Mobile WiMAX™ Test Set Solutions

Accelerating time-to-market for Mobile WiMAX products
Challenges For WiMAX Design

WiMAX™ technology, which provides wireless broadband access as an alternative to cable and DSL, is evolving rapidly. WiMAX is creating new opportunities for companies of all sizes to enter the IP access and mobile communications markets.

Mobile WiMAX, which supports high-bandwidth mobile services at speeds greater than 120 km/hour, is expected to grow substantially over the next several years. However, the ultimate success of Mobile WiMAX will be determined by the end-user experience. As the technology moves quickly from concept to design to volume production, it requires new and efficient methods of verifying the integrity and quality of subscriber handsets and similar products.

Leading edge designers developing Mobile WiMAX chipsets, modules, and devices require a solution to quickly ensure standards-compliant design performance and accelerate time-to-market.

With elements of design regularly developed in different places, it is important to have common, industry-standard test tools that enable groups to share information and resolve problems quickly.

The quickening rate of technology changes means a faster cycle time for new products entering the verification stage. With cutting-edge technology shipping as early as possible, interoperability and conformance testing become increasingly important to ensure product quality and customer satisfaction is maintained. So as you take WiMAX forward, Agilent clears the way.

E6651A meets the challenge

The Agilent E6651A Mobile WiMAX test set fills the wireless industry’s urgent and growing need for a flexible test and measurement tool that accelerates the time-to-market for Mobile WiMAX products. The E6651A combines Agilent’s measurement expertise with innovative engineering to create a valuable solution to a fast-emerging customer need.

Solutions for the complete development lifecycle:

Conformance
- Minimize test house usage with pre-mIOT and pre-RCT test capabilities
- Key component in RPT systems
- PCT systems with WiMAX Forum-validated test cases to certify WiMAX base stations and mobiles

Protocol
- TTCN-3 scripting for 802.16-2004/Cor2 D3 Mobile WiMAX testing and custom test development
- Stack-based protocol tests
- Built-in base station emulation
- Real-time protocol debug and analysis

RF performance
- Frequency coverage to 6 GHz
- Two downlink channels for MIMO MS test
- Full suite of RF parametric tests
- Automation software provides ready-to-use test plans

Functional application performance
- IP connection, with > 10 Mbps data throughout, supports real-time, end-to-end testing of any application
- Assess device performance under real-life conditions
- Control of network environment helps optimize application test
This one test set, combined with a suite of software products, has application throughout the WiMAX design cycle – from the early stages of research and development; through to integration, verification, conformance, interoperability, and operator acceptance testing. This single hardware platform provides unrivaled test coverage, making it the natural choice for those looking to minimize costs and optimize benefits.

The E6651A is a universal tool that can be used by different user groups within an engineering company – for example, by those focused on protocol development, RF and baseband design verification, or functional application and mobile interoperability test (mIOT) – so this test asset never sits idle.

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The E6651A is at the heart of Agilent’s development and conformance solutions for Mobile WiMAX. The E6651A test set and associated products incorporate the latest industry-required measurements, and are found in pre-conformance radio conformance test (pre-RCT), radiated performance test (RPT), and protocol conformance test (PCT) systems. This family of products provides insight into your design that can reduce the time, complexity, and cost of testing – without sacrificing the essential quality and reliability of your finished product.

We know wireless, and we have the tools, technologies, and people to help you guarantee that your product will work as specified with products from other vendors.

Figure 2: E6651A and related products
The Family Of Products

### E6651A
Mobile WiMAX test set
- Fully-integrated test set
- Instrument grade signal generator and analyzer to 6 GHz
- Real-time base station emulation
- Multiple input multiple output (MIMO) options for Wave 2 device test

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### N6422C/23C
WiMAX wireless test manager
- Automation software for pre-RCT applications
- Ready-to-use tests, test plans, and test sequencing
- Framework for fast development of new test plans

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### E6655A
WiMAX lab application
- Enables real-time, end-to-end functional application testing
- Controlled network environments — no need to run tests on a live network

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### N6421A
WiMAX protocol logging and analysis
- Real-time logging and decoding of PHY and MAC layer protocol
- Post-capture analysis of log files

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### N6430A
WiMAX protocol conformance test and development solution
- Script-based protocol development and conformance test software solutions for mobile and base stations

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**NOTE:** Shaded areas of the tables indicate application focus of each product
The E6651A offers a unique combination of base station (BS) emulation, RF parametric test, and protocol test in one integrated unit. For RF PHY layer and baseband testing, the E6651A provides:

- Frequency coverage to 6 GHz with instrument-grade RF signal generation and signal analysis
- Additional downlink channel for MIMO mobile station (MS) receiver test that enables you to keep pace with evolving standards
- Support for today's popular WiMAX profiles that can be extended to cover future profiles
- A suite of RF measurements for characterization, calibration, and verification of WiMAX transmitter and receiver performance
- BS emulation that removes the need for a golden radio and reduces support burden
- Baseband analog IQ/IF interface for RF fading applications and baseband module test

Once a product design is complete, developers help ensure conformance to the WiMAX standards using the E6651A test set to check the product against RF PHY requirements set forth in the WiMAX Forum®'s RCT documents. Valuable time and effort can be lost if multiple visits are required to a WiMAX Forum-designated certification laboratory. Pre-conformance testing using the E6651A as part of a design verification system increases confidence that the design is compliant with the standard and helps assure smooth passage through the conformance test process.

Figure 3: RF measurements using the E6651A

Figure 4: RF test configuration
Get to market fast with automation software

The addition of the Agilent N6422C/23C WiMAX wireless test manager makes it easy to automate test plans and increase test coverage for pre-conformance testing prior to full RCT.

The WiMAX wireless test manager software provides ready-to-use tests, test plans, test sequencing, and menu-selectable hardware support for quick and easy automation of device pre-conformance test processes. An integrated test development wizard simplifies software modifications, such as adding user-defined tests and specific module calibration. The N6422C is the developer version of the software; the N6423C is the run-time license.

The test manager runs on a Windows® PC and supports Agilent test system hardware.

Overcome battery-powered device testing challenges

When coupled with Agilent’s mobile communications DC sources and 14565B device characterization software it is possible to add battery drain analysis capabilities to the N6422C/23C WiMAX wireless test manager. More than just measuring battery run time, battery drain analysis allows you to characterize the current drain and make tradeoffs in design that impact battery life. By providing CCDF measurements and long-term battery drain data logging, the 14565B software and 66319/21 DC sources provide a complete solution for analyzing current drain so that you can optimize your device designs to achieve maximum battery run time.

Key features of the 14565B software include:
• Three specialized modes of operation for measurement and analysis:
  1. Current waveform capture and analysis
  2. Long-term current drain data logging and analysis — log current drain measurements from 10 seconds to 1,000 hours at 64,000 measurements per second
  3. Long-term current drain capture and CCDF distribution analysis
• Programming interface layer for automated control from other programs

Figure 5: Automate test plans with the N6422C WiMAX wireless test manager
Results in all three modes can be readily saved, recalled, and compared for evaluating and quantifying differences in design changes and performance settings for optimizing power savings. The programming interface allows the 14565B to be controlled from, and return measurement results to, other programs, enabling overall test system automation.

Figure 6: Automated 14565B current drain measurements for a WiMAX device

Features of the Agilent 66319B/D and 66321B/D DC sources include:

- A high-speed, 16-bit, DSP-based digitizing measurement system, similar to a digital scope, but with extended dynamic range and resolution
- Three current measurement ranges suited for a device’s active, standby, idle, and off modes of operation

These capabilities eliminate the need to use multiple external current shunts or probes as well as a high speed digitizing data acquisition system, digitizing DMM, or digital oscilloscope to measure and digitize a WiMAX device’s current drain.

Figure 7: Agilent 66319B/D and 66321B/D mobile communication DC sources
The E6651A is also used in radiated performance test (RPT) systems. RPT will become part of the WiMAX Forum’s product certification process. The goal of the product certification process is to assure that WiMAX-enabled products perform as expected and provide the customer with a reliable communication experience. The RPT is one portion of this process that measures transmit power and receive sensitivity of WiMAX devices.

The E6651A, used by ETS-Lindgren in its AMS-8500 RPT system, enables these RPT measurements to be made and helps assure customers of their product quality.

The system performs both 2-D (polar) and 3-D (spherical) antenna pattern measurement on transmit power and receiver sensitivity for notebooks, PCMCIA cards, and other terminals with WiMAX.

As active members of the global wireless standards organizations, the combined expertise of ETS-Lindgren and Agilent in wireless testing provides customers with confidence in their product’s performance and acceptance by global regulatory agencies.
With base station emulation and protocol tests built-in, the E6651A can be configured for a wide range of network parameters. It is capable of both stack-based protocol operation, which allows it to act as a base station — and script-based operation, which enables it to run pre-defined suites of protocol tests, including protocol conformance tests (PCTs).

Realistic base station emulation is enabled by the protocol stack built into the instrument. Base station emulation provides a controlled environment in which to verify network entry, IP traffic connection, and functional performance. For design verification, this approach is much more efficient than testing a device against a base station or in a live network. It allows developers to use it immediately, without requiring strong knowledge of the air interface — simply plug in the mobile station, power it on, and obtain a connection. There is no need to travel to test centers or countries that run a particular type of network. It also enables mobile station developers to run pre-mIOT tests using an independent base station implementation. This does not replace the need for mIOT testing, but it does help increase confidence levels and reduce the need for repeat visits to a test house. A reduction in test house usage can provide key time-to-market savings as well as cost savings on travel, equipment, and test house fees.

Regular stack and feature enhancements, including MIMO protocol support, idle mode, and HARQ mode testing, enable the E6651A to meet evolving test needs.

Running network entry test is straightforward when everything works, but what if the device will not connect, or fails intermittently? How do you find the root cause of the problem, and identify which design group needs to fix it?

The Agilent N6421A WiMAX Protocol Logging and Analysis software can be used to record real-time PHY and MAC messages exchanged between the E6651A test set (base station emulator) and the mobile station under test. The ability to log and view UL and DL MAPs enables you to debug PHY layer issues. With as much capture bandwidth as you need, you can quickly create log files that can be easily shared across teams and geographies — enabling you to resolve problems quickly.

Figure 9: Protocol logging and analysis configuration
In addition to functional protocol applications, the E6651A is at the heart of Agilent’s N6430A WiMAX protocol conformance test and development solution.
The Agilent N6430A product family provides the addition of TTCN-3 scripting interface to the E6651A. This new interface enables a comprehensive suite of test solutions for 802.16-2004/Cor2 D3 Mobile WiMAX protocol conformance and development testing. The offering includes products for testing both base and mobile stations.

The Agilent N6430A Series significantly grows the test coverage that can be supported by the E6651A. R&D engineers can develop their own TTCN-3 scripts for use during their development, as well as for regression testing and design verification. In addition, the N6430A Series PCT systems are being used by the world’s leading WiMAX Forum Designated Certification Labs (WFDCLS) to certify WiMAX base stations and mobiles. With these solutions you can perform protocol conformance testing, secure in the knowledge that you are using WiMAX Forum-validated PCT test cases.

For more information visit www.agilent.com/find/pct

Figure 12: Agilent N6430A series is configurable from bench-top to multi-cell system.
With the trend toward incorporating more third-party developed applications into devices, more strenuous integration testing is required. The reason is simple, if an application doesn’t work, the customer will blame the device and the brand will be de-valued. Features of emerging mobile devices are increasing in complexity and software content. Only by testing these features in a realistic network environment can you ensure the quality of your subscriber equipment. The E6655A WiMAX lab application provides convergence service network (CSN) emulation to allow you to connect the E6651A to the IP network. With data throughput rates of over 10 Mbps, you can test any application – supporting real-time, end-to-end functional application test of your WiMAX design.

Using a simulated network environment is much more efficient than testing a device in a live network since it provides a predictable and repeatable environment in which to test your application. By varying the E6651A's parameters, it is easy to simulate network conditions that cause application problems. For example, by suddenly dropping the RF power for five seconds you can simulate passing through a tunnel during a video call.

The E6655A also enables you to run functional application tests, such as PING and file data transfer, in order to highlight problems prior to entering the full mIOT process, which saves time and money.

These tools enable you to assess true device performance in real-life situations, to ensure the quality of your equipment and maximize customer satisfaction.

Figure 13: Application and functional testing configuration
E6651A: Supporting Your Investment

Each E6651A or N6430A PCT system includes on-site start-up assistance from an Agilent professional, often from your own country and in your own language, enabling you to use your tools as quickly and effectively as possible.

Typically included in your start-up assistance is:

- Solution overview describing the component parts of your system
- Description of software licensing schemes and installation process, including STSC licence redemption
- System set-up including installation and configuration of software applications
- Demonstration of product features, including hands-on measurements

Software and technical support contracts (STSCs) are also available for these Mobile WiMAX R&D test solutions. STSCs enable you to keep pace with fast-moving developments in WiMAX, maximize the potential of your R&D tools, and protect your investment throughout the product lifetime.

The STSCs entitle you to software updates, feature enhancements, and direct access to product experts for technical support. The STSC for the E6651A covers the E6651A Mobile 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. The N6430A protocol development and conformance products have separate STSCs. STSCs are mandatory for the first year with initial purchases and are then available for renewal on an annual basis.

STSCs give you direct access to technical product experts to increase your productivity and minimize the software difficulties you encounter. These technical support engineers are experts on the N6430A PCT software, the E6651A WiMAX test set, and its complementary software products. They have instant access to instruments and software to enable them to resolve your issues as quickly as possible.

There are three methods of accessing your technical support:

- Web-based*: MySupportCenter (www.agilent.com/find/mysupportcenter)
- E-mail
- Phone

For fastest response times, we recommend using the Web-based or email access methods, as these provide the most direct route to your technical support expert.

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<td>E6432A-1TY 12 months Wave 1 &amp; 2 MS developers software &amp; technical support</td>
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<td>WiMAX Base Station Protocol Test N6442A-1TP</td>
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PCT customers need BOTH E6651A STSC and PCT STSC

Figure 14: STSCs and supported products

1. Web-based support (MySupportCenter) coming soon.
Each support request will be given a unique case number that you can use to track the progress of your support case. All support cases may be viewed and tracked through the online support center (MySupportCenter), regardless of how you initially contacted technical support.

A technical expert will contact you via phone or email (whichever you have stated as your preferred option) to resolve your issue. Support is available in English, Japanese, Korean, and Mandarin.

For more information on STSCs, refer to Agilent Mobile WiMAX R&D Test Set Solutions: Software and Technical Supports Contracts, Product Overview (literature number 5989-9121EN.)
Agilent is committed to providing regular feature enhancements as the WiMAX standards change and your test requirements develop.

The most significant evolution in the Mobile WiMAX standard is the introduction of Wave 2 functionality, including MIMO. WiMAX Forum Wave 2 conformance standards are aimed at ensuring mobility in WiMAX systems. MIMO enables increased capacity in a WiMAX system and is the most important aspect of the Wave 2 standard for RF/PHY layer testing.

To enable mobile stations to be tested to the latest WiMAX standards, MIMO options for Wave 2 testing are available on the E6651A test set.

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

The E6651A is an essential tool for WiMAX MIMO RF testing. With base station emulation signaling to support MIMO modes, and two RF sources for mobile station receiver test, the E6651A is the only one box tester that can comprehensively test a mobile station’s MIMO operation.

Related literature

- E6651A Mobile WiMAX Test Set, Technical Overview, literature number 5989-6438EN
- N6430A WiMAX Protocol Conformance Test and Development Solution, Technical Overview, literature number 5989-7513EN
- N6430A WiMAX Protocol Conformance Test and Development Solution, Configuration Guide, literature number 5989-7512EN
- Agilent WiMAX Solutions, Brochure, literature number 5989-5914EN
- N6422C WiMAX Wireless Test Manager, Technical Overview, literature number 5989-7851EN
- Agilent Mobile WiMAX R&D Test Set Solutions: Software and Technical Support Contract, Product Overview, literature number 5989-9121EN
- Optimizing Power Savings on WiMAX™ and Other Cellular WWAN Interface Devices, Application Note, literature number 5989-8870EN

For more information

Further information on the E6651A and related products is available at www.agilent.com/find/e6651a

Further information on Agilent’s protocol testing solutions for WiMAX is available at www.agilent.com/find/pct

Further information on Agilent solutions for WiMAX is available at www.agilent.com/find/wimax
Remove all doubt

Our repair and calibration services will get your equipment back to you, performing like new, when promised. You will get full value out of your Agilent equipment through-out its lifetime. Your equipment will be serviced by Agilent-trained technicians using the latest factory calibration procedures, automated repair diagnostics and genuine parts. You will always have the utmost confidence in your measurements.

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www.agilent.com/find/removealldoubt

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Americas

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Revised: October 1, 2008

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Printed in USA, October 20, 2008
5989-7633EN

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