warranty 36 months with scheduled calibration
W3030/105	Standard Extended Warranty 60 months
W3030/105C	Standard Extended Warranty 60 months with scheduled calibration
	Optional Accessories
43138/421	SMA link cable
46885/224	SMA connector saver
82536	PXI Assy, 8 slot chassis with 2.2 GHz P4 Embedded Controller (Windows XP)
82537	PXI Assy, 8 slot chassis with PCI-PXI Interface
82538	PXI Assy, 18 slot chassis with 2.2 GHz P4 Embedded Controller(Windows XP)
82539	PXI Assy, 18 slot chassis with PCI-PXI Interface
46662/767	PXI hard carry case (for use with 82536, 82537)
	Optional Application Libraries
See separate data sheets	
Option 100	GSM/EDGE measurement suite
Option 101	UMTS FDD uplink measurement suite

When purchased as an upgrade, then order as:

RTROPT100/3030	GSM/EDGE enable
RTROPT101/3030	UMTS enable

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

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