

how it works

WITH MOST OF THE ADULT POPULATION CARRYING CELL PHONES, EFFORTS TO RESTRICT THEIR USE FOR SAFETY REASONS OR JUST COMMON COURTESY HAVE FALLEN ON BOTH SIDES OF THE LAW.

Jam that ringing cell phone?

By Warren Webb, Technical Editor

CELL-PHONE USE has grown astronomically over the past decade. The Cellular Telecommunications and Internet Association estimates that there are more than 135 million cell-phone subscribers in the United States alone; other estimates have placed worldwide users

at more than a billion. Along with the convenience of instant communications, cell phones have brought plenty of controversy. Opponents cite privacy, security, safety, and even tranquility issues in their call for regulations and electronic technology to limit cell-phone use in certain situations or locations. Moviegoers, restaurant patrons, and travelers have long complained of ringing phones and rude cell-phone users disturbing their peace and quiet.

In addition to their being annoying, cell phones are associated with several safety issues. Driving an automobile while talking on a mobile phone is the most visible example and raises the most concern. A recent Harvard Center for Risk Analysis study linked cell-phone use to as many as 2600 fatalities and 1.5 million accidents per year. New York state has banned the use of handheld cell phones while users are driving, and several other states are considering similar measures. Accident victims have also sued and won cases against employers when employees are at fault because they were driving while using cell phones.

Federal regulations prohibit mobile-phone operation aboard aircraft to prevent interference with navigation instruments. Likewise, there are posted restrictions on transmitter operation near gasoline pumps and blasting zones. A Mayo Clinic study

finds that cell phones might interfere with sensitive operating and diagnostic medical instruments. Cell phones also bring up security and confidentiality issues. For example, phones hidden in meeting rooms or government facilities may leak sensitive information or trade secrets. Gambling casinos want to restrict cell phones to reduce cheating, and prisons want to stop communications to increase security.

Although most of these activities have legitimate reasons to stop cell-phone use in a limited area, only a few ways exist to stop RF transmissions. The most common approach is simply to ask users to voluntarily turn off their phones. Facilities can also screen or electronically sense RF signals to guarantee a transmission-free area. Although it does not eliminate RF transmissions, electronic jamming stops all cell-phone activity in a limited area. Unfortunately, the practice is illegal in the United States and most of Europe. Federal Communications Commission regulations prohibit you from operating, owning, manufacturing, marketing, or offering for sale any device that intentionally interferes with any RF transmissions. These activities are punishable by an \$11,000 fine and as much as a year in prison.

TOWER TALK

You can understand how electronic jammers and detection devices operate with a little background on cell-phone basics. Each cell-phone company divides coverage areas into 5- to 10-square-mile cells with base-station antenna towers at their center. Each carrier is allocated channels within frequency bands set aside for cell phones. In the United States, the AMPS (Advanced Mobile Phone System) and PCS (Personal Communications Services) systems use hundreds of channels for digital and analog sig-



Figure 1

The Taiwanese WAC1000 wave-deactivator cellular-phone jammer suppresses mobile-communications activity inside a 50-ft-radius sphere.

nals in the 869- to 849-MHz and 1930- to 1990-MHz bands. Most cell phones in Europe, Africa, and Asia operate on the GSM (Global System for Mobile communications) system in the 935- to 960-MHz and 1805- to 1880-MHz bands. Although the frequency bands support fewer than 1000 channels, phone systems can accommodate millions of conversations by reusing channels in nonadjacent cells. When you turn on a cell phone, it continually scans for the strongest signal from the nearest base-station tower. If the phone cannot locate a tower, it displays an out-of-service indication.

Brute-force jamming kills cell-phone operation by overpowering the signal from the base-station tower. Although cell phones can change channels or increase their power to overcome interference, typical electronic jammers cover all of the channels for a specific system. A more intelligent jamming system is harder to detect, because it provides an interfering signal just long enough to disable communications, and then shuts down. Because users cannot tell whether their phone is being jammed or is simply out of range or blocked by building characteristics, illegal electronic jammers may continue to operate without complaints from the general public.

Special Electronic Security Products of Israel produces a series of cell-phone jammers with a range of 9m to 1 km. Customers can select any worldwide cellular frequency band or a combination of them. The vendor's smallest device, the Ctn101, is battery-powered and fits into a briefcase or purse. The top-of-the-line CTN106 requires a 19-in. rack-mount package and jams large areas, such as prison compounds and military installations.

Hubgiant, a Taiwanese company, produces several versions of its WAC1000 wave-deactivator cellular-phone immobilizer (**Figure 1**). These small, battery-operated devices cover a sphere with a radius of approximately 50 ft and can cover one or multiple worldwide cell-phone bands. The device output power is 10 to 20 dBm (10 to 100 mW) for each frequency band. Although its operation is illegal in the United States, Hubgiant's Model WAC1000A covers the 800- and 1900-MHz bands. Netline of Israel offers the \$6500 C-Guard HP, a ruggedized, portable, weatherproof jamming system built into a hardened carrying case (**Figure 2**). Netline suggests applications in prisons, bomb squads, military bases, and police forces. With an effective jamming range of 20 to 1000m, depending on base-station-signal strength at the site, the C-Guard HP can eliminate cellular communications over a wide area.

CELLULAR DISTRACTION

Cell Block Technologies of Fairfax, VA, has proposed a novel technique for blocking cell-phone use

in a limited area. Although the company has no products for sale, Cell Block proposes to simulate a base-station tower and distract the cell phone from establishing communications with a real base station. Once the Cell Block control unit establishes communications with the phone, it instructs the phone to go to a channel that is not active in that cellular system. This action prohibits the phone from receiving communication from the original system's base station. Although it does prevent communications within range of its transmitter, the company claims that its device does not interfere with—but rather intervenes in—communications. No one has tested this theory in

court. Uniquely, Cell Block proposes to monitor the strength of the base-station signal and adjust the signal level of its device to ensure a constant effective range.

Although people often think of jamming as the only way to stop cell-phone abuse, several companies offer alternative electronic products to help restrict wireless communications. Bluelinx offers Q-zone, which silences Bluetooth-based cell phones within 10m of a Bluelinx node. When a mobile phone enters a designated quiet zone, its ring volume changes, depending on its specifications. For example, one type



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Figure 2

Netline's high-powered C-Guard HP has an effective jamming range of 20 to 1000m, depending on base-station-signal strength.

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of phone may switch to vibrating mode, another may ring at a much lower volume setting, and a third might divert callers to voice mail. Once it leaves the quiet zone, the phone seamlessly reverts to its previous volume settings. Bluelinx nodes cost about \$500 (Figure 3).

Cell-phone detectors are another legal alternative to jamming. Passive devices can scan the cellular-frequency bands and sound an alarm or flash a light when they detect a cell-phone signal. Enforcement or restricted entry is then up to the establishment.

Zetron offers the Cell Phone Detector Plus, a small, wall-mounted, receiver-only device that searches for nearby transmissions in the mobile-phone or two-way-radio spectrum (Figure 4). The unit covers 400 to 2000 MHz and delivers a voice message along with local and remote alarms. You can adjust the device's sensitivity to cover a



Figure 3 The Q-zone uses Bluetooth communications to signal compatible phones to switch to vibrating mode when they are in a quiet zone.

sphere with a 2 to 30m diameter. Probably the simplest legal way to eliminate all cell-phone activity in an indoor space is to line the area with grounded metal mesh to create a simple Faraday cage. This shield blocks RF transmissions into and out of the space.

The technology is available for even more widespread regulation of cell-phone activity. For example, the government requires location information for its E911 program to be available in all cell phones by 2005. Thus, carriers could prevent cell-phone

operation within certain “quiet zones” and simply route all of the subscriber’s calls to voice mail or at least switch the phone to vibrating mode. Even though some of these futuristic approaches are possible, it seems that good manners could eliminate many cell-phone complaints. □



Figure 4

The Cell Phone Detector searches for transmissions in the 400- to 2000-MHz spectrum and issues voice warnings along with remote alarms.