Detect & Locate Contraband Cell Phones

An alternative to cellular jamming

Hirayr M. Kudyan
BVS Senior Hardware Designer

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The advent of the cell-phone technology with the relentless push towards micro-miniaturization of devices increases the temptation to exploit and mis-use this technology for illegal purposes. Consequently, a very real need exists today, for individuals, businesses, institutions and the government to take measures to detect and identify the unauthorized use of cell-phones within the bounds of their controlled premises and facilities.

Berkeley Veritronics Systms, Inc. (BVS) of Metuchen, New Jersey has developed a product addressing this very need. Sources detected by fixed sensors configured via a facility-wide Local Area Network (LAN) may be detected by BVS's hand-held mobile sensor (ie, the Wolfhound Cell Detector unit) for locating and identifying at close range in a given region of a controlled facility. The Wolfhound Cell Detector unit may be used by itself or in combination with other Wolfhound Cell Detector units, independently of each other. The Wolfhound Cell Detector is currently available from BVS as a stand-alone kit, seen in Figure 1. (receiver unit, AC adaptor, earbuds, omnidirectional antenna, direction finding antenna and case).

Figure 1.Wolfhound Cell Detector Package

How It Works

The Wolfhound Cell Detector sensor unit is a multi-band receiver controlled by an on-board processor to sequentially scan up-link channels for GSM, CDMA, WCDMA and PCS cell phone activity. The Wolfhound systematically covers all the bands of specific frequency ranges allocated to cell phone signals listed in Table 1:

GSM	890-915 MHz
CDMA	824-849 MHz
WCDMA	1920-1980 MHz
PCS	1850-1910 MHz

Table 1. Frequency Bands Allocated to Cell Uplink Channels

The Wolfhound receiver uses a square-law detector and can detect RF power in multiple cell phone channels simultaneously. Once cell phone activity is detected in one or more uplink channels, the receiver will output the signal strength (proportional to the RSSI of the detector) via one or more of the following indicators:

1. the LED signal level indicator
2. audible alert (speaker or earpod)
3. vibrator alert

To be detected, a cell phone has to be in either active or idle mode. When the cell phone is powered off or disconnected from its battery, it will not transmit significant RF energy, hence it cannot be detected. When powered up, a cell phone must perform a "Location Registration" operation with the Base Station (BS) serving the cell it is located in. This requires a burst of high-level RF energy because the BS has to be able to distinguish and detect the new cell phone's transmission in its existing domain. When the cell phone is registered and in active use, it will be radiating RF energy in

its assigned frequency band, hence it will be detected by the Wolfhound Cell Detector receiver regardless of whether used for Voice, Data (with data cards) or for Texting(SMS). If the cell phone is not in active use but just powered up or between calls (i.e., in Idle Mode) it will still be detected by the Wolfhound Cell Detector because it must intermittently re-transmit its "Location Update" data to the BS .

Wolfhound Cell Detector may be deployed in various conditions, using one of the antennas included in the package. For simply monitoring cell phone use, the omnidirectional antenna is recommended. For pursuing and locating a specific cell phone being used, the directional antenna has to be used. In all cases however, its use may be classified into one of the following typical scenarios:

a) Outdoors - No Obstructions between Source and Receiver & No Reflecting Boundaries

In this scenario the laser-assisted Direction Finding (DF) antenna used with the Wolfhound Cell Detector will guide the user to the source with minimal ambiguity because there are no significant reflecting surfaces to create interference patterns. The detected signal level will be determined mainly by the distance from the source and the transmit power level of the hand set (see Fig.2).
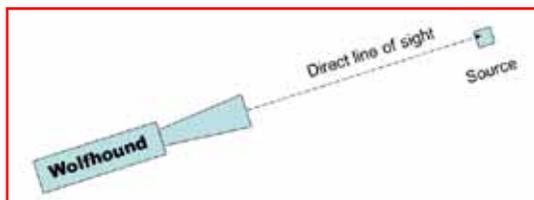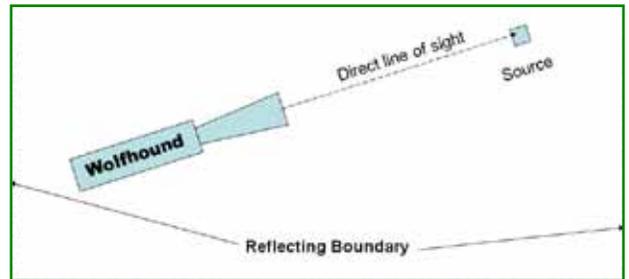

Figure 2. Scenario One

b) Indoors - No Obstructions between Source and Receiver & Reflecting Outer Boundaries

The reflecting boundaries enclosing the indoors space implies that the source is partially shielded from the Base Station by these reflecting boundaries (see Fig.3). The outer boundaries cannot shield the signal completely because of the existence of windows or other openings with at least one dimension that exceeds half a wavelength of the carrier frequency of the signal. Therefore, to maintain the link with the Base Station, the hand set will automatically raise its uplink signal level. This will make it easier for the Wolfhound Cell Detector to detect the uplink signal radiated by the hand set. Wolfhound Cell Detec-

Berkeley Varitronics Systems, Inc.
255 Liberty Street, Metuchen NJ 08840
1-888-737-4287   +1 732-548-3737
www.bvsystems.com   sales@bvsystems.com

tor may still be used with the DF antenna as long as the user is pointing it away from the reflecting boundaries, in order to avoid possible reflections and to maximize line-of-sight source exposure.

Figure 3. Scenario Two

c) Indoors - Obstructions between Source and Receiver & Reflecting Outer Boundaries

The existence of obstructions and reflecting boundaries enclosing the indoor space (see Fig.4) would cause the cell phone to raise the uplink signal level to high levels. Also, due to the scattering of the source signal by the obstructions one would expect diffraction patterns between adjacent conducting objects around corners and standing wave patterns supported by the reflecting surfaces bounding the inner space. If the cell phone is used in a room with a door and a small window, as long as a link is established and maintained with a Base Station outside, some of the carrier RF energy will leak out via apertures on the door as well as around the air gap of the door (even if it is made of metal) . Wolfhound Cell Detector will detect the hand set uplink channel with either type of antenna. Nevertheless, the user will still be able to locate the source by "tracking" maximum output from the Wolfhound Cell Detector.
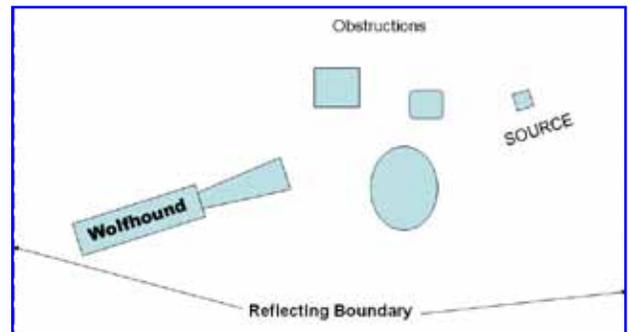
Figure 4. Scenario Three

Summary of Capabilities

Radius of Coverage Area
0-50 feet
Receiver Sensitivity
-60dBm
Receiving Modes
High-Speed Scanning
Multi-Band, Direction Finding Antenna
Receiving Antennas Supported
Direction Finding (3"x 4" with SMA port)
Omni Directional