

digital den



**A DIGITAL DEN
HANDS-ON PROJECT:
TESTING THE NEW
802.11A/G GEAR.**

Combo, please

By Maury Wright, Editor-in-Chief

WIRELESS-LAN (WLAN) technology—based on the various flavors of the IEEE 802.11 standard—continues to soar in popularity in roles from home networking to public “hotspot” access. Indeed, you can now get free WLAN access with your order at some McDonald’s restaurants. I’m not sure I’ll visit the venerable burger chain anytime soon, but based on recent tests with some of the latest 802.11 products, I’ll take a combo. New gear that supports both 802.11a and 802.11g offers the ultimate in flexibility.

I ran my latest series of WLAN tests using two notebook PCs, each of which I tested with two different WLAN interface cards. I used a Compaq Evo notebook (700-MHz Mobile Pentium III, 128 Mbytes of memory) and a Dell Latitude C610 (1-GHz Mobile Pentium III, 256 Mbytes of memory).

The Compaq system has an integrated 802.11b interface, which, as I discussed in an earlier hands-on report (Ref-

erence 1), links to the PC internally via USB, thus limiting the 802.11b data rate somewhat. To test 802.11a performance with the Compaq machine, I used a first-generation 802.11a PC Card from Actiontec (www.actiontec.com), which I first tried in a previous hands-on test (Reference 2).



Linksys's Wireless A+G access point.

With the Dell notebook, I used two products from Linksys (www.linksys.com): an 802.11b PC Card and one of the company’s brand new “a/g” combo cards, the Wireless A + G.

On the access-point side of the link, I used a Linksys 802.11b access point, which has an integrated 10/100 Eth-

ernet switch, and a new Linksys Wireless A + G access point.

For all the tests, I transferred a 60-Mbyte folder of files from a desktop PC on my network to each client notebook via the 802.11 link under test. With the “a/g” access point, I also performed tests at various distances to see how range impacted data rate. (You can find a table containing all of my bandwidth measurements with this article at www.edn.com.)

For purposes of comparison, I started by running my file transfer over a 100-Mbit/sec, full-duplex Ethernet connection, which yielded an effective rate of 22.7 Mbits/sec to the Dell system.

I next began the wireless tests by establishing baseline 802.11b performance using the Linksys 802.11b access point. The Dell system realized 2.6 Mbits/sec and the Compaq realized 2 Mbits/sec.

Having established this baseline, I disabled the wireless access in the 802.11b switch/access point and un-

AT A GLANCE

▶ New wireless-LAN gear that supports both the 802.11a and the 802.11g standards offers the ultimate in flexibility.

▶ According to my tests, the 5-GHz “a” technology still trails the 2.4-GHz “b” and “g” technologies when it comes to providing a usable data rate over longer distances.

▶ Despite range limitations and higher prices, I can’t imagine combo “a/g” products not dominating the market.

▶ No 802.11 wireless technology is adequate to support distribution of digital audio and video in the home, especially when you take range into account.

**WITH THIS ARTICLE AT
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**A table summarizing all the
bandwidth measurements.**

boxed the new Linksys Wireless A + G access point. Once I connected the dual-band product to the Ethernet switch, I was immediately able to access its configuration pages by entering a specified IP address into a browser on the PC I was using to perform the file transfers. I had planned on disabling the “a” radio while testing the “g” (and vice versa), but the access point doesn’t allow such choices, so I actually changed nothing in its configuration.

I first set out to measure “b” performance through the new access point. The 802.11g standard is a follow-on to 802.11b, which uses the same 2.4-GHz frequency band but specs a maximum data rate of 54 Mbits/sec. The “g” spec also provides backward compatibility for 11-Mbit/sec “b” products. My tests revealed that the new access point slightly improved “b” performance on the Compaq—from 2 to 2.4 Mbits/sec.

Next, I tested the “g” mode on the Dell system. The Linksys combo card comes with a utility that allows you to select “a,”

“g,” or “a/g” operating modes. The software appears to allow you to swap between modes on the fly, but I found that I had to restart the Dell system each time I wanted to change. And I found that in combo mode, the “a” flavor took precedence over the “g” flavor.

With the “g” connection, the Dell notebook experienced an upsurge in data rate to 5.8 Mbits/sec—a substantial increase, but lower than I had expected. As my 100-Mbit/sec Ethernet test reveals, real throughput always comes in far lower than maximum bandwidth, due to overhead in network protocols and inefficiency in the Ethernet media-access controller. Still, despite the 5× increase in raw bandwidth, the “g” test revealed a mere doubling in realized data rate. I suspect that the brand-new “g” spec and a first-generation “g” chip set deserve the blame for this poor showing.

I also tested “g” performance in two different modes that the access point allows: an 802.11g-only mode and a mixed mode, in which the access point can si-

multaneously service both “g” and “b” nodes. The user manual warned that the mixed mode would yield lower “g” performance. I found that simply enabling the mixed mode didn’t have a direct impact. However, when I powered up the Compaq “b” node, the “g” performance dropped to 4.3 Mbits/sec, even though the “b” link was idle. In other words, you can leave the mixed mode on and get penalized only when a “b” node is present.

Next, I moved on to test the 5-GHz, 54-Mbit/sec “a” mode, hoping to see whether the maturing technology could overcome the problems I saw when I first tested it about a year ago. And indeed, the “a” tests delivered impressive data rates: 8 Mbits/sec for the Compaq and 10.6 Mbits/sec for the Dell. These numbers were in line with my expectations based on the maximum bandwidth and my experience with realizable Ethernet data rates.

However, data-rate performance wasn’t the big problem in my earlier tests of 802.11a; first-generation “a” products

suffered from severely limited range. Happily, the new combo access point performed much better. The new Linksys "a" node showed almost no degradation at 30 feet, although performance dropped off dramatically at greater distances.

Surprisingly, the first-generation Actiontec "a" PC Card worked far better with the new Linksys access point than it

did with a first-generation access point. The Compaq with the "a" node was plenty fast at 30 feet and still usable at more than 40 feet.

Alas, the 5-GHz "a" technology still trails the 2.4-GHz "b" and "g" technologies in real usable range. At 65 feet from the access point, the Dell in "a" mode received an unusable 0.2 Mbits/sec. In "g"

mode it still enjoyed nearly 2 Mbits/sec at that distance. The data rate for the Compaq in "b" mode at 65 feet barely dropped, from 2.4 to 2.1 Mbits/sec, even though the meter showed a relatively weak signal.

Despite these range limitations, however, I can't imagine combo "a/g" products not dominating the market, even though users will pay a premium for them right now. I've argued often in the past that 2 Mbits/sec is more than adequate for most users. And that remains true for surfing the public Internet, on which congestion limits download speeds. Recently, however, I began using a VPN (virtual private network) link to my company's e-mail server. Private links like this can provide much higher bandwidth than the public Internet, thus making a faster WLAN beneficial. My e-mail-retrieval experience is far faster using "a" than using "b."

I expect that most public hotspots will also go for max rates and offer combo access points. For instance, the "b" access provided by T-Mobile in American Airlines lounges has gotten slower as the number of users has grown. A faster raw rate translates directly into supporting a greater number of users at reasonable rates.

What I hoped that I could report based on these tests—that new WLAN technologies could support home video distribution—will have to wait for another speed upgrade. As Special Projects Editor Matthew Miller reported recently (**Reference 3**), we still need a multimedia-capable network that can distribute digital audio and video in the home. Pro-

ponents claim that 802.11 will deliver that ability with no new wires. But even the recent improvements in WLAN products leave real-world data rates too low for video, especially when you take range into account. □

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