BumbleBee-EX/LX/RFID

Multi-Band Spectrum Analyzer

manual version 1.2 for all EX, LX & RFID models

Contents

Unpacking Your BumbleBee

BumbleBee with accessories

BumbleBee user's manual and software

DOCUMENTATION

WIRELESS PRODUCTS

BumbleBee unit includes calibrated receiver, iPAQ and battery system

omni directional antennae (2.4 GHz, 3.4-3.6 GHz, 5 GHz)

larger case handle, hex keys & spare data/power cable for iPAQ

iPAQ charging/ data USB cradle

BumbleBee AC power adapter

BumbleBee BOTTOM VIEW

SMA Male antenna input
Warning: Maximum input 0 dBm NO DC Input

Air Intake
Cooling Fan

Air Vent
(Output)

Warning: You must remove THIS electrical connection removed before performing any actions near any "HOT" electrical surface.

BumbleBee Receiver
Power/Charging Connector

BumbleBee TOP VIEW

Air Vent
(Intake)

DF Antenna
screw mounts

SMA Male antenna input
Warning: Maximum input 0 dBm NO DC Input

iPAQ Power/Charg-
ing Connector

About Your BumbleBee

Unpack and assemble your BumbleBee unit as shown. Your BumbleBee is a self-contained spectrum analyzer. 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 BumbleBee 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 BumbleBee.

iPAQs supplied by BVS have the BumbleBee software pre-installed. If you need to install the BumbleBee software, see the software installation/re-installation section.

Tap the windows Start icon in the upper left corner and then choose BumbleBee in the pulldown menu. If the BumbleBee does not appear in the pulldown menu, tap on the "Programs" folder. Tap on the BumbleBee icon.

Running the BumbleBee software will power the BumbleBee spectrum analyzer.

If the BumbleBee software loses communication with the BumbleBee, 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.

900 MHz Direction Finding Yagi

Vertical   Horizontal
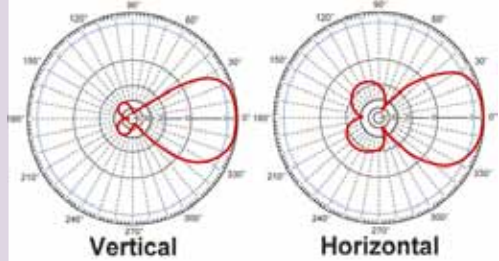
Frequency	890-960 MHz
Gain	9 dBi
Polarization	Horizontal or Vertical
Horizontal Beam Width	54°
Vertical Beam Width	48°
Front to Back Ratio	14 dB
Impedance	50 Ohm
Max. Input Power	100 Watts
VSWR	< 1.5:1 avg.
Elements	5
Weight	1.5 lbs. (0.7 kg)
Length	19.6 in. (0.5 m)
Mounting	2 in. (50.8 mm) diameter mast max.
Operating Temperature	-40° C to to 85° C (-40° F to 185° F)
Lightning Protection	DC Short
Connector	N-Female

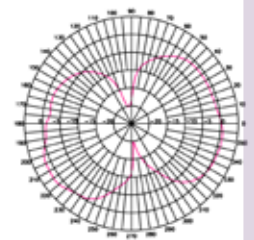# 900 MHz Omni-Directional (9.5" long)

Electrical Properties:

Frequency Range: 890~960 MHz GSM Band or 824~896 MHz AMPS Band
Impedance: 50Ω nominal
VSWR: <2.0:1
Gain: 2.0 dBi
Radiation: Omni
Polarization: Vertical
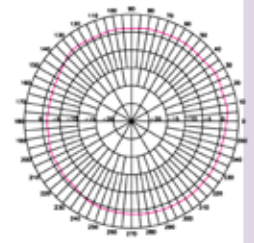Wave: Half Wave Dipole

Mechanical Properties:

Connector: SMA Plug(male)
Material:
  Whip: Polyurethene(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

E-Plane Pattern @ 925 MHz

H-Plane Pattern @ 925 MHz
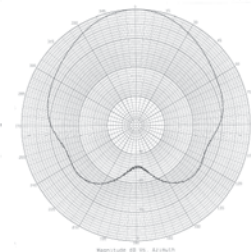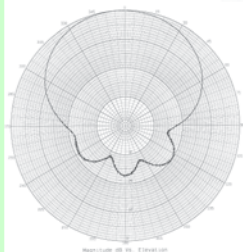
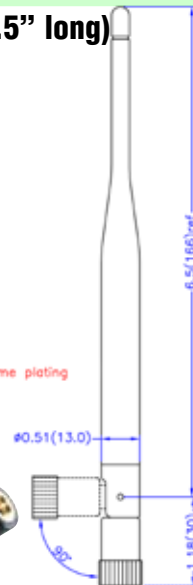# 2.4 GHz Direction Finding Corner Reflector

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: Polyurethene(Black)
  Swivel Mechanism: Polyurethene(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)
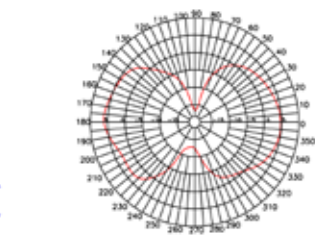
Electrical Properties:

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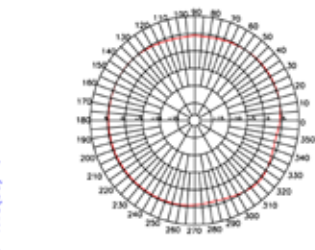
Mechanical Properties:

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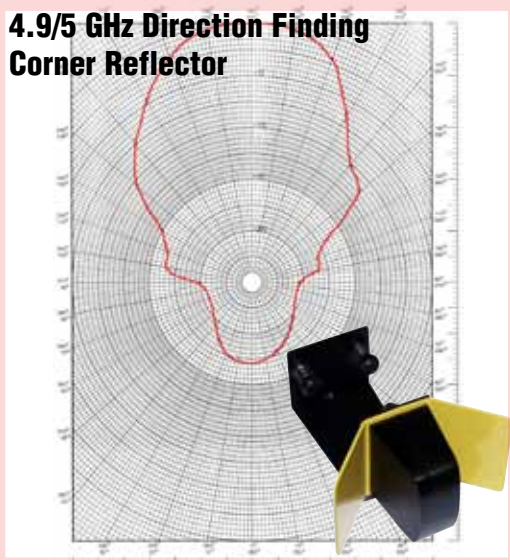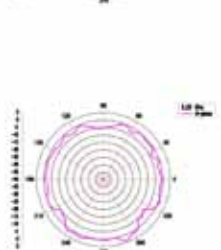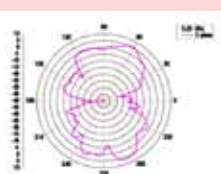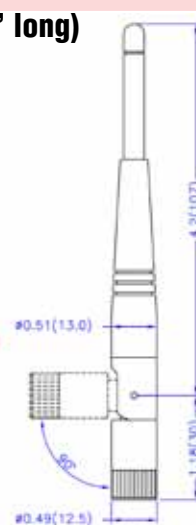Storage Temp.: −30°C to +75°C

Accessories

Your BumbleBee 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.

BumbleBee Power System

BumbleBee 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.

NOTE: BVS recommends charging the unit once every 2 weeks (once a month at an absolute minimum). Failure to do so may damage the battery and/or reduce battery run time. Not following these instructions may void warranty coverage on the battery.

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 BumbleBee POWER ISSUES

Your BumbleBee Spectrum Analyzer and your HP iPAQ are both charged and/or powered through the 4 pin power port at the bottom of the BumbleBee. 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 BumbleBee 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.

NOTE: If unit is not being charged occasionally, the Lithium-Ion battery pack will completely discharge which permanently damages it. This is true for any Lithium-Ion powered device. BVS recommends charging the unit once every 2 weeks (once a month at an absolute minimum). Failure to do so may damage the battery and/or reduce battery run time. Not following these instructions may void warranty coverage on the battery.

HARDWARE CONNECTION ISSUES

When the BumbleBee 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 BumbleBee and the iPAQ. The charge (Yellow) LED on the iPAQ should be flashing if the cable is connected correctly and the BumbleBee 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 BumbleBee software.

NOTE: Your BumbleBee receiver will only support one spectrum analyzer model. Please note the frequency that your model covers:

BumbleBee-EX (2.0-4.0 & 4.9-5.9 GHz)
BumbleBee-LX (750-2000 MHz)
BumbleBee-RFID (860-960 MHz & 2.4-2.5 GHz)

SOFTWARE INSTALLATION/RE-INSTALLATION

The BumbleBee software can be installed/re-installed in three ways.

CD installation
1. Connect the iPAQ to the PC by connecting through ActiveSync. Note that ActiveSync needs to be installed on the PC. It is preinstalled on the iPAQ.
2. Insert the CD. If the installation program does not appear after a few seconds, run autorun.exe from the root directory of the CD.
3. Choose the BumbleBee software button.
4. Follow the installation instructions.
5. Software is now installed on the user's iPAQ.

SD (secure digital) card installation
(The iPAQ must be removed in order to access the SD card slot. Be careful not to touch the cooling fan while it is spinning)
1. The BumbleBee shipped with an SD card that contains a copy of the BumbleBee software.
2. Insert the SD card into the SD slot on the iPAQ.
3. Go to File Explorer on the iPAQ. Proceed to the SD Card folder off of the root directory ("My Device").
4. Run install.exe.
5. Choose the model of your iPAQ and press the install button.
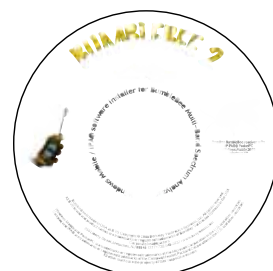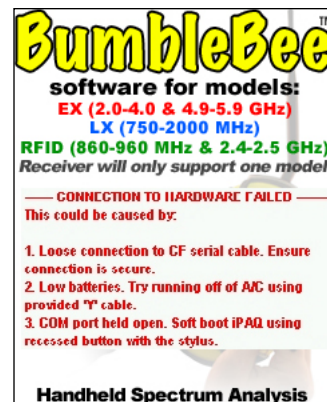
6. Software should now be installed on your iPAQ.

OPERATIONAL TIPS

SURVEYING

While surveying, BumbleBee 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 BumbleBee software that you do not have either 802.11b or Bluetooth running on the same iPAQ. This will interfere with BumbleBee 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 BumbleBee 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 BumbleBee 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.
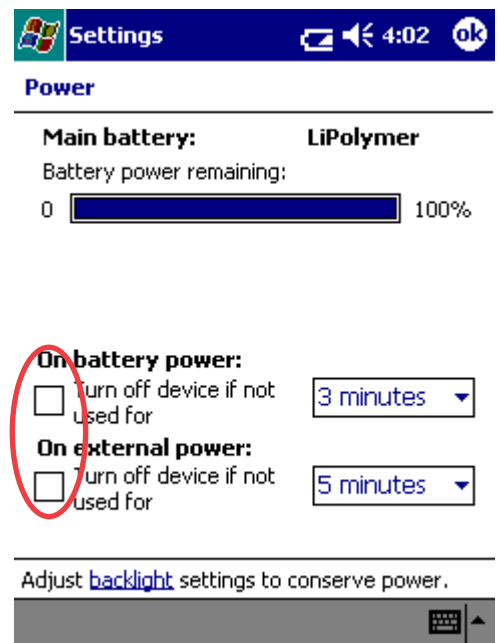
Choose Settings and then choose System settings at the bottom. Select battery icon for Power Settings to access this screen. These power settings come unchecked from the BVS factory to ensure BumbleBee-EX software runs optimally.

Accessories for your Bumble Bee

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

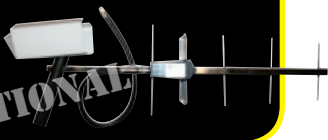Ni-MH Fast-Charger
4 AA 6 V
P/N NIMH-001
$ 55.00 *STANDARD*

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

900 MHz Direction Finding Yagi Antenna with mounting bracket, cable & SMA male
9 dBi gain
P/N HG909Y
$ 125.00 *OPTIONAL*

Data Playback Windows PC Software
$ 250.00 *OPTIONAL*

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

Nectar
PC Spectrum Analysis Software
Ask for a Quote *OPTIONAL*

Honeycomb
Interference 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 Omni Antenna
SMA male swivel
P/N S151AM-2450S
$ 25.00 *STANDARD*

900 MHz Omni Antenna
SMA male swivel
P/N C191AM-925
$ 25.00 *STANDARD*

2.4 GHz Direction Finding Antenna with mounting bracket, cable & SMA male
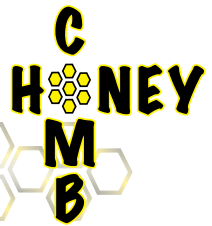9 dBi gain
P/N 2ND
$ 250.00 *OPTIONAL*

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*

HONEYCOMB™

RF INTERFERENCE-MAPPING SITE SURVEYS

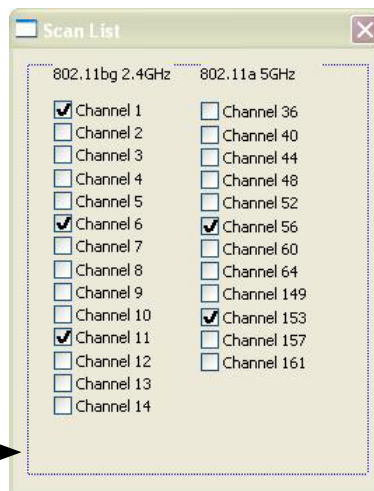**HONEY COMB**

1 Create Survey Maps:
HONEYCOMB PROJECTOR (PC)

Import any image file of a floorplan or site
Create a distance projection
Add simple objects to image
Add custom objects to floorplan
Scale and crop image
Save for use in Collector and Analyzer

HoneyComb™ is Windows XP and Mobile 5.0 interference-mapping software designed for use with of BVS Bumble Bee™ spectrum analyzer system. It consists of three parts: Projector, Collector, and Analyzer. Sources of interference can be separated from 802.11 WLAN signals, allowing the user to graph severity of interference, percentage of channel capacity remaining and other significant interference related quantities. HoneyComb™ aids in locating jamming interference, unintentional interference and network intrusion as well as channel verification.

HoneyComb™ will also map all likely signal sources and strengths for helping to clear "RF free zones." Floorplans or site maps can be used as a reference to collect data leaving the resulting interference maps to be overlayed onto floorplans for easy identification of interference prone areas.

Honeycomb™ allows users to take measurements at anytime in the field using your iPAQ and Berkeley's calibrated receiver technology.

Honeycomb™ scan list allows users to search all Wi-Fi channel allocations for 802.11b/a/g while still in the field.

Scan List

802.11bg 2.4GHz

☑ Channel 1
☐ Channel 2
☐ Channel 3
☐ Channel 4
☐ Channel 5
☑ Channel 6
☐ Channel 7
☐ Channel 8
☐ Channel 9
☐ Channel 10
☑ Channel 11
☐ Channel 12
☐ Channel 13
☐ Channel 14

802.11a 5GHz

☐ Channel 36
☐ Channel 40
☐ Channel 44
☐ Channel 48
☐ Channel 52
☑ Channel 56
☐ Channel 60
☐ Channel 64
☐ Channel 149
☑ Channel 153
☐ Channel 157
☐ Channel 161

2 Instant RF Surveys:
HONEYCOMB COLLECTOR (iPAQ)

Save multiple data files while using same projection file
Ability to choose up to 26 802.11b/a/g channels
Adjust duration of scan
Adjust period of scan for each channel
Automatically saves data to file
Take screen snapshots of any site
Saves data for further analysis in HoneyComb™ Analyzer
Shows walk/drive path
Access information on any point at any time

HoneycombAnalyzer - [bvs1.bpf]

File Edit View Window Help

Files | Channels | Report

Show Selected Files
Show Selected Channels
Show Survey Path
Show Access Points
Show Interference Sources
Show Signal Analysis
Show Interference Analysis
Show Total Signal Analysis

Path
— bvs2

Power dBm
-35:-30
-39:-35
-44:-39
-48:-44
-53:-48
-37:-53
-62:-57
-66:-62
-71:-66
-75:-71

3 Plot Interference Analysis:
HONEYCOMB ANALYZER (PC)

Imports data from other Honeycomb applications
Detect/Separate interference from Wi-Fi signals
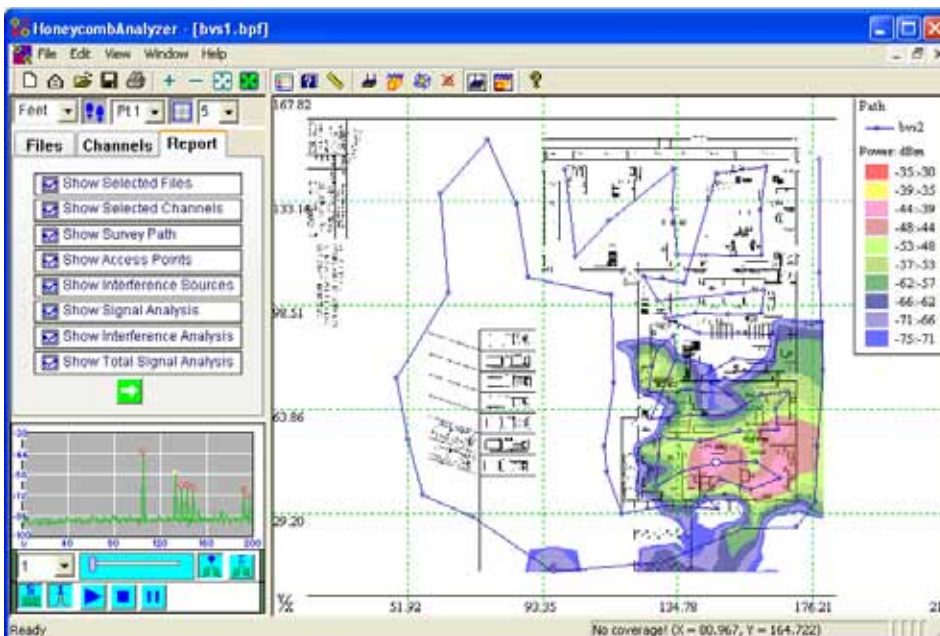Interference severity and channel
Plot and view interference-related problems
Wi-Fi channel capacity for intrusion detection
Plot and view "RF free zones"
Print and export plots into bmp files
Create a HTML report for any survey area

OPTIONAL SOFTWARE AVAILABLE FOR YOUR BUMBLEBEE

NECTAR™

RF Spectrum Analysis Software On Your PC

Nectar™ is a Windows® XP software application that scans and monitors a variety of wireless networks. *Nectar*™ utilizes the **BumbleBee**™ Receiver Module to continuously scan **BumbleBee**™ frequency bands **900 MHz, 2.4 GHz and 5 GHz**, **2.4, 4.9 and 5 GHz** or **(BumbleBee Wi-MAX frequencies)**. Users must specify the desired RF frequency models when ordering. Current **BumbleBee**™ customers may use their receivers with the **Pollenator**™ PC interface with *Nectar*™ software. User selectable channel, preset and log settings ensure that *Nectar*™ software is able to distinguish your network's signal strength from other networks and sources of RF interference. Laptop or PC control via USB and ethernet creates customized, time-stamped log files for true 24/7 monitoring. In addition, JPEG/BMP snapshot features allow users to instant capture waveforms at key moments for later analysis. *Nectar*™ software features up to 5 distinct waveform traces (1 live and 4 peak), screen averaging, video smoothing and packet/interference triggering.
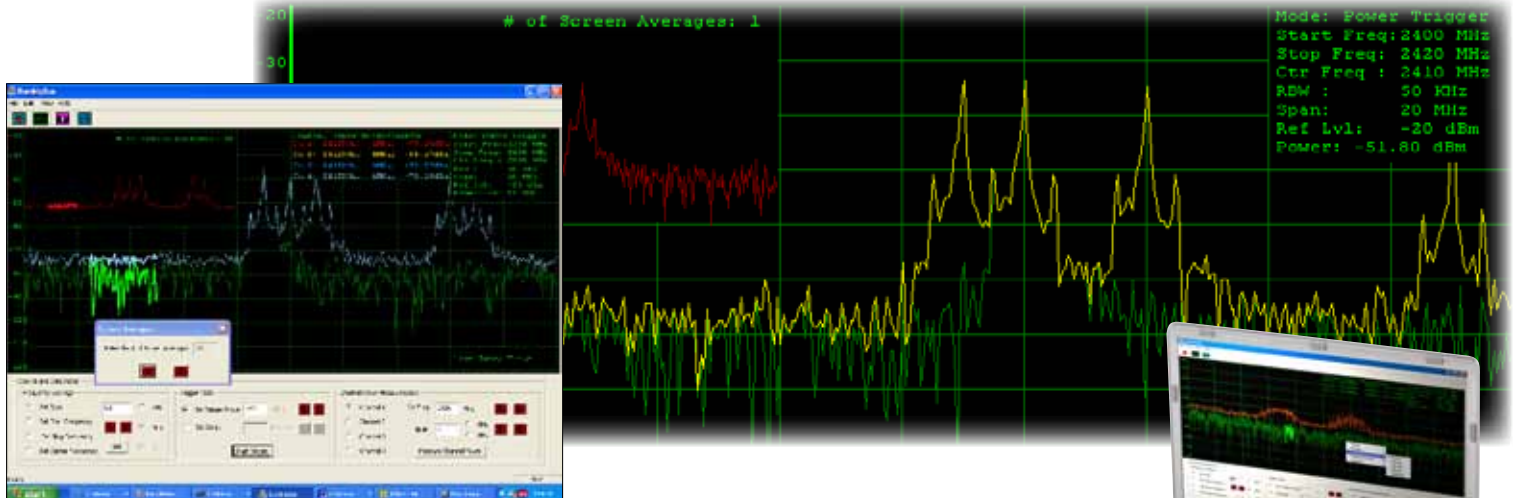
✔ Full Spectrum Analysis using BumbleBee™ calibrated receiver technology

✔ Channel Power Measurements (up to 4 user selectable channels)

✔ Adjacent Channel Power Measurements

✔ Presets for different frequency bands

✔ Choose Between 3 Different Models: **(900 MHz, 2.4 & 5 GHz)** **(2.4, 4.9 & 5 GHz)** **(BumbleBee Wi-MAX frequencies)**

✔ Interfaces to BumbleBee receiver via USB & Ethernet (using Pollenator™)

✔ Power Trigger Modes (with measurement delay)

✔ 5 Waveform Traces (1 live & 4 peak traces)

✔ Screen Averaging (up to 100 traces)

✔ Video Smoothing (VBW : 50 kHz)

✔ JPEG/BMP Snapshots of the screen

Use BumbleBee™ hardware on your desktop or laptop for spectrum analysis monitoring 24/7.

Use your BumbleBee™ receiver and Pollenator™ to interface with your PC via the USB or Ethernet port.

OPTIONAL SOFTWARE AVAILABLE FOR YOUR BUMBLEBEE

BumbleBee Controller iPAQ Windows Mobile Software

Introduction

The BumbleBee is a precision hand-held spectrum analyzer and packet demodulator. Data is displayed by YellowJacket software running on an iPAQ. This iPAQ is connected to the BumbleBee via a serial cable. The BumbleBee features Trace Peak Hold, Persistence Display and Channel Power Trigger to detect and measure bursty signals and bursty interference. See each feature's section in this manual.

Installation of Software

The BumbleBee 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 BumbleBee software.

Getting Started

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

BUMBLEBEE CONTROLLER DISPLAY AT STARTUP

Quick Tour

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

Spectrum Analysis - This section contains data relating to spectrum analysis including averaging, triggering, peak hold, marker and delta.

System Information - Information such as serial number, firmware version, and frequency bands are displayed here.

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 BumbleBee is on external power. If a battery is shown, the unit is operating on batteries and a percentage remaining will be displayed.

BumbleBee 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 or Chameleon.

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 BumbleBee screens shown in this section of the manual were saved using this option.

SPECTRUM ANALYSIS

Navigating through the menus
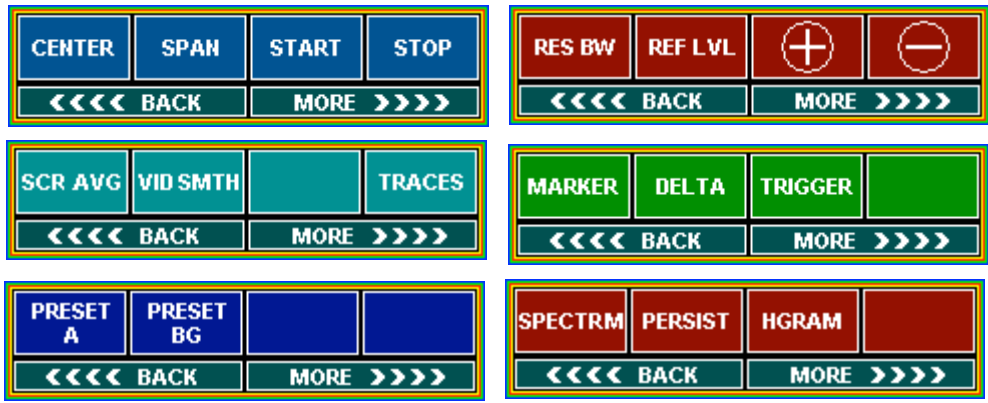
Shown below are the different options for the spectrum analysis mode. To navigate through these options, simply press the "MORE" and "BACK" buttons. Pressing either button repeatedly will eventually scroll back to the first set of options.

Entering data for some options requires using the numeric data entry screen and/or the level entry screen (as shown above). For the numeric entry screen, tap out the number and then press either the Ghz or Mhz button. To cancel the entry, press the 'X' button.

For the level entry screen, use the arrows to scroll up and down through data values. Press 'OK' when the correct value is selected. Press 'X' to cancel the selection.

Making a Measurement

This section describes the basic procedure to measure off-air signals in the 2.4 – 2.5 GHz band.

1. Start your BumbleBee, if it is not already, as described in the Getting Started section.
2. Connect the 2.4 GHz omnidirectional antenna to the BumbleBee.
3. Go to spectrum analysis mode: Tap the spectrum tab.
4. Set the frequency range to scan to 2400-2500 MHz.
5. Set the Reference Level: Tap the "REF LVL" option. Verify that the reference level is set to – 40 dBm.
6. Set the Trace options: Tap the "TRACES" option. Tap the "PEAK" button for trace 1.
7. If the Trace is drawn off the top of the screen, tap the "TRACES" option. Tap the "Live" button for trace 1. Continue with step 5, but raise the Reference Level 10 dB.
8. Continue with step 6.

If the Trace is drawn does not display any signal after a minute or two, tap the "TRACES" button on the data entry portion of the screen. Tap the "Live" button for trace 1. Continue with step 5, but lower the Reference Level 10 dB. Continue with step 6.

Options

Center Frequency

This menu option allows the user to set the new center frequency to be displayed. The value, along with the current span, must not be outside the valid receiver bands.

Frequency Span

This menu option allows the user to set the span. The value, along with the center frequency, must not be outside the valid receiver bands. Use the numerical data entry instructions to set the value.
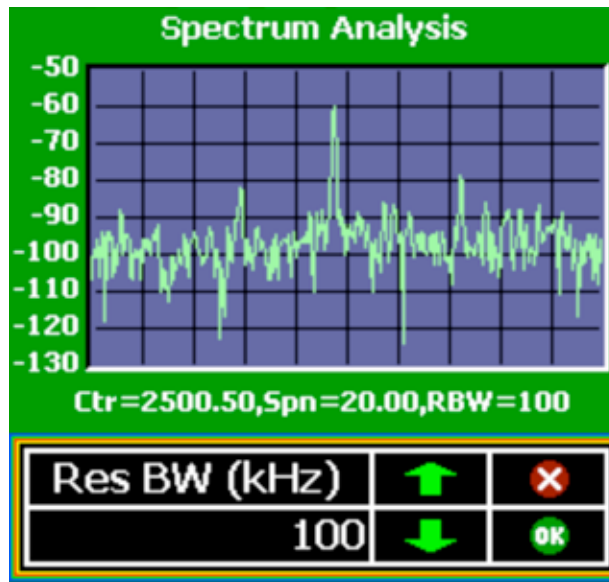
Start Frequency

This menu option allows the user to set the new start frequency. The value, along with the current span, must not be outside the valid receiver bands.

Stop Frequency

This menu option allows the user to set the new stop frequency. The value, along with the current span, must not be outside the valid receiver bands.

RESOLUTION BANDWIDTH

WHAT IS IT?

The BumbleBee measures the energy present in different frequency bins, each bin's width equal to the resolution bandwidth.

HOW TO SET IT?

The resolution bandwidth is set by setting the level for the resolution bandwidth desired.

WHY TO USE IT?

Why use a small Resolution Bandwidth? A small Resolution Bandwidth is appropriate to measure frequency components and signal characteristics. Smaller Resolution Bandwidths increases the Sweep Time (number of traces displayed per second) for a given frequency Span. Why use a large Resolution Bandwidth? A large Resolution Bandwidth is appropriate to measure large Spans of frequencies quickly. A Resolution Bandwidth larger than the signal's bandwidth can measure channel power. The BumbleBee may be set to a large Resolution Bandwidth and a large Span to quickly sweep and identify frequencies of interest. The Span and Center can then be decreased to measure frequency components and the signal's characteristics.

REFERENCE LEVEL
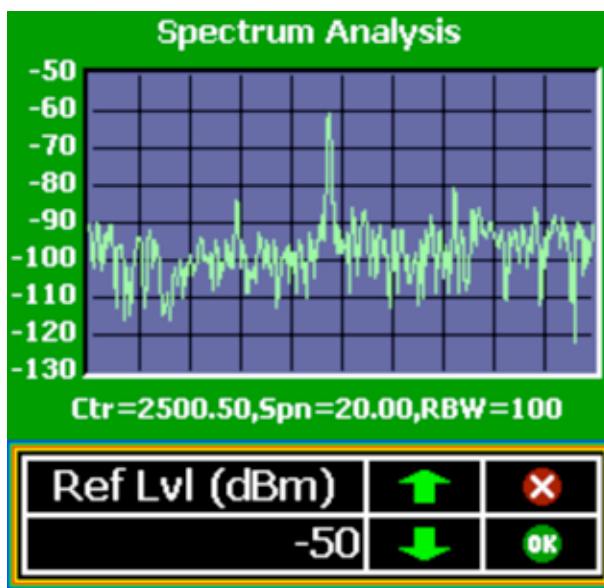
WHAT IS IT?

This menu option allows the user to set the current reference level of the receiver. The valid choices are between -20 and -70 dBm, in 10 dBm increments.

HOW TO USE IT?

The level indicated by the BumbleBee at the top of the measurement display is the reference level. The Reference Level should be adjusted to obtain the greatest dynamic range. The Reference Level should be set so that the strongest signal on the display is about 10 dB down from the top of the measurement display. If a signal is drawn off the top of the measurement display or the message "clipped" is displayed, lower the Reference Level. The highest Reference Level is –20dBm. The lowest Reference Level is –70dBm.

ZOOM IN

WHAT IS IT?

Zoom In will reduce the span shown on the display and re-center on the stylist tap.

HOW TO SET IT?

Simply tap on the frequency of interest. The span will be cut in half.

WHY TO USE IT?

Zooming in on a signal is used to get a clearer picture of a signal by reducing the span.

ZOOM OUT

WHAT IS IT?

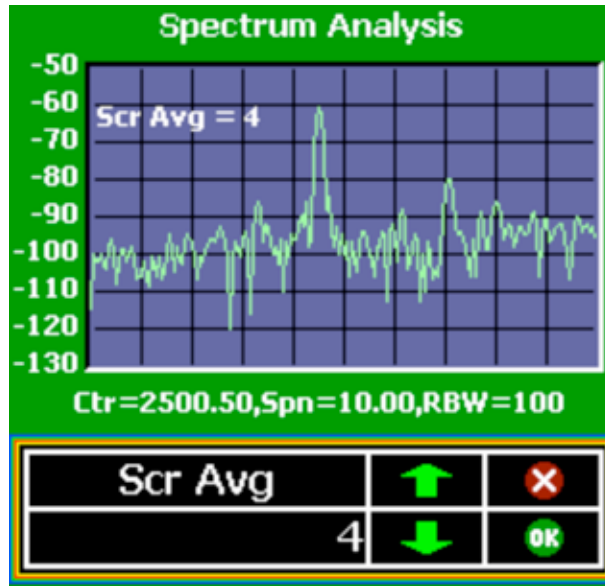Zoom Out will double the span shown on the display.

HOW TO SET IT?

Simply tap on '-' . The span will be doubled.

WHY TO USE IT?

Zooming out from a signal is used to get a broader picture of a signal by increasing the span.

SCREEN AVERAGING

WHAT IS IT?

The screen averaging option provides an average of data points over the last N traces.
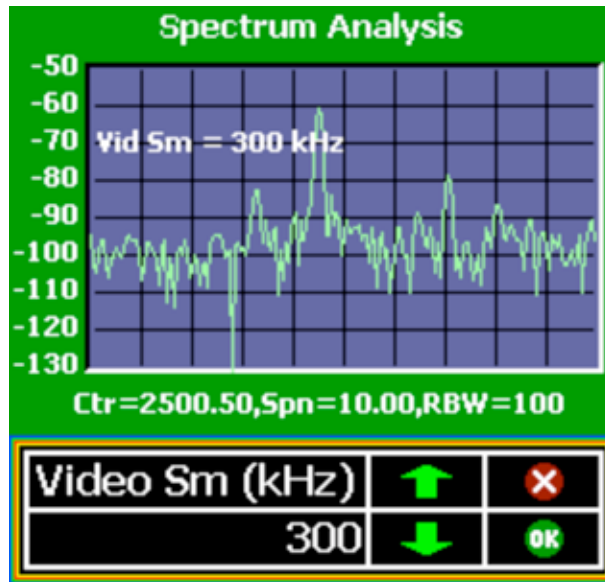
HOW TO SET IT?

Use the up and down arrows to set this value. 1 is no averaging. Any value over 1 will take the last N traces and display the average value for each frequency.

WHY TO USE IT?

Screen averaging is used as another method of smoothing the signal to average noise fluctuations.

VIDEO SMOOTHING

WHAT IS IT?

Video Smoothing uses adjacent bin averaging to reduce the amount of fluctuation in the measured trace due to noise. This is different from Screen Averaging, which averages the same frequency bin from different traces.
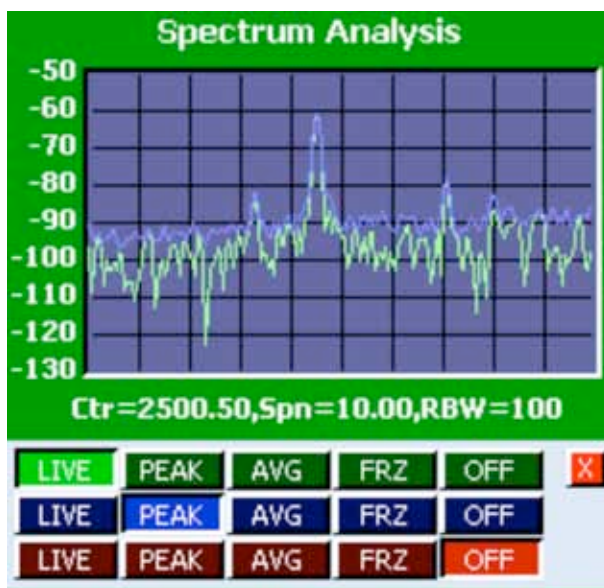
HOW TO SET IT?

Use the arrows to increase or decrease the bandwidth which are averaged for the smoothing. When properly set, Video Smoothing can reduce the variation of the trace due to noise without distorting the trace. It is especially useful for smoothing signals that are not continuous or repetitive.

WHY TO USE IT?

The user must use good judgment when applying Video Smoothing. It is possible to smooth the trace too much so that the trace no longer represents the spectrum of the signal.

TRACES

WHAT IS IT?

The Traces menu item allows the user to display three different traces in different ways. Each trace can be set to live, peak, average, freeze, or blank.

HOW TO SET IT?

Each trace has a different color. Assign the action for the trace based on the same color buttons. To make a trace report 'live' data, press the 'LIVE' button. To make a trace hold the peak value at each point, press the 'PEAK' button. The reported value will be the highest power at each frequency. To see averaged data (i.e. screen averaging or video smoothing), press the 'AVG' button. To freeze the current report of a trace, press the 'FRZ' button. This will display the last report for each frequency. To remove the trace from the screen, press the 'OFF' button.

TIP: Periodically clear "PEAK" hold data by setting the Trace to "LIVE" and then resetting it to "PEAK" hold. 31

MARKER FUNCTIONS
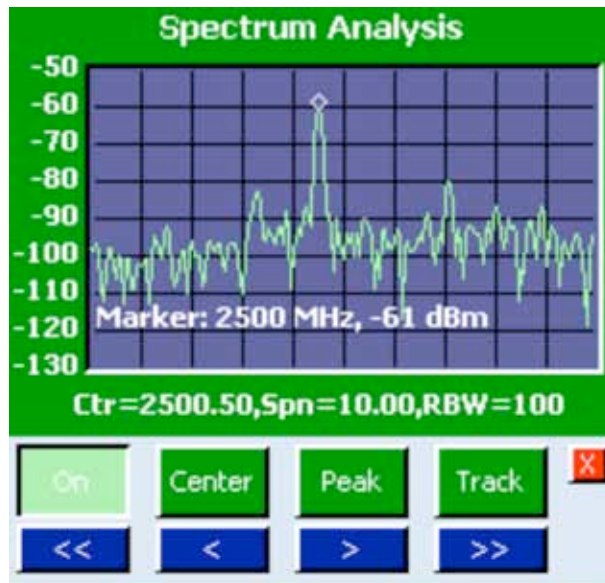
WHAT IS IT?

The marker menu option allows the user to place a marker at a certain frequency. The frequency and power values are shown at the marker position. It also allows a delta marker. This delta marker shows the difference in frequency and power from the marker.

HOW TO SET IT?

To turn on the marker value and/or the delta marker value, simply tap the 'ON' button for either value. Use the arrows to move the marker or delta value left or right across the screen. Use the double-arrows to move faster. To center the marker on the screen, press the 'CENTER' button. To place the marker on the highest power value, press the 'PEAK' button. To track the peak value, press the 'TRACK' button.

TRIGGER
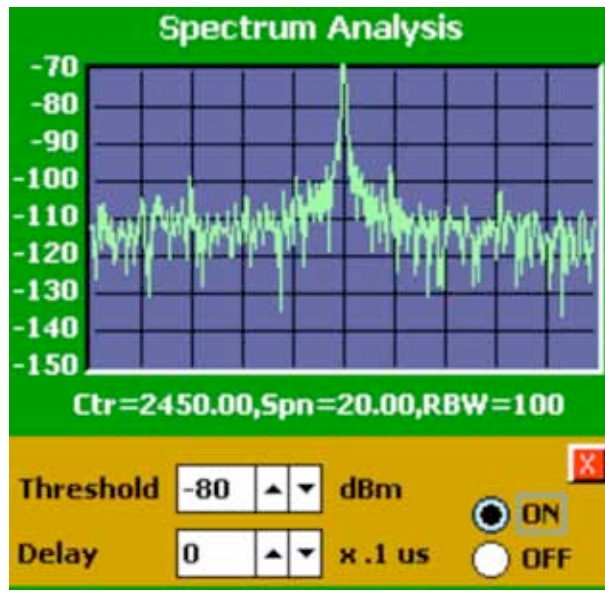
WHAT IS IT?

Trigger Mode enables the BumbleBee to quickly capture the spectrum from sources that are not continuously transmitting. The trigger threshold represents the amount of CHANNEL POWER that when exceeded will trigger the BumbleBee to measure the spectrum. The trigger delay sets a delay between the trigger threshold being exceeded and the measurement of the spectrum.

HOW TO SET IT?

The trigger threshold is set by the user in dBm, and its range is from the current Reference Level to 20dB below the current Reference Level.

NOTE: Span MUST be set to 20 Mhz.

WHY TO USE IT?

Trigger Mode is very useful to capture the spectrum from any source that is not continually transmitting on the same frequency. This includes 802.11 a,b,g devices and Frequency Hoppers.

Trigger Mode Example to Measure off-air signals.

This section describes how to use the BumbleBee's advanced Trigger Mode to measure offair signals. This example will measure signals on 802.11 b/g channel 1, but the center frequency may be changed to any that your BumbleBee can tune.

A Reference Level Setting of –40 dBm is appropriate for most off-air measurements, and is recommended to start off-air measurements. Changing the Reference Level to –30 dBm will decrease the BumbleBee's sensitivity for stronger signals, and lowering the Reference Level to –50 will increase the BumbleBee's sensitivity for weaker signals.

The Trigger Threshold represents the amount of channel power in a 20 MHz channel that must be exceeded to trigger the BumbleBee to measure the spectrum. The Trigger mode requires the span to be set to 20 MHz.

The Trigger Delay is not typically used for off-air testing and can be left at 0.

1. Start your BumbleBee, if it is not already, as described in the Getting Started section.

2. Connect the 2.4 GHz omnidirectional antenna to the BumbleBee.

3. Set the frequency range to scan: Tap the "Preset BG" option. Tap "1" on the data entry portion of the screen. This will set the center frequency.

4. Set the Span: Tap the "SPAN" button and set the Span to 20 Mhz.

5. Set the Reference Level: Tap the "REF LVL" option. Change the reference level to –30 dBm.

6. Set Trigger options: Tap the "TRIGGER" option. Change the Threshold to –45 dBm.

7. Start the Trigger: Tap the "ON" radio button

8. Check for relatively Strong Signals: The BumbleBee will now trigger and display the spectrum of any signals that have a channel power greater than –45 dBm. If the BumbleBee does not trigger and display a spectrum, no signals are present with a channel power above –45 dBm.

9. Stop the Trigger: Tap the "OFF" radio button.

10. Set the Reference Level: Tap the "REF LVL" option. Change the reference level to –40 dBm.

11. Set Trigger options: Tap the "TRIGGER" option. Lower the Threshold to –55 dBm.

12. Start the Trigger: Tap the "ON" radio button.

13. Check for Signals: The BumbleBee will now trigger and display the spectrum of any signals that have a channel power greater than –55 dBm. If the BumbleBee does not trigger and display a spectrum, no signals are present with a channel power above –55 dBm.

14. Stop the Trigger: Tap the "OFF" radio button.

15. Set the Reference Level: Tap the "REF LVL" option. Change the reference level to –50 dBm.

16. Set Trigger options: Tap the "TRIGGER" option. Lower the Threshold to –65 dBm.

17. Start the Trigger: Tap the "ON" radio button.

18. Check for Relatively Strong Signals: The BumbleBee will now trigger and display the spectrum of any signals that have a channel power greater than –65 dBm. If the BumbleBee does not trigger and display a spectrum, no signals are present with a channel power above –65 dBm.

19. Stop the Trigger: Tap the "OFF" radio button to exit the Trigger Mode.

The Reference Level and Trigger Level can be further lowered to check for weaker signals. Stronger signals may "clip" the display when checking for weaker signals, but weaker signals will not "clip".

PERSISTENCE
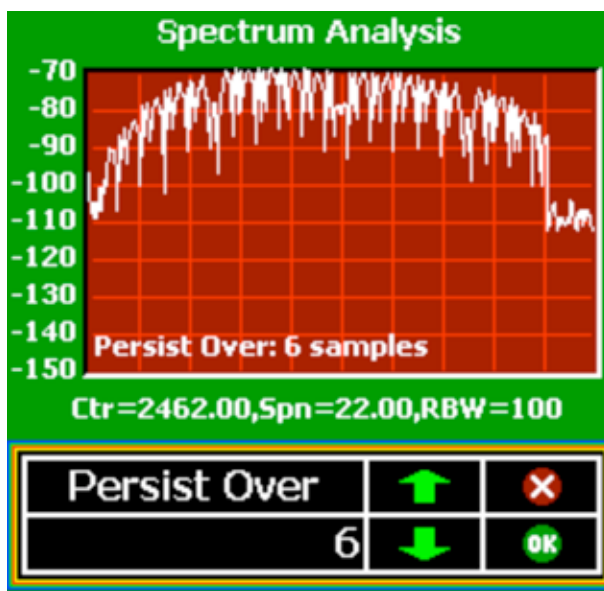
The persistence display holds the peak value of each point in the spectrum sweep for N number of sweeps. The number of sweeps is determined by adjusting the value in the level entry block for persistence. The X-axis is the current frequency range. The Y-axis displays the power values.

HISTOGRAM
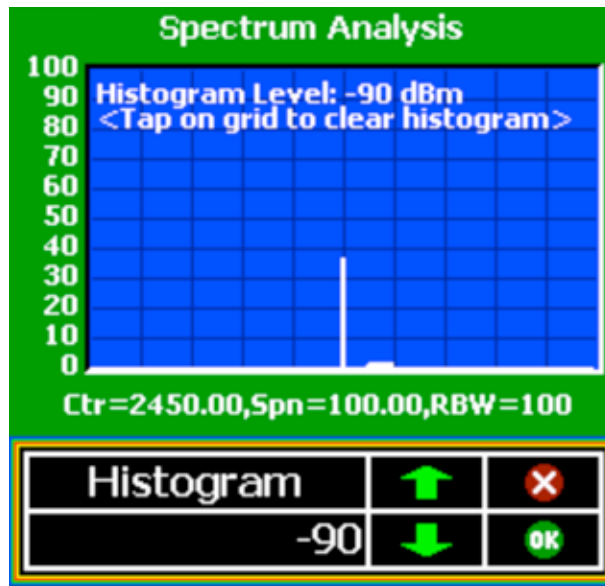
The histogram display shows the percentage, over the last 100 sweeps, of power values at each frequency that is above the user set level.

The level is selected by adjusting the value contained in the histogram level entry block. The X-axis is the current frequency range. The Y-axis is the percentage of time (from 0 to 100) when the power value at each frequency was above the set level. The current percentage values displayed can be cleared by pressing the "clear" button on the histogram data entry block.

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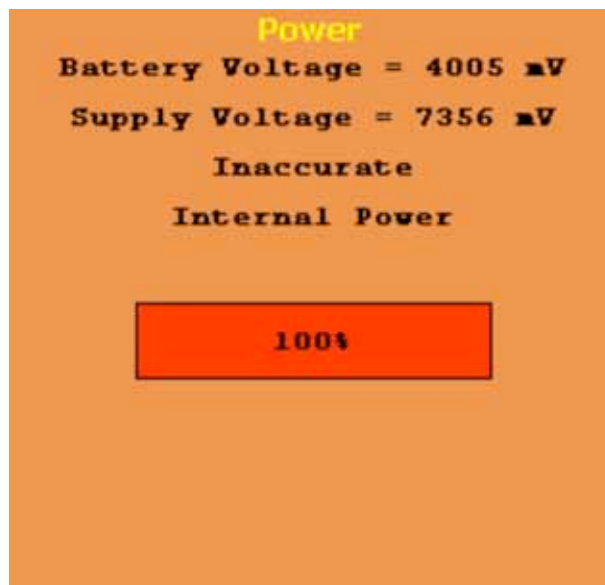
The system information tab shows the unit firmware version, serial number, and the frequency ranges which are tunable.
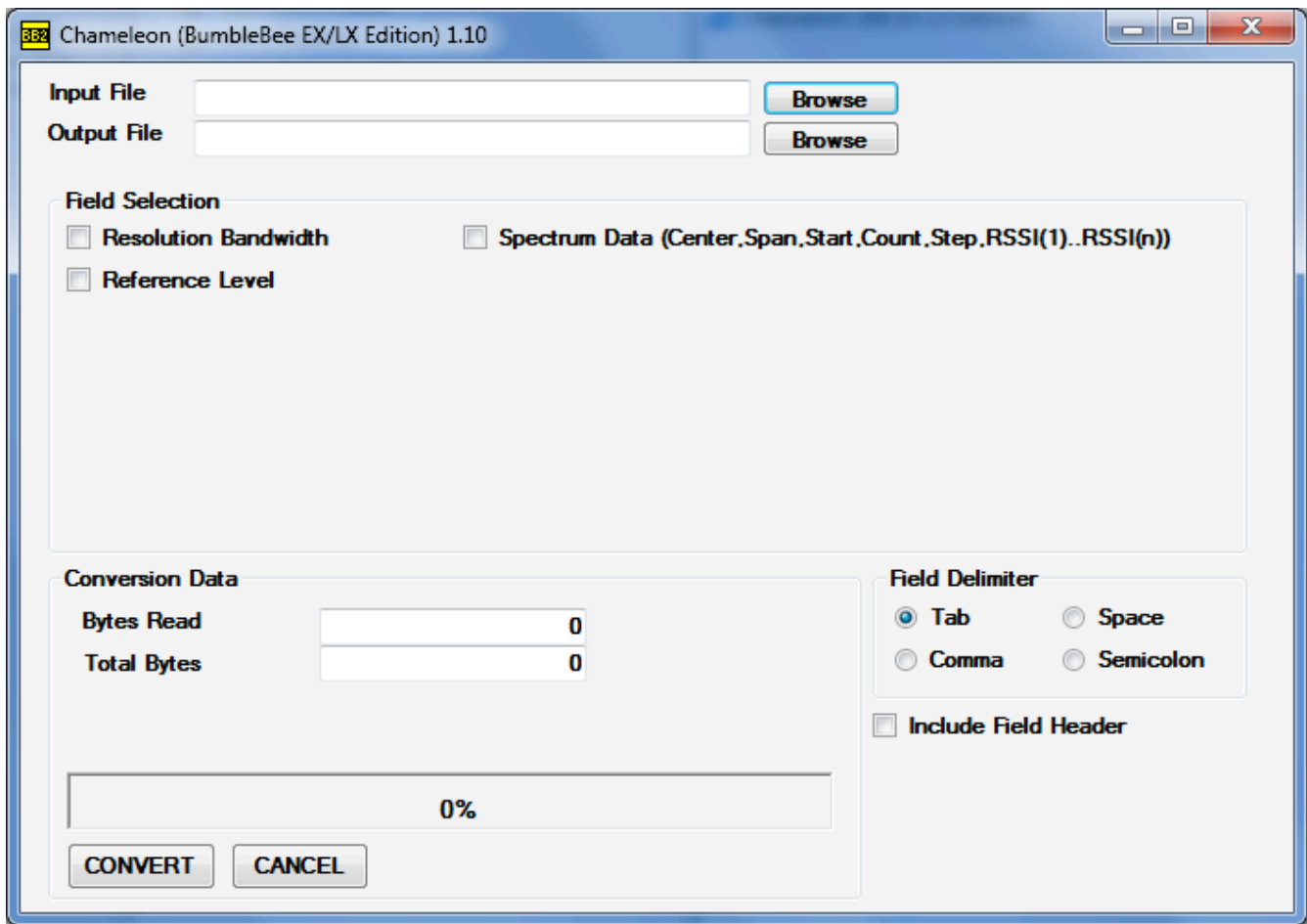

POWER PROFILE

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.)

CHAMELEON (BUMBLEBEE EX/LX EDITION)

Introduction

The Chameleon application software is the data conversion and filtering tool for the BumbleBee. Chameleon was designed to greatly simplify the conversion of binary receiver data to an ASCII delimited format. Most post-processing applications can then import this converted data. The following sections of this document outline how to convert data using the Chameleon software.

Installation

Installation of Chameleon is straightforward. Insert the SD provided with the   BumbleBee purchased into the PC. Look in the PC folder and run the setup application for Chameleon.

Icons will be placed on the desktop and on the start menu.

Running the Application

After starting the application, the main screen will appear. The steps to conversion are outlined

in the following sections.

Input / Output Files

Choose the data file that is to be converted as the input. A default output file name will be chosen with the .OUT extension. This may be modified to suit the users needs.

Field Selection

Select the fields that are to be placed in the output file. Simply check the fields desired.

The delimiting character may also be chosen. Field titles may be placed in the output file by checking the "Header" box.

Conversion

Press the CONVERT button. The progress bar will be updated as the file is being processed. After the message appears stating that the conversion has been completed, the converted file will be ready for import into most post-processing applications.