

IQsignal for WiMAX Analysis Software

Introduction

The LitePoint IQsignal™ for WiMAX Software adds WiMAX signal analysis capability to the Tektronix RSA3408A, allowing detailed analysis of 802.16e-2005 / WirelessMAN-OFDMA and 802.16-2004 / WirelessMAN-OFDM PHY waveforms.

Please contact your local LitePoint Sales Representative for further information and a demonstration. A current list of local sales resources can be found at: www.litepoint.com/company/contact.php

Application areas:

- Component and System R&D
- Product Development
- Design Verification
- Product Debugging

Features:

- Optional software suite for WiMAX 802.16e-2005 / WirelessMAN-OFDMA and 802.16-2004 / WirelessMAN-OFDM signal analysis
- Easy to use graphical user interface, running on standard PC
- Compatible with LitePoint IQmax WiMAX Test System and Tektronix RSA3408A Real-Time Spectrum Analyzer.

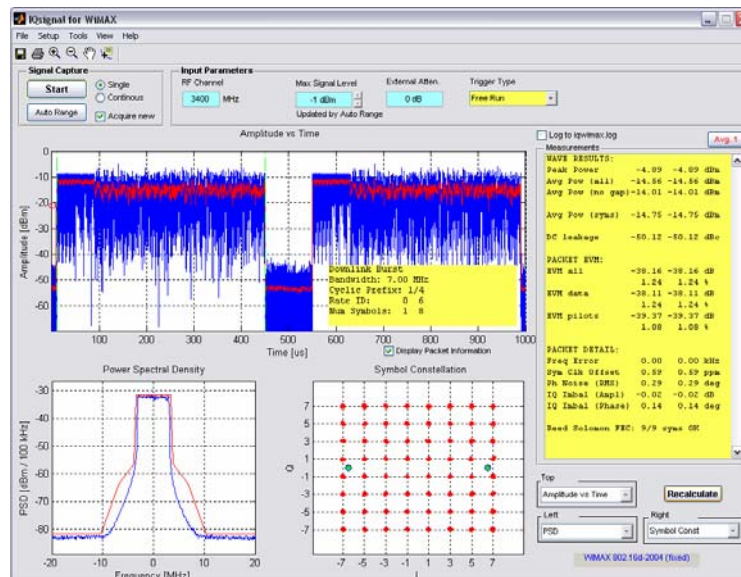


Figure 1. The IQsignal for WiMAX analysis screen

1. Basic Functionality Description

A PC is used to run the IQsignal for WiMAX analysis software and is typically also used to control the DUT through the IC vendor's driver. Interface between the PC and the RSA3408A is via either 10/100 Base-T TCP/IP Ethernet or IEEE 488.2 GPIB. The installer program on the included CD loads all software, associated documentation, and any required files.

2. Software Description

IQsignal for WiMAX offers advanced analysis of WiMAX waveforms captured by the RSA3408A or retrieved from file, including EVM and spectral measurements. For example, IQsignal for WiMAX can easily analyze frequency settling time and phase error that occurs during a burst transmission. Such capabilities significantly help in understanding and debugging RF performance-related issues.

The IQsignal for WiMAX software supports in-band transmit analysis through a graphical display of these tests including:

- Spectrum (PSD) and mask
- symbol constellation
- spectral flatness, delta spectral flatness
- captured waveform display in the time domain

To support product debugging, various other graphical displays are supported by IQsignal for WiMAX, including:

- phase error versus time
- frequency error versus time
- CCDF (to support compression analysis)
- spectrogram
- EVM (versus OFDM subcarriers; versus time)

Besides the graphical display of VSA measurements, IQsignal for WiMAX also presents relevant numerical data including:

- EVM (all, data, pilots)
- power (peak, average)
- frequency error
- symbol timing error
- integrated phase noise
- I/Q imbalance (amplitude, phase)
- Reed-Solomon errors

Average of numerical data over multiple captures can be displayed as well.

IQsignal for WiMAX additionally provides a wide range of compensation methods that can be used for advanced analysis of a captured signal's sensitivity to certain impairments. For example, the available compensation methods when analyzing OFDM signals include:

- phase tracking (off, fast)
- channel estimation (based on averaging of the long training sequence, averaging of the full packet)
- symbol timing tracking
- frequency synchronization (based on long training sequence, or full packet)
- amplitude tracking

3. Applications Information

For developers of WiMAX products the IQsignal for WiMAX Analysis Software offers the capability to analyze the functionality and performance of the DUT through the intuitive and powerful GUI. All key transmit parameters of a WiMAX prototype can be verified.

The IQsignal for WiMAX software can be used to analyze "live" captures from the RSA3408A instrument, or it can analyze captures stored in a file (off-line analysis). The software supports the Tektronix' .IQT fileformat, and LitePoint's .SIG and .MOD formats.

4. Analysis Measurement Parameters

capture mode	single / continuous	enables one-shot or non-stop data capture and analysis
sample interval	100 μ s, 200 μ s, 300 μ s, 400 μ s, 500 μ s, 1 ms, 2 ms, 3 ms, 4 ms, 5 ms, 10 ms	The sample interval is limited by the buffer size and A/D sample rate of the instrument.
signal type	<ul style="list-style-type: none"> 802.16-2004 / WirelessMAN-OFDM (fixed WiMAX) 	<ul style="list-style-type: none"> Automatically detected: Signal type (up- / downlink burst), Bandwidth, Modulation / coding, Cyclic Prefix length
	<ul style="list-style-type: none"> 802.16e-2005 / WirelessMAN-OFDMA (mobile WiMAX) 	<ul style="list-style-type: none"> Automatically detected: Signal type (up- / downlink burst), Bandwidth, Modulation / coding, Cyclic Prefix length, Uplink fields. User defines up- and downlink maps (GUI) Supported mode: PUSC, single zone, single constellation per symbol.
decode	on / off	enable or disable payload decoding (fixed WiMAX only)
input mode ¹	baseband / RF	selects type of signal input and enables appropriate ports
IQ swap ¹	on / off	interchanges I and Q channel signals on input ports
triggers	<ul style="list-style-type: none"> free run external trigger 	<ul style="list-style-type: none"> data capture trigger mechanism
max signal level	<ul style="list-style-type: none"> RF input: -60 to +30 dBm in 1 dB increments baseband input: -60 to +30 dBV in 1 dB increments 	<ul style="list-style-type: none"> peak signal level at instrument input, affecting display ranges can be determined automatically (Auto Range function) limited by instrument performance
external attenuation	-25.0 to 125.0 dB with 0.1 dB resolution	<ul style="list-style-type: none"> attenuation between DUT output and IQmax input (applied as a correction to measurements) RF input mode only
acquire new	on / off	<ul style="list-style-type: none"> acquire new signal capture for analysis or reload current capture
EVM & power averaging	1, 10, 20, 40, 60, 80, 100	<ul style="list-style-type: none"> number of measurements (packets) used to calculate average EVM and power LitePoint API allows arbitrary number of measurements to be used
Rx IF	0 MHz, 5 MHz, 10 MHz, 11 MHz	<ul style="list-style-type: none"> to assess Tx performance at IF, down convert the signal to 5 MHz, 10 MHz, or 11 MHz and input it to the baseband ports to assess Tx performance at baseband or at a supported RF channel, set to 0 MHz
RF channel (RF mode only)	<ul style="list-style-type: none"> user-defined center frequency (resolution is HW dependent) 	
phase tracking / correction	<ul style="list-style-type: none"> off symbol-by-symbol correction 	<ul style="list-style-type: none"> phase tracking method symbol-by-symbol correction is specified by IEEE standard for EVM calculation but will mask measurement of Tx phase noise
channel estimate	<ul style="list-style-type: none"> raw (averaging over long training sequence) raw (averaging over full packet) 	<ul style="list-style-type: none"> channel estimation method averaging over long training sequence is most common in practical receiver implementations
symbol timing tracking	on / off	<ul style="list-style-type: none"> enable timing jitter correction symbol timing tracking is specified by IEEE standard

¹ Only relevant when Option 03 is installed on the RSA3408A

frequency sync	<ul style="list-style-type: none"> long training sequence (includes short training sequence if present) full data packet 	<ul style="list-style-type: none"> carrier frequency error estimation method estimation based on short or long training sequence is most common in practical receiver implementations
amplitude tracking	on / off	enable automatic gain control

Note that the specified corrections are implemented prior to measurement taking; for example, EVM is calculated after any specified corrections are applied, thereby affecting the results.

5. Analysis Measurement Results – Graphical Display

amplitude vs time	instantaneous and peak power averaged over a symbol duration (dBm) versus time
spectrogram	<ul style="list-style-type: none"> 3D plot of power spectral density versus time time is displayed on x-axis; frequency offset on y-axis; color coding represents power (maximum strength is red; minimum strength is green)
PSD	<ul style="list-style-type: none"> power spectral density (dBm/Hz) versus frequency offset spectrum mask per IEEE 802.16-2004 center frequency \pm 30 MHz resolution bandwidth 100 kHz
symbol constellation	visual display of each demodulated symbol in the I/Q complex plane (data symbols are red; pilot tones are green)
spectral flatness	variation from average energy as a function of OFDM subcarrier number (dB).
spectral delta	power delta between adjacent subcarriers (dB).
phase noise (PSD)	phase noise power spectral density (dBc/Hz) versus frequency offset
phase error (time)	integrated phase error of pilot tones (degrees) versus time
CCDF (complementary cumulative distribution function)	probability of peak signal power being greater than a given power level versus peak-to-average power ratio (dB). Shown over all data or payload only.
I & Q signals	I/Q signal voltages (Vrms) versus time
frequency error	<ul style="list-style-type: none"> frequency error (kHz) versus time frequency error during short and long training sequences
EVM versus carrier	Error Vector Magnitude averaged over all symbols for each subcarrier (dB) versus OFDM subcarrier number
EVM versus time	Error Vector Magnitude averaged over all subcarriers (dB) versus time

6. Analysis Measurement Results – Numerical Data

packet information	<ul style="list-style-type: none"> Signal type, down and uplink Bandwidth, cyclic prefix Modulation and coding per burst (rate ID) Number of symbols for each rate ID type
EVM all	<ul style="list-style-type: none"> EVM averaged over all symbols and all subcarriers (dB; %)
EVM data	<ul style="list-style-type: none"> EVM averaged over all symbols and all data subcarriers (dB; %)
EVM pilots	<ul style="list-style-type: none"> EVM averaged over all symbols and all pilot subcarriers (dB; %)
peak power	peak power over all symbols (dBm)
average power (all)	average power of complete data capture (dBm)
average power (no gap)	average power over all symbols after removal of any gap between packets (dBm)
average power (syms)	average power over all symbols, excluding preamble (dBm)
LO (DC) leakage	variation from center carrier (dBc)
I/Q amplitude error	I/Q amplitude imbalance (%)
I/Q phase error	I/Q phase imbalance (degrees)
total I/Q mismatch (combined)	approximate contribution of amplitude and phase imbalances to EVM (dB)
frequency error	carrier frequency error (kHz)

symbol clock error	symbol clock frequency error (ppm)
rms phase noise	integrated phase noise (degrees)
Reed-Solomon errors	Number of symbols with RS errors (available only if payload decoding is enabled; fixed WiMAX only)

Note that the above measurements are shown for the current data packet only.

7. PC System Minimum Requirements

PC	Intel Pentium processor or compatible, 500MHz (1GHz or higher recommended)
operating system	Microsoft Windows 2000 (SP3 or higher), Windows XP (SP1 or higher) US English versions
memory	512MB of RAM
disk space	500MB of available hard disk space
monitor	1024 x 768 resolution
connectivity	TCP/IP over 10/100BaseT Ethernet

8. Shipping Contents

IQsignal for WiMAX Analysis CD

9. Order Information

<u>ORDER CODE</u>	<u>PRODUCT DESCRIPTION</u>
RSA-IQWIMAX	LitePoint IQsignal for WiMAX Analysis Software

LitePoint Corporation

575 Maude Court, Sunnyvale, CA 94085

+1.408.456.5000 www.litepoint.com

IQview is a registered trademark, LitePoint, TrueChannel, IQnxn, IQflex, IQmax, IQsignal, IQwave, IQfact, IQcheck, IQdiagnostic, IQapi, IQtest, and IQdebug are trademarks of LitePoint Corporation.. All other trademarks are the property of their respective owners. The information furnished by LitePoint Corporation is believed to be accurate and reliable. However, LitePoint assumes no responsibility for its use. LitePoint reserves the right to change specifications and documentation at any time without notice. Copyright © 2006 LitePoint Corporation. 08/06