



Boost Weak Cell Service at Home: Your Options

Even the best wireless networks often can't deliver a consistent signal inside your house. Femtocells and repeaters will usually help, but they'll cost you.

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Verizon Wireless's ["Dead Zone" ads](#) may be creepy, but they capture the essence of a problem familiar to many cell phone users: When you're indoors, even within your carrier's coverage area, the network's signal sometimes simply isn't strong enough to support voice calls or data services. A slew of products now address the problem--but they don't come cheap.

The signal-boosting products generally fall into one of two categories: femtocells or signal repeaters. Both types of equipment can deliver strong signals within buildings, but they work in fundamentally different ways.

Femtocells act as miniature cell phone towers that connect to a home network router and use your wired broadband connection to move voice calls and data services to and from your carrier's network. Femtocells don't rely on the carrier's towers at all, but because they use technology that can direct data and calls back to the carrier networks over the Internet, most of them are sold by the carriers themselves.

Repeaters and boosters, on the other hand, amplify and rebroadcast cell tower signals. Since they don't require carrier support, they tend to be manufactured and sold by third parties such as Wi-Ex (under the brand name ZBoost) and Wilson Electronics.

Femtocells

While repeaters have been around for several years, femtocells are relative newcomers to the mobile scene. Of the four major U.S. carriers, two--Sprint and Verizon--have been selling femtocells (under the brand names [Airave](#) and [Network Extender](#), respectively) for the past year or so.



AT&T's 3G MicroCell, made by Cisco. Image: AT&T

AT&T, which has been conducting trials in several areas, announced at the recent CTIA mobile telecommunications trade show that it will begin widespread commercial deployment of its [3G MicroCell](#) femtocell this month.

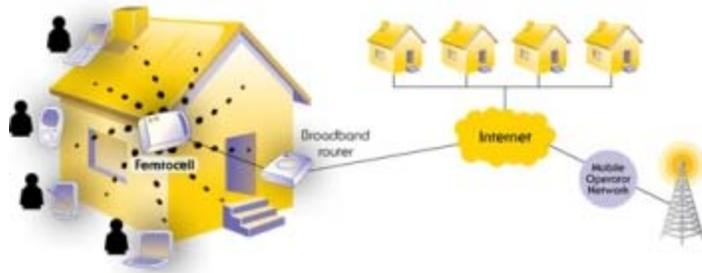
Sprint charges \$100 for its Airave hardware plus a \$5 a month for service. It also offers a couple of optional unlimited calling plans, ranging from \$10 to \$20 per month, for calls made via the Airave service--options that might appeal to people who are considering dropping their landline voice services. Verizon Wireless charges \$250 for its Network Extender, but it imposes no monthly service fee. AT&T sells the MicroCell for \$150, also with no mandatory service fee, though the carrier does offer an optional \$20-a-month unlimited calling plan plus price breaks for customers who also sign up for the company's DSL service.

Femtocell Strengths

Femtocells appeal to consumers and carriers on several levels. Consumers like them because they provide immediate five-bar coverage across an area of up to 2500 square feet--regardless of how far you are from a cell phone tower.

A strong signal typically means better voice quality, fewer dropped calls, and faster data speeds (to the extent that the femtocell supports data services; right now, only AT&T's MicroCell has 3G support). Good signals also improve a phone's battery life, since its radios don't have to work as hard.

Another benefit: You can configure the femtocell to recognize and prioritize the phones you authorize, so neighbors can't mooch off your service at your expense. (Femtocells typically don't support an unlimited number of simultaneous users: Sprint's FAQ says Airave supports a maximum of three calls at a time.)



Femtocells are low-power wireless access points that operate within a licensed spectrum to connect standard mobile devices to a mobile operator's network via residential DSL or cable broadband connections. Image: Femto Forum

Interestingly, Verizon Wireless's FAQ for its Network Extender says that, though you can prioritize up to 50 Verizon Wireless numbers, the device will remain available to all Verizon Wireless subscribers within range when priority numbers aren't using it.

This brings us to a big reason why [carriers like femtocells](#): They offload some of the expense that the carriers might otherwise incur in order to expand network capacity and/or coverage--or to avoid losing customers in locations where they couldn't significantly improve reception on their own (such as basements, suburbs that don't want new cell towers, locales with difficult topography such as steep hills and valleys, and skyscrapers with thick walls). In fact, forum posts indicate that Sprint has occasionally given customers Airave units to forestall them from switching to another carrier.

Femtocell Weaknesses

Femtocells that carriers sell have some limitations. For starters, Sprint and Verizon femtocells support only 2G data speeds, though most observers expect them to introduce new versions with support for their [3G EvDO networks](#) later this year. Similarly, the IDEN network technology that Nextel uses doesn't have femtocell support.



You can use a femtocell only at the address where it is registered; and to enforce that restriction, the FCC stipulates that all femtocells must be equipped with GPS receivers, and either placed close enough to a window to receive GPS signals directly, or connected to a GPS antenna that can pick up the signals.

David Nowicki, marketing vice president for femtocell vendor Airvana and for the [Femto Forum](#) trade association, says the FCC imposed the location restriction to enable carriers to track the femtocell's position and disable its operation in areas where the carrier doesn't own the frequencies that the femtocell supports and where, consequently, using the femtocell might interfere with another carrier's network.

(A femtocell's awareness of its location isn't necessarily a bad thing. Coupled with the device's ability to recognize when an authorized phone is nearby, it could enable carriers to offer customers additional services that go beyond improving reception. For example, Nowicki says that NTT DoCoMo customers in Japan can pay for a service that notifies parents when their child's phone connects to a femtocell at home.)

Unfortunately, forum posts suggest that femtocells sometimes hurt neighbors' regular network reception when deployed in close proximity.

Network handoff issues are another concern. [Sprint's Airave FAQ](#) (PDF) says that a call started on Airave can be handed off to the regular Sprint network as you leave the Airave's coverage area (if the network signal is strong enough), but that calls initiated on the regular network can't be handed off to Airave.

And finally, critics complain about having to pay for a product and a service that essentially deliver what the wireless network is supposed to have provided all along. "It's a fair point," Nowicki said. But carrier spokespeople say that no carrier can provide coverage in all locations of its service area. Verizon Wireless spokesperson Thomas Pica described the Network Extender as a "niche product," given that the vast majority of Verizon customers don't need one because of the carrier's robust network.

What about the broadband ISP that now gets to carry the wireless carrier's traffic? Nowicki says that the bandwidth consumption of mobile devices is tiny compared to that of most home and office networks, so femtocells don't impose a significant burden on the ISP, which in some cases is run by the same company as the mobile carrier anyway.

T-Mobile's Approach

The fourth major national carrier, [T-Mobile](#), has taken a different approach to improving weak cell signals: It's Even More plans offer Unlimited Hotspot Calling using UMA (Unified Mobile Access) technology to route calls over Wi-Fi hotspots (including home networks) seamlessly. This works only with phones that support both T-Mobile's GSM/GPRS wireless network and Wi-Fi; qualifying models include T-Mobile's extensive BlackBerry lineup. T-Mobile has no announced plans to introduce femtocells.

One third-party vendor has said that it will sell a femtocell product without carrier support. MagicJack's upcoming [FemtoJack product](#) is essentially a USB dongle that communicates with cell phones over carrier frequencies and then moves traffic to and from the mobile carrier over the user's broadband ISP's network.

Because the carrier isn't involved, the FemtoJack can't directly talk to the mobile network. Instead, it reportedly uses some kind of forwarding to route calls to a new number, which then completes the call or data transaction. I was unable to track down a MagicJack official for details on exactly when the product will launch or how it works; published reports quote company officials as saying it will cost \$40, with a service charge of \$20 per year.

Though the FemtoJack will operate on frequencies that carriers own, MagicJack officials have been quoted as saying that the device doesn't infringe on carrier property because it's designed to run within a home--and the airwaves within a home belong to the homeowner or renter. It's not clear how this argument will play out after the product arrives.

Repeaters and Boosters

Repeaters (also called "boosters"), the other class of products designed to improve poor cell reception, depend on at least a weak cell tower signal to amplify and rebroadcast. They work with specific frequencies, independent of carrier; some support more than one frequency. On the frequencies they support, repeaters improve both voice calls and data speeds.

What's in the Box



The Wi-Ex ZBoost repeater kit includes a signal antenna (for outside reception), a coaxial cable, a power supply, and a mountable base unit. Image: Wi-Ex

Many repeaters have multiple parts. There's an antenna, which you place as close as possible to the strongest cell tower signal--typically, near a window or even outdoors. The antenna transmits signals over a cable connected to an amplifier, which boosts the signal and retransmits it indoors. In some cases, the amplifier and indoor antenna are integrated; in others, the amplifier hooks up to a separate, centrally located indoor antenna in the home or office. The area of coverage depends on the strength of the amplifier and of the signal being amplified.

Unlike femtocells, repeaters can't be configured to recognize specific phones. Consequently, the amplified signals benefit any mobile device within range that operates on the supported frequencies--though obviously the owner's devices are more likely to benefit than a neighbor's devices located farther away from the indoor antenna. It's up to you (with the help of your reseller) to ensure that your repeater kit amplifies the frequency or frequencies that your carrier uses in your area. You can get help in choosing the right repeater kit from specialty retailers such as wpsantennas.com or RepeaterStore.

Price Considerations

Repeater kits can be more expensive than femtocells. Pricing depends on how large an area you want to cover. Wi-Ex's ZBoost line includes SoHo products that range in price from \$169 to \$399, and you can

spend up to \$600 for kits that cover areas larger than the 2500 feet handled by femtocells. On the other hand, Wi-Ex marketing vice president Sharon Cupett notes, there are no monthly fees for repeaters--and of course, no broadband service is involved.

Though repeaters rebroadcast over carrier-owned frequencies, they are legal if they don't interfere with cell tower signals (which is why repeater signals have limited strength). One way to avoid problems is to look for FCC-certified repeaters; some are still awaiting approval, however. Check with the reseller.

Repeater vs. Femtocell

Should you get a repeater or a femtocell? Right now, Sprint and Verizon Wireless smartphone users are better off with repeaters because current femtocells don't support 3G data. Similarly, Nextel users should look for IDEN repeaters, because that network doesn't support femtocells.

We'll have to wait to see how well AT&T's 3G MicroCell performs; but if it works as promised, it could be a good match for iPhone customers who don't want to pay \$300 or more for equivalent repeater coverage. In general, femtocells promise good coverage without a lot of the antenna-positioning hassles that repeaters entail. You do need a GPS signal, but those are available pretty much everywhere; cell tower sites with signals that repeaters can work with are probably less common.



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