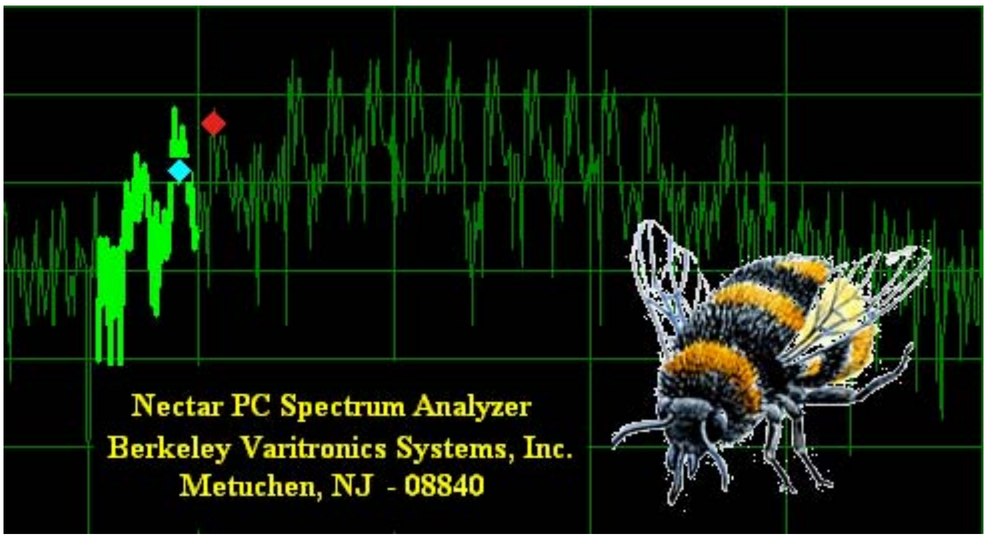
Nectar™

PC based Multi-band Spectrum Analyzer.

For software version 3.2



BVS Nectar package contents

The BVS Pollenator™ 802.11b WLAN Monitoring package comprises of

1. The Pollenator™ Interface
2. Nectar Spectrum Analysis software CD
3. 10/100 Base-T Ethernet Cable.
4. USB 2.0 cable.
5. Pollenator receiver USB port drivers, which get stored in the same folder as the Pollenator Software Application once the CD is installed.

IMPORTANT NOTE:

1. The Pollenator™ interface has to be powered up using the Power Supply for the BumbleBee receiver, by removing the iPAQ connector.

IMPORTANT: *You will require the **Registration Code** for the Software Application. This can be found inside the Nectar ™ CD case. If TCP/IP connection is desired for interfacing the software with the hardware, the **MAC address of the Pollenator™ Ethernet port** may be needed, which can* *be found on the Pollenator™ above the Ethernet port.*

Table of Contents

<u>**PLEASE READ THE IMPORTANT INSTRUCTIONS ON PAGE 9 BEFORE OPERATING THE BUMBLEBEE-EX AND THE POLLENATOR TO AVOID ANY DAMAGE TO YOUR UNIT.**</u>

1. Instructions for Hardware Installation

1.1 Mounting the Pollenator™ on the BumbleBee:

Before starting up the software application, make sure that the **Pollenator™** needs to be properly interfaced to the BumbleBee Receiver as shown on the page above. After having detached the iPAQ from the BumbleBee Receiver, the Pollenator has to be mounted on the same face of the BumbleBee Receiver. It can be held in place that way by inserting the screws on the **Pollenator™** into the two screw holes on the BumbleBee Receiver next to the Swivel Antenna.

Fig 1: Pollenator-BumbleBee Assembly

The Pollenator interface has to be powered up using the power supply provided with the BumbleBee. To do this, detach the iPAQ charging connector from the power supply port and connect this port to the **Pollenator™** interface power supply port. You will then need to remove the CF card connector from the BumbleBee. Connec the connector hanging from the Pollenator to the BumbleBee connector. This forms the Serial Port Link between the BumbleBee and the Pollenator.

1.2 Interfacing the Pollenator with the BumbleBee-Ex

If you have purchased a BumbleBee-Ex and need to interface the Pollenator with it, these are the steps you should follow. Please read and understand the procedure well to successfully interface your BumbleBee-Ex with the Pollenator:

1.2.1 Remove the Upper half of the BumbleBee-Ex case:

This can be done by unlocking the four clamp latches on the four corners of the BumbleBee-Ex case.

1.2.2 Remove the Vent Panel on the Top Half:

To do this, you need to remove the black holder plugs on either side of the vent panels on the inside of the Top Half of the BumbleBee-Ex. This will un-clamp the vent panel and it will come off.

1.2.3 Fix the External Connector Interface in the Vent Panel Slot:

Match the Interface connector to the Vent Panel slot such that the bottom of the connector circuit faces the glass cover on the upper half. Fix the black holder clamps in place again to hold the interface connector in place.

1.2.4 Disconnect the iPAQ:

Disconnect the iPAQ by removing the connector from the bottom of the iPAQ. Be careful while doing so, taking care that adjacent wires are not disturbed.

1.2.5 Connect the BumbleBee-Ex to the Interface Connector

1.2.6 Fix the Top Half of the BumbleBee-Ex back to the Lower Half:

Clamp the latches back to securely fix the upper half back to the lower half.

1.2.7 Fix the Pollenator to the BumbleBee-Ex:

Use the Screws on the Pollenator Backpanel to securely fasten the Pollenator to the BumbleBee-Ex. The screws need to be attached to the BumbleBee-Ex on the Top of the unit. Match the hole on the Pollenator Back-panel with the Antenna connector on the BumbleBee-Ex.

1.2.8 Connect the BumbleBee-Ex to the Pollenator

You can connect the cable on the interface connector to the round 6 pin connector on the Pollenator.

Your BumbleBee-Ex – Pollenator assembly is now ready to be interfaced to the PC using the USB or the Ethernet port on the Pollenator. Make sure you power up the Pollenator externally using the external power supply.

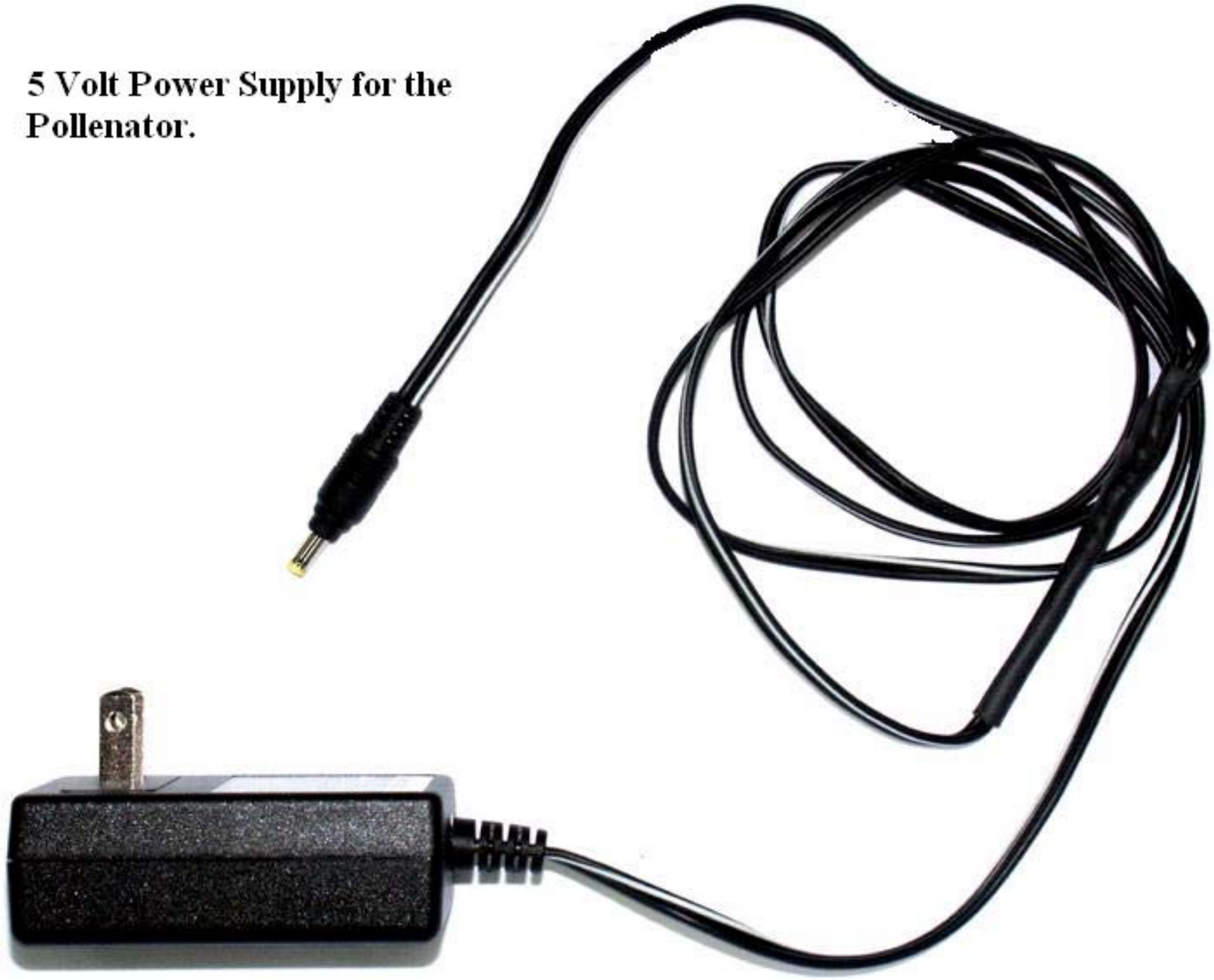
IMPORTANT NOTES:

1. **The BumbleBee-Ex must be powered up using the external DC power supply adapter when using it with the Pollenator. Running the BumbleBee-Ex off the BumbleBee-Ex internal batteries will cause the batteries to drain out and eventually die and you will not be able to replace the batteries at your end.**

2. **The Pollenator and the BumbleBee-Ex must be powered separately. The BumbleBee-Ex power supply adapter provides 12 Volts DC and has a 4-pin Hiroshi connector while the Pollenator power supply adapter provides 5 Volts DC and has a plug connector as shown below.**

3. **VERY IMPORTANT: DO NOT ATTEMPT TO INSERT THE 4-PIN BUMBLEBEE-EX POWER SUPPLY INTO THE 6-PIN ROUND SERIAL PORT CONNECTOR OF THE POLLENATOR. DOING SO WILL DAMAGE THE POLLENATOR.**

Circular 4-Pin Hiroshi Connector Power Supply for the BumbleBee-Ex.



Instal the Nectar PC Spectrum Analyzer software. When you connect the USB cable to the PC, you will be prompted to install the USB Drivers. Upon installing the drivers, the software is good to be used with the BumbleBee-Ex-Pollenator assembly

USB DRIVERS: ***The USB drivers get downloaded to the application folder.*** **BY DEFAULT*, this folder is C:>Program Files\BVS\ Nectar Spectrum Analyzer\USB Drivers.***

1.3 Interfacing the Pollenator™-BumbleBee Assembly to the Nectar Software:

If the medium of interface to the PC is via the USB cable, the Operating System will prompt you to load the appropriate USB drivers. The USB drivers have been provided along with the application and can be found in the same directory as the **Nectar™** application, once the application has been installed using the **Nectar™** Application Installation CD. Make sure that the driver is correctly installed before using the USB port as the interface to the software.

The **Pollenator™** can be interfaced to the **Nectar™** software application over the Internet or within the local network. If the **Pollenator™** is to be used within the local network connect the provided Ethernet cable to the Ethernet port of the **Pollenator™** and the other end to either a hub, switch or a router on the subnet to which the PC on which the **Pollenator™** software application is likely to be running. The other end can also be connected to the Ethernet port of the PC itself.

If the **Pollenator™** is to be interfaced to the **Nectar™** application via the internet, make sure you have the Gateway of the Network to which the Pollenator-BumbleBee 'B' receiver connected, properly configured to forward IP traffic over to the Pollenator-BumbleBee 'B'. You will have to configure the Gateway Router or server to forward any IP traffic on port **10001** to an IP address permissible within that local network so as to enable remote connection to the Pollenator-BumbleBee receiver. Once you do that, you will be prompted to enter the IP address of the Gateway router or server of the Network in which the Pollenator-BumbleBee receiver has been connected.

Fig 2: Ethernet/USB and the Power Supply connection on the Pollenator.

Having installed the **Pollenator™** receiver successfully, the CD can be installed. Go through the CD installation process and store the application in the desired location. A shortcut to the application will be created on the Desktop and Program Files menu of the Windows Start Menu. A soft copy of this manual will also get downloaded on your PC. To check for software/manual upgrades, go to **http://www.bvsystems.com/Tech/tech.htm** or contact **info@bvsystems.com**.

1.4 Establishing a Connection with the receiver:

After double clicking the Nectar Software icon on the Desktop, the following window will show up on the screen:

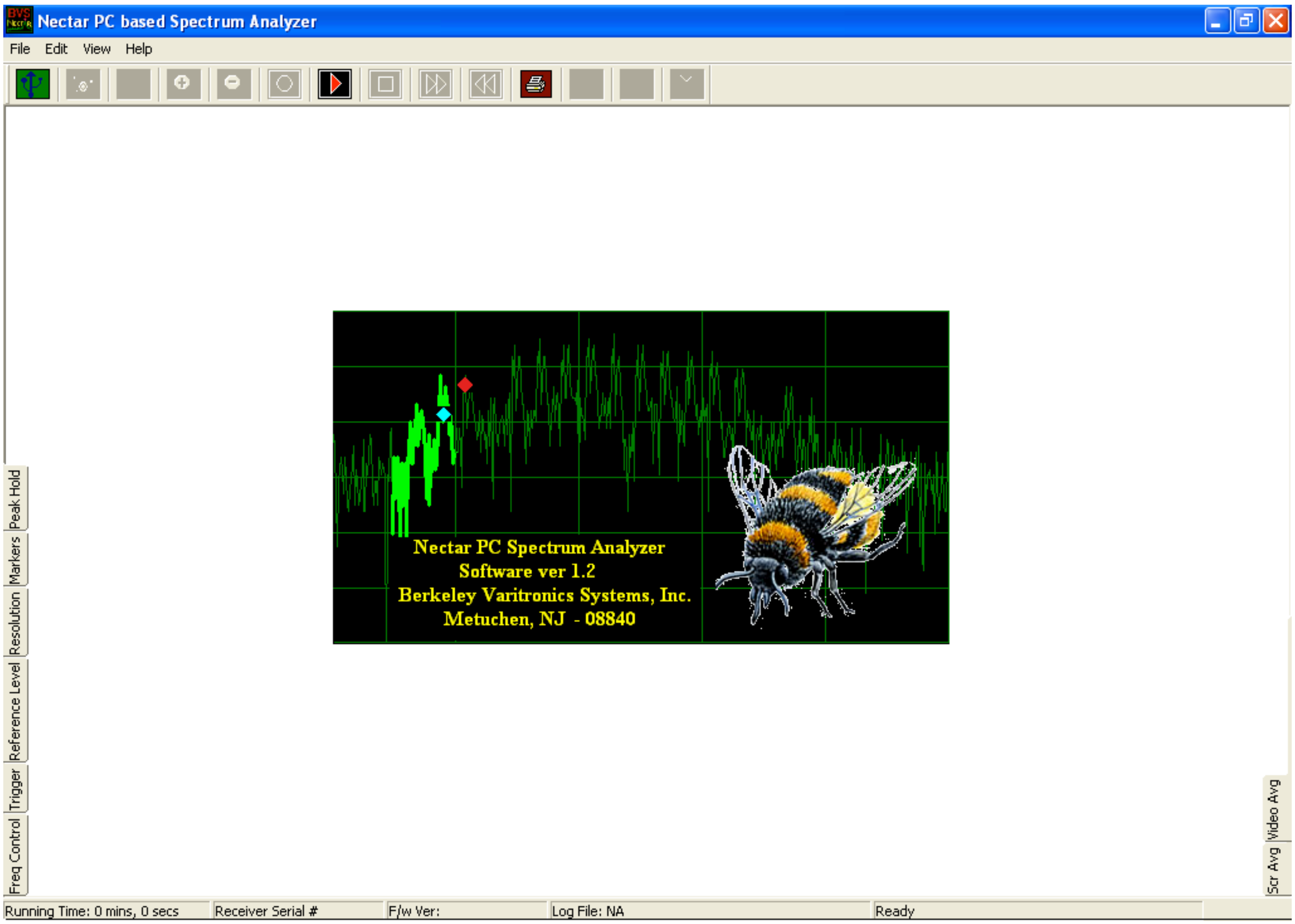


Fig 1: Nectar Software Window.

Click  on the toolbar to establish a connection with the receiver either using the USB port or TCP/IP.

2.1 Setting up a USB connection:

If the USB connection is selected, the appropriate USB device selection dialog Box will pop up:

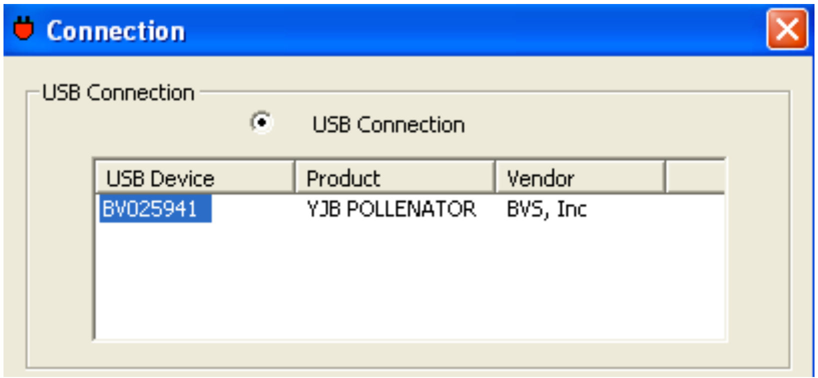


Fig 1.1: Interfacing the receiver to the PC using a USB connection

Important: *Upon selecting the Pollenator USB device and clicking OK, the LED on the Pollenator interface will turn* ***Orange*** *if the USB connection has been properly established.*

2.2 Connecting to the receiver remotely using TCP/IP (Internet Access)

If the user has to connect to the receiver over the Internet, he would need to enter the IP address of the Gateway router or server of the network to which the Pollenator-BumbleBee has been connected.

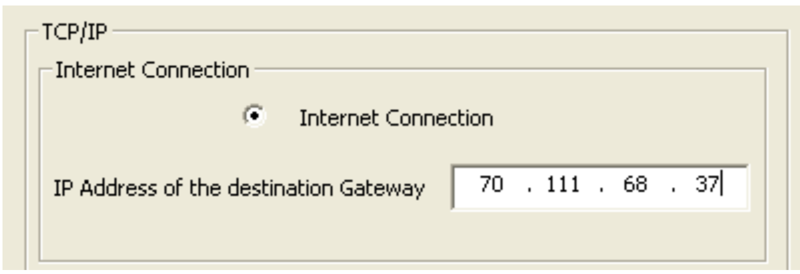


Fig 1.2: Setting up a remote connection over the Internet

2.3 Receiver connected within the Local Network or Subnet:

2.3.1: Obtaining an IP Address automatically using DHCP

If the Pollenator – BumbleBee has been connected within the Local network, the user can choose to Configure the Local Network access for the Pollenator-BumbleBee, by either Statically assigning an IP address or allowing the DHCP server on the Local Network to Dynamically assign an IP address to the Pollenator-BumbleBee.

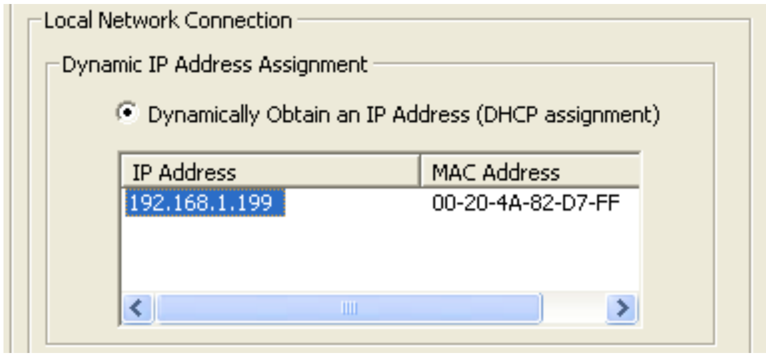


Fig 1.3: TCP/IP connection using DHCP

2.3.2 Assigning a static IP Address to the Receiver:

If the user selects a Static IP address assignment, then he will have to enter the MAC address, which has been attached close to the Ethernet port on the receiver, and then assign an appropriate IP address. Upon doing so, the user has to click "Set IP Address" to set the IP address. If the IP address has been successfully set, then the user will be notified to click "connect" to establish a TCP/IP connection with the receiver and will be directed towards the registration box.

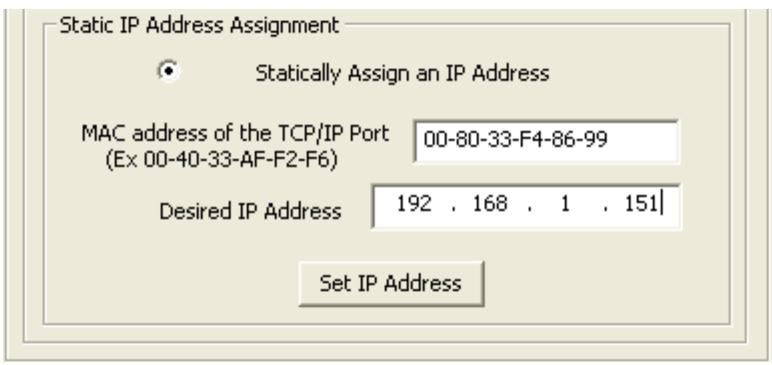


Fig 1.4 Static IP address assignment.

2.4 Registration Code Validation:

Once the connection to the receiver has been established, you will be prompted to enter the Registration Code for validation and authentication. The Registration Code is printed on the inside of the CD cover below the Receiver Serial Number. You will also be sent a letter with the Registration Code for the Nectar software. This Registration code, once entered, will be stored in the Registry for future references. Every piece of software is locked to the corresponding BumbleBee hardware using the Registration Code. If you use the same software with another BumbleBee receiver, you will be prompted to enter the corresponding Registration Code again.

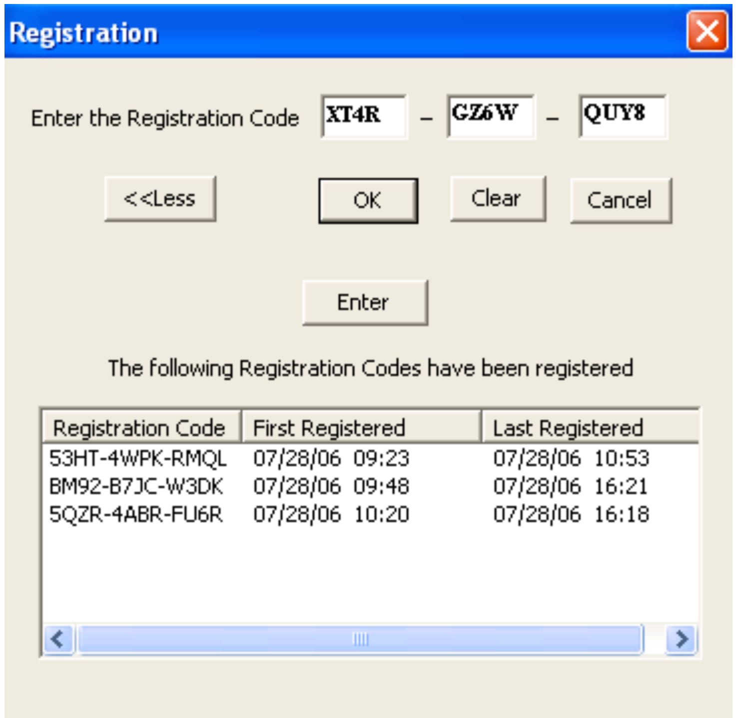


Fig 1.5: Registration Code Dialog Box

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All Registration Code entries are saved registry. If you click the "More>>" button on the dialog box, you will see the registration codes already used, when they were first used to activate the software and when the last authentication took place.

This also happens while Re-playing Spectrum Log Files, which have been logged using another BumbleBee receiver. If you attempt to replay log files, which have been logged using a different piece of hardware, you will be prompted to enter the corresponding registration code. Once the connection to the hardware has been established and the registration codes have been validated, the various controls on the application window become enabled and the software application is ready to use.

On clicking OK, the software will establish a connection with the BumbleBee Receiver. Once connection is successful, the receiver will be set in the default spectrum mode which is centered at 2425 MHz and spans 50 MHz with a Resolution Bandwidth of 50 KHz and a Receiver reference level of –20 dBm.

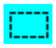
3 Description of Tool Bar Buttons:

3.1  Connection:

This button is establishes a connection with the hardware as discussed above.

3.2  Snapshot:

This button takes a snapshot of the application window. The snapshot can be saved either as a jpeg or a bmp at any location.

3.3  Selection Tool:

This button is used to select an area on the Display to measure spectral power within the selected area or to zoom into the selected area.

This button is first clicked, then the mouse is dragged while keeping the Left Button down, over the desired Spectral Region and that area is highlighted. Spectral Power within this selected region is calculated and displayed as shown:

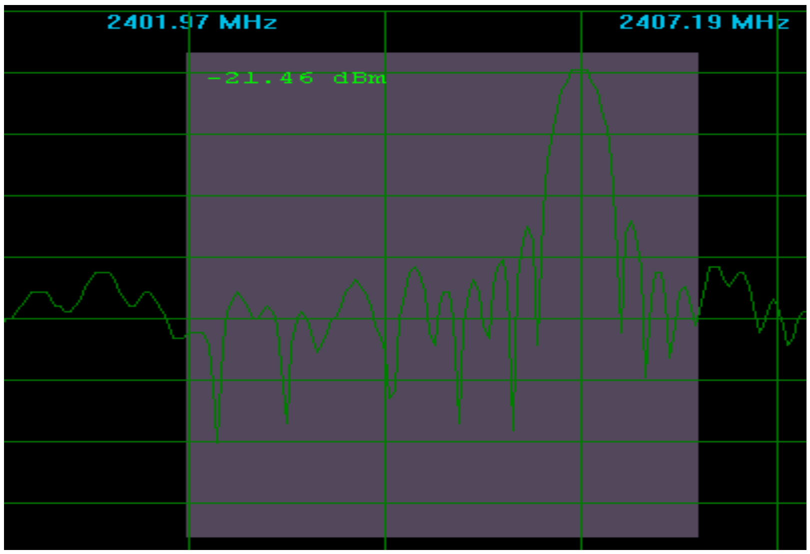


Fig 4: Spectrum Selection

3.4  Zoom In:

This button zooms into a selected area.

3.5  Zoom Out:

This button zooms out from a previously zoomed in region.

3.6  Record/ Log Spectrum:

Once in the Spectrum Mode or the Trigger Spectrum Mode, the Spectrum Data being viewed on the Screen may be logged by clicking this button. The Logged File is saved with the *.spl extension.

3.7  Replay the Logged Spectrum for post-processing/analysis:

This button selects Spectrum Log Files (with extension .spl) and replays them for post-processing and analysis. Once the playback begins, this button changes in appearance to **.** Clicking this changed button freezes the playback and the button becomes  in appearance again. Click this button again to resume normal playback.

3.8  **Stop Recording/Playback:**

Stop the current recording or playback.

3.9  **Fast Forward:**

The replay speed is doubled. Click this button again to resume normal playback.

3.10  **Rewind:**

The play back is reversed at doubled speed. Click this button again to resume normal playback.

***NOTE:** For detailed explanation on Logging and re-playing a Spectrum Log File, see page29*

3.11  **Print Preview & Print.**

This prints out the current Spectrum Display. The Display can be printed out either in **True Color:** A true snapshot of the Display screen is printed as seen on the Display (with the Black Background); or in **Econo Color:** A snapshot of the Display is taken and printed against a white background or in **Black and White:** A Black and White print out is taken (i.e. Black foreground against a white background). The options can be changed in the File menu by Clicking on "Print Color Options". Once clicked, the following Dialog Box pops up. Then select the option of choice and then click OK and click  see a preview of the screen.

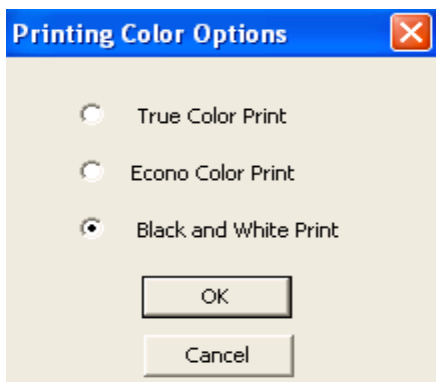


Fig 5: Print Color Selection Options Dialog

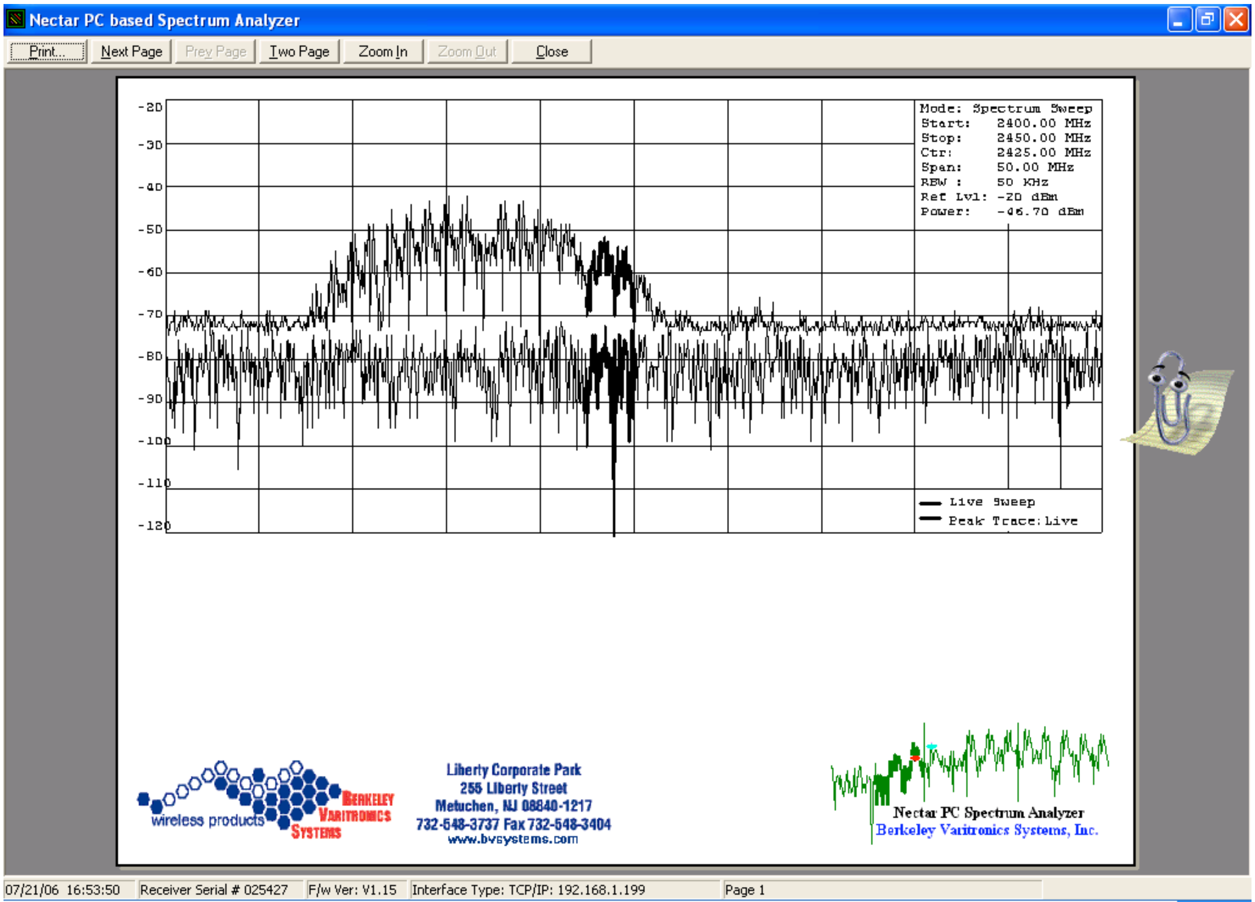


Fig 6: A Print Preview for a Black and White (Monochrome) print out.

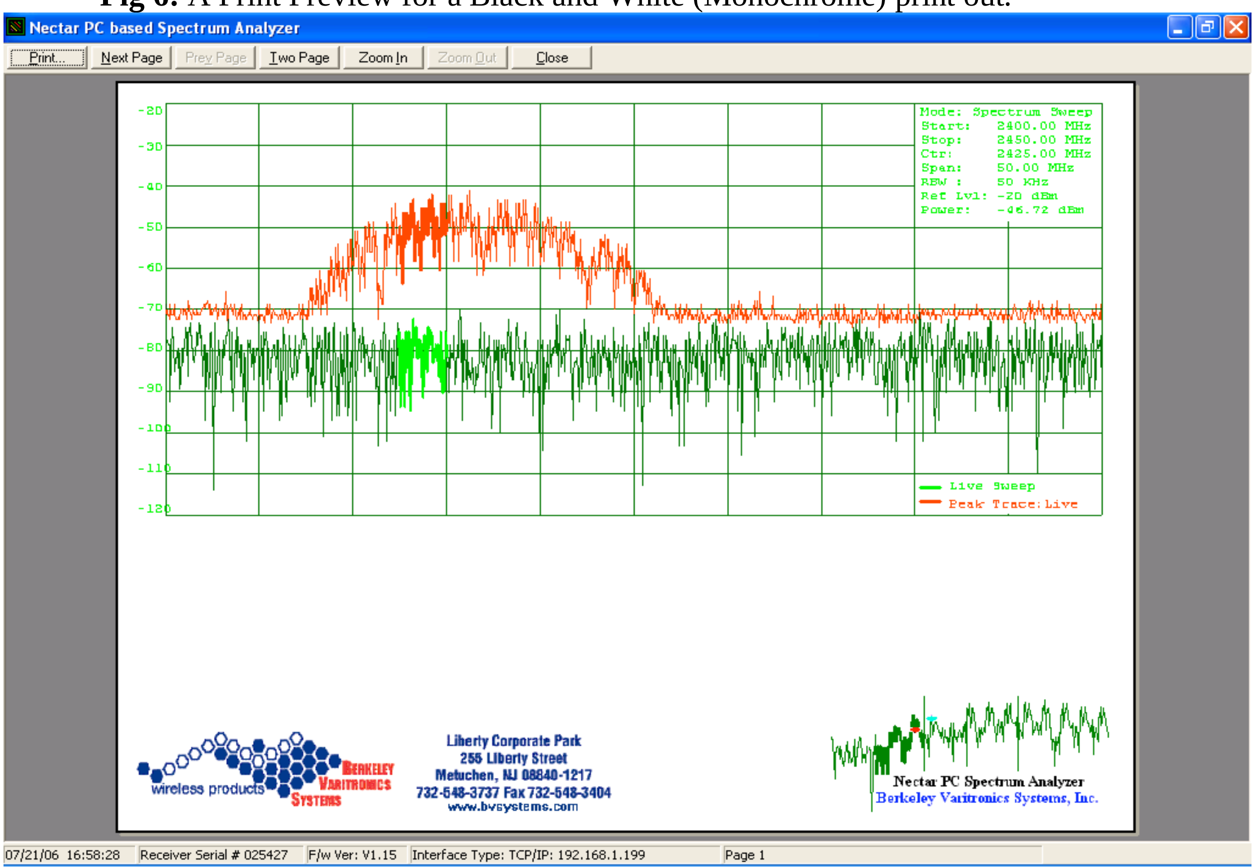


Fig 7: An Econo Color Print Preview Option

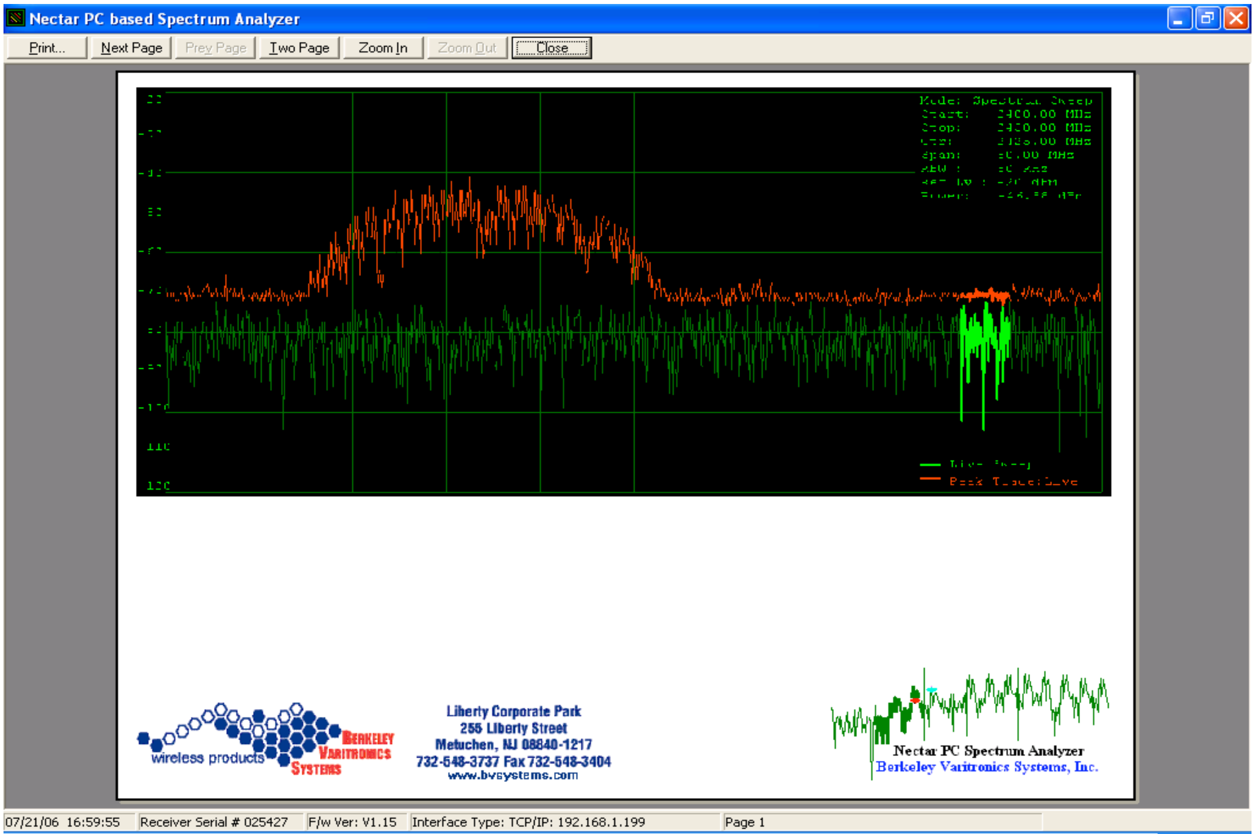
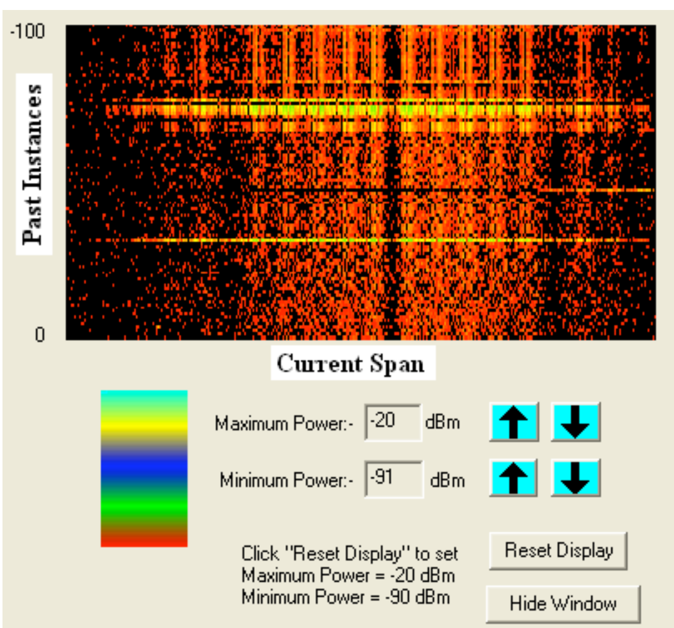


Fig 8: A true Color Print

3.12 Spectrogram Display:



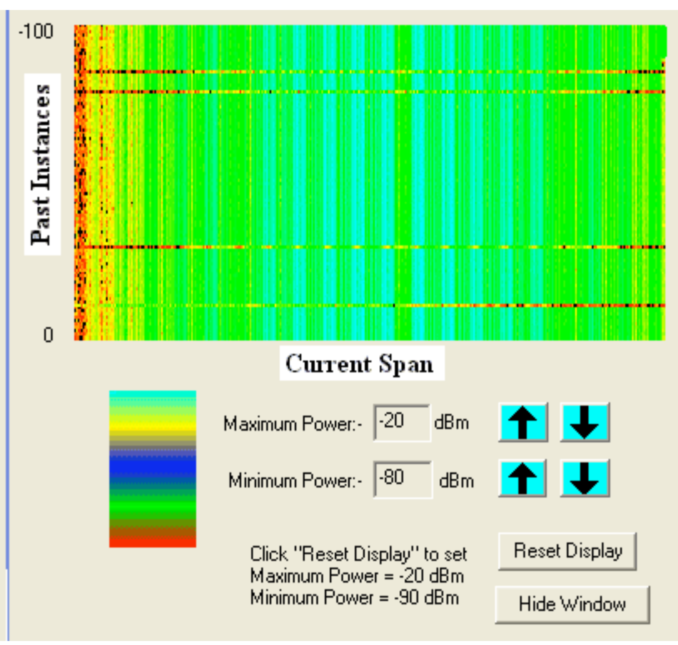


Fig 9.1: Burst of Microwave Energy from a Microwave oven.

Fig 9.2: Persistence of a Direct Sequence Spread Spectrum Signal; from an 802.11b AP

The Spectrogram Display shows the power gradient of the last 100 spectral sweeps. The Power Gradient is plotted with Past Instances vs. the Current Span. The spectrogram is displayed using the colors given on the Color Bar. The Colors in the Color Bar represent the power values between the defined Maximum and Minimum power values. By selecting either Max Power or Min Power the corresponding values can be changed by clicking the  buttons. Any power value greater than the Maximum Power value set is represented by **WHITE** color in the spectrogram while, any power value lesser than the set Minimum Power value is represented by **BLACK.** The Spectrogram can also be displayed for Spectrum being replayed from the Nectar Log Files.

3.13  Histogram Display:

This displays the Histogram Display for the current waveform. The Histogram displays the percentage of time that the power in each frequency bin is above the threshold.

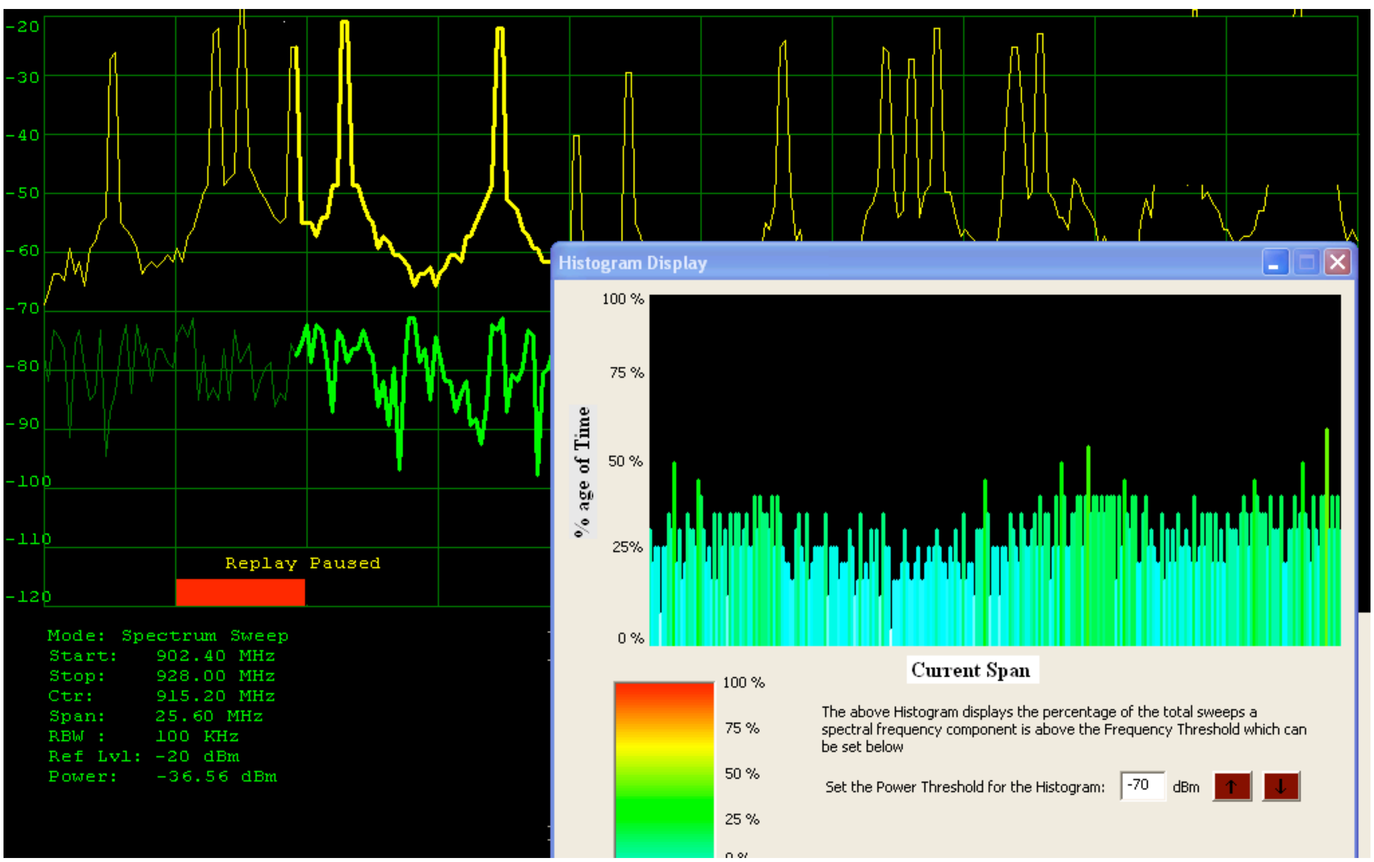


Fig 10: Histogram Display of an RFID waveform.

2.14  Interference Analyst:

The Interference Analyst is a collection of waveforms of most commonly used digital modulation and transmission techniques in the 900 MHz, 2.4 GHz and 5.8 GHz frequency bands. The Interference Analyst provides visual representation and description of waveforms of Direct Sequency Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS), Orthogonal Frequency Division Multiplexing (OFDM), Microwave oven Power Leakage. It also provides visual images of what the Spectrum looks like when one transmission scheme interferes with another. The Interference Analyst is very useful for users who do not have a good understanding of the above mentioned digital modulation and transmission schemes. It can be a handy feature for them to detect and identify the type of device transmitting on a particular channel.

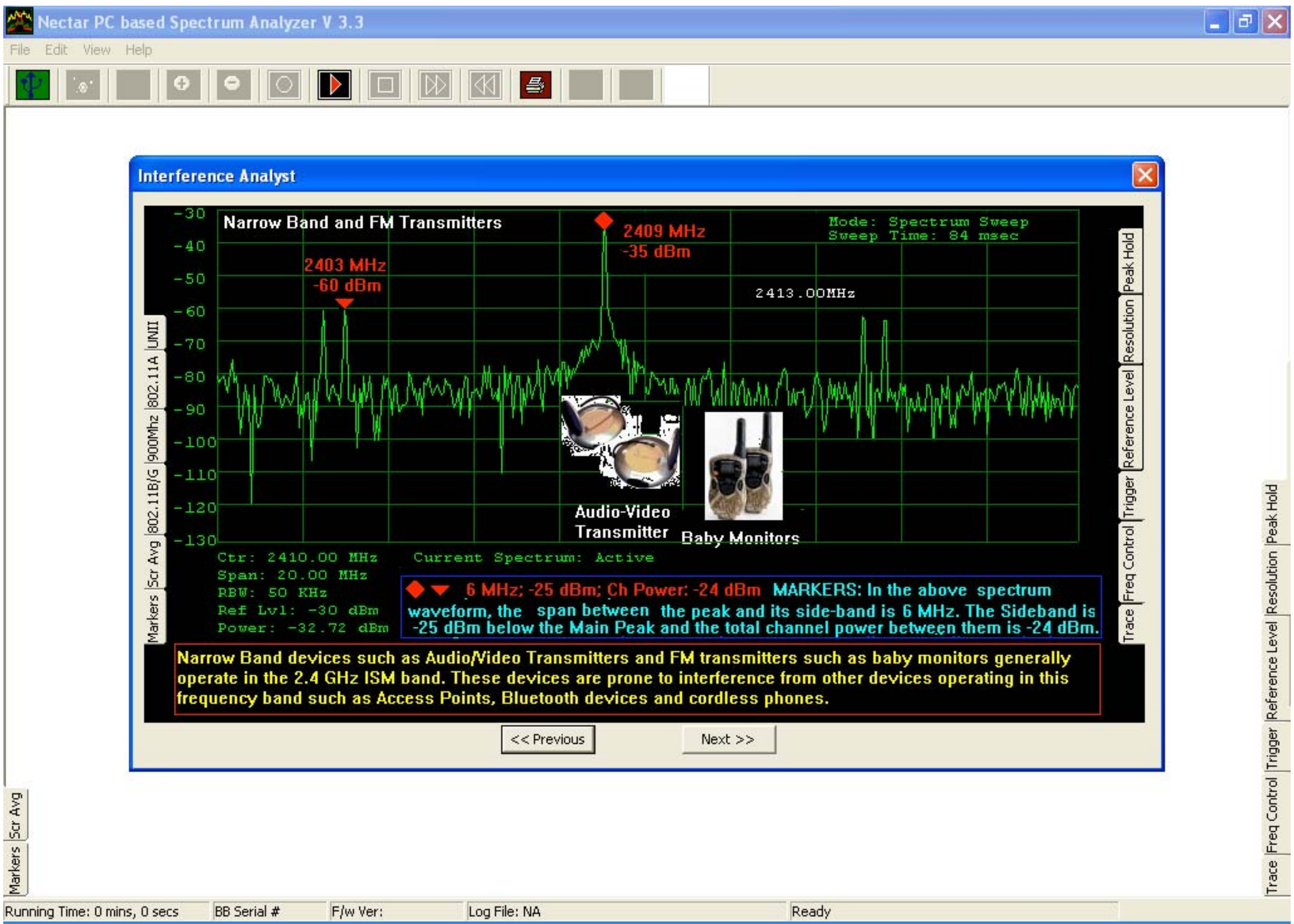
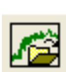


Fig 11: Interference Analyst Display of a Narrow Band waveform.

2.15  Create a User defined Spectrum Preset by saving a Spectrum Context File.

2.16  Re-Open a saved Spectrum Context File to trigger a User-defined Spectrum Preset.

4. Tab Options:

The Tabs on the Left and Right hand edge of the application window form the Control and Data Panel for the Nectar Software. Tapping on a Tab with the Stylus will make it pop out on the screen. Tapping outside the Tab will cause the popped up Tab to slide back and hide.

4.1 Frequency Control Panel:

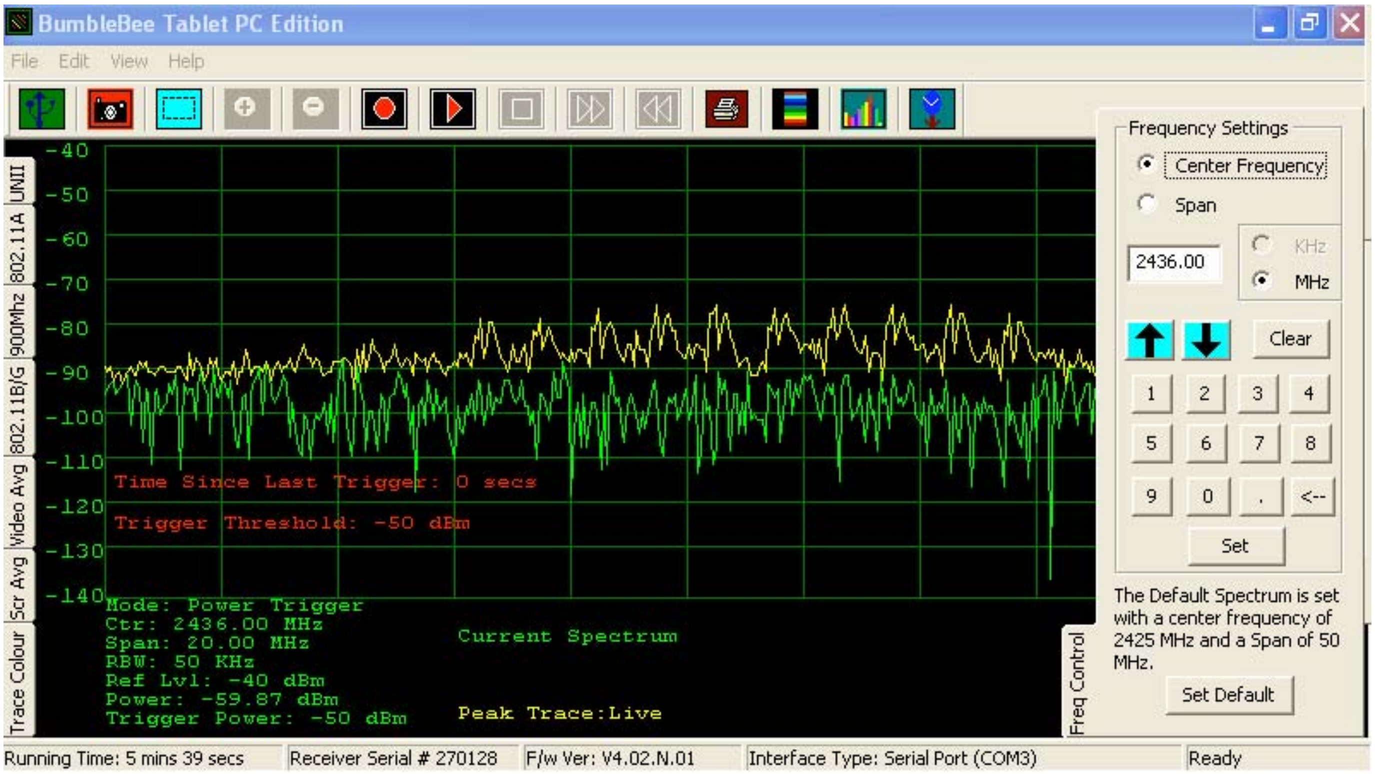


Fig 11: Frequency Control Panel

The Frequency Control Panel allows the user to set the Center Frequency and the Span of the Spectrum Analyzer.

To set the Center Frequency

1. Click the Radio Button for the Center Frequency.
2. Click “Clear” to delete the value shown.
3. Enter the Center Frequency value in the Text Box.
4. Select the units (KHz/MHz).
3. Click “Set”.

To set the Span, repeat the steps 2 through 5 after clicking selecting Span.

IMPORTANT NOTE:

1. *The Center Frequency has to be within the Frequency Band supported by the BumbleBee Receiver.*

2. *The Span is divided equally on both the sides of the Center Frequency.*

3. *The software performs "Span Checking" to make sure that the span does not exceed the bounds of the Frequency Band supported by the BumbleBee Receiver. For example: For a BumbleBee which supports the 2400 MHz – 2500 MHz frequency band, if the current center frequency is 2480 MH,. the maximum span which can be set would be 40 MHz.*

The Legend on the bottom of the window is explained as below:

```
Mode:  Spectrum Sweep--------> Current Mode of the Receiver
Start:    2400.00 MHz--------> Start Frequency
Stop:     2450.00 MHz--------> Stop Frequency
Ctr:      2425.00 MHz--------> Center Frequency
Span:     50.00 MHz   --------> Span
RBW :     50 KHz     --------> Resolution Bandwidth
Ref Lvl: -20 dBm      --------> Current Reference Level
Power:    -45.46 dBm  --------> Total Power within the current Span
```

3.2 Trigger Mode:

The Swept Spectrum Mode can be slow in detecting and measuring bursts of signal energy. This is because when the receiver scans a certain portion of the spectrum, it will miss a burst of signal energy such as a frequency hop of a Frequency Hopping device on a nearby frequency. In the Swept Spectrum Mode, the only time the receiver will detect and measure signal energy is when the burst of signal energy occurs at the frequencies the BumbleBee receiver is currently scanning. This problem can be particularly compounded if the Sweep Span is large and the resolution bandwidth is small. As a solution to this problem, the BumbleBee Receiver has a Power Trigger Mode. In this mode, the user can set a power threshold for the receiver to trigger on, every time the channel power exceeds this threshold. This way, the receiver captures bursts of signal energy occurring over a 20 MHz channel bandwidth whenever the Channel Power within this 20 MHz channel exceeds the Power Threshold. In addition to this, the user can set a delay so that the receiver will measure the channel power only after the amount of specified delay following a trigger. This setting ensures that the RF energy of the desired portion of the data packet is measured.

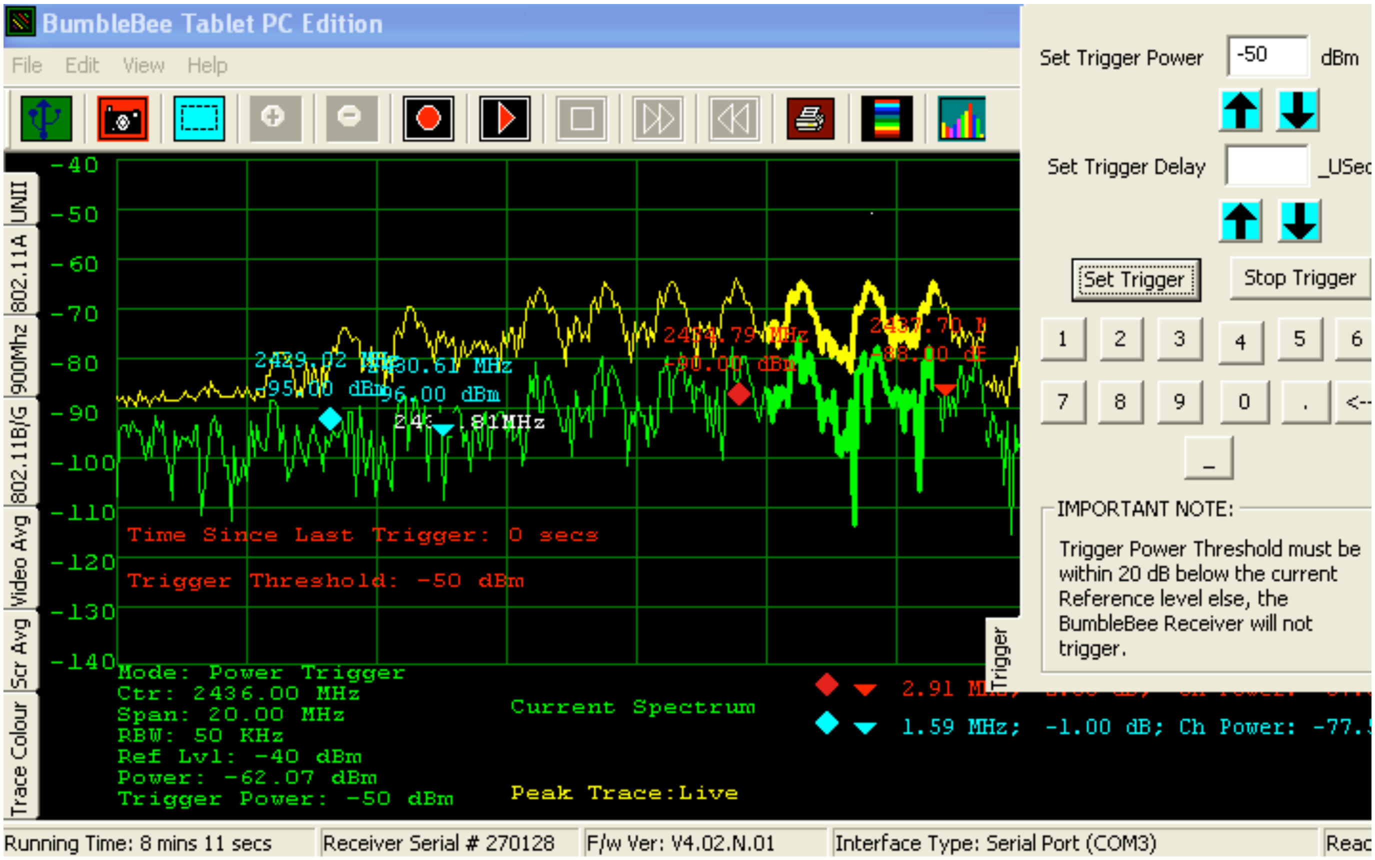


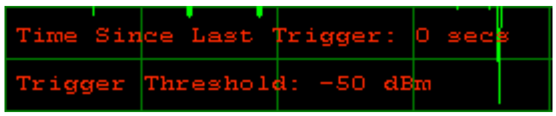
Fig 12: Trigger Mode Settings: The Direct Sequence Spread Spectrum Waveform above shows the presence of an 802.11 B Access Point.

To Set the Receiver to Trigger on a Channel Power greater than the Power Threshold:

1. Set the Receiver Reference Level.
2. Set the center frequency of the channel. This can be done either using the Frequency Control panel or the Preset Panels. **IMPORTANT**: **The Span must be set to 20 MHz**.
3. Tap the stylus on the Trigger Tab to pop up the Trigger Panel.
4. Set the Trigger Threshold power to within 20 dB of the current Reference Level[1].
5. Click "Set Trigger" to Set the BumbleBee Receiver to Trigger on a Channel Power greater than the Power Threshold.
6. To change any Spectrum parameter when the unit is in trigger mode, Stop the Trigger, make the desired setting and then click "Set Trigger" again.
7. A Trigger Delay in Micro Seconds can be entered to set the receiver to measures the spectrum after the delay following the channel power exceeding the power threshold.

IMPORTANT NOTES:

1. **The Trigger is only applied for a maximum Span of 20 MHz**. Set the Center Frequency to a suitable value and then set the Span to 20 MHz.
2. **The Trigger Threshold Power must be within 20 dB of the Reference Level.** If the Threshold value is below 20 dB of the Reference Level, the BumbleBee Receiver will not trigger. To adjust the threshold level greater than 20 dB below the reference level, lower the reference level and then adjust the trigger threshold.
3. **Stop the Trigger by clicking "Stop Trigger" to exit the Trigger Mode and resume the normal Spectrum Mode.**



IMPORTANT TIPS WHILE USING THE TRIGGER MODE:

The trigger mode will trigger when the power in a 20 MHz channel exceeds the set power threshold. The presets can be very helpful in conjunction with the trigger mode.

- **Select a channel using the Preset tabs.**
- **Set the Reference Level and the Resolution Bandwidth.**
- **Set a threshold value to be within AT MOST 20 dB below the reference level.**
- **Start the trigger. The receiver will now trigger on the preset channel.**
- **Click "Stop Trigger" to stop the trigger.**

3.3 Reference Level:

The Dynamic Range of Power measurement of the BumbleBee can be changed by varying the Reference Level of the Receiver. The Reference Level Settings for the BumbleBee Receiver can be changed from –20 dBm to –70 dBm in steps of 10 dB. For measuring very strong signals the reference level can be set to a high value like –20 dBm while low power signals can be measured by setting the reference level to –70 dBm. Hence when the Reference level has been set to –20 dBm, the receiver can measure signals with a maximum value of –20 dBm. If the reference level is a low value compared to the value of the received signal, the signals are subjected to clipping as seen in **Fig 13.**

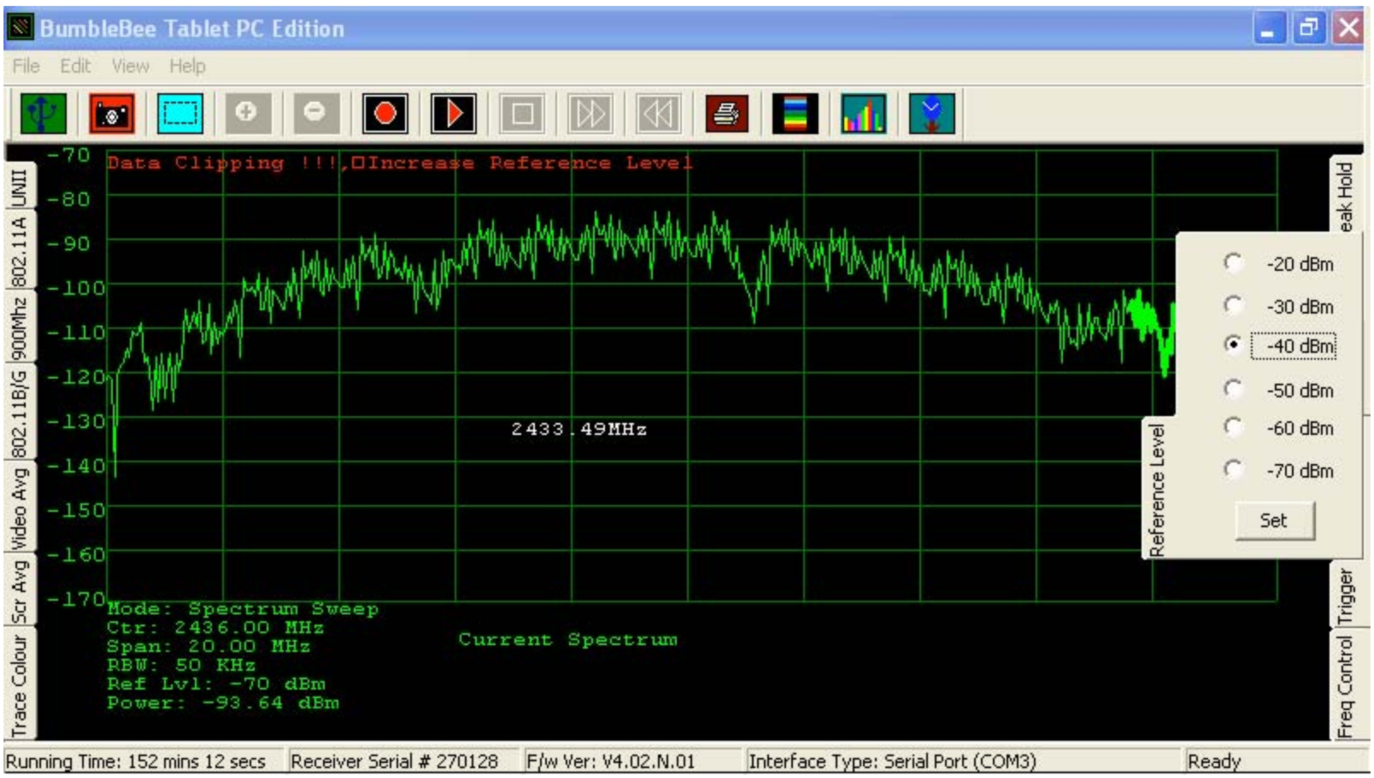


Fig 13: Reference Level Settings

IMPORTANT NOTE:

When using the Trigger Mode, the Reference Level setting must be at most 20 dB above the set Power Threshold value otherwise the BumbleBee Receiver will not trigger.

3.4 Resolution Bandwidth:

The BumbleBee measures the energy present within the frequency bins. The width of each bin is equal to the Resolution bandwidth.

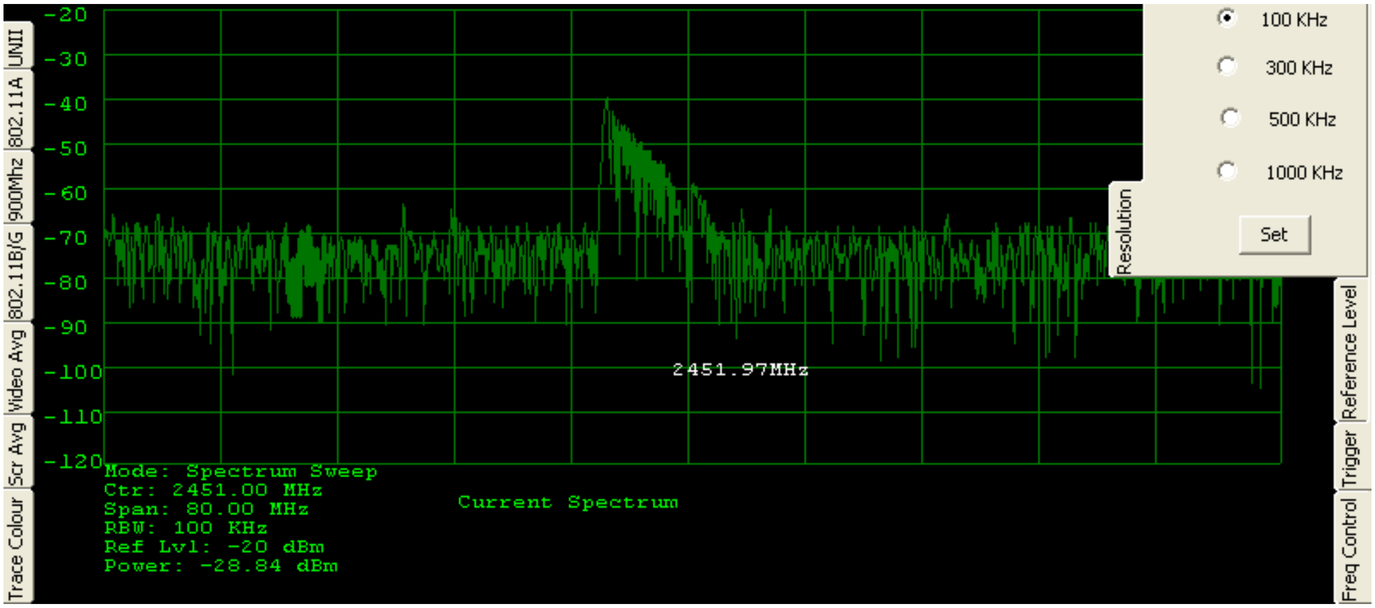


Fig 14.1 Burst of Signal Energy as observed using a 100 KHz resolution bandwidth.

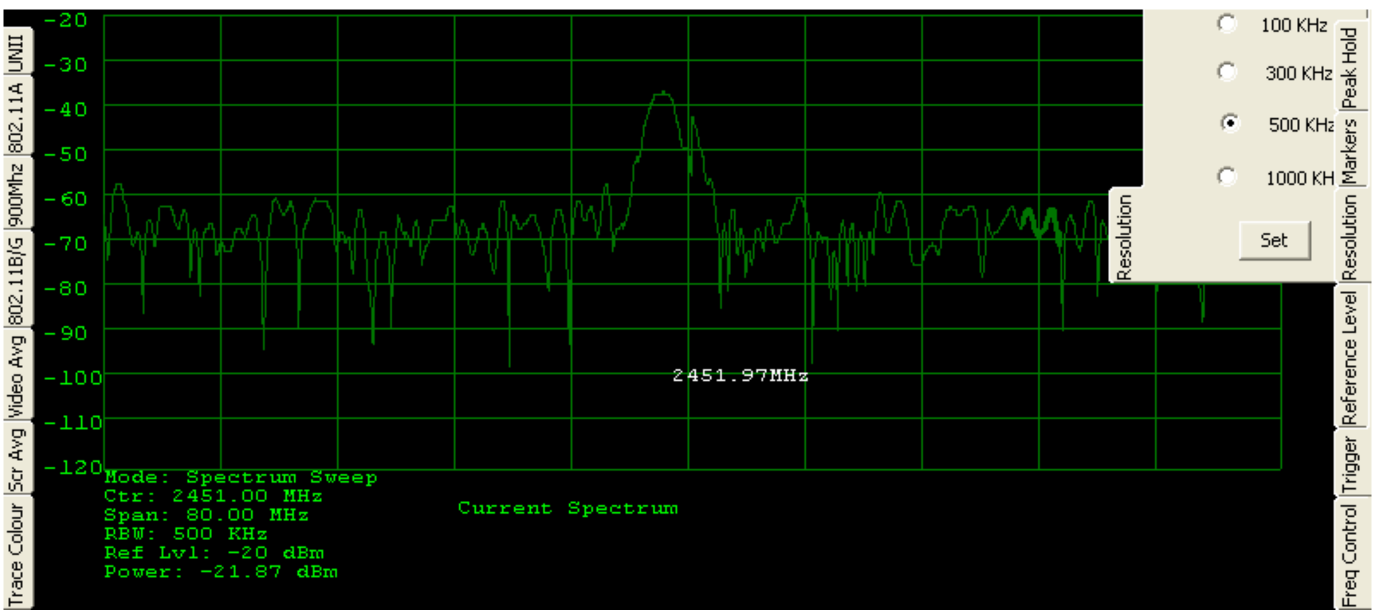


Fig 14.2 Burst of Signal Energy as observed using a 500 KHz resolution bandwidth.

The Resolution Bandwidth of the trace shown in **Fig 14.2** is 500 KHz. Each point in the spectrum above represents the total energy present in a frequency bin 500 KHz wide. A lower Resolution Bandwidth is very useful in accurately capturing and measuring individual frequency components within the spectrum. However, for a large span, a smaller Resolution Bandwidth would result in a longer sweep time. A higher Resolution Bandwidth can be used for a large span to reduce the sweep time. A Resolution Bandwidth greater than or equal to the bandwidth of the signal can be used to measure the Channel Power.

3.5 Markers/Delta Markers

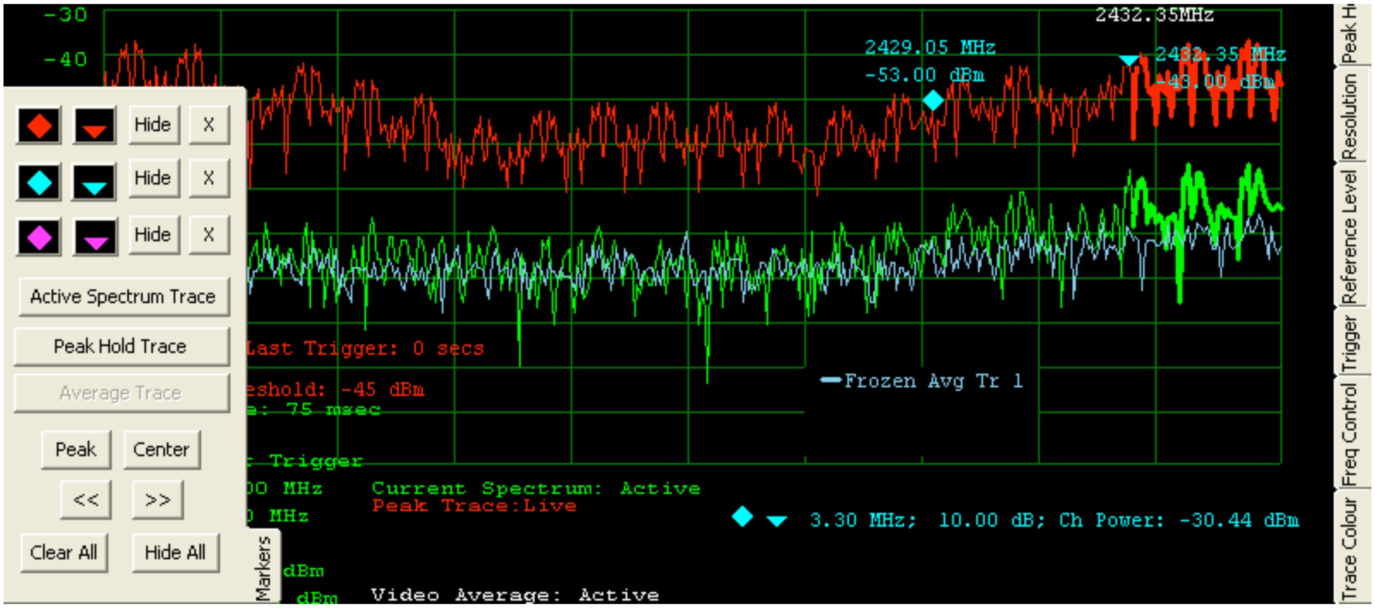


Fig 15: Markers/Delta Markers Settings

This Tab Panel can be used to set Markers/Delta Markers on the Spectral waveform at desired frequencies to measure power at that frequency. The Marker/Delta can be positioned either on the Active Trace, the Peak Hold Trace or the Average Trace provided those traces are active and not frozen

IMPORTANT: The Selection feature must be disabled. If the button is , then click the button again to restore it to and disable the Selection feature.

In order to set the Marker and the Delta:

1. Click on the Marker Tab Panel to set the Marker.
2. Then tap the stylus on the spectrum at the point of interest. This will set the Marker () at the desired point.
3. Click **on** the Marker Panel to set the Delta.
4. Then again tap the stylus at some point away from the Marker to place the Delta at that point.
5. The Frequency and the Power at the Marker and the Delta will be displayed just above them as shown below.
6. If the Markers need to be placed on the Peak Hold or the Average Trace, click the respective button on the Marker Settings Panel. This will cause the markers to shift from the Active SpectrumTrace to the selected Trace. To set the Markers back to the Active Spectrum Trace, click “Active Spectrum Trace” on the Marker Settings Panel.

7. If the Marker/Delta have been positioned on the Peak Hold Trace or the Average Trace, the markers will shift on the Active Spectrum Trace the moment the Peak Hold or the Average Trace is disabled.

8. Click Peak to position the markers on the Peak value of the trace on which they have been set.

9. Click Center to position the markers on the Center Frequency of the trace on which they have been set.

10. Click << to shift the Marker/Delta to the left and click >> to shift the Marker/Delta on the right of the trace on which they have been set.

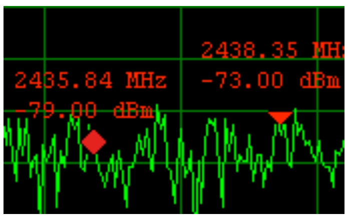


Fig 15.1: Marker/Delta Marker

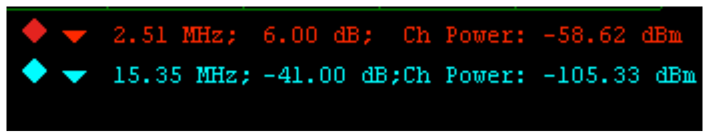


Fig 15.2. Marker/Delta Info

Fig 15.2 shows the measurements between the Maker and the Delta. The **Red** Marker/Delta pair is 2.51 MHz apart with the Delta being 6 dB above the Marker. The Channel Power between the Marker and the Delta marker is –58.62 dBm. Similarly the **Blue** Marker/Delta marker pair is 15.35 MHz apart, with the Delta being 41 dB below the Marker. The Channel Power between them is –105.33 dBm.

3.6 Peak Hold Traces:

Up to four traces, each, which traces the Peak Power in the Live Sweep waveform, can be set. However, only one of these four traces can be active at a given time. An active trace can be frozen by clicking the "Freeze" button for further analysis. If a peak trace is frozen, a new trace can be activated by clicking the corresponding check box, without disabling the frozen trace. Clicking "Hide" check box can hide the traces. **Fig 4** shows the Peak traces in detail.

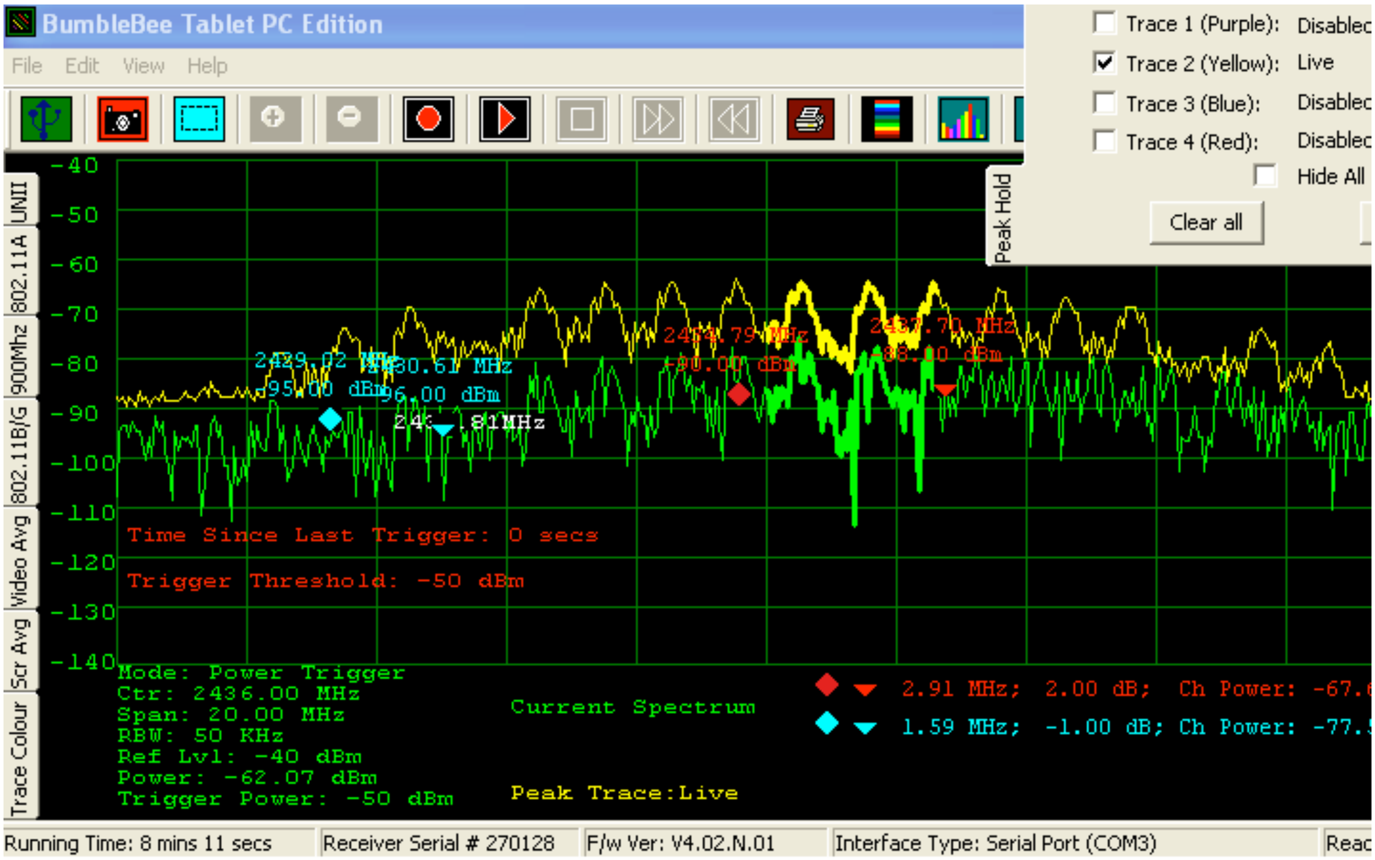


Fig 16 Peak Traces

3.7 Trace Averaging:

Trace Averaging is useful to obtain a trace, which is the average of the last N traces. This is helpful in reducing Noise in signals that are continuous to obtain a smooth trace with fewer variations. Non-continuous signals can be filtered with Adjacent Bin Averaging discussed later.

When 'Trace Averaging' is selected, a dialog box as shown on the left hand will pop-up. The desired number of traces to be averaged can be increased or decreased using the up/down arrow buttons. **Fig 5** shows the trace averaged over the last 7 sweeps

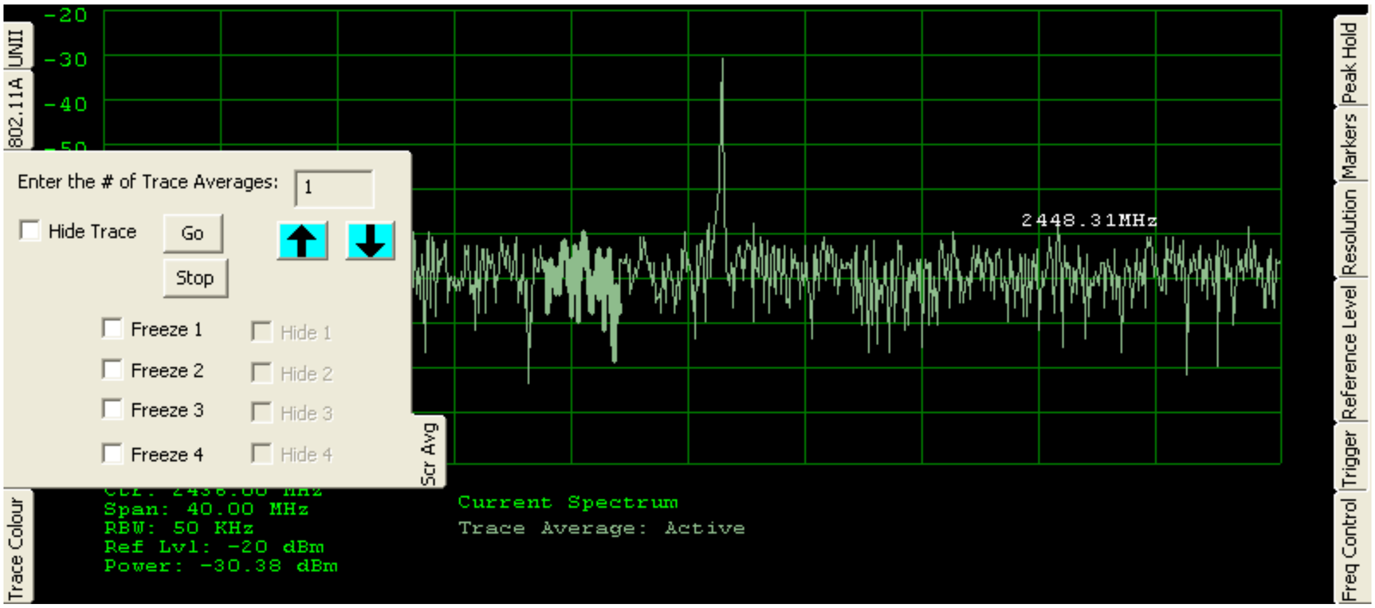


Fig 17.1: The trace in **OLIVE** color is the trace representing NO Averaging.

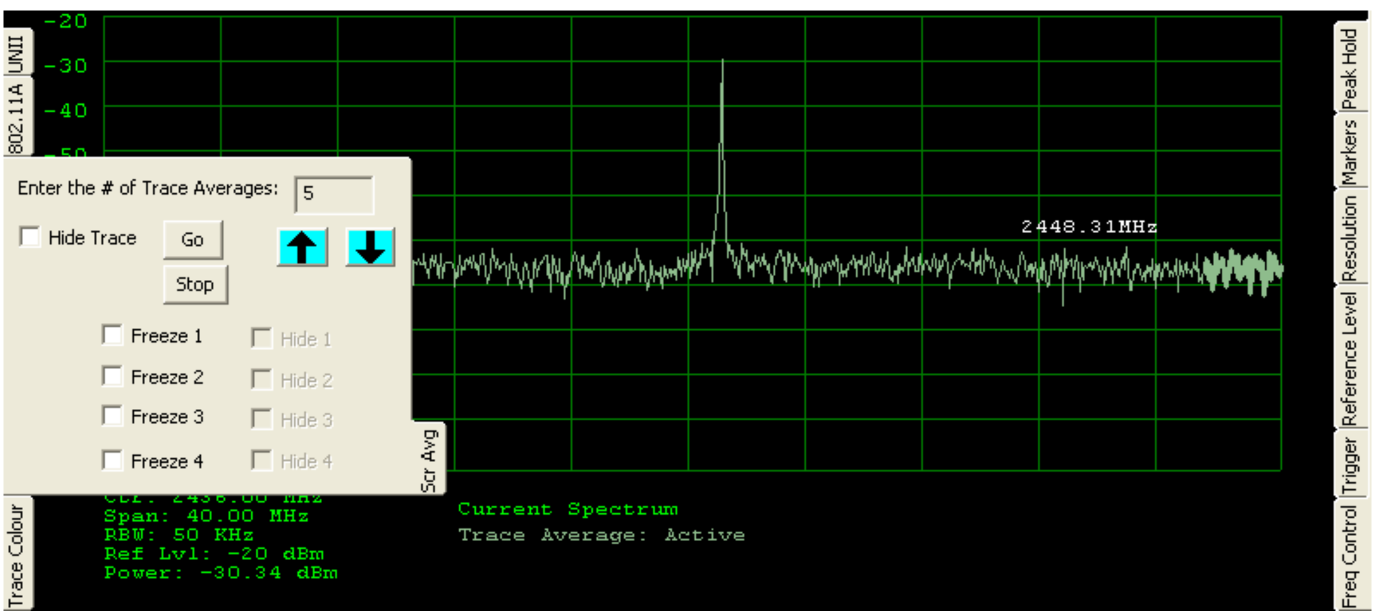


Fig 17.2: The above trace contains points which are an average of the last 5 trace points.

3.8 Adjacent Bin Averaging:

Adjacent Bin Averaging is also called Video Smoothing. This technique uses the adjacent-point averaging to reduce the amount of fluctuation in the measured trace due to the noise. N points of a trace are averaged together to produce each point. This reduces fluctuations in Noise and smoothes the trace. However, the user has to apply good judgment over the amount of smoothing to be applied as excessive smoothing could lead to loss of the desired information, with the waveform conveying nothing. **Fig 18.2** displays the live trace smoothed over 6 consecutive adjacent bins.

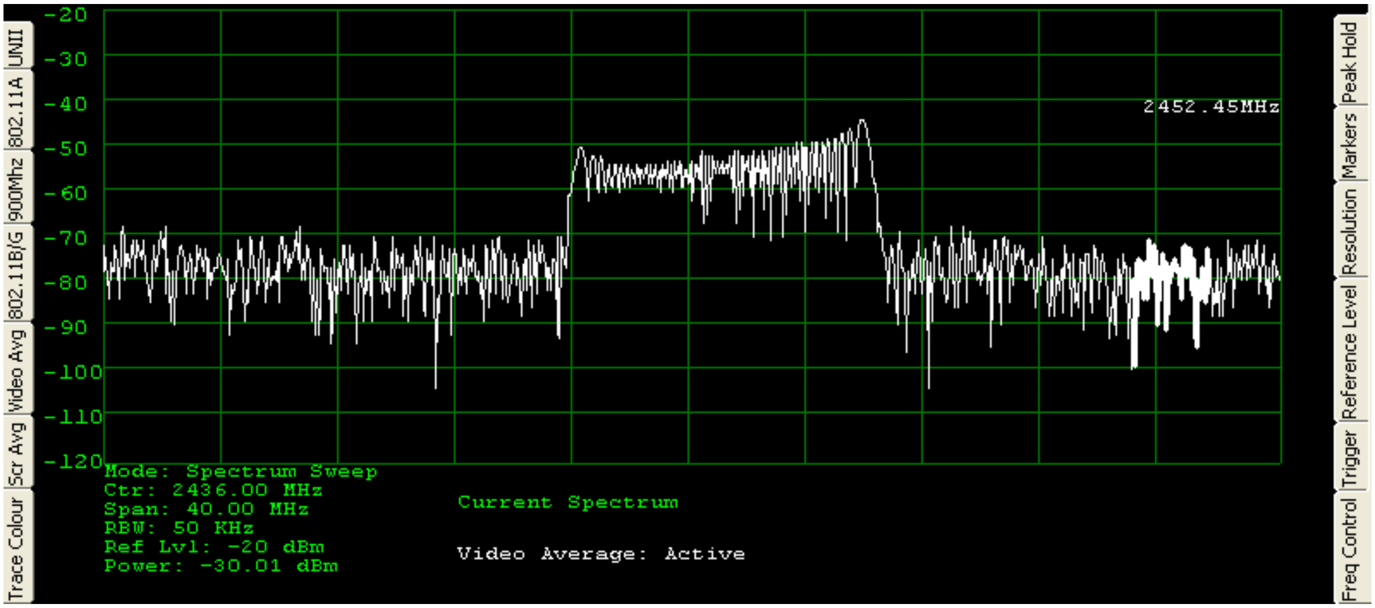


Fig 18.1: The White trace represents a waveform with no adjacent bin averaging

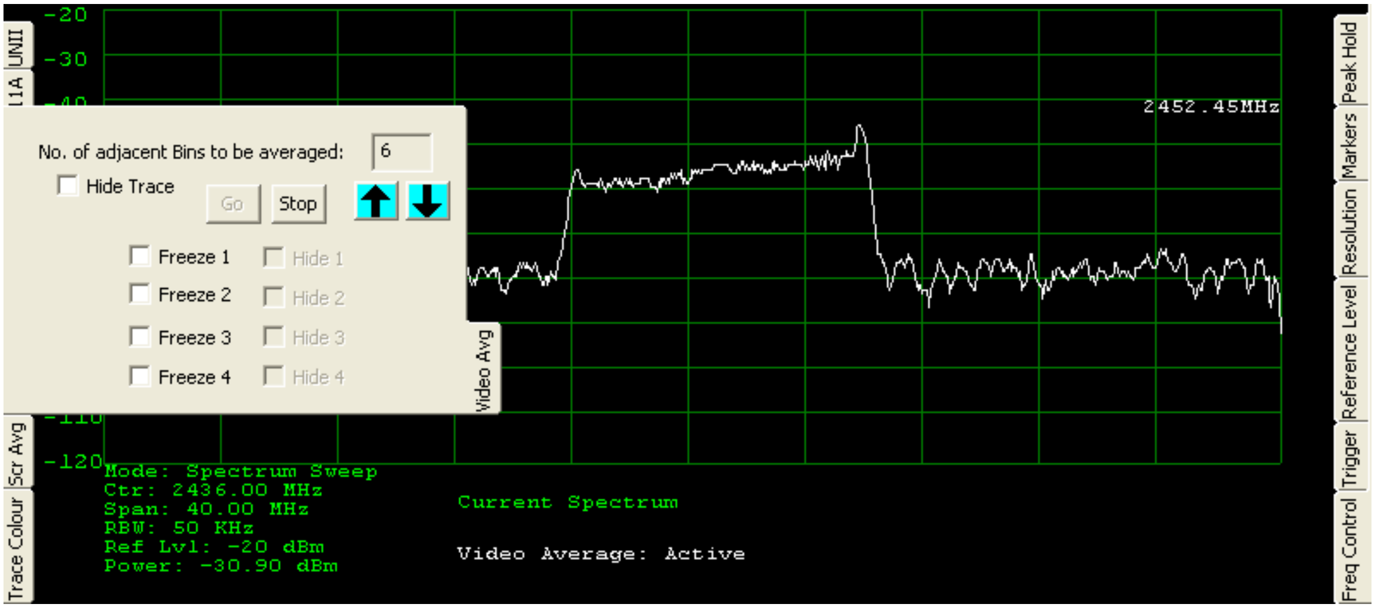
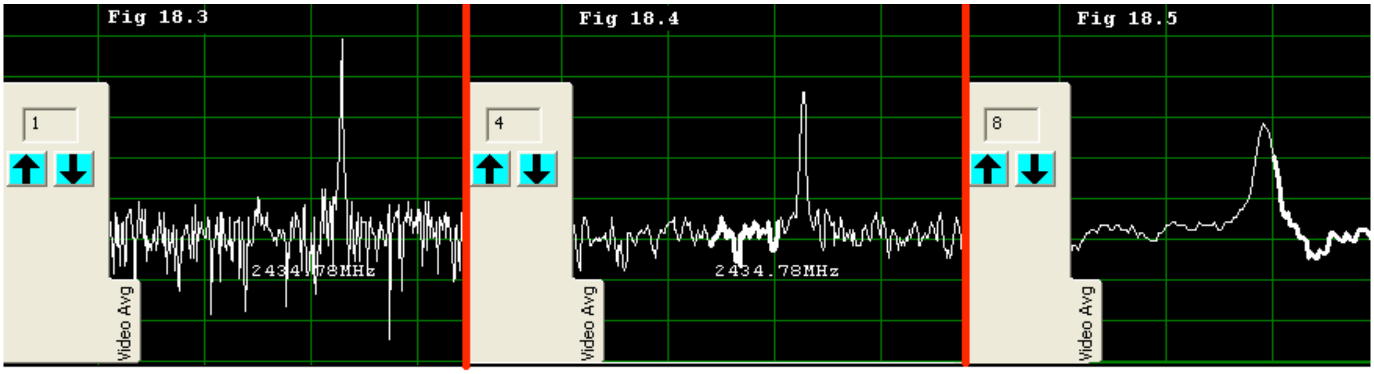


Fig 18.2: The White trace represents the average trace over 6 consecutive adjacent bins of the active trace.



The above figure demonstrates the use of Video Averaging. The **Fig 18.3** shows the waveform with no averaging; **Fig 18.4** shows a waveform with 4 adjacent bin averaged, while **Fig 18.5** shows a waveform with 8 adjacent bins averaged. It must be noted that lack of good judgment while using Video Averaging can cause a loss of information. This can be seen in **Fig 18.5** which seems to be "over-averaged". The **Fig 18.4** shows a good use of the video averaging feature with 4 adjacent bins being averaged. This not only eliminates the rapid noise fluctuations, but also retains the signal amplitude, which happens to be the information of interest.

3.9 Presets:

Presets allow the user to set the spectral parameters for channels of interest without manually setting all the parameters. Presets are a 'One Button Selection' for changing channels for various wireless standards. The figure below shows the Presets for the 802.11 B/BG standard. Check the desired channel.

IMPORTANT TIPS WHILE USING THE TRIGGER MODE:

The trigger mode will trigger when the power in a 20 MHz channel exceeds the set power threshold.

The presets can be very helpful in conjunction with the trigger mode.

- **Select a channel using the Preset tabs.**
- **Set the Reference Level and the Resolution Bandwidth.**
- **Set a threshold value to be within AT MOST 20 dB below the reference level.**
- **Start the trigger. The receiver will now trigger on the preset channel.**
- **Click "Stop Trigger" to stop the trigger.**

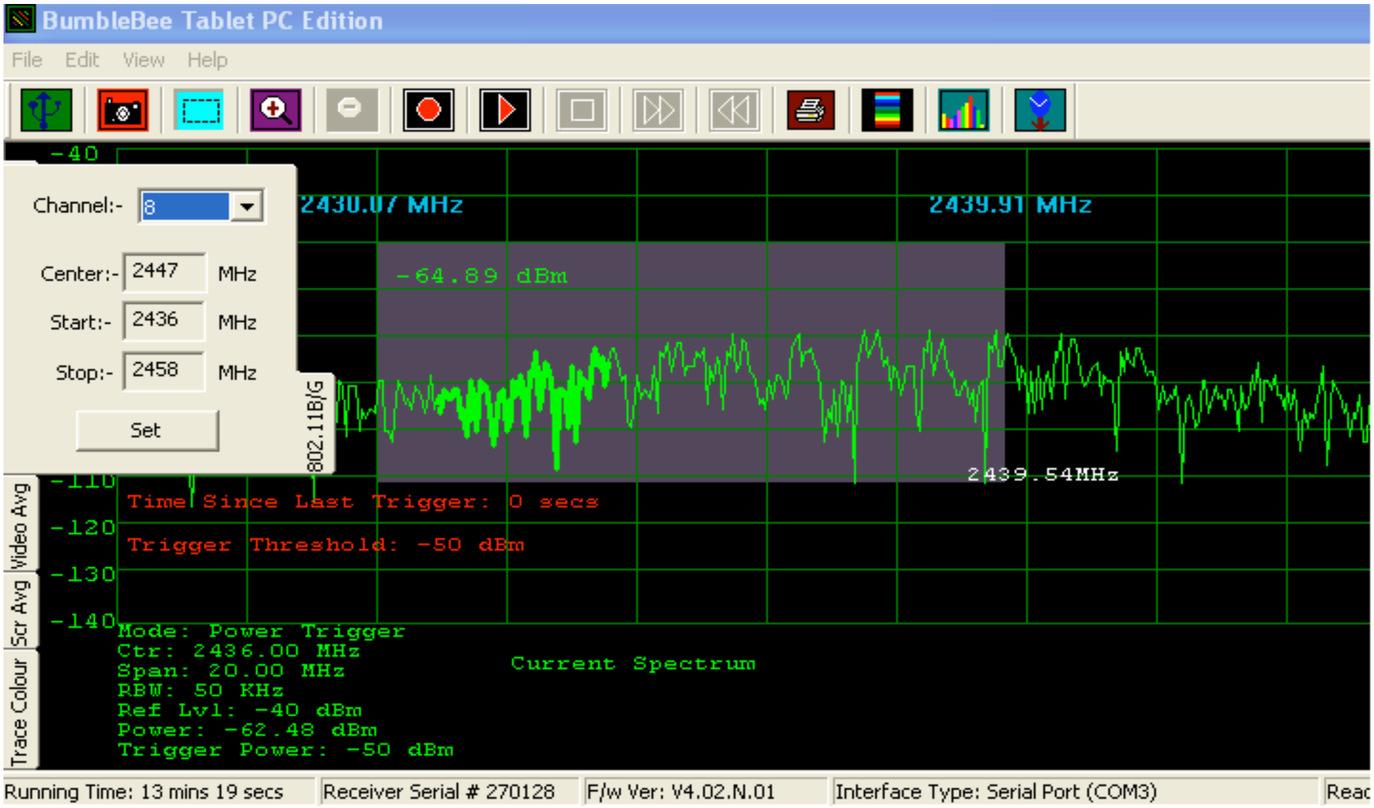


Fig 19: 802.11 B/G Channel Presets

4. Channel Power Measurements using the Nectar software

Measurement of channel power is an important application of the Nectar software and this can be done in **three** different ways.

4.1 Using Frequency Markers and Delta Markers:

By setting the Markers and Delta Markers as described in **4.4** on **page 11**, power will be calculated in the Spectrum between the marker and the delta marker.

4.2 Selecting a portion of the Spectrum Display:

By selecting a portion of the Display using the Selection tool as described on **page 10**, The spectral power within the selected region is calculated and displayed within the selection in the color corresponding to the trace whose power it represents. The measurement is only made on the live trace **(GREEN)**. Power for the Peak and Average Traces is not measured. Measurement stops if the selected region is cleared.

Examples of Channel Power Measurement Capabilities:

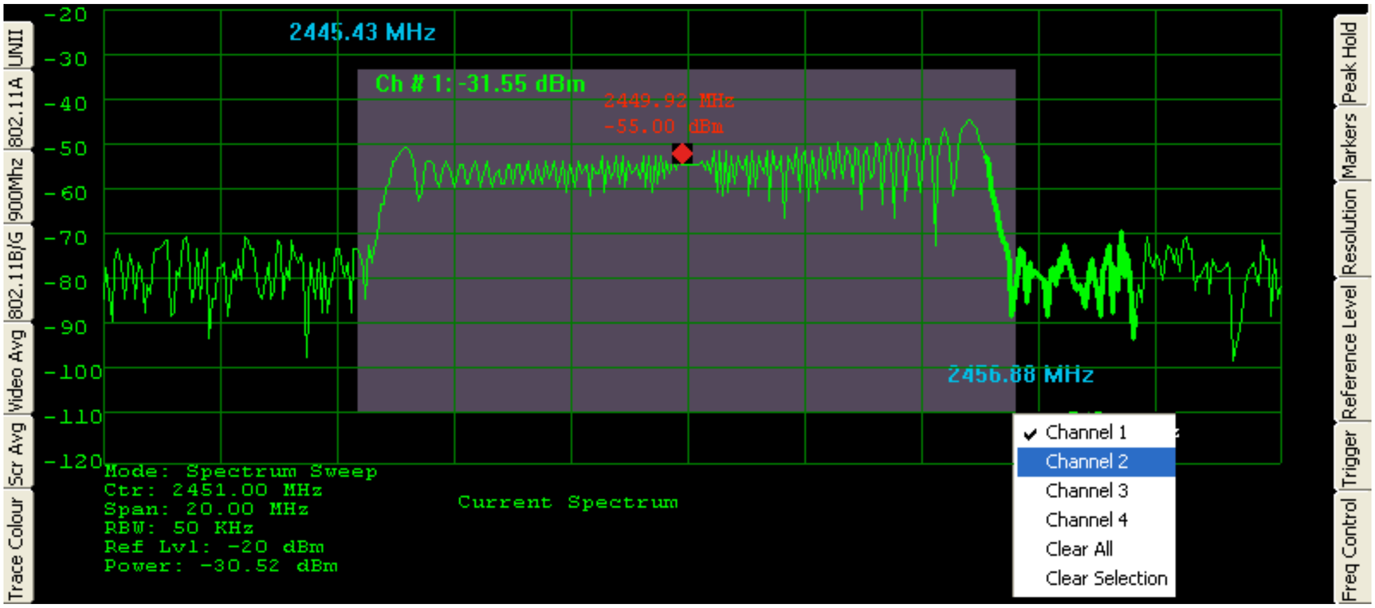
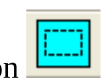
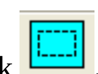
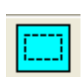


Fig 20.1: Wideband FM Signal centered at 2451 MHz with a power of –31.55 dBm

The Figure above shows a Wideband Frequency Modulated signal with a center frequency of 2451 MHz and a span of approximately 11 MHz. The Channel Power can be measured by clicking on  and then dragging the stylus across the spectrum. It should be noted that when you click , the button will change to . To assign a channel to the selected region, tap and hold the stylus on the screen for a couple of seconds. A pop-up menu will drop down and when you click “Channel 1”, for example, the selected region will be set to channel 1. This will ensure that if you tap the stylus on the display thereafter, the selected region for Channel 1 will not get disrupted until you again tap the stylus on the screen and check off “Channel 1” from the pop-up menu. To stop selections, click  which will then disable the selection tool and return the button to .

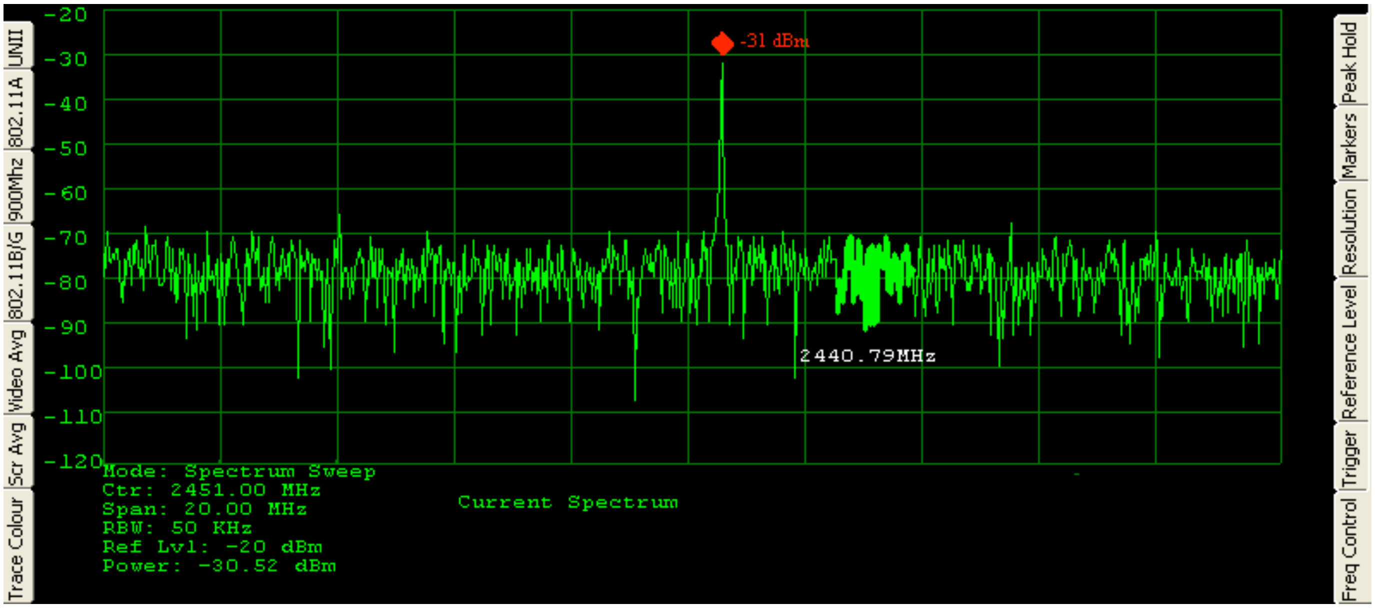
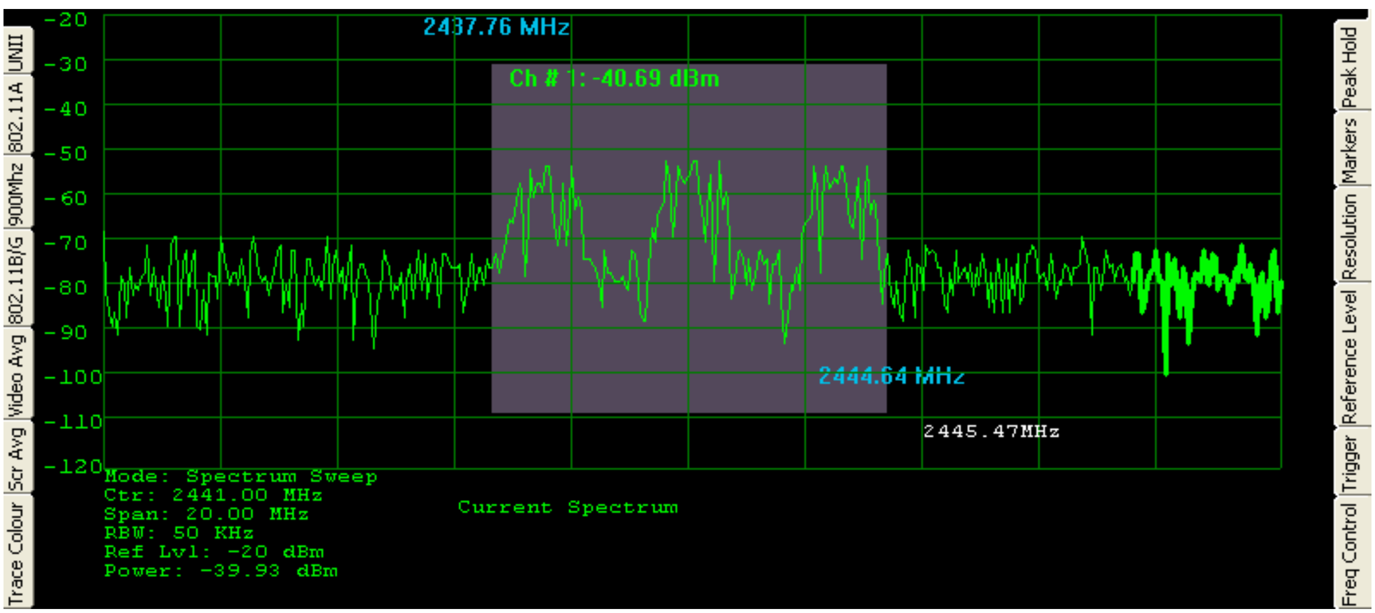


Fig 20.1: Narrowband unmodulated Signal with a peak power of –31 dBm.

Upon turning the Frequency Modulation off, it can be seen that the spectrum consists of a single peak at the center frequency of the previous Frequency Modulated signal. The Red Marker on the Peak indicates a Peak power of –31 dBm. This is in agreement to the principles of modulation that the power in the modulated signal is the same as the power in the unmodulated signal.

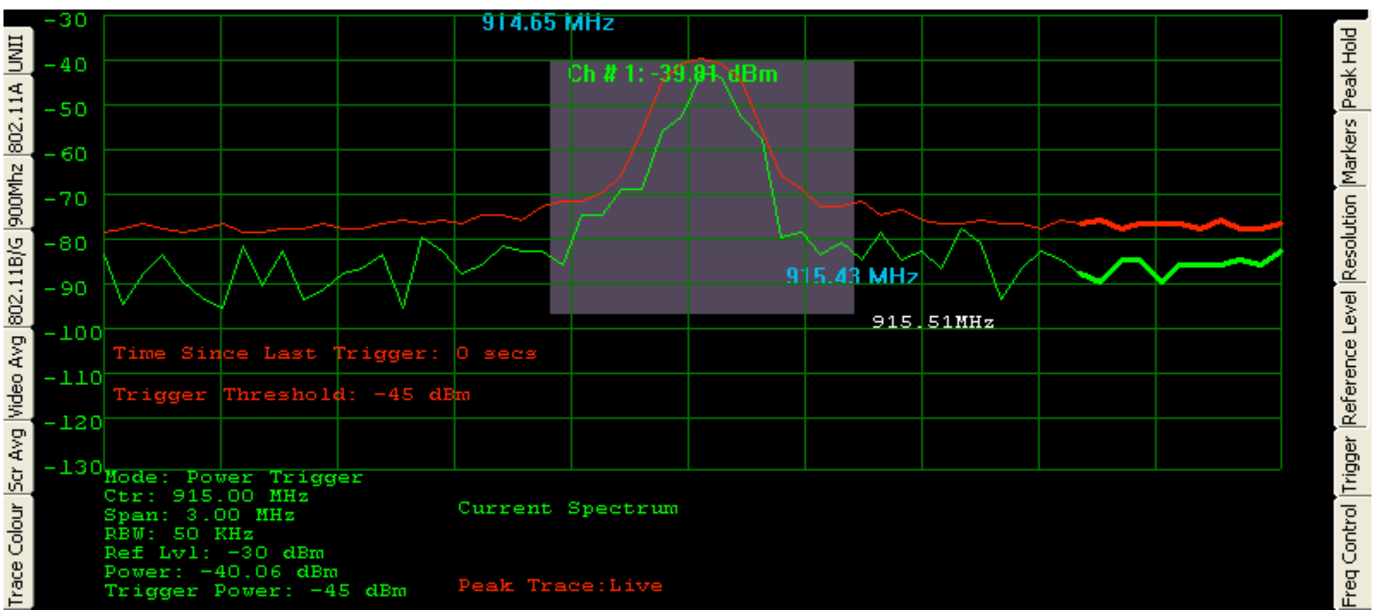


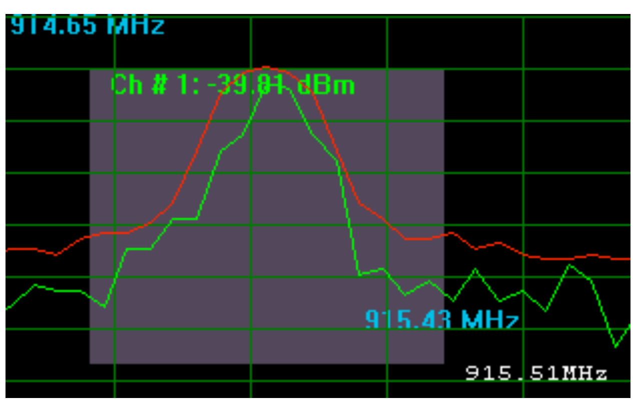
The Figure below shows the power measurement of a 3 channel, multicarrier CDMA waveform. For demonstration purposes, this is simulated using a CDMA signal source within the 2.4GHz frequency band. The signal generated has a total channel power of –40 dBm. The Nectar software accurately captures and measures this signal power as can be seen below.

Measurement of Power from a GSM Signal in the 900 MHz frequency band.

The Nectar software can accurately capture and measure power from a GMSK modulated GSM Signal in the 900 MHz band. A GSM Signal is narrow band signal (~ 200 KHz), the following procedure should be followed to capture and measure GSM Signals:

1. Set the span to a low value: about 2 – 3 MHz.
2. Center the frequency to the frequency of the desired channel.
3. Set the Resolution bandwidth to either 50KHz or 100 KHz.
4. After setting the Reference Level to a desirably suitable value, set the receiver to trigger on a certain power threshold.
5. Turn the Peak trace on. You will then gradually be able to see the spectral envelope of the GSM signal, which alternates between several narrow band signals in the 200 KHz bandwidth.
6. By clicking , drag the stylus across the Peak GSM Signal. Hold the stylus for a couple of seconds on the screen to be able to set the selected region to Channel 1.
7. The Signal power will then be displayed within the selected region.





4.3 Power Trigger Mode:

The Power Trigger Mode is a useful mode, in which, the receiver triggers only when the channel power exceeds a certain threshold, which is set by the user. If the user has set a value for the measurement delay, the receiver will take measurements only after that delay time. The device will trigger when the detected channel power exceeds the set power threshold. This mode is useful in detecting activity from non-continuous transmission sources such as Beacon packets from an AP or Frequency Hopping Spread Spectrum (FHSS) Packets from a Bluetooth device or any other Narrow band or CW signal.

Important Note: The trigger mode can be set only for a 20 MHz channel.

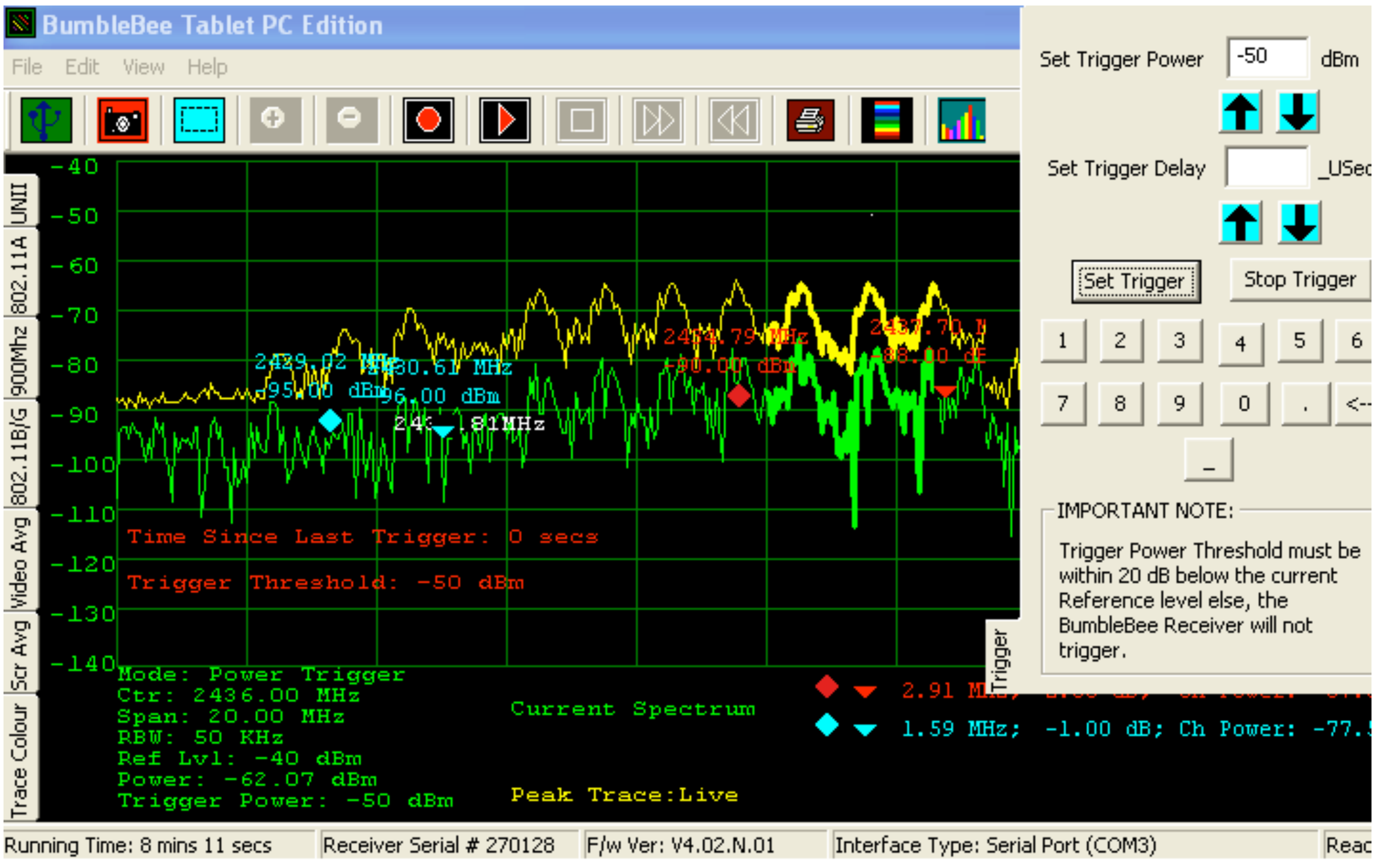


Fig 21: The Power Trigger Mode: A Direct Sequence Spread Spectrum Signal Possibly from an 802.11 B Access Point. The BumbleBee receiver has been set to trigger at –50 dBm with no delay in measurement.

5.1 Recording/Creating a Spectrum Log File for Future Playback:

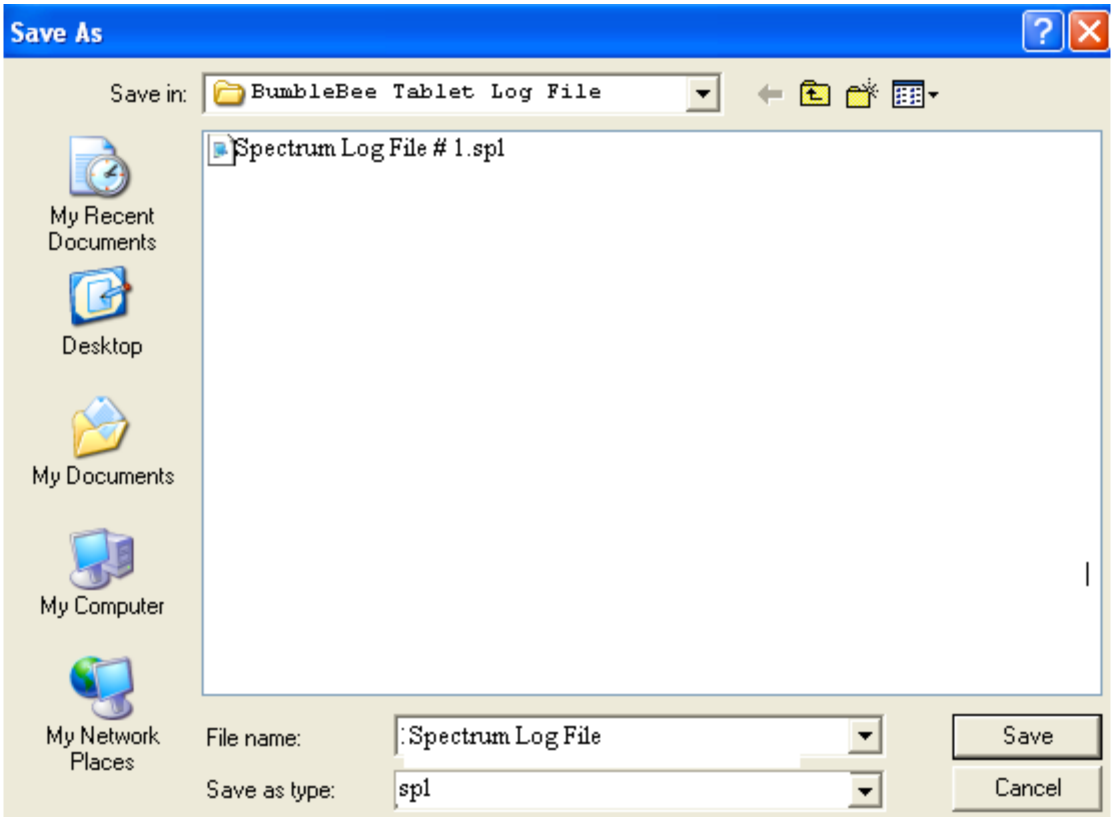
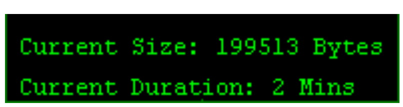


Fig 22: *Creating and Saving a Spectrum Log File.*

Once in the Spectrum Mode or the Trigger Spectrum Mode, the Spectrum being observed on the display can be logged in a Log File for future analysis. This is done by clicking the  **(Record)** button on the toolbar. Save the Log File at a desired location.

NOTE: *The log file will be created and stored with a **.spl** extension.*

Once logging begins, the Current Log File size (in Bytes) and the Current duration (in Minutes) of the file logged on the Display portion of the Spectrum are shown:



To stop the logging, simply click the  **(Stop)** Button. This does not stop the current spectrum display.

5.2 Replaying the Logged File:

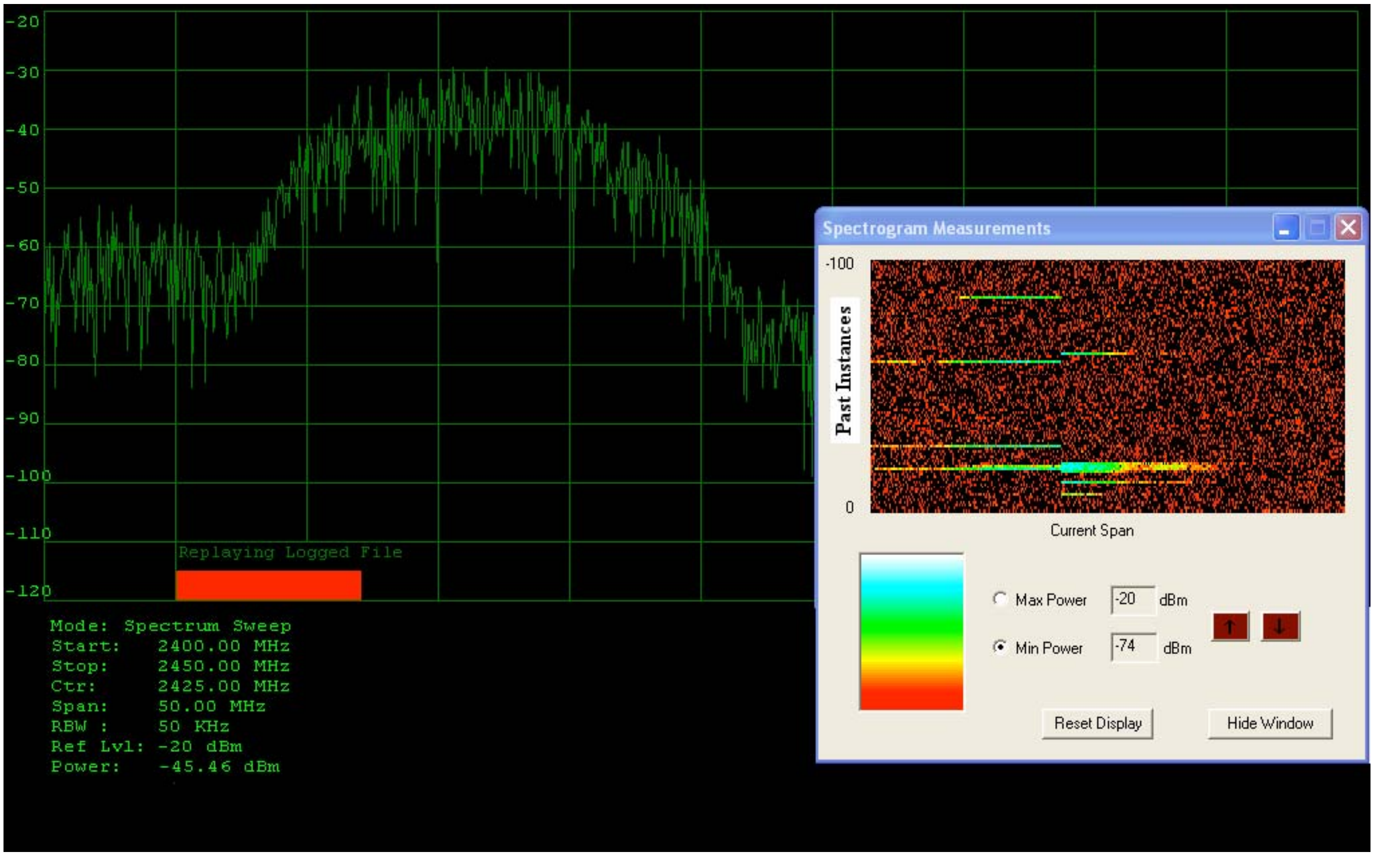
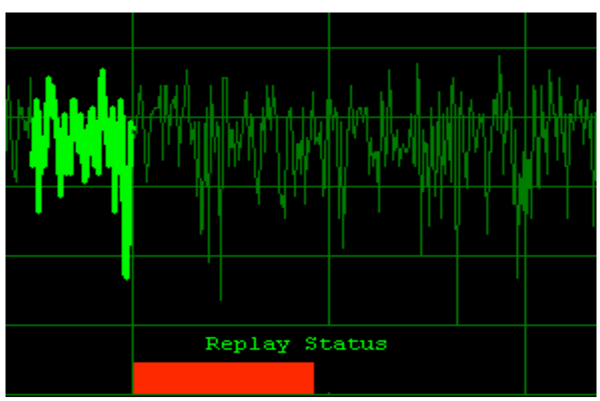
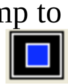


Fig 17: Replaying a previously Logged File.

A previously logged file (with extension **.spl)** can be replayed by clicking the  **(playback)** button. The replay begins and the replay progress can be seen as a **red** progress bar on the bottom left of the display as shown in the Fig 3.2 above and the figure below:



Using the  and  buttons, the playback can be "forwarded" or "rewound" respectively at higher speeds, so as to jump to points of interest within the logged spectrum display quicker. To stop the playback, click the  **(Stop)** button.

5.3 User-defined Presets:

A particular spectral context of interest can be saved in a file at the click of the above tool-bar button for future access. This provides for user-defined presets for quck-access in situations when certain spectral settings need to be changed frequently. Upon clicking the Save Context button  the software displays the current spectrum analyzer settings which can be saved in a file:

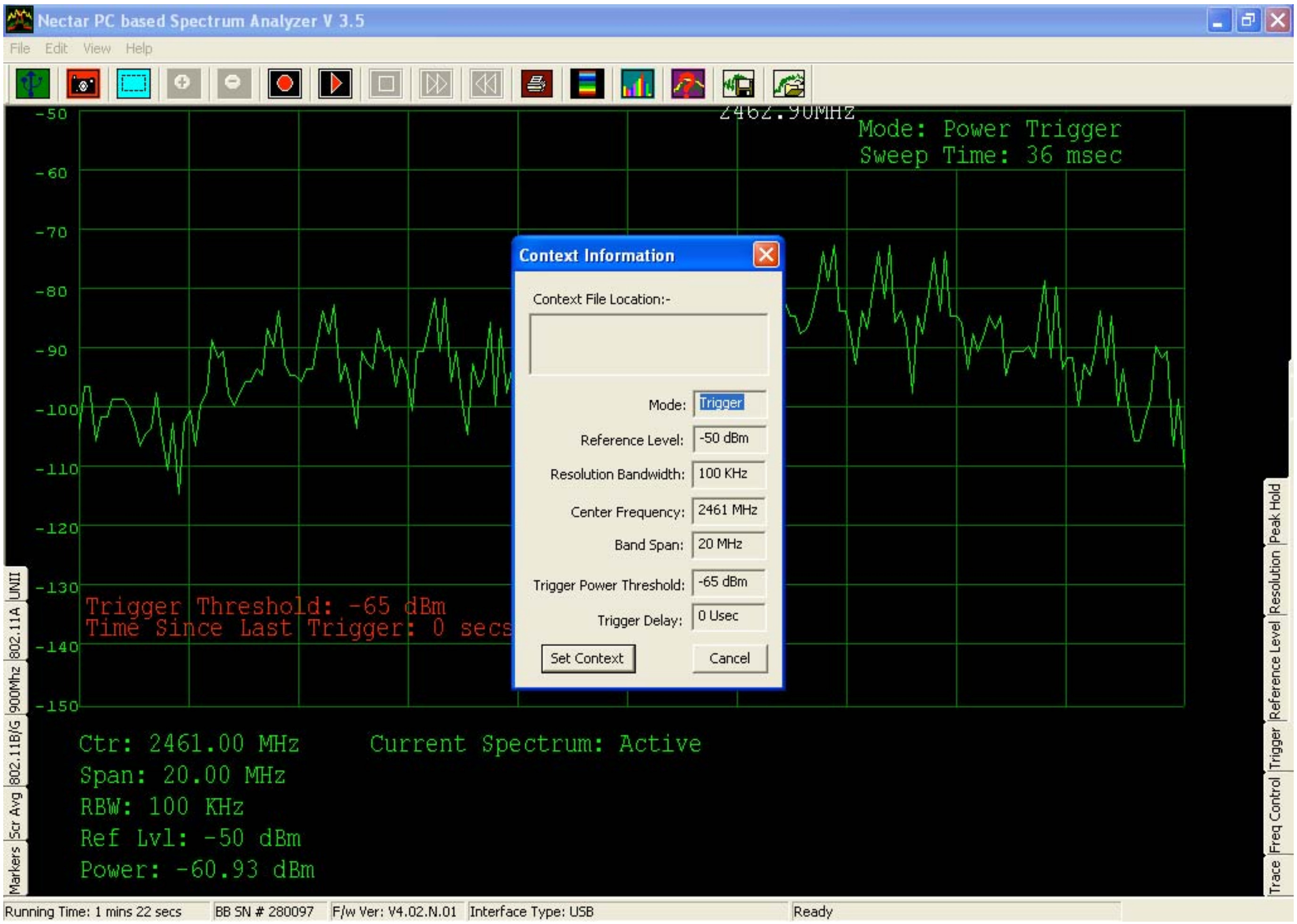


Fig 18: Create a user-defined preset by saving a Spectrum Context to a file.

Upon clicking the "Set Context" button on the settings display dialog, the settings can be saved to a file at a desired location. This saved context file can later be invoked by clicking the  button on the toolbar to set the BumbleBee spectrum analyzer to operate in that context. This way, the user can store frequently visited contexts and later revisit them conveniently without having to change the settings often.