PXI Modules

WLAN Measurement Suite

A complete suite of measurement functions to analyze IEEE802.11 WLAN transmitter RF performance in conjunction with 3030 series RF digitizers.

- Transmit power
- Transmit burst length
- Transmit power on, off timing
- Spectral mask
- Occupied bandwidth
- Frequency tolerance
- Symbol / chip clock frequency tolerance
- Carrier suppression/leakage
- Modulation accuracy (EVM)
- Spectral flatness
- Use with 3030 series PXI RF digitizer

Introduction

The WLAN measurement suite expands the capability of the Aeroflex 3030 series PXI RF digitizers to perform OFDM and DSSS power, spectrum and modulation measurements in accordance with WLAN standards IEEE 802.11a, b and g.

The WLAN measurement suite is a Windows .dll with interfaces to C++ and VB for use in a broad range of application software development environments such as LabVIEW, LabWindows/CVI, Visual Basic and Visual C/C++.

The WLAN measurement suite performs analysis of IEEE 802.11a, b and g PHY (physical layer) RF transmission parameters using digital IQ data derived from a RF digitizer. This makes it ideal for use in conjunction with Aeroflex 3030 series RF digitizers and enables precision characterization and alignment of WLAN transmitters.

Applications

The WLAN measurement suite is designed for PXI based RF test systems used in development and manufacturing. It is complemented by IQCreator, a waveform creation application software for generating complex modulation including IEEE 802.11a, b and g signals compatible for use with 3020 series digital RF signal generator modules.

Highlights

The WLAN measurement suite provides analysis of all major RF transmit signal characteristics as defined in IEEE 802.11a,b PMD 1999 and IEEE 802.11g PMD 2003.

Automatic setting of modulation format.

Data rates and corresponding modulation and encoding formats up to 54 Mb/s are supported. Modulation format selection is automated, the data rate and modulation type are determined directly from preamble and header decoding. The preamble type is also automatically determined making using the measurement library easy to integrate within a test application.

Most measurement parameters can be calculated from a single set of acquired data. Spectral mask and Adjacent channel power measurements combine the data from multiple acquisitions at different frequencies. The number of acquisitions necessary is a function of the

	Data rate Mb/s	Burst length (ms)	Number of IQ samples	Spectral Mask (ms)	Power & EVM (ms)	All (ms)
802.11a/g	6	1.393	92160	426	170	600
OFDM	18	0.480	30720	175	55	230
	24	0.364	30720	175	44	220
	54	0.176	30720	175	26	200
802.11b	1	4.286	184320	820	580	1400
DSSS	2	2.239	122880	550	285	835
	5.5	2.239	122880	550	285	835
	11	0.563	30720	175	65	240

required measurement span and the digitizer bandwidth. Individual measurement groups may be calculated in isolation in which case measurement time can be accelerated for a single measurement type.

Measurement Speed

Complete WLAN Tx analysis is achieved in 200 ms. Typical measurement times (ms) for different test conditions are shown in the table above. These measurements were performed using a Pentium P4 2.2 GHz embedded PXI controller to measure an OFDM PPDU with 1024 octets and a DSSS PPDU with 512 octets acquired with a sampling rate of 30.72 Ms/s and a digitizer bandwidth of 20 MHz. Higher speed measurement is possible when using a wider bandwidth digitizer e.g 3030A/3035 or a higher speed controller.

Measurements are based upon a general assumption that the device under test is commanded to transmit RF bursts. Analysis may be performed for continuous transmission with the addition of a pointer to the start of the preamble in the input IQ data.

Example Code

The measurement suite is supplied with comprehensive help including useful example source code to aid the user in the development of measurement applications. Examples are supplied for a variety of applications development environments including Visual Basic (VB6) and C/C++.

SPECIFICATION

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

System Type	Modulation	Data Rate Mb/s	IEEE spec
OFDM	BPSK	6, 9	802.11a/g
	QPSK	12, 18	
	16QAM	24, 36	
	64QAM	48, 54	
DSSS	DBPSK	1	802.11b
	DQPSK	2	
	CCK/PBCC(QPSK)	5.5, 11	
	PBCC (8PSK)	22	802.11g

BURST POWER MEASUREMENTS

TRANSMIT POWER

The Peak and RMS power is measured for a single PPDU

Indication

dBm

Accuracy

S/N >40 dB in the temperature range 23°C ±5°C

3030 <0.6 dB, Typ 0.3 dB
3030A/3035 <0.45 dB, Typ 0.3 dB

BURST LENGTH

The burst length is the number of samples between the rising and falling edge of a single PPDU burst as determined by a user defined capture threshold magnitude applied to the IQ data.

Indication

The burst length is reported in number of samples

RAMP UP, RAMP DOWN (802.11b and g)

Measures the time taken for the burst power of a single PPDU to change between 10% and 90% of it's 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)

An array of dBm power values for each sample within the length of the PPDU burst

OBW (802.11A AND G ONLY)

Bandwidth containing 99% of total of the transmitted PPDU spectrum in 34 MHz

Indication

Hz

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/g
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

Arrays containing the FFT power spectrum and mask values

Accuracy

typically ±0.05 dB/10 dB

Assumes common 3030 series attenuator settings for reference and offset measurements

ADJACENT CHANNEL POWER

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

±11 MHz, ±22 MHz

Indication

1st lower dBc
2nd lower dBc
1st upper dBc
2nd upper dBc
main channel dBm

Measurement Range

typically 62 dB for IEEE802.11a/g 54 Mbps QAM

typically 65 dB for IEEE802.11b 11 Mbps CCK

Accuracy

typically ±0.05 dB/10 dB

Assumes common 3030 series attenuator settings for reference and offset measurements

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

EVM (rms) all carriers
EVM (rms) for a single carrier (issue 1.1.0)
EVM (rms) all data carriers
EVM (rms) all pilot carriers
EVM (Peak) - 802.11b/g only
EVM (Peak IEEE) - 802.11 b only

Indication

%

An array of symbol/chip EVM values

A two dimensional array of EVM values for each symbol on every sub carrier

System type, Modulation type, PSDU data length.

Accuracy (averaged over 20 bursts)

Residual EVM typically -40 dB

FREQUENCY TOLERANCE

Lock Range

±50 ppm

Indication

Hz

Accuracy

As per reference frequency

TX CENTRE FREQUENCY LEAKAGE / RF CARRIER SUPPRESSION

Indication

dB

SYMBOL / CHIP CLOCK TOLERANCE

Range

±50 ppm

Indication

ppm

Accuracy

As per reference frequency

SPECTRAL FLATNESS (802.11A AND G ONLY)

Indication

Pass/Fail

Upper Pass/Fail

Lower Pass/Fail

52 element array representing dBr values for each sub carrier

ORDERING

This application is designed for use in conjunction with the 3030 series PXI RF Digitizer.

It may be purchased either with the RF digitizer at time of order or purchased as an upgrade.

When purchased with the 3030, order as:	*3030 option 103*
When purchased as an upgrade, then order as:	*RTROPT103/3030*

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

CHINA Shanghai
Tel: [+86] (21) 5109 5128
Fax: [+86] (21) 5150 6112

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] 8131 2926-0
Fax: [+49] 8131 2926-130

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

INDIA
Tel: [+91] 80 5115 4501
Fax: [+91] 80 5115 4502

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

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

SPAIN
Tel: [+34] (91) 640 11 34
Fax: [+34] (91) 640 06 40

UK Burnham
Tel: [+44] (0) 1628 604455
Fax: [+44] (0) 1628 662017

UK Cambridge
Tel: [+44] (0) 1763 262277
Fax: [+44] (0) 1763 285353

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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A passion for performance.

www.aeroflex.com

info-test@aeroflex.com

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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