# WiMAX vs. LTE

**WiMAX and LTE continue to pose many unanswered questions.**

**Q: What common or overlapping technologies do WiMAX and LTE have in common and will they ever converge for certain applications?**

By Joe Cozzarelli, Senior Director Broadband RF Products and Glenn Eswein, Director of Product Marketing, Broadband RF Business
After three years of deliberation, the IEEE802.16m air interface definition will be ready for prime time in the next few months. This critical step toward creating true 4G cellular technology based on WiMAX is important enough to earn compliant products a new name: WiMAX 2.

Further proof came last month, when an impressive subset of the WiMAX community created the WiMAX 2 Collaboration Initiative to "improve the economics of mobile broadband" and "to create a better value chain for service providers."

In the U.S., service providers have been in a hurry to reinvent their infrastructures to support 4G. Sprint has partnered with Clearwire to roll out WiMAX-based services, while Verizon is basing its network enhancement plans on another mobile broadband technology: LTE. It's a safe bet that these players would like to see some harmonization between WiMAX 2 and LTE, and take advantage of any economy of scale provided by the availability of standard equipment.

WiMAX and LTE both use OFDM signaling and are similar enough for baseband chip vendors to state confidently that they have chips that can handle either standard. That leaves the RF solutions providers to join the harmonization party, but the many wireless frequency bands and varying power requirements make this easier said than done. SDR (Software Defined Radio) in one of its many flavors may be the answer for the radio chip.

Power amplifiers and filters, on the other hand, have a difficult balancing act to perform. Tradeoffs between operating bandwidth and power efficiency drive decisions regarding which and how many frequency bands to support in a particular product. And disparities in the transmit power levels between WiMAX and LTE beg the question: under which conditions should one optimize PA performance?

ANADIGICS is a leader in providing PAs for both WiMAX and LTE, and in developing multi-chip modules that integrate multiple PAs, covering the most appropriate frequency bands for a particular geography or application. Our experience indicates that PAs optimized for WiMAX will support LTE signals as well, and our BiFET process enables the design of PAs which can support both WiMAX and LTE products without compromising key performance.. But as LTE and WiMAX usage models are refined,

will they lead to a common set of highly-optimized performance traits? Or will multi-mode capability be a requirement for PAs that support both standards?

Much like any new technology deployment, 4G performance is - and will continue to be - a moving target. As system requirements evolve and the carriers clearly identify their 4G needs, semiconductor companies will have to continue to adapt.

Graham Celine, Senior Director of Marketing, Azimuth Systems

There are several aspects that WiMAX and LTE have in common. For example, WiMAX and LTE both provide broadband wireless access using advanced wireless modulation (OFDM) and state-of-the-art antenna technology (MIMO). Both technologies use similar RF transmission techniques and modulation schemes, allowing each to supply and support very similar capabilities and performance. The standards defining each are also similar with next generation versions already in the pipeline- 802.16m for WiMAX and 3GPP Release 10 and beyond for LTE-Advanced. Furthermore, WiMAX and LTE can reach similar data rates through large scale multi-antenna base station deployments and operate in whatever band is allocated to them at high or low mobility speeds. However, where and what they will do in common, or differently, will be defined by the service providers that deliver broadband wireless.

There are key unanswered questions that will remain common as well, such as what level of mobility can be tolerated, what range can be achieved with antenna beamforming, does the range and the interference level affect performance at all frequencies equally, and what are the positive and negative effects of the propagation conditions on the solution? The main challenge will be to effectively test and deploy these technologies and to grow the offering of broadband wireless worldwide in line with market and user expectations. This is a technology shift –and expectations are high.

If the vendors and the technology live up to the challenge where anyone can watch the news while riding their bike or download a file while driving to an appointment, the promise of 4G can be delivered. The challenge in getting to that point is a test challenge – the new technology must be trialed and challenged in as many scenarios as possible to ensure it will work when installed and used by the customer.

Will WiMAX and LTE converge for any of these applications? Certainly not in the immediate future. The standards and the underlying technologies, although very similar in many respects, will remain independent for some time to come.

Scott Schober, President & CEO of Berkeley Varitronics Systems

WiMAX has gained and maintained millions of subscribers around the globe. Whereas, LTE appears to be coming out of the starting gate a bit slower, yet has achieved significant momentum with both Verizon and AT&T strongly backing the

technology with the licensed spectrum they both have heavily invested in.

Berkeley Varitronics Systems (BVS) has witnessed this development via the surge in YellowFin WiMAX 802.16e Mobile Analyzer sales in the past 2 years as WiMAX deployments have exceeded 400 globally. We are seeing a shift in T&M equipment requests for LTE tools. Many of the companies we work with have actively been developing systems that support both the WiMAX and the LTE communities because of the similarities. Much of the underlying Intellectual Property in these systems supports both of these technologies. BVS has supported much of the buildout in the domestic WiMAX infrastructure led by companies such as Clearwire. Yet, it is interesting that even Clearwire has acknowledged the need to support LTE in its future expansion opportunities.

WiMAX has always been regarded as a “backhaul technology” for providing backhaul services only and LTE would be deployed to provide access to them. In reality, neither of these technologies could displace the other, because eventually the customers will choose a service provider based not on the basis of “technology” but in terms of what fits their existing network and operational needs, in terms of reliability, cost, flexibility, etc. For example, existing islands of Wi-Fi cannot be replaced exclusively by either WiMAX nor LTE because of well-established usage habits by customers. Therefore, since it would be reasonable to expect that neither LTE nor WiMAX could eliminate one another in the foreseeable future, the two technologies will have to coexist and be dependent on each other by providing valuable high-speed services to their mutual customers, by virtue of their strengths and relative advantages.

The costs to migrate the existing 3G infrastructure over to LTE can be expensive, yet some major suppliers such as Huawei and Motorola are heading in this direction. The adoption of the technology by the growing customer base will favor the deployment of both technologies in the next several years. As our mobile phones become sophisticated universal gadgets (telephone, notebook, message machine, web browser, etc.) we can count on the need for significant advances in speed and the development of amazing new applications to be supported by WiMAX and/or LTE 4G technologies, quickly replacing our 3G mobile phones that we can't live without.

Linley Gwennap, Principal Analyst, The Linley Group

Technically, WiMax and LTE are quite similar. For business reasons, however, convergence will not happen in the near future, if ever. There is no doubt that a chip can be designed to support both technologies; in fact, several WiMax startups are developing such dual-mode products, and Wavesat has already sampled one. About 80-90% of the hardware in the baseband can be shared between LTE and WiMax, with the main differences being in the RF circuitry and the protocol firmware.

The customer demand for a WiMax/LTE chip, however, is simply nonexistent. Almost every established cellular operator in the world is planning to move to some version of LTE as its 4G protocol. LTE was developed by 3GPP as the logical successor to the

UMTS 3G protocol used by 80% of the operators. The other 20% of the operators use Qualcomm's CDMA protocol for 3G, but given Qualcomm's decision to abandon its 4G protocol (UMB), CDMA operators will also move to LTE. The one major exception is Sprint, which is currently building a WiMax network.

WiMax is gaining some momentum, but mainly with small broadband service providers and greenfield operators that are offering wireless service for the first time. Rather than wait for LTE, these operators are using WiMax to deploy their 4G networks. As LTE ramps and economies of scale kick in, new operators may begin to adopt LTE instead of WiMax.

The main reason for a mobile device to support multiple protocols is for roaming. With little WiMax or LTE deployment available today, combining the two protocols adds little value. Both WiMax and LTE vendors are more likely to include in their chips UMTS (or CDMA), which offers much greater coverage and a backup for situations where 4G is not available.

If WiMax remains a niche solution, LTE operators will have little need for WiMax capability. As LTE becomes widely deployed, WiMax operators may wish to provide LTE compatibility for roaming, but the size of such WiMax/LTE deployments will be small. Thus, big chip suppliers will likely focus on LTE only, while a few small chip makers will deliver WiMax and, eventually, WiMax/LTE devices.

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