

A comprehensive suite of measurement tools enabling the analysis of all WLAN OFDM, DSSS and DSSS-OFDM RF signal characteristics in accordance with the requirements of IEEE 802.11a, IEEE 802.11b, PMD 1999, IEEE 802.11g, PMD 2003, IEEE 802.11n 2009 and IEEE 802.11ac /D1.0

- Transmit power
- Transmit burst length
- Transmit power on, off timing
- Spectral mask
- Occupied bandwidth
- Frequency tolerance
- Symbol/chip clock frequency tolerance
- Carrier suppression/leakage
- Skew/Gain imbalance
- Modulation accuracy (average EVM and peak EVM)
- Spectral flatness
- MIMO support⁽¹⁾⁽²⁾
- DSSS and OFDM equalization
- CCDF
- Channel bandwidth support: 20 MHz, 40 MHz or 80 MHz

(1) Analysis Library support up to 8 spatial streams

(2) Build-in support for up to 3x3 MIMO tests for 802.11n, using Aeroflex 3061 RF combiner

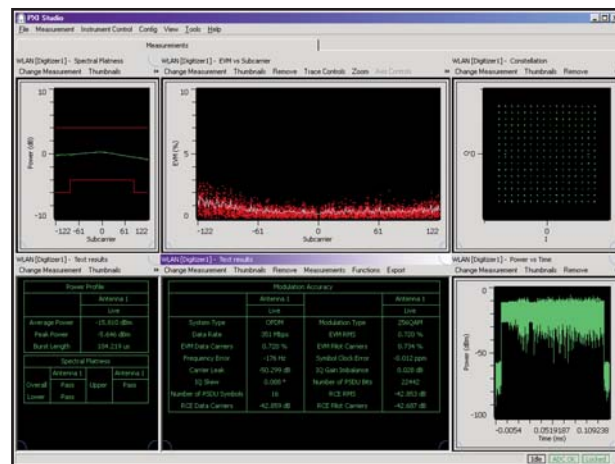


Figure 1. WLAN plug-in typical screenshot

Modulation format, data rate and modulation type are all determined automatically from preamble and header decoding, thus requiring no user set-up making using the measurement library easy to operate and integrate within a test application.

Measurements may be performed with/without compensation for pilot time, amplitude and phase tracking enabled.

For 802.11n testing, modulation and coding schemes (MCS) 0–23 and 32–52 are supported, while for 802.11ac testing, MCS 0–9 are supported.

WLAN

All specifications for accuracy and range relate to performance when used in conjunction with a 3030 Series PXI RF digitizer with option 103 and 113 operating in any ISM band up to 6 GHz. 3030 option 113 (802.11ac) has a dependency on 3030 option 103 (802.11a/b/g/n), which must be fitted before 3030 option 113 can be enabled.

Measurements are per IEEE 802.11a,b,g,n and ac standards.

Specifications are defined with the input signal at the RF digitizer tuned frequency and at the reference level unless otherwise specified.

CONFIGURATION

The WLAN measurement suite assumes the measured signal includes a correctly formatted PSDU containing valid header information in order to perform demodulation.

Automatic setting of system type (OFDM/DSSS/DSSS-OFDM), Data rate, modulation type is decoded from header information. For 802.11n HT, 802.11ac HT and 802.11ac VHT signals, this also includes MCS index.

Analysis Mode

802.11a/b/g

802.11n HT (High Throughput), 802.11n non-HT

802.11ac VHT (Very High Throughput)⁽³⁾, 802.11ac HT (HT signal in 80 MHz bandwidth)⁽³⁾, 802.11ac non-HT⁽³⁾

Channel Bandwidth

	802.11a/b/g	802.11n	802.11ac ⁽³⁾
Channel bandwidth (MHz)	20	20, 40	20, 40, 80

Channel Offset (802.11n and 802.11ac only)

None, Upper1, Upper2⁽³⁾, Lower1, Lower2⁽³⁾

Auto BSS Bandwidth

Enable or disable. When disabled, BSS bandwidth can be defined by user.

Auto Detect Number of Symbols to Analyze

On/Off

Number of Symbols

1 to packet length (OFDM)

16 to packet length (DSSS)

DSSS Reference Filter (802.11b and 802.11g)

None

Rectangular

Raised Cosine

Gaussian

Alpha (Raised cosine only)

0 to 1.0

BT (Gaussian only)

0 to 1.0

Number of Spatial Streams (Nss)⁽⁴⁾

1, 2 or 3

Compensation

Pilot time tracking, on/off

Pilot amplitude tracking, on/off

Pilot phase tracking, on/off

Equalization

DSSS:

Enable/disable

Filter length range 3 to 99 (odd values)

OFDM:

Pre-amble

Pre-amble plus pilots and data

Burst Profile Type

Average power or peak power

MEASUREMENTS

The results are available for live, average, min hold, max hold, std dev.

POWER MEASUREMENTS

Transmit Power (in dBm)

The Peak and RMS power is measured for a single PPDU.

Accuracy

See 3030 Series module level accuracy spec.

Burst Length (in μ s)

The burst length is the time between the rising and falling edge of a single PPDU burst.

Rising / Falling Edge Time (in μ s)

Measures the time taken for the burst power of a single PPDU to change between 10% and 90% of its value (peak or RMS).

Rising / Falling Edge Status (802.11b and g)

Indication

Global pass/fail

Ramp up pass/fail

Ramp up time in μ s (10% to 90% points)

Ramp down pass/fail

Ramp down time in μ s (90% to 10% points)

Burst position μ s relative to trigger point

Trace

Power vs.time trace

OCCUPIED BANDWIDTH (OBW) (in Hz)

Bandwidth containing 99% of total of the transmitted PPDU spectrum

Accuracy

Typically <100 kHz

SPECTRAL MASK

The spectral density of the transmitted PPDU signal should lie within the spectral mask.

The mask is frequency aligned to the maximum spectrum density.

Mask types 802.11a

802.11b

802.11n

802.11ac⁽³⁾

User defined

Measurement BW

100 kHz

Indication

Global pass/fail

The worst case dBc level value and its corresponding frequency relative to the mask.

Accuracy

< ±0.05 dB per 10 dB

Trace

Spectral trace display with mask

ADJACENT CHANNEL POWER (FOR DSSS SIGNALS) (in dBc)

The power measured in the upper and lower adjacent and alternate channels relative to the power in the reference channel.

Reference Channel Bandwidth

22 MHz

Adjacent and Alternate Channel Bandwidth

±11 MHz, ±22 MHz

Measurement Range

Typically 65 dB for IEEE 802.11b 11 Mbps CCK

Accuracy

< ±0.05 dB error per 10 dBc

MODULATION ACCURACY

The error vector magnitude (EVM) is the magnitude of the IQ vector at the decision point measured relative to the ideal constellation point.

EVM

Composite EVM⁽⁴⁾ (% rms) and RCE (rms dB)

EVM (% rms) and RCE (rms dB) all data carriers

EVM (% rms) and RCE (rms dB) all pilot carriers

EVM (Peak) — 802.11b/g only

Accuracy

The following table shows the combined nominal residual EVM when 3025C is used as input to 3035C.

			Input Level		
			-10 dBm	-20 dBm	-30 dBm
Fc 2.412 GHz	20 MHz	802.11b	0.2% / -51 dB	0.3% / -49 dB	0.4% / -47 dB
		802.11g/n	0.3% / -49 dB	0.4% / -47 dB	0.6% / -44 dB
	40 MHz	802.11n	0.4% / -47 dB	0.5% / -45 dB	0.8% / -41 dB
	Fc 5.81 GHz	20 MHz	802.11a/n	0.5% / -45 dB	0.6% / -44 dB
40 MHz		802.11n	0.4% / -46 dB	0.5% / -45 dB	0.7% / -42 dB
20 MHz		802.11ac	0.5% / -45 dB	0.5% / -45 dB	0.6% / -44 dB
			0.6% / -44 dB	0.6% / -44 dB	0.8% / -41 dB
80 MHz			0.7% / -42 dB	0.7% / -42 dB	1.2% / -38 dB

Results based on the max. modulation rate for the given standards

Traces

Constellation display

Trace of EVM values vs. sub carrier or symbol number

General Information Derived from Demodulation

System type, modulation type, data rate, number of PSDU bits/symbols, HT format (Greenfield or Mixed), 802.11n — HT mode only, short GI (11n/ac only)

IQ Gain Imbalance (in dB)

IQ Skew (in degrees)

Carrier Leak (in dB)

Frequency Error Tolerance (in Hz)

Lock Range

±50 ppm

< ±312.5 kHz

Accuracy

< ±10 Hz + (Freq standard error × transmitter freq (MHz))

Carrier Leak (in dB)

Symbol / Chip Clock Tolerance (in ppm)

Range

±50 ppm

Accuracy

As per reference frequency

SPECTRAL FLATNESS (FOR OFDM SIGNALS)

Indication

Pass/fail

Upper pass/fail

Lower pass/fail

Trace display of dBr vs. sub carrier and mask

HT/VHT[®] CROSS POWER (in dBm)

Support for up to two spatial streams

CCDF

Complimentary cumulative distribution function

Trace

Peak to average power (dB) vs. probability (%)

(3) Require 3030 option 113

(4) Support for Nss = 2 or higher requires the presence of an Aeroflex 3061 RF combiner

GENERAL

Operating System

Windows[®] XP (service pack 2) and 32-bit Vista

Required Memory

512 Mbytes minimum, 1024 Mbytes recommended

Display Resolution

Minimum 1024 × 768

Hardware Compatibility

	Bandwidth	Standard	PXI RF Digitizer
2.4 GHz band	20 MHz	802.11b/g/n	all
	40 MHz	802.11n	3030C, 3035C or 3036
5 GHz band	20 MHz	802.11a/n	3035, 3035C or 3036
	40 MHz	802.11n	3035C or 3036
	20/40/80 MHz	802.11ac	3035C or 3036

Other

Aeroflex 3000 Series modules require NI VISA version 3.1 or later (NI Visa 4.2 or later under Windows® Vista).

802.11ac (3030 option 113) PXI Studio plug-in requires PXI Studio version 2.1 or later.

ORDERING

When purchased with a 303x, order as:

3030 option 103 (802.11a/b/g/n) and option 113 (802.11ac)

When purchased as an upgrade, then order as:

RTROPT103/3030 (802.11a/b/g/n) and RTROPT113/3030 (802.11ac)

It should be noted that 3030 option 113 has a dependency on 3030 option 103 which must be fitted before 3030 option 113 or RTROPT3030/113 can be enabled.

CHINA Beijing

Tel: [+86] (10) 6539 1166
Fax: [+86] (10) 6539 1778

CHINA Shanghai

Tel: [+86] 21 2028 3588
Fax: [+86] 21 2028 3558

CHINA Shenzhen

Tel: [+86] (755) 3301 9358
Fax: [+86] (755) 3301 9356

FINLAND

Tel: [+358] (9) 2709 5541
Fax: [+358] (9) 804 2441

FRANCE

Tel: [+33] 1 60 79 96 00
Fax: [+33] 1 60 77 69 22

GERMANY

Tel: [+49] 89 99641 0
Fax: [+49] 89 99641 160

HONG KONG

Tel: [+852] 2832 7988
Fax: [+852] 2834 5364

INDIA

Tel: [+91] 80 [4] 115 4501
Fax: [+91] 80 [4] 115 4502

JAPAN

Tel: [+81] (3) 3500 5591
Fax: [+81] (3) 3500 5592

KOREA

Tel: [+82] (2) 3424 2719
Fax: [+82] (2) 3424 8620

SCANDINAVIA

Tel: [+45] 9614 0045
Fax: [+45] 9614 0047

SINGAPORE

Tel: [+65] 6873 0991
Fax: [+65] 6873 0992

TAIWAN

Tel: [+886] 2 2698 8058
Fax: [+886] 2 2698 8050

UK Stevenage

Tel: [+44] (0) 1438 742200
Fax: [+44] (0) 1438 727601
Freephone: 0800 282388

USA

Tel: [+1] (316) 522 4981
Fax: [+1] (316) 522 1360
Toll Free: 800 835 2352

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www.aeroflex.com
info-test@eroflex.com



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