WiMAX Portability on Today’s WiMAX Fixed Networks—Wi-X Supplement

A WiMAX system or network that can support portable operation addresses a much larger market need than a strictly &quotfixed&quot 802.16-2004 WiMAX implementation does that must be plugged in or bolted to walls. To date, it has been stated and accepted by the industry at large that portable operation must wait for the benefits of 802.16e before viable products can be delivered. However, when the requirements for portable operation are closely examined, it becomes clear that this, in fact, is not the case, and portable operation is possible with &quotfixed&quotWiMAX-compliant products.

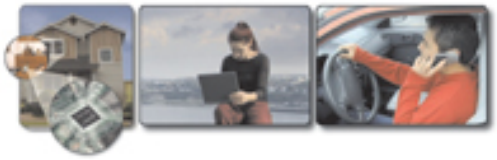
By David Sumi

The limitation to delivering portable operation lies not in the standard, but in the implementation of the standard, and specifically, in the ASICs that power WiMAX products. An 802.16-2004 WiMAX chip that meets the requirements for delivering Portable WiMAX offers operators advanced services and additional revenue opportunities before full broadband mobility arrives.

Portability &#151 What It Is and Where It Works

The portable mode of operation supports wireless broadband communication within a given service area while the end-user or device is either stationary or moving slowly at &quotpedestrian&quot speeds through the area. This means a user can connect to a WiMAX &quotfixed&quot network at home, take their WiMAX-enabled device (PDA, laptop modem, handset, etc.) to work or play and connect to a WiMAX &quotfixed&quot network at those locations as well. In addition, the user can maintain their broadband connection as they move around within the WiMAX &quotfixed&quot network coverage area. From a service-provider perspective, this means they can &quotown&quot the end user throughout this large coverage area, providing increased revenue opportunity on their 802.16 2004 WiMAX network. Figure 1 presents some of these scenarios graphically.

Portability Technical Requirements &#151 The Standard



[1]

The primary requirements for portability lie in the fact that the devices used are portable, and as a result, are typically battery-powered. This is addressed in the 802.16-2004 standard by allowing an optional implementation called &quotsub-channelization.&quot In this technique, a CPE or device does not have to transmit to the BTS on all the sub-carriers or tones on the waveform, thus conserving power.

In the 802.16e standard supporting SOFDMA, this same technique is used. The CPE, or end-user device, will only transmit on a small subset of tones. Although there are several other significant differences between the two standards, in terms of power conservation for the CPE device, this is the main feature. Thus, a product that supports 802.16-2004 and the optional sub-channelization feature will be as power efficient as a device based on 802.16e.

Portability Technical Requirements &#151 The Products

Since both the 802.16-2004 and 802.16e standards can support portable operation and portable devices, it is up to the products themselves to deliver portable broadband. The requirements for a portable device largely rely on the ASIC supporting MAC and PHY compliance as well as the RF chain. The requirements for the baseband/MAC ASIC are summarized as follows:
&#149 Power consumption (active receive) &#151 Battery life is a critical issue in portable devices. Therefore, it is important that the standard supports basic operation that, at a core technical level, can reduce power consumption. But the implementation of these features in the product itself must do more. The ASIC must be power efficient, consuming no more than 700 mW of power when in the active-receive state.
&#149 Power consumption (transmit) &#151 While most of the power consumed is typically in the receive state, it is equally important to conserve power in the transmit mode as well. This can be addressed somewhat with sub-channelization, an optional feature in WiMAX. It can be further enhanced when techniques such as transmit diversity combining are also supported from the CPE to the BTS.
&#149 Heat &#151 Portable devices demand small size and density. The chips for these devices will likely be built into very small spaces (consider a PCMCIA card) and hence the heat generated must be limited. Of course, heat and power are related, so the more power an ASIC consumes the more heat it generates.
&#149 Performance or range &#151 The greater the range of coverage for a portable device, the more &quotusable&quot it becomes. When a WiMAX CPE is

implemented in a small device such as a PDA, the ability to include high-gain antennas for range extension is not possible because portable devices use smaller antennas. In order to compensate, the device must derive the necessary performance, or additional dB of link budget, with advanced signal-processing techniques such as MIMO and diversity combining. To take advantage of these techniques, two antennas are required.
&#149 Footprint &#151 Portable devices are, by definition, small and lightweight. For most chips, weight is not the issue. However, for some, footprint or space required is very much a problem. There are no hard limits to the size of a chip that can be used in a laptop or PCMCIA or even a handset, although smaller is better. When advanced techniques such as MIMO are implemented, dramatically improving performance even more, it is vital that the multi-antenna processing techniques that are used to extend the range or performance be supported in a single chip. A single baseband/MAC ASIC must be able to support two antenna inputs.

From a technical standpoint, the existing standard, IEEE 802.16-2004, if implemented properly, can support the portable mode of operation just as well as 802.16e, and it can do so *sooner*. With parity between the &quotfixed&quot and &quotmobile&quot 802.16 standards in terms of technical features supporting low-power operation, it is up to vendors to deliver 802.16-2004 chips that power the PDAs, laptops and handsets, meeting all the requirements for portable operation mentioned above for portability on today's WiMAX &quotfixed&quot networks.

Conclusion: Portable WiMAX &#151 A Giant Step Toward Broadband Ubiquity

The real value of wireless technologies lies in their ability to un-tether the end-user while communicating. WiMAX &quotfixed&quot can and will have widespread adoption, delivering voice and data communications to buildings and facilities around the world. But it is the capability of chips to deliver portable broadband that will greatly enhance the applicability of the IEEE 802.16-2004 standard.

The eventual goal of wireless is broadband ubiquity &#151 multi-megabit connectivity wherever and whenever you want it. By supporting portable operation under the IEEE 802.16-2004 standard and being fully WiMAX &quotfixed&quot-compliant, the addressable market for broadband wireless is significantly expanded, enabling operators around the world to take a huge step toward achieving broadband ubiquity, with attractive operator economics, without waiting for the &quotnext best thing.&quot

About the Author

David Sumi is VP of Product Management and Marketing at TeleCIS Wireless, a fabless semiconductor company dedicated to delivering multi-protocol wireless System-on-a-Chip (SoC) solutions to the Broadband Wireless Communications industry, and is also Secretary of the WiMAX Forum. Mr. Sumi was one of the early pioneers establishing fixed Broadband Wireless Access as a viable technology and market during its infancy stages via his work at several start-ups in BWA, including Multipoint Networks, Wireless Inc. and Malibu Networks. His extensive experience in both international and domestic BWA markets, combined with his technical grounding in the Rf and networking issues associated with these systems, gives him a solid overall perspective in the Broadband Wireless domain.

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