



## Mobilize Your Internet

Enabling the Wireless Broadband  
Revolution with Intel® WiMAX Technology

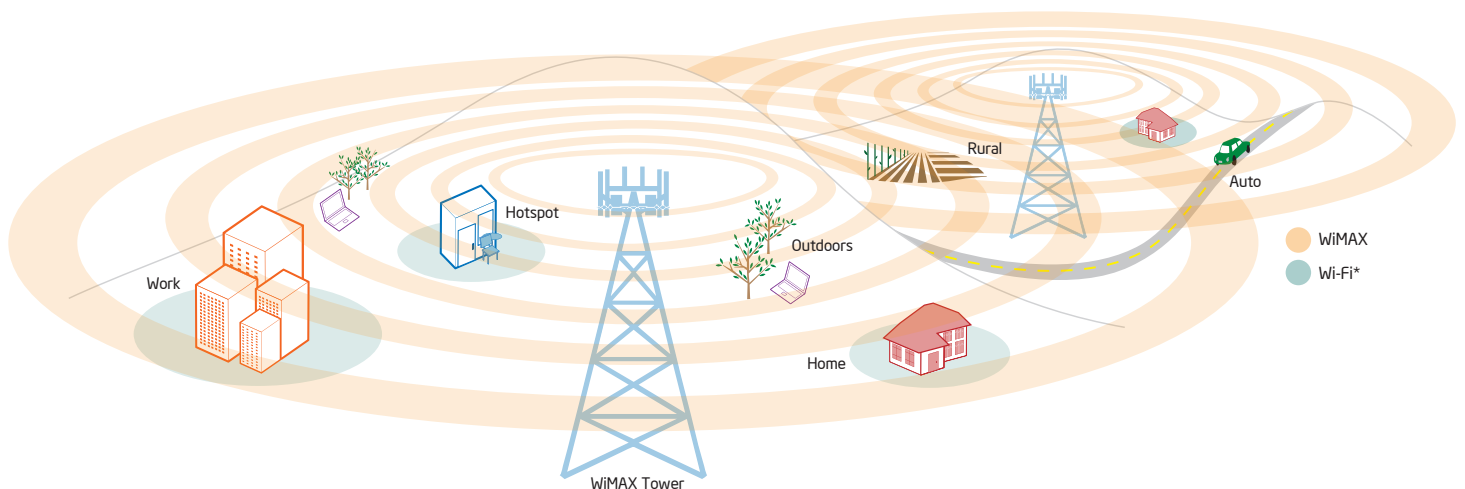


## Expand Your Wireless World with WiMAX

WiMAX is the next giant step in wireless network evolution that mobilizes your Internet – miles from the nearest Wi-Fi\* hotspot. Mobile WiMAX will blanket large areas – wide area networks (WANs), be they metropolitan, suburban or rural – with multi-megabit-per-second mobile broadband Internet access.<sup>1</sup> WiMAX will free broadband from location, transforming it into personal mobile broadband that moves with you. Together, WiMAX and Wi-Fi are ideal companions for enabling convenient, affordable mobile broadband Internet services.


Mobile WiMAX is powered by new wireless technology breakthroughs codified in the IEEE 802.16e-2005 standard. They make WiMAX a “spectrally efficient” wireless technology that delivers higher speeds than today’s wide area wireless technologies. And WiMAX is built from the ground up for Internet applications and services with its “all IP” architecture.

WiMAX is being adopted and deployed in many countries around the world. For example, two carriers in the U.S., Sprint and Clearwire, will be deploying WiMAX services in 2008, and over 100 carriers are currently trialing Mobile WiMAX<sup>2</sup> around the world. Intel® Centrino® processor technology is poised once again to be at the center of this wireless broadband revolution with an industry-leading Wi-Fi/WiMAX solution that cost-effectively leverages the synergies of both technologies.



**WiMAX will blanket large areas to deliver broadband Internet access that moves with you beyond Wi-Fi hotspots.**





For more information on WiMAX and Intel® WiMAX products, go to [www.intel.com/go/wimax](http://www.intel.com/go/wimax)

## Intel's Integrated Wi-Fi/WiMAX Solution

Intel is leading the next generation of mobility with an innovative, integrated, and embedded combo Wi-Fi/WiMAX module for laptops. The Intel® Wi-Fi/WiMAX dual-mode module code-named "Echo-Peak" planned for the Intel Montevina laptop platform, will deliver compelling benefits for laptop OEMs, WiMAX operators, and mobile users.

- **Laptop OEMs** – Intel's platform-level optimizations deliver unprecedented economic advantage for mobile wireless broadband. The Echo Peak Wi-Fi/WiMAX module minimizes the incremental cost and design overhead, streamlines certification, improves power management, and saves valuable laptop real estate.
- **Mobile WiMAX Operators** – Intel Centrino processor technology-based laptops enable new business models for mobile WiMAX operators with potentially lower client device subsidies and consistent subscriber activation processes. Combining Wi-Fi for local area network (LAN) with WiMAX for the WAN opens up new service opportunities.
- **Mobile Users** – Echo Peak silicon and platform optimizations enhance battery life, simplify network access management, and maximize performance in a compact form factor for a richer mobile broadband experience. Users can connect to Wi-Fi or WiMAX networks, depending on their location, mobility and quality-of-service requirements.

### Cost-Effective Architecture

Intel's innovative Echo Peak design achieves breakthrough cost points for WiMAX network access. Embedding Wi-Fi/WiMAX into the mobile platform provides unmatched platform-level optimizations for OEMs. Wi-Fi and WiMAX integration on the same MiniCard or Half MiniCard form factor frees up valuable laptop real estate. Shared antenna innovations ease design-in and enable a platform approach to noise mitigation. Streamlined certification dramatically reduces PC OEM testing time and costs.

### Echo Peak Features

#### Air Interface

IEEE 802.16e-2005 Mobile WiMAX and IEEE 802.11a/b/g/n

#### Host Interface

USB (2.0) and PCI Express Mini Card (v1.1)\*

#### Mobile Form Factor

PCIe Mini Card and PCIe Half Mini Card\*

#### Frequency Ranges<sup>3</sup>

WiMAX: 2.5-2.7 GHz

Wi-Fi: 2.4-2.48 GHz, 5.1-5.8 GHz

#### OS Support

Microsoft Windows XP\* and Microsoft Windows Vista\*

#### Software Application

Co-Existence Layer and Intel Connection Utility for WiMAX

#### Manageability

Over-the-air provisioning, management and upgrade support streamline subscriber management for wireless service providers. Support for remote Wi-Fi client management with Intel® Active Management Technology<sup>4</sup> version 4.0 enables remote client management for the enterprise.

#### Wi-Fi LAN Performance

Wi-Fi 802.11a/b/g/n 3x3 (450 Mbps), 1x2 (300 Mbps Rx Downlink)

#### WiMAX WAN Performance

Receives up to 10 Mbps (2 Rx Downlink), transmits up to 4 Mbps (1Tx Uplink)<sup>5</sup>



## Efficient Design for Laptops

Efficient use of laptop real estate is critical for PC OEMs. Keeping the laptop form factor as small as possible is also a highly desirable feature for mobile users. By putting Wi-Fi and WiMAX on a single MiniCard and Half MiniCard, Intel's solution squeezes new value for OEMs out of laptop real estate already slated for Wi-Fi. Combining Wi-Fi and WiMAX onto the same MiniCard also frees up a PCMCIA slot. Mobile users benefit from the embedded MiniCard design by not having to carry a WiMAX card, and potentially damaging the antenna on the card.

## Streamlined Certification

A primary goal of the WiMAX Forum\* is to streamline the certification process. Streamlined module-based certification saves OEM testing time and costs, and reduces time to market for laptops. Once a laptop is WiMAX Forum Certified\*, OEMs do not have to go back and re-certify through the service providers.<sup>6</sup> Intel certifies the entire Echo Peak module at a WiMAX Forum Designated Certified Lab\* (WFDCL) for the following tests:

### Certification Profile and System Release

- Protocol Conformance Tests (PCT)
- Radio Conformance Tests (RCT)
- Interoperability Testing (IOT)

### Network Release

- Network Conformance Tests (NCT)

### Over-the-Air Performance

- Radiated Performance Tests (RPT)

OEMs integrate the module into their laptops, then perform RPT and a reduced set of NCT and carrier over-the-air field testing.

Find out more about  
Intel® Next-Gen Wireless-N at  
[www.intel.com/go/wifi](http://www.intel.com/go/wifi)

## MIMO-Powered High Throughput

Echo Peak harnesses the range and performance benefits of the latest smart antenna technology called Multiple Input Multiple Output (MIMO). MIMO technology provides significant increases in throughput and range using the same bandwidth and overall transmission power of Single Input Single Output (SISO) communication systems. Wireless MIMO communication exploits environmental phenomena such as multi-path propagation to increase data throughput and range, or reduce bit error rates, rather than attempting to eliminate effects of multi-path propagation.

MIMO uses multiple antennas at both the base station and subscriber unit to enable data to travel along different independent paths. MIMO technology is incorporated in the IEEE 802.11n specification (Draft-N) and the IEEE 802.16e-2005 standard (WiMAX).

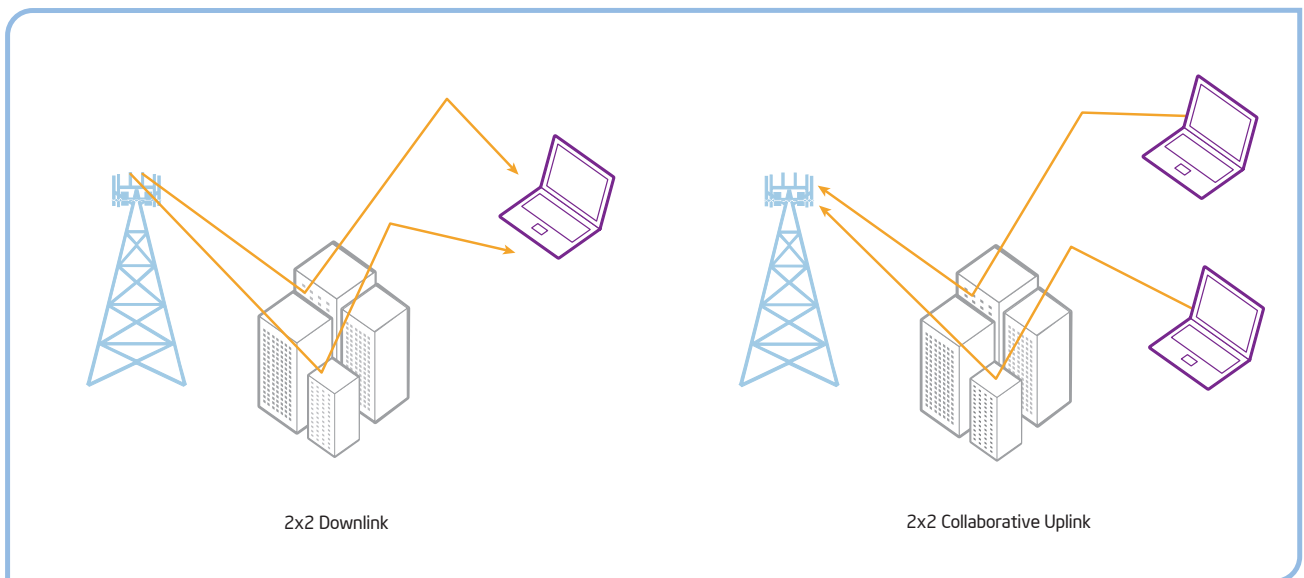
MIMO configurations on the Echo Peak module are 1x2 for WiMAX and 3x3 for Wi-Fi. 1x2 refers to a 1 Tx (transmit) and 2 Rx (receive) antenna configuration and 3x3 refers to a 3 Tx and 3 Rx configuration. For Wi-Fi, a Wi-Fi access point connected to a 3x3 Wi-Fi MIMO client needs 3 Tx and 3 Rx antennas to take full advantage of the client's configuration.

For WiMAX, with its asymmetric antenna configuration, the base station is assumed to have 2 Tx antennas that transmit to the 2 Rx antennas on Echo Peak, enabling what is referred to as 2x2

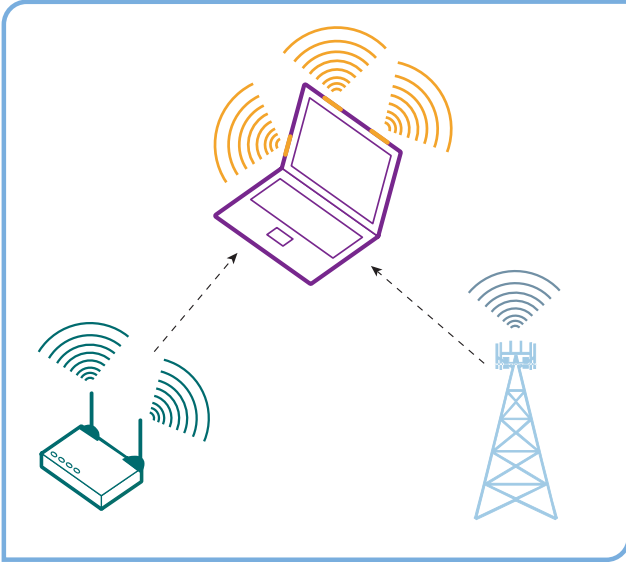
downlink (DL) MIMO. On the uplink (UL), 802.16e-2005 supports a feature called "collaborative MIMO." So although the Echo Peak module has only 1 Tx antenna, the base station to which it connects can have 2 Rx antennas and can receive simultaneous signals from two different clients, enabling what is referred to as 2x2 collaborative MIMO on the UL. With this configuration, Echo Peak clients can support up to 10 Mbps on DL and up to 4 Mbps on UL.

## Flexible Radio Frequency Band Support

The radio antennas to support MIMO capabilities are placed in the laptop LCD display lid and shared by both Wi-Fi and WiMAX to reduce costs, ease design considerations, and enable a platform approach to noise mitigation. In the half MiniCard Echo Peak form factor, Wi-Fi and WiMAX also share an integrated radio component. In contrast, non-integrated WAN data cards don't make use of the integrated lid antennas in the laptop. These cards have their own antenna which may or may not have been validated with the platform. As a result, noise mitigation management is not necessarily optimized at the platform level.



**MIMO is a key enabler of WiMAX that exploits environmental phenomena such as multi-path propagation to increase data throughput and range.**



**Innovative integrated antenna design enables both Wi-Fi and WiMAX to share antennas for platform-level noise mitigation**

## Coordinated Power Management

Echo Peak's coordinated, platform-level power management delivers great battery life. The Echo Peak Wi-Fi/WiMAX module goes through validation cycles at the platform level to help ensure that the laptop's built-in power management, which manages such power features like laptop sleep or hibernation states, operates properly in the presence of Wi-Fi and WiMAX connectivity.

Using non-integrated PC WAN cards increases the likelihood of uncoordinated laptop power management. For example, the PC Card may not support Advanced Configuration and Power Interface (ACPI) suspend states, or the user may not be able to get the laptop to go into sleep mode, resulting in the battery needlessly draining its power.

## Advanced Wireless Security

Echo Peak supports the most advanced WiMAX security features for authentication and encryption to protect information as it travels across the wireless link. Extensible Authentication Protocol (EAP) handles authentication of the user for secure login to the network. Advanced Encryption Standard (AES-CCM) encrypts the wireless link between the client and the base station

to guard against security breaches such as spoofing (the ability to generate messages that appear to be from someone else); replaying (taking a message sent by the user and replaying or re-sending it again); and snooping (reading private messages).

## Enhanced Wi-Fi Performance and Range

The Echo Peak Wi-Fi module includes the latest Wi-Fi advances from Intel's new Wi-Fi solution, code-named "Shirley Peak," to enhance performance. Echo Peak fully supports 802.11a/b/g networks and the latest WLAN technology based on draft version 2.0 of the IEEE 802.11n specification, which delivers up to 2x the range and up to 8x the performance of existing 802.11a/g networks.<sup>7</sup> The high performance and reliability of 802.11n enable multimedia and other bandwidth-intensive enterprise applications.





## Intel Moves Your Mobility Forward

WiMAX will leverage a new generation of wireless technologies to mobilize broadband Internet access. Intel® architecture-based laptops with Echo Peak on the Montevina platform will transform wireless mobility for users while delivering compelling benefits for laptop OEMs and wireless service providers. For OEMs, platform-level optimizations for the integrated, dual-mode Wi-Fi/WiMAX module deliver economics not seen before for mobile wireless broadband. For mobile WiMAX operators, laptops with Intel Centrino processor technology and integrated Wi-Fi/WiMAX reduce client subsidies and streamline subscriber activation. For mobile users, Echo Peak on the Montevina laptop platform unleashes the power of next-generation mobile computing.

<sup>1</sup> The service level provided to WiMAX subscribers is solely determined by the service provider. Intel's Echo Peak module is capable of receiving data at speeds up to 10 Mbps.

<sup>2</sup> WiMAX Forum database of publically announced Mobile WiMAX trials.

<sup>3</sup> We expect mobile WiMAX deployments in additional frequency bands like 2.3 GHz and 3.5 GHz to become more prevalent in 2009 timeframe and will enable product support commensurate with operator demand.

<sup>4</sup> Intel® Active Management Technology (Intel® AMT) requires the computer system to have an Intel AMT-enabled chipset, network hardware and software, as well as connection with a power source and a corporate network connection. Setup of Intel AMT requires configuration by the purchaser and may require scripting with the management console or further integration into existing security frameworks to enable certain functionality. It may also require modifications or implementation of new business processes. With regard to laptops, Intel AMT may not be available or certain capabilities may be limited over a host OS-based VPN or when connecting wirelessly, on battery power, sleeping, hibernating or powered off. For more information, see [www.intel.com/technology/manage/iamt](http://www.intel.com/technology/manage/iamt).

<sup>5</sup> Actual performance will vary depending on signal reception.

<sup>6</sup> Initially, the service provider may decide to conduct random field tests, until WiMAX Forum Certification is more mature.

<sup>7</sup> Up to 2x greater range and up to 8x better performance with Intel® Next-Gen Wireless N technology enabled by 3x3 Draft N implementations with 3 spatial streams. Actual results may vary based on your specific hardware, connection rate, site conditions, and software configurations. See [www.intel.com/performance/mobile/wireless/index.htm](http://www.intel.com/performance/mobile/wireless/index.htm) for more information. Requires Intel® Next-Gen Wireless N technology and Connect with Intel® Centrino® processor technology certified wireless n access point. Wireless n access points without the Connect with Intel Centrino technology processor identifier may require additional firmware for increased performance results. Check with your PC and access point manufacturer for details.

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