Using SpectraVue with SDR-IQ RF hardware for potential frequency selection.

SDR-IQ is a software controlled radio scanner that offers a broad range of spectrum analyzer and demodulation capabilities (will not work for 42MHz systems). The scanner can detect frequencies from 100 Hz - 30 MHz.
SpectraVue is a Windows based program that collects digitized signal data from the SDR-IQ and displays the frequency domain spectrum on the PC screen. Other SDR-IQ features are included in the appendix.

Computer System Requirements:

- PC with 1GHz Pentium processor or higher.
- 128 MB RAM minimum. (the more memory the better).
- Fast graphics card. (Faster the better).
- Windows XP or Windows 2K required.
- PC with USB 2.0 port. SDR-IQ is USB powered. No external power supply required. Runs from the USB power from your computer. (Desktop or laptop).
- The software will run on Windows OS on a MAC PC, with Bootcamp or Parallels or VMWare Fusion, but performance might be degraded or might experience system crashes, so running directly on Windows PC is advisable.

Hardware Requirements:

- SDR-IQ radio receiver.
- Antenna.(in this case a wire with BNC adapter provided by Codar).
- Installation CD for SpectraVue that comes with SDR-IQ (provided by Codar).

In order to assist you with frequency selection, please collect and send the following data to Codar:

- When you have completed your "frequency use" survey, please send us all of your data (.csv files) on a CD/DVD, flash(USB) drive or external hard-drive or arrange for it to be transferred to us via the Internet.
- The data you need to send is described in Step 3.6 of Section 3 (also see Figures 13 and 14). These files will each be 60 seconds(1 minute) in length.
- Your saved configuration file that contains all the settings you have used. This is the .ini file that you will save at the end of step 10 in Section 2 of this document.

This document is divided into three sections: Section 1 covers steps for installing SpectraVue software on a Windows PC. Section 2 covers the hardware configuration of the SDR-IQ scanner with the PC. Section 3 covers configuring the parameters of the SpectraVue Software, required for collecting valid data.

Section 1: Installing SpectraVue software on a Windows PC.

Here is a list of instructions to get started using the SDR-IQ and SpectraVue software. ***Please install the SpectraVue software first*** before connecting the SDR-IQ.

1.1 Run SETUP.EXE from the installation CD. The window as in Fig 1 on the next page will pop up.

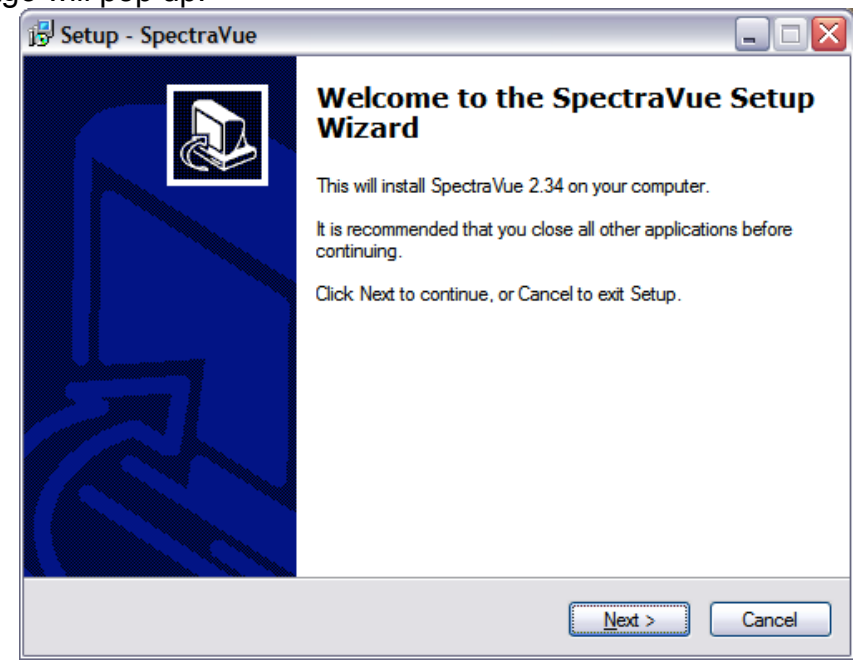

Fig 1: Setup Wizard

1.2 Continue by clicking next. Accept the License Agreement as in Fig 2.

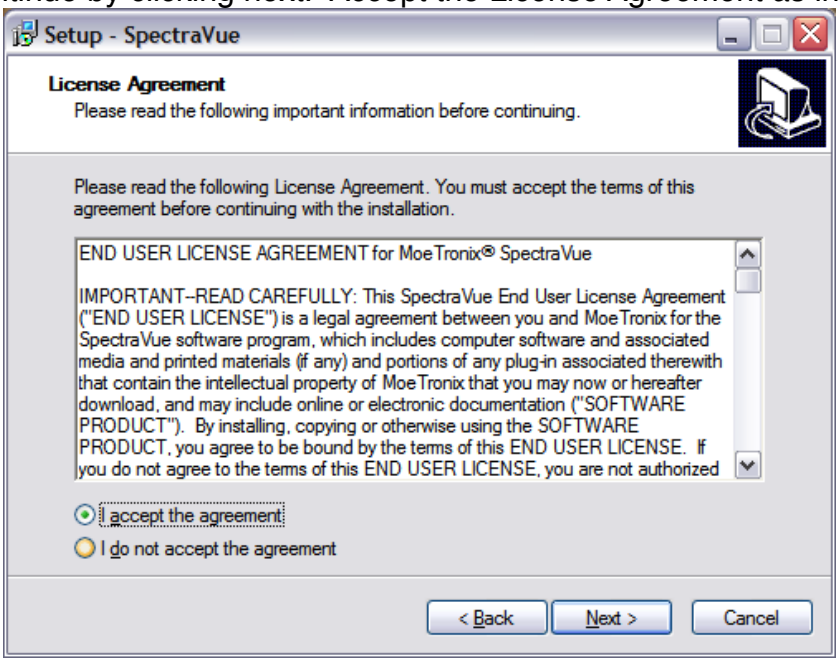

Fig 2: License Agreement

1.3 Continue by clicking next. Select the installation directory and click next.

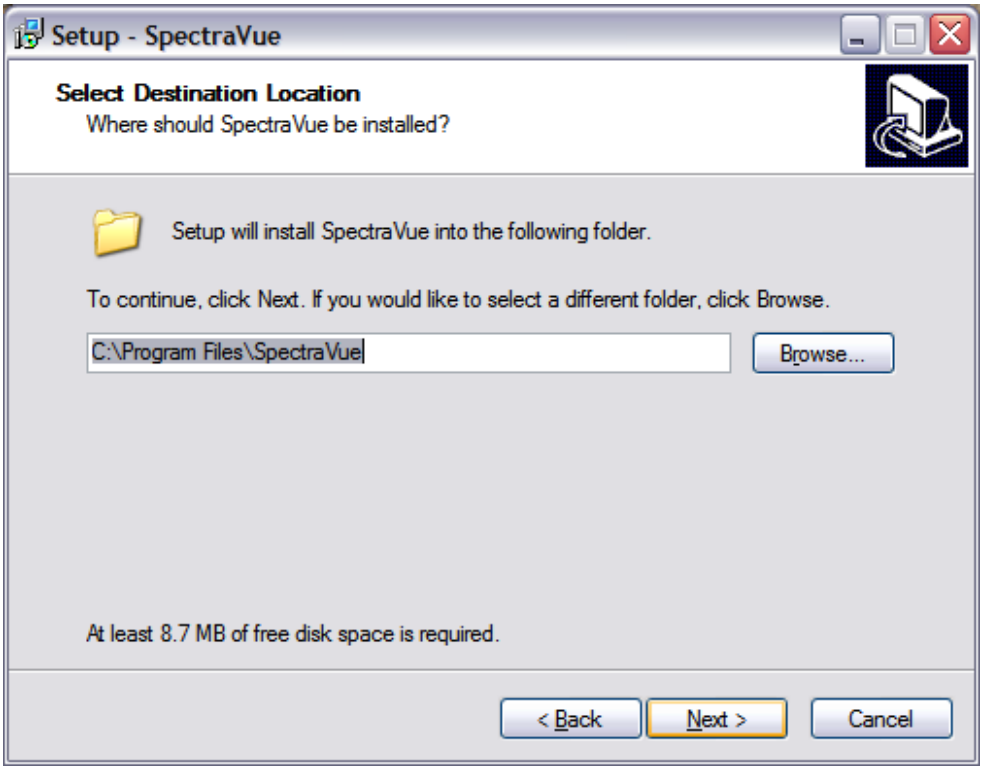

Fig 3: Select the installation directory.

1.4 Create the program shortcut in the Start Menu folder as in Fig 4.

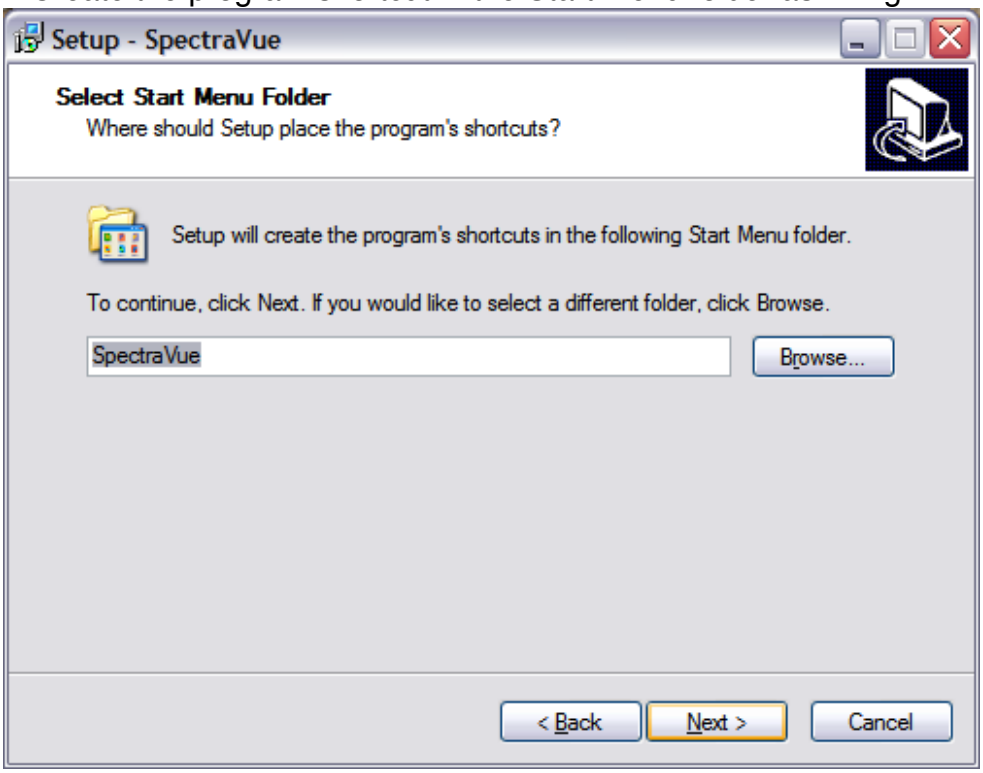

Fig 4: Program Shortcut

1.5 If you would like a desktop icon, select “Create a desktop icon” and click NEXT.

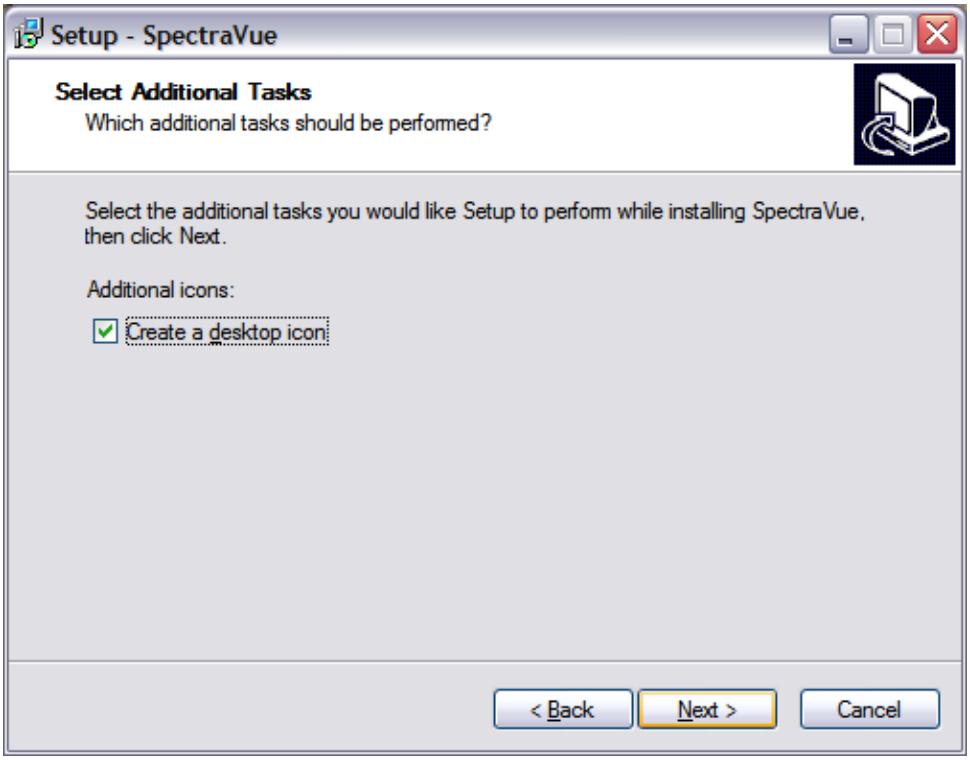

Fig 5: Create a desktop icon

1.6 Click “Install” to install the software as shown in Fig 6.

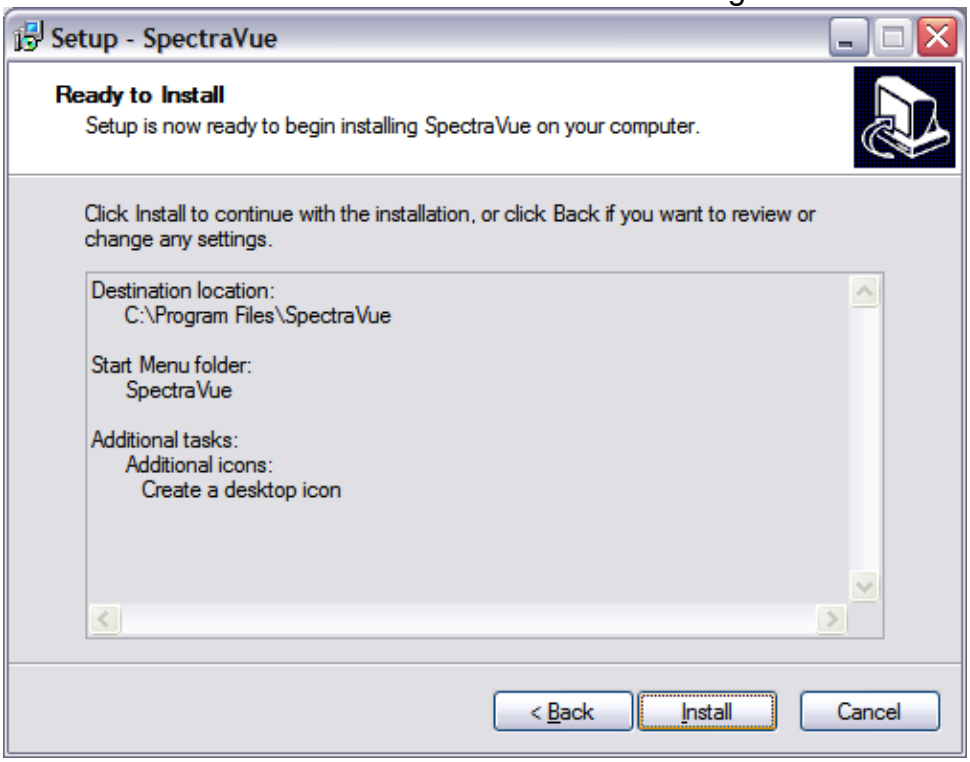

Fig 6: Install the software.

1.7 Click “Finish” to exit the setup as in Fig 7.

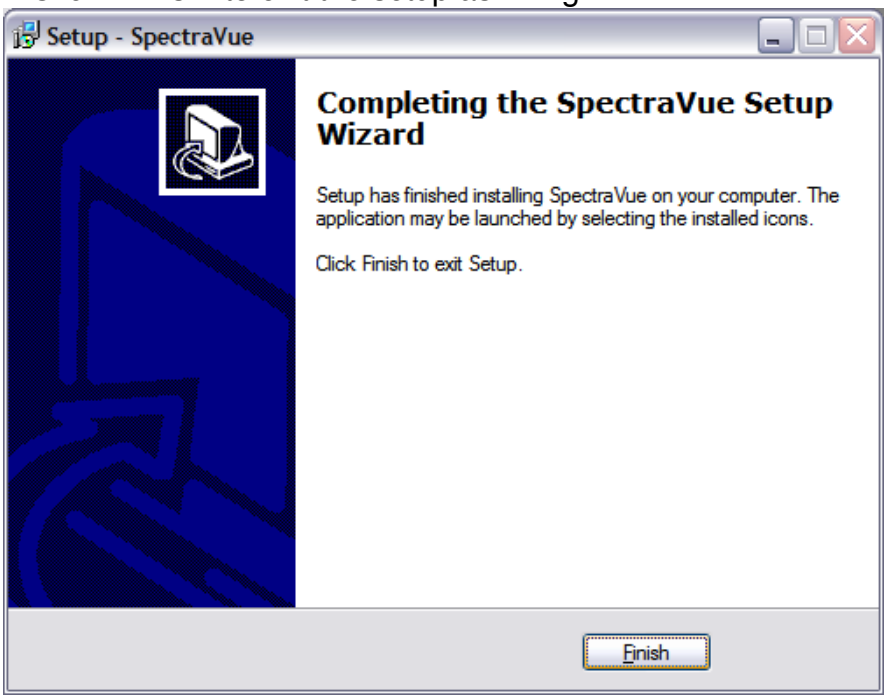

Fig 7: Finish and exit Setup.

At this point, SpectraVue should be installed under **/ProgramFiles/SpectraVue.** Along with this, the required USB drivers will also be installed under the folder **“/ProgramFiles/SpectraVue/SDRIQUSBdriver.”**

Section 2: Hardware Configuration

2.8 Connect the mini-USB end of the USB cable to the mini USB port at the back of SDR-IQ as shown in Fig 8 below. Also connect the BNC adapter of the antenna wire to the BNC antenna connector as in Fig 8.

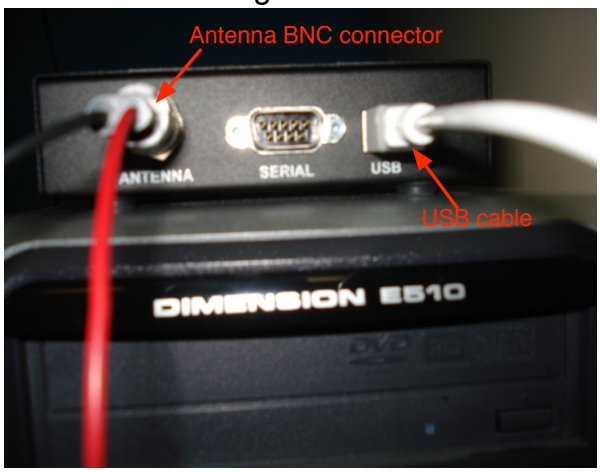

Fig 8. Connect USB and antenna cables to SDR-IQ.

2.9 Connect the other end of the USB cable to computer’s USB port.

Windows will detect the SDR-IQ unit and will request the driver. Please point the window to the location where the SDR-IQ USB DRIVER is located. **(/Program Files/ SpectraVue/SDRIQUSBdriver/)**. If Windows complains about not having passed "Windows Logo Testing", don't worry. SpectraVue doesn't use the Windows logo.

Attach the other end of the antenna wire to a point outside the building, so that the scanner can get clear reception of the signals, else you will get very weak or no signals at all inside buildings. The antenna wire sent to you by Codar should be long enough for this purpose and **will be similar but not exactly like the picture shown in Fig. 8 above.**

2.10 If the USB driver is recognized properly, then the green power LED on the SDR-IQ will glow as in Fig. 9. The yellow communication LED will start blinking very slowly indicating that SDR-IQ is in idle mode. Also, when you initially plug in the SRD-IQ you may hear a clicking noise and the red LED may also turn on a couple of times as in Fig 9. Do not worry as the red LED will turn off and the clicking noise will stop after couple of seconds.

2.11 Now launch SpectraVue program on your computer.

If all the previous steps are completed successfully, the program should now say **"Idle" in the lower right hand window as in Fig.10** on next page. This is an indication that the SDR-IQ has been detected and is now in idle mode. Some computers require the SDR-IQ to be disconnected and reconnected once, after the initial installation of the driver.

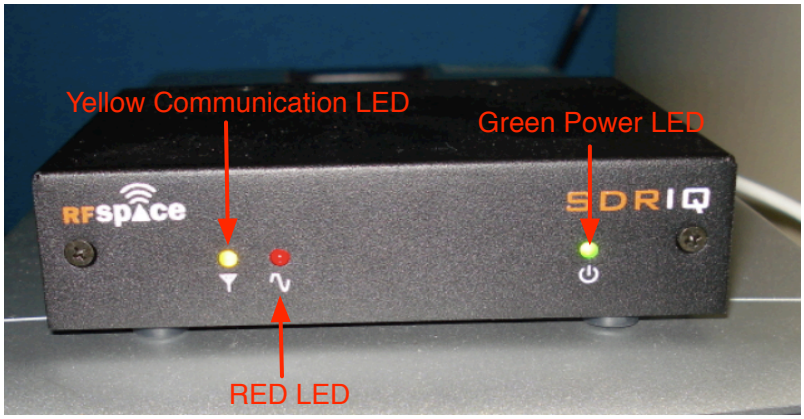

Fig 9: LED indicators on the SDR-IQ

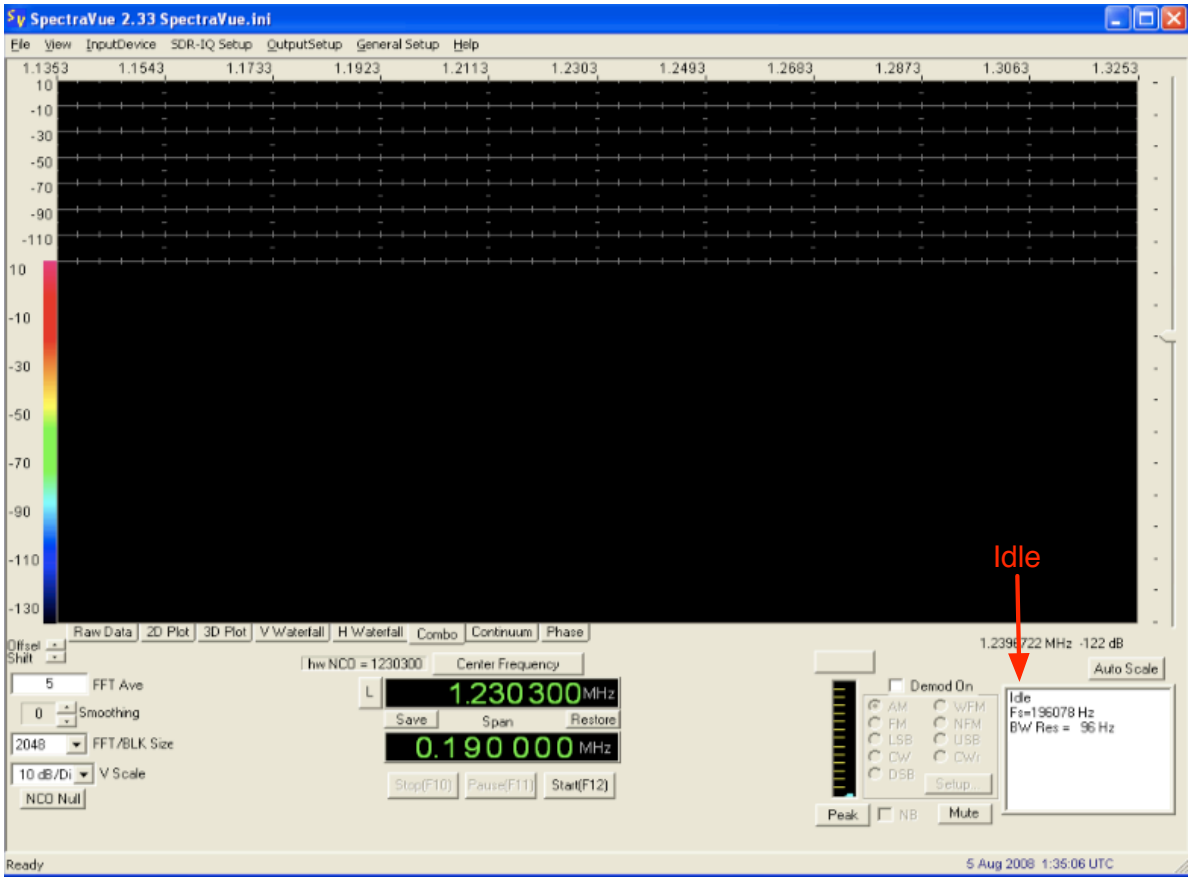

Fig 10. Idle mode

1.12. The lower right hand window will always show the status of the SDR-IQ. It sometimes reads "Loading 6620" This means that the filter settings have changed and the new settings are being sent to the receiver.

The SDR-IQ setup is now complete and you are ready to use it with the SpectraVue program.

The next step is to set up SpectraVue's parameters as described below.

Section 3: Configuring SpectraVue's parameters.

SpectraVue saves its default setup parameters in a setup file called **SpectraVue.ini.** This setup file is loaded whenever you launch the SpectraVue program. You can also save different sets of setup parameters in different setup files using different names and then load the desired setup file.
The default setup file is stored under **/ProgramFiles/SpectraVue/SpectraVue.ini.**

3.1. When you launch SpectraVue for first time, you will see the window as in Fig. 11.

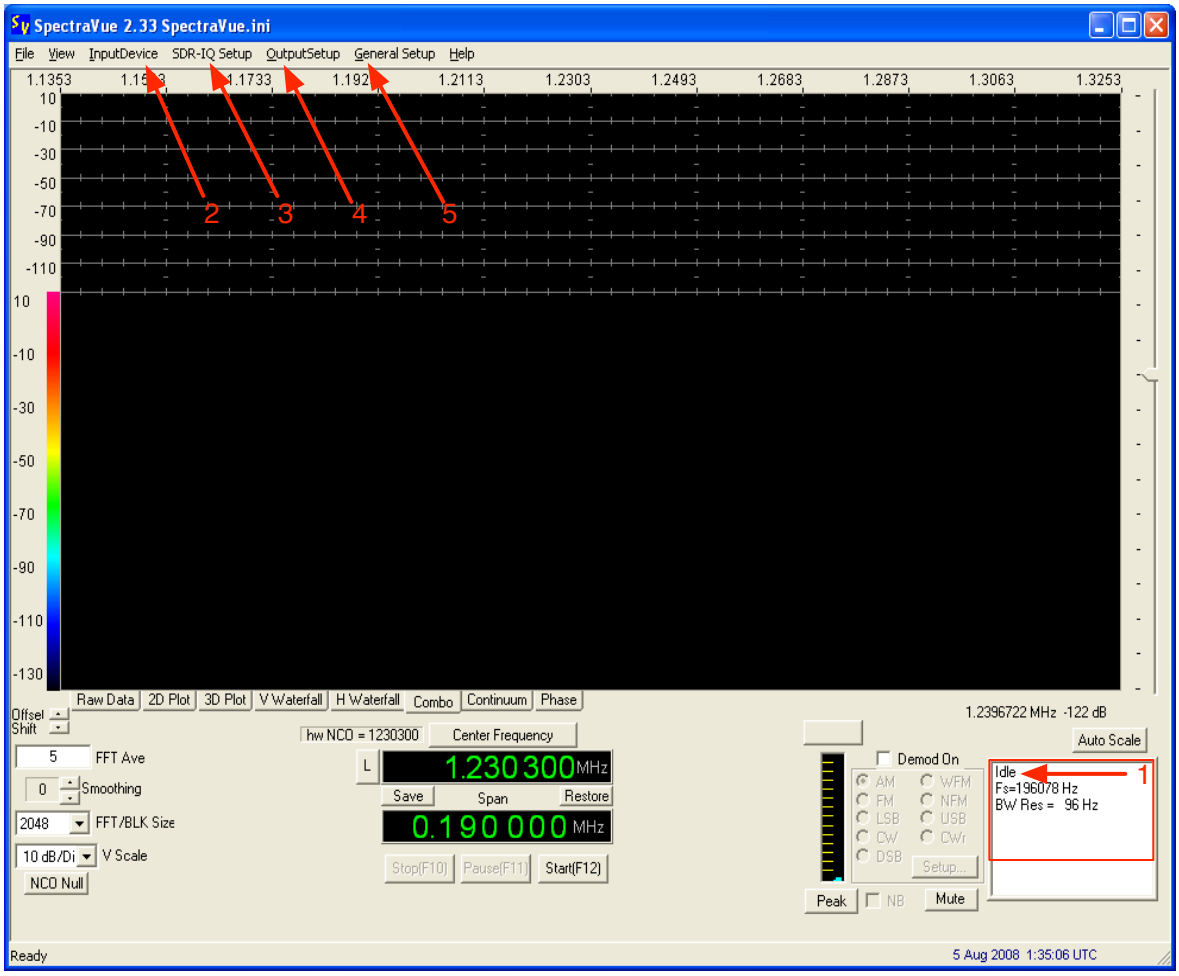

Fig 11: SpectraVue Setup

3.2. Initially, SDR-IQ will be in idle mode as shown by arrow 1 in Fig 11.

3.3. The arrows in Fig 11 above, point to different setup menus that you will need to configure before using SpectraVue to collect data.

3.4. Select the input device as SDR-IQ under “InputDevice” menu as shown by arrow 2.

3.5. Select the “SDR-IQ setup” menu shown by **arrow 3**. The window as shown in Fig 12 on the next page will pop up. Make sure your settings match the same as shown in Fig 12. Most of the settings are default and you may not need to change anything The most important thing is to make sure that the filter bandwidth is set to 190 KHz. This is the maximum bandwidth that can be used with SDR-IQ. A bandwidth of 190 KHz may not work with computers with slow processor/slow graphics card. If you have problems with this setting or if the red indicator light turns on, on the SDR-IQ scanner then you should change your bandwidth to the next smaller value of 150 KHz.

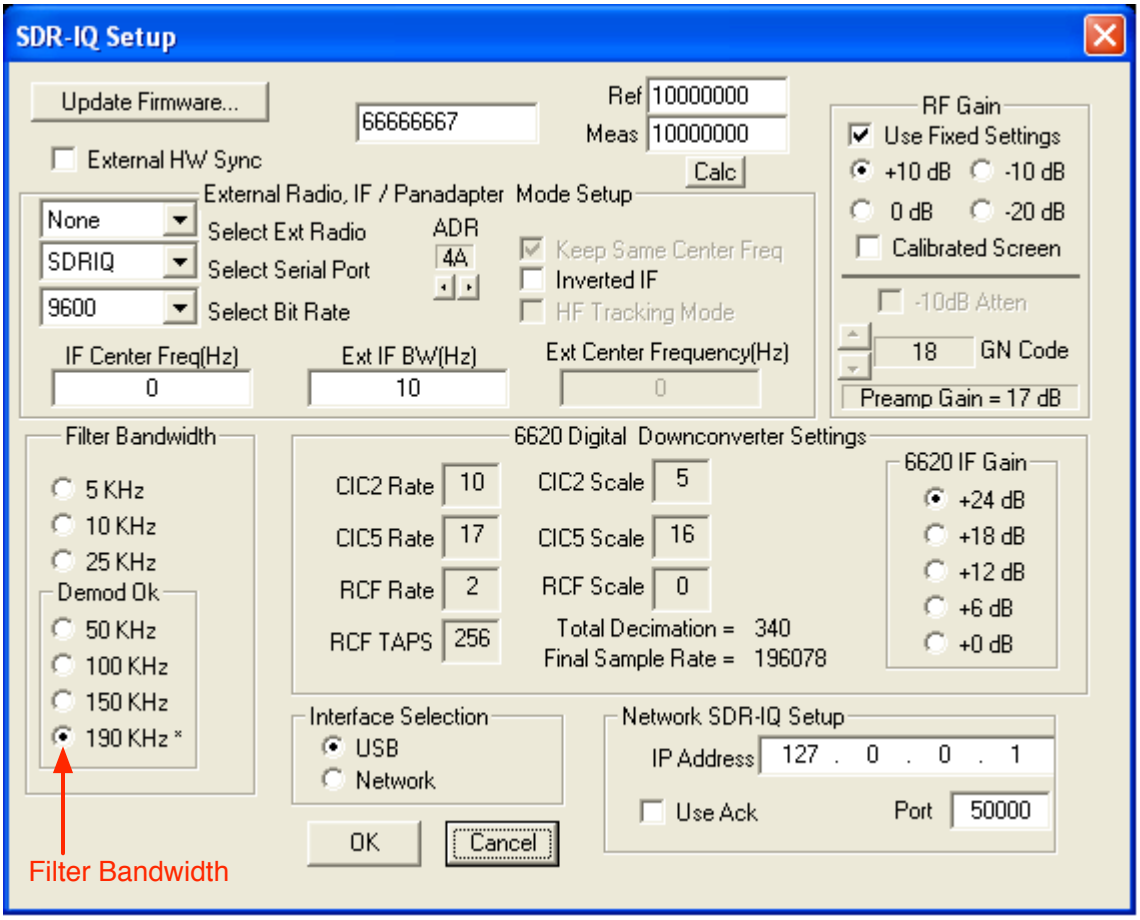

Fig 12: SDR-IQ Setup

3.6. Select the “Output setup” menu shown by **arrow 4** in Fig 11. The window as shown in Fig. 13 on the next page will pop up. SpectraVue allows you to save different types of output formats like Wave File capture, Screen Capture images of the main window, waterfall FFT data and FFT Data as CSV Excel Format file.
All options except for the FFT data in CSV format, can result in large file sizes, which might fill up the hard-disk quickly.
Our goal is to capture as much data as we can, so the best option is to select FFT Data as CSV Excel Format File as shown in Fig 13 by arrow A.

- Enter 60 seconds in the box labelled “Timed Saves” as shown by **arrow B** in Fig. 13. This creates CSV files every 60 seconds(1 minute).
- Next, select the “Timestamped Files” option as shown by **arrow C**. This will save the FFT files with time stamps.
- Next, Click “Select Out File” button. This allows you to point to the location where you want to save the FFT data file and you can name the file as shown by **arrow D.**
- With these settings, SpectraVue will save the FFT data files with a time stamp in the desired location as shown in Fig 14 below.

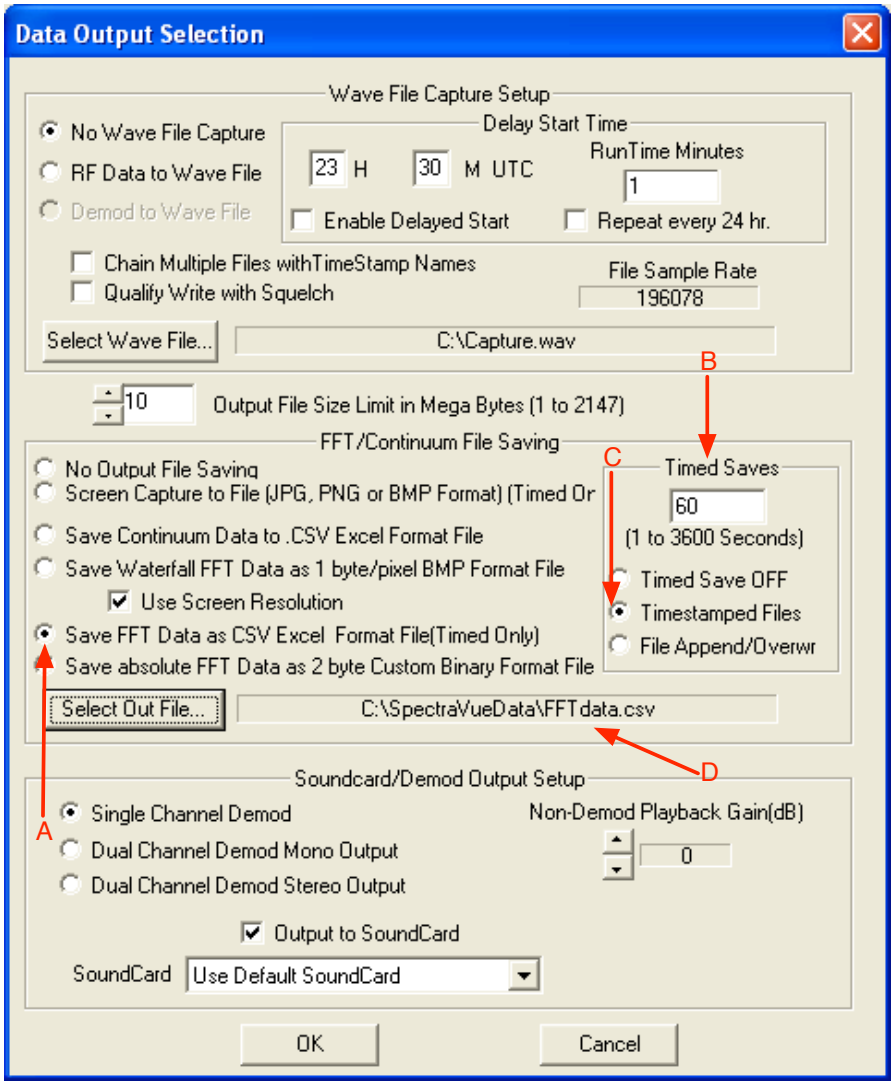

Fig 13: Output Setup

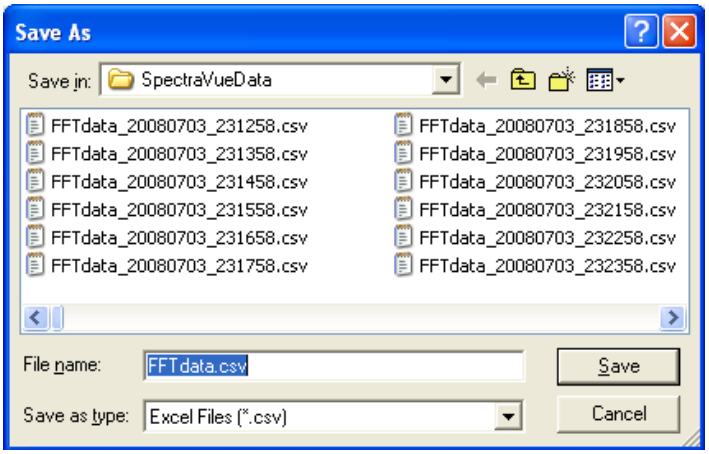

Fig 14: Save File

3.7. Select the “General Setup” menu shown by **arrow 5** as in Fig. 11. A window as shown in Fig. 15 below will pop up. Make sure that your settings match Fig 15.

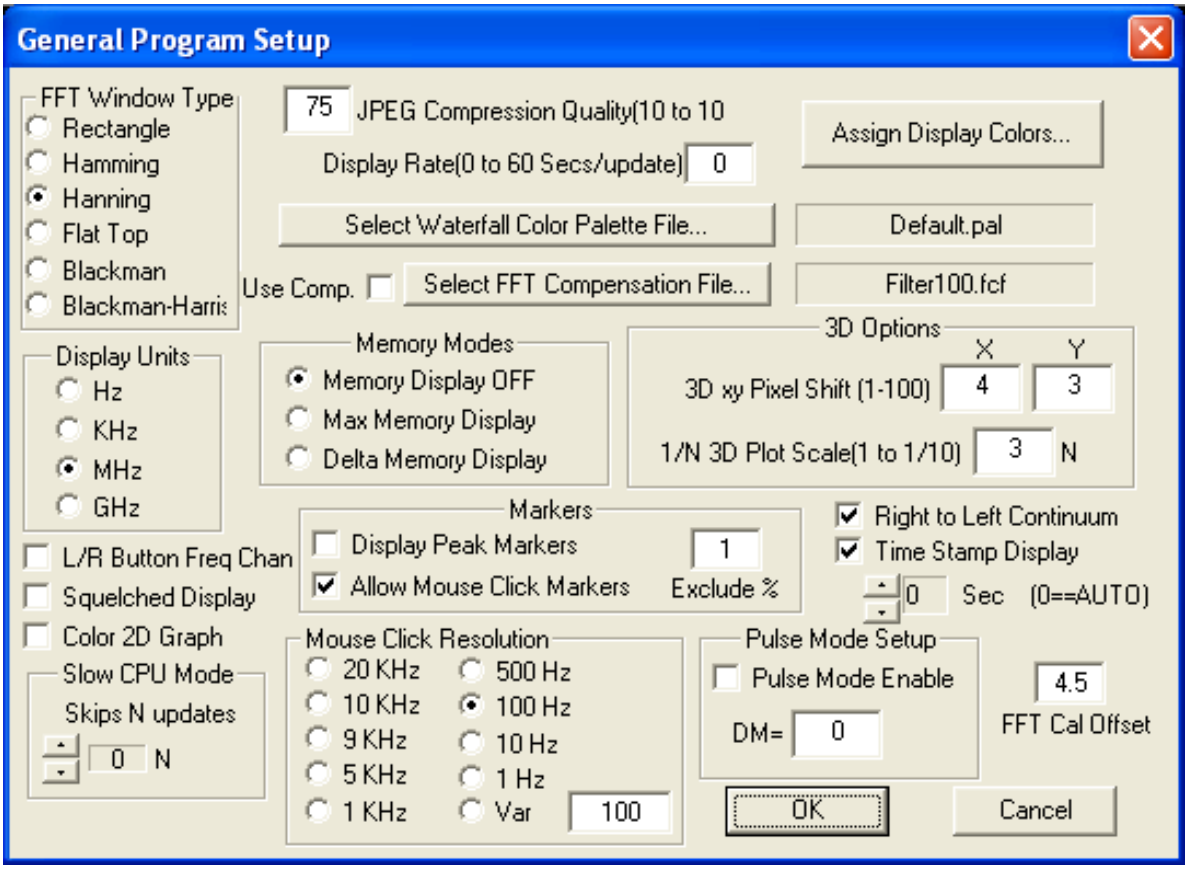

Fig 15: General Program Setup

3.8. The main display window contains a tabbed view screen where the user can click on a desired display mode tab. There are seven different view screens that can be selected as shown in Fig 16 and in Fig 17(entire display window) by **arrow D.**

Fig 16: Different View options

- Next, select the button “Combo” to display both the vertical waterfall and 2D Plot, as shown by **arrow 1 in Fig 17** on next page.
- The 2D Plot display shows the spectrum amplitude versus frequency plot of the incoming signal. This is shown by **red box** in Fig 17.
- Amplitude in dB referenced to full scale is displayed on the left side of the display and frequency along the top.
- The center frequency and frequency span are set by the two main controls just below the FFT display area. The slider control on the right can be used to shift the amplitude display up or down.
- The vertical waterfall FFT display shows the spectrum amplitude as a color instead of as a height on the display. Frequency is the horizontal axis and time is the vertical axis. This is shown by the **yellow box** in Fig 17. Figure 17 shows blank displays, an example of real time data is shown in Fig 19 in the following pages.

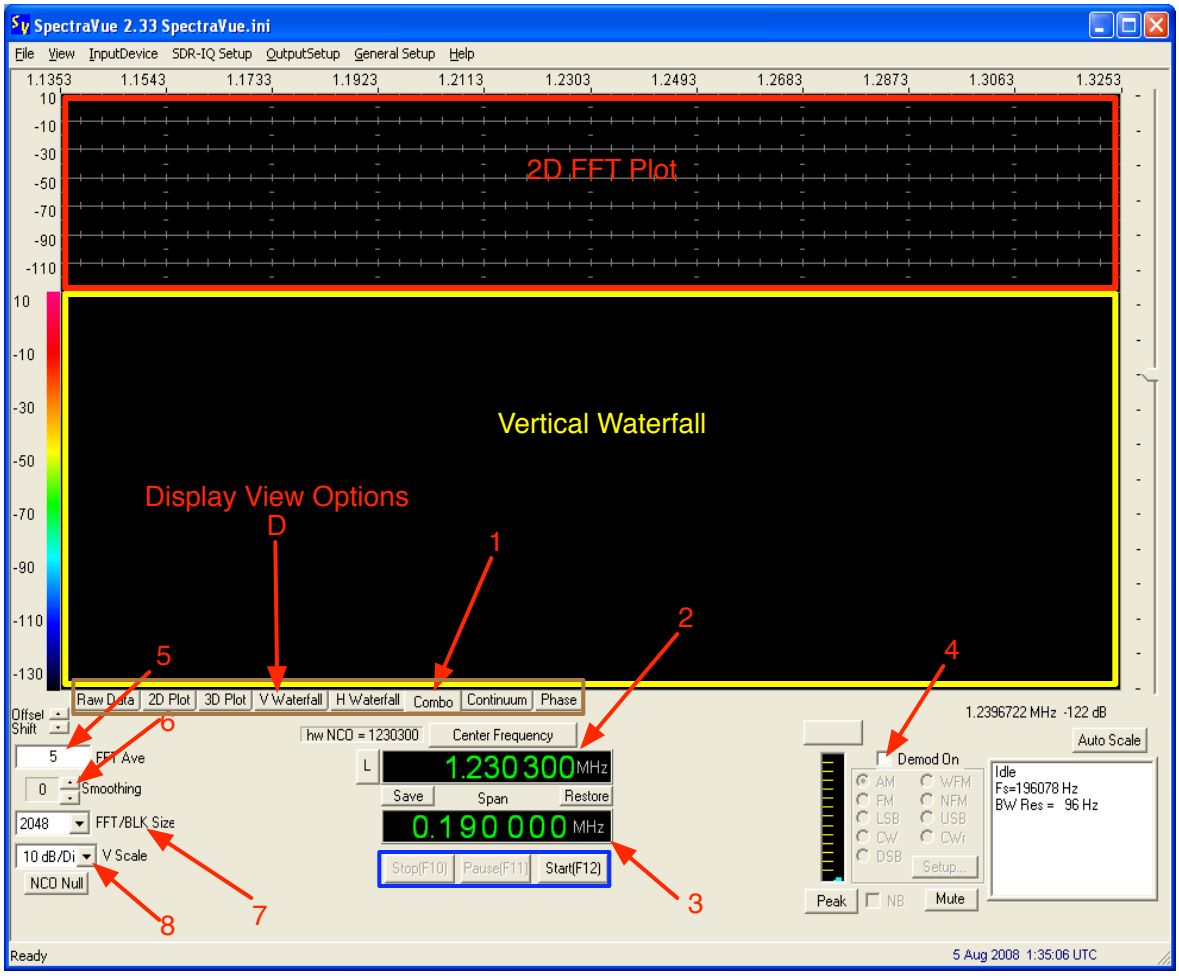

Fig 17: Display and FFT controls.

3.9. **Frequency and FFT Controls.**

- At the bottom of the window, you will see different controls where Center frequency(CF), frequency span and other FFT settings can be changed.
- The center frequency can be changed in the box shown by **arrow 2 in Fig 17** above by using any of the several ways to edit center frequencies, as described in next step.
- Place the mouse cursor on the digit you wish to change or press one of the arrow keys. The digit background will change color as in Fig 18. Use the mouse or left or right arrow keys to change digit positions within the control.

Fig 18: Center Frequency Control

- You can also use the mouse scroll wheel to increment/decrement the digit value.
- Use Left and Right mouse buttons to increment/decrement digit. (This mode was selected in “General Setup” Menu in Fig 15 in step 3.7 above.

- You can also select the Center Frequency, by clicking on the desired location in the 2D plot.
- There are other options available but the settings described here will work best for our purpose.
- Similarly the “Span Frequency” can be changed in the box shown by **arrow 3 in Fig 17** above. The span frequency sets the range of frequencies that will be displayed on the screen. The display will always show frequencies from (Center - Span/2) to (Center + Span/2).
- In this case, **always use Span Frequency as 0.19 MHz(190 KHz).**
- Next, **UNCHECK** the “Demod On” button as shown by **arrow 4 in Fig 17.**
- Set the FFT Ave to “5” as shown by **arrow 5 in Fig 17**. This function averages out noise.
- Set “Smoothing” to “0” as shown by **arrow 6.**
- Set FFT/BLK Size to 2048. From the drop down button select 2048 as shown by arrow 7 in Fig 17. This sets the FFT data points. 2048 is the smallest size we can use.
- Set the vertical scale to 10dB/div as shown by **arrow 8** in Fig 17.
- Three buttons at the bottom of the screen control the starting, stopping, pausing, or resuming of the data capture process. Function keys F10, F11, and F12 are mapped to these buttons as well. This is shown by **blue box** in Fig 17.
- F10--> Stop, F11 --> Pause, F12 --> Start.

3.10 Once you have set all the above parameters properly, you can save your setup configuration from the “File” menu by clicking “Save Setup File As” and then giving the desired name to your file. This file will have extension “.ini”.
Please send this configuration file to Codar along with the other data.

3.11 Finally with all the above steps followed properly and with antenna wire connected to the BNC connector at the back of the SDR-IQ, you are ready to collect data.

3.12 Hit the “Start” button and you should see the combo display as shown in Fig 19 on the next page.

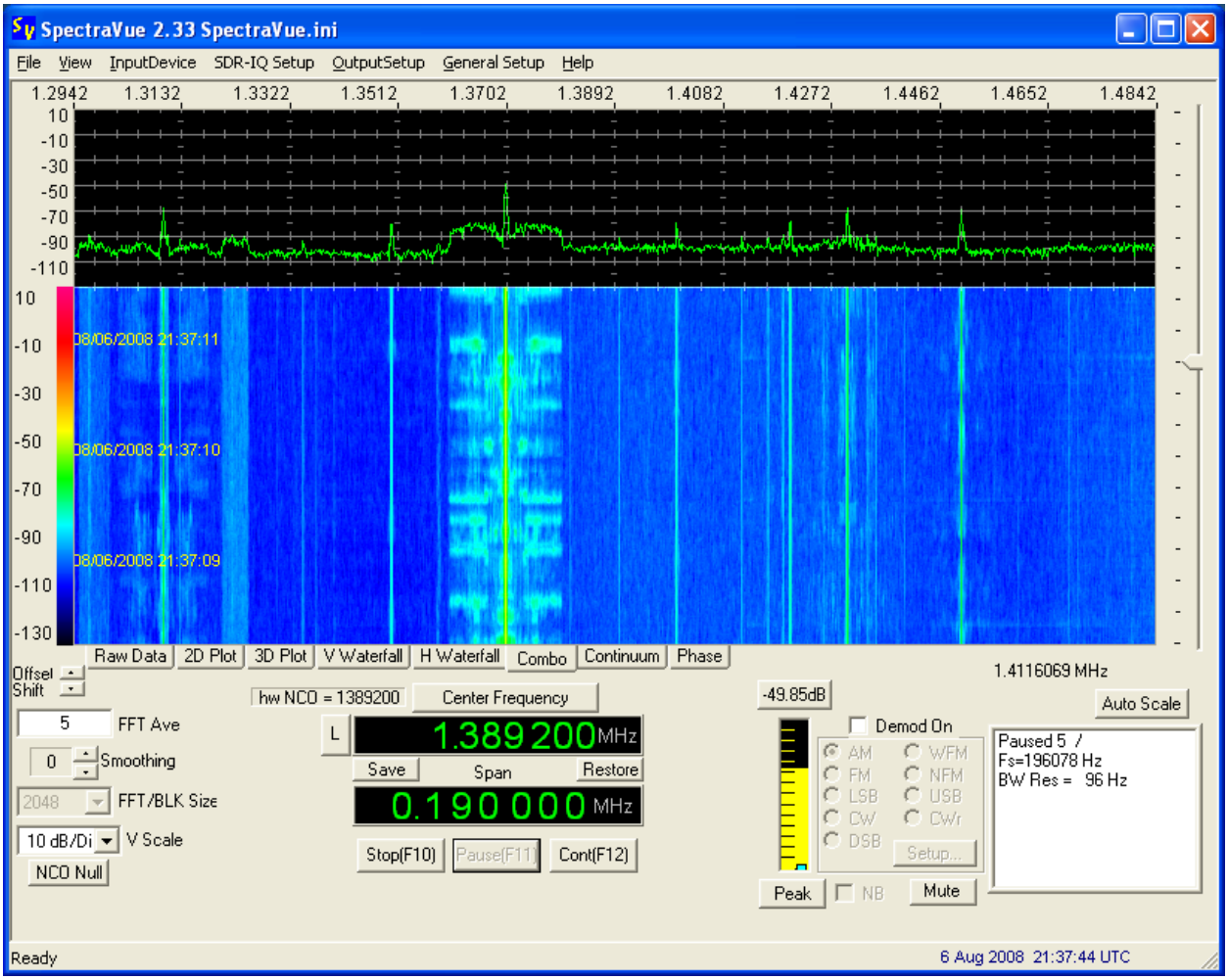

Fig 19: FFT plots.

Once you start this process, all the FFT data files with ".csv" extension will be collected at the location you chose and stored in Step 3.6 as in Figures 13 and 14. Files will be generated every 60 seconds(1 minute).
Also make sure that the files are getting stored at the correct location, that you selected earlier.

How to get the Data to Codar

- Please contact Codar Support to discuss, how many days of data you need to collect and if any special settings are required.
- Once all data is collected, send us the data(.csv files) on a CD/DVD, flash(USB) drive, external hard-drive or arrange for it to be transferred to us via the Internet. The method you use will depend on the amount of data collected.
- Also send us your configuration file that containing the settings you selected.
- This will be the .ini file that you saved at the end of step 3.10.
- Codar will analyze the data and comment/advise about the feasibility of the frequency that you have selected.

Appendix:

SDR-IQ Features:

- Frequency Range: 500Hz to 30 MHz in 1 Hz steps. (Usable down to 100 Hz)
- Input Impedance: 50 Ohms.
- USB powered. No external power supply required. Runs from the USB power from your computer. (Desktop or laptop). USB 2.0 port required.
- Voltage: 5 Volts (USB port powered)
- Current Draw: 425 mA
- Connectors at the back: BNC (RF In), USB 2.0, RS-232 (Serial Bi-directional)
- Indicators on the front side: Power (Green), Sample (Yellow), ADC Clip (Red)
- Data is sent from the receiver to the PC for processing via USB 2.0 interface.