

# BEETLE-B/A/N/G

802.11 BANG Wi-Fi Optimizer  
manual version 1.0



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### Beetle-B/A/N/G/iPAQ Interface Hardware

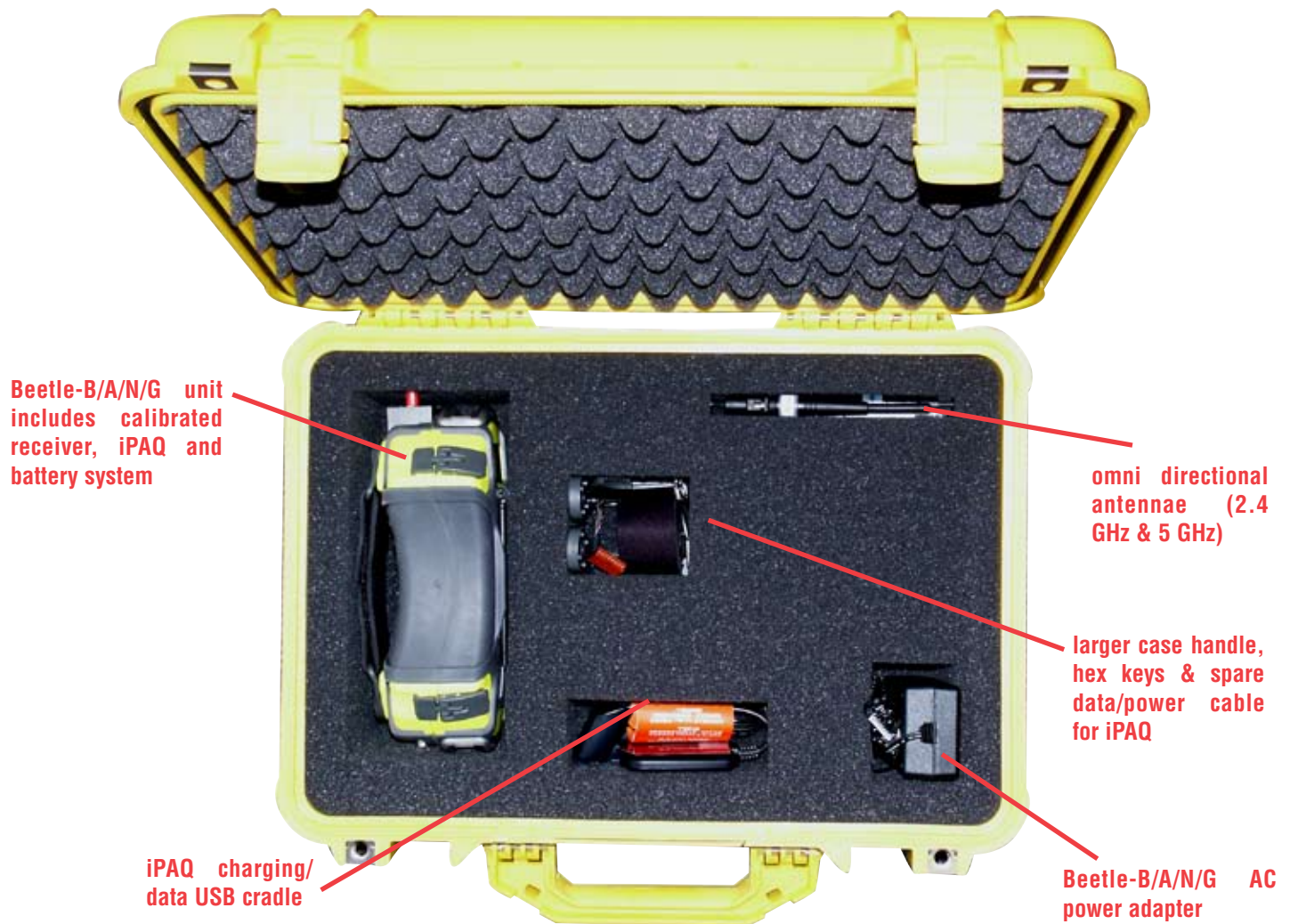
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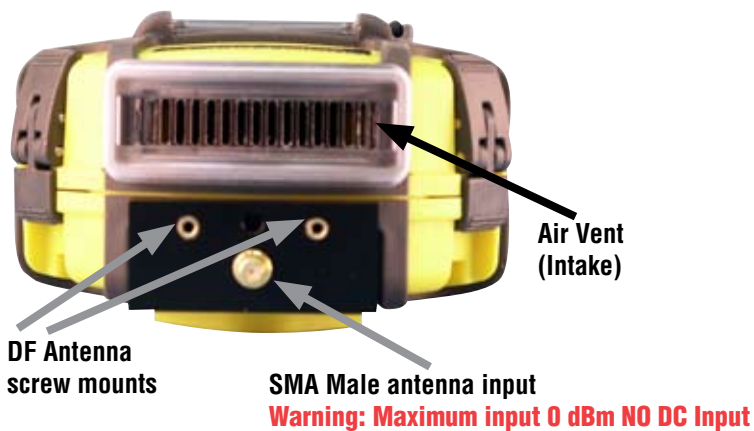
## Unpacking Your Beetle-B/A/N/G



### Beetle-B/A/N/G BOTTOM VIEW



### Beetle-B/A/N/G TOP VIEW



## About Your Beetle-B/A/N/G

Unpack and assemble your Beetle-B/A/N/G unit as shown. Your Beetle-B/A/N/G is a self-contained Wi-Fi optimizer. The user interface (iPAQ), antenna and power connections are all accessible, but there is usually no need to open the protective, yellow hard case. If you should need to open the case to remove the iPAQ or address the internal connections, simply unhook all 4 latches on the case. Remove top cover to reveal iPAQ, cooling fan and power/data connector. The Beetle-B/A/N/G receiver and battery system are below these components. The iPAQ may be disconnected and removed by users but the other components should only be accessed by Berkeley technicians. Removing such components will void your hardware warranty.

Power up the iPAQ by pushing the **power button** in the upper right corner of the iPAQ. Connect the appropriate frequency antenna to the SMA antenna input. iPAQs shipped by BVS are optimized for the Beetle-B/A/N/G.

iPAQs supplied by BVS have the Beetle-B/A/G software pre-installed. If you need to install the Beetle-B/A/N/G software, see the software installation/re-installation section.

Tap the **windows Start icon** in the upper left corner and then choose Beetle-B/A/N/G in the pulldown menu. If the Beetle-B/A/N/G does not appear in the pulldown menu, tap on the "Programs" folder. Tap on the Beetle-B/A/N/G icon.

Running the Beetle-B/A/N/G software will power the Beetle-B/A/N/G Wi-Fi optimizer.

If the Beetle-B/A/N/G software loses communication with the Beetle-B/A/N/G, perform a soft reset by pressing the iPAQ's reset button. If communications problems persist, perform a hard reset by holding down the **two outer buttons** on the front of the iPAQ while holding in the soft reset button. Remember, hard resets erase all data collected and software installed so backup all data and see software re-installation for details.



## 2.4 GHz Direction Finding Corner Reflector

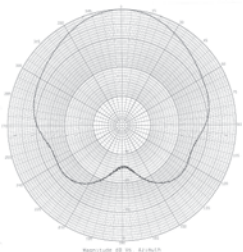
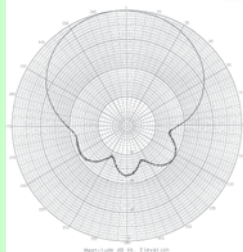


2.4GHz Multi-Corner-reflector  
Frequency: 2.4GHz-2.5GHz  
P/N: 2.400-000  
Part Number: 2.400-000

BVS P/N DFA-001  
&  
DFA-000

2.4GHz Multi-Corner-reflector  
Frequency: 2.4GHz-2.5GHz  
P/N: 2.400-000  
Part Number: 2.400-000

BVS P/N DFA-001  
&  
DFA-000



## 2.4 GHz Omni-Directional (7.5" long)

### Electrical Properties:

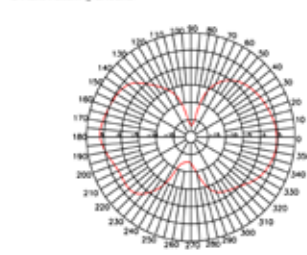
Frequency Range: 2.4~2.5 GHz  
Impedance: 50Ω nominal  
VSWR: <2.0:1  
Gain: 5 dBi  
Radiation: Omni  
Polarization: Vertical

### Mechanical Properties:

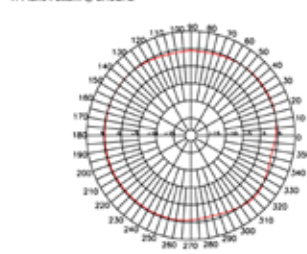
Connector: SMA Plug(male)  
Material: Whip: Polyurethane(Black)  
Swivel Mechanism: Polyurethane(Black)  
Connector: Brass with black chrome plating  
Operation Temp.: -20°C to +65°C  
Storage Temp.: -30°C to +75°C



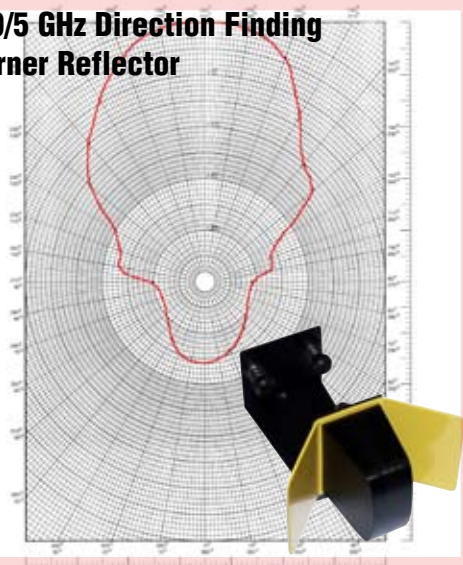
E-Plane Pattern @ 2.45GHz



H-Plane Pattern @ 2.45GHz



## 4.9/5 GHz Direction Finding Corner Reflector



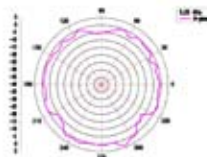
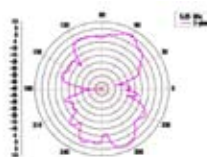
## 4.9/5 GHz Omni-Directional (5.5" long)

### Electrical Properties:

Frequency Range: 5.15~5.35 GHz  
Impedance: 50Ω nominal  
VSWR: <2.0:1  
Gain: 5 dBi  
Radiation: Omni  
Polarization: Vertical

### Mechanical Properties:

Connector: SMA Plug(male)  
Material: Whip: Polyurethane(Black)  
Swivel Mechanism: Polycarbonate(Black)  
Connector: Brass with black chrome plating  
Operation Temp.: -20°C to +65°C  
Storage Temp.: -30°C to +75°C



## Accessories

Your Beetle-B/A/N/G includes the following accessories: 3 antennae, spare data/power cable (for iPAQ), larger case grip with hex key tools, an AC power/charging adapter, user's manual, SD software install card and CD-ROM software installer.

## Beetle-B/A/N/G Power System

Beetle-B/A/N/G offers three choices of powering: internal Li-PO battery, external 12VDC (11-15 V) power supply or external auxiliary battery. The power smoothly transitions from one source to another providing uninterrupted functionality while plugging or unplugging the external supplies. The IPAQ runs from the built-in battery or from an internal regulated 5VDC supply when the external 12VDC is applied. Both batteries – the IPAQ built-in battery and the system Li-PO battery – are charged when the external 12VDC is applied. The charge time is 3 to 4 hours depending on the depth of discharge and the ambient temperature. The run time exceeds 3 hours when the batteries are completely charged.

The IPAQ battery is usually depleted at the same time as the system Li-PO battery. However, if the IPAQ battery is low while the system is still running, the equalizing mode of operation is provided. In this mode the IPAQ is powered from the system Li-PO battery. To enter this mode, set the IPAQ to “USB Charge” ON. This may prolong the total system run time. **Do not keep the “USB Charge” setting ON all the time since it will drain the system battery faster, eventually reducing the system run time.**

It is recommended to keep the IPAQ and/or the application software OFF while charging. The system supports a simultaneous charge and run though the charge time may substantially increase due to increased internal temperature.

When the internal temperature exceeds the maximum allowed for the Li-PO batteries the system automatically interrupts the charge. The red LED that can be seen through the bottom transparent hatch will be blinking. The same LED is solid ON when the charge is going and turns OFF completely when the charge is finished.



# **TROUBLESHOOTING**

## **IPAQ AND Beetle-B/A/N/G POWER ISSUES**

Your Beetle-B/A/N/G Wi-Fi optimizer and your HP iPAQ are both charged and/or powered through the 4 pin power port at the bottom of the Beetle-B/A/N/G. Both the receiver and iPAQ have their own internal batteries but both of these batteries are maintained and charged through the 4 pin power port. Here are some tips for prolonging the life of your hardware and data:

- The iPAQ's internal batteries are discharged when the iPAQ is "off" to maintain its memory. Keep the iPAQ charged! Charge it at least once a week!
- If the iPAQ's batteries are completely discharged, it will need several hours of charging before it can be powered on or even flash the charging (yellow) LED. Once the iPAQ is charged it may need to be soft or hard reset before powering on. The Beetle-B/A/N/G software must be re-installed from an SD card or downloaded via ActiveSync. In order to install software using the SD card, the iPAQ must be removed.

1. Unhook all 4 latches and remove the top cover.
2. Remove the (optional) DF antenna by loosening the 2 thumb screws and unscrewing the antenna connection.
3. Be sure not to touch the air intake cooling fan while it is spinning. This fan spins to regulate the temperature of the receiver and batteries so be sure to keep all obstructions and objects from the fan's air path.
4. Remove the power/data connector at the bottom of the iPAQ. This connector provides communication and charging/battery power to the iPAQ.

You may now remove the iPAQ from its holder for other uses.



## **HARDWARE CONNECTION ISSUES**

When the Beetle-B/A/N/G software is started, the following screen will appear if the software was unable to detect the hardware. The following may cause this:

1. Loose connection to iPAQ serial cable. The serial cable may not be fully seated in the power/data slot on the bottom of the iPAQ. Check the connection. A soft boot of the iPAQ may be required. Soft booting is accomplished by pressing the recessed reset button on the iPAQ with the stylus.
2. Low batteries. Test this by running off of A/C power using the supplied 4 pin power connection to the Beetle-B/A/N/G and the iPAQ. The charge (Yellow) LED on the iPAQ should be flashing if the cable is connected correctly and the Beetle-B/A/N/G red power LED should be on.
3. COM port is held open. Soft boot the iPAQ to clear out the possibility that the serial port is being held open by a previously running copy of the Beetle-B/A/N/G software.

## **SOFTWARE INSTALLATION/RE-INSTALLATION**

The Beetle-B/A/N/G software can be installed/re-installed in via the included SD card. There are 3 different folders for 3 different platforms:

iPAQ folder:

Beetle-BANG iPAQ software

MS .NET Compact Framework for iPAQ

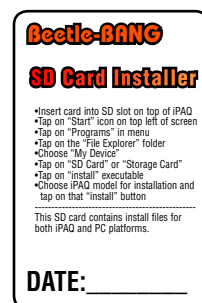
PC folder:

Beetle-BANG Chameleon for PC

PC/XP folder:

ActiveSync for Windows XP PCs (not Vista)

All applications can be installed from their setup files.





## **OPERATIONAL TIPS**

### **SURVEYING**

While surveying, Beetle-B/A/N/G achieves the most accuracy when antenna is at a vertical 90 degree angle and completely perpendicular to the ground or floor.

### **OPTIMIZATION**

Remember that your iPAQ comes from the BVS factory optimized for powerful spectrum analysis right out of the box, but sometimes these optimized settings can be lost (back to HP's factory defaults) when the iPAQ's battery completely drains. The following are procedures for:

#### **Disabling Bluetooth and 802.11 on an iPAQ**

It is essential when running your Beetle-B/A/N/G software that you do not have either 802.11b or Bluetooth running on the same iPAQ. This will interfere with Beetle-B/A/N/G measurements in the 2.4 GHz band.

#### **Turning Off Bluetooth**

HP iPAQ 27xx series:

From the main screen on the iPAQ, select the antenna icon in the lower right-hand portion of the screen. Then choose the Bluetooth button to turn off Bluetooth.

The blue LED on the iPAQ should not be flashing when the radio is off.

#### **Turning Off 802.11b**

HP iPAQ 27xx series:

From the main screen on the iPAQ, select the antenna icon in the lower right-hand portion of the screen. Then choose the Wi-Fi button to turn off 802.11b.

#### **Battery Settings**

**NOTE:** In order to prevent the Ipaq from freezing when running Beetle-B/A/N/G software, make sure to:

1. ALWAYS leave the checkboxes in the SETTINGS/SYSTEM/POWER screen unchecked. Power-save mode will lock up the

application due to the fact that the application is stopped while communicating with the hardware..

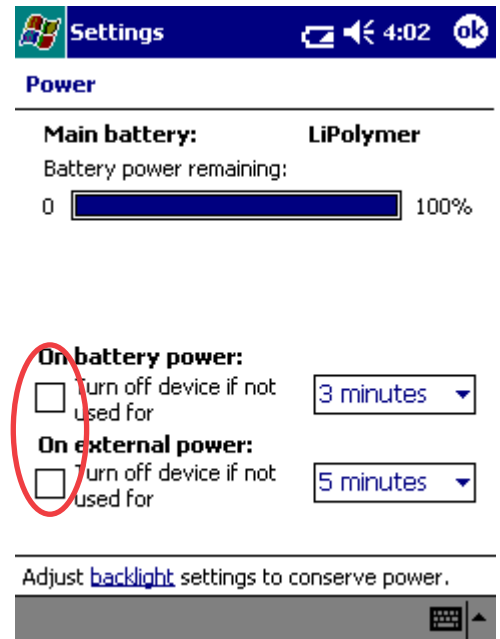
2. Make sure that the battery level on the Ipaq remains above 40%. The serial card interface may cease to operate when the battery level is under 40%.

To resolve the freeze, simply press the soft reset button on the iPAQ with the stylus.

### Disabling Screen Saver on an iPAQ

DockWare (by default) runs a screen saver with a calendar on any new iPAQ (47xx series). This could interfere with the operation of Beetle-B/A/N/G software. To disable:

1. Tap on the Windows icon in the upper-left corner of the iPAQ screen.
2. Tap “Programs” in the menu.
3. Tap on “DockWare”.
4. Once running, tap-and-hold on the screen.
5. Uncheck “Start Automatically”.
6. Now tap the upper right corner of the screen to terminate DockWare (where the ‘X’ would usually be).
7. DockWare is now disabled. It will need to be disabled again if the batteries completely discharge on the iPAQ.



Choose Settings and then choose System settings at the bottom. Select battery icon for Power Settings to access this screen. These power settings come unchecked from the BVS factory to ensure Beetle-B/A/G software runs optimally.

# Accessories for your **Beetle-B/A/N/G**

12VDC to 110VAC car cigarette  
lighter power inverter  
75 Watts output  
P/N BB-12V  
\$ 35.00



**OPTIONAL**

Rugged Carrying Case  
ABS Plastic  
P/N P-CASE  
\$ 100.00



**STANDARD**

4.9/5 GHz Direction Finding Antenna  
with mounting bracket, cable & SMA  
male  
9 dBi gain  
P/N 5NE  
\$ 250.00



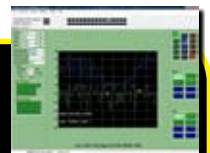
**OPTIONAL**

External Li-Ion battery pack  
with belt clip (+4 hours runtime)  
P/N BATT-PK  
\$ 375.00



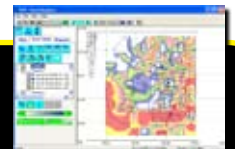
**OPTIONAL**

Remote Manager  
802.11b/a/n/g monitoring software  
Ask for a Quote



**OPTIONAL**

Swarm  
802.11b/a/n/g mapping software  
Ask for a Quote



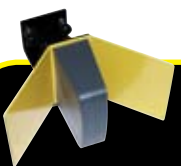
**OPTIONAL**

30 dB attenuator pad for use with  
directional antennas (between  
DF antenna & BumbleBee) SMA  
male to female  
P/N bbpad30  
\$ 30.00



**OPTIONAL**

2.4 GHz Direction Finding  
Antenna with mounting brack-  
et, cable & SMA male  
9 dBi gain  
P/N 2ND  
\$ 250.00



**OPTIONAL**

2.4 GHz Omni Antenna  
SMA male swivel  
P/N S151AM-2450S  
\$ 25.00



**STANDARD**

4.9/5 GHz Omni Antenna  
SMA male swivel  
Co-Linear Dipole 5 dBi VSWR 1.8:1  
P/N K181AM-5250S  
\$ 25.00



**STANDARD**

# SWARM™

## 802.11B/A/N/G WI-FI INDOOR/OUTDOOR SITE SURVEYS

### 1 Create Survey Maps:

#### SWARM PROJECTOR (PC)

Import any bitmap for use in your Beetle B/A/N/G

Create geo-coded site files for analysis

### 2 Constant Realtime Wi-Fi Surveys:

#### SWARM COLLECTOR (IPAQ)

Scan all 802.11 channels on BOTH 2.4 GHz and 5 GHz

JPEG snapshots of any survey screen

Collect survey data automatically via GPS

Collect data by manually tapping touch-screen

### 3 Coverage Reliability Analysis:

#### SWARM ANALYZER (PC)

Plot surveys in multiple graphical and table views

Plot coverage by APs or AP channels

Locate unknown APs' positions

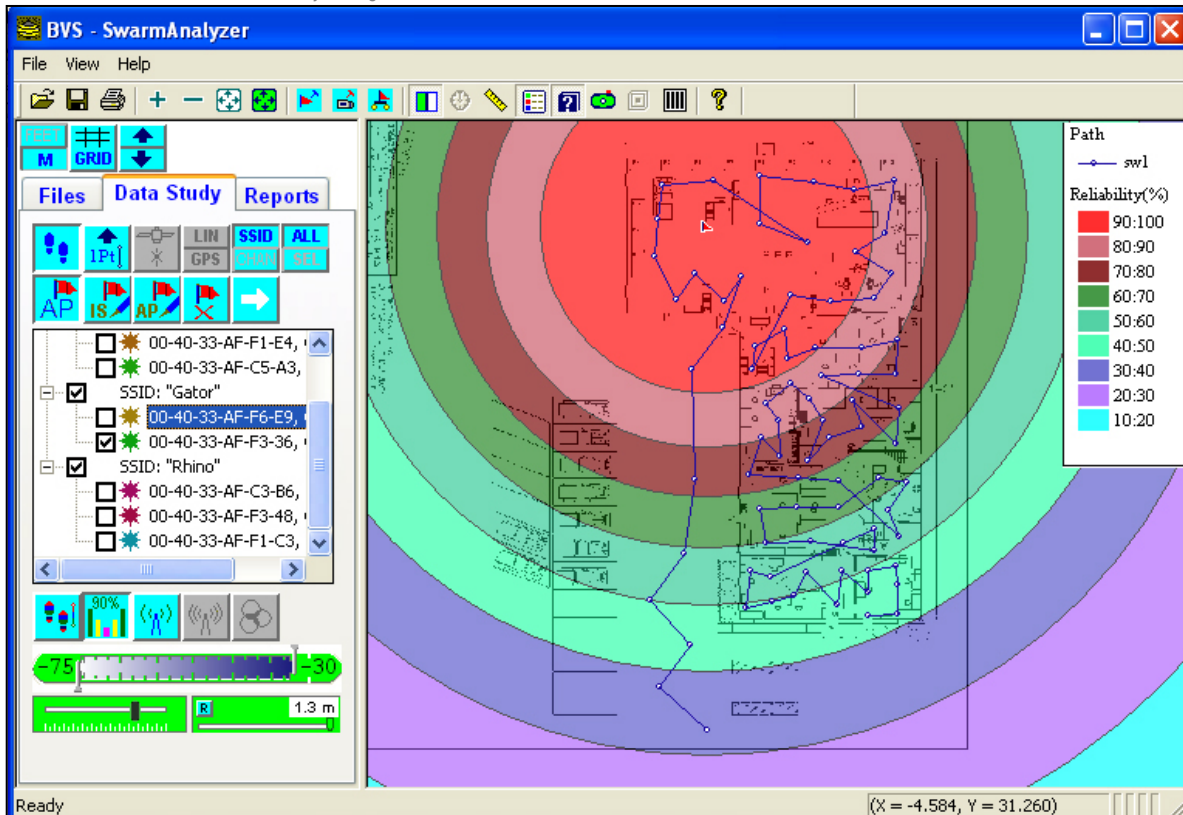
Print and export plots into bmp files for spreadsheets

Create KML file for plotting coverage over Google Earth™



**Swarm™** combines the power of realtime Beetle® 802.11b/a/n/g Wi-Fi measurements with GPS geo-coding accuracy. First, create your survey bitmaps with both Linear and GPS **PROJECTOR** software. Next, simply walk or drive to any spot with GPS reception while **Swarm™ COLLECTOR** scans all 802.11b/a/n/g channels and correlates them to your exact location automatically via GPS or manually by tapping on the touch-screen. GPS measurements provide both LAT and LON as well as time stamping for a complete Wi-Fi survey path anywhere in the world. **Swarm™ COLLECTOR** allows JPEG screen snapshots to be taken at particular points of interest throughout the survey. Finally, survey data such as RSSI, MAC and SSID may be exported into **Swarm's ANALYZER** for further mapping coverage studies in multiple graphical and tabular layouts. In areas with little or no GPS reception, **Swarm™ ANALYZER** only needs a few reference points to fill in the locations for the rest making it effective for quick outdoor studies. Surveys may be exported further into KML files for plotting in applications such as **Google Earth™**.

Use Beetle 802.11b/a/n/g Wi-Fi receiver hardware for handheld surveys using a touch-screen interface.



#### FEATURES:

- Create survey bitmaps with BVS' Linear or GPS Projector software
- Collect data by using GPS position for outdoor surveys
- Collect data by manually tapping locations for indoor studies
- Choose any 802.11b/a/n/g Wi-Fi channels to scan
- JPEG screen snapshots may be taken throughout the survey
- Survey data such as RSSI, MAC and SSID is exported into Swarm Analyzer for further mapping coverage studies in multiple graphical and spreadsheet layouts
- Surveys may be exported further into KML files for plotting in applications such as GoogleEarth™

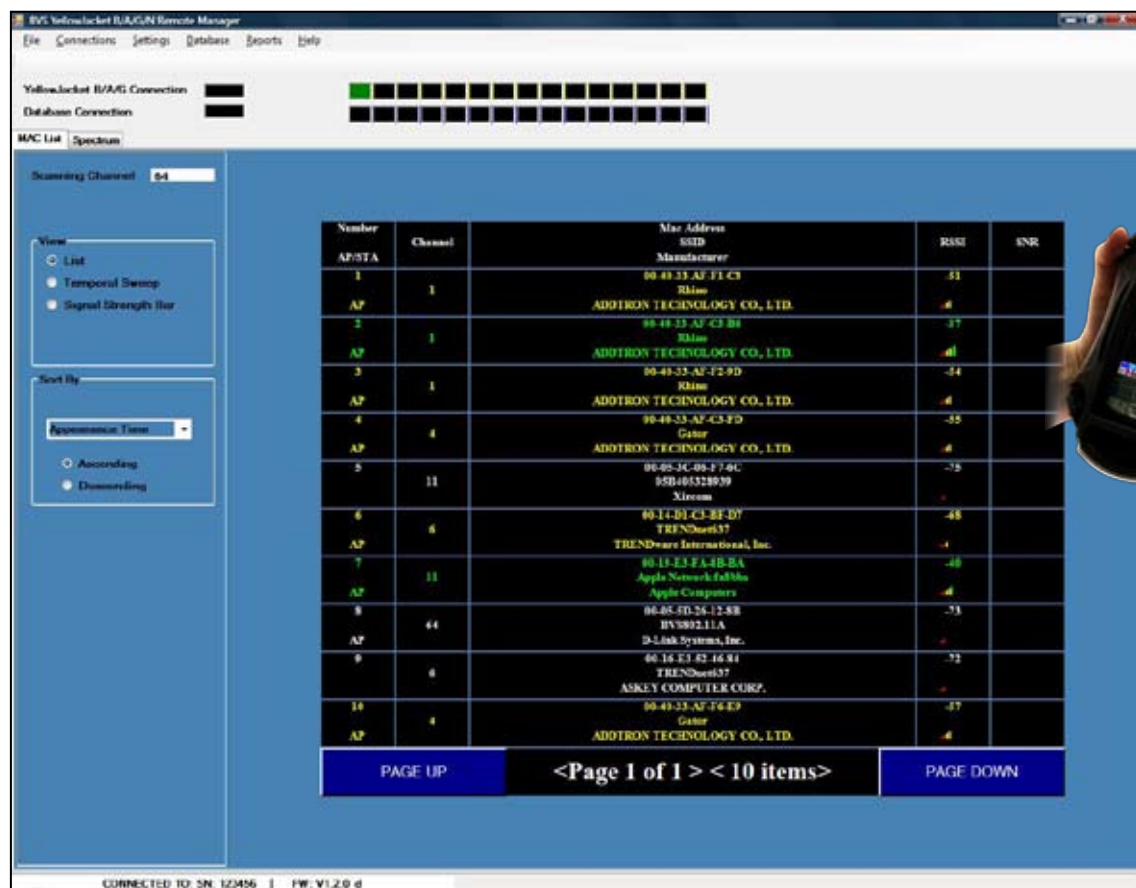
OPTIONAL SOFTWARE AVAILABLE FOR YOUR Beetle-B/A/N/G

# REMOTE MANAGER™

software

software for your  
**BEETLE-B/A/N/G**

802.11 B/A/N/G REMOTE MONITORING SOFTWARE



now you can see everything  
your Beetle® BANG sees...

MAC

SSID

Multipath

Power Triggers

Waveform Traces

Absolute Channel

Spectrum Analysis

Peak Hold/Search

Signal-to-Noise Ratios

...from anywhere

## FEATURES

- Controls Beetle B/A/N/G remotely from any RJ-45 connection
- Monitor your network from anywhere - home and office.
- Data collected in real-time and stored in a relational database\*
- Create comprehensive reports from your measured network data
- Export reports to PDF® and MS Excel® formats
- Collect spectrum data from the RF environment
- Collect packet data parameters on such as MAC, SSID, Channel
- Data reports over various time periods for temporal overview of your network
- Software includes ethernet receiver dongle and cable

**Beetle® B/A/N/G Remote Manager™** software is a data monitoring & reporting application that connects to any **Beetle® B/A/N/G** through a standard 10/100 ethernet connection. With **Remote Manager™**, users can control what wireless data is to be collected via the **Beetle® B/A/N/G** receiver and store that data in a relational database\* for future retrieval and analysis. **Remote Manager™** allows users to scan the RF spectrum for packets and interference over time creating a network footprint of usage to find out who's in your network airspace with or without authorization. **Remote Manager™** even creates comprehensive PDF or MS Excel reports for an IT manager's overview. All of this can be accomplished from anywhere in the world; all you need is access to an ethernet connection to place your **Beetle® B/A/N/G** receiver.

OPTIONAL SOFTWARE AVAILABLE FOR YOUR Beetle-B/A/N/G



## Beetle-BANG Data Logger iPAQ Windows Mobile Software

### Introduction

The Beetle-BANG Receiver (802.11B/A/N/G) is a precision hand-held Wi-Fi packet demodulator and optimizer. Data is displayed by Beetle-BANG software running on an iPAQ. This iPAQ is connected to the BANG via a serial cable. The BANG has several features to detect packets on or off the user's network.

802.11b, 802.11g, 802.11n and 802.11a are demodulated by the BANG receiver and displayed accordingly by the iPAQ software (BANG Controller).

### Installation of Software

The BANG software is pre-installed on iPAQ computers purchased from BVS. A completely depleted iPAQ battery will erase the software. See re-installation of software in the troubleshooting section of this manual.

For users who are using their own iPAQ, follow the CD or SD card installation instructions in the troubleshooting section of this manual to install the BANG software.

### Getting Started

1. Power your BANG receiver and iPAQ as described in the "starting-up your BANG" section of the manual.
2. Tap the Start button on the iPAQ.
3. Tap on the "Programs" folder.
4. Tap on the "BANG" icon.
5. The MAC list display will appear initially and will scan the 2.4GHz channels by default.



#	CH	MAC/SSID/MAN ID	RSSI
1	6	00-40-33-AF-F3-48 Butterfly WiFi Power Meter ADDTRON TECHNOLOGY CO.,	-50
2	11	00-40-33-AF-C3-FD Caterpillar WiFi Power Analyzer ADDTRON TECHNOLOGY CO.,	-47
3	11	00-19-E3-FA-8B-BA Apple Network Fa8bba Apple Computers	-33

<Page 1 of 1> <3 items> <Ch 5>

CHAN SORT PG DN PG UP

**BANG CONTROLLER DISPLAY AT STARTUP**

## Quick Tour

The BANG Controller has a tab control menu on the top of the display which separates the functionality into main sections. These are:

1. Packet Processing-This section contains data relating to processing 802.11 packets. Information such as MAC address, SSID, channel, RSSI and SNR (Signal To Noise ratio) information are displayed.
2. GPS-This is the area where global positioning information is displayed.
3. System Information-Information such as serial number, firmware version, and frequency bands are displayed here.
4. Power Profile -Information on battery life, voltage, and power source.

Next to the tabs are two indicators. The first is a yellow section which spins in a circle. This indicates that the software is functioning. Sometimes (for example in trigger mode) data will not update at a constant rate. This circle shows that the software has not frozen and is simply waiting for data.

The second indicator is for power. If a plug is shown, the BANG is on external power. If a battery is shown, the unit is operating on batteries and a percentage remaining will be displayed.

## BANG Toolbar Options

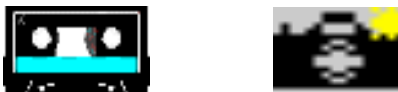
From left to right, the toolbar buttons perform the following functions:

### LOG FILE

When this icon is pressed, the log file control panel will be displayed. Use this control panel to choose a log file, start and stop recording. Press the icon again to remove the control panel. Log files can be used to post-process data with the PC Viewer utility.

### SNAPSHOT

When the camera icon is pressed from the toolbar at the bottom of the screen, a snapshot of the currently viewable display is taken. The snapshot is saved as a BMP format picture for viewing at a later time or for importing into documents and reports. As an example, the images of the BANG screens shown in this section of the manual were saved using this option.



BANG CONTROLLER TOOLBAR ICONS

## PACKET PROCESSING

The packet processing tab (MAC Information) puts the BANG in a mode to demodulate 802.11 B/A/N/G packets. The packets are separated by MAC address and put into a list. Each item in the list can be selected. This will lead to another series of screens for detailed analysis on the individual MAC address.

## **MAC LIST**

The MAC list by default is populated as the different addresses arrive. The MAC addresses will only show in the list if it can be proven that the channel it is seen on is the channel it is transmitting from. This is so the correct RSSI value is shown. If the information was shown while it was off-channel, then the RSSI value would appear lower.

Each list item displays the following: Item number, whether it is an AP or not, channel number, MAC address, SSID, Manufacturer's ID, and RSSI value. The color of the information will vary depending on the strength of the signal. Green would be a stronger signal and red would be a weaker signal. There are also bars (as a phone would display) to show signal strength. These are located under the RSSI value.

There is a series of buttons under the list. These buttons are explained in the following paragraphs.

## **CHANNEL SELECTION**

Pressing the 'CHAN' button at the bottom of the MAC list, a dialog appears with choices for channels to scan. Entire bands can be selected or deselected, as well as single channels.

## **LIST SORTING**

The MAC list can be sorted by pressing the SORT button at the bottom of the list. The list can be sorted by:

1. Appearance Time – When a new MAC address shows up, it goes to the end of the list.
2. MAC Address – Alphabetically by MAC address.
3. RSSI – Strongest signals go to the top of the list.
4. SSID – Alphabetically by SSID.
5. Channel – By channel number

Just choose the appropriate radio button and press 'OK'.

## **PAGE DOWN**

Loads the next (up to) 5 items in the list.

## **PAGE UP**

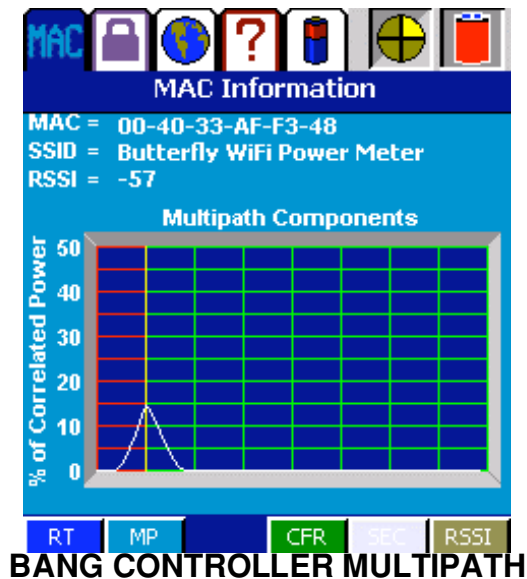
Loads the previous 5 items in the list.

## INDIVIDUAL MAC

When an individual MAC is chosen by tapping on its entry in the list, a set of screens become available. The first screen is the multipath screen. All of the screens are described below.

## MULTIPATH

The multipath screen is chosen by pressing the 'MP' button. It also comes up by default after choosing the MAC from the list. The screen shows a ratio of correlated power versus time.



## HIGH THROUGHPUT (802.11n)

The HT (High Throughput) screen will display high throughput data if the access point/client is 802.11n capable and transmitting the high throughput information elements.

The data is a series of tabs. The first tabs are high throughput capabilities such as information about the 40 MHz mode. The next set are transmitter beamforming capabilities. This is followed by antenna selection capabilities and finally other data such as channel information.

The data on this screen is not valid on a non-802.11n access point.

**MAC Information**

MAC = 00-19-E3-FA-8B-BA  
SSID = Apple Network fa8bba  
RSSI = -37

**802.11n HT Information**

Primary Channel = 11  
Sec Ch Off = None  
STA Ch Width = 20 MHz  
RIFS = Prohibited  
PSMP STAS Only = False  
Srv Int Gran = 5  
Operating Mode = 1

Xmit BF 3 Ant Sel Caps Info Pg 1

RT MP HT CFR SEC RSSI

**MAC Information**

MAC = 00-19-E3-FA-8B-BA  
SSID = Apple Network fa8bba  
RSSI = -35

**802.11n HT Information**

PCO Active = No  
PCO Phase = 20 MHz

Info Pg 1 Info Pg 2 Info Pg 3

RT MP HT CFR SEC RSSI

**MAC Information**

MAC = 00-19-E3-FA-8B-BA  
SSID = Apple Network fa8bba  
RSSI = -36

**802.11n HT Information**

Non-Greenfield Pres = No  
Xmit Burst Limit = Yes  
OBSS Non-HT STA's = Yes  
Dual Beacon = No  
Dual CTS Protect = Not Required  
Sec Beacon = No  
L-SIG TXOP Prot Full = No

Ant Sel Caps Info Pg 1 Info Pg 2

RT MP HT CFR SEC RSSI



## 802.11 INFORMATION

**MAC Information**

MAC = 00-19-E3-FA-8B-BA  
 SSID = Apple Network fa8bba  
 RSSI = -36

**802.11n HT Capabilities**

LPDC Coding Caps = NOT SUPPORTED  
 Channel Widths = 20 MHz only  
 SM Power Save = SM Enabled  
 Greenfield Support = NO  
 Short GI 20 MHz = NO  
 Short GI 40 MHz = YES  
 HT Delayed Block = NOT SUPPORTED

Caps 1 Caps 2 Caps 3 Caps 4 X ◀ ▶

RT MP HT CFR SEC RSSI

**MAC Information**

MAC = 00-19-E3-FA-8B-BA  
 SSID = Apple Network fa8bba  
 RSSI = -36

**802.11n HT Capabilities**

Tx STBC Support = NO  
 Rx STBC Support = No Support  
 Max A-MSDU Length = 7935  
 DSSS/CCK 40 MHz = USED/ALLOWED  
 40 MHz Intolerant = False  
 PSMP Support = No  
 L-SIG TXOP Protect = Not Supported

Caps 1 Caps 2 Caps 3 Caps 4 X ◀ ▶

RT MP HT CFR SEC RSSI

**MAC Information**

MAC = 00-19-E3-FA-8B-BA  
 SSID = Apple Network fa8bba  
 RSSI = -36

**802.11n HT Capabilities**

Max Rx A-MPDU = 65535  
 Min MPDU Start = 0  
 Highest Data Rates = 0  
 Tx Max Spatial = 0  
 Tx Unequal Mods = Not Supported  
 PCO = Not Supported  
 PCO Transition Time = No Transition

Caps 1 Caps 2 Caps 3 Caps 4 X ◀ ▶

RT MP HT CFR SEC RSSI

**MAC Information**

MAC = 00-19-E3-FA-8B-BA  
 SSID = Apple Network fa8bba  
 RSSI = -36

**802.11n HT Capabilities**

MCS Feedback = None  
 +HTC = Not Supported  
 RD Responder = Not Supported

Caps 1 Caps 2 Caps 3 Caps 4 X ◀ ▶

RT MP HT CFR SEC RSSI

## 802.11N HIGH THROUGHPUT CAPABILITIES

MAC Information

MAC = 00-19-E3-FA-8B-BA  
 SSID = Apple Network fa8bba  
 RSSI = -37

802.11n Beamforming

Implicit TxBF = Not Supported  
 Receive Staqqer = Not Supported  
 Xmit Staqqer = Not Supported  
 Receive NDP = Not Supported  
 Xmit NDP = Not Supported  
 Implicit TxBF = Not Supported  
 Calibration = Not Supported

Caps 3 Caps 4 Xmit BF 1 Xmit BF 2

RT MP HT CFR SEC RSSI

MAC Information

MAC = 00-19-E3-FA-8B-BA  
 SSID = Apple Network fa8bba  
 RSSI = -33

802.11n Beamforming

Explicit CSI TxBF = Not Supported  
 Exp NonComp Feedbk = Not Supported  
 Exp Comp Feedbk = Not Supported  
 Explicit TxBF CSI = Not Supported  
 Explicit NC Fdbck = Not Supported  
 Explicit Comp Fdbck = Not Supported  
 Minimal Grouping = None

Caps 4 Xmit BF 1 Xmit BF 2 Xmit BF 3

RT MP HT CFR SEC RSSI

MAC Information

MAC = 00-19-E3-FA-8B-BA  
 SSID = Apple Network fa8bba  
 RSSI = -36

802.11n Beamforming

CSI Num Ant = 1  
 NC Fdbck Mtrx Ant = 1  
 Comp Fdbck Mtrx = 1  
 CSI Max Rows = 1  
 Space/Time Streams = 1

Xmit BF 1 Xmit BF 2 Xmit BF 3 Ant Sel Caps

RT MP HT CFR SEC RSSI

MAC Information

MAC = 00-19-E3-FA-8B-BA  
 SSID = Apple Network fa8bba  
 RSSI = -31

802.11n Beamforming

Ant Select = Not Supported  
 Exp CSI Fdbck Tx = Not Supported  
 Ant Ind Fdbck Tx = Not Supported  
 Exp CSI Fdbck = Not Supported  
 Ant Ind Fdbck = Not Supported  
 Rx ASEL = Not Supported  
 Xmit Sndng PPDU's = Not Supported

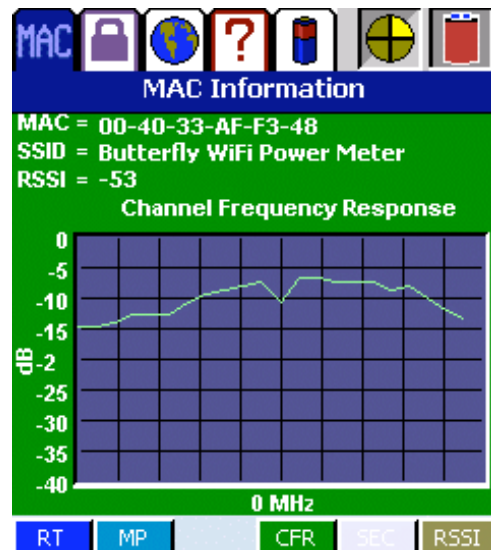
Xmit BF 3 Ant Sel Caps Info Pg 1

RT MP HT CFR SEC RSSI

## 802.11N BEAMFORMING CAPABILITIES

## CHANNEL FREQUENCY RESPONSE

The channel frequency response screen shows the frequency response for the MAC in question. The plot is signal strength versus frequency.

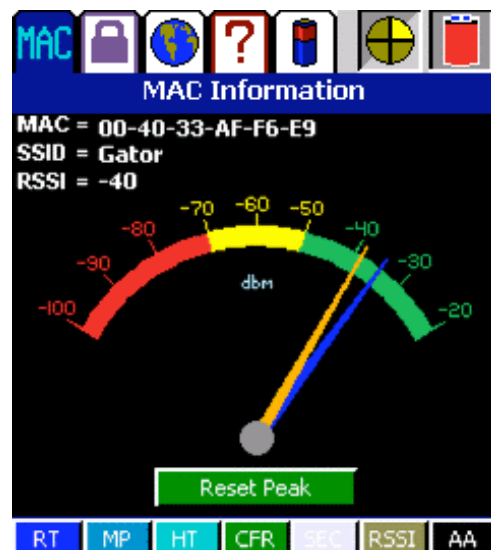


## BANG CONTROLLER CHANNEL FREQUENCY RESPONSE

## WISP ANTENNA ALIGNMENT

By clicking on the 'AA' button, a gauge will display. This gauge shows the current RSSI value (yellow) along with the peak value (blue) in dBm. The peak indicator can be reset by pressing the "Reset Peak" button.

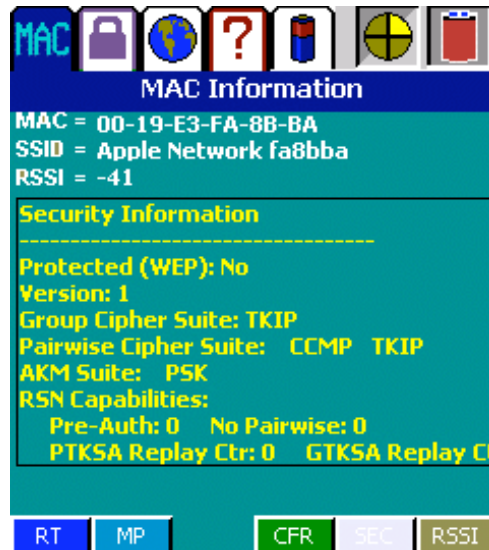
By connecting a direction-finding antenna to the YBAG, this gauge will assist in locating an access point. Simply change direction and watch the gauge. The peak indicator will mark the strongest signal received. By turning the unit until the current indicator approaches the peak indicator, the direction of the incoming signal can be located.



**Antenna Alignment Screen**

## SECURITY

The security screen shows any security information that can be ascertained from the packets for this MAC address. Information on security types such as WEP,TKIP,CCMP, etc. may be shown.

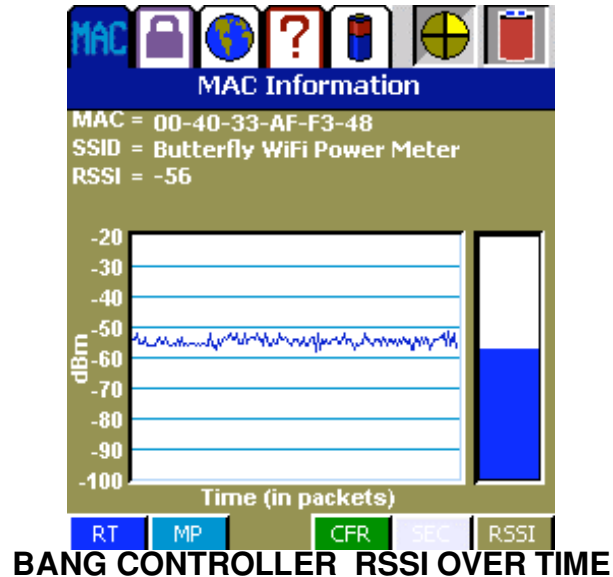


## BANG CONTROLLER SECURITY INFORMATION



## RSSI OVER TIME

The RSSI over time screen simply shows the RSSI values of packets coming in for the selected MAC address. If the update stops, that means there are no packets currently arriving from that MAC address.



## SECURITY (AUTHORIZED/UNAUTHORIZED LISTS)

By pressing the tab with the lock, a security/authorization screen will appear.

The security screen allows for entering and maintaining of authorized and unauthorized access point lists. This is a feature that is used for determining if there are rogue/hostile access points within striking distance of the network. Checking the “Enable Security” checkbox enables the security feature.

### Authorized List

The authorized list is a list that contains the MAC addresses of access points that are authorized to broadcast in the area to be concerned. This list can be created one of three ways. The first way is by entering MAC addresses in the topmost edit field on the security screen. Then the “ADD” button is pressed to add the address to the list. The next method is to retrieve a previously saved list or a list that has been created on a PC or laptop.

The final method is by pressing the “Generate Authorized List” button. This may be pressed after leaving the YBAG in the MAC list screen for a period where all access points have been seen. All of these MAC addresses will be moved into the authorized list. This list can be saved to RAM by pressing the “Save List” button. This list can be cleared by pressing the “Clear” button next to the list box.

The input file format for the authorized and unauthorized MAC list is as follows:

It is an ASCII file separated by CR/LF's. The first line is the number of authorized addresses in the list. Then each MAC is on a separate line.

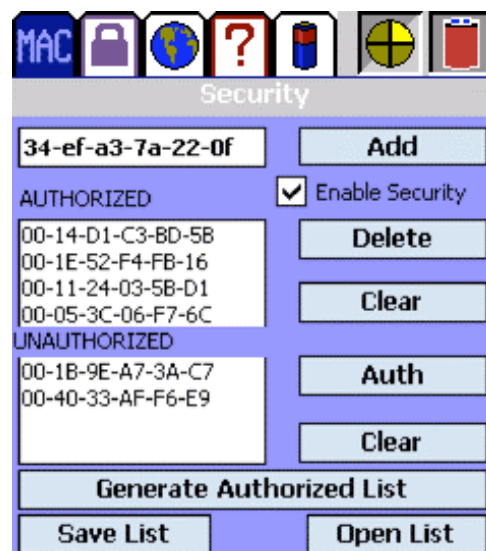
```
AUTH COUNT
AUTH MAC#1
AUTH MAC#2
.
.
.
AUTH MAC#N
UNAUTH COUNT
UNAUTH MAC#1
UNAUTH MAC#2
.
.
.
UNAUTH MAC#N
```

After creating this file, it may be imported by using the ‘Retrieve List’ option.

## Unauthorized List

The unauthorized list is populated when the security feature is turned on. Any MAC addresses seen and demodulated by the receiver which are not in the current authorized list will be flagged and inserted into the unauthorized MAC address list.

Items in this list can be saved or retrieved to/from RAM along with the authorized list by pressing the “Save List” or “Retrieve List” buttons. If the MAC addresses in the unauthorized list are wished to be authorized, simply select the entry in the list box and press the “Auth” button. This list can be cleared by pressing the “Clear” button next to the list box.

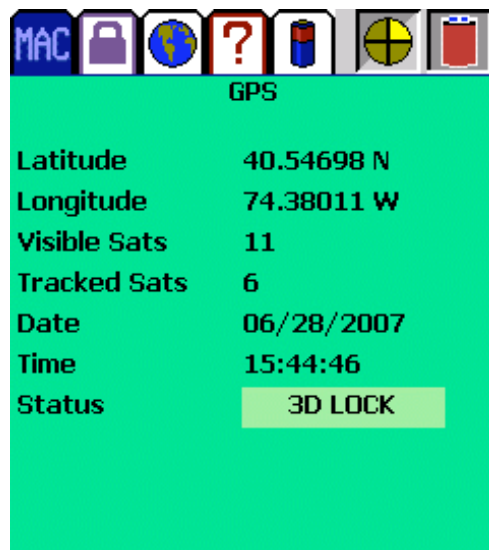


The screenshot displays a software interface titled "Security". At the top, there is a row of seven icons: a blue square with "MAC", a purple padlock, a globe, a red question mark, a blue battery, a yellow and green circle, and a red trash can. Below the title bar, the interface is divided into several sections. At the top left, a text box contains the MAC address "34-ef-a3-7a-22-0f", with an "Add" button to its right. Below this, there are two main sections: "AUTHORIZED" and "UNAUTHORIZED". The "AUTHORIZED" section contains a list of four MAC addresses: "00-14-D1-C3-8D-5B", "00-1E-52-F4-FB-16", "00-11-24-03-5B-D1", and "00-05-3C-06-F7-6C". To the right of this list is a "Delete" button. The "UNAUTHORIZED" section contains a list of two MAC addresses: "00-1B-9E-A7-3A-C7" and "00-40-33-AF-F6-E9". To the right of this list are "Auth" and "Clear" buttons. Above the "UNAUTHORIZED" list, there is a checkbox labeled "Enable Security" which is checked. At the bottom of the interface, there are three buttons: "Generate Authorized List", "Save List", and "Open List".

**Authorization Screen**

## GPS Information

The GPS tab makes visible the GPS information screen. Information includes current latitude and longitude, number of visible and tracked satellites, data and time, and whether or not the receiver is locked. If the receiver is not locked, the status box will become red. It will appear yellow if there is a 2 dimensional lock, and green if it has a 3 dimensional fix.



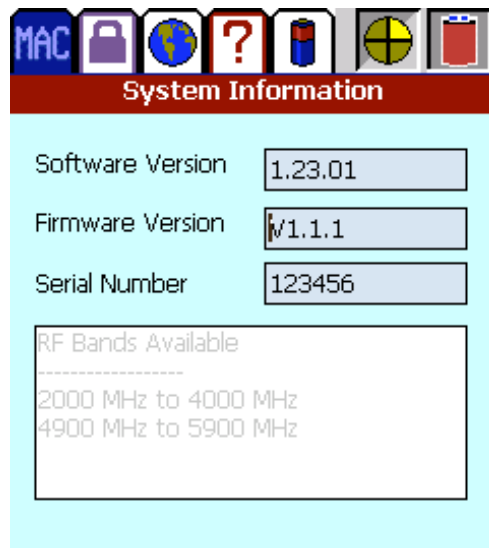
GPS DISPLAY

**NOTE:** The internal GPS receiver is activated as soon as the iPAQ application starts. The first time the GPS receiver is used in a new location it may take up to 30 minutes to achieve a lock. After that it should only take a few minutes. Make sure that the GPS antenna is attached to the Beetle-BANG BANG GPS connector and threaded hand tight.

The GPS antenna should be in an area that can see a majority of the sky. GPS satellites are in orbit and change position. The antenna needs to be able to see a number of these satellites at any time. If you are using the Beetle-BANG BANG in a vehicle, it is best to mount the antenna on the roof. If you are walking outside, hold the antenna flat to the sky and keep at least 1 foot from the Beetle-BANG.

## System Information

The system information tab shows the unit firmware version, serial number, and the frequency ranges which are tunable.



The image shows a graphical user interface for a 'System Information' tab. At the top, there is a row of seven icons: a blue square with 'MAC', a purple padlock, a blue globe, a red square with a white question mark, a blue battery, a yellow and black circular target, and a red document. Below these icons is a red header bar with the text 'System Information' in white. The main content area has a light blue background. It contains three labels with corresponding text boxes: 'Software Version' with '1.23.01', 'Firmware Version' with 'V1.1.1', and 'Serial Number' with '123456'. Below these is a larger white box with a black border. The title 'RF Bands Available' is in grey. Below it is a dashed line, followed by two lines of grey text: '2000 MHz to 4000 MHz' and '4900 MHz to 5900 MHz'.

System Information	
Software Version	1.23.01
Firmware Version	V1.1.1
Serial Number	123456
<b>RF Bands Available</b> ----- 2000 MHz to 4000 MHz 4900 MHz to 5900 MHz	

## SYSTEM INFORMATION DISPLAY



## Power Profile

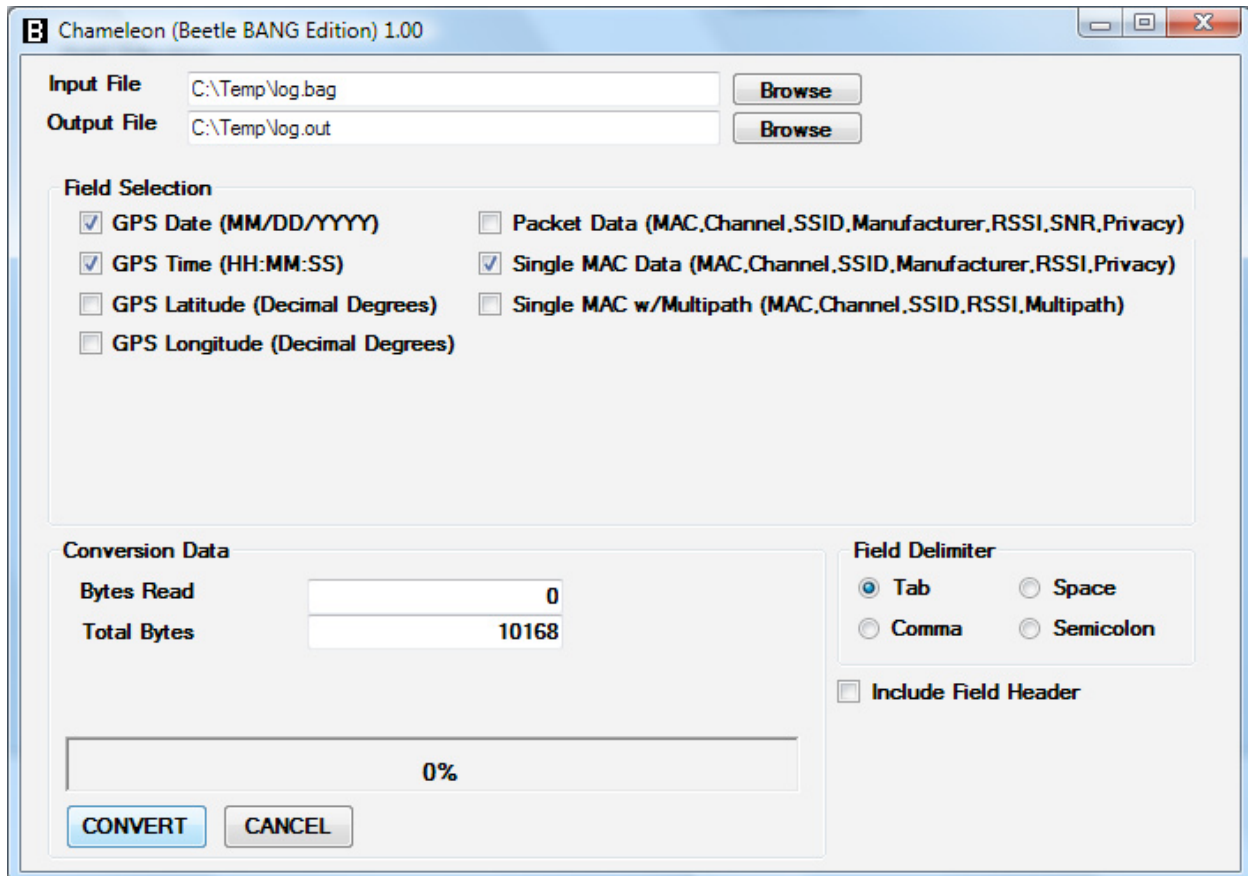
The power profile tab shows battery and supply voltage, internal/external source, and percentage of battery life left. If this screen says “Inaccurate”, the battery has not been trained (needs a charge/discharge cycle.)



POWER PROFILE DISPLAY

## Chameleon Software for Beetle-BANG

Chameleon software allows users to gather collected Wi-Fi data and export it as organized ASCII text or spreadsheets such as Excel. Chameleon is included on the Beetle-BANG SD installer card and runs under Windows XP on a laptop or desktop PC.



Chameleon Screen