Agilent Technologies

N7613A Signal Studio for 802.16-2004 (WiMAX™) Technical Overview

Create WiMAX waveforms with ease

Signal Studio for 802.16-2004 enables you to easily create WiMAX waveforms that comply with the 256-carrier OFDM physical layer specified in the IEEE 802.16-2004 standard. The software's intuitive graphical interface provides convenient access to the physical layer parameters, coding parameters, and basic MAC layer parameters, providing the versatility you need to configure waveforms for both component and receiver testing. Download your WiMAX waveform files to the E4438C ESG, E8267D PSG, N5162A MXG ATE, or N5182A MXG vector signal generator for playback.

Free 14-Day Trial

Download the software today to investigate the signal creation capability and generate test signals using a free 14- day trial license. After the trial license expires, each vector signal generator must be licensed separately to playback waveforms created by the software. For more information, visit:

www.agilent.com/find/signalstudio

Key Features

- Flexible signal parameters, including bandwidth, cyclic prefix ratio (G), sampling factor (n), frame length, and TDD downlink/uplink ratio
- Up to 16 frames of the same configuration with incrementing frame numbers and continuous data in MAC PDU
- Downlink and uplink frames with preamble, FCH, and data bursts
- Different coding and modulation types/rates for each data burst (BPSK, QPSK, 16QAM, or 64QAM)
- Various payload data types: fixed data patterns, PN9 or PN15 sequences, or user data files
- Raw or fully coded data (with randomization, RS convolutional coding, and interleaving)
- Frame configuration modes designed for component test and receiver test
- Real-time AWGN capability (requires E4438C-403, E8267D-403, N5162A-403, or N5182A-403)
- Intuitive display of frame structure as you build the waveform
- Plots of waveform characteristics, such as CCDF curves, I/Q signals, and baseband spectrum
- Signal generator settings accessible through software, including I/Q adjustments, triggering, and markers
- LAN and GPIB connectivity

Software Applications

Receiver testing

The software's MAC PDU frame setup mode enables you to create WiMAX standard-compliant frame structures for testing receiver designs in all stages of development. In this mode, the software automatically generates the preamble, FCH, and broadcast messages (DL-MAP, UL-MAP, DCD, UCD). Each data burst is fully coded with Reed-Solomon convolutional coding, randomization, and interleaving. You also have the flexibility to configure individual burst parameters, such as modulation type and rate, payload data, and the option to include header and CRC information in each MAC PDU for fully testing receiver designs. Frames can include both downlink and uplink bursts.

Component testing

The software's Physical (PHY) frame setup mode lets you construct spectrally accurate waveforms for testing a variety of WiMAX components, such as amplifiers. In this mode, you can choose which waveform components you want in the frame, including the preamble, FCH, and data bursts. You also have access to the physical layer parameters: modulation type, payload data, fully coded (RS-CC, randomization, and interleaving) or raw data, coding rate, symbol length, and amplitude. Frames can include both downlink and uplink bursts.

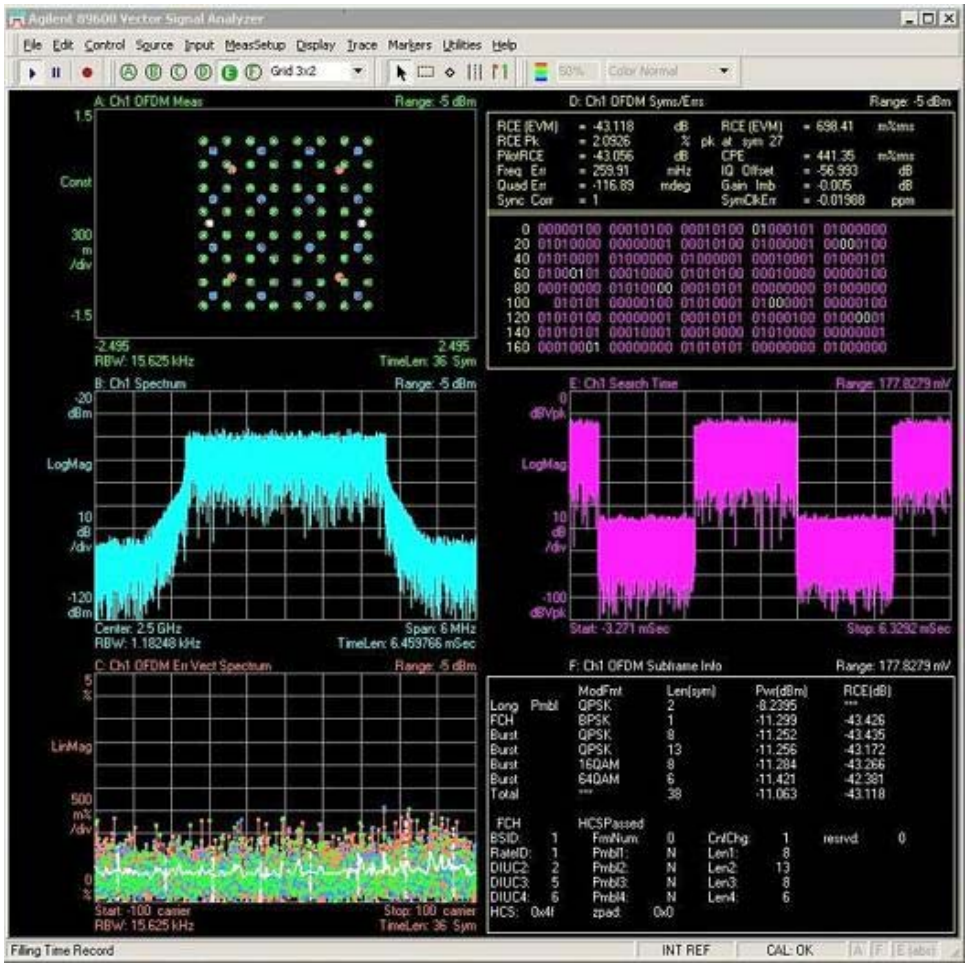

Figure 1. This screen capture shows a signal generated with the Signal Studio of 802.16-2004 software displayed on the Agilent 89600 Series vector signal analysis software (v.5.3 or higher) with Option B7S, 802.16 (WiMAX) OFDM modulation analysis.

Add real-time AWGN and other impairments

If your signal generator is equipped with the optional calibrated AWGN capability (Option 403 for the E4438C, E8267D, N5162A, or N5182A), you can add real-time AWGN to the WiMAX signal without using a stand-alone calibrated noise generator. You can conveniently configure the noise parameters through the software interface. The signal generator also enables you to add other impairments, such as I/Q skew, I/Q gain, I/Q offset, AM, FM, and ΦM. Many of these impairments can be configured through the software interface.

Expand your test capability with Agilent Baseband Studio products

- Add channel impairments to the WiMAX signal with the Agilent N5115B Baseband Studio for fading solution (ESG/PSG only)
- Access digital IQ and digital IF test signals with the Agilent N5102A Baseband Studio digital signal interface module (ESG/PSG only)

Software Features

Configure waveforms quickly and easily

Signal Studio for 802.16-2004 (WiMAX) provides a flexible, intuitive graphical user interface that makes waveform set up easy and straightforward. Additionally, you can control the signal generator settings from the graphical user interface as well as calibrated AWGN noise when you use Option 403 for your signal generator of choice.

The software provides feedback on your waveform settings, enabling you to quickly resolve any conflicts.

- The Check Parameters feature verifies that the configured bursts do not exceed the length of the defined frame. The software's status bar also displays any waveform setup conflicts.
- The Waveform Generation Log allows you to view the bits (in hexadecimal) that the software automatically generates when you are using the MAC PDU mode.

Quickly analyze your data

Graphical displays make it easy to confirm the parameters you've chosen. The CCDF graph displays the probability (in percentage) of the generated waveform's calculated peak-to-average power ratio (measured in dB) meeting or exceeding a certain level. The table to the left of the CCDF plot displays the calculated peak-to-average values for the waveform. Additional graphical options allow you to plot Gaussian data, designate a reference curve, and display up to three previous plots, allowing you to make comparisons of waveform characteristics as you adjust parameters.

You can also select the portion of the waveform used to calculate the CCDF data. Waveform CCDF will include all components of the configured frame including gaps and non-transmitted portions (both RF burst on and off portions). Burst CCDF will include the configured bursts only (not including gaps or times when the RF burst is off).

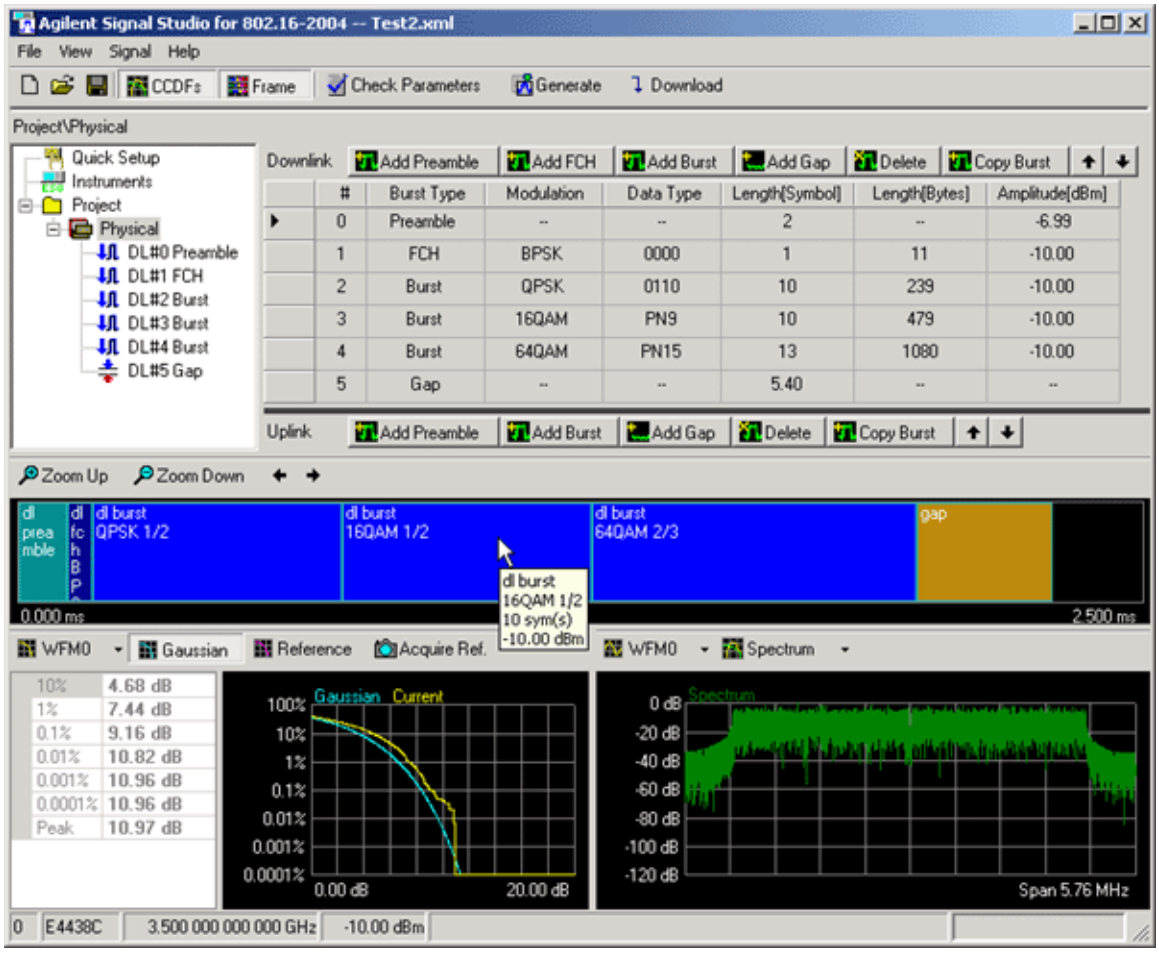

Figure 2. The user interface includes visualization tools to view waveform characteristics and frame structure prior to downloading the waveform to the signal generator.

Performance Characteristics[1]

EVM − E4438C ESG Vector Signal Generator

Carrier Settings	Characteristic Value[2]	Performance Range[3]
2.5 GHz / −20 dBm	−46.0 dB (0.5%)	−49.2 to −42.5 dB (0.3 to 0.8%)
3.5 GHz / −20 dBm	−42.0 dB (0.7%)	−46.4 to −38.7 dB (0.4 to 1.1%)
5.8 GHz / −20 dBm	−48.0 dB (0.4%)	−50.4 to −45.8 dB (0.3 to 0.5 %)

EVM − E8267D PSG Vector Signal Generator[4]

Carrier Settings	Characteristic Value[2]	Performance Range[3]
2.5 GHz / −20 dBm	−46.0 dB (0.5%)	−49.2 to −40.2 dB (0.3 to 0.9%)
3.5 GHz / −20 dBm	−42.0 dB (0.7%)	−48.6 to −38.7 dB (0.4 to 1.4%)
5.8 GHz / −20 dBm	−44.0 dB (0.6%)	−49.1 to −37.1dB (0.3 to 1.3 %)

EVM − N5162A/N5182A MXG Vector Signal Generator

Carrier Settings	Characteristic Value[2]	Performance Range[3]
2.5 GHz / −20 dBm	−45.0 dB (0.6%)	−50.9 to −42.1 dB (0.3 to 0.8%)
3.5 GHz / −20 dBm	−45.0 dB (0.6%)	–50.3 to −42.2 dB (0.3 to 0.8%)
5.8 GHz / −20 dBm	−43.6 dB (0.7%)	−48.3 to −41.7 dB (0.4 to 0.8 %)

1. Performance characteristics apply to WiMAX waveforms with bandwidths up to 10 MHz and all valid modulation types.
2. Non-warranted value based on testing during development phase of this product. The majority of instruments tested met this value.
3. Non-warranted range based on testing during development phase of this product. All instruments tested performed within this range.
4. Performance characteristics based on PSG signal generators with the standard pulse modulation option, E8267D-UNU. EVM performance degrades without this option.

Configurations

Signal Studio for 802.16-2004 (WiMAX) Software Options

N7613A-101[1]	License: E4438C ESG
N7613A-102[2]	License: E8267D PSG
N7613A-103[3]	License: N5162A MXG ATE
N7613A-103[4]	License: N5182A MXG

E4438C ESG with the following options:

E4438C-506	Frequency range from 250 kHz to 6 GHz
E4438C-602[5]	Internal baseband generator, 64 MSa memory
E4438C-403	Calibrated noise (AWGN) personality (required for C/N capability)
E4438C-005	6 GB internal hard drive
E4438C-UNJ	Enhanced phase noise (required with E4438C-506)

E8267D PSG[6] with the following options:

E8267D-520	Frequency range from 250 kHz to 20 GHz
E8267D-602[5]	Internal baseband generator, 64 MSa memory
E8267D-403	Calibrated noise (AWGN) personality (required for C/N capability)
E8267D-005	6 GB internal hard drive
E8267D-UNU	Standard pulse modulation

N5162A MXG ATE with the following options:

N5162A-506	Frequency range from 250 kHz to 6 GHz
N5162A-654[7]	Internal baseband generator, 125 MSa/s (recommended); (N5162A-652 (60 MSa/s) required)
N5162A-019[8]	Increase baseband generator memory to 64 MSa
N5162A-UNV[8]	Enhanced dynamic range
N5162A-403	Calibrated noise (AWGN) personality (required for C/N capability)

N5182A MXG with the following options:

N5182A-506	Frequency range from 250 kHz to 6 GHz
N5182A-654[7]	Internal baseband generator, 125 MSa/s (recommended); (N5182A-652 (60 MSa/s) required)
N5182A-019[8]	Increase baseband generator memory to 64 MSa
N5182A-UNV[8]	Enhanced dynamic range
N5182A-403	Calibrated noise (AWGN) personality (required for C/N capability)

1. Requires ESG firmware revision C.04.10 or later.
2. Requires PSG firmware revision C.04.10 or later.
3. Requires MXG ATE firmware revision A.01.40 or later.
4. Requires MXG firmware revision A.01.04 or later.
5. Recommended option: the baseband generator option can be any of the following:
E4438C-001, -002, -601, -602 or E8267D-601, -602.
6. The narrow pulse modulation option, E8267D-UNW, is not recommended. EVM performance degrades at frequencies ≤ 3.5 GHz.
7. Bandwidth can be 20 MHz (46.08 MHz sampling rate) or 28 MHz (64 MHz sampling rate) for fixed WiMAX.
8. Recommended but not required.

Additional Product Information

For more information about the software, including release notes, user interface descriptions, tutorials, and installation information read the online documentation at the following websites:

Signal Studio Software
www.agilent.com/find/signalstudio

Baseband Studio Software
www.agilent.com/find/basebandstudio

Related Literature

Agilent E4438C Vector Signal Generator, Brochure, Literature number 5988-3935EN

Agilent E4438C Vector Signal Generator, Data Sheet, Literature number 5988-4039EN

Agilent E4438C Vector Signal Generator, Configuration Guide, Literature number 5988-4085EN

Agilent MXG Signal Generators, Brochure, Literature number 5989-5074EN

Agilent N5182A MXG Vector Signal Generator, Data Sheet, Literature number 5989-5261EN

Agilent MXG Signal Generators, Configuration Guide, Literature number 5989-5485EN

Accurate amplifier ACLR and ACPR testing with the Agilent MXG Vector Signal Generator, Application Note, Literature number 5989-5471EN

Agilent 89600 Series Vector Signal Analysis Software 89601A/89601AN/89601N12, Technical Overview, Literature number 5989-1679EN

Agilent 89600 Series Vector Signal Analysis Software 89601A/89601AN/89601N12, Data Sheet, Literature number 5989-1786EN

Web Resources

For more information, visit:

www.agilent.com
www.agilent.com/find/esg
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Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and onsite education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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Revised: March 24, 2009

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