YELLOWFIN

Fixed Fixed WiMAX Tablet PC Analyzer

manual version 1.0

YellowFin Receiver Hardware User's Manual

YellowFin/YellowFin Interface Hardware

BVS YellowFin Controller Software User's Manual

Chameleon (YellowFin Edition) Software User's Manual

IMPORTANT NOTE:

Please disable the Wireless LAN Radio and the Bluetooth Transmitter on the Tablet PC to minimize interference with the YellowFin Receiver before you establish a connection.

# *Unpacking Your YellowFin Fixed WiMAX Analyzer*

Opening your box reveals YellowFin protective case, documentation box and monopole.

Documentation includes software (some products use CD-ROM while others use SD card installers), user's manual and claibration certificate and USB communication cable.

Unpack and assemble your YellowFin unit as shown. Your YellowFin is a self-contained spectrum analyzer. The tablet PC interface, antenna and power connections are all accessible, but there is usually no need to open the protective, yellow and black hard rubber casing. The tablet should not be disconnected and removed nor batteries changed by users. Removing such components will void your hardware warranty. Please consult the included Samsung Q1 documentation for complete operating instructions, troubleshooting and tips of tablet PC. When you open your yellow, hard, protective case you will see the YellowFin unit with receiver hidden below it, included antennas, SD software loader card, receiver power/charging adapter, ethernet cable and GPS antenna. The required USB communication cable is located in the documentation box.
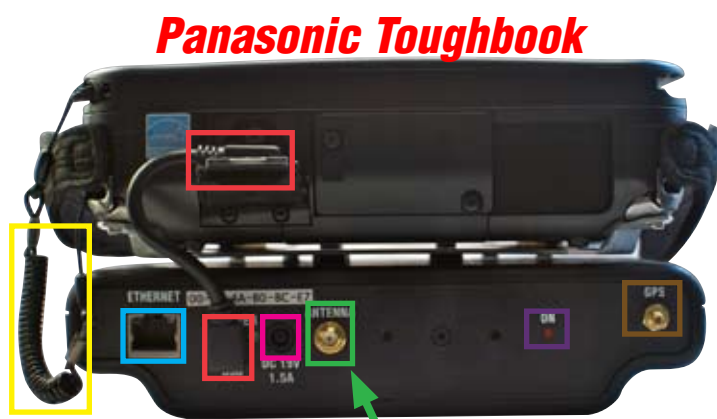
SMA Male Antenna Input
Warning: Maximum input 0 dBm NO DC Input
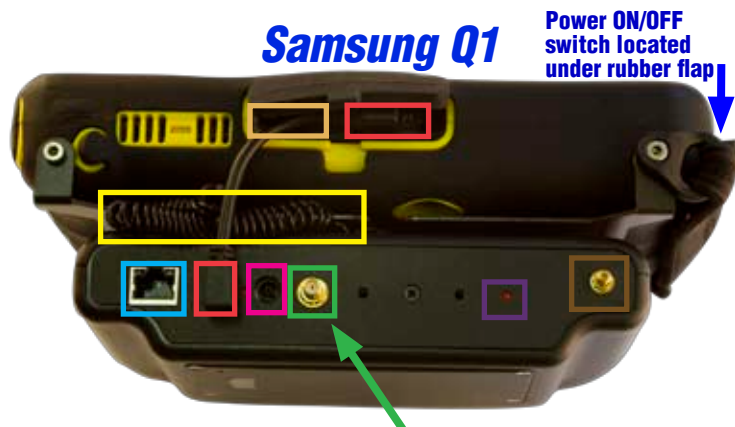
SMA Male Antenna Input
Warning: Maximum input 0 dBm NO DC Input

YellowFin Top View
(both models shown)

About Your YellowFin

All basic ports and functions on the Samsung Q1 Tablet portion of your YellowFin Fixed WiMAX Analzyer are explained in your Samsung Q1 user's manual included with your YellowFin unit. The YellowFin receiver contains all indicators and ports you need to communicate with the Q1 tablet. The receiver should not be removed from the tablet unless a BVS technical support expert has instructed you to do so. The ethernet 10/100 Mbit port is used to communicate with a PC. Be sure that the USB comm cable is securely connected between the Q1 tablet and YellowFin receiver. The SD card slot is located next to that for installing, removing or re-installing the YellowFin software. The SMA male antenna connector is for use with the included omni directional antennas or the optional DF antenna systems. Please consult with Berkeley engineers before employing any antenna not supplied by BVS. The sylus can be found connected to the attached coil-cord which is attached to the bottom of the Q1 tablet. The unit also contains a GPS antenna input when GPS data is required for studies.

Powering Your YellowFin

Powering up your YellowFin begins by switching power on the Tablet PC. The Power ON/OFF switch is located on the side of the tablet PC under the rubber flap. YellowFin receiver contains an internal, rechargeable Li-Ion battery system in the receiver unit on the bottom. Users should not open the receiver unless a BVS technical support expert has instructed you to do so. The internal batteries are charged using the supplied DC power adapter connected to the power input. Consult the technical specifications sheet for common charging and running times for your unit. The red LED light next to this power input will blink while charging and go solid red when charging is complete. When your YellowFin receiver is charged, the Samsung Q1 tablet is powered on and the YellowFin software is running, the red LED on the receiver (next to the GPS antenna input) will turn on. This indicates constant communication between the receiver and the tablet interface.

Opening Your YellowFin

Always contact BVS technical support (1-888-737-4287 or +1 732-548-3737   8AM - 6PM EST or e-mail support@bvsystems. com) before attempting any modifications or repairs to your Yellowjacket-TABLET. In some cases, users may replace batteries or perform simple changes within the receiver module but failure to contact BVS technical support for procedural steps before proceeding will result in a VOIDED WARRANTY.

Optional Directional & Omni Antenna Specifications
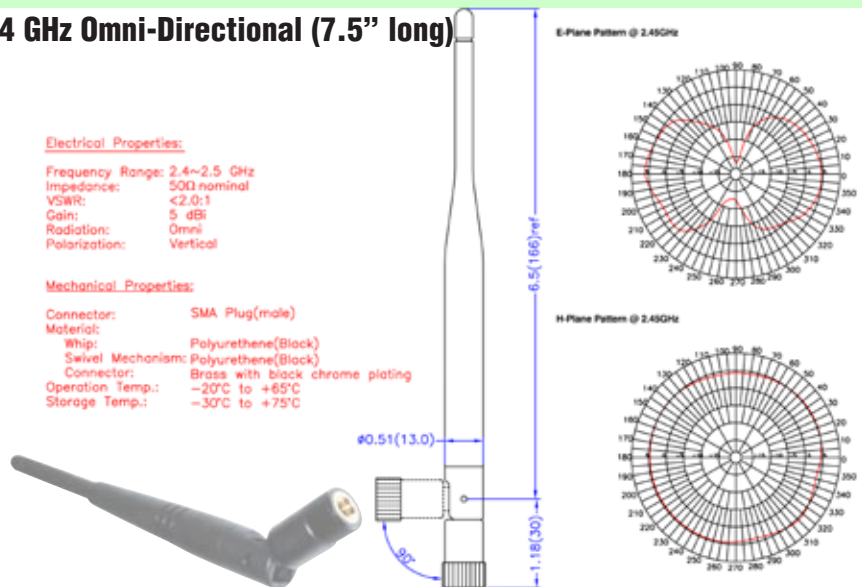
2.4 GHz Direction Finding Corner Reflector
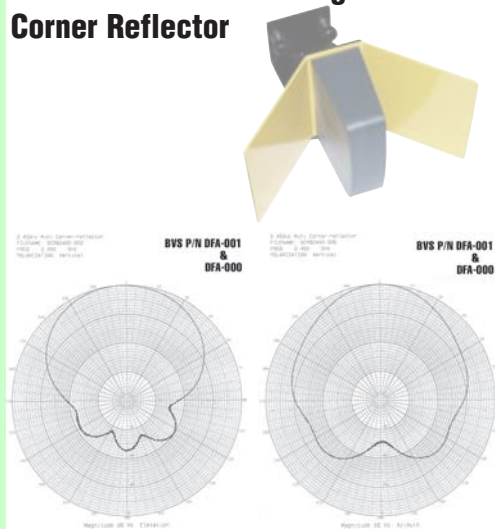
2.4 GHz Omni-Directional (7.5" long)

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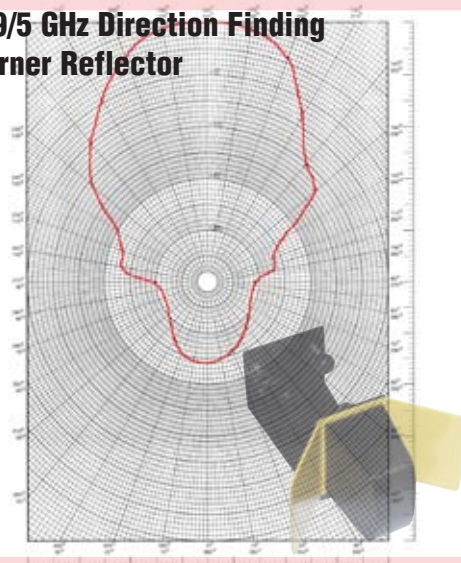
Frequency Range: 5.15~5.35 GHz
Impedance: 50Ω nominal
VSWR: <2.0:1
Gain: 5 dBi
Radiation: Omni
Polarization: Vertical

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

2.6GHz Swivel Antenna — 151 Model

Connector Interface — SMA Plug (AM)

6.5 (166)

Ø0.51 (13.0)

1.18 (30)

90°

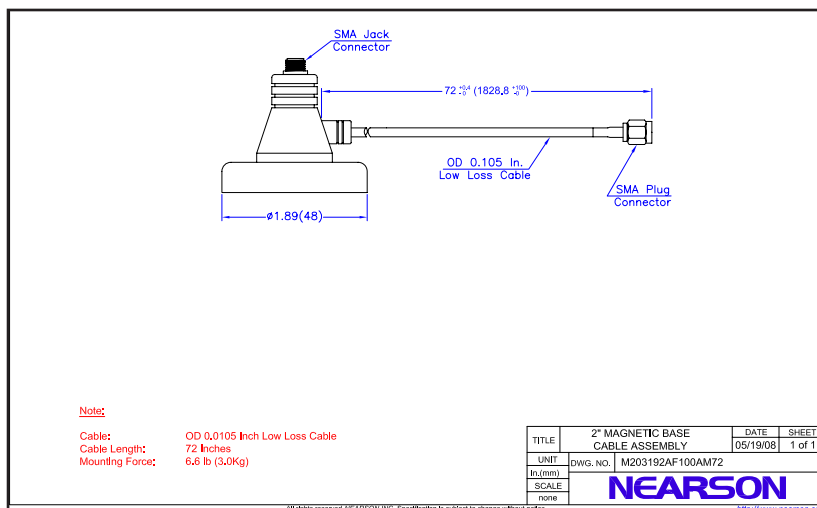Ø0.49 (12.5)

Electrical Properties:

Frequency Range: 2.5~2.7 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
Operation Temp.:   −20°C to +65°C
Storage Temp.:   −30°C to +75°C

TITLE	2.6GHz Swivel Antenna 151 Model	Rev. Date 03/13/07	VER. 1.0
UNIT in.(mm)	DWG. NO. F151AM−2600S		
SCALE None			

NEARSON

3.5 GHz Swivel Antenna — 152 Model

Ø0.24 (6)

Connector Interface — SMA Plug (AM)

5.7 (145) REF.

Ø0.39 (10)

90°

1.0 (25.7)

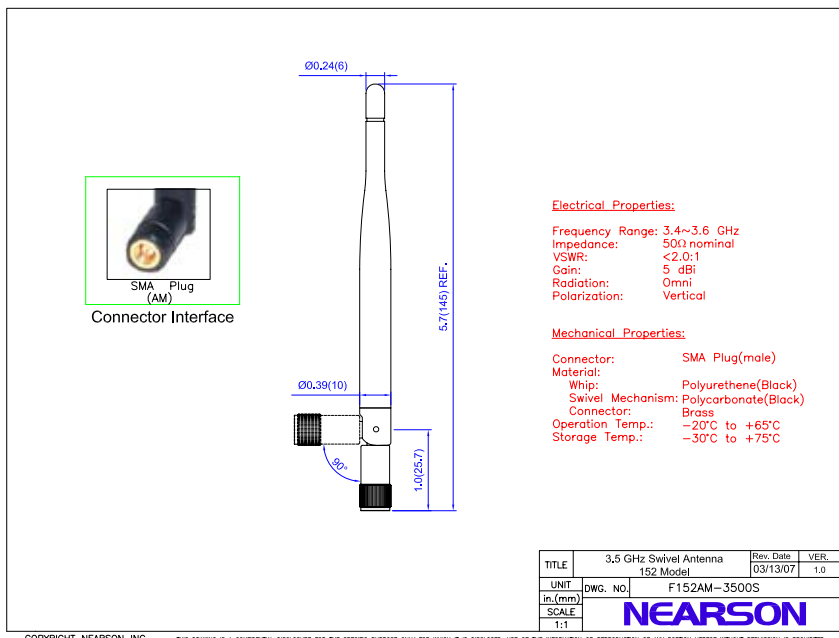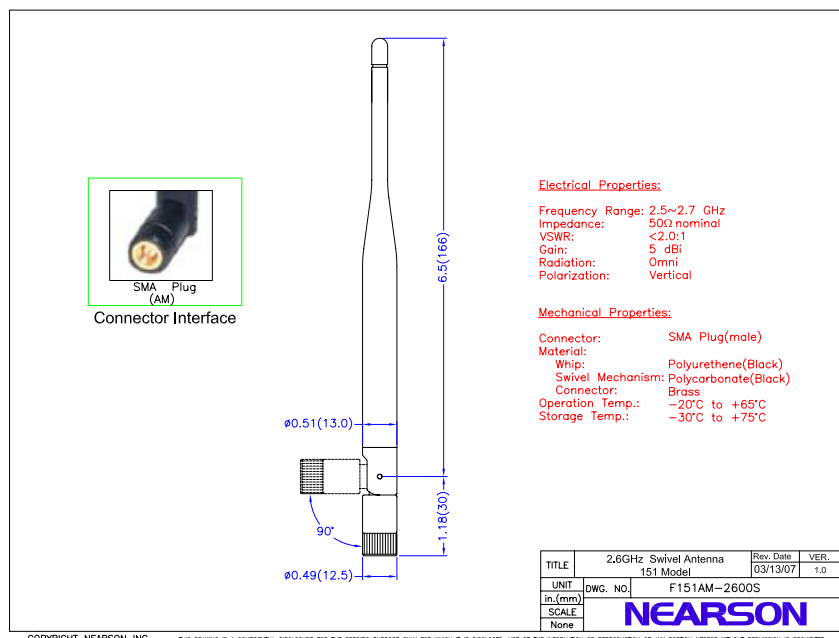**Electrical Properties:**

Frequency Range: 3.4~3.6 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
Operation Temp.:   −20°C to +65°C
Storage Temp.:   −30°C to +75°C

TITLE	3.5 GHz Swivel Antenna 152 Model	Rev. Date 03/13/07	VER. 1.0
UNIT in.(mm)	DWG. NO. F152AM−3500S		
SCALE 1:1			

NEARSON

SMA Jack Connector

72 +0.4/−0 (1828.8 +100/−0)

OD 0.105 In. Low Loss Cable

SMA Plug Connector

Ø1.89 (48)

Note:

Cable: OD 0.0105 Inch Low Loss Cable
Cable Length: 72 Inches
Mounting Force: 6.6 lb (3.0Kg)

TITLE	2" MAGNETIC BASE CABLE ASSEMBLY	DATE 05/19/08	SHEET 1 of 1
UNIT In.(mm)	DWG. NO. M203192AF100AM72		
SCALE none			

NEARSON

Accessories for your YELLOWFIN

12VDC to 110VAC car cigarette lighter power inverter
75 Watts output
P/N YF-12V-USB
$ 75.00   OPTIONAL

Rugged Carrying Case
ABS Plastic
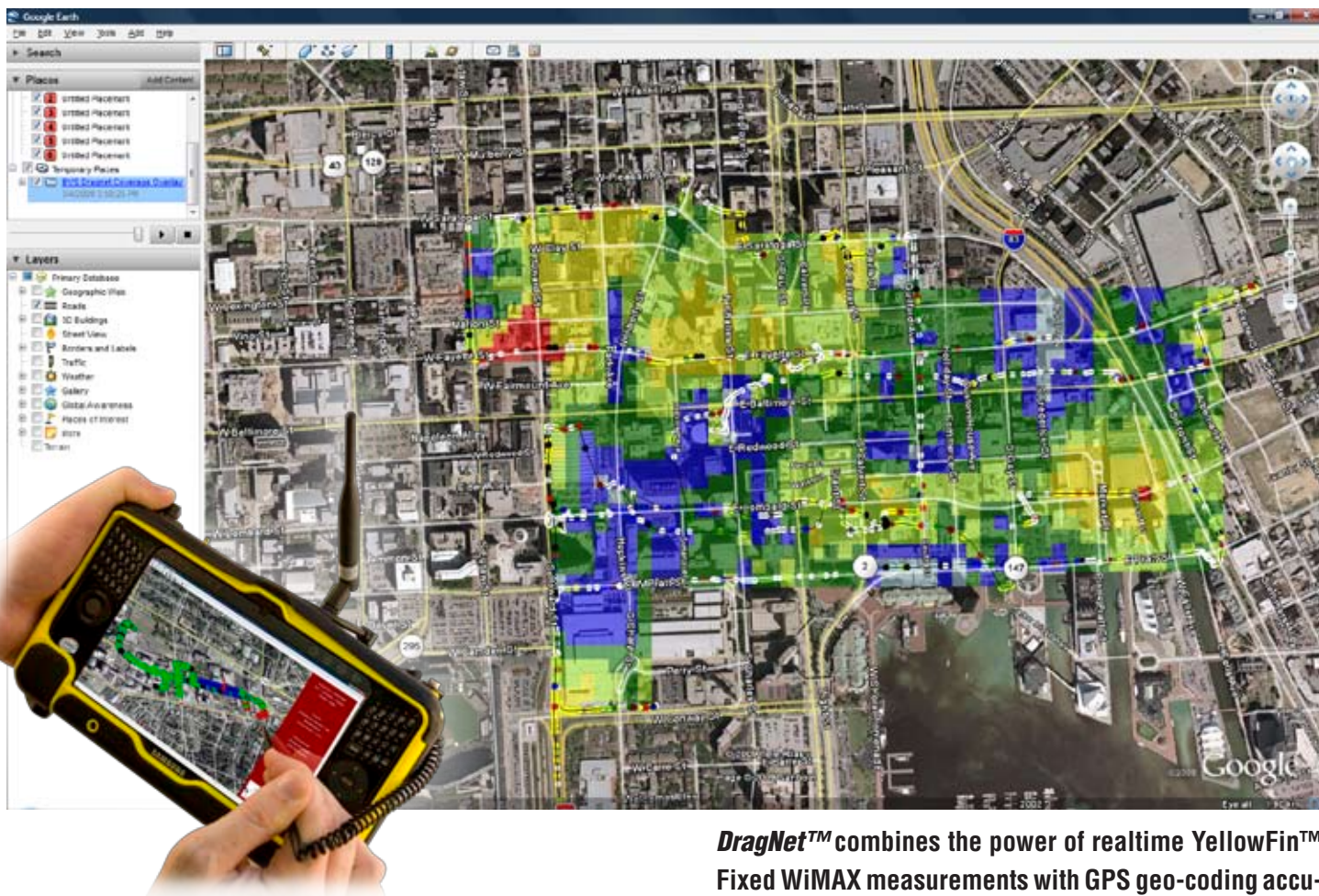**P/N P-CASE**
$ 150.00   STANDARD

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

DragNet
Fixed WiMAX site survey software   OPTIONAL

30 dB attenuator pad for use with directional antennas (between DF antenna & YellowFin) 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

3.5 GHz Omni Antenna
SMA male swivel
P/N 5NP
$ 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
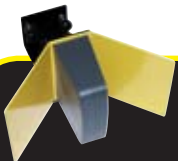
DRagNet

Fixed WiMAX Mobile Site Survey Software

DragNet™ combines the power of realtime YellowFin™ Fixed WiMAX measurements with GPS geo-coding accuracy. First, create your survey bitmaps with Berkeley's GPS **PROJECTOR** software. Next, simply drive to any spot with GPS reception while *DragNet™* **COLLECTOR** scans selected Fixed WiMAX Mobile channels and correlates them to your exact location automatically via GPS. GPS measurements provide both LAT and LON as well as time stamping for a complete Fixed WiMAX survey path anywhere in the world. Finally, survey data such as RSSI, Cell ID & Segment ID data on a preamble basis may be exported into *DragNet's* **ANALYZER** for further mapping coverage studies in multiple graphical and tabular layouts. Surveys may be exported further into KML files for plotting in applications such as Google Earth™.

Features

- Create comprehensive drive-study survey bitmaps with GPS Projector

- Collect Fixed WiMAX data by using GPS position for outdoor surveys

- Choose among 802.16e for detailed coverage analysis

- JPEG screen snapshots throughout survey

- KML, PDF and Excel export and report printout support

- Survey data such as RSSI, Cell ID & Segment packet data on a preamble basis 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™

Call us today for more information:
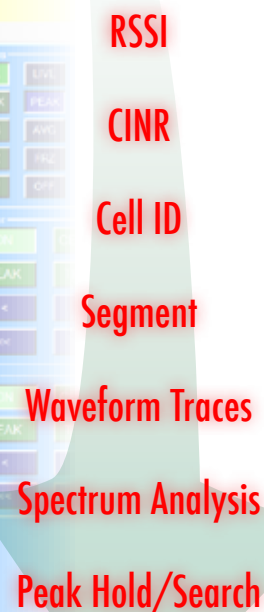TOLL FREE 1-888-737-4287
Tel: +1 732-548-3737   Fax: (732) 548-3404
www.bvsystems.com   email: sales@bvsystems.com

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## OPTIONAL SOFTWARE AVAILABLE FOR YOUR YELLOWFIN

BVS YellowFin Controller User Manual
WiMAX Fixed (IEEE 802.16d)

INTRODUCTION

The BVS YellowFin Controller software runs on a Windows-based Tablet (XP/Vista) that is connected to a YellowFin WiMAX system. This connection is made through USB. The YellowFin Controller can also run on a Windows PC or laptop if portability is not desired.

Through this connection, a YellowFin can be controlled. The YellowFin can be set to any mode and settings available. Data can be monitored in real-time and stored in a log file later viewing and reporting.
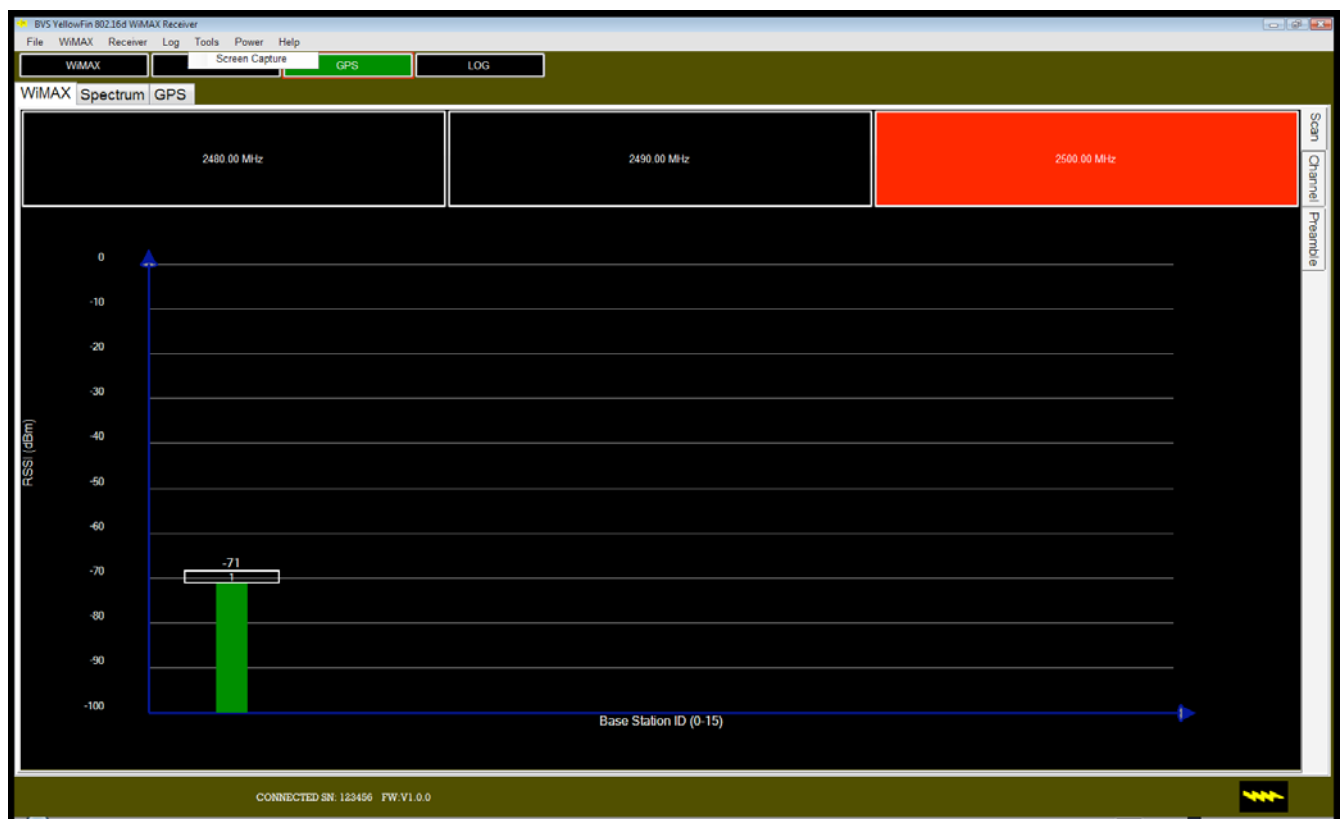
INSTALLATION

The YellowFin Controller software can be installed from the SD card provided using the USB SD card adapter. .NET Framework needs to be installed on the computer in order for the Controller to function correctly. This framework is already installed on some tablet systems. If the Controller will not run, install the framework from the SD card or get the latest from www.microsoft.com.

SYSTEM REQUIREMENTS

Below is the minimum system requirements recommended to run the Controller.

Supported Operating Systems: Windows XP,Vista
Processor Speed: >= 1.33 GHz
Memory: >= 1 GB RAM
Hard Drive Space: >= 1 GB free

CONNECTION STATUS

The status bar on the bottom of the main window will display the serial number of the YellowFin hardware and the firmware version installed. This information will only be displayed if the software has connected properly. A 'NOT CONNECTED' message will be displayed if this information was not able to be retrieved.

OPERATING MODES

WiMAX MODE

WiMAX scan mode comes up by default when the YellowFin software is started. This mode will display any base stations found on any of the frequencies in the scan list.

SCAN MODE
By default, the last frequency list selected is used. A new or existing channel table can be loaded by choosing the "channel list" option from the WiMAX menu. Using this dialog, a user can create a new list, and save/restore existing lists to /from a file. To send the list to the YellowFin, simply press "SET AS CURRENT LIST".

The bandwidth of the signals to be found can be selected by using the 'bandwidth' option off of the WiMAX menu. Tap on the bandwidth to be selected. The current bandwidth will be highlighted.
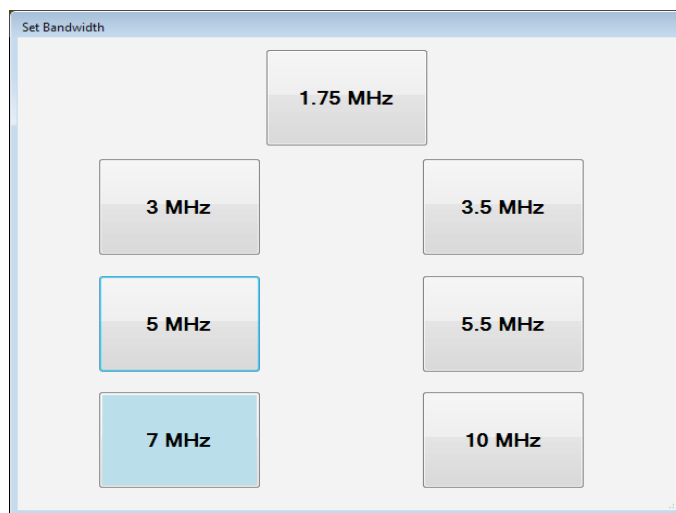

Scan Mode will scan through these frequencies one at a time. Each frequency in the list is color-coded

(up to 16 frequencies are allowed). Any bases that show up when the receiver is tuned to a particular frequency will show up in the color of the frequency box. To look at an individual frequency only, touch the frequency box desired.

SINGLE CHANNEL MODE

The list at the top of the screen will display any bases that were found on the selected frequency. If the base has not been seen for a time period it will eventually fall off of the list.
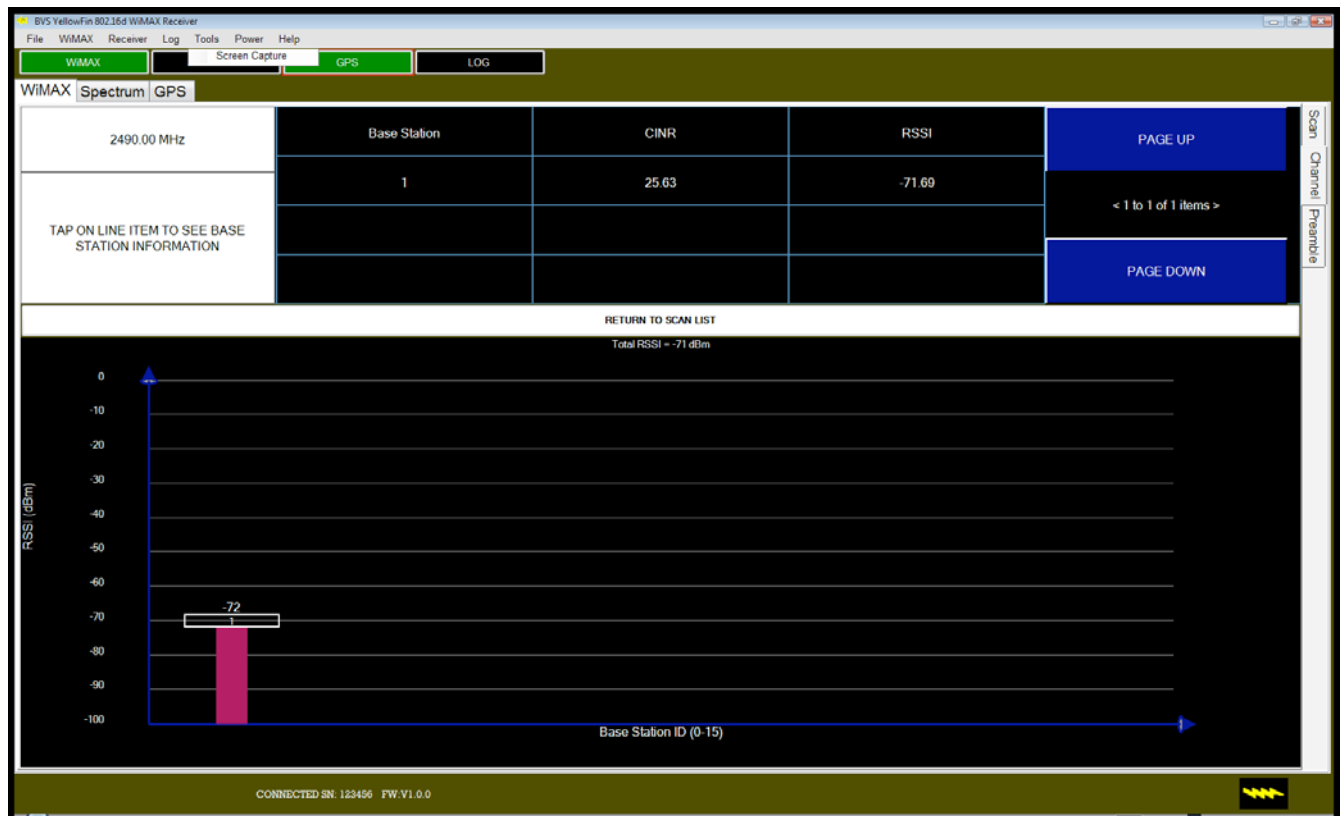
SINGLE CHANNEL SCREEN

The following fields are shown in the list:

• **BASE ID – Base Station ID from 0-15 (last 4 digits of device MAC address).**
• **CINR – Carrier to Interference plus Noise Ratio.**
• **RSSI – Received signal strength indicator in dBm.**

Press 'Return to Scan List' to go back to scan mode.

SINGLE BASE ID MODE

A closer look can be made at each of the base stations in the list. Clicking on an item in the list will put the YellowFin into individual base mode. Only information from the selected base will be displayed. Press the 'Return To Channel' to go back to Single Channel mode. Press 'Return to Scan List' to return to Scan Mode.

The current CINR and RSSI are displayed on the top of the screen along with the frequency and base number. There are three data screens to see in single base mode. These are RSSI over Time, Multipath, and Individual Spectrum. The RSSI over Time display shows by default. To navigate between displays, simply touch the data display and making a sliding motion with your finger or stylus to the left or right. The next display will come into view as the previous one leaves.

RSSI over TIME

The RSSI over Time will show the RSSI values in dBm of the base. The most recent values will enter from the left. The high and low values of the base will be marked with a watermark.
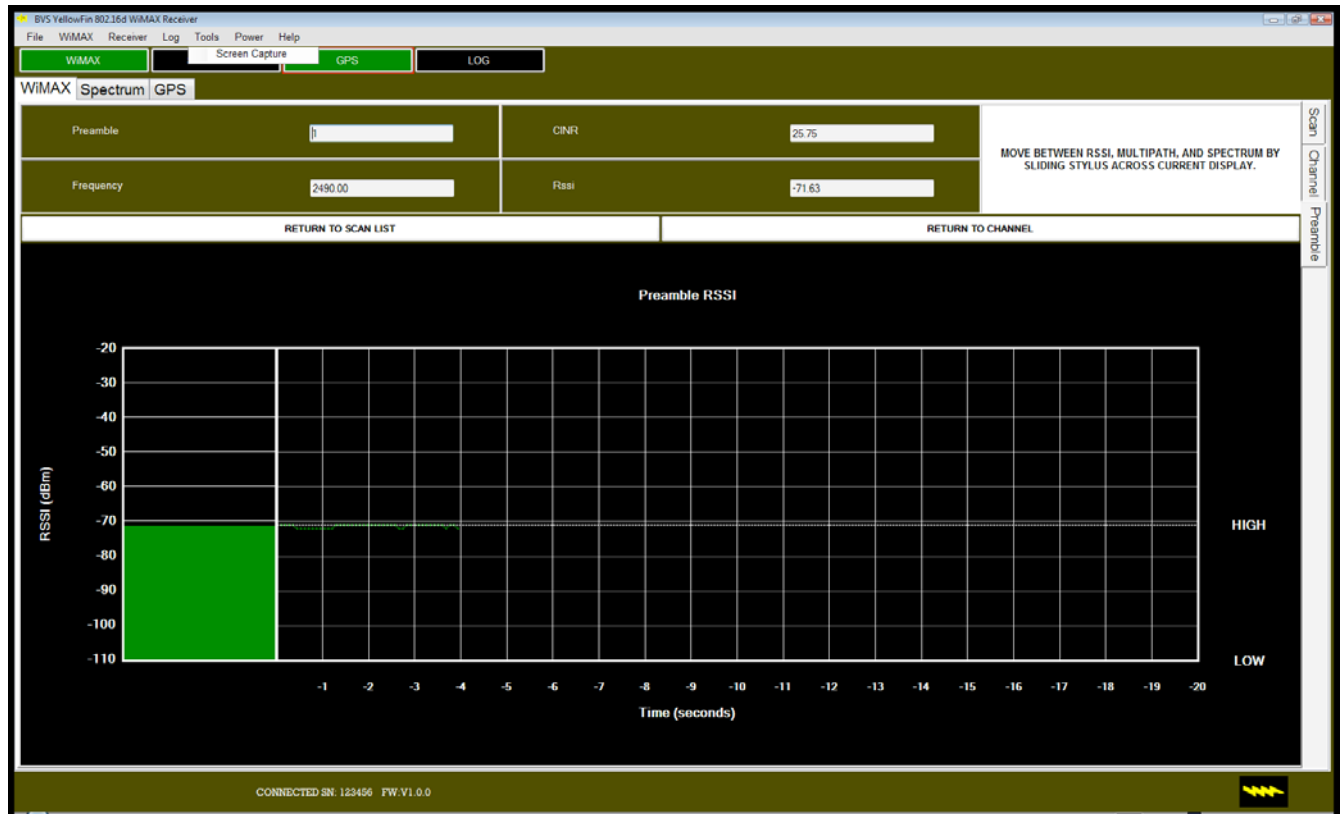
RSSI over TIME SCREEN

INDIVIDUAL MULTIPATH

This display shows the multipath components for the base in question. In general, there should be one peak at or near the blue grid line. The red grid line to the left is before the signal arrives. If multiple peaks are displayed to the right of the main peak, these would be multipath components.
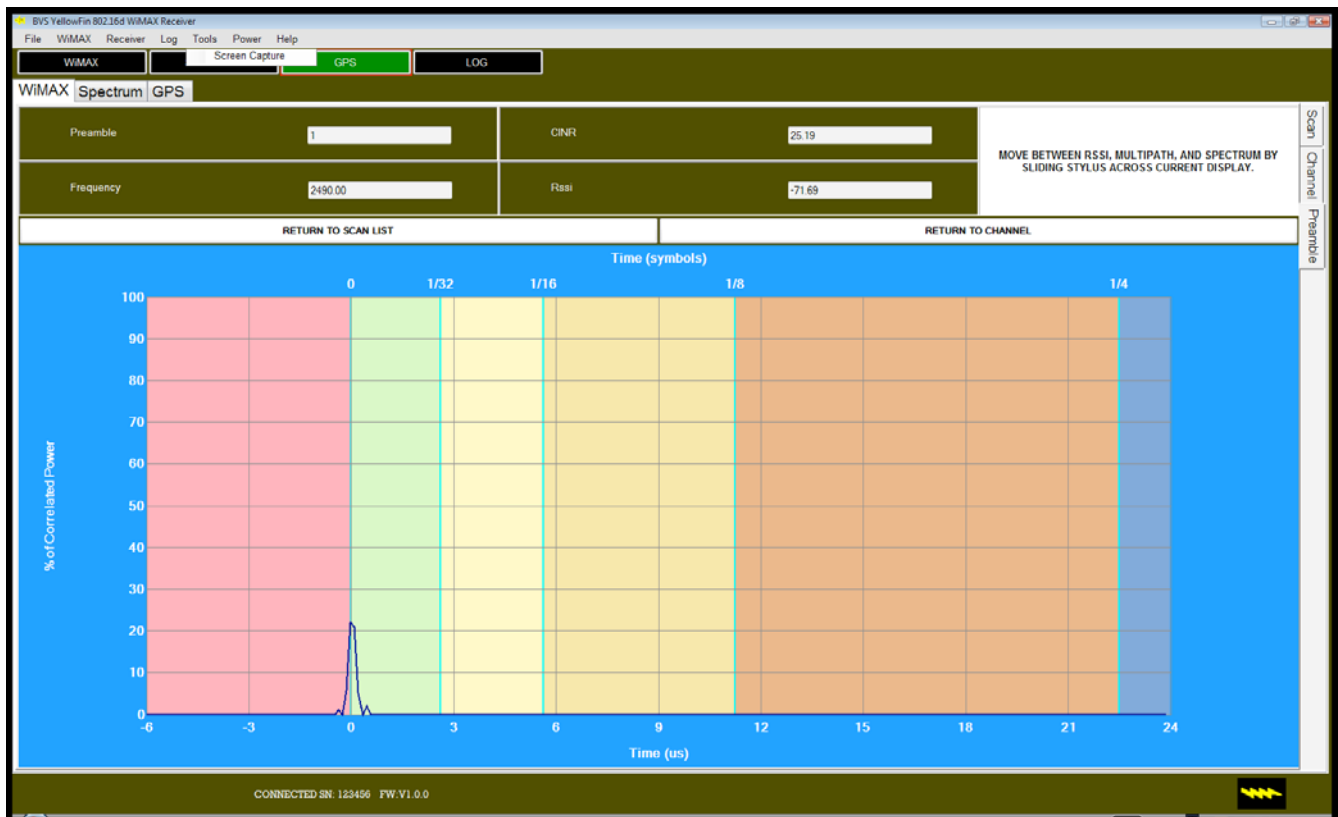
MULTIPATH SCREEN

In essence, reflections of the main received signal path are seen. This could be from walls inside a building or clutter in the outside environment such as buildings.

INDIVIDUAL SPECTRUM

Individual spectrum shows the spectrum for the chosen base.

INDIVIDUAL SPECTRUM SCREEN

WiMAX Signal Search (Band Scan)

If the frequencies for the WiMAX signals are not known, the YellowFin has a search engine for locating any existing signals. Choose "Signal Search" from the WiMAX menu. The Signal Search dialog will appear. The parameters for the search are the start and stop frequencies along with the frequency step.

To change any of the parameters, simply tap on the box with the appropriate frequency. Use the number pad to select the correct frequency and select 'MHz' for the units.

When all of the parameters have been chosen, press the 'Search' button on the WiMAX Signal Searcher screen. A progress indicator will appear to show how many WiMAX frequencies have been found and the time elapsed during the search. Every frequency searched could take up to 1 second, so choose the parameters for the smallest search range needed.

After the search has been completed, the WiMAX Signal Search dialog will show the frequencies found in the 'Found' list box.

Move the frequencies to be used in scan mode over to the 'Keep' list box by using the buttons provided. Using the 'double' arrow button will move the entire list over to the 'Found' box.

Now press the 'Set Selected Frequencies' button to move the frequencies kept into the scan list. Then

press 'Exit'. Scan mode will resume with the new frequencies.

SPECTRUM ANALYZER MODE

By selecting the Spectrum button, the YellowFin being controlled will switch to spectrum analyzer mode. To maximize this display, choose the 'Tools/Display/Max' option from the menu. Choose the 'Tools/Display/Normal' option to return the default size. There are various menu options to control the output of the spectrum analyzer.

CENTER/SPAN/START/STOP

These fields are located on the left panel when the display is at the default size. Here the center frequency may be set. The span, start and stop frequencies can also be selected.
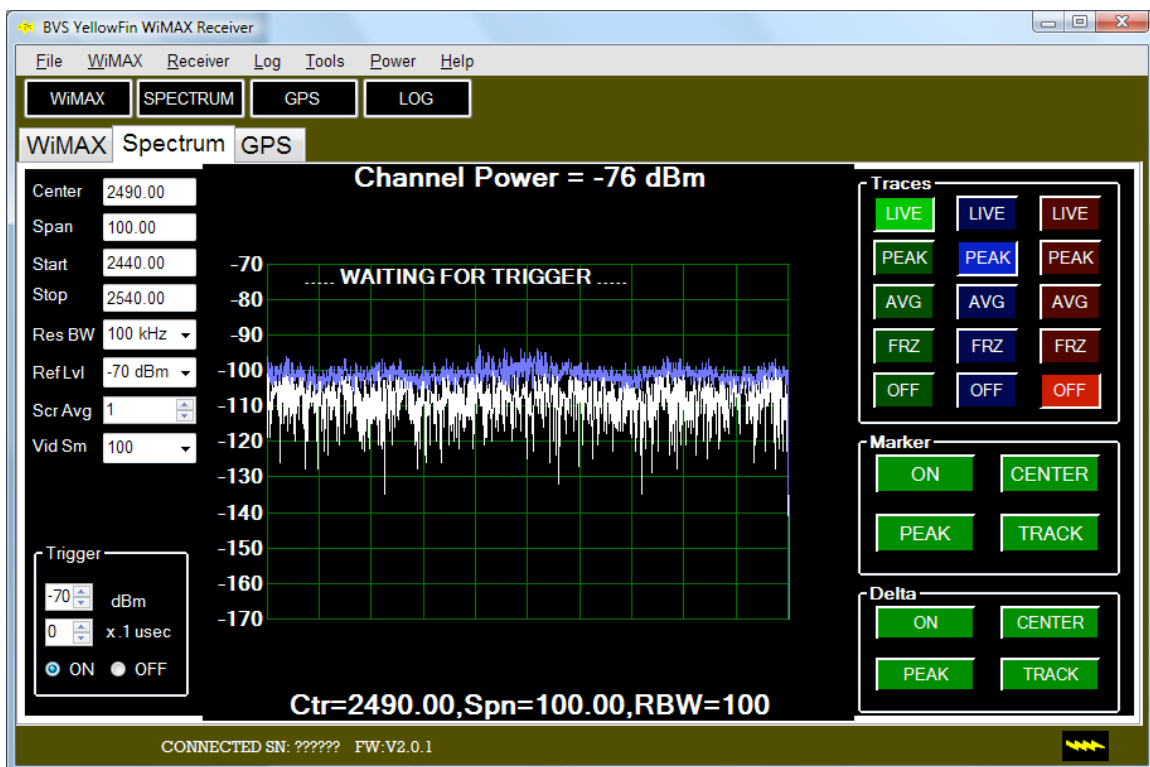
SPECTRUM ANALYSIS SCREEN

REFERENCE LEVEL

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. 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.

RESOLUTION BANDWIDTH

The YellowFin measures the energy present in different frequency bins, each bin's width equal to the resolution bandwidth. The resolution bandwidth is set by setting the level for the resolution bandwidth desired.

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 YellowFin 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.

SCREEN AVERAGE

The average of the last N sweeps will be displayed if the trace is put into AVG mode.

VIDEO SMOOTHING

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. 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. 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.

TRIGGERING

Trigger Mode enables the YellowFin 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 YellowFin to measure the spectrum. The trigger delay sets a delay between the trigger threshold being exceeded and the measurement of the spectrum. 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.

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. A more detailed discussion of the triggering function is discussed in the manual that came with your YellowFin hardware.

TRACES

There are three available traces for display. By default, trace 1 is set to the live feed. Each trace can be set to the following:

- **LIVE – Current real-time data will be displayed.**
- **PEAK – The highest value recorded at each frequency will be displayed.**
- **AVG – Video Smoothing and Screen Average results will display.**
- **FREEZE – The last sweep will be displayed and frozen.**
- **OFF – Trace will be turned off.**
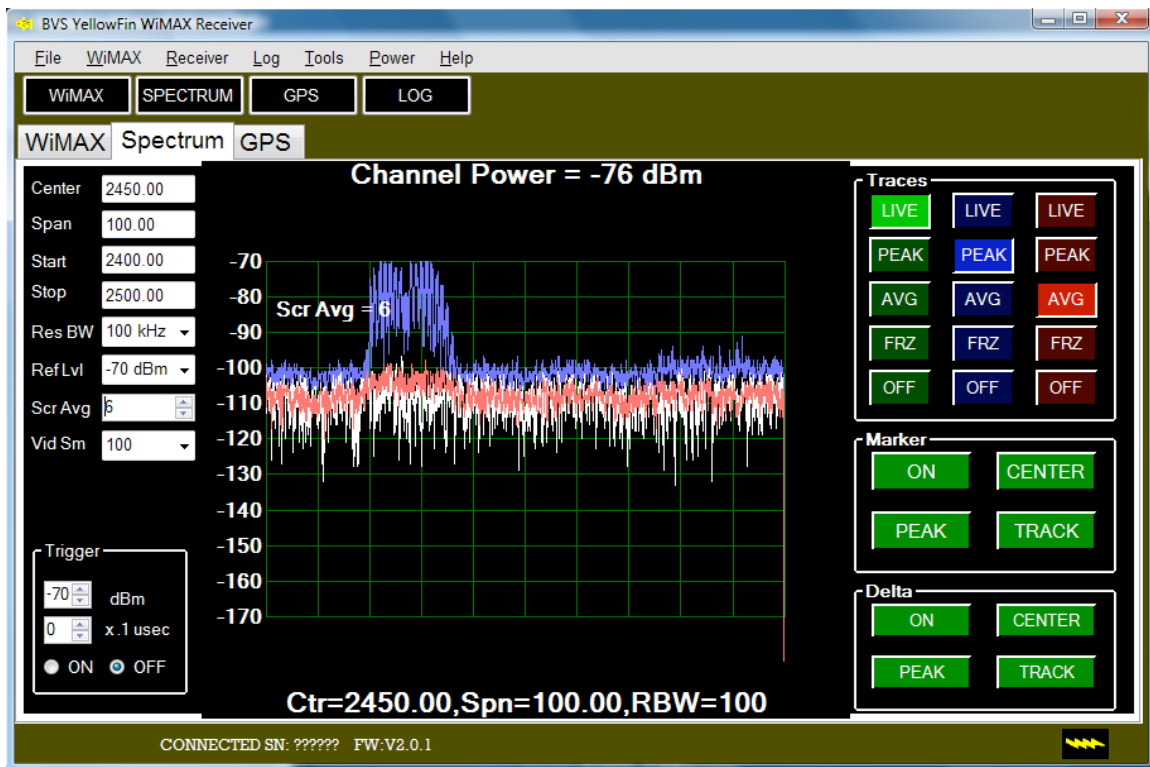
MULTIPLE TRACES

MARKER/DELTA

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. 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.

15
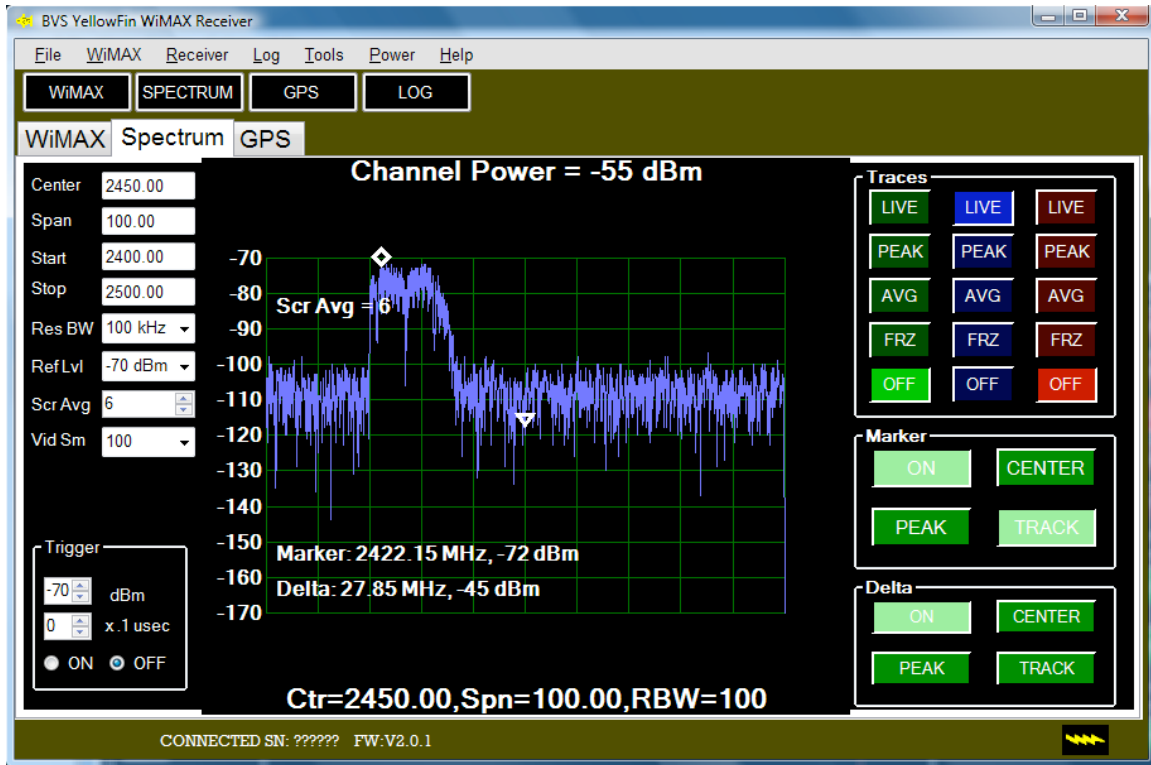
MARKER/DELTA FUNCTION

GPS DATA

The GPS information screen can be shown by pressing the GPS button. The internal GPS receiver will show the position and current time if there is a 3D lock acquired from the GPS satellites in orbit. This information can be useful in realtime and also in post-processing as it is contained in log files. If there is a point of interest during a study, the position and time will be marked in the log file along with the data taken at that point in time.
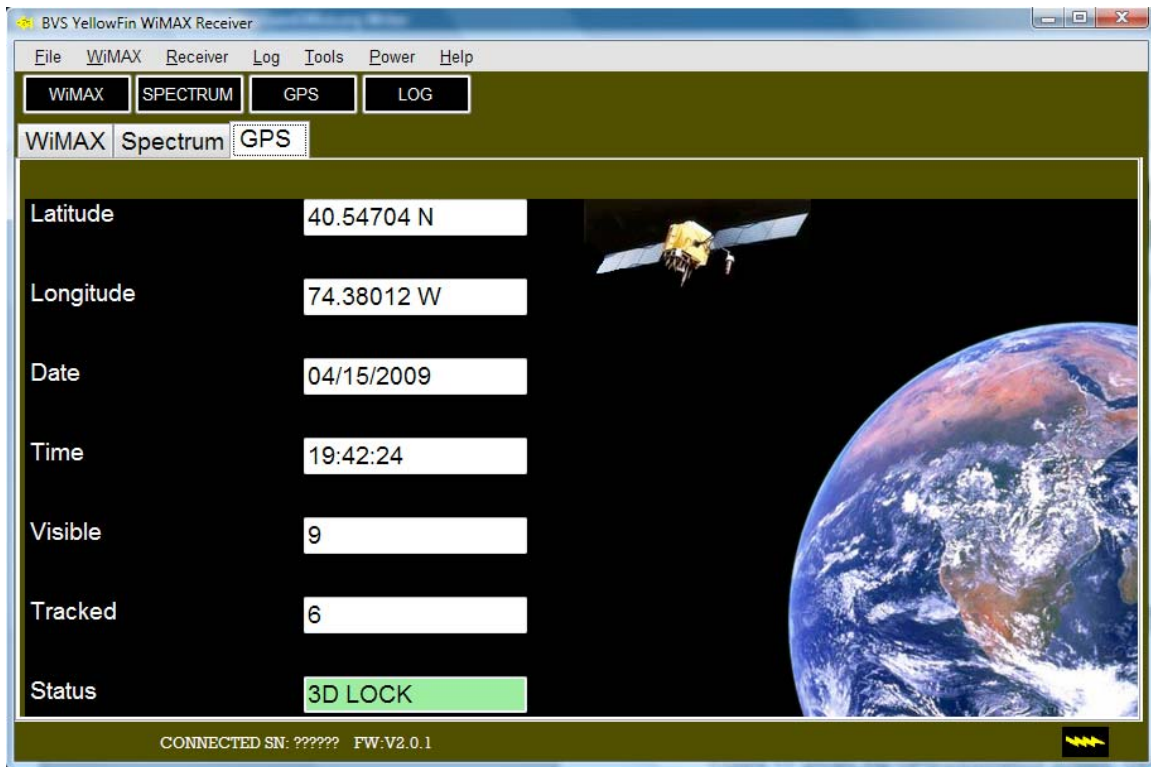
GPS SCREEN

LOG FILES

By using the 'Log' menu, a binary log file can be started and stopped. This log file will store information such as GPS data and receiver information. It will also store data from whatever mode the hardware is in currently. Note that if the YellowFin is in spectrum analyzer mode, WiMAX specific data will not be logged. Also, if the YellowFin is in WiMAX mode, spectrum analyzer data will not be stored. The binary file created can be converted into an ASCII readable file using the separate BVS utility Chameleon (YellowFin Edition).

Chameleon (YellowFin 802.16d Edition) User Manual

Introduction

The Chameleon application converts data logged by the YellowFin into an ASCII delimited file for use in post-processing. The data converted is collected from the YellowFin using the YellowFin controller application.

CHAMELEON MAIN SCREEN

Spectrum Data

Converted spectrum data consists of a section of complete sweep in every record. The center and start frequencies are reported. The step frequency between power values is also converted. The span and number of readings are also converted. These fields are then followed by all of the power values.

WiMAX Data

WiMAX data is logged information when the YellowFin is in scan mode or channel mode. Base, CINR, and RSSI appear for every trigger. Any channel change will also be output as a blank record.

NOTE: By choosing the 'placeholder' checkbox, a blank record will be added to the output file where a frequency has just been scanned and no WiMAX data was found.

WiMAX Individual Data

Choose a base station between 0 and 15 to filter. Any data collected when this individual base is available is output. Individual spectrum and multipath may be available with this data if it was chosen in the Controller program.

Other Fields

Other fields which may be put into the output file include:
- The current reference level (in dBm) (Spectrum Mode Only).
- The current resolution bandwidth (in kHz) (Spectrum Mode Only).
- GPS Date (mm/dd/yyyy).
- GPS Time (hh:mm:ss).
- GPS Latitude (decimal degrees)
- GPS Longitude (decimal degrees)

Conversion Instructions

To convert a file, use the following steps:

1. Run the Chameleon application.
2. Click BROWSE next to the input file edit field to choose a file to convert.
3. A default output filename will be created. Change if needed.
4. Choose which fields you wish to have in the output file.
5. Choose the delimiter to place between fields.
6. Choose whether or not you would like a header record with titles for each column.
7. Press the CONVERT button.

The progress bar will monitor the progress of the conversion.