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The 1 Gbps Full Duplex Radio

These radios aren't new, but it took us some time to believe they were real.

by **Alex Goldman**ISP-Planet Managing Editor
[September 20, 2007]Email this article
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We contacted the company to find out how they get that kind of performance over real distance (1 to 5 miles) and learned something about spectrum ranges that many WISPs may not know exist.

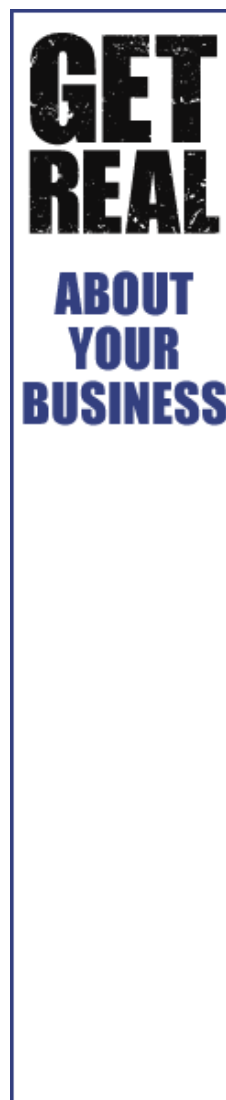
At Spring ISPCON, I asked Tom DeReggi if there was anything I should look into, new technology or products of interest. Always polite and kind, he suggested I look into Santa Clara, Calif.-based BridgeWave.

When I told him, last week, that I was finally ready to talk to the company he admitted that he's been using cheaper Proxim gear that offers the same gigabit speed but at half the range and with a less sophisticated product. Proxim's bot better prices, he said, and added, "Bridgewave still has the finest piece of gigabit hardware on the planet. I really respect what they have done from a technical perspective. They are the gigabit authority in my book."

So I was interested in learning more.

I attended a webinar and then later scheduled an interview. The webinar covered the technology in general and presented the [case study](#) of Lexington, Ky.-based WISP [QX.net](#), an ISP that evolved from residential dialup to business wireless. It was sponsored by [TESSCO](#), the wireless equipment distributor.

QX.net uses a combination of BridgeWave gear, which operates in 60 GHz and 80 GHz spectrum for point to point (PtP) shots (mostly backhaul), and then uses unlicensed gear for point to multipoint



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(PtMP) that operates in 5 GHz spectrum.

The equipment

BridgeWave's radios operate in two bands. The 60 GHz units operate in bands in the 57 to 64 GHz range that are license free. The problem with these bands is that they are very susceptible to both rain fade and oxygen fade. The maximum range of BridgeWave units in this spectrum is listed as one mile (but that could vary if your location is very wet or very dry).

The 80 GHz units operate in two bands, 71 to 76 GHz and 81 to 86 GHz with what the company calls "lightweight licensing," in which you have to register your link in an online database and pay \$75 for a 10 year license, but you don't get a license if you interfere with a pre-existing link. Jonathan Barker, CEO of QX.net, said that he's the only operator in Kentucky using the spectrum so the licenses come easy, and he likes the fact that subsequent users cannot degrade his links, which is an issue in the 5 GHz unlicensed spectrum. The 80 GHz units can have a range of up to 5 miles.

Radios in each category are available in several bandwidth versions: FE (Fast Ethernet) for 100 Mbps speeds, GE (Gigabit Ethernet) for 1 Gbps, AR (Adaptive Rate) that drops from 1 Gbps to 100 Mbps if there's a drop in signal level due to a very intense rain cell. X radios offer extended range with a larger antenna. U radios are upgradeable from 100 Mbps to 1 Gbps with a software key.

AES radios offer built in 256 AES encryption. Although the signals are on a tight beam and are therefore very secure, it can be easier to encrypt the signal instead of explaining to a customer that intercepting the beam would require physically breaking the line between the radio and receiver, both usually located far above the ground.

"If someone audits you, or if you have a breach," says Gregg Levin, BridgeWave senior vice president and chief marketing officer, "you want to be able to say that you're encrypted. We chose a price point, \$6,900 list, at which people say it's worth it. We wanted to sell to a market beyond those that have to buy it."

Of course, the tight beams of these high bandwidth radios are inherently secure. "It's easier to tap into a fiber conduit than into a beam."

Customers worry about latency, he says, but BridgeWave's hardware encryption only adds 2 microseconds of latency. Total latency over a link is 40 microseconds.

The field upgradeable units, Levin says, give BridgeWave an entry into bids where other 100 Mbps radios are cheaper, but BridgeWave's offers a path to grow.

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Selling the big links

Levin sees two situations that allow WISPs to sell fat pipes to businesses. The first is fiber replacement. There's no question that wireless is cheaper. Levin says that a GigE private network service can cost \$5,000 per month in the Bay Area (and is only available if fiber happens to run by the building). If it's a question of linking two buildings that have line of sight to each other, the up front price of a wireless link starts at a disadvantage, but the ROI is less than a year, he says.

In addition, he strongly recommends that ISPs sell their customers high bandwidth private LANs. You could choose to leave the connection to the internet to the existing monopoly provider and build the company an off-net gigabit LAN that will keep internal company traffic off an expensive WAN link.

The ILEC doesn't offer encryption, he adds, and the price of a box that handles encryption for a 1 Gbps link can be as much as the price of a pair of BridgeWave radios with encryption already built in.

When selling these services, it's important to point out how the customer saves money. Levin says that corporations with more than one office are often forced to duplicate their IT infrastructure in multiple buildings. But at gigabit speeds, there's no need for all this duplication. IT can function in one office. Furthermore, more complex client service applications become possible.

The details

You may have heard that BridgeWave's radios are impossible because at higher frequencies, attenuation grows exponentially. Levin explains that BridgeWave's radios have a tighter beam and higher gain. That's how lasers work, after all. A very tight beam allows directed light to travel much farther and with greater power



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than radiated light of the same power would.

Free Space Optics (FSO) is 0.1 degrees, Levin says. BridgeWave is .5 to 1.5 degrees. A radio in unlicensed 5 GHz spectrum might have a 12 degree beam.

If anything gets in the way of the beam, it breaks. On the other hand, the beam can get straight though some shots, such as between two buildings, that might block a wider beam.

Levin adds that tight beams allow multiple radios to coexist. "One of our customers has a tower with ten radios, and two frequencies are used for all ten radios. That wouldn't work at 5 GHz."

He adds that the larger quantity of spectrum at 60 GHz and 80 GHz allows BridgeWave radios to use lower order modulation. "We offer 1 Gbps full duplex, and we have 1.4 GHz of spectrum for each direction, plus a guard band."

At 11 to 38 GHz, Levin says, manufacturers need to use up to 512 QAM to over 100 Mbps out of 50 MHz of spectrum in each direction. He adds that some manufacturers put multiple radios in one box to obtain the speeds they need

Nevertheless, we point out, some full speed competition exists at lower spectrum. "Well, if you need to go ten miles, take theirs. If you only need one mile, take the gigabit radio!"

He says that as WISPs build out their networks, links between nodes get shorter, and BridgeWave becomes more useful, especially for WISPs building a ring architecture, instead of the traditional hub and spoke.

Pricing and availability

We cannot emphasize how **nifty it is** that the company's **pricing** is public. Prices at time of publication, with each price cited per link pair:

AR80	\$35,900
GE80	\$31,900
FE80XU	\$29,900
FE80U	\$26,900
AR60X-AES	\$36,800
AR60X	\$29,900
AR60-AES	\$30,800
AR60	\$23,900
GE60X	\$24,900
GE60	\$19,900
FE60X	\$18,900
FE60	\$14,900

Key:

GE: Gigabit Ethernet (1 Gbps)

FE: Fast Ethernet (100 Mbps)

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AR: Adaptive rate (1 Gbps where possible, able to drop down to 100 Mbps to maintain connection during rain)

X: Extended range

U: Upgradeable to 1 Gbps

AES: With 256 AES encryption

—End

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