

YELLOWFIN

WiMAX Tablet PC Analyzer

manual version 1.2



YellowFin Interface Hardware user's manual

YellowFin/YellowFin Interface Hardware

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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



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

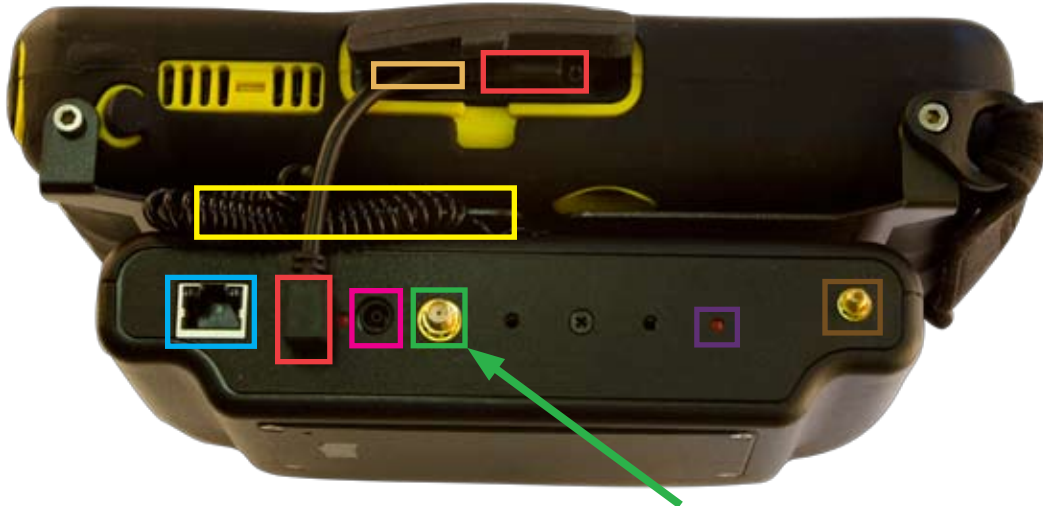


Documentation includes software (some products use CD-ROM while others use SD card installers), user's manual and calibration certificate and USB communication cable.

Unpack and assemble your YellowFin unit as shown. Your YellowFin is a self-contained spectrum analyzer. The user interface (Samsung Q1 UMPC Tablet), 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. For prolonged wireless studies, BVS recommends using the provided monopod. After screwing the bottom plate onto the monopole, the YellowFin unit simply rests on the surface to alleviate the weight for the user.



YellowFin Top View



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

About Your YellowFin

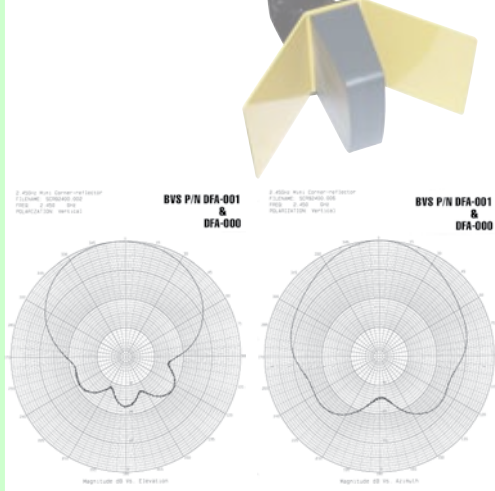
All basic ports and functions on the Samsung Q1 Tablet portion of your YellowFin WiMAX Analyzer are explained in your Samsung Q1 user's manual included with your YellowFin unit. The YellowFin receiver contains all indicators and ports you need to communicate with the Q1 tablet. The receiver should not 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 stylus 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

YellowFin WiMAX Analyzer 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 WiMAX Analyzer 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.

Optional Directional & Omni Antenna Specifications

2.4 GHz Direction Finding Corner Reflector



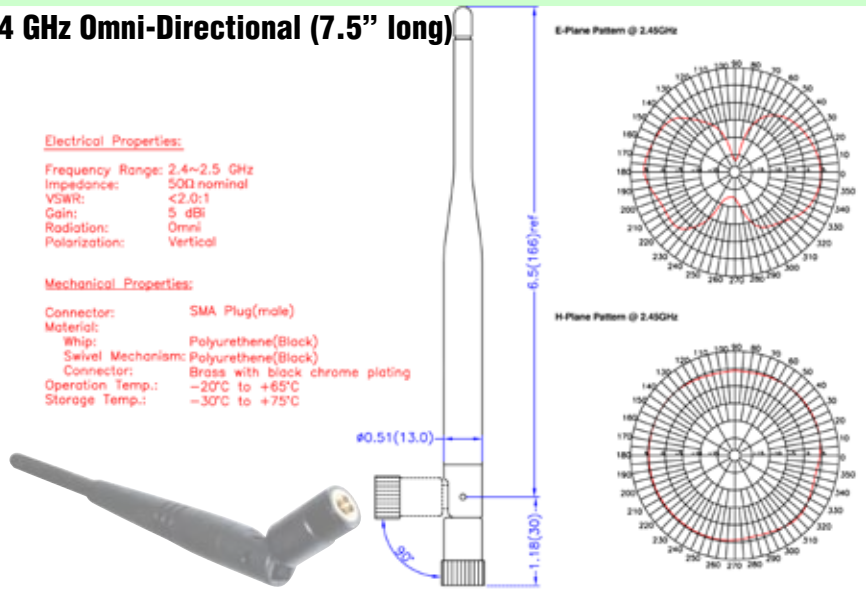
2.4 GHz Omni-Directional (7.5" long)

Electrical Properties:

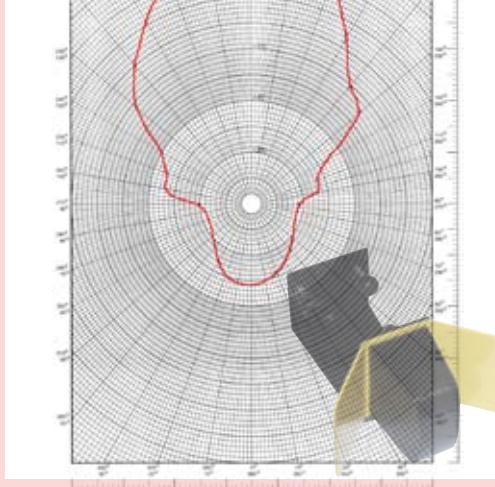
Frequency Range: 2.4~2.5 GHz
 Impedance: 50Ω nominal
 VSWR: <2.0:1
 Gain: 5 dBi
 Radiation: Omni
 Polarization: Vertical

Mechanical Properties:

Connector: SMA Plug(male)
 Material: Polyurethane(Black)
 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



4.9/5 GHz Direction Finding Corner Reflector



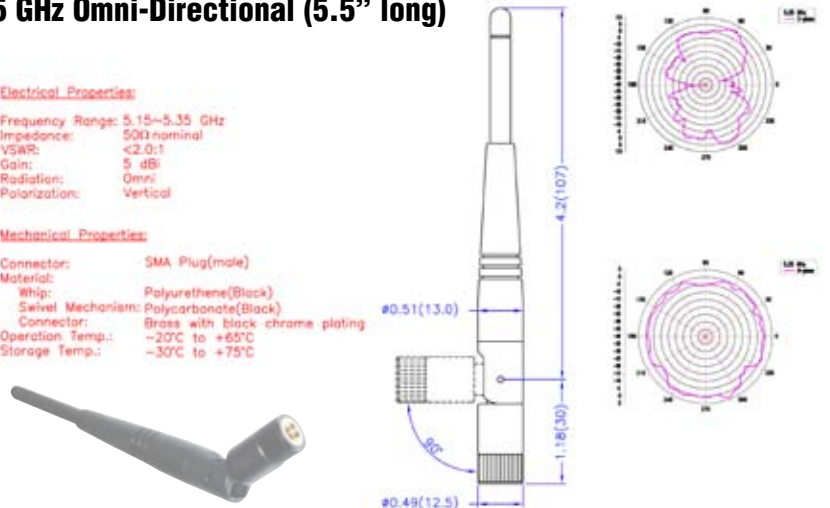
4.9/5 GHz Omni-Directional (5.5" long)

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: Polyurethane(Black)
 Whip: Polycarbonate(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 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
WiMAX site survey software
Ask for a Quote

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



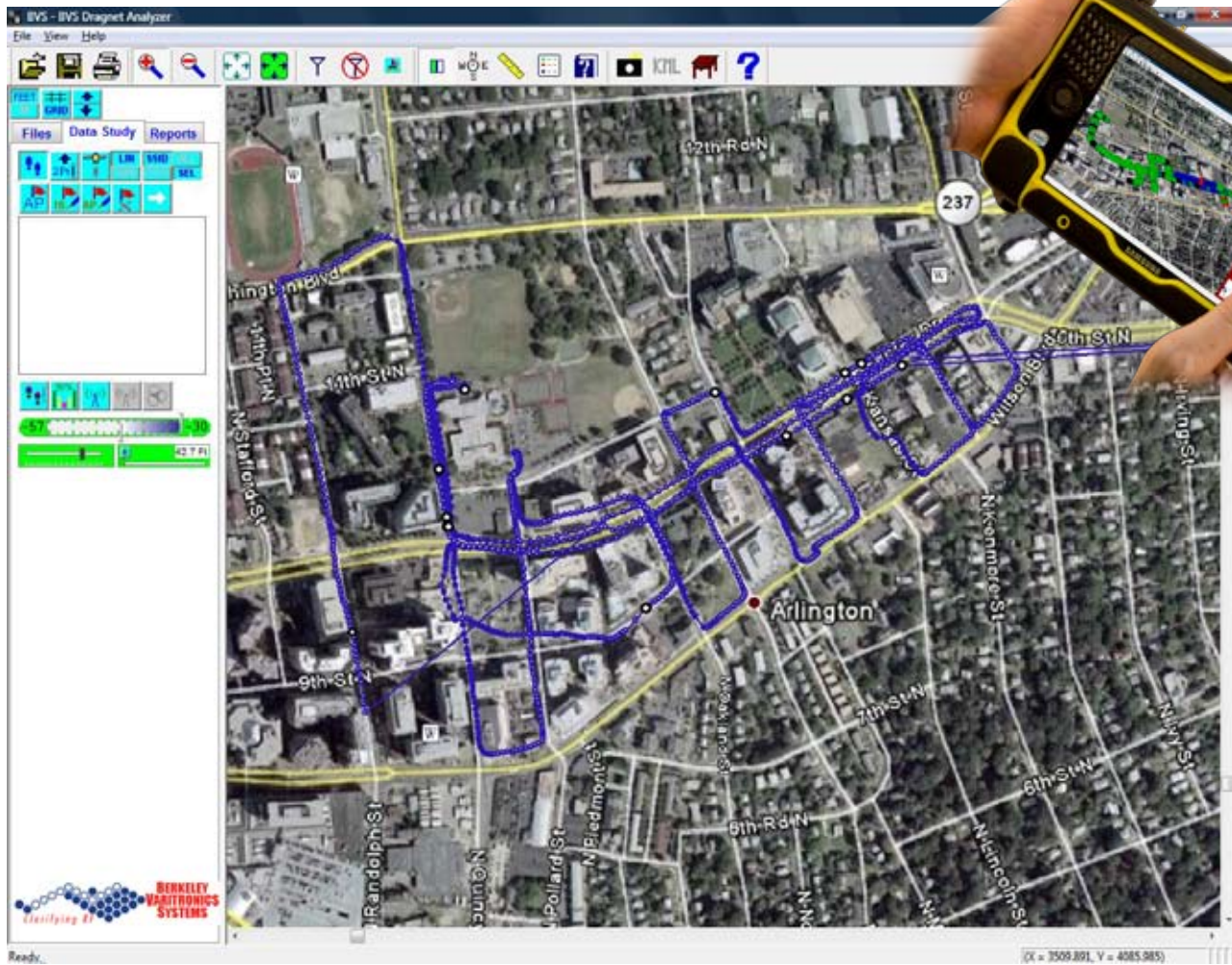
4.9/5 GHz Omni Antenna
SMA male swivel
Co-Linear Dipole 5 dBi VSWR 1.8:1
P/N K181AM-5250S
\$ 25.00

STANDARD



DRAGNET

WiMAX MOBILE SITE SURVEY SOFTWARE



FEATURES

- Create comprehensive drive-study survey bitmaps with GPS Projector
- Collect WiMAX data by using GPS position for outdoor surveys
- Choose among 802.16e networks
- JPEG screen snapshots may be taken throughout the survey
- 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 **Google Earth™**

DragNet™ combines the power of realtime YellowFin™ 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 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 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™**.

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Providing wireless solutions for over 35 years.

OPTIONAL SOFTWARE AVAILABLE FOR YOUR YELLOWFIN

BVS YellowFin Controller User Manual

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.

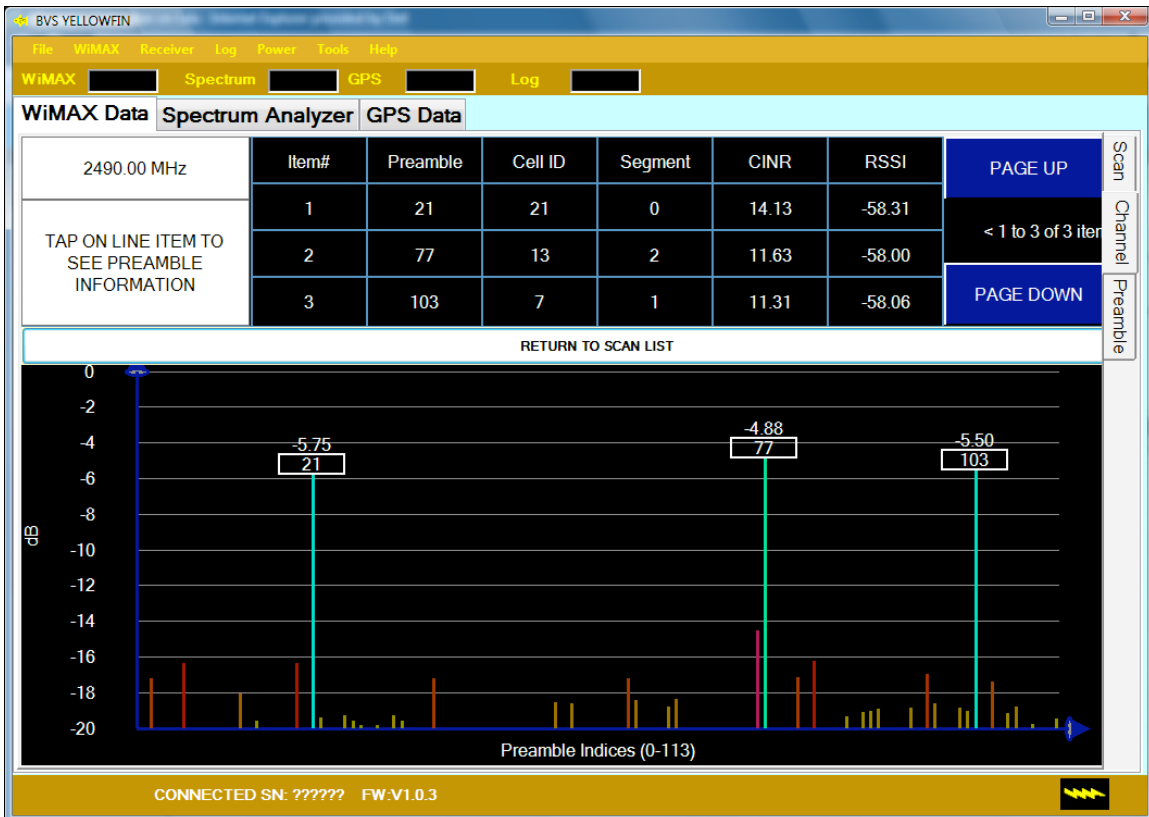


Figure 1 - YellowFin Controller WiMAX Data Screen

INSTALLATION

The YellowFin Controller software can be installed from the SD card provided using the USB SD card adapter. It may also be installed from the installation CD if installing on a PC or laptop. .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 needed to run the Controller.

Supported Operating Systems:	Windows XP,Vista
Processor Speed:	>= 1.33 GHz
Memory:	>= 0.99 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 preambles 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”.



Figure 2 – WiMAX Channel List Dialog

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 preambles 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, press the select button on the desired frequency.

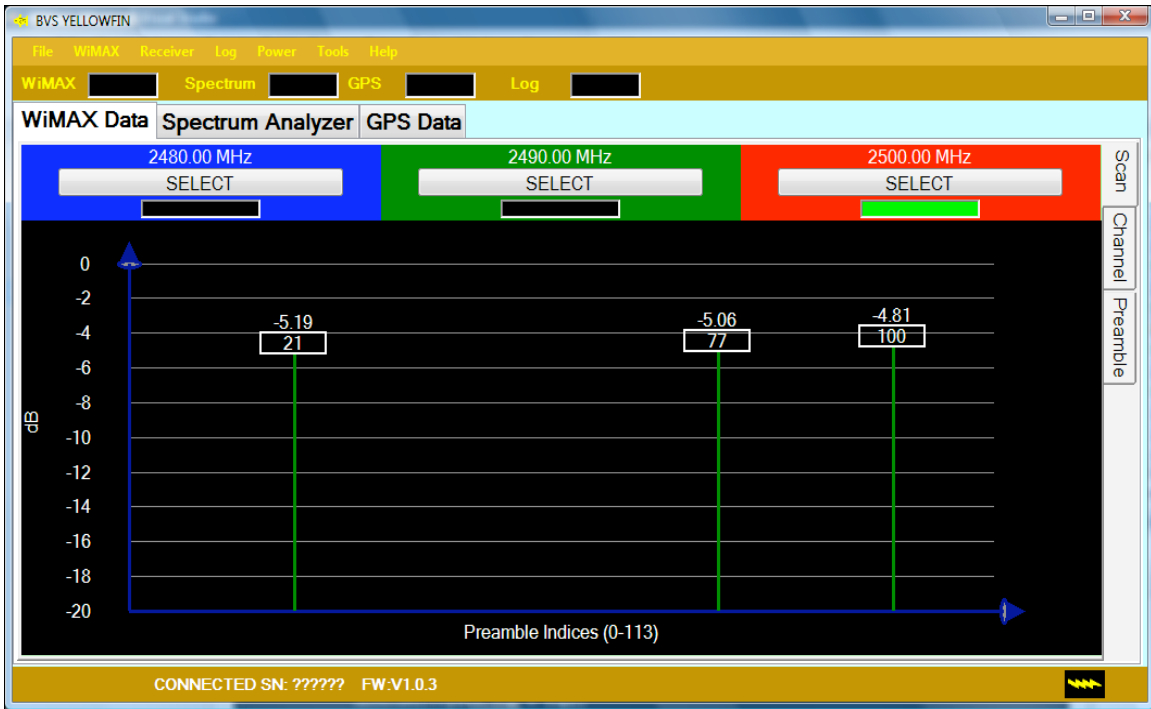


Figure 3 – WiMAX Scan Mode

SINGLE CHANNEL MODE

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

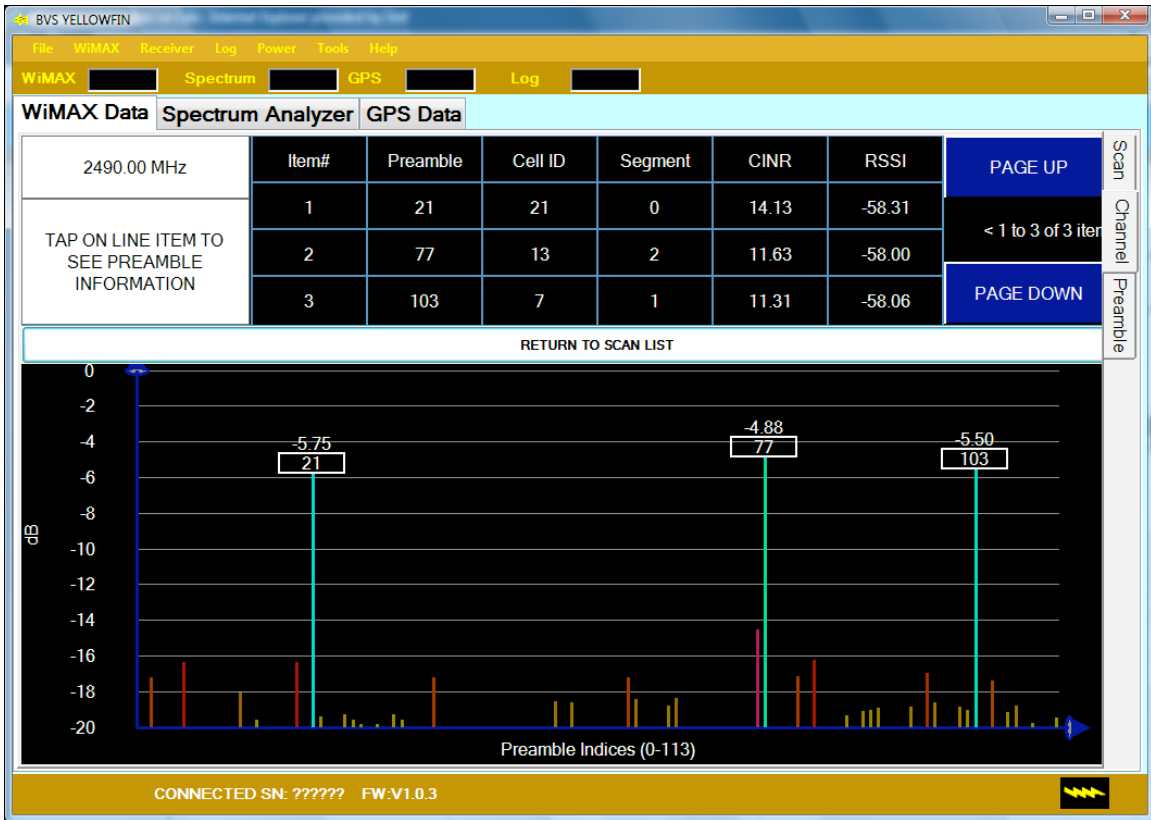


Figure 4 – WiMAX Single Channel Mode

The following fields are shown in the list:

- **ITEM** – Item number in the list.
- **PREAMBLE #** – Preamble number from 0-113.
- **CELL ID** – Cell ID for this preamble.
- **SEGMENT** – Segment of this preamble.
- **CINR** – Carrier to Interference plus Noise Ratio.
- **RSSI** – Received signal strength indicator in dBm.

Figure 4 shows the relative strength of each of the possible 114 preambles. The stronger the signal, the greater the possibility that the preamble can be demodulated. In Figure 1, preambles 15 and 34 are much stronger than the other 112 preambles and can be demodulated. This fact can be clearly seen in the list above it as preambles 15 and 34 appear.

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

SINGLE PREAMBLE MODE

A closer look can be made at each of the preambles in the list. Clicking on an item in the list will put the YellowFin into individual mode. Only information from the selected preamble will be displayed. Figure 5 shows a typical display in individual multipath mode. Press the 'Return To Channel' to go back to Single Channel mode. Press 'Return to Scan List' to return to Scan Mode.

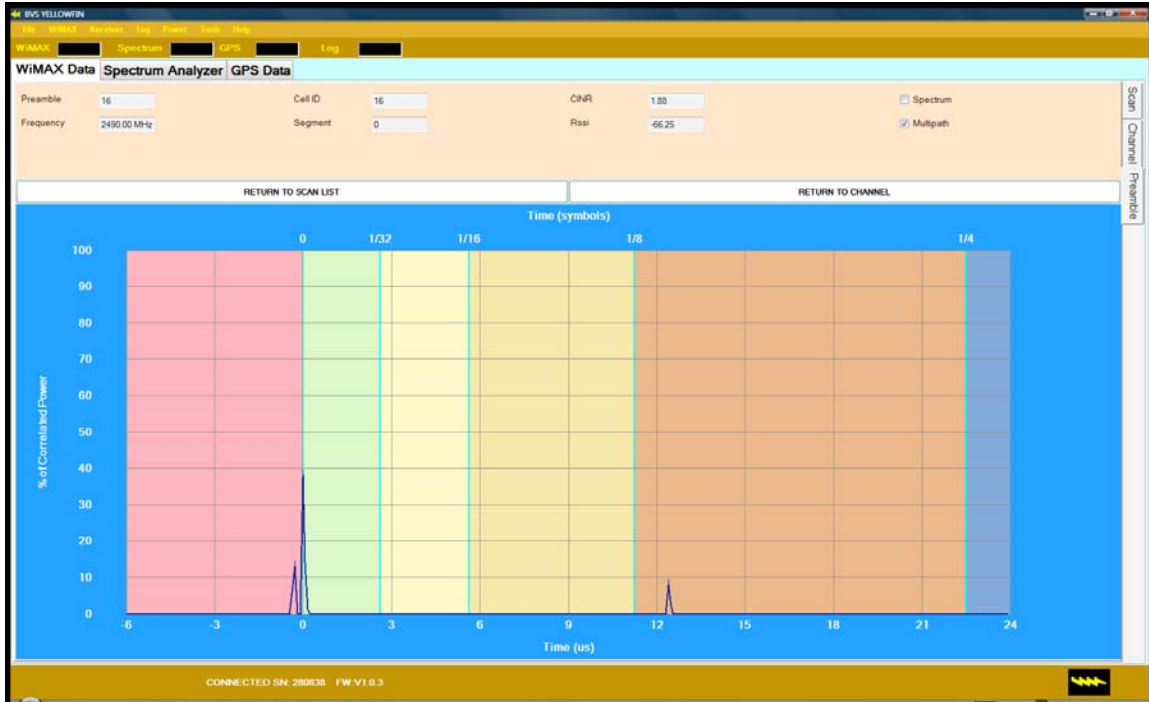


Figure 5 - WIMAX Individual Multipath Mode

The current CNR and RSSI are displayed on the top of the screen along with the frequency, preamble number, Cell ID, and segment.

INDIVIDUAL MULTIPATH

The right of the display show the multipath components for the preamble 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.

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.

The multipath display can be maximized by unchecking the 'Spectrum' checkbox.



Figure 6 - WiMAX Individual Spectrum Mode

INDIVIDUAL SPECTRUM

The left of the display show the individual spectrum centered on the carrier frequency. This display can also be maximized by unchecking the 'Multipath' checkbox. The spectrum shown in Figure 6 is with three preambles on a single frequency. Each preamble is on a different segment. If there were less preambles or the preambles were on the same segment, some of the spectrum components within the waveform would drop down to noise values.

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.

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.

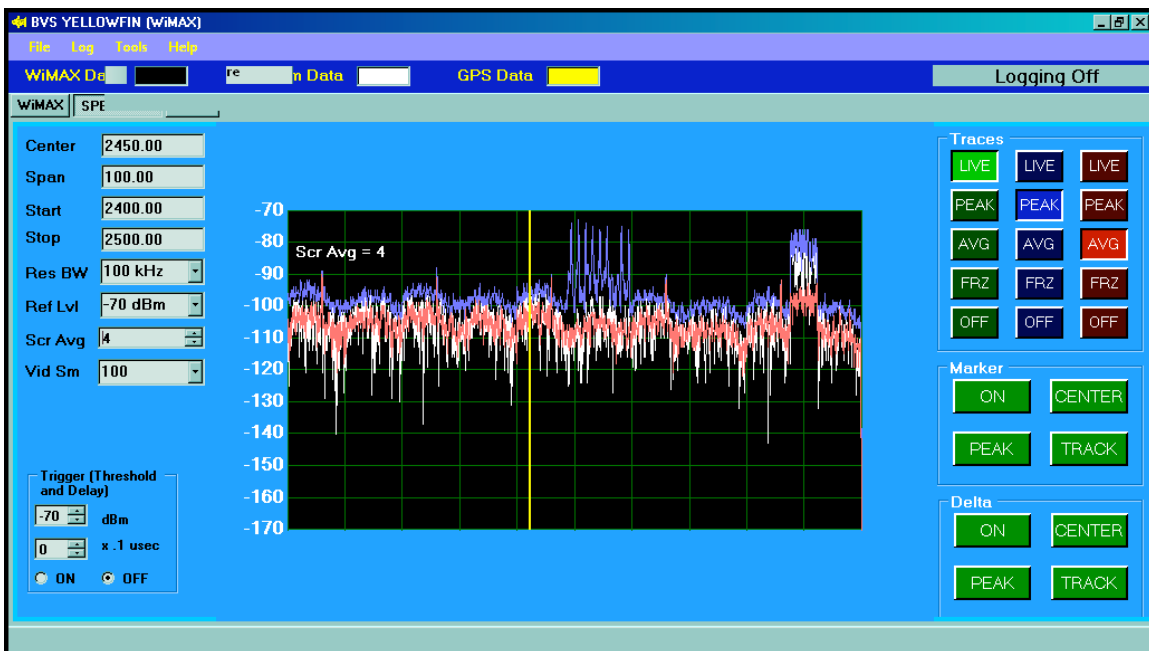


Figure 8 – Multiple Traces

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.

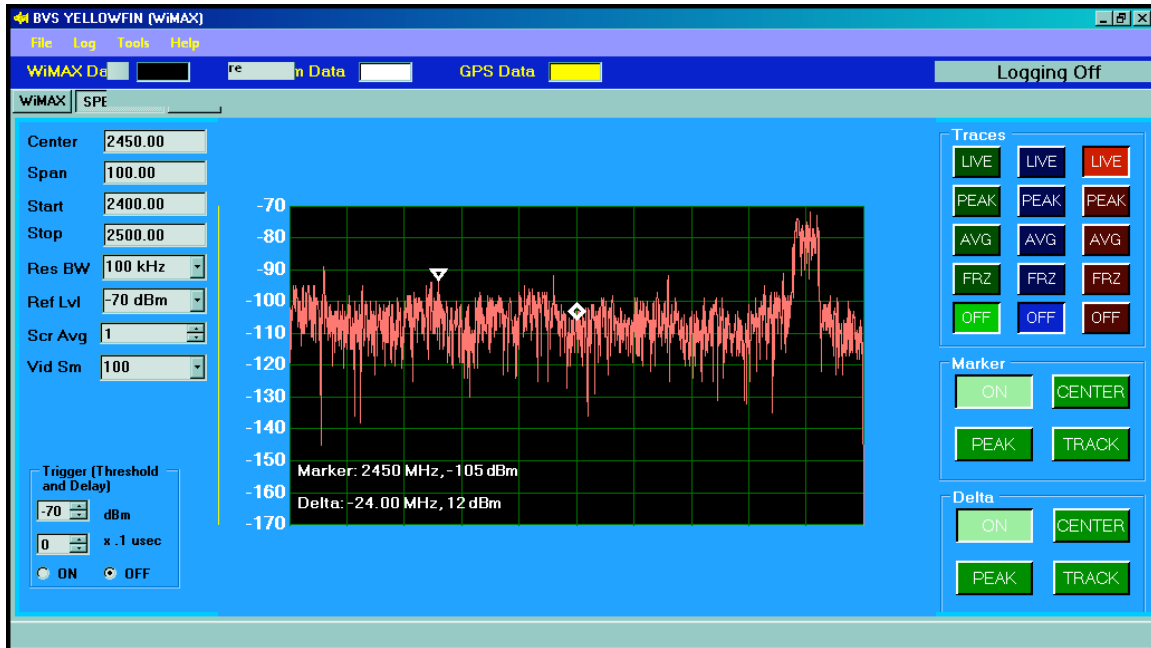


Figure 9 – Marker/Delta Function

GPS DATA

Figure 8 shows the GPS information screen. This display 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 real-time 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.

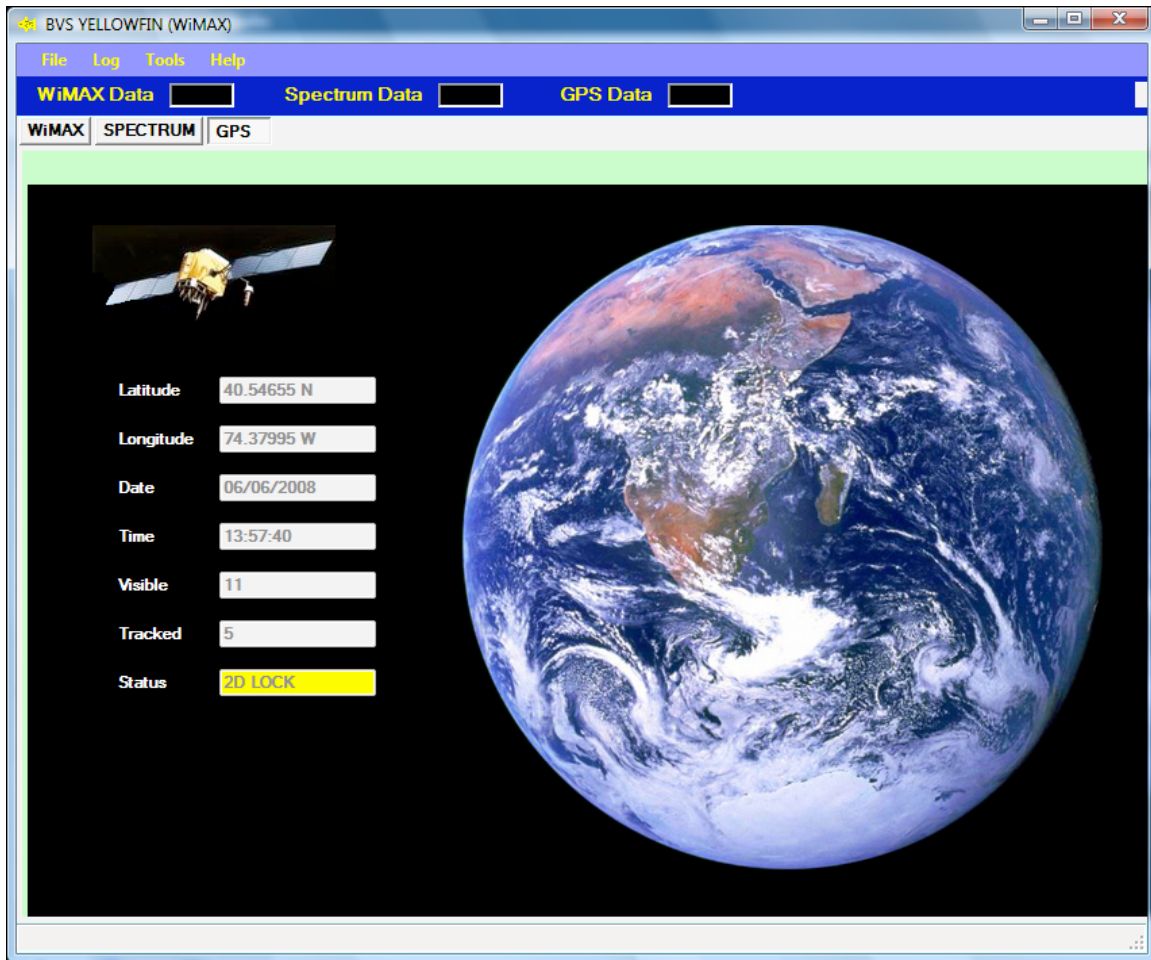


Figure 10 – GPS Screen

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).