



# Ultra-Wideband (UWB) Technology

## **One Step Closer to Wireless Freedom**

*The wireless freedom experienced by personal computer, handheld, consumer electronics and cell phone users is moving into the digital home and office. People want greater freedom and convenience in connecting all types of devices. The answer is Ultra-Wideband (UWB) Technology. This power-efficient solution will provide the high bandwidth required by the latest and future portable home and office devices for multiple digital video and audio streams.*



## **The Future Belongs to the Unwired**

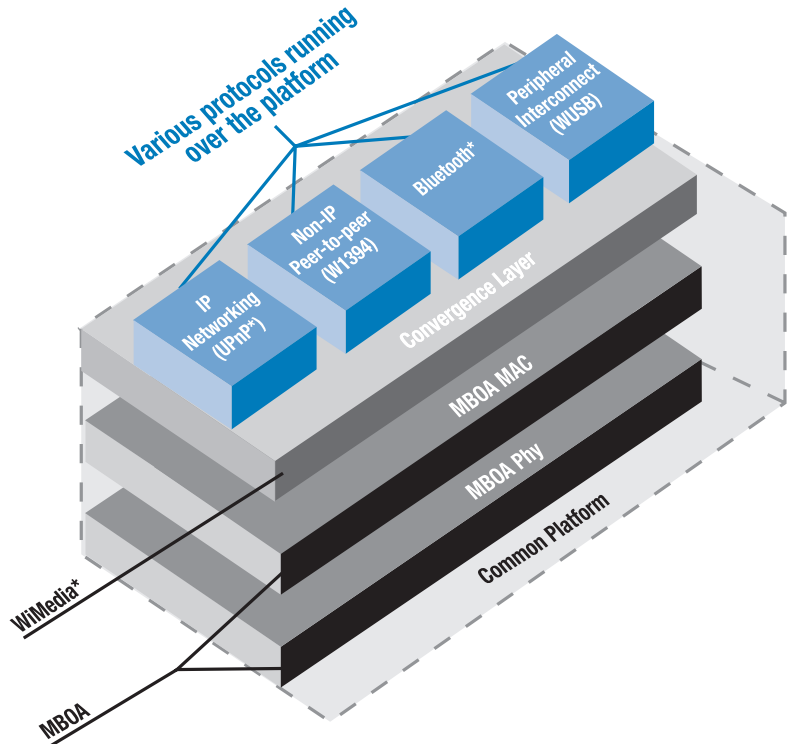
Analysts predict that in 2005 there will be over 80 million wireless LANs (WLANs) in use worldwide and nearly 13 million wireless home networks in the United States. Yet there's still a missing link. The growing number of media-intensive devices in the home – such as PCs, digital camcorders, digital cameras, high-definition TVs (HDTVs), and gaming systems – need a high-bandwidth wireless solution for easy connection and media exchange.

The answer is Ultra-Wideband (UWB) technology. This short-range radio technology is ideal for wireless personal area networks (WPANs). UWB complements existing longer range radio technologies – such as Wi-Fi\*, WiMAX, and cellular wide area communications – that bring in data and communications from the outside world. UWB provides the needed cost-effective, power-efficient, high bandwidth solution for relaying data from host devices to devices in the immediate area (up to 10 meters or 30 feet).

## How UWB Works

UWB differs substantially from conventional narrowband radio frequency (RF) and spread spectrum technologies (SS), such as Bluetooth\* Technology and 802.11a/b/g. A UWB transmitter works by sending billions of pulses across a very wide spectrum of frequency several GHz in bandwidth. The corresponding receiver then translates the pulses into data by listening for a familiar pulse sequence sent by the transmitter.

UWB's combination of larger spectrum, lower power and pulsed data improves speed and reduces interference with other wireless spectra. In the United States, the Federal Communications Commission (FCC) has mandated that UWB radio transmissions can legally operate in the range from 3.1 GHz up to 10.6 GHz, at a limited transmit power of  $-41\text{dBm/MHz}$ . The result is dramatic short-range channel capacity and limited interference.



## The Pieces Are Already in Place

Intel has mapped out a vision of UWB radio as a “Common UWB Radio Platform” spanning many different applications and industries. In this vision, the UWB radio, along with the convergence layer, becomes the underlying transport mechanism for different applications. Some of the more notable applications that could operate on top of the Common UWB Radio Platform would be Universal Serial Bus (USB), IEEE 1394/FireWire, next generation of Bluetooth\*, and Universal Plug and Play (UPnP\*).

By providing sharing rules, the convergence layer allows each application to use the same radio, instead of requiring a radio for each application. The standardization of a common UWB development platform will enable PC, mobile and consumer electronics (CE) manufacturers to take advantage of this efficiency. Intel is working closely with key industry groups such as Multiband OFDM Alliance (MBOA), WiMedia\* Alliance and Wireless USB Promoter Group (see sidebar) to enable commercial development of UWB standards-based products in 2005.

## Speeding the Development of UWB Through MBOA

In June 2003, Intel took an important leadership step in forming the Multiband OFDM Alliance (MBOA) with many of the most influential players in the consumer electronics, personal computing, home entertainment, semiconductor, and digital imaging market segments. The goal of this organization is to produce a specification that can be used for a diverse set of applications. To date, MBOA has demonstrated great momentum with more than 170 participants supporting a single technical proposal for UWB.

The MBOA uses a Multiband Orthogonal Frequency Division Multiplexing (OFDM) approach. The benefits of this approach include:

- Spectral flexibility using software-configurable emissions
- Easier adoption to different world wide regulatory environments
- Future scalability and backward compatibility
- Use of standard CMOS technology to take advantage of the principles of Moore's Law, speeding development and advancing performance
- Excellent robustness in multi-path environments
- Broad multi-industry support from leading CE, PC and cellular manufacturers

## Freedom from the Ties That Bind

Today most computing and CE devices, from a digital camcorder and DVD player to a mobile PC and a HDTV, require wires to record, play and exchange media. UWB could eliminate these wires, allowing people to "unwire" their lives in new ways. Through UWB:

- Devices in a home office – such as a printer, scanner, external hard drive, and digital camera – could be connected to your PC without any wires
- The components for an entire home entertainment center could be set up and connected to each other without a single wire
- A digital camcorder could play a video on a friend's HDTV without anyone having to fiddle with wires
- A portable MP3 player could stream audio to high-quality surround-sound speakers anywhere in the room
- A mobile computer user could wirelessly connect to a digital projector in a conference room
- Digital pictures could be transferred to a photo print kiosk for instant printing without the need of a cable

## Wireless USB: The First High-speed Personal Wireless Interconnect

**If you love the ease of connection and installation you get with USB, it's time you met its unwired equivalent. Wireless USB will be the first high-speed wireless personal interconnect technology to take advantage of UWB. Building on the success of wired USB, it will bring USB technology into the wireless future.**

**To maintain the same usage and architecture as wired USB, the Wireless USB Promoter Group is defining the Wireless USB specification as a high-speed host-to-device connection. This will enable an easy migration path for today's wired USB solutions. Targeted bandwidth is 480 Mbps – plenty fast for multimedia streaming and high bandwidth data transfers. With one billion units in the installed base, USB is already the de facto interconnect for PC and many CE and mobile devices. With Wireless USB, all the benefits of USB will be realized but without the wire.**

## An Important Part of Wired for Wireless

Intel's work in Ultra-Wideband is an important part of Intel Corporate Technology Group (CTG) wireless technologies research and development efforts. Imagine if wireless devices were as carefree as a portable radio. Intel wants wireless to mean that kind of freedom. The freedom to connect seamlessly anywhere. Anytime. With any device. Without having to worry about what technology you're using. Or having to sign up and pay multiple wireless services for each place you want to use it. We're making it happen. With more than 35 years of technology experience and an end-to-end commitment to the wireless industry, Intel is wired for wireless like no other company. Through our expertise and silicon process technologies, Intel continues to expand our position as a major force in delivering the next generation of wireless technologies.

### For More Information

#### Industry Organizations

Multiband OFDM Alliance  
[www.multibandofdm.org](http://www.multibandofdm.org)

WiMedia Alliance  
[www.wimedia.org](http://www.wimedia.org)

WUSB Promoter Group  
[www.usb.org/wusb](http://www.usb.org/wusb)

#### Intel Web Pages

Ultra-Wideband  
[www.intel.com/go/uwb](http://www.intel.com/go/uwb)

Wireless USB  
[www.intel.com/go/wusb](http://www.intel.com/go/wusb)

Wired for Wireless  
[www.intel.com/technology/comms/wireless/index.htm](http://www.intel.com/technology/comms/wireless/index.htm)

Intel Communications Technology Lab  
[www.intel.com/technology/comms/ctl/](http://www.intel.com/technology/comms/ctl/)

Intel Research and Development  
[www.intel.com/technology](http://www.intel.com/technology)

#### White Papers

Ultra-Wideband (UWB) Technology:  
Enabling High-speed Wireless  
Personal Area Networks  
[www.intel.com/technology/comms/uwb/download/Ultra-Wideband.pdf](http://www.intel.com/technology/comms/uwb/download/Ultra-Wideband.pdf)

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