

## Pre-Conference Workshop Content At-A-Glance

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# An Overview of WiMAX Radiated Performance Test Requirements

At present, more than 500 companies representing all aspects of the WiMAX ecosystem have become members of the WiMAX Forum. The forum is an industry-led, not-for-profit organization organized to certify and promote broadband wireless products based upon the harmonized IEEE 802.16/ETSI HiperMAN standard. Member companies are service providers, regulators, equipment manufacturers, test equipment manufacturers, certification labs, and application service providers working together to ensure global adoption of a common platform for the delivery of broadband wireless services. There is considerable emphasis on making sure that WiMAX technology provides an exceptional user experience out of the box.

The WiMAX Forum is today the exclusive organization dedicated to certifying the interoperability and performance of products in this ecosystem. Certified products that have been through the process will reduce investment uncertainties for all parties in the wireless access network value chain, from technology providers to service providers to end users. To support the certification test demand, the WiMAX Forum has a network of designated certification laboratories in China, Korea, Spain, Taiwan and the US.

As a leader in systems for wireless performance testing, ETS-Lindgren recognized early on that the WiMAX industry would benefit from over-the-air radiated performance data in much the same way that the wireless carriers have come to rely upon it for the evaluation of phones to be approved for use on their networks. In these ecosystems, a 2 dB loss in radiated performance can result in the need for 25 percent more base stations. With this in mind, radiated performance tests (RPT) for subscriber and mobile stations will become required tests in 2008.<sup>1</sup>

### Certification Tests

The WiMAX Forum has defined the required conformance and interoperability tests to ensure that different vendor systems work seamlessly with one another. Those products that pass conformance and interoperability testing are permitted to use the mark WiMAX Forum Certified and may be found listed in the WiMAX Forum Certified Product Registry. There are four required certification tests in this ecosystem:

1. Radio Conformance Test (RCT)
2. Protocol Conformance Test (PCT)
3. Interoperability Test (IOT)
4. Radiated Performance Test (RPT)

The first three tests, RCT, PCT and IOT, are cable-based tests and are not the subject of this article. The RPT is the focus and it is noteworthy that the test was developed using an ETS-Lindgren solution following more than 18 months of research and development. As a member company, ETS-Lindgren provided principal technical contributions to the creation of the WiMAX Forum Radiated Performance Tests for Subscriber and Mobile Stations.<sup>2</sup>

There are two primary metrics within the RPT. If you think of this in terms of verbal communication, Total radiated power (TRP) is the "talk" metric, which measures how loud the device can speak. Total isotropic sensitivity (TIS) measures how well the device can hear. Additional detailed information including time-lapse video of actual tests and three-dimensional radiated pattern measurement data are available at [www.wimaxrpt.com](http://www.wimaxrpt.com).<sup>3</sup>

### RPT Performance Parameters to be Measured:

**Total Radiated Power (TRP)** is the total power radiated by the device under test (DUT) in all directions and is determined by integrating the effective isotropic radiated power (EIRP) over the surface of a sphere surrounding the DUT. It represents the average directional transmit performance of the DUT, accounting for losses due to the efficiency of the antenna and other transmit interaction factors.

**Total Isotropic Sensitivity (TIS)** or total radiated sensitivity (TRS) is the equivalent sensitivity level of the DUT if it had a theoretical isotropic receiver for an antenna. It is determined by integrating the effective isotropic sensitivity (EIS) over the surface of a sphere surrounding the DUT. It represents the average directional receive performance of the DUT, accounting for losses due to the efficiency of the antenna and other receive interaction factors.

Figure 1 below shows a system diagram for a recommended WiMAX RPT test system. Note that the system operates in an RF-shielded, absorber lined, fully anechoic test chamber. Key components of the system are the multi-axis device positioning and controlling mechanism, communication and measurement antennas, measurement instrumentation and a system computer with data acquisition and analysis software.

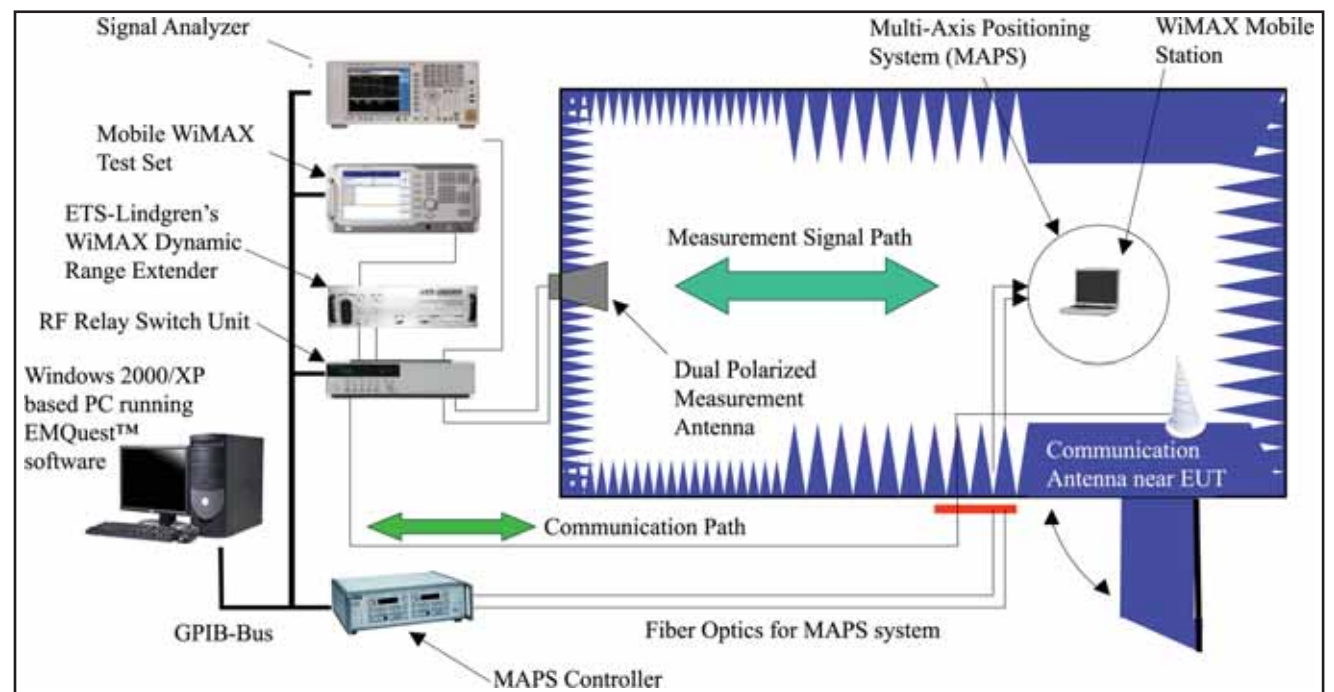


Figure 1: Typical WiMAX BPT Test System Diagram - Photo courtesy of ETS-Lindgren

### Conclusion

The WiMAX Forum has developed a set of radiated performance tests to evaluate the performance of mobile WiMAX devices. The results of these tests will help network operators ensure that WiMAX certified devices operate reliably on their networks. Advantages of using RPT measurements are that a device maker (CPE, handset, etc.) can measure the effect of changes to a product platform, such as the embedded antenna(s) without having to repeat other certification tests on an embedded radio that has already been certified as a "compliant portion". In this way, certification of device based upon a predicate, where basic components such as display may be changed, is streamlined without concerns as to the impact on device performance. Knowledge of the RF performance of the base stations, as well as that of the client devices, is essential for good network design. Errors of one or two dB are costly to network layout. Since it's even more costly to add base stations once a network is designed, metrics like TRP and TIS can provide vital information for that a desired level of RF performance can be guaranteed.

### References

1. M. D. Foegelle, "Determining Radiated Performance of Mobile WiMAX Devices," *Microwave Journal*, Vol. 51, No. 3, March 2008, pp. 80-92.
2. *WiMAX Forum Radiated Performance Tests (RPT) for Subscriber and Mobile Stations, V0.1.0 Draft*, WiMAX Forum, Beaverton, OR, December 2007.
3. B. Saylor, "Executive Interview Series: MJW Speaks with Bryan Saylor," *Microwave Journal*, Vol. 51, No. 3, March 2008, pg. 80 ([www.mwjjournal.com](http://www.mwjjournal.com)).
4. "Agilent Technologies, ETS-Lindgren Test Equipment Selected by AT4 wireless for Use in First Test Facility for WiMAX Radiated Performance Test," [www.forbes.com](http://www.forbes.com), January 10, 2008.
5. M.D. Foegelle, "Antenna Pattern Measurement: Concepts and Techniques," *Compliance Engineering, 2002 Annual Reference Guide*, Vol. XIX, No. 3, pp. 22-33.
6. M. D. Foegelle, "Radiated Performance Testing of WiMAX Mobile Devices," *Wireless Design Magazine*, March 2008, pp. 16-18.

To learn more about this topic, plan to attend the workshop (*Advances in Antenna and Wireless Test and Measurement*) hosted by ETS-Lindgren in cooperation with the 2008 Antenna Systems Conference on September 24, 2008. Hands-on demonstrations of wireless test systems will be conducted to supplement the technical material presented. Attendees will also tour an ISO 17205 certified open area test site, A2LA-accredited calibration lab, CATL OTA lab and the NVLAP accredited acoustics lab. To register, please visit [www.antennasonline.com/ast08\\_reg.php](http://www.antennasonline.com/ast08_reg.php).

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