

# Ultra-Wideband Wireless Networks on the Horizon

*Stan Schatt*

## Giga Position

Ultra-wideband (UWB) wireless technology has the potential to offer very high bandwidth at a low cost and with low power requirements. It will compete with current wireless technologies such as Bluetooth and IEEE 802.11. Giga believes UWB vendors will receive Federal Communications Commission (FCC) approval for transmission within the 2.4GHz spectrum and that security products utilizing this technology are likely to appear in 2002, with Bluetooth-like products appearing in 2003.

## Proof/Notes

UWB wireless is an emerging technology that is very different from conventional approaches. Rather than broadcast continuous signals at a fixed frequency, UWB uses pulse position modulation to transmit a high volume of signals (around 40 million pulses/second) in short (around a trillionth of a second) low power radio bursts that extend across a wide spectrum from 1GHz to 4GHz. Non-UWB receivers interpret the short bursts as low-level interference. The FCC's "Part 15" classification allows digital devices to emit low levels of electromagnetic radiation that do not interfere "harmfully" with devices licensed to use the radio spectrum. UWB proponents have requested that their technology be governed by Part 15.209 rules the same way that devices such as hair dryers and laptop computers are regulated. The FCC is expected to rule before the end of the year, and Giga believes UWB technology will receive the Commission's blessings albeit with some possible restrictions to ensure lack of interference with global positioning systems (GPSes) [.7p].

## The Benefits of UWB

The reason Giga expects the FCC to rule in favor of UWB technology is that there are so many possible benefits, including the following:

- UWB radios need less than a milliwatt of power compared to three watts for cell phones and four watts for CB radios.
- UWB is far less complex than other wireless technologies from an engineering perspective and, in fact, can be reduced to a single, relatively low-priced chip. Coupled with the low power requirements, this means a product incorporating UWB technology can be manufactured and sold at a price far lower than competing wireless technology.
- Incredible speed is possible. UWB transmissions can travel at 10Mbps or more at distances of up to 150 feet. For very short distances UWB can transmit at 100Mbps.
- Since a non-UWB receiver is not able to piece together the bursts, because it is not synchronized properly and interprets the transmissions as just noise, UWB is very secure.
- UWB's short, high-speed bursts can penetrate walls, as well as most other objects, and the short intervals of bursts mean that it is constantly pinging objects, giving it many of the same characteristics as radar. This means that applications such as locating buried objects or measuring the levels of liquids stored in tanks is possible.
- UWB has a very low probability of interference; it is unlikely to interfere with other transmissions since it does not continually broadcast in any one frequency. Similarly, it is relatively immune to

interference as it is not likely to encounter interference from other broadcasts focused on a single frequency.

### Who Opposes Approval of Spectrum for UWB?

Perhaps the major opposition comes from the aviation industry because of concern that UWB transmissions might interfere with GPSs. Some cell phone manufacturers have also expressed concern that widespread UWB transmissions could degrade cell phone service. Finally, the National Association of Broadcasters has expressed concern about possible UWB interference with satellite-based content distribution. Still, despite this opposition, all comments from the FCC appear to be positive. There is consensus among most FCC observers that the commission is most likely to support UWB's access to the 2.4GHz spectrum because it might solve more problems than it causes. The argument the FCC appears to be embracing is that UWB will simply be perceived as background noise that is fleeting enough not to cause any serious interference while providing a huge benefit — helping to solve the problem of interference found with more and more devices competing in narrowband transmissions within the 2.4GHz band. In other words, the background “noise” of UWB transmissions is far less a concern than Bluetooth, IEEE 802.11, devices and products, such as microwave ovens, interfering with each other.

### Possible UWB Products

Vendors are interested in developing UWB-based products in two key areas: radar and high-speed voice and data. Radar products would take advantage of UWB's ability to penetrate walls and provide detailed views. UWB's ability to locate objects to within one inch is very appealing to law enforcement departments, rescue units and the military. One very practical home use of this radar capability is to find wall studs, and, in fact, **Zircon** is developing a product to help construction engineers detect steel girders and other metal objects inside concrete. An industrial use for UWB is to look at large drums filled with liquids or even solids and determine the exact level of the drum filled. A consumer use is a UWB “tag” that enables people to locate their car in a crowded parking lot. UWB transmissions could find people buried in a collapsed building or criminals hiding within a large building.

The high bandwidth offered by UWB is very appealing to companies like **Siemens**, **WorldCom** and **Sony**, which all have invested in this technology. **IBM** recently partnered with **Time Domain** to produce a chip capable of transmitting 1.25Mbps, with a potential to produce a data rate of billions of bits per second. The wide bandwidth potentially could support thousands of cell phones without interference. Time Domain estimates it will have chips supporting fourth-generation (4G) and fifth-generation (5G) technology within five to seven years. Certainly UWB, with its low power, represents a direct threat to Bluetooth products. In fact, it eventually might challenge IEEE 802.11b products because its high speed and low power consumption could be a boon for mobile devices that need high-speed local area network (LAN) connections without draining limited battery power.

### UWB's Prospects and a Possible Time Line

Assuming the FCC approves UWB's transmission even with some limitations by the end of the first quarter of 2002 [.7p], products should begin appearing before the end of 2002. The events of Sept. 11 have reshaped some vendors' priorities and it is likely that security products will be the first to appear [.7p]. Bluetooth-like products with relatively short transmission distances are likely to appear in 2003 [.6p]. It will be at least 2006 before any cell phone supported products begin to appear [.6p].

### Alternative View

The FCC could approve UWB but with severe transmission restrictions in the low end of the 2.4GHz spectrum. Such limited approval would still support security devices but would restrict bandwidth for many of the voice and data applications.

## Findings

UWB wireless transmission uses thousands of very short pulses spread over a wide spectrum band. The result is a high-speed transmission that has the following advantages over other types of wireless technology:

- Virtual immunity to interference
- Very low power requirements
- Radar-like ability to see through objects
- Less likelihood of creating interference for narrow-band transmissions since UWB transmissions are generally perceived as very low-level background noise
- Very high capacity
- Relative simplicity means low cost for developing receivers

## Recommendations

Investment clients should use the References section of this document to research the few vendors that currently are active in developing this technology, as well as note the significant investments already made by companies such as WorldCom and Siemens.

Enterprise clients developing long-range strategic plans for their wireless infrastructure need to track UWB technology since it could very well occupy some of the roles currently slated for Bluetooth.

## References

### Related Giga Research

IdeaByte, [Orthogonal Frequency Division Multiplexing: All-Digital Resilience for Broadband Mobile Systems](#), Bernt Ostergaard

### Relevant Links and Other Sources

Aether Wire, [www.aetherwire.com](http://www.aetherwire.com)

Multispectral, [www.multispectral.com](http://www.multispectral.com)

Pulse-Link, [www.pulselink.net/html.html](http://www.pulselink.net/html.html)

Time Domain, [www.timedomain.com](http://www.timedomain.com)

Xtreme Spectrum, [www.xtremespectrum.com](http://www.xtremespectrum.com)

Zircom, [www.zircom.com](http://www.zircom.com)

The FCC's plans to modify regulations, see docket 98-153, [www.fcc.gov/Bureaus/Engineering\\_Technology/Orders/1998/da982650.txt](http://www.fcc.gov/Bureaus/Engineering_Technology/Orders/1998/da982650.txt)

Ultra-Wideband Working Group's Web site, [www.uwb.org](http://www.uwb.org)

"Ultra-Wideband Technology for Short- or Medium-Range Wireless Communications," Jeff Foerster, Evan Green, Srinivasa Somayazulu, David Leeper, *Intel Technology Journal*, second quarter 2001, [http://developer.intel.com/technology/itj/q22001/articles/art\\_4.htm](http://developer.intel.com/technology/itj/q22001/articles/art_4.htm)