Agilent E6651A
Mobile WiMAX™ test set

Technical Overview

Accelerate time-to-market for your IEEE802.16e mobile station designs

The E6651A represents a significant breakthrough in Mobile WiMAX testing. It incorporates flexible base station emulation and RF parametric tests into one integrated unit and extends Agilent's unmatched portfolio of WiMAX™ test solutions for development, verification, and manufacturing customers.

The E6651A Mobile WiMAX Test Set allows 802.16e-2005 mobile station designers and manufacturers to move rapidly from development to volume production, and to improve the integrity and quality of products while reducing cost.

The Agilent E6651A includes a suite of RF measurements that may be used for characterization, calibration, and verification purposes. The test set provides flexible profile support, with RF signal generation and signal analysis capability up to 6 GHz.

To enable mobile stations to be tested to the latest WiMAX standards, MIMO options for Wave 2 testing are available. Capabilities include an additional downlink channel for Mobile Station testing and support for the following IO-MIMO modes:

- Downlink Space-Time Coding (STC) (Matrix A)
- Downlink Spatial Multiplexing (MIMO) (Matrix B)
- Uplink Collaborative Spatial Multiplexing

With realistic base station emulation, the Mobile WiMAX test set offers a controlled environment in which to verify network entry, traffic connection and functional performance. It provides flexibility to configure a range of network parameters so you can test, stress, and debug the protocol and data handling capabilities of your design. Software tools are available to enable protocol and application testing.

With this exciting product, Agilent helps you get your design to market faster and more efficiently, and continues to provide comprehensive tools for all stages of your product lifecycle. So, as you move WiMAX forward, Agilent clears the way.

Agilent Technologies

E6651A Features

IEEE 802.16e OFDMA Mobile WiMAX mobile station (MS) tester
- Real-time Mobile WiMAX downlink (DL) signal modulation
- Real-time Mobile WiMAX uplink (UL) demodulation
- Base station emulation with MAC, protocol stack
- MS and BS-initiated handover support for functional test
- Sleep and idle mode support for testing battery life of device
- PKMv2 encryption and pass-through support to FreeRADIUS AAA server for security testing
- TDD synchronization (auto-switching) for UL and DL
- Settable IDs for cell, segment DL PUSC, DL FUSC, DL AMC 2x3, UL PUSC
- MIMO options for Wave 2 device test
- End-to end IP connection with >10Mbps data throughput (UDP transport) for real-time functional application test (using E6655A WiMAX lab application)

Mobile WiMAX Radio (PHY) Measurements

MS receiver (DL) test

- RF simulation in base-station emulation mode, or with MS set to receive only
- Settable frequency, power and modulation schemes
- Additive white Gaussian noise (AWGN) generator
- Reporting of PER, RSSI, CINR, ECINR, Tx Power (if available on MS UL)
- Receiver sensitivity testing using ping or user datagram protocol (UDP) with variable modulation format, coding and payload size
- Additional RF source available for MIMO MS receiver test
- HARQ mode testing supports ACK/NACK detection with settable modulation format, payload size, number of sub-bursts and number of retransmission attempts.

MS transmitter (UL) test

- RF analysis in base-station emulation mode, or with MS set to transmit only
- Spectrum measurements with adjustable frequency, span, channel bandwidth, and resolution bandwidth
- Modulation measurement displaying OFDM I/Q constellation and EVM (BPSK, QPSK, 16QAM)
- Power versus time
- Sub-carrier power flatness
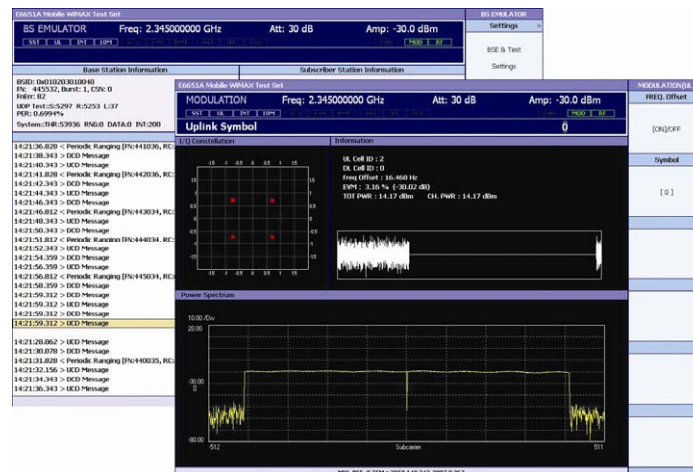
E6651A measurement display

Mobile WiMAX MAC Test Items

- Network entry procedure, including ranging, registration, service flow establishment
- MS MAC layer verification and performance test
- Power control, power adjust
- Map scheduling flexibility, including support for normal and compressed MAP modes
- Neighbor cell advertisement
- UL MAP display

Product Configuration

Frequency range

E6651A-503	Mobile WiMAX test set, 450 MHz to 2.7 GHz
E6651A-506	Mobile WiMAX test set, 450 MHz to 6 GHz

MIMO options

E6651A-xM1 options provide an additional RF source for mobile station test.

E6651A-3M1	MIMO for mobile station test, 2.7 GHz
E6651A-6M1	MIMO for mobile station test, 6 GHz

Software and technical support contract

The E6651AS-1SY software and technical support contract (STSC) entitles you to 12 months software updates and feature enhancements for the E6651A WiMAX test set firmware, the N6421A WiMAX protocol logging and analysis software, the E6655A WiMAX lab application and the N6422C/N6423C WiMAX wireless test manager software. Direct access to product experts for technical support is also provided. The N6430A protocol and network protocol development and conformance products have separate software and technical support contracts. N6430A protocol development and conformance solutions are only supported with corresponding E6651A firmware releases. Therefore, N6430A customers must purchase **both** PCT/NCT and E6651A STSCs to ensure compatibility with the E6651A and validated PCT/NCT test cases releases.

E6651AS-1SY	12 month software and technical support contract (included with initial E6651A purchase)

Start-up assistance

PS-S20-01	1 day start-up assistance (included with initial E6651A purchase)

Support options

E6651A-UK6	Commercial calibration certificate with data

Repair options

R-51B-001-C	1 year Return-to-Agilent warranty
R-51B-001-3C	1 year Return-to-Agilent warranty extended to 3 years
R-51B-001-5C	1 year Return-to-Agilent warranty extended to 5 years

Related products

E6655A	WiMAX lab application
N6421A	WiMAX protocol logging and analysis
N6422C	WiMAX wireless test manager (development license and software)
N6423C	WiMAX wireless test manager (run-time license and software)
N6430A	Protocol development and conformance software solutions
14565B	Device characterization software with test automation
66319B/D	Dual output mobile communications dc source with battery emulation
66321B/D	Mobile communications dc source with battery emulation

E6651A Specifications

The test set will meet its warranted performance after one hour within the stated environmental operating range plus one hour after turn on. Unless otherwise stated all specifications are valid over the operating temperature range. Supplemental characteristics are intended to provide additional information, useful in applying the instrument by giving typical (expected), but not warranted, performance parameters at room temperature (20 to 30 °C). These characteristics are shown in *italics* or labeled as nominal.

Signal analyzer specifications

Frequency	
Frequency range	450 MHz to 2.7 GHz (E6651A-503)
	450 MHz to 5.99 GHz (E6651A-506)
Frequency resolution	1 Hz (< 3 GHz), 2 Hz (≥ 3 GHz)
Frequency accuracy	Same as frequency reference
Modulation analysis bandwidth	10 MHz

Amplitude	
Measurement range[1]	+27 to -50 dBm
Absolute measurement accuracy[2]	*±0.5 dB (attenuator 0 to 31 dB)*
	±1 dB (E6651A-506 attenuator 32 to 62 dB, or
	32 to 59 dB for E6651A-503)
Residual response	*-85 dBm at 10 kHz RBW*
	-55 dBc (excluding IF image)
Spurious responses[3]	*-40.5 dBc (including IF image) for serial numbers*
	MY4731xxxx
	-45 dBc (including IF image) for serial numbers
	MY4815xxxx or later

Performance	
Quantization	16-bit ADC (hardware revision A.2.x)
	14-bit ADC (hardware revision A.1.x)
Residual (EVM)[4]	*≤ 1.5% (symbol)*
Pass-band ripple	*±0.5 dB (over 16 MHz bandwidth)*
Triggering	Automatic

Signal generator specifications

Frequency	
Frequency range	450 MHz to 2.7 GHz (E6651A-503)
	450 MHz to 5.99 GHz (E6651A-506)
Frequency resolution	1 Hz (< 3 GHz), 2 Hz (≥ 3 GHz)
Frequency accuracy	Same as frequency reference

Amplitude	
WiMAX preamble power range[5]	*-22 to -102 dBm (< 3 GHz)*
	-27 to -102 dBm (≥ 3 GHz)
CW power range	*-7 to -127 dBm (< 3 GHz)*
	-12 to -127 dBm (≥ 3 GHz)
CW power accuracy[6]	*Frequencies < 3 GHz*
	±0.6 dB (-7 to -78 dBm)
	±0.75 dB (≤ -78 to -93 dBm)
	±1.0 dB (≤ -93 to -103 dBm)
	Frequencies 3 GHz to 5.99 GHz
	±1.0 dB (-12 to -95 dBm)
Resolution	0.01 dB

[1] Verified using typical WiMAX signals of 7 MHz, 8.75 MHz and 10 MHz bandwidth

[2] Verified using CW measurements. For modulated measurement amplitude accuracy, add +0.5dB to CW amplitude accuracy.

[3] At 2345 MHz, span 16 MHz (for serial numbers MY4731xxxx), span 60 MHz (for serial numbers MY4815xxxx, MY4832xxxx or MY4914xxxx)

[4] Error Vector Magnitude verified using signals of input frequencies from 700 MHz to 5500 MHz, with bandwidths of 7 MHz, 8.75 MHz and 10 MHz and at a level of -20 dBm

[5] Verified using typical WiMAX signals of 7 MHz, 8.75 MHz and 10 MHz bandwidth

[6] For modulated signal power accuracy, add +0.5dB to CW power accuracy

Signal generator specifications
(continued)

Performance	
Phase noise at 3 GHz	*-102 dBc/Hz @ 10 kHz offset*
Residual (EVM)[2]	*≤ 3%*
ACLR[3]	*≤ -50 dBc at adjacent channel*
Harmonics	*≤ -30 dBc (1 GHz CW, -7 dBm)*
	≤ -30 dBc (2.7 GHz CW, -7 dBm)
Sub-harmonics	*≤ -30 dBc (5.99 GHz CW, -12 dBm)*
Non-harmonic spurious[4]	*≤ -60 dBc, offsets > 10 kHz (< 3 GHz)*
	≤ -65 dBc, offsets > 10 kHz (≥ 3 GHz for RF2 output[5])
	≤ -70 dBc, offsets > 10 kHz (≥ 3 GHz, for RF1 output)

Downlink analog IQ interface[1]

Connector type	BNC
Analog IQ outputs	Connectors DL1-Iout, DL1-Qout, DL2-Iout, DL2-Qout
I/Q bandwidth	Determined by profile used
Output impedance	*50 Ω*
Maximum output voltage level	*340 mVrms; 1 V pk-pk*
Analog IQ inputs	Connectors DL1-Iret, DL1-Qret, DL2-Iret, DL2-Qret
I/Q bandwidth	*>25 MHz*
Input impedance	*50 Ω*
Maximum input voltage level	*+/-500 mVrms complex signal on I or Q*
	+/- 0.5 Vdc on I or Q

Uplink analog IQ/IF interface[1]

Connector type	BNC
	Connectors UL-IF1/I, UL-IF2/Q
Input impedance	*50 Ω*
Maximum input voltage level	*1 V pk-pk*
Standard IF frequency for 802.16e WiMAX	*78 MHz for 5MHz and 10MHz BW profiles*
	72 MHz for 7MHz BW profiles
	70 MHz for 8.75MHz BW profiles

Maximum data throughput

End-to-end IP connection[6]	*11.6 Mbps DL; 3 Mbps UL (UDP; hardware revision A.2.x)*
	10.8 Mbps DL; 2.9 Mbps UL (UDP; hardware revision A.1.x)
E6651A test mode	*13 Mbps DL (UDP); 2.9 Mbps UL (PING) (hardware revision A.2.x)*
	11.5 Mbps DL (UDP); 2.9 Mbps UL (PING) (hardware revision A.1.x)

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[1] Downlink IQ and Uplink IF interface available as standard on units with serial numbers MY4815xxxx and MY4832xxxx. Downlink IQ and Uplink IQ/IF interface available as standard on units with serial numbers MY4914xxxx and later

[2] Error Vector Magnitude measured at output frequency 2345 MHz
[3] Output power -22 dBm at 2345 MHz. Measured at 5 MHz, 8.75 MHz, and 10 MHz BW channels
[4] CW measurement, output -7 dBm, 2350 MHz
[5] Second RF output (RF2) available on instruments with MIMO options E6651A-3M1, E6651A-6M1
[6] Using E6655A WiMAX lab application

General Specifications

RF input/output impedance	*50 Ω (nominal)*
RF input/output VSWR	*< 1.5:1 (< 3 GHz)*
	< 2.0:1 (3 to 6 GHz)
Maximum safe input level	+27 dBm
Interfaces	USB, LAN, trigger in/out, IQ/IF inputs/outputs
RF reference input/output	*10 MHz, 4 dBm to 15 dBm*
Frequency reference accuracy	*± 1E-6*
Power requirement	90 to 250 Vac, 50/60 Hz, 590W
Size (w x d x h)	*444 mm x 647 mm x 222 mm*
Weight	*28.94 kg (E6651A-503/506)*
	30.38 kg (E6651A-3M1/6M1)
	31.8 kg (E6651A-3M2/6M2)
Operating temperature	0 to 50 °C
Operating humidity	*5 to 85% non-condensing*
Storage temperature	-40 to 71 °C
Storage humidity	*0 to 90% at 65 °C*
Operating altitude	*Up to 2000 m*

Related Literature

Mobile WiMAX™ Test Set Solutions, Brochure, Literature number 5989-7633EN

N6422C WiMAX™ Wireless Test Manager, Technical Overview, Literature number 5989-7851EN

N6430A WiMAX Protocol Conformance Test and Development Solution, Technical Overview, Literature number 5989-7513EN

N6430A WiMAX Protocol Conformance Test and Development Solutions, Configuration Guide, Literature number 5989-7512EN

Agilent Mobile WiMAX R&D Test Set Solutions: Software and Technical Support Contract, Product Overview, Literature number 5989-9121EN

Agilent WiMAX™ Solutions, Brochure, Literature number 5989-5914EN

For more information on the E6651A and associated products, please visit **www.agilent.com/find/E6651A**

For more information on Agilent WiMAX solutions, please visit **www.agilent.com/find/wimax**

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