



WiMAX Questions & Answers

Index

[General Consumer WiMAX™ Questions](#)

[WiMAX Forum® Questions](#)

[WiMAX Certified™ Questions](#)

[WiMAX™ vs. Other Technologies Questions](#)

[Industry Questions](#)

[Spectrum Questions](#)

[IEEE 802.16 Questions](#)

[Technical Questions](#)

General WiMAX Questions

What is WiMAX™ technology?

WiMAX™ technology is based upon the IEEE 802.16 standard, enabling the delivery of wireless broadband services anytime, anywhere. WiMAX products can accommodate fixed, portable and mobile usage models. The IEEE 802.16 standard was developed to deliver non-line-of-sight (NLoS) connectivity between a subscriber station and base station with typical cell radius of three to ten kilometers. All base stations and subscriber stations claiming to be WiMAX compliant must go through a rigorous WiMAX Forum Certified™ testing process. WiMAX Forum Certified systems can be expected to deliver capacity of up to 40 Mbps per channel with current technology, and over 300Mbps with the next generation WiMAX standard. This is enough bandwidth to simultaneously support hundreds of businesses, thousands of residences, and thousands of mobile Internet users. The WiMAX Forum expects mobile network deployments to provide up to 30 Mbps of capacity within a typical cell radius of up to three kilometers. WiMAX technology already has been incorporated in notebook computers and PDAs to deliver high speed mobile Internet services anytime, anywhere.

What will WiMAX services offer to the average consumer?

WiMAX networks will provide broadband connectivity and mobile Internet anytime,,anywhere, for any device and on any network.

Examples include:

- High speed internet access where it is currently unavailable.
- Substantially increase data speeds (over 2G/3G technologies) for applications to include online gaming, streaming video, video conferencing, VoIP and location based services.
- Drive wireless mobile Internet equipment and access prices to an open and competitive price point

- In the U.S., Mobile WiMAX services from Sprint and Clearwire will reach more than 150 million consumers by year end 2010.
- In rural areas, WiMAX technology will establish an affordable and efficient broadband network. The purchase and installation process of WiMAX technology is faster, simpler and cheaper than other offered solutions. Additionally, the non-line-of-sight (NLoS) capability means that WiMAX technology can provide coverage despite the challenges of geography and the limited footprint of wireline-based solutions.
- In developing countries, WiMAX technology provides the opportunity to connect people with Internet and VOIP services faster and more affordably than wireline technology.

What are the key elements of WiMAX technology?

A key differentiator for WiMAX is the interoperability of WiMAX Forum Certified equipment, resulting in mass volume economy of scale and assurance for service providers that equipment from different vendors is compatible and interoperable. The WiMAX Forum has assembled an alliance of more than 530 leading companies in the communications and computing industries to drive a common platform for the global deployment of IP-based broadband wireless services. Other key elements include cost, coverage, capacity and standards for both fixed and mobile wireless usage models.

Lower cost

A standards based platform for WiMAX technology drives down costs and delivers volume economics to WiMAX equipment.

Wider coverage

The technology behind WiMAX has been optimized to provide excellent non-line-of-sight (NLoS) coverage. NLoS advantages are coverage of wider areas, better predictability of coverage and lower cost as it means fewer base stations and backhaul, simple RF planning, shorter towers and faster CPE install times. Thanks to techniques for improving NLoS coverage, such as antenna diversity, MIMO, space-time coding, and Automatic Retransmission Request (ARQ), coverage and signal reliability are increased.

Higher capacity

A key advantage of WiMAX technology is the use of Orthogonal Frequency-Division Multiplexing (OFDM) over CDMA which is used in older technologies like Edge, GPRS, and HSPA. OFDM delivers higher spectral efficiency and therefore higher data rate and overall system capacity. Adaptive modulation also increases link reliability for carrier-class operation and the possibility to keep higher order modulation at longer range, extend the total capacity of the network.

Standard for all usage models (fixed to mobile)

The WiMAX technology was designed to become the most cost-effective solution for carriers for any usage model from fixed to mobile. Newer versions of the WiMAX standard support higher speeds of mobility and always maintain backward compatibility with previous Mobile WiMAX releases.

What is the data transfer speed of WiMAX technology for end users?

Users can expect to have broadband access speeds ranging from 1-5 Mbps depending on the service provider offering. The exact data rate may also depend on a number of factors, including which frequency is being used, distance of the user from the base station or node, whether there is line of site or NLoS to the base station, and the number of users on the network.

When the WiMAX Forum refers to data rate of 40 Mbps, it is referring to a single channel (as part of the network) that is likely being shared among multiple users. Individual users will have access to that amount of capacity, but the network operator will typically limit the speed per use to about 1-5 Mbps, which is similar to the cable experience. There is the potential to burst to higher speeds, but that would depend on the operator's plans and business model.

Is there a difference between Fixed and Mobile WiMAX™?

The original WiMAX standard (published in 2004) was designed to support Fixed Wireless Broadband Applications. WiMAX technology has evolved considerably since and today WiMAX technology (also called Mobile WiMAX) serves all usage models from fixed to mobile with the same infrastructure. Based on the IEEE 802.16e-2005 standard, Mobile WiMAX offers fixed, nomadic, portable and mobile capabilities

How many subscribers can a single WiMAX node serve?

A single WiMAX base station or node should be able to serve thousands of subscribers. The actual number of users will depend on the number of sectors, the amount of spectrum available and the guaranteed bandwidth to each user..

WiMAX Forum Questions

What is the WiMAX Forum?

The WiMAX Forum was established in June 2001 and is an industry-led, not-for-profit organization of more than 530 companies to include over 200 operators formed to certify and promote broadband wireless products based upon the harmonized IEEE 802.16/ETSI HiperMAN standard. The WiMAX Forum strives to ensure global adoption of a common platform to deliver Broadband Wireless services as a standard alone is not enough to effect mass adoption of a technology. Along these lines, the Forum works closely with service providers, regulators, equipment vendors, test equipment manufacturers, Certification labs, and application service providers to ensure that WiMAX Forum Certified™ systems meet customer and government requirements. WiMAX Forum Certified™ products are fully interoperable and support all usage models of broadband wireless services.

Which companies are involved with the WiMAX Forum?

WiMAX Forum member companies represent the entire ecosystem of companies necessary for bringing WiMAX Forum Certified products to market, including equipment manufacturers, network operators, system integrators, silicon and component makers, test equipment manufacturers, test labs, content and application providers. Each one of its members is essential to the progress of the WiMAX Forum's vision of global adoption of WiMAX as the Mobile Internet technology of choice anytime, anywhere and in a wide variety of products. Regulators are invited as observers as they play a critical role in determining spectrum opportunities for WiMAX technology. Detailed information on each member can be found at www.wimaxforum.org under the "About Us" tab.

What are the current challenges faced by the WiMAX Forum? How are you trying to address them?

The complexity of obtaining spectrum allocated in all major marketing regions around the globe is a challenge for the industry. The adoption of flexible regulatory attitudes toward mobile broadband technologies like WiMAX is particularly critical at this time. Pent-up demand for mobile broadband is present in developing and emerging countries. Moreover, many new mobile digital devices capable of a wide range of functionality and in novel form factors are poised to enter the marketplace over the next few years. Consumer demand to secure Internet access globally is strong and WiMAX is poised to deliver on this opportunity.

Furthermore, operators will accelerate the deployment of the mobile broadband infrastructure if they have the flexibility they need to be able to implement the technologies that will support the services in demand by their subscribers. A forward-looking regulatory attitude will hasten the day when the widest possible segment of global consumers will benefit from WiMAX technology and true mobile broadband access.

WiMAX Forum Certified™ Questions

What does WiMAX Forum Certified mean? How is this different from “WiMAX compliant?”

As the exclusive organization dedicated to certifying the interoperability of products based upon IEEE 802.16/ETSI Hyperman, the WiMAX Forum defines and conducts conformance and interoperability testing to ensure that different vendor systems work seamlessly with one another. Those that pass conformance and interoperability testing will receive the WiMAX Forum Certified™ designation.

Vendors claiming their equipment is “WiMAX-like,” WiMAX-compliant,” etc., are not WiMAX Forum Certified™, which means that their equipment is *not* independently certified to be interoperable with other vendors’ equipment and operators are encouraged to be wary of this type of claim. Only WiMAX Forum Certified™ equipment is proven interoperable with other vendors’ equipment that is also WiMAX Forum Certified™.

What are the benefits of WiMAX Forum Certified™ products?

The ultimate goal of the WiMAX Forum is to accelerate the introduction of cost-effective broadband wireless services into the marketplace. Standards-based, interoperable solutions enable economies of scale that, in turn, drive price and performance levels unachievable by proprietary approaches, making WiMAX Forum Certified™ products cost-effective at delivering broadband services on a wide scale. Designed for carrier-class deployments WiMAX Forum Certified™ systems deliver high-capacity service throughput and provide a range of up to few kilometers in non-line-of-sight conditions. The systems are scalable for up to thousands of users and because they are interoperable, service providers will be able to purchase equipment from multiple vendors, thereby reducing the overall risk and creating a price-competitive marketplace.

For consumers, WiMAX Forum Certified™ products will ensure interoperability among devices and networks to ensure service anytime, anywhere at a lower price point.

How will WiMAX Forum Certified products benefit enterprises? Residential users?

The ease of deployment for WiMAX Forum Certified systems can benefit enterprises by bringing new competition into the marketplace and lowering prices, as well as reaching out to locations not served by wireline Internet access. This is especially relevant for industries like gas, mining, agriculture, transportation, construction and others that operate in remote locations.

For some residential customers in suburban and rural areas (where DSL or cable modem service is not available), WiMAX technology can provide the ability to finally have the broadband access they need. This is particularly true in developing countries, where traditional telecom infrastructure is not readily accessible.

Mobile WiMAX brings the concept of personal broadband and mobile Internet. This means that the user gets access to all the resources on the Internet anytime, anywhere and at DSL-like user experience.

The WiMAX Forum has six certification test labs located in the U.S., Europe, China, Korea and Taiwan. With two more labs (India and Japan) planned to be opened, Mobile WiMAX certification will have capacity to support global deployments.

When will WiMAX Forum Certified products be commercially available?

Since the announcement of the first WiMAX Forum Certified products in January 2006, the certification program has rapidly expanded its scope, addressing new profiles (meaning new spectrum bands) and expanding its global presence. There are now more than 30 certified Fixed WiMAX™ products and eight certified Mobile WiMAX™ products. This is just the beginning. By the end of 2008 more than 100 Mobile WiMAX products are expected to complete the certification process.

When will the WiMAX Forum begin work certifying FDD mobile WiMAX products?

The IEEE 802.16 standard includes both FDD and TDD. Mobile WiMAX TDD is currently included within the IMT-2000 family of standards, and Mobile WiMAX FDD is to be proposed for inclusion later this year as enhancement of the existing air interface. With an increased interest in the 700 MHz band and more service providers around the world choosing WiMAX as their next generation mobile broadband technology, the WiMAX Forum has added this frequency band to our technology roadmap. Current market demand indicates that the priorities for additional TDD and FDD profiles are 700 MHz and FDD profiles for the US "AWS" band. The WiMAX Forum is currently working on FDD certification profiles for this spectrum. Work on the technical specifications for 700 MHz WiMAX Forum certification is already underway in the association's working groups. The specifications will be published as they are completed and they will support both TDD and FDD certification profiles.

What companies offer products that have received the WiMAX Forum Certified™ designation?

Approximately 30 Fixed WiMAX network products have been certified and include systems from Airspan Networks, Alvarion, Aperto Networks, Axxcelera Broadband Wireless, Proxim Wireless, Redline Communications, Selex Communications, SEQUANS Communications, Siemens, SR Telecom and Wavesat have received the WiMAX Forum certification. The first set of Mobile WiMAX products in the 2.3GHz band completed the certification process in April 2008. Eight Mobile WiMAX Certified products gained approval, including four base station modules and four subscriber station modules, representing four different equipment vendors: Posdata, Runcom, Samsung, and Sequans.

How does the WiMAX Forum's certification process and organization structure compare to other certification and testing groups, such as the Wi-Fi Alliance or ZigBee Alliance?

The structure and process of WiMAX Forum certification is most like that of Wi-Fi Alliance, except that Wi-Fi Alliance only tests products for interoperability, whereas WiMAX Forum tests for both conformance to the technical specifications and protocol interoperability. Testing conformance to the standard means that products don't just work with each other out of luck, rather they are designed in a manner that allows them to implement the protocols in exactly the same way. This ensures that over time the products can be enhanced or new models can be issued and deployed in the same network.

WiMAX vs. Other Technologies Questions

How does WiMAX technology compare to broadband and Wi-Fi transfer speeds?

WiMAX provides high-speed broadband connection to the Internet and is typically deployed on a city wide, region or even nationwide basis. Wi-Fi is a wireless local area network technology. WiMAX and Wi-Fi are complementary as WiMAX provides the wide-area access and Wi-Fi can provide the local area access.

Numerous device manufacturers/CE companies are incorporating Wi-Fi/WiMAX modems into portable devices and mini PCs. The application will automatically select the best connection based on the availability of service at a certain location.

Industry Questions

What does the intellectual property rights (IPR) landscape for WiMAX technology look like? What is the WiMAX Forum's position on IPR and WiMAX technology?

WiMAX Forum member companies have been the first to bring standardized solutions to the marketplace for wireless broadband, making broadband services more cost-effective to deploy on a wide scale. As of September 2006, there were more than 1,500 patents distributed among 330 companies on WiMAX technologies. Of the 23 companies that hold more than ten patents, 74 percent are WiMAX Forum members. As additional products become WiMAX Forum Certified™ and additional patent holders join the Forum, we believe that we will be able to achieve our goal of interoperability between OEMs and carriers.

What is IMT-2000 and define its current relationship with WiMAX technologies?

In 1999 the International Telecommunications Union – Radio communications (ITU-R) defined a set of standards called IMT-2000, commonly known as 3G technologies. These technologies benefit from access to harmonized spectrum bands worldwide that facilitate global economies of scale. The IMT-2000 provides a framework for worldwide wireless access by linking the diverse systems of terrestrial and satellite based networks. Since the original IMT-2000 standards were agreed upon, updates have been made but no new standards have been approved.

The IEEE submitted a formal proposal to the ITU-R to make a subset of the 802.16 (WiMAX) standard a member of the IMT-2000 family, as defined by ITU-R recommendations. The process of considering the submission began in Cameroon in January. A special meeting of ITU-R Working Party 8F was held in Seoul Korea Aug 29-31st in an attempt to complete consensus on the inclusion of WiMAX into the IMT-2000 set of standards. As a result, three draft recommendations have been forwarded to the Study Group 8 (parent group) chair for consideration at the upcoming Radiocommunications Assembly October 15-22 in Geneva.

The WiMAX Forum provided substantial supporting material in order to make WiMAX a member of the IMT-2000 family. The WiMAX Forum was instrumental in the development of the supporting material necessary to include WiMAX in the IMT-2000 family.

Spectrum Questions

What frequencies will WiMAX technology operate on?

The WiMAX Forum is working with regulators, operators and equipment manufacturers to expand the frequency allocation to cover all the key spectrum bands that our member companies identify as interesting to potential WiMAX services. The first certified mobile products operate at 2.3 GHz and meet the regulatory requirements of the Korean market. This will be followed by products at 2.5 GHz, a frequency band that is widely used in the global market. WiMAX Forum Certified products for Mobile WiMAX started in December 2007. Certification will continue to add additional profiles. As such, with what we are currently seeing in the market, 3.5 GHz will be added as the next frequency that the WiMAX Forum will certify. This is expected to begin in the second half of 2008. The WiMAX Forum has the ability to respond rapidly to development of additional profiles as additional spectrum is auctioned or markets change.

What is the state of WiMAX spectrum harmonization efforts?

The WiMAX Forum continues to see the allocation of spectrum evolve. Underused spectrum is being recalled and reclassified by governments and new allocations are being issued. For the initial Fixed WiMAX Forum Certified™ products the majority of spectrum was in the 3.4 – 3.6 GHz spectrum range. For mobile applications, regulators are allocating spectrum in the 2.3 and 2.5 – 2.6 GHz regions, as well as the 3.4 – 3.6 GHz band. The WiMAX Forum continues to track regional and country-specific policies and promote the availability of technology-neutral spectrum.

Members of the WiMAX Forum have access to a database to help identify available spectrum. The WiMAX Forum has formed an agreement with AT4 wireless to provide the WiMAX Forum Spectrum and Regulatory Database, allowing member companies access to real-time data regarding worldwide spectrum licensing and regulatory information.

Where can I find out more about spectrum adoptions worldwide?

The WiMAX Forum Spectrum and Regulatory Database provides full technical, licensing, and regulatory information by country. Access to the full database is included with Principal membership in the Forum and is available to regular member companies by subscription. Frequent updates provide WiMAX Forum member companies worldwide spectrum licensing and regulatory requirements as well as additional new features to be implemented by AT4 wireless.

The database is available at http://www.wimaxforum.org/members/spectrum_database. If you have additional questions, please feel free to contact a WiMAX Forum representative at membership@wimaxforum.org.

IEEE 802.16 Questions

What is the difference between IEEE 802.16 and WiMAX technology?

One of the main objectives of the WiMAX Forum is to certify products based upon the IEEE 802.16 and ETSI HiperMAN harmonized standard. WiMAX Forum defines a System Profiles based upon what the WiMAX Forum determines in terms of service provider and vendor equipment demand.

Compliance with the 802.16 standard does not mean equipment is WiMAX Forum Certified™ or that it is interoperable with other vendors' equipment. However, if a piece of equipment has earned the WiMAX Forum Certified™ designation, it is *both* compliant with the 802.16 standard and interoperable with other vendors' equipment that is also WiMAX Forum Certified™.

What is the 802.16m standard?

802.16m is the next generation standard beyond 802.16e-2005 and will become adopted by the WiMAX Forum once the standard is completed in the 2009 time frame. 802.16m is considered to be a leading candidate as a 4G technology. The IEEE has defined its expected parameters for 802.16m and can be found on the IEEE web site.

Technical Questions

What is the difference between High-Speed Downlink Packet Access (HSDPA) and WiMAX technology?

WiMAX technology performs at about 2.5 times the speed of HSDPA platforms (depending on equipment and operating conditions). HSDPA cannibalizes voice spectrum bandwidth to supply data services, which can affect call quality and availability. WiMAX technology is designed to deliver IP traffic, increasing the bandwidth without compromising voice service quality.

What is orthogonal frequency division multiplexing (OFDM)?

OFDM is a digital encoding and modulation technology. It has been used successfully in wire-line access applications, such as Digital Subscriber Line (DSL) modems and cable modems as well as WiFi. Products from WiMAX Forum member companies are using OFDM-based 802.16 systems to overcome the challenges of NLoS propagation.

OFDM achieves high data rate and efficiency by using multiple carrier signals instead of just one. All future 4G technologies will be based upon OFDM.

Orthogonal Frequency Division Multiple Access (OFDMA) is enhanced OFDM and used in Mobile WiMAX technology and the IEEE 802.16e-2005 standard, and it is the foundation for the next-generations of mobile broadband to come. It is a multi-user version of Orthogonal Frequency-Division Multiplexing (OFDM). The difference between the two technologies is that OFDMA assigns subsets of sub-carriers to individual users allowing simultaneous low data rate transmission from several users.