ITT

Detecting and Locating Cell Phones in Correctional Facilities

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The Cell Phone Problem

In recent years, there has been growing recognition of the problem of contraband cell phones inside correctional facilities. These phones can be used to operate both internal and external criminal enterprises, threaten witnesses, harass victims, orchestrate uprisings, and undermine prison security by coordinating the activities of separated inmates.

Advances in compact wireless devices and high-bandwidth data services also pose an increasingly significant problem. A single individual could upload large quantities of data or photos using a cell phone smuggled into a correctional facility.

A need clearly exists to monitor and control cell phone use within correctional facilities. What are the requirements for an effective solution?

Requirements for an Effective Solution

A successful, practical cell phone monitoring and control system must:

- Cover all types and brands of cell phones and all available networks
- Detect and locate voice calls, text and picture messages, and data sessions
- Cover the entire region of interest
- Not generate nuisance alarms due to legitimate phone use in nearby areas outside the controlled space
- Not interfere with legitimate phone use
- Provide continuous, ongoing, real-time coverage to capture phones as they are introduced and before they can be moved or hidden
- Have a reasonable cost
- Not require court orders for use
- Fully comply with all FCC regulations
- Be operable by minimally-trained personnel
- Allow monitoring of the entire facility from a central location

Possible Solutions

Now that the core requirements have been identified, we consider possible solutions.

Physical Search

Many facilities rely on physical search using metal detectors or other techniques to prevent the introduction of contraband cell phones. Unfortunately, this approach is not 100% effective and might also be compromised by persons tempted by the high prices commanded by the devices. Furthermore, cell phones can be thrown over a fence or be smuggled in by other means that bypass physical search entirely.

Nonlinear Junction Detector

These devices detect semiconductor devices by illuminating objects with a powerful radio frequency (RF) signal and looking for specific characteristics in the reflected signal. The detector is typically held within a few inches of the device being scrutinized. Although these are useful for searching for phones hidden in everyday objects, the technology is not well-suited for use over a large region.

Jamming and Shielding

Cell phones must transmit and receive RF signals in order to operate. This suggests the possibility of jamming these RF signals. However, jamming is illegal in the U.S. and many other countries, even when confined to privately-owned spaces or secure facilities.

Shielding might be used to block RF signals from the area of interest. Effective shielding, however, is expensive and requires maintenance. It is also difficult to determine if shielding has been compromised or sabotaged without expensive regular testing.

Network Provider Location-Based Screening

Cellular providers could, in principle, be required to block calls to or from handsets within specific forbidden geographic regions. Although location information is available through E911 systems, the accuracy may not be good enough to reliably discriminate between forbidden and legitimate usage areas. This solution could also involve significant infrastructure costs for the network providers with no financial return. Legislation forcing the providers to implement such a solution is unlikely.

RF Detection

As we have seen, blocking or jamming cell phone signals is difficult, expensive, and/or illegal in many situations. A more practical means of controlling cell phones involves detecting their RF signals, followed by confiscation or other intervention.

There are a number of simple cell phone RF detectors on the market. These are typically intended for use in a small area, such as a conference room. Many of these devices are technology-specific and only work with certain types of phones. For example, GSM (used by Cingular and T-Mobile and others in the U.S.) is the world's foremost cellular standard and is therefore supported by a number of detectors. However, fewer detectors work with the CDMA standard (used by Verizon and Sprint and others in the U.S.) or the iDEN standard (popularized by Nextel). The latter two standards are deployed primarily in North America with limited adoption elsewhere.

Another limitation of detection-only schemes is that they provide little or no indication of where the phone is located other than "near" the detector. To cover a large facility such as a prison, simply placing a number of independent sensors throughout the facility is not an efficient solution. Such a system cannot provide monitoring from a central location. Simple detectors may also generate false alarms due to permitted phone use in nearby spaces such as parking lots or sidewalks.

The EVI Solution

None of the alternatives considered above offers a completely satisfactory solution to the cell phone problem. The EVI cell phone detection and location system was developed to address the shortcomings of the other methods.

The system is based on technology developed for the U.S. Government. The system not only detects the RF emissions from a cell phone, but also uses proprietary software to determine the phone's location. The system is fully compliant with all FCC regulations and does not require any licenses, court orders, or warrants for operation. The system detects and locates any type or brand of phone used on any cellular network.

The system uses a network of sensors distributed throughout the monitored area. The sensors are controlled by a central computer. Proprietary software analyzes simultaneous readings from the sensors to determine the location of any active phone. The system uses proprietary techniques to avoid nuisance alarms due to phone use in nearby public areas – such as parking lots – that could fool a detection-only system. The location is displayed on

a facility map to allow appropriate action, including camera surveillance, lockdown, and/or confiscation of the device.

How Many Sensors are Required?

Detection Range

In order for the system to detect and locate cell phones throughout the region of interest, one or more sensors must be located within detection range of any point in the region. Typical detection range for a sensor in an indoor prison environment is about 50 – 100 ft. In outdoor locations, the typical detection range is about 300 ft.

Location Accuracy

The location accuracy is affected by a number of factors, including details of the facility construction, the orientation of the user's head in comparison to the cell phone antenna, etc. Generally, the estimated location is more accurate when more sensors are within detection range, because this gives the system more measured data to process. The table below shows typical location accuracy for several example cases.

Covered Area	Number of Sensors in Area	Accuracy
100 x 100 ft = 10,000 sq ft	4	25 ft
400 x 400 ft = 160,000 sq ft	4	100 ft
400 x 400 ft = 160,000 sq ft	16	25 ft
1000 x 40 ft = 40,000 sq ft	10	20 ft

Typical Location Accuracy

Note that more sensors provide better results for a given coverage area. This allows the system to be tailored to provide better location accuracy in regions where phones are more often used and/or more easily concealed, such as cellblocks, while other areas can be monitored with fewer sensors to optimize the cost/benefit ratio for the installation.