CELLPHONE DETECTOR WOLFHOUND™

Manual version 1.5

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PLEASE NOTE: All Bloodhound references and images refer directly to your Wolfhound unit. The product has changed from Bloodhound to Wolfhound only in name. All features remain the same.

INTRODUCTION

The Wolfhound cell phone detector unit is a multi-band receiver controlled by an on-board processor which continuously scans up-link channels for multiple air interface technologies and frequency bands, in North America, the European Union, Asia and Australia.

The Wolfhound comes in two versions. One of them is for North American and the other for European/Asian/Australian frequency bands as summarized in Table 1:

Table 1. Frequency Bands for the two versions of Wolfhound

Air Interface	Frequency Band (MHz)
North America	
GSM-850, GSM-900, CDMA, Cellular	824-849
	890-915
GSM-1900 / PCS-1900	1850-1910
E.U./Asia/Australia	
E-GSM-900	880-915
GSM 1800 (DCS-1800)	1710.2-1784.8
WCDMA/UMTS	1920-1980

The Wolfhound receiver uses a square-law detector. It can detect RF power in multiple cell phone channels simultaneously. The receiver output is proportional to the output of the detector, which is used to drive one or more of the following indicators:

1. LCD signal level indicators
2. Pulsating Laser beam (optional accessory)
3. Sound Alert (speaker or ear bud)
4. Vibrator Alert

The Wolfhound unit may be used in the hand-held mode either with an Omnidirectional antenna (see left side of Figure 1 below) for only detecting cell phone use, or with a Direction Finding (DF) antenna (see right side of Figure 1) for identifying the relative orientation (i.e. Line Of Position) of a radiating cell phone. Either antenna interfaces with the Wolfhound unit via the coaxial port located at the LCD end of the unit as seen in Figure 1 :

Figure 1. Wolfhound Hand-Held Unit used with the Omnidirectional or Direction Finding Antennas

Items Supplied

Figure 2 shows a photograph of the Wolfhound unit and its accessories as shipped:

Figure 2. Wolfhound unit and accessories

The Wolfhound package includes the following items:

Wolfhound unit
VELCRO hand strap
Ear bud
AC Charger
Bracket-mounted pulsed green Laser
Omnidirectional monopole antenna
Direction Finding (DF) Antenna assembly with Laser module
Pelican® briefcase (with secure lock and keys)

WOLFHOUND UNIT DESCRIPTION

A photograph of the Wolfhound unit appears in Figure 3. The unit has an LCD, two LED lights, three electrical interfaces (Antenna, Audio and DC Power) and a 7 button keypad:

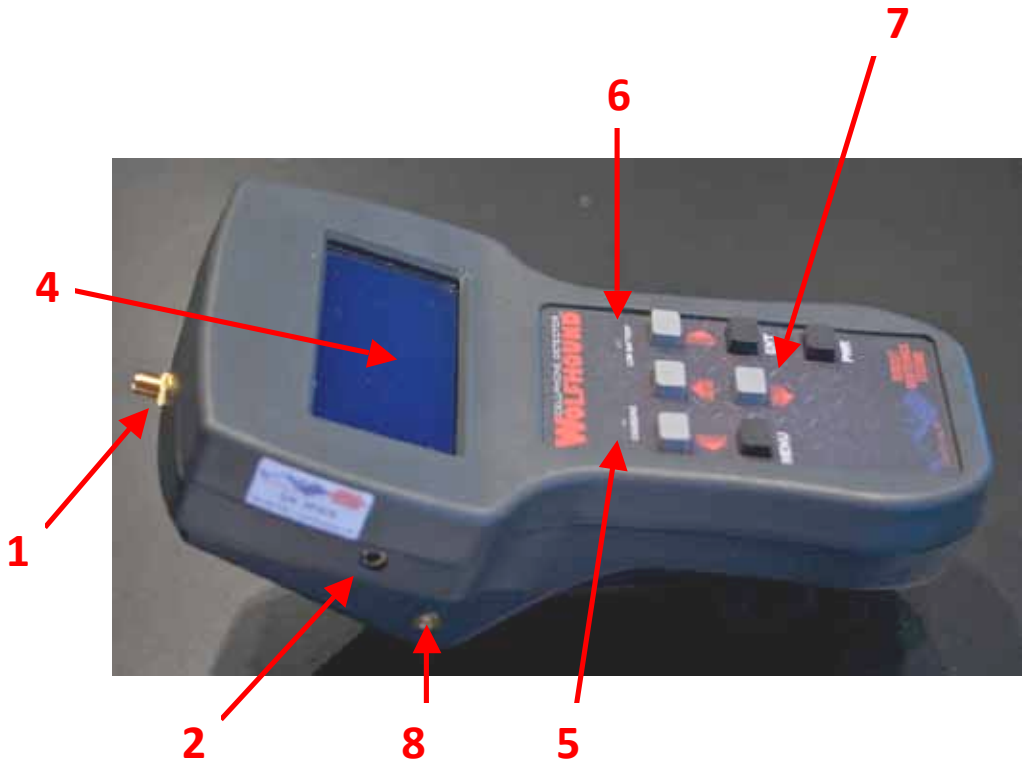


Figure 3. The Wolfhound Unit, Controls, Indicators and Interfaces

1. Antenna port
2. Audio (ear bud) jack
3. DC Power jack
4. LCD
5. Charging LED
6. Low Battery LED
7. Keypad
8. Laser jack

Liquid Crystal Display (LCD)

The Wolfhound unit is powered by pressing the "PWR" button on the unit keypad. When the unit is powered-up, the LCD display will show the top-level monochrome screen shown in Figure 4, which will be referred to as the "Monitoring Screen" in the rest of this manual. (i.e., the Wolfhound unit icon, the graduated bar-chart and the battery status indicator on the lower right hand corner, as well as the laser, audible alert and vibrating alert icons when one or more of these are activated).

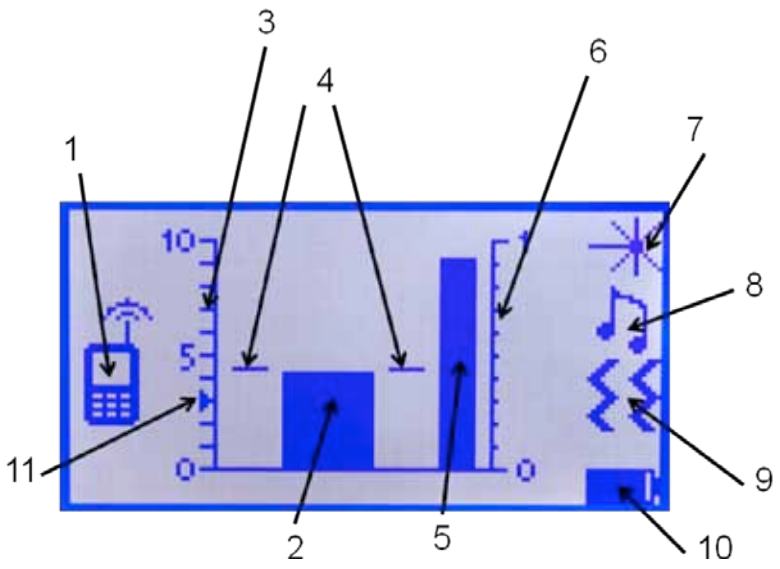


Figure 4. Wolfhound LCD Monitoring Screen fields

The following is a complete list of items that may be displayed at any time on the unit LCD display (see Figure 4):

1. Wolfhound Icon (will be displayed as long as coarse signal level exceeds pre-set value of the Threshold Level indicated by the triangular marker (11) in Figure 4)
2. Detector Output Coarse bar-chart
3. Coarse bar-chart scale (0-10)
4. Coarse Scale Maximum Hold marker (_ _)
5. Detector Output Sensitive bar-chart
6. Sensitive bar-chart scale
7. “Laser ON” indicator
8. “ Sound ON” indicator
9. “ Vibrator ON” indicator
10. “Battery Status” gauge
11. Marker indicating Threshold Level setting for Wolfhound Icon and Vibrator activation.

"CHARGING" LED (steady Blue)

When the Wolfhound unit is not powered by the AC Adaptor/Charger, the unit runs on an internal pair of Lithium Ion-Polymer batteries. When these batteries are in charging mode this indicator light will turn on (steady Blue). The light will go off when the unit batteries are in the fully charged state. The unit may be turned on while the batteries are being charged by the AC Adaptor/Charger.

"LOW BATTERY" LED (blinking Red)

When the AC adaptor/charger is connected to the unit or the batteries are charged this light will be out. This LED indicator will turn on (blinking Red) and stay so when the charge held by the unit batteries has fallen below a pre-determined fraction of full capacity but not fully discharged. If the unit is used beyond this point without charging, the unit LCD will display the warning message: "**Battery Critically Low Shutting Down**" and the unit will turn itself off. After the AC Adaptor/Charger output is connected to the unit, the LOW BATTERY LED will turn off (and the steady blue CHARGING LED will turn on). While the batteries are being charged, their status will be indicated by the Battery Status gauge (variable between empty and full) located at the lower right corner of the LCD Monitoring window (see arrow (10) in Figure 4).

Battery Charger/AC Power Adaptor

When the unit batteries need to be charged, or the user wants to keep batteries charged while using the unit, the AC Adaptor/Charger needs to be deployed.

SETUP

Setup of the unit involves the following sequence of steps:

1. Attaching one of the provided antennas to the unit as applicable.
2. powering up the unit by pressing the **PWR** key on the keyboard [1]
3. activating accessories and adjusting contrast and volume as indicated below

Antenna Connection

The antenna port (SMA-jack connector) is located just below the LCD when the unit is held in the normal orientation (arrow (1) in Figure 3). Either one of the two antennas (Omnidirectional or Direction Finding) will interface with this connector, as follows:

Attachment of Omnidirectional Antenna

Simply screw the antenna connector at the base of the antenna to the antenna jack on the unit (see left side of Figure 1).

[1] Powering the unit before connecting the antenna should be avoided.

Attachment of Direction Finding (DF) Antenna

Attaching the DF antenna to the unit is done in three steps, as follows:

1) attach bracket to the DF antenna flange using the two thumb screws with plastic heads

2) attach the DF antenna assembly RF and Laser connectors to the Antenna[2] and Laser jacks respectively (see Figure 5, left and right sides)

secure the Wolfhound unit to the DF antenna assembly bracket (see Figure 6) by tightening the thumb screw on bracket (finger-tight only).

Figure 5. Attaching DF Antenna Assembly Connectors to Antenna and Laser jacks on unit ("finger-tight" only)

Figure 6. Securing DF Antenna Assembly Bracket to Unit with Thumb-Screw

CAUTION:

The antenna connector should be **hand-tightened only** to the unit SMA port. Use of a wrench for this purpose will result in damage to the unit housing and/or the connector, hence null the product

[2] Use of wrench to tighten antenna connector may damage unit. Finger-tight only -- DO NOT use a wrench.

warranty. Application of stress to the DF Antenna should also be avoided to preclude permanent damage to Unit and/or the DF Antenna assembly.

Activating Accessories

Press the “MENU” button on keyboard to obtain

the Settings menu (see Figure 7):

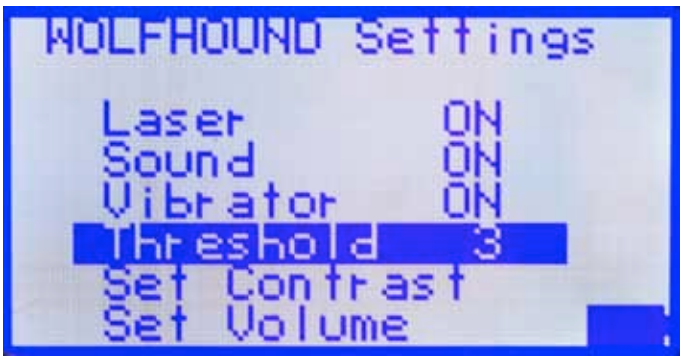


Figure 7. Wolfhound Settings menu

The Laser the Sound , and the Vibrator are turned ON (or OFF) by scrolling the cursor to the desired item (using “**↑(up arrow)” or “↓(down arrow)**” buttons) then pressing the “ENT” button., these accessories will behave as follows:

Laser:

In the ON state the pulsating green Laser duty cycle increases with detected signal level

Sound:

In the ON state beeping rate increases with detected signal level

Vibrator:

In the ON state, the Vibrator will activate if the detected signal level exceeds the pre-set Threshold Level (see “Threshold” below)

Threshold:

When the cursor is on “Threshold” (see Figure 7 above), pressing “ENT” repeatedly will display “1” through “9” to allow the user select the desired threshold level on the Coarse Scale. The selected threshold level will become effective when the user returns to the Monitoring screen by pressing “MENU”. The effective Threshold level will be indicated by a triangular marker on the Coarse Scale in the Monitoring Screen (see (11) in Figure 4 above).Thus, if the Threshold level is set to “3”, the Vibrator and Wolfhound icon will not activate unless the detected signal level reads “3” or more on the Coarse Scale, as seen in Figure 4 above.

Setting Contrast or Volume

To adjust Contrast, press "ENT" while the cursor is on "Set Contrast" to enter the screen in Figure 8:

Figure 8. Adjust Contrast screen

The Contrast is adjusted by repeated strokes on the "**↑(up arrow)" or "↓(down arrow)**" buttons as needed.

Volume is adjusted by pressing the "ENT" button while the cursor is on "Set Volume", to enter the screen in Figure 9:

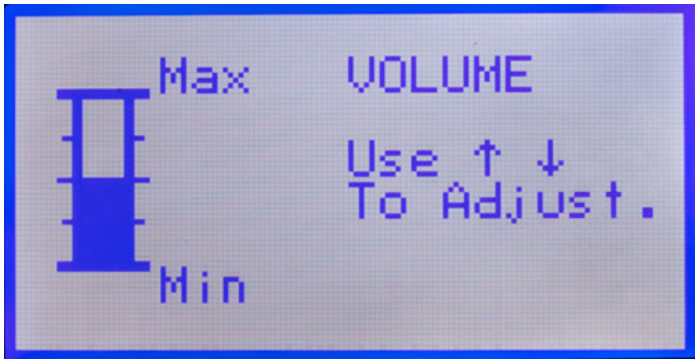


Figure 9. Adjust Volume screen

Adjust Volume by stroking on the "**↑(up arrow)" or "↓(down arrow)**" buttons as needed.

OPERATION & USE

Depending on the desired mode of use (i.e., detection or location of cell phone(s)) one of the antennas shipped with the unit has to be connected to the antenna jack (see (1) in Figure 3 above) before powering unit up. Powering up the unit without an antenna should be avoided.

Keypad

Figure 10 shows the Wolfhound unit keypad;

Figure 10. Wolfhound Keypad

The function(s) associated with each of the keys are as follows:

PWR

The Wolfhound unit is turned on/off by pressing the "PWR" switch (see Figure 1) located on the lower right hand side of the unit keyboard. After pressing this button, the BVS logo and the version of the unit firmware will be displayed in the LCD while the unit is starting (see Figure 11):

Figure 11. Wolfhound LCD Starting Window

The unit firmware information (consisting of version "v 1.13" followed by "USA" or "EU") is displayed on the lower left corner of the Starting Window.

MENU

Pressing this button repeatedly will alternate the unit LCD between the "Monitoring" screen and the "Settings" screen.

↑ (up arrow)

When in the Wolfhound Settings screen, pressing this button will Scroll the cursor up to make a selection for unit setup.

↓ (down arrow)
When the LCD is displaying the Monitoring screen, pressing this button resets the Coarse Scale Maximum Hold marker (see arrow (4) in Figure 4) register to "zero" on the Coarse Scale (see arrow (3) in Figure 4). Pressing the "**↓(down arrow**)" button will also make the Sensitive bar-chart read maximum for as long as the detector output stays at the same level. If the detector output decreases from the last Maximum Hold register value by more than 1/10 of the Coarse Scale, the Sensitive bar-chart will read "zero" (i.e., disappear). The Coarse Scale Maximum Hold marker register may be re-set to zero at any time, from the LCD Monitoring screen.

When the LCD is displaying the Wolfhound Settings screen, pressing this button "**↓(down arrow**)" will Scroll the cursor down to make a selection for unit setup.

ENT
When in the Wolfhound Settings screen, pressing this button will enable (ON) or disable (OFF) any one of the first three selections (i.e., Laser or Sound, or Vibrator). Pressing this button when the cursor is on "**Set Contrast**"will invoke the menu screen to allow the user to adjust contrast using "**↑ (up arrow)"** and **"↓(down arrow)"** key strokes (continuous pressing will not change contrast).

← (left arrow)
Not Used

→ (right arrow)
Not used

Antennas

The Wolfhound unit comes with the Omnidirectiomal antenna and the Direction Finding (DF) antenna assembly with pulsed green Laser.

The Omnidirectional antenna is a monopole (quarter-wave) antenna for multiple bands. When it is oriented vertically (i.e., tip of monopole pointing straight up) the Omnidirectional antenna will detect signals with uniform sensitivity around 360 degrees in the horizontal plane. Since this antenna will detect RF signals incident from any direction in the horizontal plane with uniform sensitivity, the user cannot distinguish the azimouth angle of the RF source.

The Direction Finding antenna is also for multi-band use and it will help identify the relative orientation of cell phones transmitting RF waves. The DF antenna output will be maximum when the imaginary line connecting the antenna to the source is approximately perpendicular to the plane defined by the flat face of the DF antenna panel. Sources falling to the rear of the plane of the DF antenna panel will produce diminished antenna output. To help the user maintain proper orientation of the DF antenna, a

pulsed green Laser (located at the lower edge of the DF antenna panel) is integrated into the DF antenna assembly. The duty cycle of the pulsed Laser will increase when the detected signal level increases.

General Guidelines for Good Signal Reception

The Wolfhound unit should be kept at about waist to head height from the floor, and away from walls and obstructions for proper performance. For the same reason, keep the Wolfhound unit at least one foot (but preferably more) away from large metal obstructions or surfaces (i.e., reflecting metal walls, heavy steel structural elements, metal-wire screens, etc.). The unit should not be used while its antenna (either kind) is contained by bags or enclosures made of metal, carbon or other RF energy absorbing or shielding materials; doing so will seriously degrade its performance. These criteria are listed in Table 2 below:

Table 2. General Criteria for Good Signal Reception

Keep unit away from large conducting surfaces which tend to short out tangential component of electric fields (this includes the human body).
The unit should have 360 degree un-obstructed view in the region of space being monitored.
Avoid enclosing unit in other objects, in particular objects with conducting or energy dissipating surfaces

Monitoring Cell Phone Use in Real-Time

For real-time monitoring of cell phone use, observe the Coarse and Sensitive bar charts in the LCD Monitoring screen (see arrows (2), (5) in Figure 4).

Monitoring Coarse Scale Maximum Hold

The Coarse Scale Maximum Hold marker (see arrows (4) in Figure 4) represents the maximum observed level of the detector output signal since the last re-set of the Coarse Scale Maximum Hold marker register. The Coarse Scale Maximum Hold register can be re-set to zero at any time while in the LCD Monitoring screen, by pressing the "**↓(down arrow)"** button.

Using Wolfhound Unit with the Omnidirectional Antenna

To detect and monitor the existence of powered-on cell phones in a confined space, place the Wolfhound unit at about waist to head height from the floor, away from walls and obstructions. For best performance, the Omnidirectional antenna should be oriented vertical with respect to the floor plane.

Using the Wolfhound Unit with the Direction Finding (DF) Antenna

After an initial Line Of Position (LOP) is established by a 360 degree sweep, the user re-confirms the LOP orientation by sweeping the unit back and forth about the initial LOP (see Figure 12), while observing the receiver output on the Sensitive Scale.

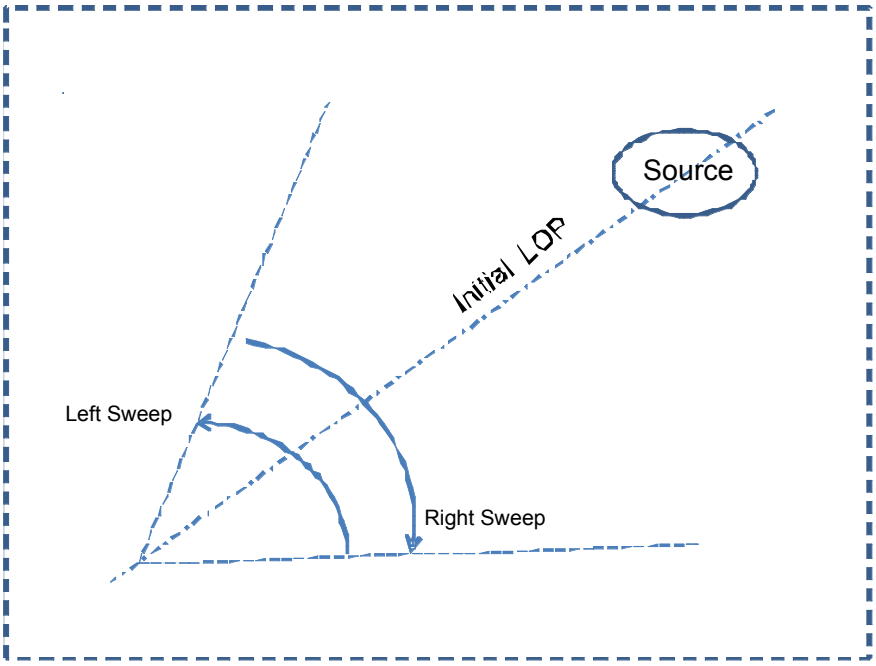


Figure 12. LOP Continually Re-Confirmed About Initial Orientation

Once the initial LOP is determined, sources can quickly be located using one of the following two methods:

Method 1: Maximizing Signal Along the Same LOP

This method is based on approaching the source along the same LOP (see Figure 13) to maximize receiver output.

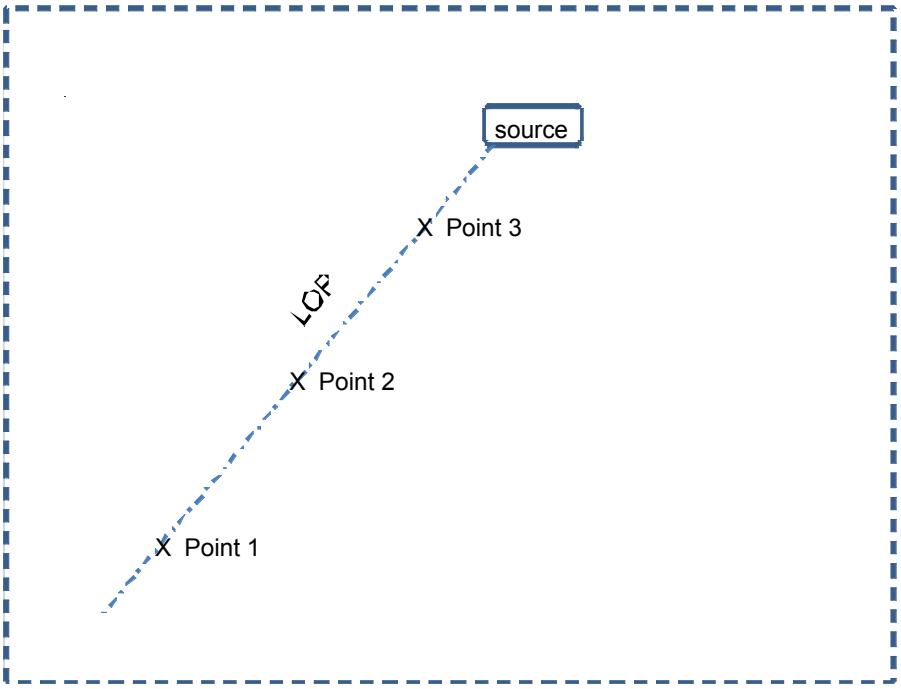


Figure 13. Method 1: Pursuing Source Along the Same LOP

For Method 1 use the following sequence:

1. Level the DF antenna by pointing the flat surface of the DF antenna to the potential source).
2. Keeping it level (or at the angle of the potential source), scan the DF antenna azimouthally, from side to side within an arc of about 90 degrees (i.e., 45 degrees to right, then 45 degrees to left,

and repeat …) to determine relative direction for maximum detector output on the Sensitive bar-chart (see arrows (5) and (6) in Figure 4).

3. While the DF antenna is pointing at the potential source, re-set the Coarse Scale Maximum Hold marker register by pressing the "**↓(down arrow)"** button. This will make the Sensitive bar-chart read maximum level (i.e. 1 on the Sensitive Scale") to help the user make small adjustments to his/her intermediate heading to "lock-in" on the actual orientation of the source.

4. Walking slowly in the same heading, scan the unit again for maximum signal in the same manner, while the signal level increases.

5. Keep walking in the same direction and repeat Steps 3 and 4 for increased signal till the source is found.

Method 2: "Triangulate" with Two (or more) LOPs

This method helps the user rapidly "triangulate" the approximate location of source by determining two (or more) LOPs of the source from two (or more) positions on the floor (see Figure 14).

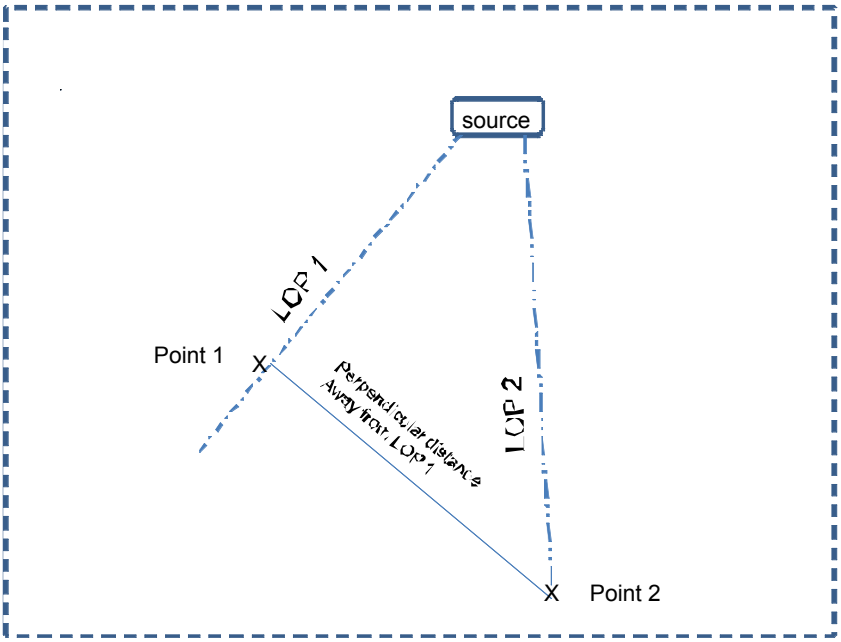


Figure 14. "Triangulating" the Source on Two LOPs

Once the approximate location is known, Method 1 can be used to "zoom-in" on the source, by maximizing receiver signal level. The following sequence is used:

1. Choose Point 1 and determine LOP1
2. Move away from LOP 1 in the perpendicular direction to Point 2 without getting too close to obstructions and/or walls. At Point 2 determine LOP2.
3. Mentally determine approximate area of intersection for LOP1 and LOP2 within the space monitored.
4. Move to point of intersection (of LOP1 and LOP2) and use Method 1 to zoom-in on the source, if necessary.

MAINTENANCE and TROUBLESHOOTING

Charging Batteries

The unit batteries are charged by attaching the AC Adaptor/Charger output plug to the DC in jack on the unit. Starting with fully depleted batteries (i.e., after the unit has turned itself off), the Battery Status gauge in the Monitoring screen will show "full" in about 3.5 hours using the AC Adaptor/Charger. After this point, it will take about an hour more for the CHARGING LED indicator (steady Blue) to go out completely; indicating batteries are charged 100%. A partially discharged unit (i.e., before the LOW BATTERY (blinking Red) LED comes on) can be returned to fully charged state at most within an hour.

1/2 wave Device Antennas

Dual Band for CDMA/GSM (EV-DO)

PSKN series in Straight Position

PSKN series in Right Angle Position

- Sleek profile with adjustable elbow for straight or angled operation
- Compact design, groundplane independent with high performance
- Models for all wireless modems including GSM/GPRS/EVDO/1xRTT
- Reverse polarity connectors available for ISM 915 operation

The PSKN Dual band antennas offer excellent performance for broadband wireless data applications. The halfwave design means they can be used on plastic or metal without concern for proper ground size.

Two different series are available; a model for US GSM/CDMA , and a model for EU GSM. The EU GSM 900 MHz lower band also operates with the ISM 915 band, without any sacrifice in performance. Additionally, a model is available with reverse polarity SMA connector, for use in ISM 915.

The PSKN Dual band series for CDMA/GSM (EV-DO) have a "blade" type style and an adjustable right angle elbow. Overall length is 7.75" (20 cm) in a straight position, and 6.75 " (172 mm) in a right angle position. Peak gain on all bands is 3 dBi.

The radome material is a semi-flex polyurethane, providing some give when stressed but maintaining long term durability. The antennas are available in SMA, TNC and reverse Polarity SMA for 902-928 ISM applications.

Model Numbers for US CDMA/GSM/Data

Model	Frequency MHz	Connector
PSKN3-900/1900T	824-894 & 1850-1990	TNC
PSKN3-900/1900S	824-894 & 1850-1990	SMA

Model Numbers for EU GSM & ISM 915

Model	Frequency MHz	Connector
PSKN3-925/1800S	870-960 &1710-1880	SMA
PSKN3-925/1800T	870-960 & 1710-1880	TNC

Model Numbers for ISM 915 with Rev Pol SMA

Model	Frequency MHz	Connector
PSKN3-925/1800RS	870-960 & 1710-1880	Rev SMA

Model Applications/Notes:

- US GSM/CDMA, Edge/EV-DO, 1xRTT use models with nomenclature 900/1900.
- EU GSM/Data, or ISM 902-928, Mobitex, Skytel use only models with nomenclature "925/1800".

Note: WiFi, 802.11a/b/g models also available, consult separate spec sheet

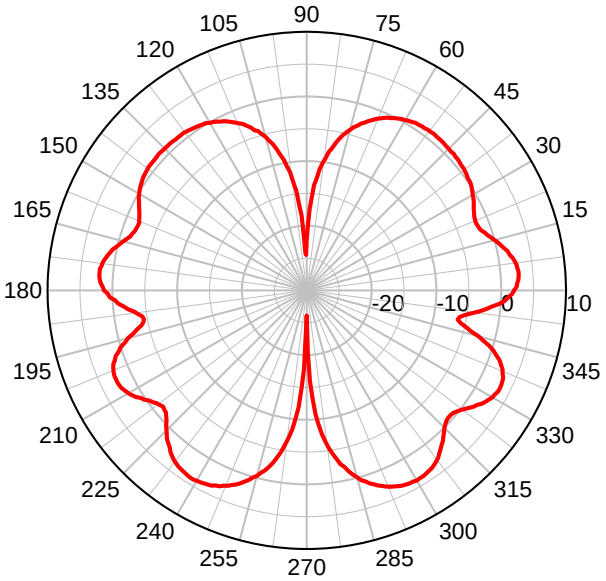
Specifications

Frequency:	
US GSM/CDMA	824-894/1850-1990 MHz
EU GSM	870-960/1710-1880 MHz
ISM 915	870 - 960 MHz
Gain:	3 dBi peak
Bandwidth@2:1SWR:	See freq range above
Impedance:	50 Ohm nominal
Maximum Power:	5 Watt
Operating Temp:	-30°C to +60°C
Connector:	SMA, TNC, or Reverse Pol SMA see models indicated above
Whip Length:	6.75" (172 mm) at 90° angle, 7.75" (197 mm) when straight
Radome Material:	Polyurethane, with black matt finish, and knurled connector

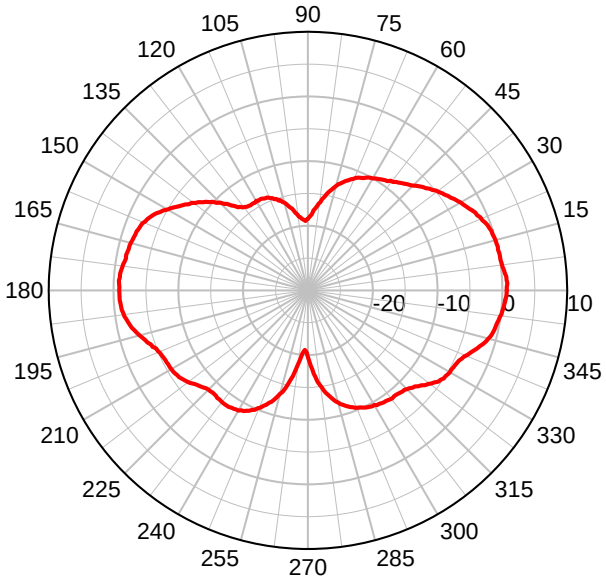
PSKN3-900/1900S Antenna

Dual Band 90degree Adj Knuckle Swivel w/SMA
3 dBi, Pattern for Cellular (824-894 MHz) & PCS (1850-1990 MHz)

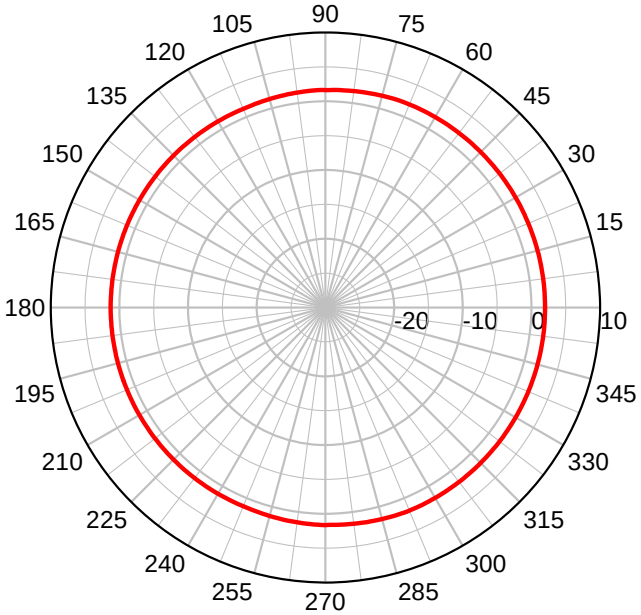
PSKN3-900/1900S-Elevation Plot at 850 MHz



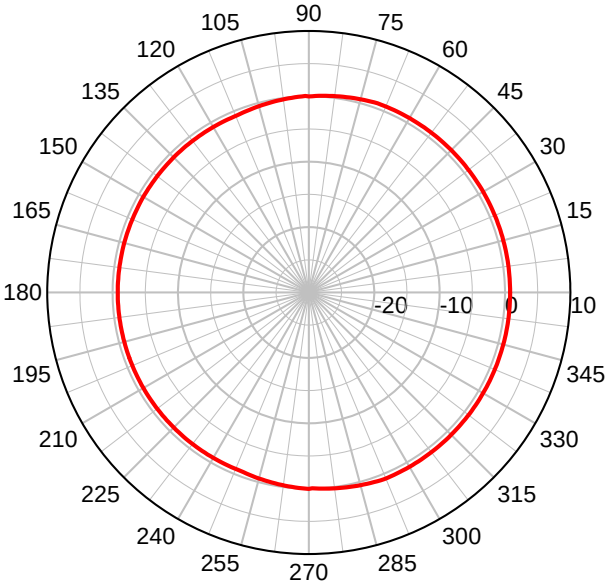
PSKN3-900/1900S-Elevation Plot at 1850 MHz



PSKN3-900/1900S-Azimuth Plot at 850 MHz



PSKN3-900/1900S-Azimuth Plot at 1850 MHz



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