

### WLAN MEASUREMENT SUITE

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 and IEEE 802.11n 2009.

- 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 (EVM and peak EVM)
- Spectral flatness
- 3x3 MIMO support\*
- DSSS and OFDM equalization
- CCDF

\* Requires use of Aeroflex 3061 RF combiner

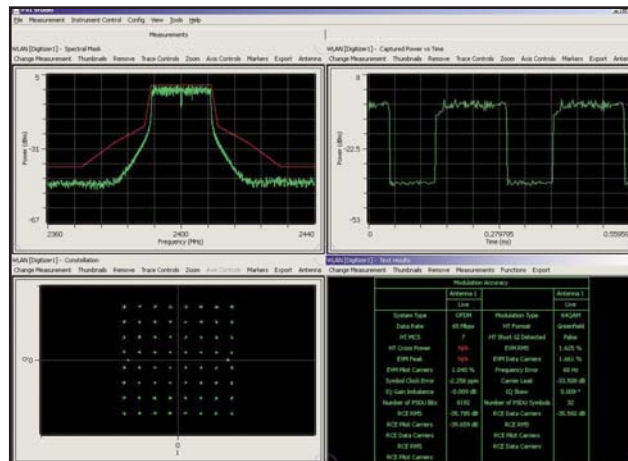


Figure 1. WLAN plug-in typical screenshot

Data rates and corresponding modulation and encoding formats up to 450 Mb/s are supported. 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, which correspond to a maximum of three spatial streams.

## WLAN

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All specifications for accuracy and range relate to performance when used in conjunction with a 3030 Series PXI RF digitizer with option 103 operating in any ISM band up to 6 GHz

Measurements are per IEEE 802.11a,b,g,n

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

## CONFIGURATION

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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 signals, this also includes MCS index.

### Analysis Mode

802.11a/b/g

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

### Channel Bandwidth (802.11n only)

20/40 MHz

### Channel Offset (802.11n only)

None, Upper, Lower

### 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)<sup>(4)</sup>

1, 2 or 3 (MCS 0–23 and 32–52)

### 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:

Enable/disable

Pre-amble

Pre-amble plus pilots and data

### Burst Profile type

Average power or peak power

## Measurement results

Live, average, min hold, max hold, std dev

## BURST POWER MEASUREMENTS

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### TRANSMIT POWER

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

#### Indication

dBm

#### Accuracy

See 3030 Series module level accuracy spec

### BURST LENGTH

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

#### Indication

μs

#### Rising/Falling Edge Time (802.11b and g)

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

#### Indication

Global Pass/Fail

Ramp up Pass/Fail

Ramp up time in μs (10% to 90% points)

Ramp down Pass/Fail

Ramp down time in μs (90% to 10% points)

Burst position μs relative to trigger point

Power vs. Time Trace

## OCCUPIED BANDWIDTH (OBW)

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Bandwidth containing 99% of total of the transmitted PPDU spectrum

#### Indication

Hz

#### Accuracy

Typically <100 kHz

## SPECTRAL MASK

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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/g

802.11n

User defined

#### Measurement BW

100 kHz

#### Measurement Range

80 MHz

#### Indication

Global Pass/Fail

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

Spectral trace display with mask

### Accuracy

$< \pm 0.05$  dB error per 10 dBc

Assumes common 3030 Series attenuator settings for reference and offset measurements.

### ADJACENT CHANNEL POWER (FOR DSSS SIGNALS)

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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 & Alternate Channel bandwidth

$\pm 11$  MHz,  $\pm 22$  MHz

#### Indication

1st lower dBc

2nd lower dBc

1st upper dBc

2nd upper dBc

#### Measurement Range

Typically 65 dB for IEEE 802.11b 11 Mbps CCK

#### Accuracy

$< \pm 0.05$  dB error per 10 dBc

Assumes common 3030 Series attenuator settings for reference and offset measurements.

### MODULATION ACCURACY

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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<sup>(2)</sup> (% 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

#### Traces

Constellation display

Trace of EVM values vs. sub carrier or symbol number

System Type, Modulation Type, Data Rate, Number of PSDU bits/symbols HT format (Greenfield or Mixed), 802.11n — HT mode only

#### Accuracy

Typically  $< 40$  dB residual EVM

#### IQ gain imbalance

dB

#### IQ skew

degrees

#### Carrier leak

dB

### FREQUENCY TOLERANCE

#### Lock Range

$\pm 50$  ppm

#### Indication

Hz

### Accuracy

$< \pm 10$  Hz + (Freq Standard Error  $\times$  Transmitter Freq (MHz))

### TX CENTRE FREQUENCY LEAKAGE / RF CARRIER SUPPRESSION

#### Indication

dB

#### SYMBOL/CHIP CLOCK TOLERANCE

#### Range

$\pm 50$  ppm

#### Indication

ppm

#### Accuracy

As per reference frequency

### SPECTRAL FLATNESS (FOR NON-DSSS SIGNALS)

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#### Indication

Pass/Fail

Upper Pass/Fail

Lower Pass/Fail

Trace display of dB vs. sub carrier and mask

### HT CROSS POWER

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Support for up to two spatial streams

#### Indication

dBm

### CCDF

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Complimentary cumulative distribution function

#### Trace

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

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

(2) For all enabled antennas

### GENERAL

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#### Operating System

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

#### Required Memory

512 Mbytes minimum, 1024 Mbytes recommended

#### Display resolution

Minimum 1024  $\times$  768

#### Other

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

Aeroflex 3000 Series module drivers version 5.4.0 or later

## ORDERING

PXI Studio is supplied as standard with plug-ins for RF Digitizer, Signal Generator, RF Combiner and Spectrum Analyzer.

Optional measurement plug-ins may be purchased with the 303x at time of order or purchased as an upgrade to the 303x.

Note: To be able to use measurement plug-ins within PXI Studio, associated options must be enabled in the 303x digitizer.

### WLAN

When purchased with a 303x, order as: 3030 option 103

When purchased as an upgrade, then order as: RTROPT103/3030

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