

# Mantis

manual version 1.6





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MANTIS DATA SHEET	

**Mantis™** is a handheld, wireless transceiver designed specifically for installing, sweeping and verifying Bluetooth devices and parameters. The instrument identifies all nearby Bluetooth devices and their status in dBm.

**Mantis** uses common AA battery cells found in any convenience store. Ni-Cad, Alkalines, Ni-MH and Li-Ion cells may all be used. **Mantis** does require 4 AA cells with at least 1500 mAh per cell. BVS supplies 8 Ni-MH battery cells and a Ni-MH charger to get users working right out of the box. Ni-MH cells are recommended for best performance from your **Mantis**. See the charger's instructions and battery tips in this manual.

**Mantis** also includes a simple 2.4 GHz threaded antenna that screws right into the top of the unit. Additional antennas may be ordered from BVS through BVS.

At the top of the **Mantis** rest the power switch and antenna connector. The power switch is a simple two way toggle switch. The antenna connector (middle) is an SMA Female 50 ohm. The provided antenna easily screws and unscrews from this connector. Be sure to unscrew antenna when transporting the **Mantis**.



## GETTING STARTED

Operation of the **Mantis** is straightforward. Insert 4 fresh battery cells into removable pack. Close back up and power on the **Mantis**. The **Mantis** will display the startup screen followed by the Main Screen.



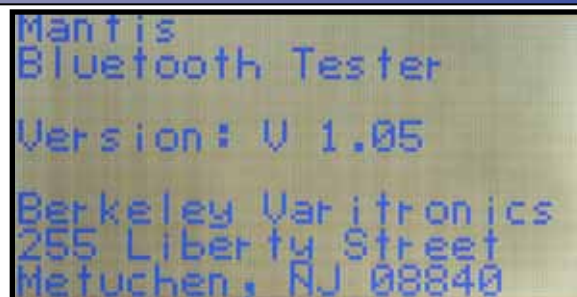
## Mantis Main Screen

Use the UP/DOWN arrows to scroll through menu selections. Push the RIGHT arrow button to make a selection and push the LEFT button to move back one previous screen.



## Product Information

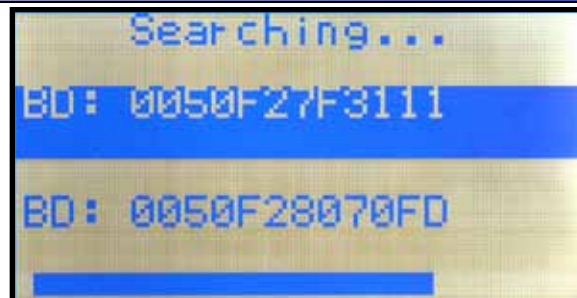
This screen displays the current version of Mantis that you are using. Visit [www.bvsystems.com](http://www.bvsystems.com) to find out if you have the latest Mantis version.



Mantis  
Bluetooth Tester  
Version: V 1.05  
Berkeley Varitronics  
255 Liberty Street  
Metuchen, NJ 08840

## Searching...

From the Main Screen, select Search for Devices and press the RIGHT arrow key. This screen will appear. Mantis takes approximately 10 seconds for a complete scan of nearby Bluetooth devices. The devices found will be listed by their ID numbers first.

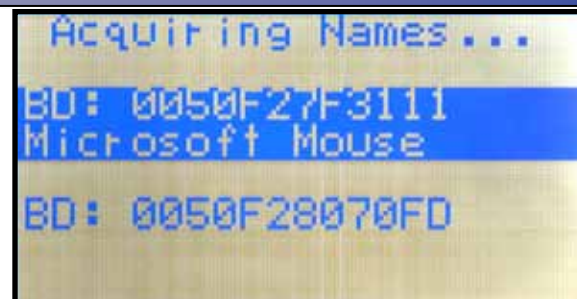


Searching...  
BD: 0050F27F3111  
BD: 0050F28070FD

## Acquiring Names...

After acquiring the ID of each device, Mantis will go back and list the name given to each device (up to 20 characters).

**NOTE:** In order for Mantis to locate and acquire names, bluetooth devices must be ON and in DISCOVERABLE mode. In the case of the iPhone (far right), this screen (Settings/General/Bluetooth) must be on in order for iPhone's bluetooth to be DISCOVERABLE. Not all bluetooth devices have a discoverable mode. These devices are typically keyboards and mice.




Acquiring Names...  
BD: 0050F27F3111  
Microsoft Mouse  
BD: 0050F28070FD



## Available Devices

After the 10 second scan, Mantis will list all Bluetooth devices found that are currently powered and operational. Use the UP and DOWN arrow keys to scroll through the list of devices. Mantis creates a list of up to 16 devices at once. Once you have selected the device you wish to verify, press the RIGHT arrow key to select that device. Press the LEFT arrow key at anytime to return to the previous menu.



Available Devices ↑  
BD: 0050F27F3111  
Microsoft Mouse  
BD: 0002C7091C02  
iPAQ PocketPC



## Selected Device

This screen provides basic information about the device including the ID number, the name and the class. **Class: Computer Desktop** the Bluetooth standard

Class: Computer Desktop

Class: Computer Handheld

Class: Peripheral Keyboard

BD: 0050F27F3111  
Microsoft Mouse  
↓  
Class: Peripheral Pointing

Use the DOWN arrow key to see Service information for the selected Bluetooth device.

## Service

This screen provides basic Service information regarding the nature and capabilities of the selected Bluetooth device. An **x** to the left of any category identifies it as a known Service. Use the DOWN arrow key to see more Service information for the selected Bluetooth device.

BD: 0050F27F3111  
Microsoft Mouse  
Service: \$  
x L2d Discovery  
- Positioning  
- Networking  
- Rendering  
- Capturing

## Service (continued)

You may use the UP arrow key to scroll back up to the top of the Service list. Use the LEFT arrow key to return back to the Main Screen. Use the RIGHT arrow key to see the Signal Strength of the selected Bluetooth device.

BD: 0050F27F3111  
Microsoft Mouse  
Service: ↑  
- Object Transfer  
- Audio  
- Telephony  
- Information

## Measurement Selection

Select the type of measurement you wish to make using the UP or DOWN arrow key. After you select either RSSI or PER, use the RIGHT arrow key to continue to the

Measurement Selection  
RSSI Test  
PER Test



## Signal Strength

This screen indicates the current received signal strength of the selected Bluetooth device in dB on a scale from -20 to 20 dB. The orange receive LED on the front of the Mantis will blink whenever any data is received. Use the arrow keys to return to the Main Screen or perform another Search.



**Note:** A transceiver that wishes to support power-controlled links must be able to measure the strength of the received signal and determine if the transmitter on the other side of the link should increase or decrease its output power level. A Receiver Signal Strength Indicator (RSSI) makes this possible.

The RSSI measurement compares the received signal power with two threshold levels, which define the Golden Receive Power Range. The lower threshold level corresponds to a received power between -56 dBm and 6 dB above the actual sensitivity of the receiver. The upper threshold level is 20 dB above the lower threshold level to an accuracy of  $\pm 6$  dB.

(BLUETOOTH SPECIFICATION Version 1.1)

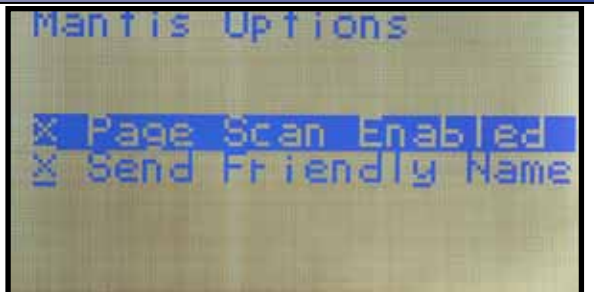
## PER

This screen indicates the PER (Packet Error Rate) of the selected Bluetooth device from 0 to 100 percent. A PER of 0% indicates optimal transmission of Bluetooth data packets.



## OPTIONS

Mantis provides two privacy options. To enable or disable an option, use the UP or DOWN arrow keys to select the option and the RIGHT arrow key to toggle the enabled "X" on or off. The LEFT arrow key returns to Main screen.



## Page Scan Enabled

When enabled, Mantis answers page scans from other Bluetooth devices. Page scans provide the Bluetooth MAC address and information about features the device has. Disabling this option prevents the Mantis from being seen by other Bluetooth devices. The default is enabled.

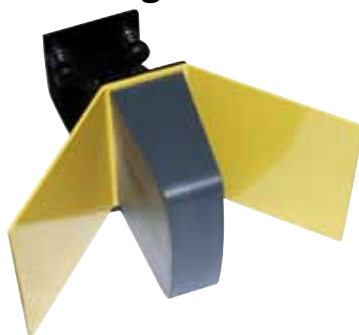
## Send Friendly Name



## USING A DIRECTION FINDING ANTENNA

Mantis ships with an optional Direction Finding Antenna for locating and pinpointing local Bluetooth devices. This antenna may be removed at anytime and replaced with the standard omni-directional antenna. See antenna specifications and guidelines below.

### 2.4 GHz Direction Finding Corner Reflector

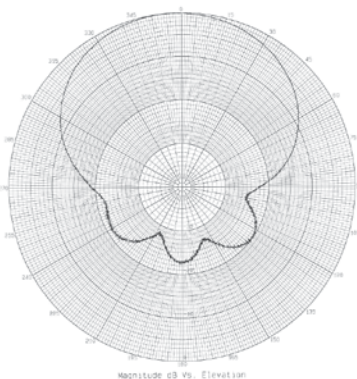


2.45GHz Mini Cornerreflector  
FLUORINE, SCREWED-ON  
FREQ: 2.450 GHz  
POLARIZATION: Vertical

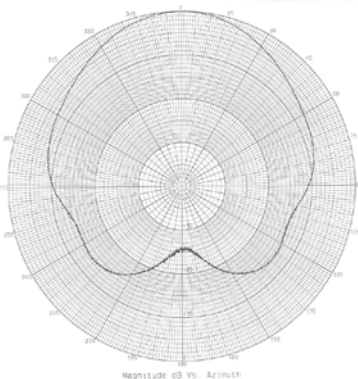
BVS P/N DFA-001  
&  
DFA-000

2.45GHz Mini Cornerreflector  
FLUORINE, SCREWED-ON  
FREQ: 2.450 GHz  
POLARIZATION: Vertical

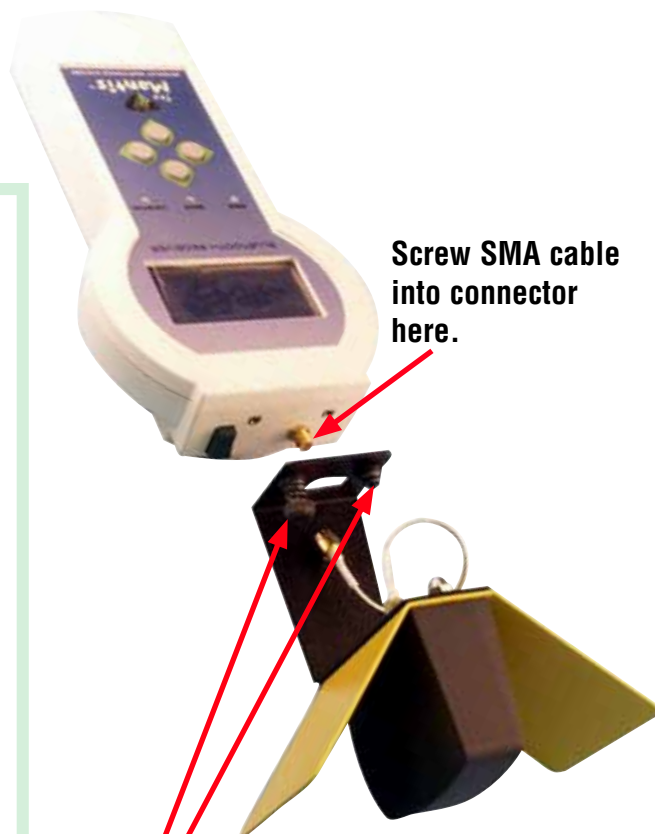
BVS P/N DFA-001  
&  
DFA-000



Magnitude dB vs. Elevation



Magnitude dB vs. Azimuth



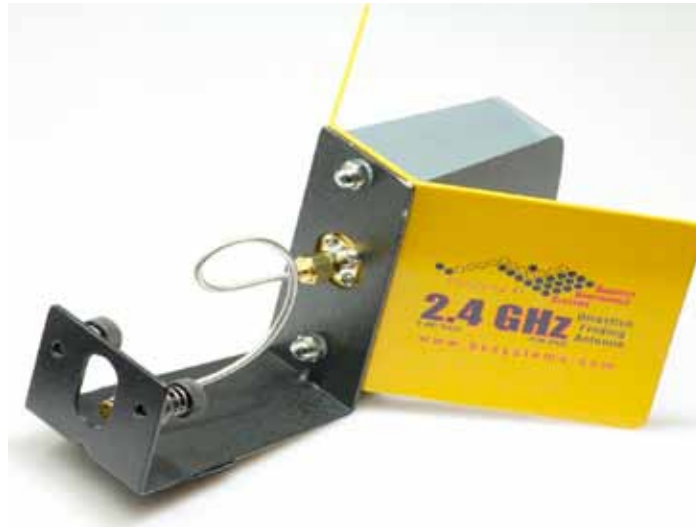
Screw SMA cable  
into connector  
here.

Secure these screws to  
the top of Mantis case.

When enabled, Mantis responds to requests for a user friendly name with “BVS Mantis Bluetooth Tester”. When disabled, it responds with a blank string.

## **USING MANTIS WITH DF ANTENNA**

The 2.4 GHz Direction Finding antenna with the Corner Reflector (see Figure 1) is an optional accessory for the MANTIS system.



**Figure 1. Optional 2.4GHz Direction Finding Antenna**

The DF antenna output will be maximum when the imaginary line from a Bluetooth Device (BTD) to the DF antenna lies in the center-plane of the DF antenna. The center-plane of the DF antenna is the vertical plane bisecting the inner and outer solid angles subtended by the corner reflector of the DF antenna. Sources facing the rear side of the corner reflector (i.e., side appearing in Figure 1) will yield substantially smaller signal output from the DF antenna. The Mantis unit with the mounted DF antenna should be kept slightly above waist height from the floor. It should generally be kept away from walls, obstructions and large metallic objects and surfaces (i.e., reflecting metal walls, heavy steel structural elements, metal-wire screens, etc.) for optimum performance, unless pointing at a source. The unit should not be used while its antenna is blocked or contained by enclosures, sacs or other objects containing metal, carbon or other RF energy absorbing or shielding materials; doing so will seriously degrade antenna performance. These criteria are summarized in Table 1 below for easy reference:

**Table 1. Guidelines 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 unobstructed view in the region of space being monitored.

Avoid enclosing unit in other objects, in particular objects with conducting or energy dissipating surfaces

### **Engaging a Bluetooth Device (BTD)**

After a BTD is selected from the “Available Devices” screen (see “Available Devices” on page 3 above), it can be engaged by clicking on “RSSI Test” from the “Measurement Selection” window (see “Measurement



Selection” on page 4 above). The RSSI Test outcomes for a particular Bluetooth device will be displayed as seen in the screen under “Signal Strength” on page 5 above. For any BTd, the outcome(s) from the RSSI test screen may be classified into four possible Mantis “States” and associated signal level ranges represented in Table 2:

Table 2. Synopsis of Possible RSSI Test Outcomes for any BTd

			State 1	State 2	State 3	State 4	Signal Level (dB)
Connecting			X				n/a
Connected	Level in GR*			X			0
	Level outside GR*	above Upper Threshold			X		> 0
		below Lower Threshold				X	< 0

\* GR: Golden Receive power range

The terms Golden Receive power range, Upper Threshold and Lower Threshold are defined under “Signal Strength” on page 5 above, in accordance with the Bluetooth Specification. The signal level is given in dB scale because it is measured relative to the upper and lower thresholds.

Before the Mantis unit has engaged an active Bluetooth device, the RSSI test screen will display the word “Connecting”, corresponding to State 1 in Table 2, with no associated signal level. After the BTd has been engaged by Mantis, the RSSI test screen will be in one of three possible States (i.e., 2, 3 or 4) with an associated signal level displayed in dB scale (last column of Table 2). The reading is relative to the upper or lower threshold defined in the Bluetooth Specification. If the absolute signal level from the BTd is determined to be within the GR (State 2), the Mantis RSSI Test screen will indicate “0dB”. Otherwise, the indicated readings will be relative to the Upper (State 3) or Lower (State 4) Thresholds.

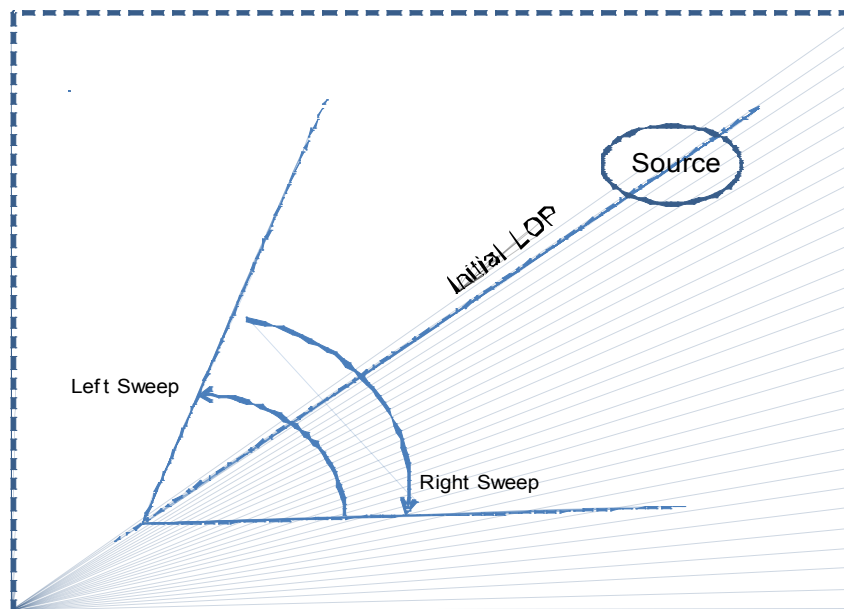
#### Inducing Mantis to Alternate Between States 3 and 4 by Sweeping in Azimuth

The Bluetooth Specification requires that a BTd with a maximum transmit power of +20 dBm (Power Class 1) shall be able to maintain the link while reducing its transmit power level down to 4 dBm or less, in a monotonic sequence, with a maximum step size of 8 dB and a minimum step size of 2 dB. For the observer using Mantis to detect BTds this means that all measured signal levels initially observed in State 3 (> 0dB) will settle to State 2 (~ 0 dB), within about a few seconds of their initial observation on the RSSI Test/Signal Strength screen. Therefore, the user should keep in mind that the Mantis with DF antenna has to be “swept” from side to side in successive 180-degree arcs in azimuth angle, each not exceeding a duration of about 1 second, while observing the measured signal level vary between positive (State 3) and negative (State 4) signal level readings. If the user stops sweeping the DF antenna during a sweep, the Mantis will slip into State 2 within a few seconds, giving a reading of ~ 0 dB. In summary, the user should avoid pointing the DF antenna in the same orientation for long, but rather keep sweeping it “toward” and “away” from suspected sources in order to have Mantis operate in States 3 and 4 alternately, thereby facilitating the determination of an azimuth direction along which the signal peaks.

#### Techniques for Determining Lines of Position

The DF antenna enables the user to determine the azimuth direction in the horizontal plane along which the

detected BTM signal level reaches maximum. The line along which the observed BTM signal is maximum is called a Line of Position (LOP). After an initial LOP is established by a quick 360 degree sweep of the unit mounted with the DF antenna, the user takes a few steps along the LOP, toward stronger signal and then re-confirms the new LOP orientation by sweeping the unit/DF antenna back and forth about the initial LOP (see sketch in Figure 2) while observing the signal level peak on the Mantis Signal Strength screen.

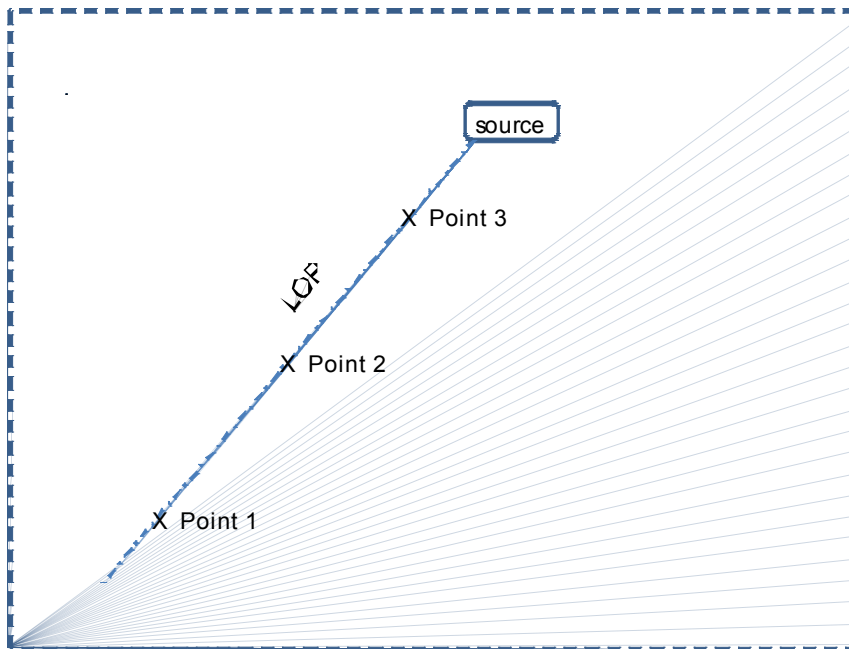


**Figure 2. LOP Continually Re-Confirmed About Initial Orientation**

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 active BTM along the same LOP to maximize receiver output at successive points towards the source (see Figure 3). This method will work best in open spaces where the BTM is relatively unobstructed by various objects or when the BTM transmitter is relatively strong.



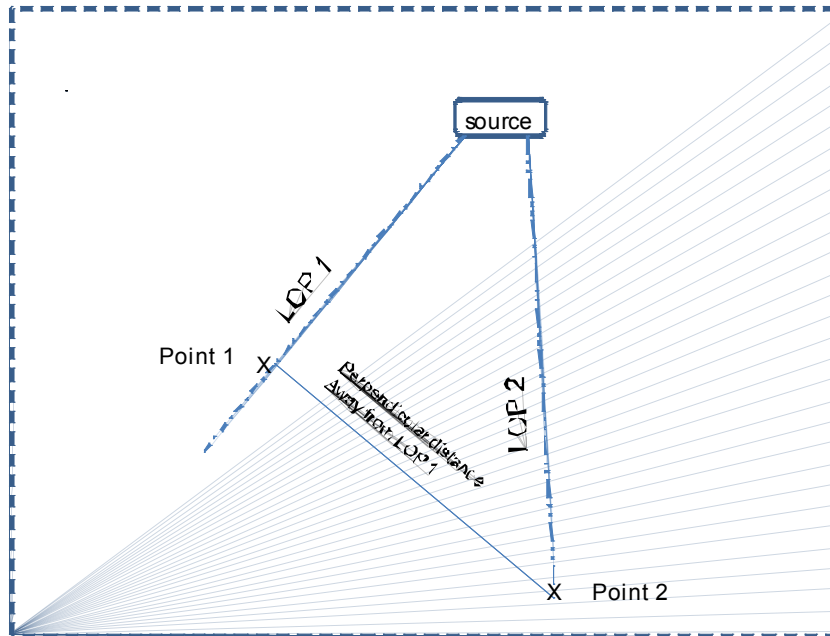
**Figure 3. Method 1: Pursuing BTDS Along an LOP in an Open Space**

For Method 1 use the following sequence:

1. Start with DF antenna level.
2. Sweep the DF antenna in the azimuthal direction, from side to side within an arc of about 180 degrees (i.e., 90 degrees to right, then 90 degrees to left, and repeat in about 1 second cycles) to determine relative directions for maximum (State 3) and minimum (State 4) signal levels.
3. Slowly take a few steps along the initial LOP.
4. Repeat the sweep cycles again to maximize State 3 signal level in the same manner.
5. Confirm LOP, repeat sequence till BTDS is found

#### **Method 2: “Triangulate” with Two (or more) LOPs**

This method helps the user rapidly “triangulate” the approximate location of a BTDS by determining two (or more) LOPs taken from two (or more) different positions in a given area (see Figure 4). This method will be useful when the BTDS is obstructed by various objects or if the BTDS signal transmitter is relatively weak.



**Figure 4. “Triangulating” the BTD on Two LOPs**

The following sequence is used for Method 2:

1. Choose Point 1 and determine LOP1 by a quick 360 degree sweep.
2. Move away from LOP 1 in the perpendicular direction to Point 2 while keeping away from obstructions and/or walls. At Point 2 determine LOP2 by quick 180 degree sweeps from side to side.
3. Mentally determine approximate point of intersection for LOP1 and LOP2 within the space monitored.
4. Move to the LOP1/LOP2 point of intersection, if still unable to locate the BTD use Method 1 (above) to zoom-in on the source.

## **BATTERY TIPS**

**The Mantis™, Grasshopper™, Locust™, Yellow Jacket™ and Yellow Jacket Plus (formally called Scorpion), Beetle™, Cricket™, and Cicada W-LAN receivers use 4 or 5 Ni-MH long-lasting “AA Cells”.**

- 1. Ni-MH batteries do not charge to full capacity the first time they are charged.**
- 2. Ni-MH batteries do not charge to full capacity the first time they are charged after a long period of inactivity, or after a long period of non-use.**

### **Cause:**

When charging Ni-MH batteries for the first time after long-term storage, deactivation of reactants may lead to increased battery voltage and decreased capacity, (which causes premature termination of charging). Because batteries are chemical products involving internal chemical reactions, performance deteriorates with prolonged storage. This is normal in Ni-MH batteries.

### **Resolution:**

Ni-MH batteries may not charge to full capacity the first time they are charged, or after a long period of inactivity.

The first-time charge of the Ni-MH Rechargeable Battery Pack should take approximately 2 hours. If the Receiver Dock light turns green, indicating a full charge, in less than 2 hours, repeat the charge cycle as follows:

### **First-time Charge:**

- 1. To begin charging, place the instrument on the Charge Dock. Refer to your instrument's User Guide for details.**
- 2. When the charge light turns green, remove the W-LAN Receiver from the dock and place back on the dock after several seconds.**
- 3. Repeat steps 1 and 2 three or four times or until the combined charge time is 2 hours.**

Subsequent charges of the W-LAN Ni-MH Battery Pack will not require multiple charging cycles unless left uncharged for a long period of time (greater than 2 months).



## **Glossary of Acronyms**

<b>AC</b>	<b>Alternating Current</b>
<b>A/D</b>	<b>Analog to Digital converter</b>
<b>AGC</b>	<b>Automatic Gain Control</b>
<b>AP</b>	<b>Access Point</b>
<b>Applet</b>	<b>a small Application</b>
<b>BER</b>	<b>Bit Error Rate</b>
<b>BPSK</b>	<b>Binary Phase Shift Keying</b>
<b>BSS</b>	<b>Basic Service Set</b>
<b>BW</b>	<b>Band Width</b>
<b>CDMA</b>	<b>Code Division Multiple Access (spread spectrum modulation)</b>
<b>DC</b>	<b>Direct Current</b>
<b>D/A</b>	<b>Digital to Analog</b>
<b>dB</b>	<b>decibel</b>
<b>dBm</b>	<b>decibels referenced to 1 milliwatt</b>
<b>DOS</b>	<b>Digital Operating System</b>
<b>DSP</b>	<b>Digital Signal Processing</b>
<b>DSSS</b>	<b>Direct Sequence Spread Spectrum</b>
<b>ESS</b>	<b>Extended Service Set</b>
<b>FIR</b>	<b>Finite Impulse Response</b>
<b>GHz</b>	<b>GigaHertz</b>
<b>IF</b>	<b>Intermediate Frequency</b>
<b>I and Q</b>	<b>In phase and Quadrature</b>
<b>IBBS</b>	<b>Independent Basic Service Set</b>
<b>kHz</b>	<b>kiloHertz</b>
<b>LCD</b>	<b>Liquid Crystal Display</b>
<b>LO</b>	<b>Local Oscillator</b>
<b>MAC</b>	<b>Medium Access Control</b>
<b>Mbits</b>	<b>Megabits</b>
<b>MHz</b>	<b>MegaHertz</b>
<b>NIC</b>	<b>Network Interface Card</b>
<b>OFDM</b>	<b>Orthogonal Frequency Domain Multiplexing (802.11a)</b>
<b>PC</b>	<b>Personal Computer</b>
<b>PCS</b>	<b>Personal Communications Service (1.8 to 2.1 GHz frequency band)</b>
<b>PER</b>	<b>Packet Error Rate</b>
<b>PN</b>	<b>Pseudo Noise</b>
<b>QPSK</b>	<b>Quaternary Phase Shift Keying, 4-level PSK</b>
<b>RF</b>	<b>Radio Frequency</b>
<b>RSSI</b>	<b>Receiver Signal Strength Indicator</b>
<b>SSID</b>	<b>Service Set IDentification</b>
<b>UCT</b>	<b>Universal Coordinated Time</b>
<b>VAC</b>	<b>Volts Alternating Current</b>
<b>VGA</b>	<b>Video graphic</b>
<b>WLAN</b>	<b>Wireless Local Area Network</b>

## **IMPORTANT GENERAL SAFETY INSTRUCTIONS**

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock and injury to persons, including the following:

- 1) Read and understand all instructions.
- 2) Follow all warnings and instructions marked on the product.
- 3) Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
- 4) Do not use this product near water, for example, near a bath tub, wash bowl, kitchen sink, or laundry tub, in a wet basement, or near a swimming pool.
- 5) Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.
- 6) Slots and openings in the cabinet and the back or bottom are provided for ventilation, to protect it from overheating these openings must not be blocked or covered. The openings should never be blocked by placing the product on the bed, sofa, rug or other similar surface. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.
- 7) This product should be operated only from the type of power source indicated on the appliance. If you are not sure of the type of power supply to your home, consult your dealer or local power company.
- 8) Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- 9) Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.
- 10) Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock. Never spill liquid of any kind on the product.
- 11) To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified service facility when some service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the appliance is subsequently used.
- 12) Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
  - A) When the power supply cord or plug is damaged or frayed.
  - B) If liquid has been spilled into the product.
  - C) If the product has been exposed to rain or water.
  - D) If the product does not operate normally by following the operating instructions. Adjust only those controls, that are covered by the operating instructions because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.
  - E) If the product has been dropped or the cabinet has been damaged.
  - F) If the product exhibits a distinct change in performance.
- 13) Avoid using the product during an electrical storm. There may be a remote risk of electric shock from lightning.
- 14) Do not use the telephone to report a gas leak in the vicinity of the leak.

## **INSTALLATION INSTRUCTIONS**

1. Never install telephone wiring during a lightning storm.

2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
4. Use caution when installing or modifying telephone lines.

#### **INSTRUCTION FOR BATTERIES**

**CAUTION:** To Reduce the Risk of Fire or Injury to Persons, Read and Follow these Instructions:

1. Use only the type and size of batteries mentioned in owner's manual.
2. Do not dispose of the batteries in a fire. The cells may explode. Check with local codes for possible special disposal instructions.
3. Do not open or mutilate the batteries. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.
4. Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery or conductor may overheat and cause burns.
5. Do not attempt to recharge the batteries provided with or identified for use with this product. The batteries may leak corrosive electrolyte or explode.
6. Do not attempt to rejuvenate the batteries provided with or identified for use with this product by heating them. Sudden release of the battery electrolyte may occur causing burns or irritation to eyes or skin.
7. When replacing batteries, all batteries should be replaced at the same time. Mixing fresh and discharged batteries could increase internal cell pressure and rupture the discharged batteries. (Applies to products employing more than one separately replaceable primary battery.)
8. When inserting batteries into this product, the proper polarity or direction must be observed. Reverse insertion of batteries can cause charging, and that may result in leakage or explosion. (Applies to product employing more than one separately replaceable primary battery.)
9. Remove the batteries from this product if the product will not be used for a long period of time (several months or more) since during this time the battery could leak in the product.
10. Discard "dead" batteries as soon as possible since "dead" batteries are more likely to leak in a product.
11. Do not store this product, or the batteries provided with or identified for use with this product, in high-temperature areas. Batteries that are stored in a freezer or refrigerator for the purpose of extending shelf life should be protected from condensation during storage and defrosting. Batteries should be stabilized at room temperature prior to use after cold storage.

The following are Radiation Patterns for the included N2400SMA1G Antenna. The Antenna Under Test was measured against a 1/2 Wave Dipole, therefore; The Gain is measured in dBd (0 dBd = 2.14 dBi).

