

# The Evolution of WiMAX Certification

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The initial wave of WiMAX certification is coming to an end and the first WiMAX-certified products are expected before the end of the year. This is a key benchmark for the entire WiMAX community: after much hype and anticipation, we will be able to assess WiMAX performance in real networks, instead of making educated guesses from abstract specifications.

These first WiMAX products, however, mark only the beginning of a certification process that will ultimately include numerous “waves” of testing. Each wave will include new certification profiles and/or new functionality, to support new frequencies and different access modes (fixed, nomadic, portable, and mobile). The changes in the program are driven mostly by technological advances and product availability. They are crucial for ensuring that certified products have the functionality that the market requires and can support new applications and services. Understanding how the certification process evolves is necessary if we are to have accurate expectations of certified products.

Often certification is perceived as a binary attribute: a product is either certified or isn't. The reality is more complex. A product may be certified for only some of the functionality it supports. For instance, WiMAX products certified in the first wave will not be certified for QoS. As a result, two certified products may work together in their basic configuration, but certified interoperability would not extend to QoS. This is a substantial limitation for a service provider that wants to offer QoS-based services like VoIP and is planning to use base stations and subscriber units from different vendors.

Product certification is an inherently complex process, especially when it involves interoperability among vendors, as is the case for WiMAX. The Wi-Fi Alliance, for instance, has been very successful in guaranteeing interoperability for certified products, but this has required a constant expansion of the number of profiles and the functionality that is tested and has taken over five years to get to where we are today. Some of the additions are certified as optional add-ons, but in some cases they soon become an integral part of the basic test suites.

The WiMAX Forum is following a similar path. It is defining different system and certification profiles for classes of products that interoperate with each other, and setting subsequent certification waves, each including additional functionality.

## Before Certification: System Profiles and Certification Profiles

Not all WiMAX products will interoperate with each other<sup>1</sup>. A subscriber unit that operates in the 3.5 GHz band, for instance, will not be able to establish a connection with a 5.8 GHz base station. However, both products are based on the same standards – IEEE 802.16 and ETSI HiperMAN – and meet the same requirements. The WiMAX Forum uses two types of profiles to address the need for different classes of products that use the same technology:

- **System profiles.** System profiles set a basic level of common requirements that all WiMAX systems have to meet. To date, only one system profile has been defined and it is based on the 802.16–2004 version of the IEEE 802.16 standard. A second system profile is currently being defined and will be based on the 801.16e amendment. The first system profile is optimized for fixed and nomadic access; the second for portable and mobile access, but also supports fixed and nomadic access.
- **Certification profiles.** For each system profile there are multiple certification profiles. For the 802.16–2004 system profile, five certification profiles have been defined so far (see Table 1). No certification profiles have been announced yet for the 802.16e system profile since the overall specification is not expected to be ratified until the end of this year, but the first ones will probably be for the 2.3 GHz and 2.5 GHz bands. Certification profiles are defined by a system profile, the relevant spectrum band, what kind of duplexing is used (time division duplexing, TDD, or frequency division duplexing, FDD), and the channel width.

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<sup>1</sup> This is of course also the case with other wireless technologies that operate in different frequencies (cellular, Wi-Fi and several proprietary BWA products) or in different modes within the same frequency (b and g in Wi-Fi)

These profiles are defined ahead of certification, based on spectrum availability in different countries and on market demand and vendor interest. Vendor interest is clearly a prerequisite for interoperability, as a minimum of three vendors are needed to get the interoperability testing under way.

Spectrum band	Duplexing	Channel width
3.5 GHz	TDD	3.5 MHz
3.5 GHz	FDD	3.5 MHz
3.5 GHz	TDD	7 MHz
3.5 GHz	FDD	7 MHz
5.8 GHz	TDD	10 MHz

Source: WiMAX Forum

## The certification process: compliance and interoperability testing

Ultimately, products need to pass two stages in the testing process to gain certification:

- **Compliance testing** to ensure that the product complies with the test specifications set forth in the system profile.
- **Interoperability testing** to ensure that subscriber units and base stations from different vendors operate within the same network.

While compliance testing is relatively straightforward, interoperability testing can cause delays during the initial phase of testing for a profile, since different vendors are often required to make changes to their products, but may not be able to do so within the anticipated timeframe due to disagreements over the changes or the difficulty of implementing them on a given vendor's system.

## The changing scope of certification

Technologies change with time and their success is tied to their ability to support new applications and, more generally, to meet the growing requirements of their

users. Certifications programs need to adapt to these changes, but this requires a delicate balancing act between supporting innovation, and maintaining compliance and interoperability across products certified at different stages.

WiMAX is no exception. The certification program has been split into several waves, with each successive wave adding new profiles and functionality along the way. The products certified under the initial wave undergo an early and more limited set of tests. This is a wise choice as it focuses on the air interface protocol of WiMAX and sets the entire program on a solid footing. In subsequent waves, new profiles and functionality will be added. This means that interoperability between a product certified during the first wave and one certified during the second wave will be limited to the basic set of features tested during the initial wave. Furthermore, it is expected that a software upgrade will be required of wave one products to ensure air protocol interoperability with wave two products. In other words, there will be no out-of-the-box interoperability and software upgrades will impose a burden on service providers trying to integrate wave one and wave two products in their networks. Vendors can of course re-submit their products for certification at later stages, but that is an expensive and time-consuming effort. Service providers and individual users will need to pay attention to the type of certification a product has received to make sure it includes the features they care about.

Table 2. WiMAX certification waves		
	Certified products	Functionality supported
<b>802.16-2004 WiMAX</b>		
First wave Air protocol	4Q2005	Air protocol interoperability
Second wave Outdoor services	1H2006	Outdoor CPEs in fixed deployments with QoS, security, advanced radio features (*)
Third wave Indoor services	2H2006	Indoor CPEs and PCMCIA cards in fixed and nomadic networks (*)
<b>802.16e WiMAX</b>		
Third wave Portable services	1Q2007	Handoffs, simple mobility (*)
Fourth wave Mobile services	2007	Full mobility (*)

(\*) Expected. Test specifications have not been finalized yet.

Source: WiMAX Forum, vendors, Senza Fili Consulting.

The certification waves announced to date by the WiMAX Forum are shown in Table 2. The first 802.16-2004 products submitted for certification in the first wave entered the certification lab in July and August 2005. The first certified products are expected to be announced by the end of 2005, with commercial availability starting in early 2006 and deployments later in the year. Certification of 802.16-2004 products will continue in wave two during the first half of 2006, and it will include QoS, security and advanced radio features. QoS is needed to support VoIP and, more generally, to prioritize access based on users or applications (e.g. for subscribers that pay higher fees, or for real-time applications). The third wave of certification will extend support to indoor customer premises equipment (CPE) and PCMCIA cards to allow nomadic access. The first certified products in the third wave are expected for the second half of 2006.

Certification for profiles based on 802.16e is planned to start in the third quarter of 2006, with the first certified products expected in 2007. Initially, 802.16e profiles will support only simple mobility, which supports handoffs across cell and sector boundaries, but not real-time applications. Subsequent waves will include support for full mobility, including real-time applications and soft handoffs.

## Different vendor strategies

Not all vendors have followed the same approach to certification. This reflects their market strategy, product timeline and overall resource availability.

Some vendors (Airspan, Aperto, Proxim and Redline) have entered products in the first wave and are committed to have the first WiMAX-certified products. Their initial involvement is not only motivated by a first-to-market strategy, but also by a desire to play a more active role in the certification process from the beginning.

Other vendors have chosen to join the certification process at a later stage. Certification requires a substantial effort, and they do not want to shift the focus away from enhancing their existing products for current customers deploying commercial networks in order to seek certification during the first wave since it will include only basic air interface testing.

This is the strategy followed by Alvarion, for instance. The company claims that the limited featured products certified during the first wave will not meet the minimum requirements of their customers and that they prefer to wait for future certification waves in order to support QoS and the other advanced features. As a result we expect that they will seek certification in the second wave for their 3.5 GHz product then, while moving exclusively to 802.16e-based products for the third certification wave. Siemens,

SkyPilot, SR Telecom and Wi-LAN have also decided to jump into the certification process at a later stage for related reasons.

The focus on portability and mobility has lead several vendors to skip certification for the 802.16-2004 system profile altogether. Alcatel, Motorola, Navini, NextNet and Nortel have all decided to develop exclusively 802.16e products, which they expect to see deployed in fixed, portable and mobile networks. In several cases, these vendors believe that 802.16-2004 WiMAX does not offer sufficient advantages over their proprietary products to justify the development of a new product line.

## The choice for operators

Where does all this complexity leave those operators that are trying to decide what solutions to deploy and when to do so? They will certainly have some homework to do if they want to deploy gear from different vendors.

Knowledge of the requirements for system and certification profiles and of the functionality added during subsequent waves is needed to assess how products will interoperate in a WiMAX network. The level of interoperability among different products may not initially cover features they consider essential or desirable (e.g. QoS or sub-channelization in the uplink). Products certified in the first wave are likely to need a software upgrade to interoperate even at the air protocol level with products certified in subsequent waves. Furthermore, the initial limited interoperability may delay the development for low cost CPEs from ODMs, whose business is driven by the large volumes that require wide interoperability.

After multiple certification waves, the degree of interoperability may vary depending on the wave during which the products involved were certified. Operators will need to look beyond the certification stamp and understand what features are covered by certification and whether they match their requirements.

## About Senza Fili Consulting

Senza Fili Consulting provides advisory support on wireless data technologies and services. Our expertise extends to cellular communications, Wi-Fi, WiMAX, and other fixed and mobile broadband wireless access (BWA) technologies. We assist vendors in gaining a better understanding of the service provider and end-user markets. We work alongside service providers in developing a wireless data strategy and gaining a better understanding of the demand for wireless services. Independent advice, a strong quantitative backing, and an international perspective are the hallmarks of our work.

At Senza Fili we have in-depth expertise in financial modeling, market forecasts and research, white paper preparation, business plan support, due diligence, training, and evaluation of end-user requirements. Our clients are international and span the entire value chain: they include fixed and mobile operators, ISPs, wireless ISPs, other service providers, vendors, solution providers, system integrators, investors, and industry associations.

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