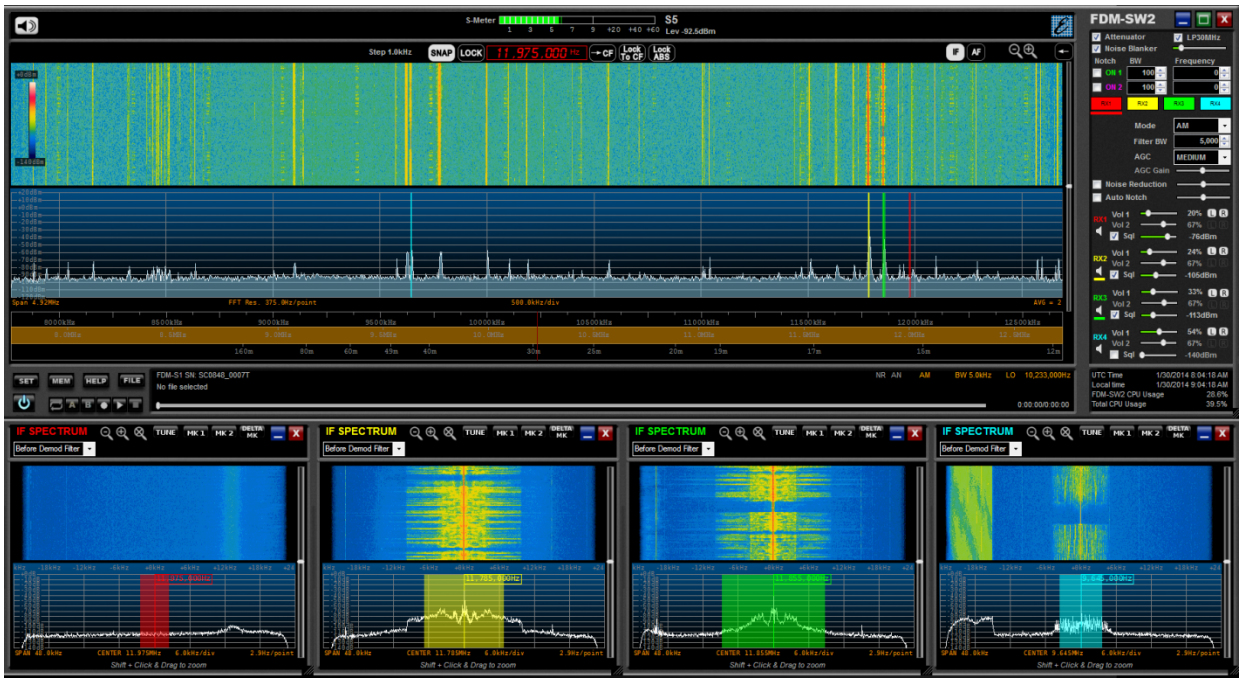
Communication

ELAD

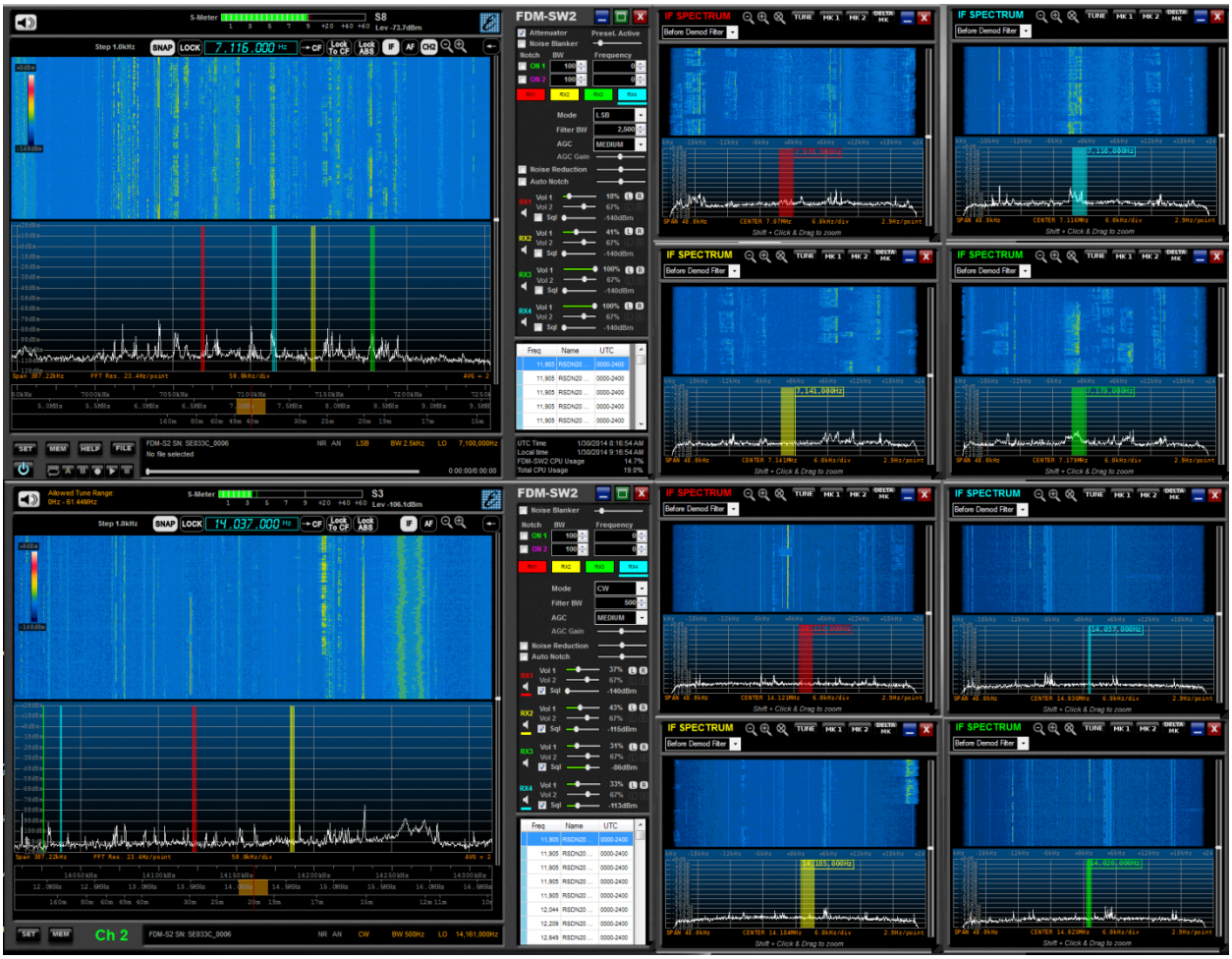
ELAD FDM-SW2 rev 1.01



USER MANUAL

Index

1 FDM-SW2 Overview

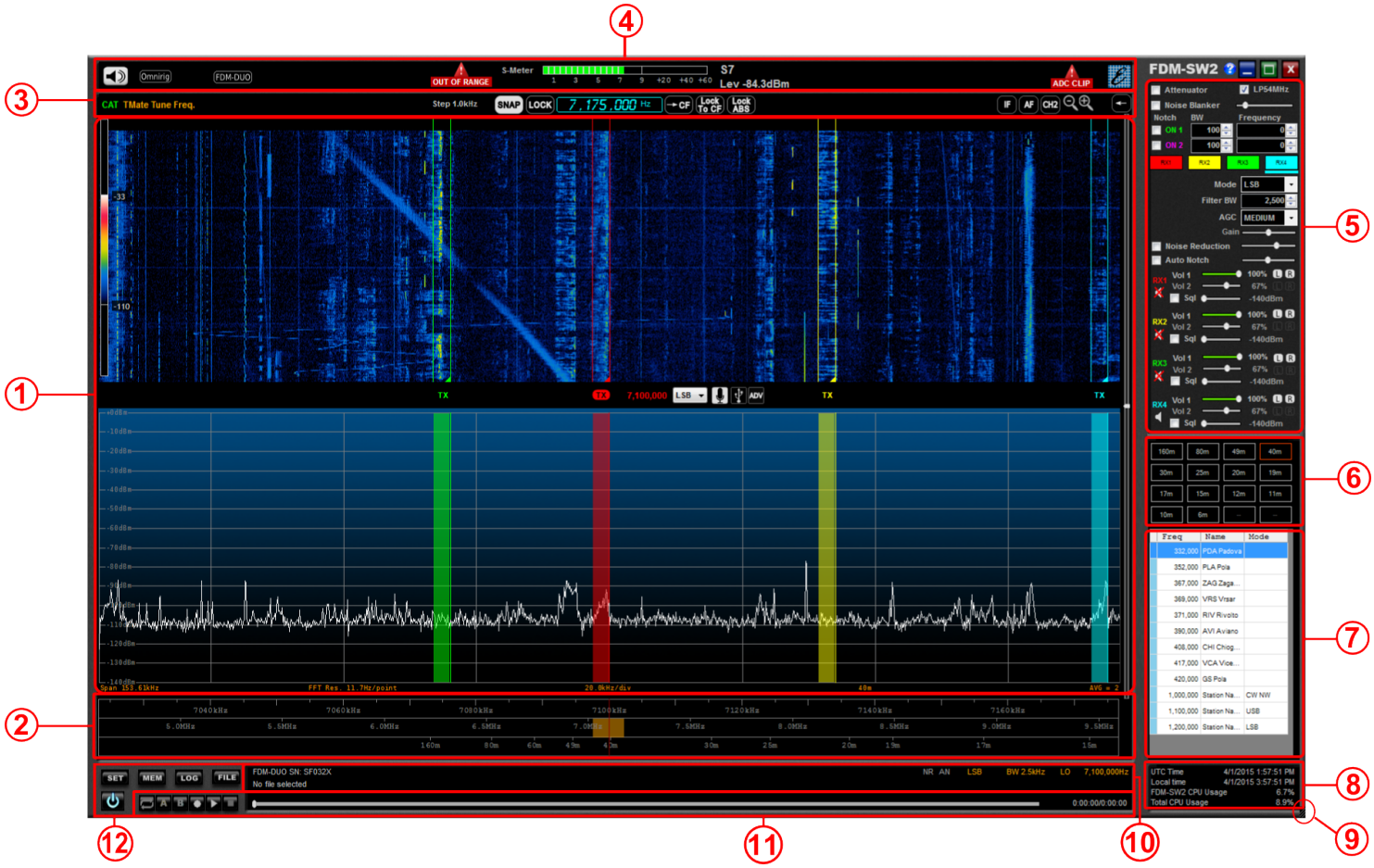


Elad FDM-SW2 is a SDR (Software Defined Radio) software that is intended to be used with the Elad FDM-Sx Receiver family and FDM-DUO Transceiver.
Please check out the latest update of this document at www.eladit.com.

Note: this manual is based on FDM-SW2 ver. 1.75.

2 Graphical User Interface (GUI)

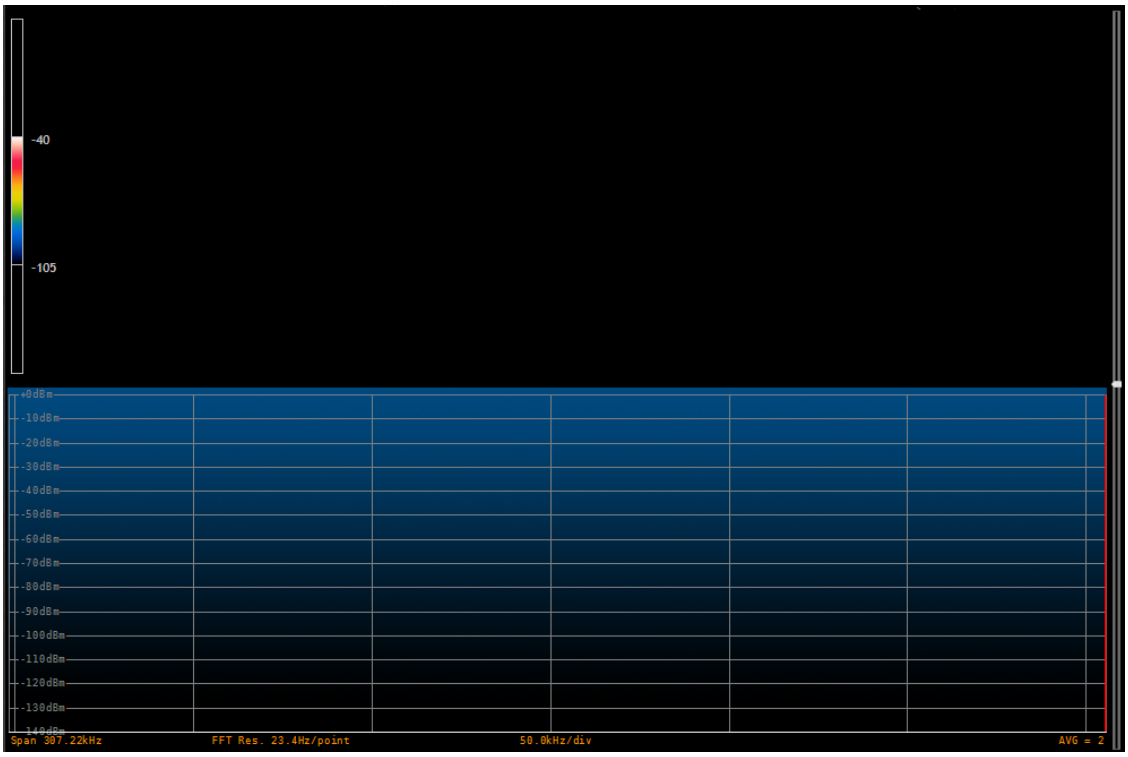
The screen shot below shows the main screen (the cockpit) of the Graphical User Interface.



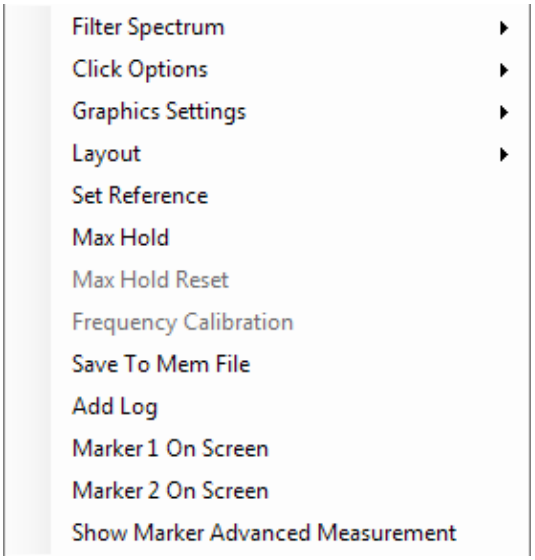
The GUI consists of 11 parts:

1. Display Window;
2. Tuning Bars;
3. Tuning Commands Panel;
4. Signal Control Display;
5. Receiver Commands Panel;
6. Preset Buttons Panel;
7. Station Memory Panel
8. System Information Panel
9. Resize Corner
10. Status Bar
11. Player/Recorder
12. Main Setting Buttons

2.1 Display Window

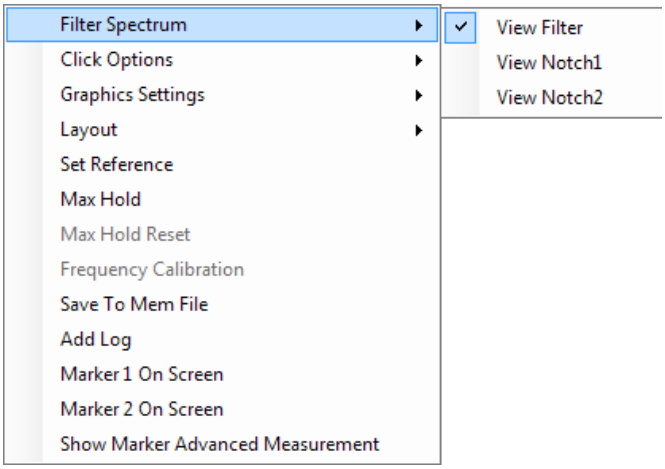


The "Display Window" displays the Spectrum and the Waterfall of input signal. The sliding bar on the right side allows the user to change the area portions assigned to the two types of graphics. The waterfall palette control on the left side allows the user to adjust the minimum and the maximum value displayed on the waterfall.
On the lower part, information about the current setting of "Span", "FFT Res", "kHz/div" and "AVG" is displayed.
When right-click is performed on the "Display Window" the software displays a pop-up menu that contains advanced options.



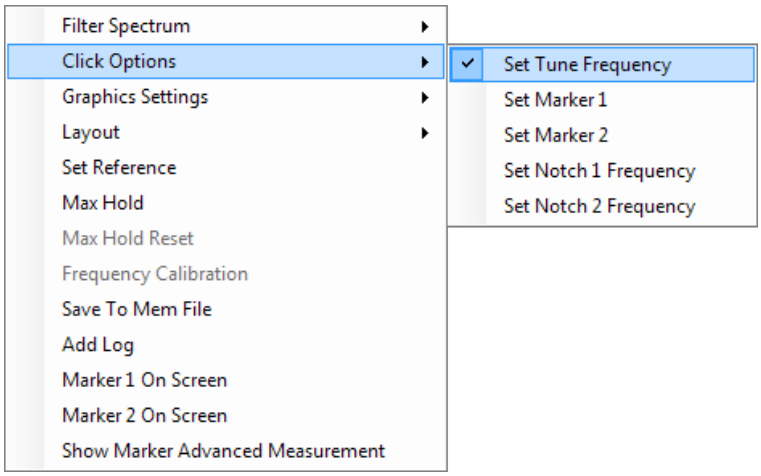
2.1.1 Filter Spectrum

Allows the user to select which information is displayed on the spectrum area.



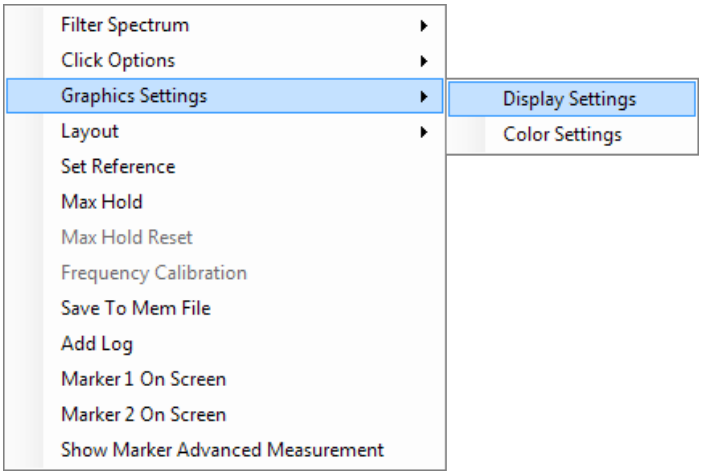
2.1.2 Click Options

Allows the user to select which kind of operation can be done when left-click is performed on the Spectrum area.



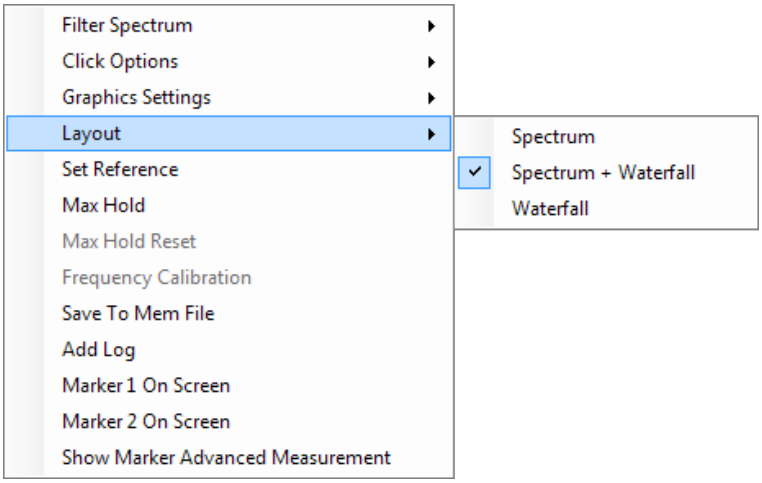
2.1.3 Graphics Settings

Allow the user to open the Display Settings to configure the parameters of the Spectrum/Waterfall graphics displayed in the "Display Window". Moreover the "Color Settings" option allows to change the colors used in the display window.



2.1.4 Layout

Allows the user to select the visualization mode.



2.1.5 Set/Reset Reference

When "Set Reference" is selected, the software displays as a reference curve the input spectrum available at the moment of the selection. "Reset Reference" disables the visualization of the reference curve.

2.1.6 Max Hold

When “Max Hold” is selected, the software displays the max hold of the input spectrum together with the real-time input spectrum trace. Click “Max Hold Reset” to reset the max hold trace.

2.1.7 Frequency Calibration

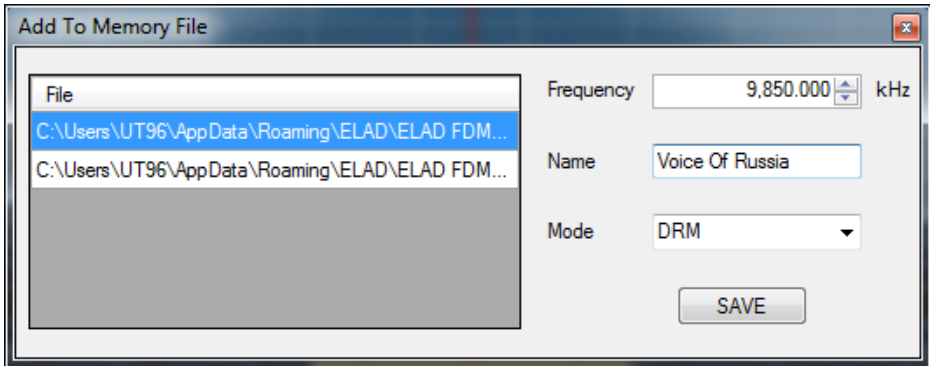
This option allows the user to modify the factory sampling frequency offset of the Elad FDM-Sx Receiver family.
Normally this operation is not needed.

As described in the pop-up above, a reference signal at the same frequency of the L.O., has to be provided at the antenna input of the receiver to perform the frequency calibration. Then, place the marker on the reference (peak), press Set Offset and then EXIT.
Clicking on Reset Offset button, the software resets the sampling frequency offset to zero.

NOTE:
This operation will cause the loss of the factory calibration. Perform this operation only if you are sure to accomplish the operation in the right way and to use a precise frequency reference.

2.1.8 Save To Mem File

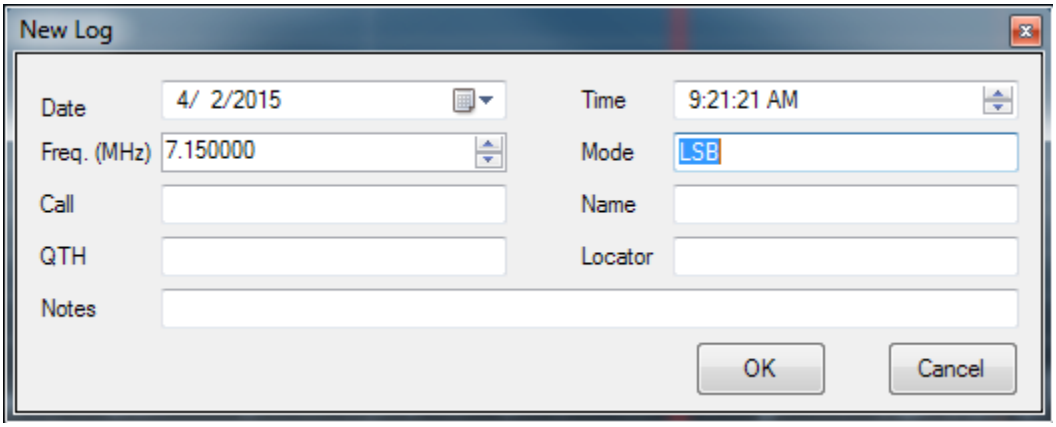
When “Save To Mem File” is clicked, the “Add to Memory File” Form is displayed.



This form allow to add a new station in station memory file (See paragraph 3.7). The user can select the memory file and save the frequency, name and a default demodulation mode for the station.

2.1.9 Add Log

When “Add Log” is clicked the “New Log” form is displayed



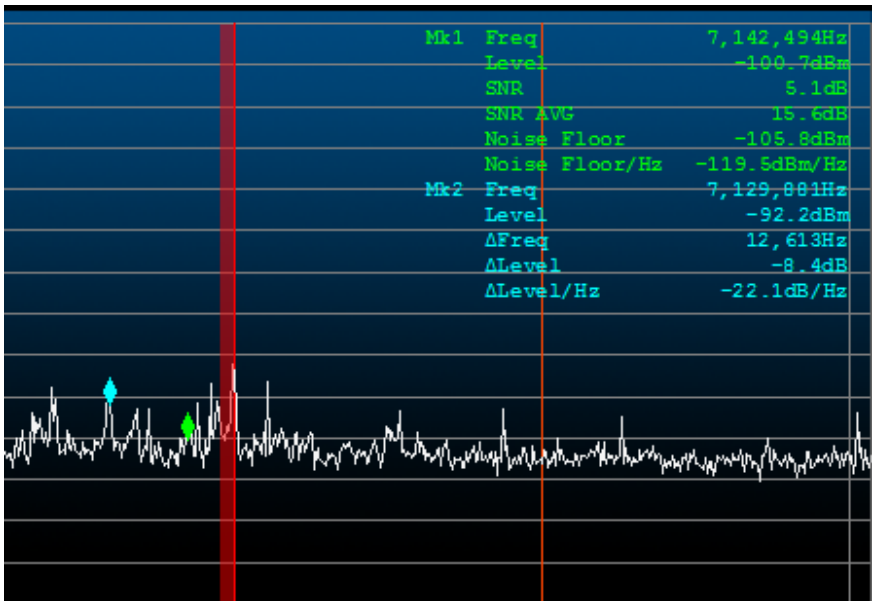
This form allow the user to add a new contact in the current logbook.

2.1.10 Marker 1 On Screen / Marker 2 On Screen

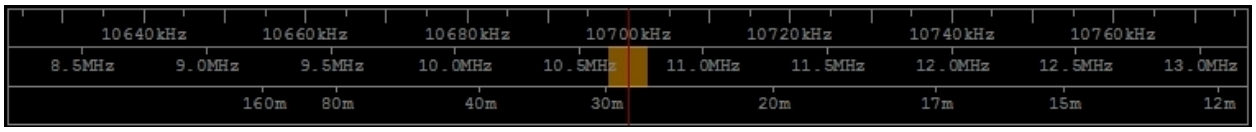
This option enables the visualization of the markers on the Spectrum. The frequency and amplitude value (dBm) of the Marker 1 frequency is displayed on top-right corner of the “Display Window”. The Marker 2 includes the “Delta Marker” feature to display the frequency and the amplitude difference between the markers

2.1.11 Show Marker Advanced Measurement

If this option is selected, signal to noise (SNR) measurement are performed and displayed.



2.2 Tuning Bars

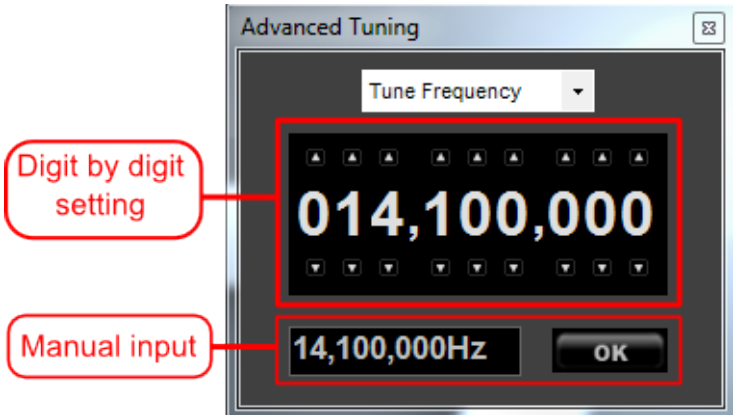


These innovative tuning bars (Patent Pending) allow the user to perform fast tuning over the whole receiver bandwidth. Each bar is characterized by different frequency spans. By performing drag-and-drop or scrolling with the mouse wheel over the different bars, the user can easily select the desired frequency using the lower bar to select the frequency band, the middle bar to make a rough tuning and the higher bar to do fine positioning.
The span of the higher bar corresponds to the frequency range of the spectrum, and can be modified using the zoom buttons in the "Tuning Commands Panel".
The frequency step of the higher bar (displayed in the "Tuning Commands Panel") can be changed using the ↑ ↓ arrows on the PC keyboard, while ← → keys increase or decrease the tuning frequency by one step respectively (see Chapter 3.2 for keyboard shortcut configuration).
The yellow segment on the middle bar represents the portion of the spectrum displayed by the software in the "Display Window".

2.3 Tuning Commands Panel

The main function of this panel is to display the tuning frequency.
Double click on the frequency display or press space bar (

) to open the "Advanced Tuning" panel.



In the "Digit by digit" section it is possible to modify the tuning frequency or the local oscillator frequency by moving the mouse over each digit and then scroll with the mouse wheel to increase or decrease the digit value. Alternatively the user can click on the small arrow button over and below each digit.
In the "Manual input" section it is possible to modify the tuning frequency or the local oscillator frequency inserting manually the desired value using the PC keyboard (Note: "+" key allow to insert "000").

If the “LOCK TO CF” button is selected (

) the tuning frequency corresponds to the center frequency of the Spectrum (that is the L.O. frequency), otherwise it’s possible to select different demodulation frequencies by clicking on the desired point on the Spectrum/Waterfall or using the mouse scroll wheel over the Spectrum/Waterfall area. If the “LOCK ABS” button is selected (

) the tuning frequency remains constant even if the local oscillator frequency is changed (until the tuning frequency falls within the selected frequency span; otherwise the tuning frequency will be set according to the frequency span limits).

If the “LOCK” button is selected (

), all the settings except the volume controls are disabled.

Clicking on 

button the software forces the L.O. frequency to be equal to the current demodulation frequency.

Use the “SNAP” button (

) to enable/disable the rounding of the tuning frequency at multiples of the frequency step.

Use the “IF” button (

) to open the IF spectrum window. Left click on this button to open/close the IF window. If the IF window is open, right click on this button to move to foreground the IF window.

Use the “AF” button (

) to open the AF spectrum window. Left click on this button to open/close the AF window. If the AF window is open, right click on this button to move to foreground the AF window.

Use the “CH2” button (

) to open the Channel 2 window. Left click on this button to open/close the AF window. If the Channel 2 window is open, right click on this button to move to foreground the Channel 2 window.

Note: this feature is available only if the connected sampler is a FDM-S2 or a FDM-DUO and the selected hardware configuration supports two channels.

Buttons  implement “zoom in”, “zoom out” and “zoom reset” respectively. Use the arrows  that appear on the “Display Window” when zoom function is active to move left/right the visualization.

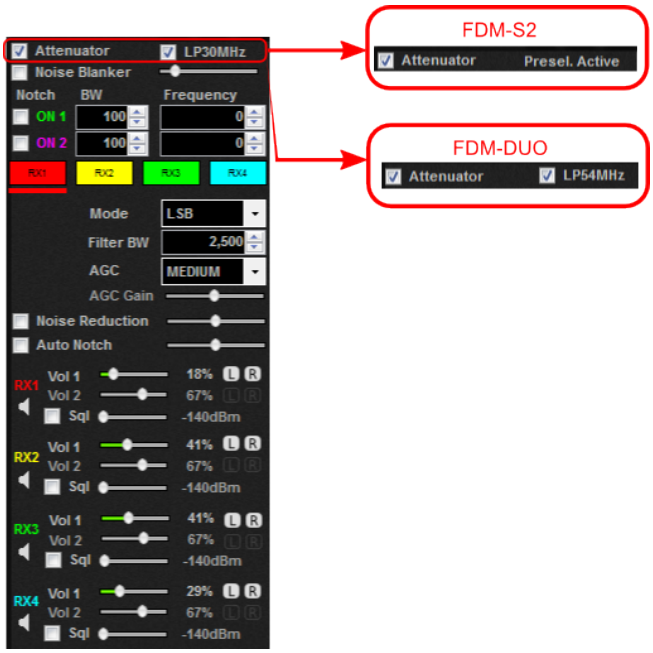
The button  hide the receiver setup.

Moreover, the “Tuning Commands Panel” shows the label 

when a Tmate is connected and the label

when the CAT protocol is enabled.

2.4 Receiver Commands Panel



This panel allows the user to:

- Switch On/Off the anti-aliasing filter only for FDM-S1 (30 MHz Low Pass) and FDM-DUO (54 MHz Low Pass);
- Switch On/Off the 20 dB attenuator (12 dB for FDM-S2 and FDM-DUO);
- Switch On/Off the noise blanker and modify its level;
- Switch On/Off the two notch filters (at IF stage) and set their parameters (frequency and bandwidth);
- Turn On/Off and select the four virtual receiver (RX1 ... RX4) available for each channel 
- Select the demodulation mode for the selected RX (CW, CW SH+, CW SH-, USB, LSB, DSB, AM, SAM, FM, WB FM Stereo, DRM is available only for RX1 of Channel 1);
- Set the bandwidth of the demodulation filter for the selected VRX;
- Set the AGC type for the selected VRX
  - if "AGC OFF" is selected, the user could adjust the AGC Gain manually;
  - if "AGC OFF" is selected, the software displays a warning 

when audio clipping is detected;
- Switch On/Off the "Noise Reducer" and modify its speed for the selected RX;
- Switch On/Off the "Auto Notch" reducer and modify its speed for the selected RX;

For each virtual receiver it is possible to:

- Set the volume of the main audio output 

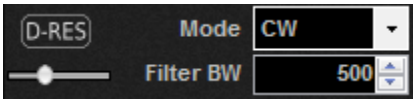
;
- Set the volume of the auxiliary audio output 

;
- Switch On/Off the squelch and set its level 

;
- Mute the VRX (only for main audio output) 
- Send the output to the left/right or both channels of main and auxiliary audio output 

2.5 CW / CW SH+ / CW SH- / CW NW Settings

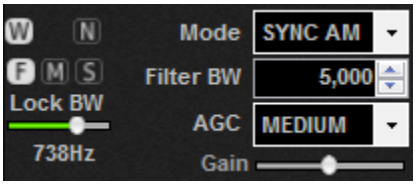
If a CW demodulation mode is selected it is possible to activate a digital resonator filter.

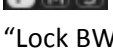


With the  button the filter is activated and with the slide bar under the button it is possible to adjust the filter bandwidth

2.6 SYNC AM Settings

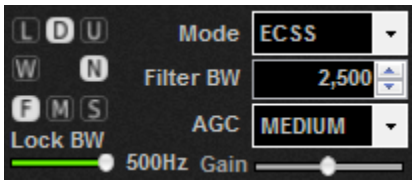
If the SYNC AM mode is selected it is possible to set some parameters to improve the signal locking.



- If the  button is clicked the initial locking filter bandwidth is set to the “Filter BW” value, when a signal is locked, the locking filter bandwidth is set to the “Lock BW “ value.
- If the  button is clicked the locking filter bandwidth is set to the “Lock BW value”.
- With the  buttons it possible to set a Fast/Medium/Slow locking speed
- With the “Lock BW” slide it is possible to adjust the locking filter bandwidth

2.7 ECSS Settings

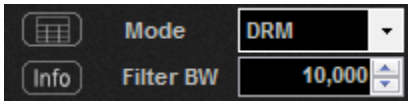
If the ECSS mode is selected it is possible to select the upper side / lower side band and to set some parameters to improve the signal locking.



- If the  button is clicked the initial locking filter bandwidth is set to the “Filter BW” value, when a signal is locked, the locking filter bandwidth is set to the “Lock BW “ value.
- If the  button is clicked the locking filter bandwidth is set to the “Lock BW value”.
- With the  buttons it possible to set a Fast/Medium/Slow locking speed
- With the “Lock BW” slide it is possible to adjust the locking filter bandwidth

2.8 DRM Info Window and DRM Schedule

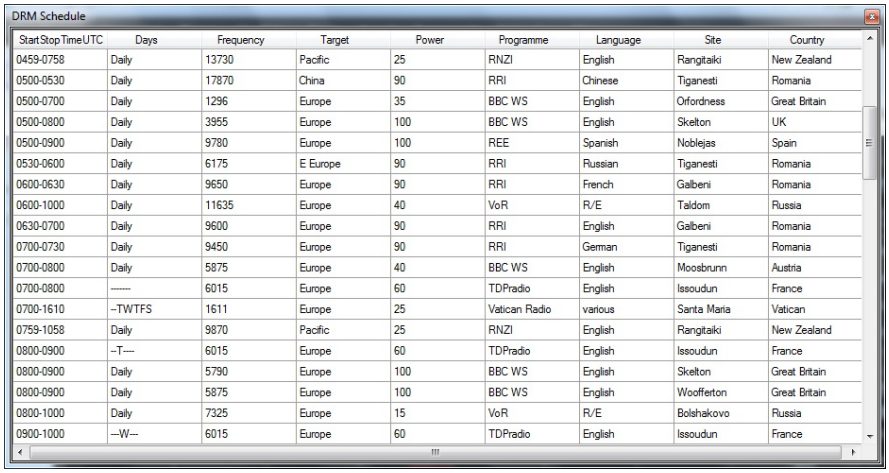
If the DRM mode is selected two buttons allows to show the DRM info window and the DRM schedule window



Clicking on 

the DRM info window is displayed. This form displays some information about the DRM transmission

Clicking on  button, if an internet connection is available, the software automatically downloads and displays the last DRM schedule from ftp://216.92.35.131.

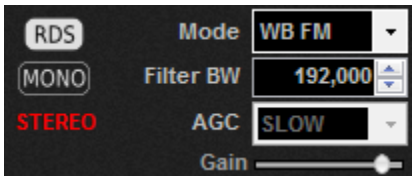


StartStopTimeUTC	Days	Frequency	Target	Power	Programme	Language	Site	Country
0459-0758	Daily	13730	Pacific	25	RNZI	English	Rangitaiki	New Zealand
0500-0530	Daily	17870	China	90	RRI	Chinese	Tiganesti	Romania
0500-0700	Daily	1296	Europe	35	BBC WS	English	Orfordness	Great Britain
0500-0800	Daily	3955	Europe	100	BBC WS	English	Skelton	UK
0500-0900	Daily	9780	Europe	100	REE	Spanish	Noblejas	Spain
0530-0600	Daily	6175	E Europe	90	RRI	Russian	Tiganesti	Romania
0600-0630	Daily	9650	Europe	90	RRI	French	Galbeni	Romania
0600-1000	Daily	11635	Europe	40	VoR	R/E	Taldom	Russia
0630-0700	Daily	9600	Europe	90	RRI	English	Galbeni	Romania
0700-0730	Daily	9450	Europe	90	RRI	German	Tiganesti	Romania
0700-0800	Daily	5875	Europe	40	BBC WS	English	Moosbrunn	Austria
0700-0800	------	6015	Europe	60	TDPradio	English	Issoudun	France
0700-1610	--TWTFS	1611	Europe	25	Vatican Radio	various	Santa Maria	Vatican
0759-1058	Daily	9870	Pacific	25	RNZI	English	Rangitaiki	New Zealand
0800-0900	--T---	6015	Europe	60	TDPradio	English	Issoudun	France
0800-0900	Daily	5790	Europe	100	BBC WS	English	Skelton	Great Britain
0800-0900	Daily	5875	Europe	100	BBC WS	English	Woofferton	Great Britain
0800-1000	Daily	7325	Europe	15	VoR	R/E	Bolshakovo	Russia
0900-1000	--W---	6015	Europe	60	TDPradio	English	Issoudun	France

2.9 WBFM Settings

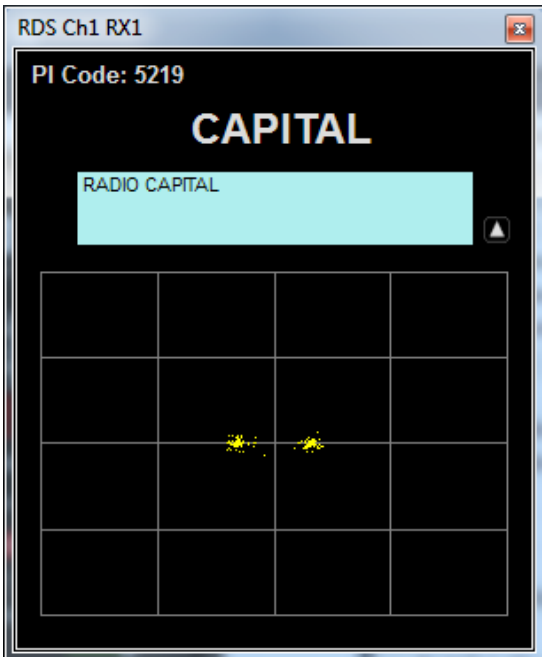
If the WBFM mode is selected it is possible to display some RDS decoding information and, by using the 

button, force a mono decoding mode.



Click on 

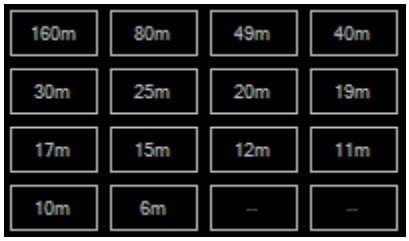
button to open the RDS Window



Use the  button to Show/Hide the RDS constellation graphic.

2.10 Preset Buttons

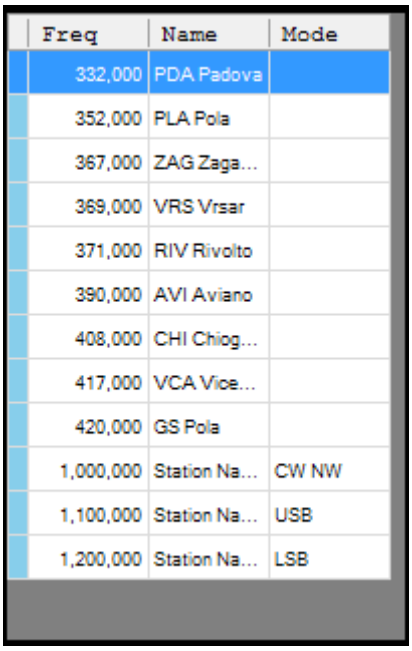
Use this buttons to quickly recall a preset containing the local oscillator frequency, RX1 tuning frequency, mode and bandwidth. By default the commons radio amateur and broadcast bands are assigned to this buttons. However the user can modify every settings in the setup window (see 3.3).



Note: if the main window size is set to the default size, this panel is not visible. Use the resize corner to increase the windows height and make visible the preset buttons panel.

2.11 Memory Panel

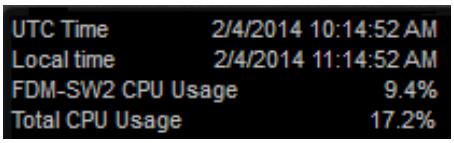
In this panel each station memory frequency name and mode are displayed. Clicking on a line of the table implies that the receiver is tuned at the selected frequency and the mode is set at the value saved in the file.



Freq	Name	Mode
332,000	PDA Padova	
352,000	PLA Pola	
367,000	ZAG Zaga...	
369,000	VRS Vrsar	
371,000	RIV Rivolto	
390,000	AVI Aviano	
408,000	CHI Chiog...	
417,000	VCA Vice...	
420,000	GS Pola	
1,000,000	Station Na...	CW NW
1,100,000	Station Na...	USB
1,200,000	Station Na...	LSB

Note: if the main window size is set to the default size, this panel is not visible. Use the resize corner to increase the windows height and make visible the preset buttons panel.

2.12 System Info Panel



This panel displays the system time (UTC and local) and the CPU usage.

2.13 Status Bar

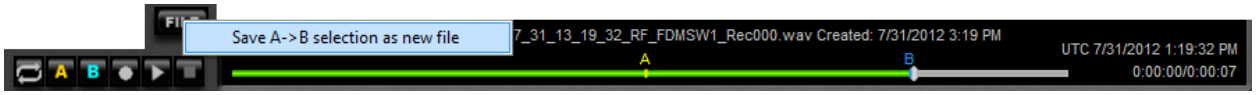
The "Status Bar" displays the following information:

- Serial number of the connected Elad FDM-Sx Receiver;
- Selected demodulation mode and filter bandwidth;
- Status of the "Noise Reducer" and "Auto Notch" (On or Off);
- Status of the "Panadapter Mode" (see Chapter 3.6)
  - If "Panadapter Mode" is activated, the PAN label is showed;
  - If AOR AR8600 Control is activated the AR8600 label is showed;
  - If "Swap I/Q" option is selected, the I/Q Swap label is showed;
- Status of the "Downconverter Mode" (see Chapter 3.6)
  - If "Downconverter Mode" is activated, the DW CONV label is showed;
  - If "Swap I/Q" option is selected, the I/Q Swap label is showed;
- L.O. Frequency;

2.14 Player/Recorder

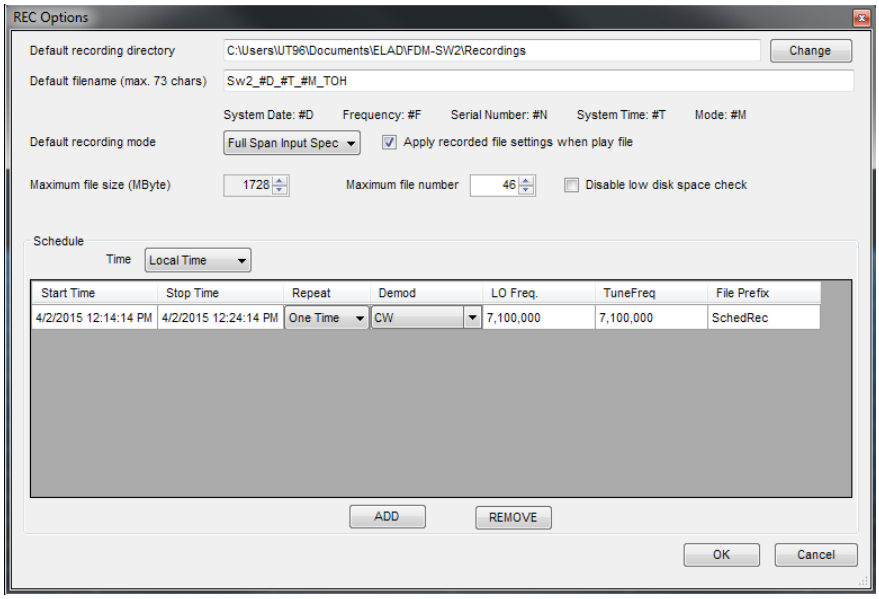
FDM-SW2 embeds an advanced player/recorder.
When the recorder is activated, the RF input signal or the audio output signal is stored in a .wav file (see Chapter 3.8). Some information regarding the settings used during the recording (file creation date, L.O. frequency, demodulation frequency, demodulation mode, filter bandwidth, etc.) is stored in the file's header.
When the file is played, the stored information is loaded by the software. When the playback is finished, last demodulation settings (demodulation frequency, demodulation mode and filter bandwidth) are stored again in the .wav header.
Six button function are available 

(Loop, A, B, Rec, Play/Pause, Stop).
After placing "A" and "B" (when the reproduction is stopped), user can create a new file with the samples included between the two markers by right-clicking the FILE button and then click the Save A->B selection as new file label.



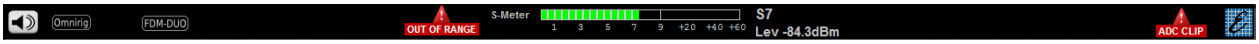
2.14.1 Recording Scheduler

When a right-click is performed on the Rec button, the “Rec Option Form" is displayed



This form allow the user to set the recoding options and schedule the recording of the input spectrum or the audio output signal.
The user can set the start and stop time of recording (UTC Time or Local Time), the repetition mode (one time or daily), the demodulation mode, the local oscillator frequency, the tuning frequency and the file name prefix.

2.15 Signal Control Display



In this area, the DFM-SW2 software displays the level of the input signal.

The 

signals an ADC saturation

The 

(FDM-S2 only) appears when the local oscillator is tuned in a frequency range not implemented in the pre-selection filters .

Use the  button to activate or deactivate the Mute function.

If Omnirig is active, click on the 

button to open the Omnirig control panel

If the device connected is a FDM-DUO, click on the 

button to open the FDM-DUO control window

2.16 Main Setting Buttons

Button  switches on/off the demodulation.

Button 

opens the “Setup” form.

Button 

opens the “Station List” form.

Button 

opens the FDM-SW2 Logbook management window.

Button 

opens the Windows dialog box to allows the user to select the file to play.

2.17 Resize Corner

Drag-and-drop the bottom-right corner to resize the “Graphical User Interface”.

3 Setup Form

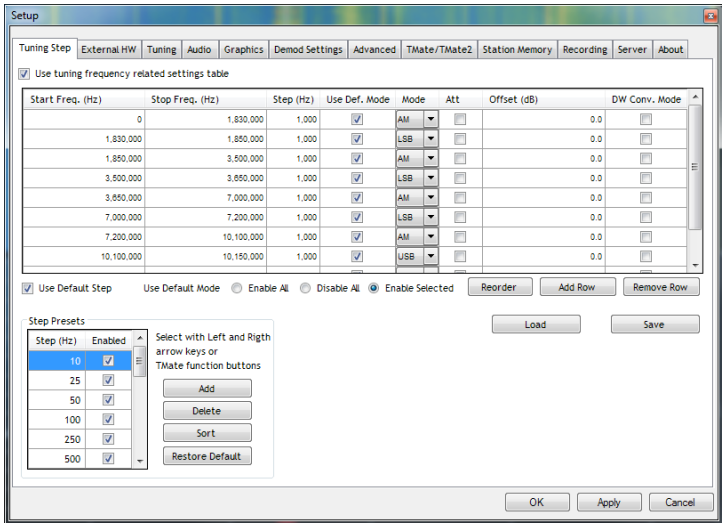
When the 

button is clicked, FDM-SW2 displays the “Setup” form. This form contains several settings that control the behavior of the software.

The “Setup” form consists of 12 tabs:

1 “Tuning Step” tab;
2 “External HW” tab;
3 “Tuning” tab;
4 “Audio” tab;
5 “Graphics” tab;
6 “Demod Settings” tab;
7 “Advanced” tab;
8 “TMate/TMate2” tab;
9 “Station Memory” tab;
10 “Recording” tab;
11 “Server”
12 “About” tab;

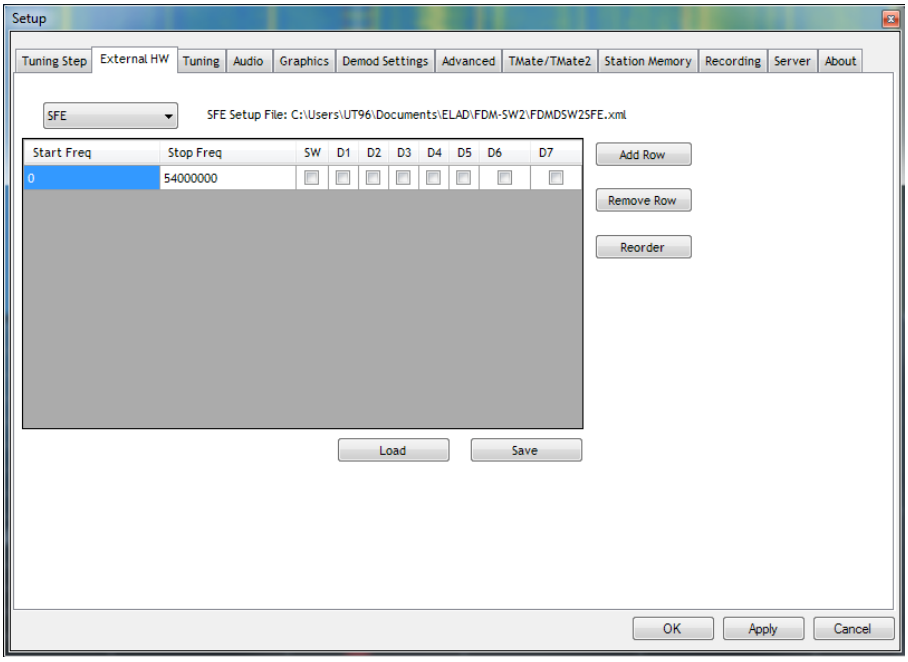
3.1 Tuning Step Tab



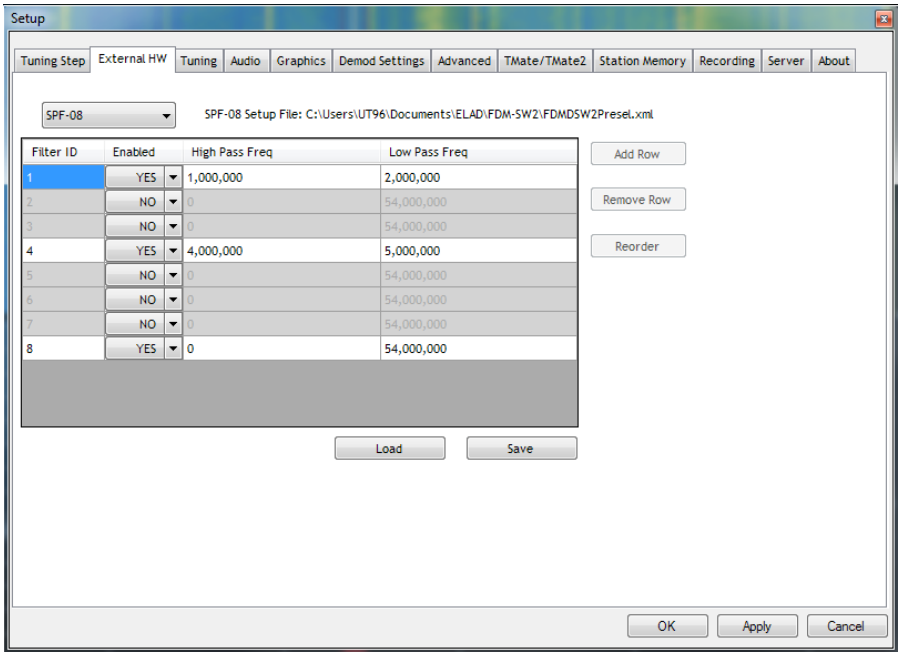
In the “Tuning Step” tab the user can configure the frequency steps that the software sets when the arrows on the PC keyboard are pressed; these frequency steps are configurable under “Step Preset” area. Moreover, the user can compile a table containing custom setting (frequency step, demodulation mode, attenuator, low pass filter (FDM-S1 only), down converter mode) that the software automatically applies if the tuning frequency falls within the user-defined frequency ranges: to make this, check “Use tuning frequency related settings table” on the top of the tab.

3.2 External HW tab

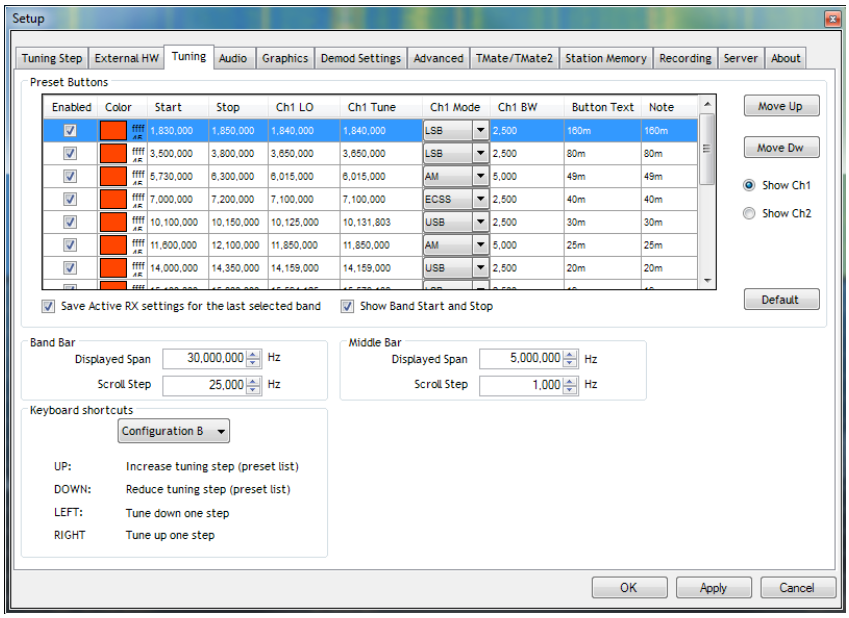
This tab allow the user to set frequency related settings for the ELAD SFE expansion board and the ELAD SPF-08 pre-selector filter board.
If the SFE model is selected, the user can compile a table containing the Ext/IO settings that the software automatically applies if the tuning frequency falls within the user-defined frequency ranges.



If the SFE-08 board is selected, the user can enable/disable each pre-selector and set pre-selector high pass and low pass frequency.



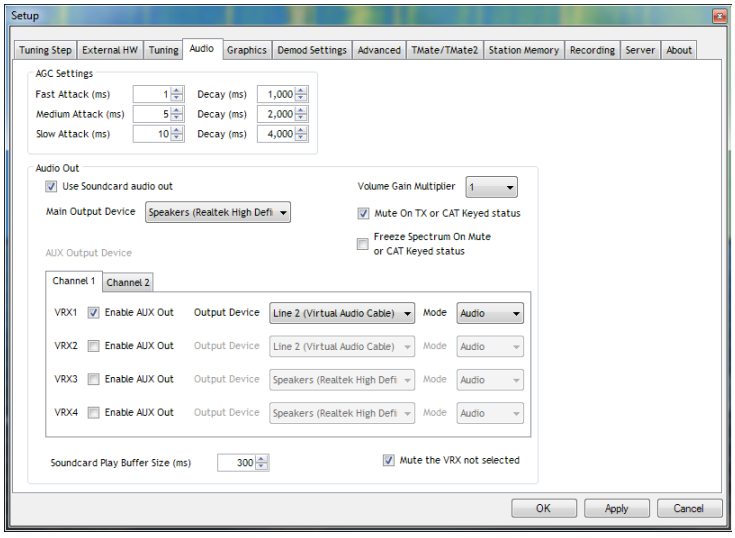
3.3 Tuning Tab



The “Tuning tab” allow the user to customize the “Preset Buttons” settings. Each button define a frequency range highlighted with to vertical lines in the spectrum graphic (if the “Show Band Start and Stop” option is checked). When a preset button is clicked, the stored local oscillator value, the RX1 tuning frequency, mode and bandwidth are applied.

The “Tuning” tab allows also the user to customize the frequency span of the “Middle” and “Band” (lower) tuning bars and the keyboard shortcuts configuration.

3.4 Audio Tab



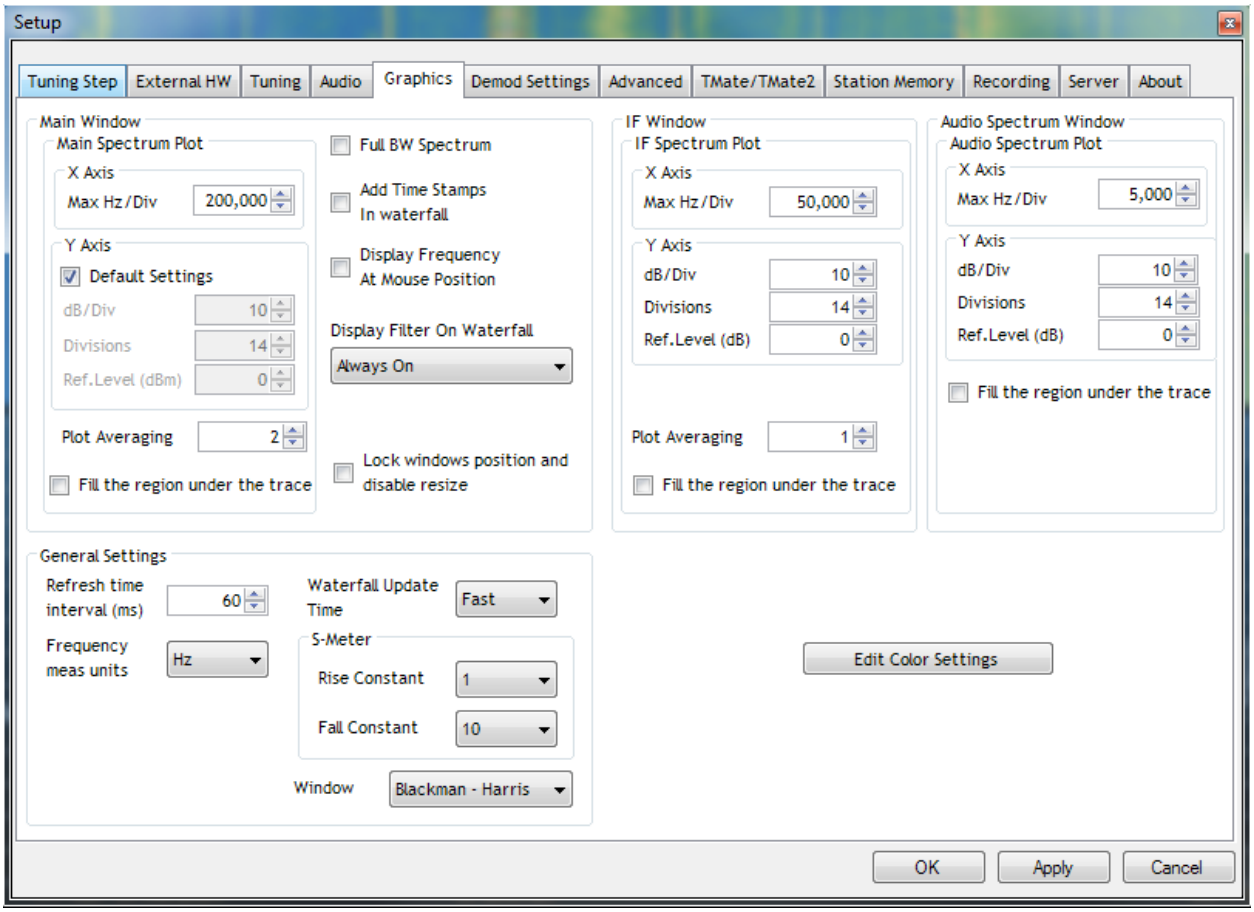
The “Audio” tab allows the user to select the main audio output device and an auxiliary output device (for example a virtual audio cable) for each of the virtual receivers.

When the “AUX” out is enabled, the user can select the data type that will be reproduced on this device:

- Audio (48 kSamples/sec)
- IF (192 kSample/sec)
- IF (48 kSample/sec)

“Soundcard Play Buffer Size” allow the user to set the soundcard buffer time used when a recoded file is reproduced.

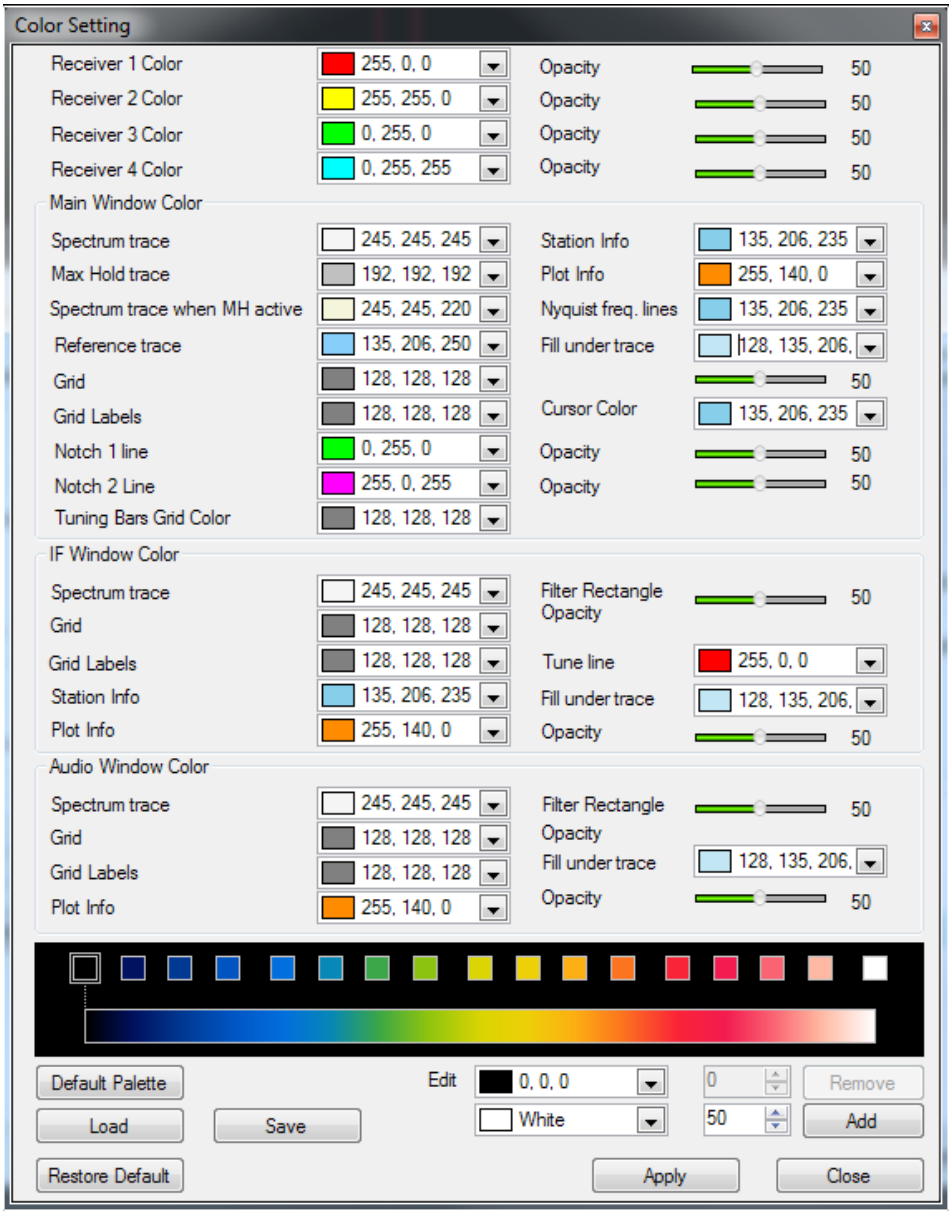
3.5 Graphics Tab



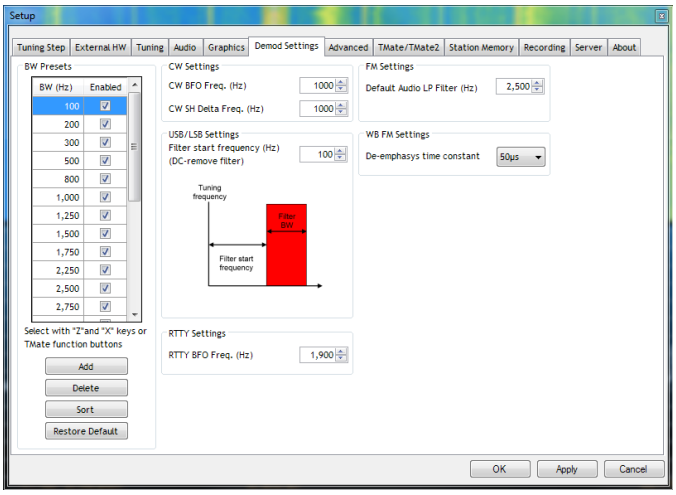
The “Graphics” tab allows the user to customize several parameters related to the “Display Window” visualization. Moreover, in this tab the user can enable and customize the visualization of the “Audio Spectrum” form (see Chapter 5), the “IF Spectrum” form (see Chapter 4) and the S-meter time constants.

3.5.1 Color Settings Window

If the "Edit Color Settings" button is clicked, the color settings window is opened. This window allow the user to change the colors used in the graphical user interface and the waterfall color palette.

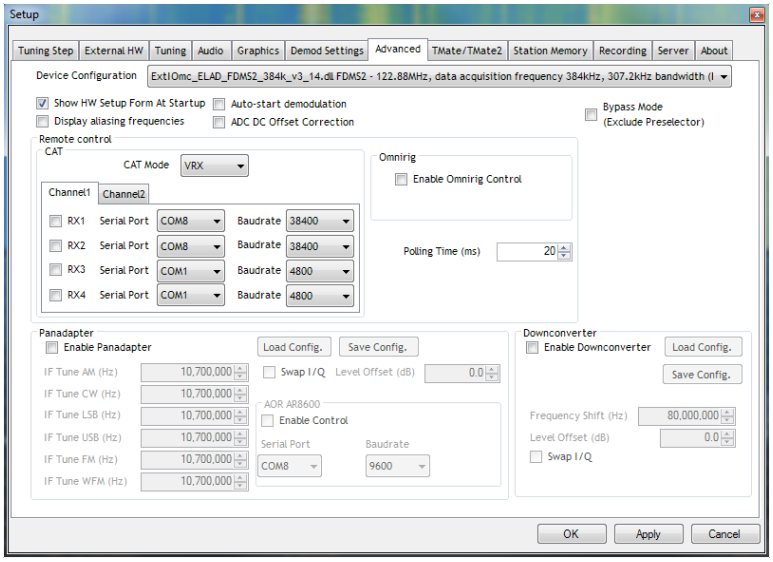


3.6 Demod Settings Tab

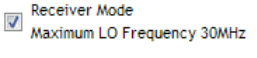


The “Demod Settings” tab allows the user to customize several parameters related to the demodulation algorithms.

3.7 Advanced Tab



In this tab, the user can select the advanced options of the software.
The combo box “Device Configuration” allows to change the device sampling frequency and if the connected device is a FDM-S2, it is possible to select a two-channel configuration.

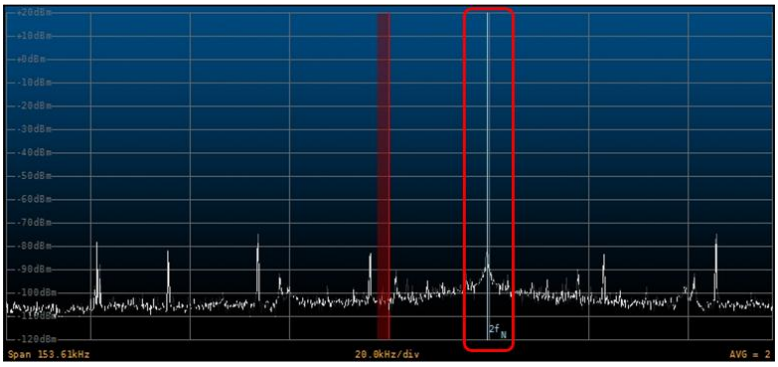
If the connected device is a FDM-S1 , if the 

checkbox is selected, the software operates in “Receiver Mode” and limits the maximum tunable frequency at the Nyquist frequency (half of the ADC sampling rate). If the checkbox is deselected, the software operates in “Sampler Mode” and unlocks the limitation.

If the connected device is a FDM-S2, if the Receiver Mode Maximum LO Frequency 160MHz checkbox is selected, the software limits the maximum tunable frequency at 160MHz. If the checkbox is deselected, the software operates in “Sampler Mode” and unlocks the limitation.

If the Bypass Mode (Exclude Preselector) checkbox is selected, the pre-selection filters are excluded. This option is disabled by default.

If the “Sampler Mode” is activated, the user can force the software to highlight the multiples of the Nyquist frequency on the Spectrum by checking the Display aliasing frequencies checkbox.



Checking the Show HW Setup Form At Startup Receiver Mode checkbox, the “FDM-SW2 Hardware Setup” form is loaded at software startup (see Chapter 7).

To enable the DC offset correction feature of the ADC, check the ADC DC Offset Correction checkbox; this option removes ADC offset at 0 Hz.

3.7.1 CAT

When the CAT control is active, the “Tuning Commands Panel” displays the CAT label. In the “CAT Panel” the user can configure the serial communication settings.
The FDM-SW2 implements the command set of the Yaesu FT-897 transceiver.

3.7.2 Omnirig

When the Enable Omnirig Control is checked, the FDM-SW2 software can control two transceivers using the Omni-Rig technology.
Please go to website http://dxatlas.com/OmniRig/ for more information about Omni-Rig.
Note: Omnirig must be installed in your PC.

3.7.3 Panadapter

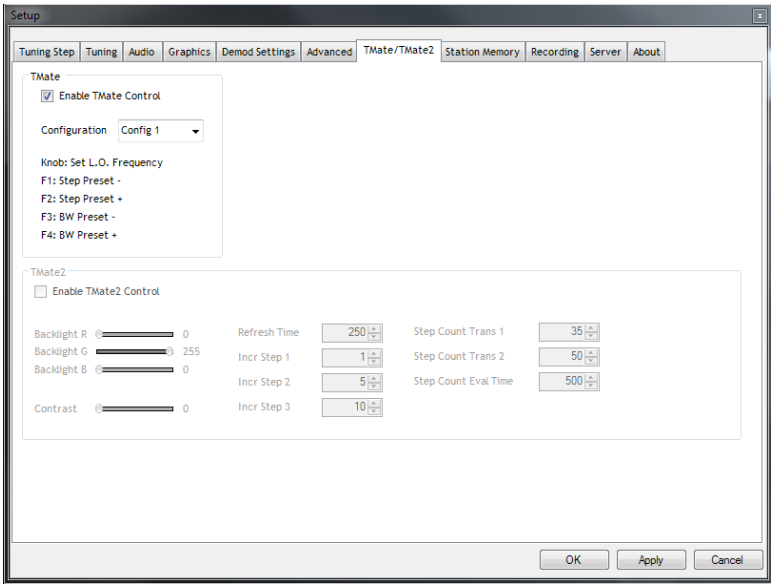
If “Panadapter Mode” is activated (the “Status Bar” displays the PAN label), the user can configure the IF frequency for the different demodulation modes and the amplitude offset that allows the right visualization. Moreover, the spectrum flip around L.O. frequency can be enabled by check “Swap I/Q” option (the “Status Bar” displays the I/Q Swap label). This configuration parameters can be saved/loaded using the buttons Save Config. and Load Config. respectively.

Enabling the AOR AR8600 Control (the “Status Bar” displays the AR8600 label), the SW can directly control this Radio through serial communication.

3.7.4 Downconverter

If “Downconverter Mode” is activated (the “Status Bar” displays the DW CONV label), the user can configure the IF frequency shift of the downconverter and the amplitude offset that allows the right visualization. Moreover, the spectrum flip around L.O. frequency can be enabled by check “Swap I/Q” option (the “Status Bar” displays the I/Q Swap label).

3.8 Tmate/Tmate2 Tab

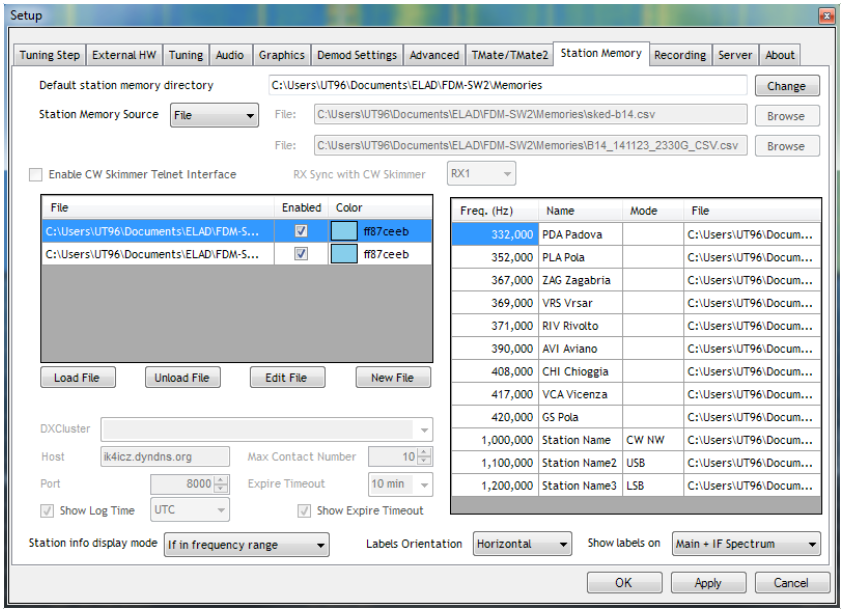


If a Tmate is connected, the “Tmate Panel” is activated. In this panel, the user can choose among the proposed configurations of Tmate’s button functions. When the Tmate control is active, the “Tuning Commands Panel” displays the following labels:

- TMate: Set LO if Lock To CF;
- TMate: Set Tune if Lock To CF or Lock ABS

If a Tmate2 is connected, the “Tmate2 Panel” is activated. In this panel, the user can set the display backlight color, the refresh time, the increment steps of the tree knobs and others timing paramenters.

3.9 Station Memory Tab



In the FDM-SW2, three types of memory source are available:

- Xml memory file;
- DX Cluster Connection;
- EIBI Database.

3.9.1 Xml memory file

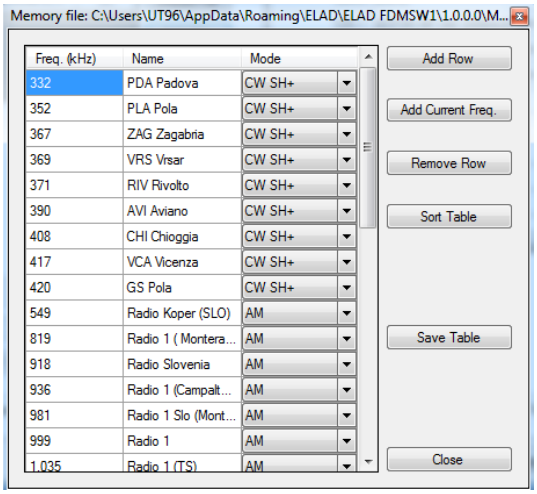
Select “File” as Station Memory Source.

Press 

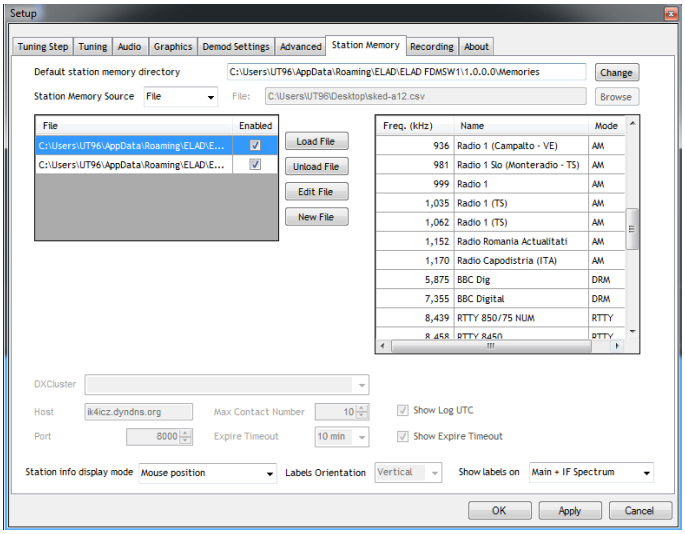
button to create a new memory file.

When a new file is created or when 

button is pressed, FDM-SW2 visualizes an “Edit” form (represented in the figure below): user can add or delete stations from the editor to create or change a memory file.



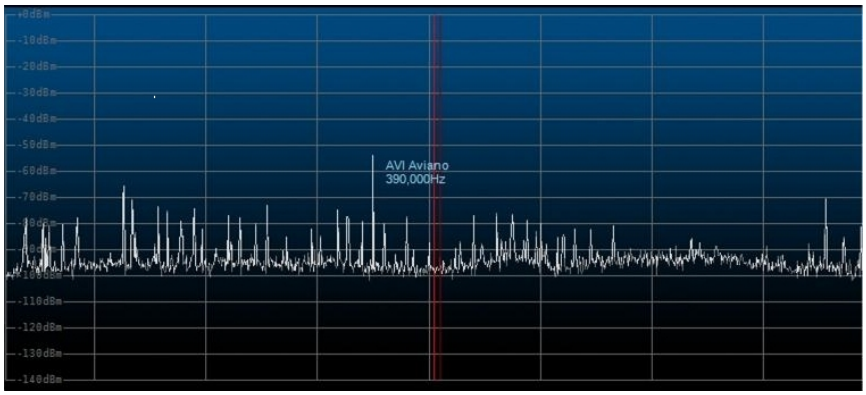
Press Load File or Unload File button to load or unload a memory file respectively (more than one memory file can be loaded at the same time).



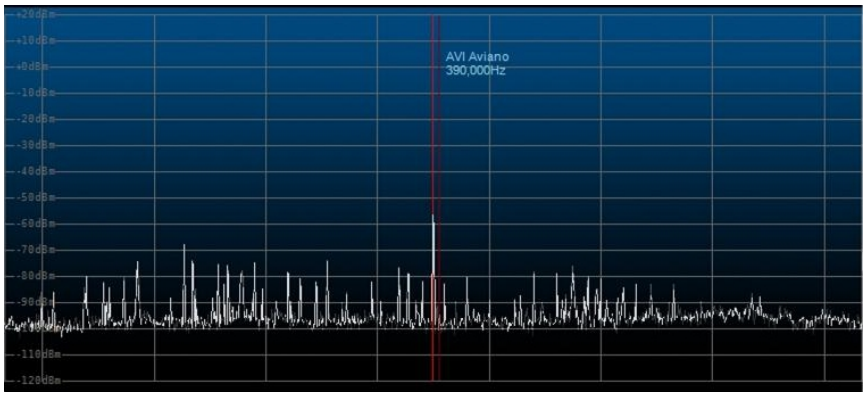
The table on the right side of the tab displays all the stations that are stored in the selected memory files.

The “Station info display mode” combo-box allows the user to choose 4 types of memories visualization on the Spectrum graphic:

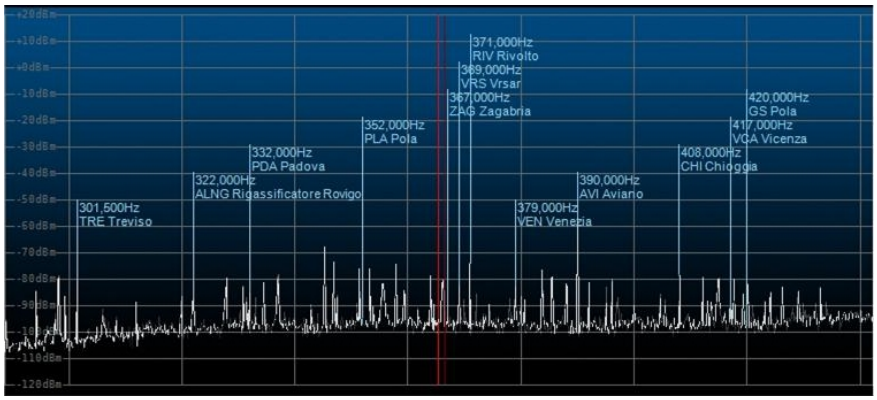
- “None”;
- “Mouse position”: a label containing the station info is displayed when the mouse is positioned over a frequency included in the selected memory files;



- “L.O. Frequency”: a label containing the station info is displayed when the L.O. frequency corresponds to a frequency included in the selected memory files;



- "If in frequency range": a label containing the station info is displayed for each frequency included in the selected memory files that falls within the Spectrum frequency range.



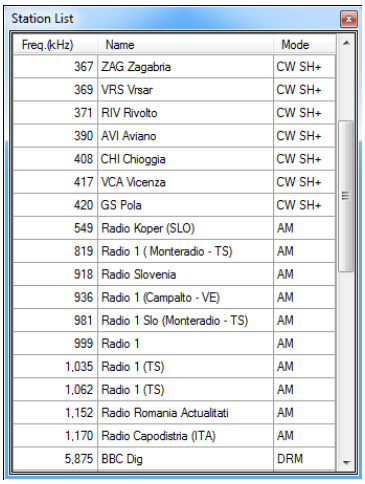
If the option "If in frequency range" is selected, the "Labels orientation" combo-box, allow the user to select three types of visualization:

- Horizontal
- Oblique
- Vertical

Finally, the combo-box "Show labels on", allow the user to enable the station memory label display on main spectrum window, on IF spectrum or on both the windows.

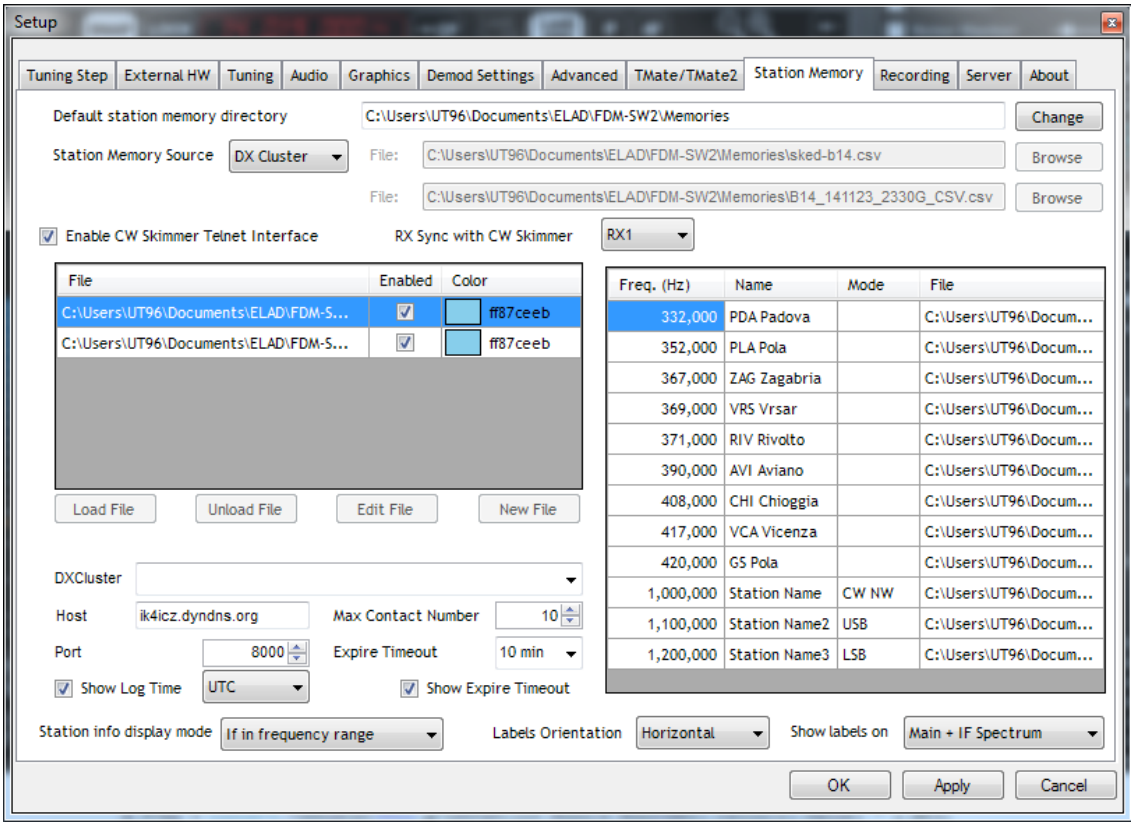
When the 

button is clicked, FDM-SW2 displays the "Station List" form. Clicking on a line of the table implies that the receiver is tuned at the selected frequency and the mode is set at the value saved in the file.

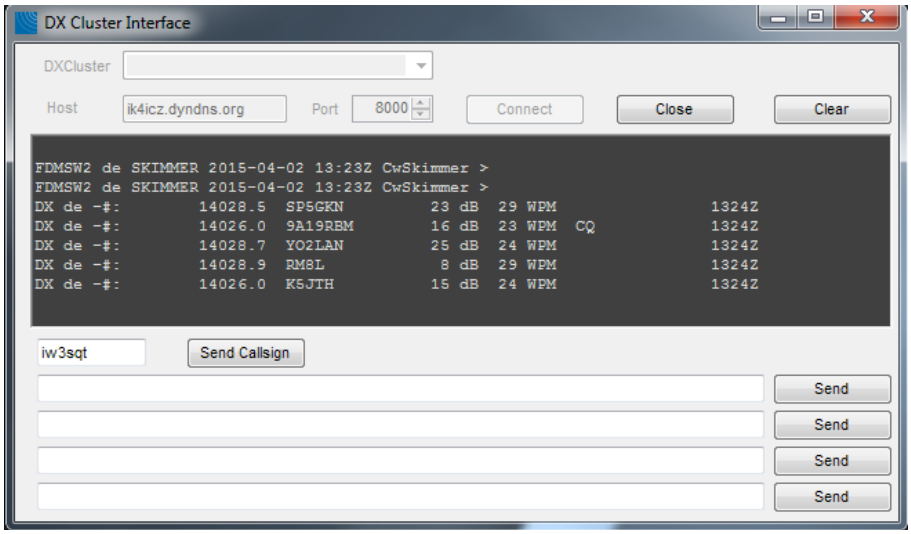


3.9.2 DX Cluster connection

Select “DX Cluster” as Station Memory Source: all options for “DXCluster” source are available on the bottom area of the tab. Select a cluster from the “DXCluster” combo-box or insert manually the cluster settings. The “Station info display mode” combo-box displays the same options described in the previous paragraph.

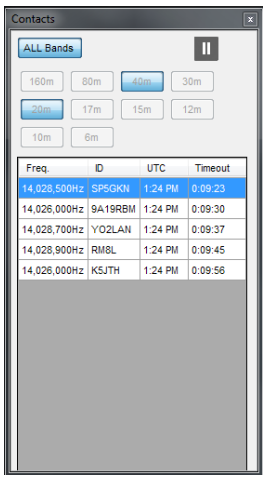


When the MEM button is clicked, FDM-SW2 displays the “DX Cluster Interface” form and the “Contacts” form.



Press Connect or Close button of the “DX Cluster Interface” form to open or close the link with the Cluster, and use Send to send the string entered in the “Send” area. If the Enable CW Skimmer Telnet Interface option is selected, when the Connect button is clicked, the software automatically opens a link with the telnet interface generated by the CW Skimmer software.

The “Contacts” form displays the users connected to the cluster. Double-clicking on a line of the table implies that the L.O. is tuned at the selected frequency. Use the “Show Log UTC” and “Show Expire Timeout” checkboxes to enable or disable the visualization of this information in the “Contacts” form.

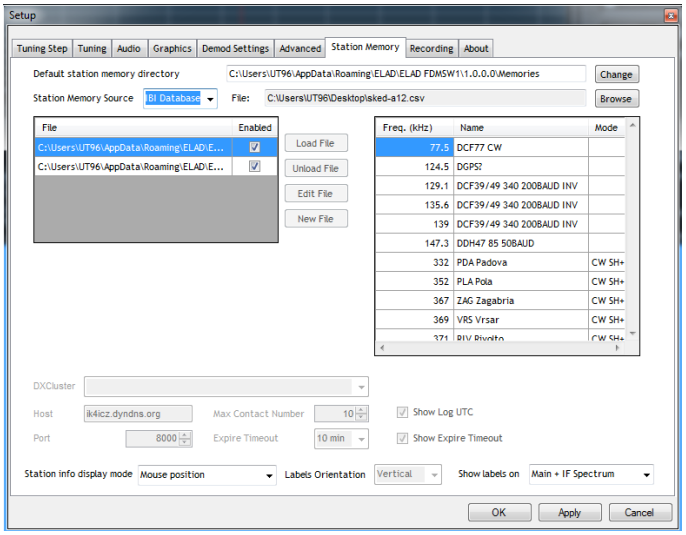


Use the button to pause/resume the contact list update process.

Check the ALL Bands to display all the contact from the cluster or select to display only from the contact only from selected radio-amateur band(s) by using the other buttons.

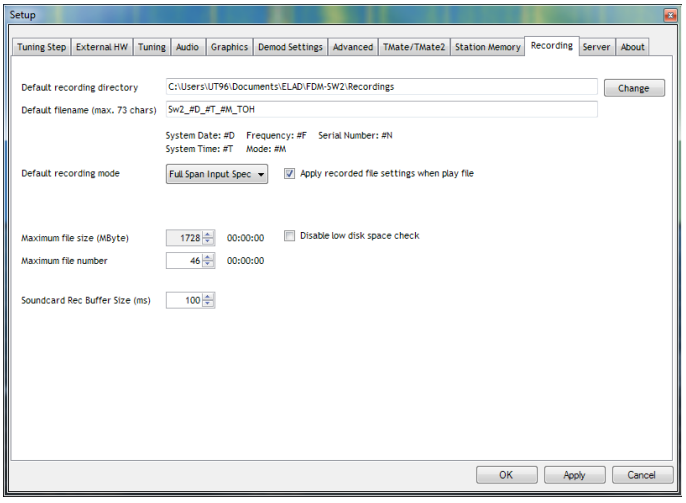
3.9.3 EIBI Database

Select “EIBI Database” as Station Memory Source. The “Station info display mode” combobox displays the same options described in the previous paragraphs.



Download the CSV database file from www.eibispace.de. Click the Browse button and select the downloaded .csf file.

3.10 Recording Tab



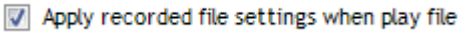
The “Recording” tab allows the user to configure:

- default directory for the recorded .wav files;
- default filename format. Use the following codes to customize the file name:
  - #D to insert the system date
  - #IF to insert the tuning frequency
  - #N to insert the receiver serial number
  - #T to insert the system time
  - #M to insert the demodulation mode

The SW automatically appends to the filename a prefix containing the data type (RF for “Full Span Input Spectrum” or AF for “Audio Frequency”) and a numeric suffix that represents the incremental index within a recording section;

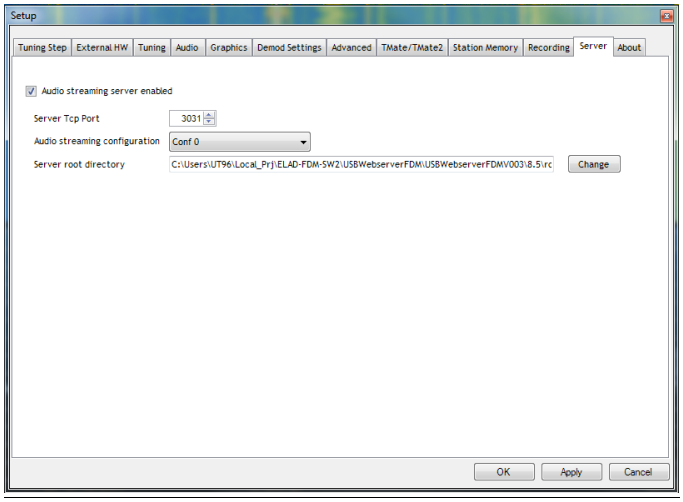
- default recording mode:
  - Full Span Input Spectrum (the sampling rate of the RF I/Q datastream depends on the HW configuration Dll loaded; see Chapter 6);
  - Audio Frequency;
- maximum allowed size for each recorded .wav files;
- maximum allowed number of .wav file for each recording session.
- “Soundcard Rec Buffer Size” allow the user to set the soundcard buffer time used when a file is recorded.

As explained in chapter 2.8, some information regarding the settings used during the recording and the playback (demodulation frequency, demodulation mode and filter bandwidth) of a .wav file is stored is stored in its header.

If the 

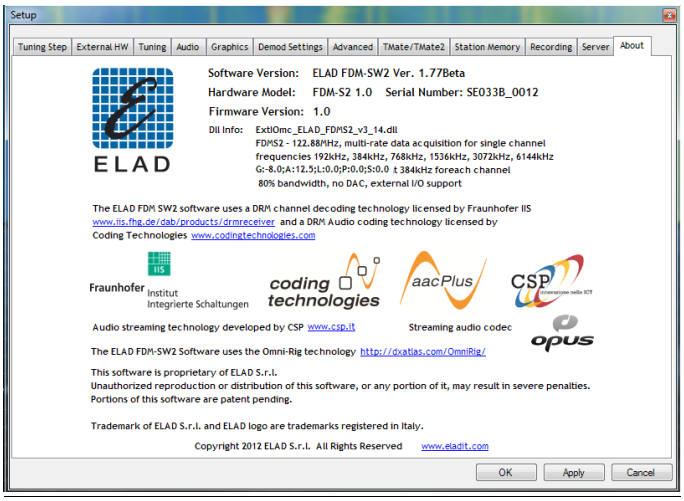
checkbox is checked, the stored information is automatically loaded by the software at the beginning of the playback of every file even though the files belong to the same recording session. This may cause an unwanted change of configuration in the transition between a file and the subsequent. If the checkbox is unchecked, the software loads the information stored in the header of the first file of the recording session and keeps this configuration unchanged until the end of the reproduction of the whole session.

3.11 Server Tab



In this tab it is possible to activate the Audio Streaming & Web Control functionality. Please see the Annex B for details

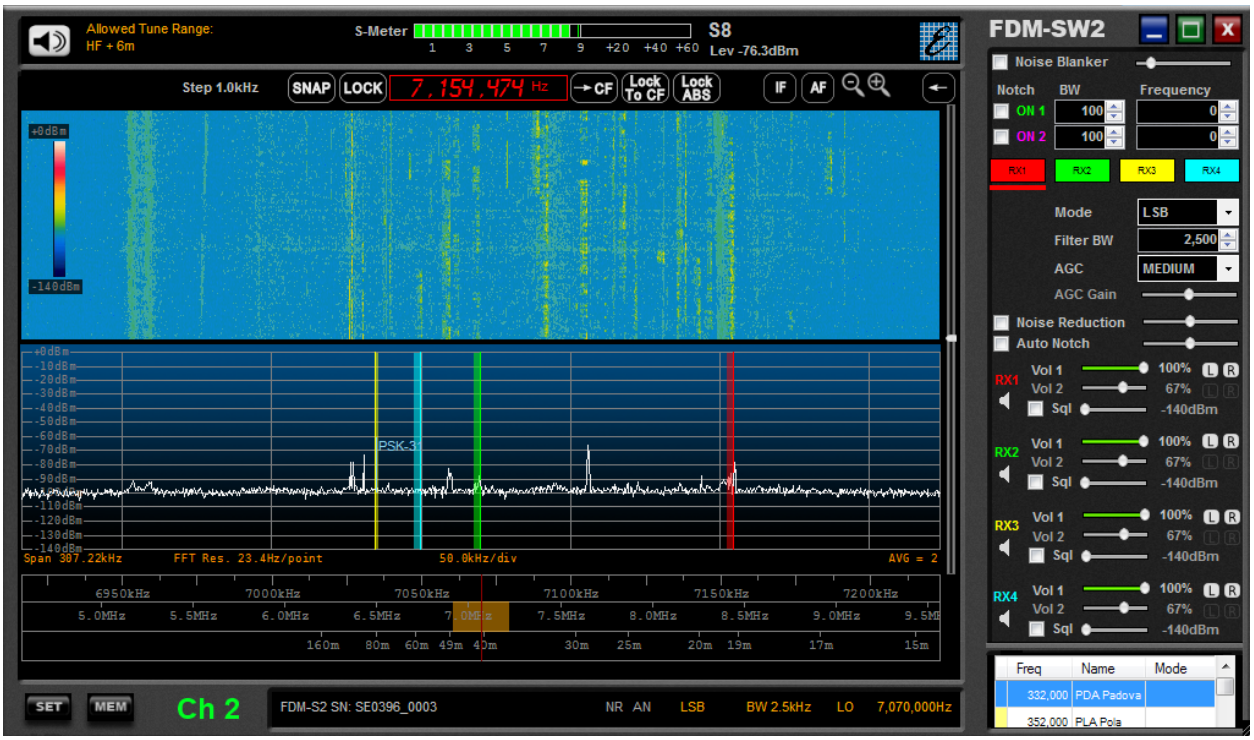
3.12 About Tab

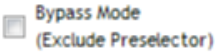


The “About” tab displays useful information about Software and Hardware.

4 Channel 2 Spectrum Window

If the connected device is a FDM-S2 and a Two-channel configuration is selected, click on CH2 button to open the Channel 2 spectrum window

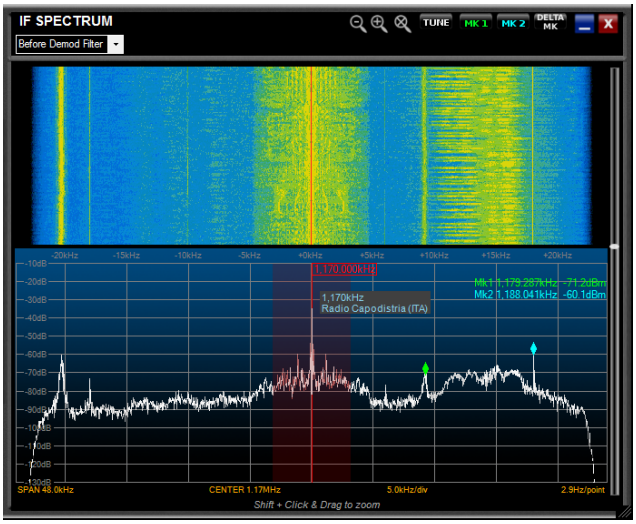


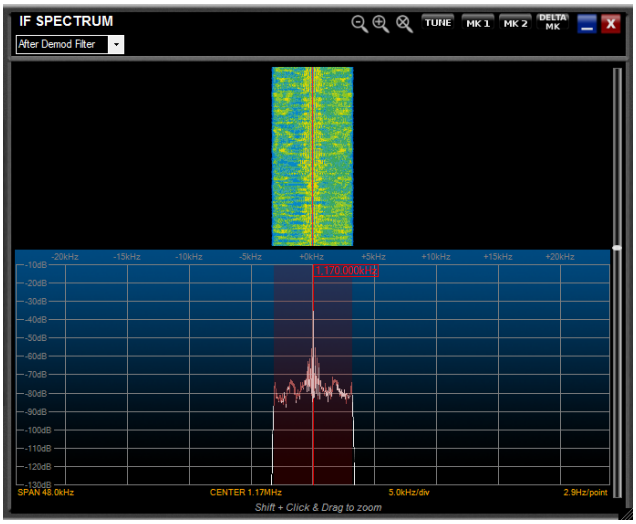
Note: If the option 

in the “Advanced” tab the setup form is not selected, the local oscillator of the Channel 2, can be tuned only in the “Allowed Tune Range” displayed in the upper left corner of the window.
This range depends by the frequency of the local oscillator in the main window.

5 IF Spectrum Form

If the Show IF Spectrum Form checkbox of the "Graphics" tab is selected (see Chapter 3.4), the "IF Spectrum" form is automatically loaded when the button is pressed.
This form displays the Spectrum/Waterfall of the IF frequency of the software. The frequency span is set to 192 kHz when the "WB FM" demodulation mode is selected, 48 kHz for the other modes.
The user can select to visualize the Spectrum/Waterfall of the IF signal "Before Demod Filter " or "After Demod Filter".

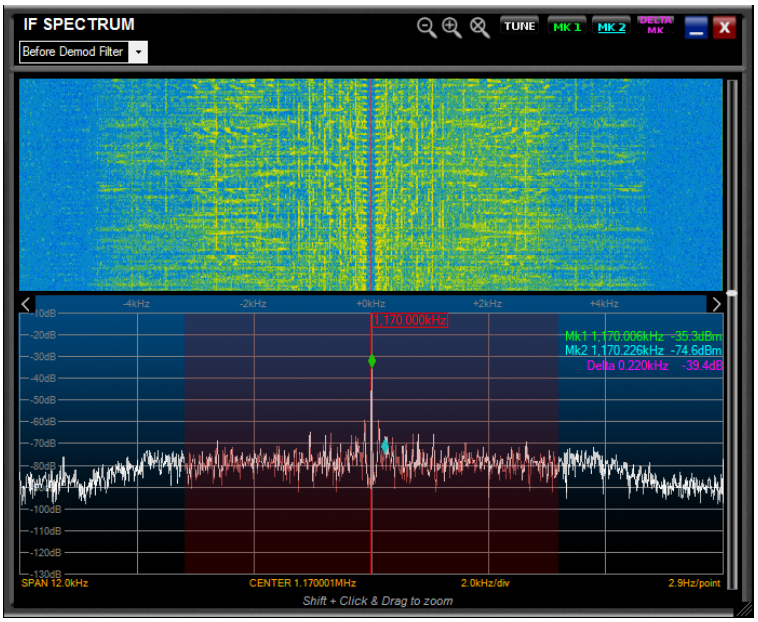




To zoom in/out the area of the tuning frequency, click on the / button.
To zoom a desired area, press the "Shift" button of the keyboard while operating the drag-and-drop action over the Spectrum. Use the arrows when zoom function is active to move left/right the visualization and click the button to reset the zoom.
User can perform three types of click function:

- set tuning to the selected frequency if TUNE is selected;
- set "Marker 1" if MK 1 is selected (Note: the label is green (MK 1) when the "Marker 1" is enabled while is green and underlined (MK 1) when the click function is active);
- set "Marker 2" if MK 2 is selected (Note: the label is cyan (MK 2) when the "Marker 2" is enabled while is cyan and underlined (MK 2) when the click function is active);

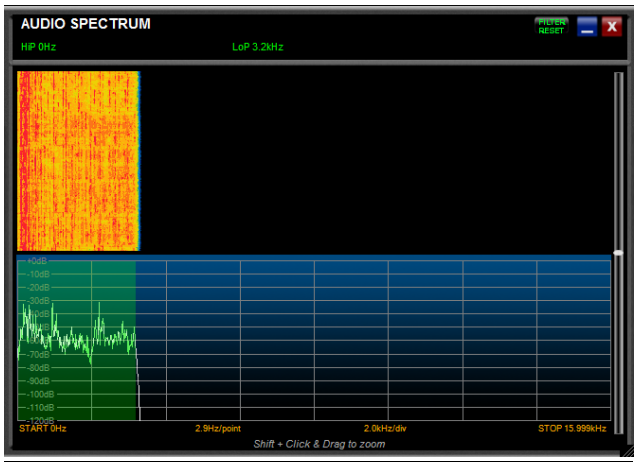
If both markers are enabled, user can activate the DELTA MK function that displays the frequency and amplitude difference between the markers.



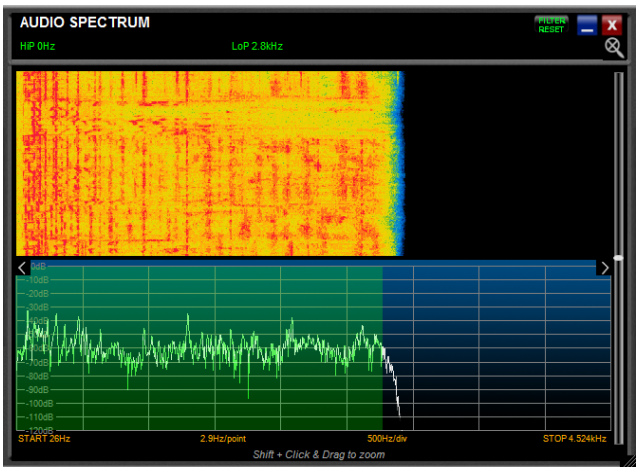
Drag-and-drop the bottom-right corner to resize the “IF Spectrum” form.

6 Audio Spectrum Form

If the Show Audio Spectrum Form checkbox of the "Graphics" tab is selected (see Chapter 3.4), the "Audio Spectrum" form is automatically loaded when the button is pressed. Furthermore, this form is loaded by default when the player is active and the data type of the reproduced .wav file is "Audio Frequency" (see Chapter 3.8).
The frequency span is set to 16 KHz for all demodulation modes.

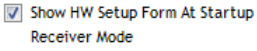


To zoom a desired area, press the "Shift" button of the keyboard while operating the drag-and-drop action over the Spectrum. Use the arrows when zoom function is active to move left/right the visualization and click the button to reset the zoom.
In CW, CW SH+, CW SH-, USB, LSB, AM, FM, SYNC AM and DSB mode an audio filter is inserted at the end of the demodulation chain (audio filter is omitted in WB FM and DRM demodulation). This filter is represented by the green area drawn over the audio Spectrum. User can modify the bandwidth of the audio filter by drag-and-drop the borders of this area (Note: the higher frequency of the audio filter is limited to the bandwidth of the demodulation filter).

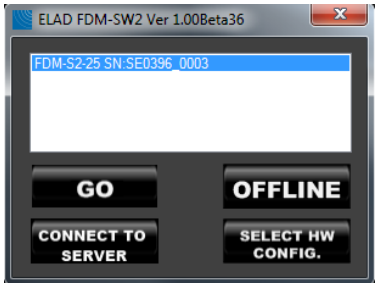


Drag-and-drop the bottom-right corner to resize the "Audio Spectrum" form.

7 FDM-SW2 Hardware Setup Form

If the option 

of the “Advanced” tab is selected, the “FDM-SW2 Hardware Setup” form is loaded at software startup (see Chapter 3.6).



Press 

button to start the FDM-SW2.

Press 

button to start the FDM-SW2 in “OFFLINE Mode” (see Chapter 7).

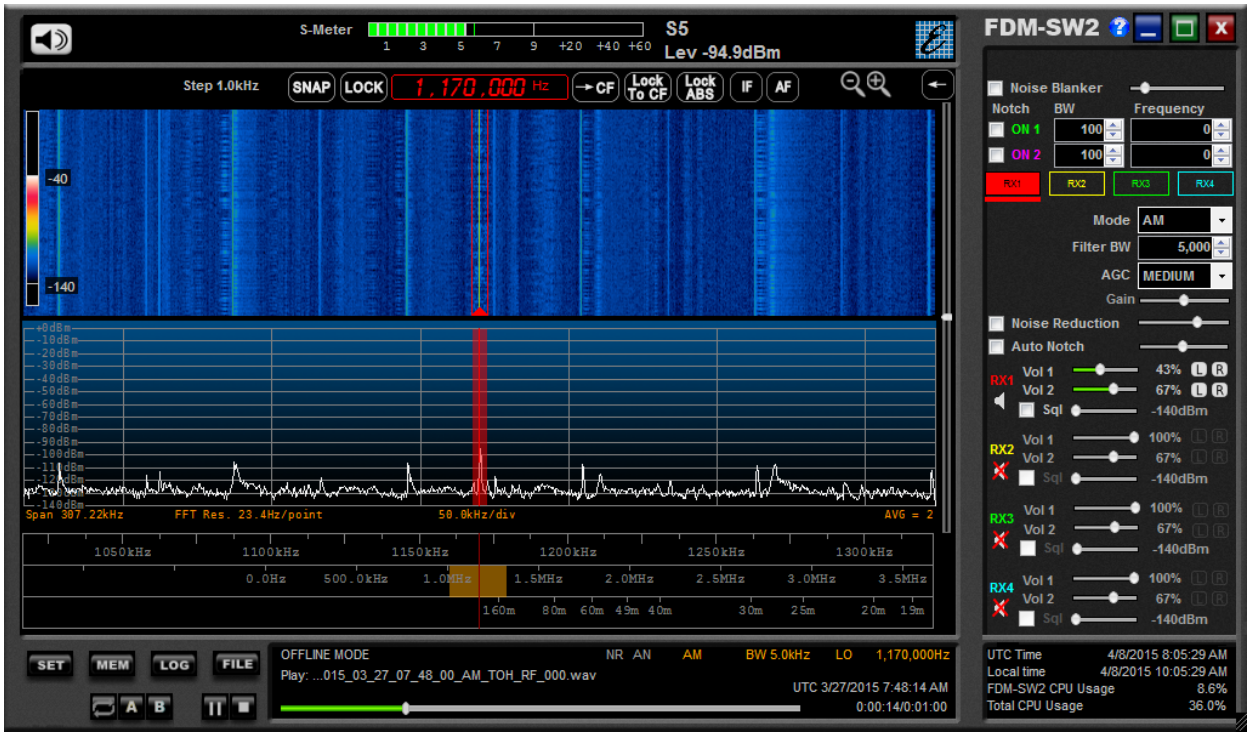
Since the FDM-SW2 is a general purpose software that works with the entire FDM-Sx Receiver family, the hardware configuration corresponding to the connected HW has to be selected. This operation is accomplished by clicking the 

button: a Windows dialog box is opened to allow the user to select the hardware configuration file (named ExtIOmc_ELAD_FDMSx_yyy.dll)

NOTE:
Please check out the latest update of your hardware related .dll file at www.eladit.com.

8 Offline Mode

If the OFFLINE button of the “FDM-SW2 Hardware Setup” form is pressed, FDM-SW2 starts in “OFFLINE Mode”. In this case, no connection with the hardware is established and only the playback of recorded files is available.



9 Connect to Server

Press the CONNECT TO SERVER button to connect the software to a remote FDM-Sx device through a server software (at the moment the server software is under development).

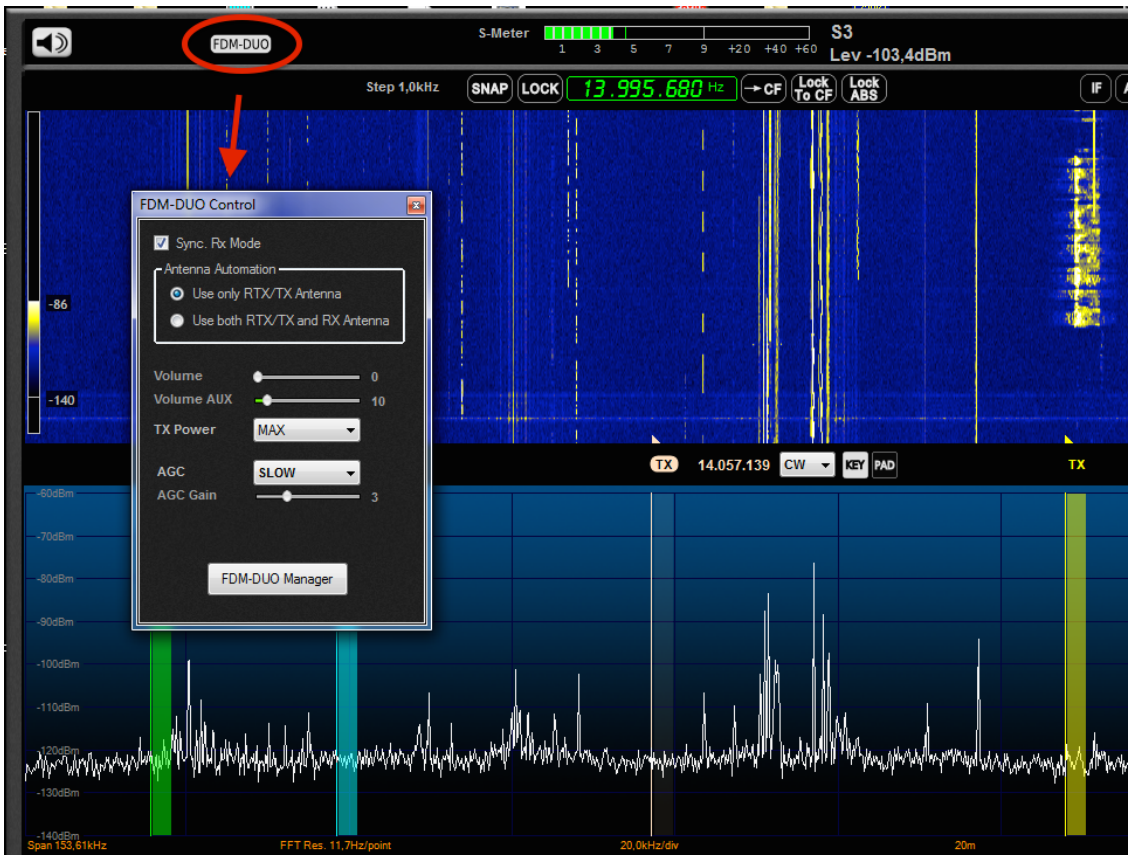
10 Serving FDM-DUO Transceiver

10.1 Introduction

When the FDM-DUO is connected to PC it is possible to explore new possibilities like monitor more than one frequencies and select where to transmit.

10.2 FDM-DUO control panel

On the main screen FDM-SW2 show a new button when connected to an FDM-DUO.
This button called FDM-DUO open FDM-DUO CONTROL PANEL. The main scope of this control panel is to setup the FDM-DUO from PC like without managing on the DUO buttons stand-alone menus.



The following paragraphs will show the functions now available

10.2.1 Sync Rx Mode

This check allow to sync the RX mode of the FDM-DUO wit FDM-SW2 software.

10.2.2 Antenna Automation

This setting allow to simply switch the RX antenna to RX/TX antenna and viceversa. It is very useful to compare 2 antennas or if the RX antenna have external preselector work in VHF frequencies.

10.2.3 Volume control

These are two sliders allow to control the Volume of the speaker of DUO and the Auxiliary volume (like Menu #3);

10.2.4 TX Power

This allow to easy set the transmit power output of the transceiver

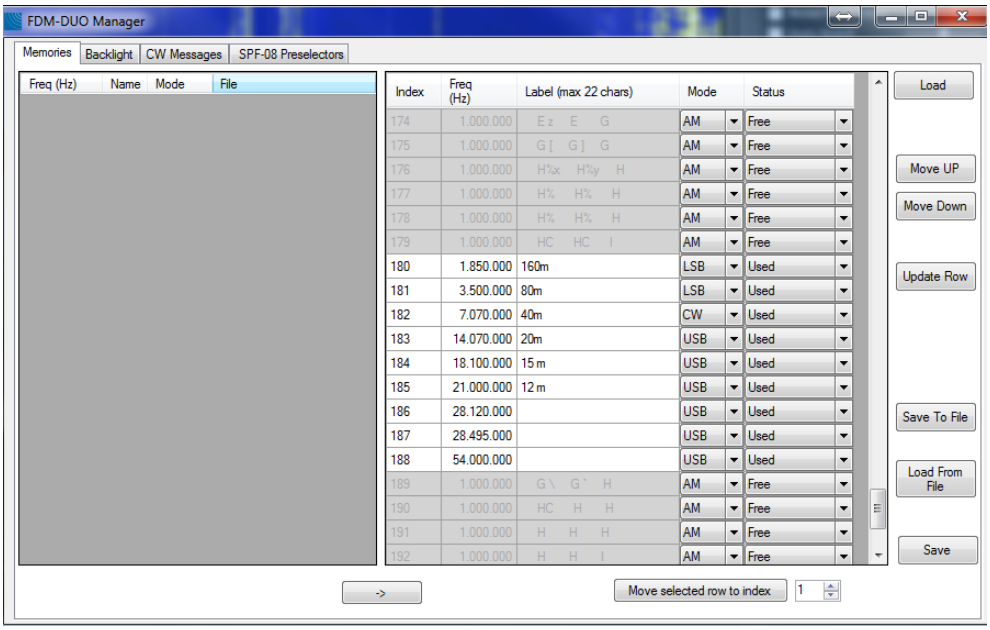
10.2.5 AGC

The AGC Mode and the Gain in case of manual AGC can be easy set by this menu.

10.3 FDM-DUO MANAGER

From the FDM-DUO control Panel is possible to access to the FDM-DUO Manager.
This operation need to have CAT USB connected.
FDM_DUO Manager allow to set some of the features memorized on the Stand-Alone FDM-DUO transceiver, like Memories, CW messages, LCD Backlight and Preselectors that can be used when in stand-alone mode.

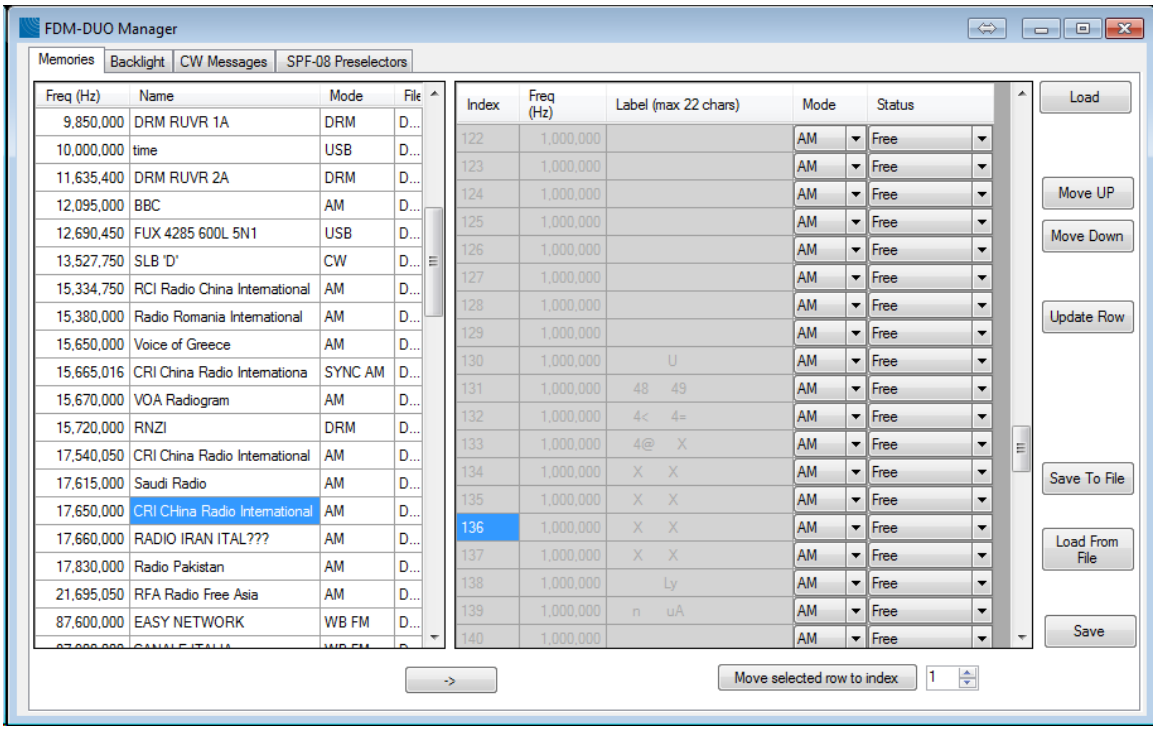
10.3.1 MEMORIES



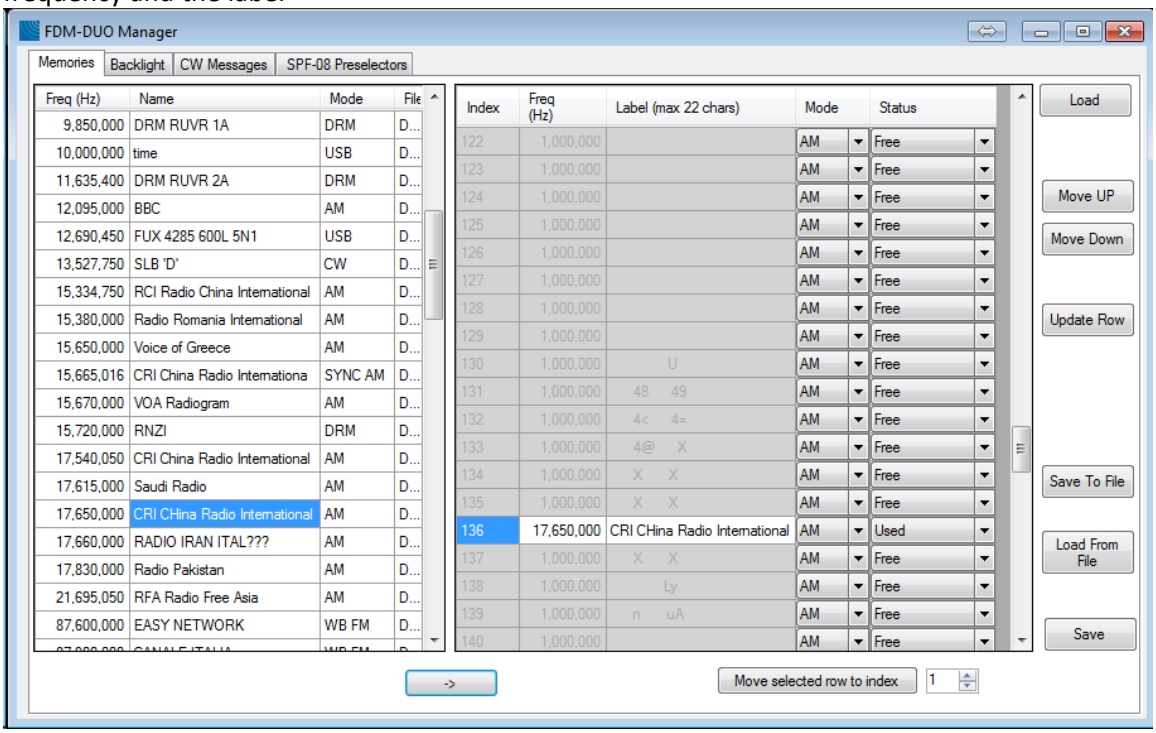
Once setup the correct COM CAT port DUO MANAGER will read all the configurations saved in the DUO RTX. The first Tab show the memory contents, here is possible to sort the memory positions (Move-UP or Move-Down), edit the labels set MODE for that frequency and SAVE to DUO with the SAVE Button.

To keep a copy of memory is possible to SAVE to FILE.

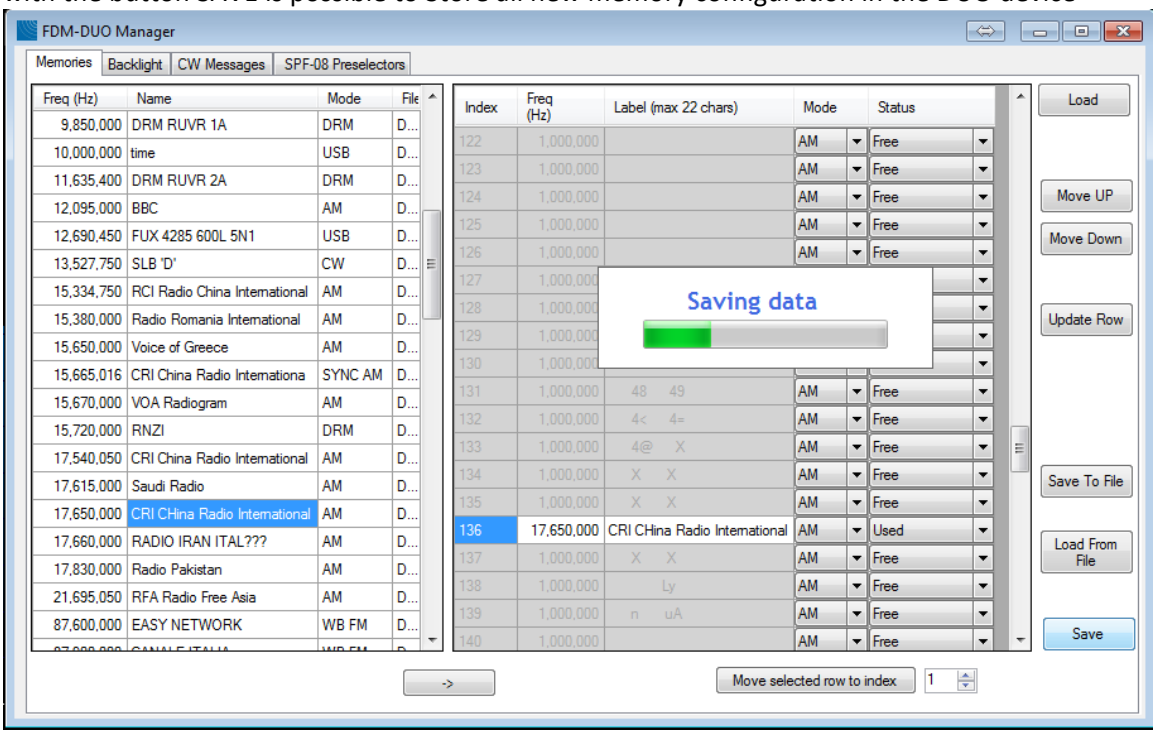
IF FDM-SW2 STATION MEMORY setting is set to File, on the left part of the FDM-DUO Manager will appear the directory of the stations memorized on FDM-SW2 like the figure below:



It is possible to copy the content of SW2 memories to DUO memories simply selecting the memory position (on left Radio China) and selecting the position you want to copy in the right side (in this example MEMO #136) then clicking on arrow button -> is possible to copy the frequency and the label

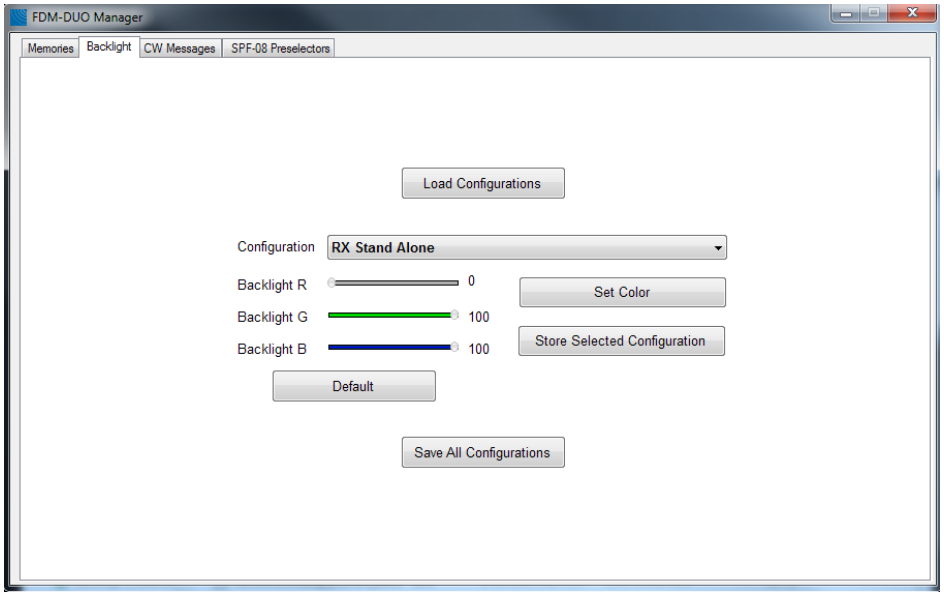


with the button SAVE is possible to Store all new memory configuration in the DUO device



10.3.2 BACKLIGHT

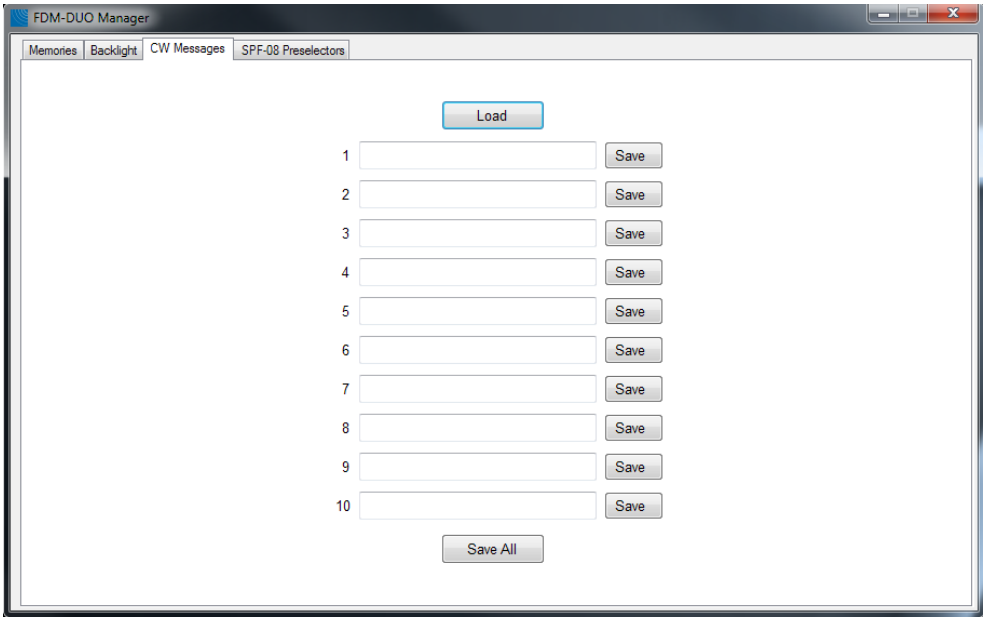
In this tab the user can configure the backlight color for each operating mode of the FDM-DUO



- "Load Configurations": reads from the FDM-DUO the backlight configuration settings
- "Configuration": select the configuration to modify
- Backlight R/ Backlight G/ Backlight B: adjust the red, green and blue component of the backlight for the selected configuration
- "Set Color": apply (without save) the slide bars settings
- "Store Selected Configuration": save the settings for the selected configuration
- "Default": set all configuration (without save into the FDM-DUO) to default values
- "Save All Configuration": save all configurations in the FDM-DUO

10.3.3 CW MESSAGES

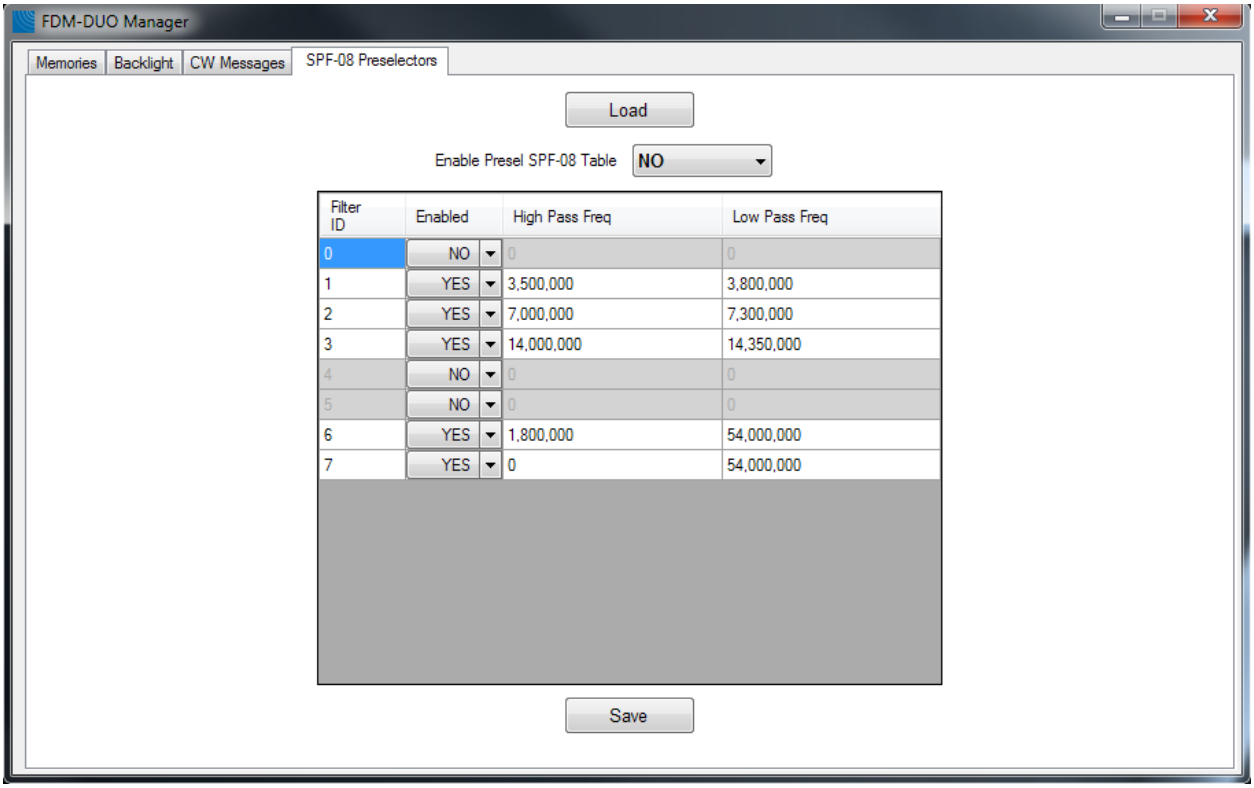
In the FDM-DUO it is possible to store ten CW messages



- "Load": reads from the FDM-DUO the stored CW messages
- Enter the CW message in a text boxe and click on "Save" to store the message
- Click on "Save All" to save all the messages

10.3.4 SPF-08 Preselector

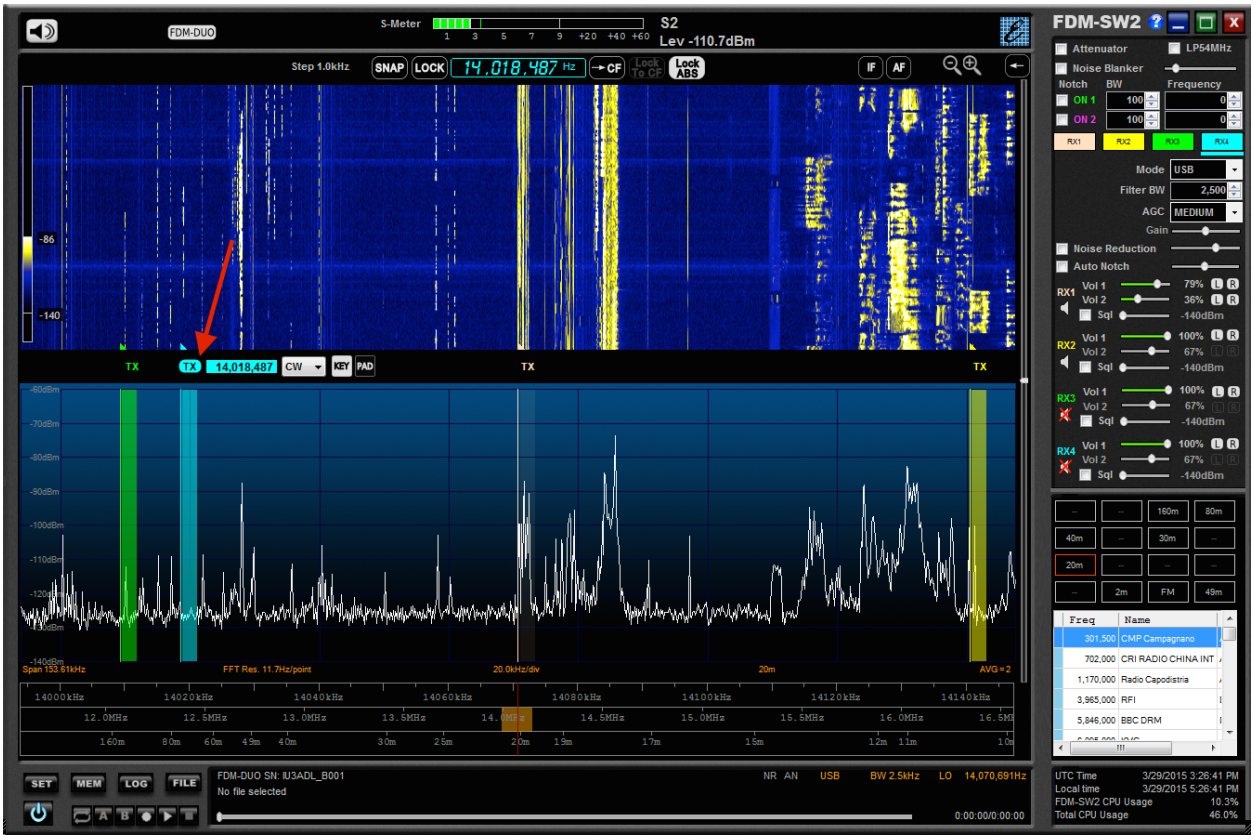
If the SFE-08 board is selected, the user can enable/disable each pre-selector and set pre-selector high pass and low pass frequency.



- "Load": reads the SPF-08 preselectors configuration stored in the FDM-DUO
- "Enable Presel SPF-08 Table": enable/Disable the Presel SPF-08 management
- "Save": save the configuration in the FDM-DUO

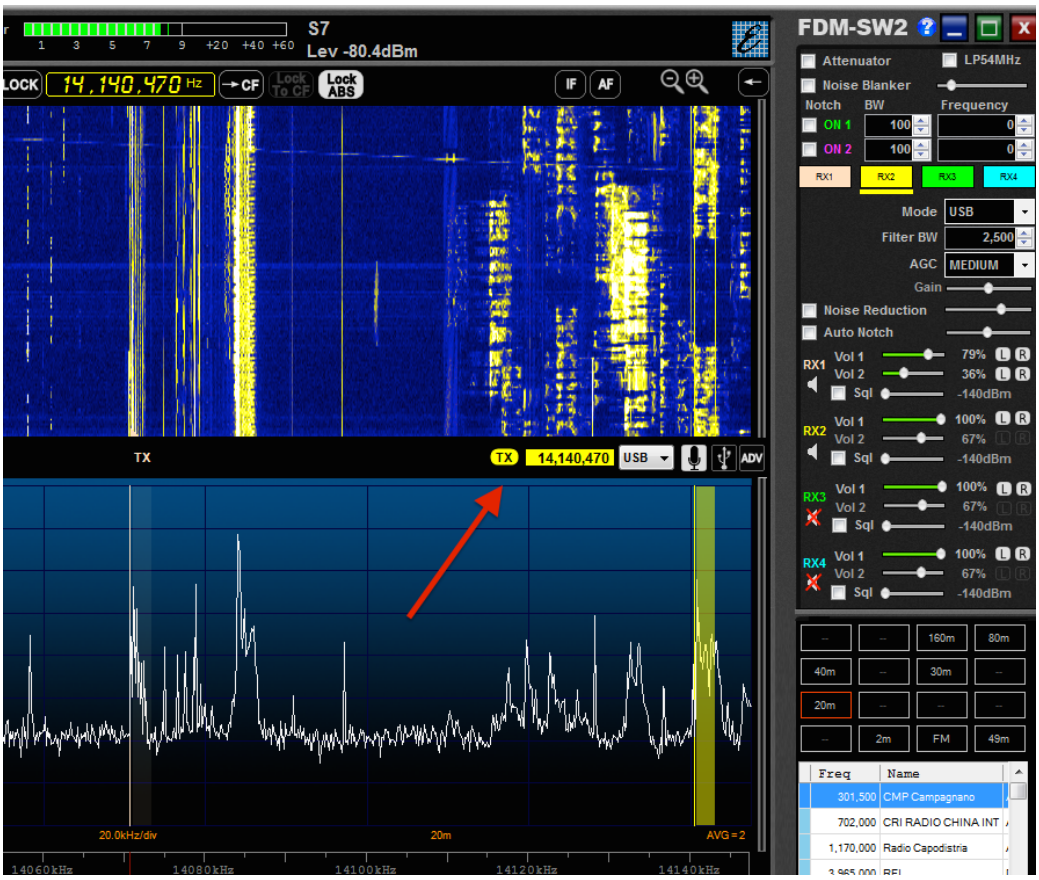
10.4 TRANSMITTING with DUO

FDM-DUO internal hardware have completely separate RX and TX block, FDM-SW2 take advantage of this by means of the function SPLIT.
When the SPLIT mode is selected the VFO A frequency is reserved for RX while VFO B set frequency is reserved for TX; showing this on the main panel of SW2 activating the receiver 4 TX button



the center center frequency is 14.070691 KHz (VFO A), the DUO VFO B is set to 14.018487 Hz, while in selecting the TX button Yellow (relative to RX2) the TX frequency (VFO B) will be set to 14.470140Hz.

ON the FDM DUO will appear SP meaning to be in SPLIT mode, and, in this condition is possible to monitor the TX frequency setting the display to visualize VFO-B.



The TX mode is selectable in the combo-box TX panels (CW, USB, LSB, AM and FM)

10.4.1 CW Transmitting mode options

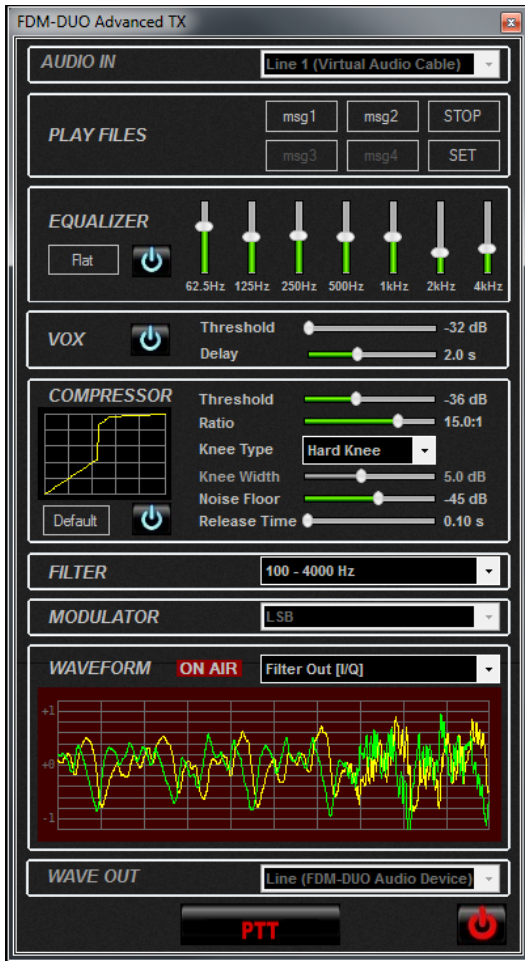
If the transmitting mode is set to CW, the user can choose the TX input between key or paddle

10.4.2 USB, LSB, AM, FM Transmitting mode options

If the transmitting mode is set to USB, LSB, AM or FM, the TX input can be set to:

-  : Microphone
-  : USB input soundcard
-  : If this button is clicked the Advanced TX controls widows is opened

10.4.3 FDM-DUO Advanced TX



- AUDIO IN: Select input device for transmission. It could be a microphone connected to the PC or another audio input device
- WAVE OUT: Select the output device. If you want to use the FDM-DUO to transmit, connect the FDM-DUO TX USB soundcard to the PC an select the device “Line (FDM-DUO Audio Device)”
- Click on  to start the process.
- The  is the ”Push To Talk” button.
- PLAY FILES
- EQUALIZER
- VOX
- COMPRESSOR
- FILTER
- MODULATOR
- WAVEFORM

Annex A
ELAD FDM-SW2 CAT Protocol

The FMD-SW2 implements a subset of the CAT commands of the Yaesu FT-897 transceiver.
The parameters of the serial port are listed in the following table.

Baud rate	38400
Data Size	8
Parity	None
Start Bits	1
Stop Bits	2

The command sent to FDMSW2 consists of 5 bytes and is structured as follows:

Data 1	Data 2	Data 3	Data 4	Command

FDM-SW2 software implements the following commands derived from the command set of FT-897:

Command Description	Data 1	Data 2	Data 3	Data 4	Command	Remarks
Set LO Frequency	100/10MHz	1MHz/100kHz	10/1kHz	100/10Hz	0x01	This commands sets the current frequency (see following command description)
Set operating mode	Mode Byte	X	X	X	0x07	See following command description
Read Receiver Status	X	X	X	X	0xE7	This command returns one byte containing receiver status (see following command description)
Read Frequency and mode	X	X	X	X	0x03	This command returns five bytes (see following command description)
Read EE prom Data	Address MSB	Address LSB	X	X	0xBB	This command causes ***two*** bytes of EEPROM data to be returned, beginning with the address in data bytes 1 and 2. (Approximately 6.25k of EEPROM data may be accessed - see following command description)
Read TX Metering	X	X	X	X	0xBD	This command returns one byte (00) when in receive. When in transmit, this command returns **two** bytes (in BCD format) indicating Forward power, VSWR, ALC, and Modulation.
Read Transmitter status	X	X	X	X	0xF7	This command returns one byte containing transmitter status (see following command description)
Set PTT ON	X	X	X	X	0x08	This "keys" the FT-817. In CW, this sets the radio to transmit mode, but does key the transmitter. Keying and unkeying the PTT line will cancel the transmit mode (i.e. put it back into receive.) This command returns 00 if the '817 was unkeyed, and F0 if already keyed.
Set PTT Off	X	X	X	X	0x88	This command puts the FT-817 into receive mode. This command returns 00 if the '817 was keyed, and F0 if already unkeyed.

Command Description

Command 0x01 - Set local oscillator frequency: the local oscillator frequency is set by the transmission of 4 Binary Coded Decimal (BCD) bytes. For example, to set the frequency at 435.12345 MHz the bytes to be sent are: **[43][51][23][45]** followed by the byte command **[01]**.
The command returns 1 byte set to **[00]**.

Command 0x03 - Read local oscillator frequency and mode: this command returns 5 bytes. The first four bytes contain the local oscillator frequency in the same format of the command **0x01** (4 BCD bytes), while the last byte contains the operating mode encoded as follows:

Mode	Value
LSB	0x00
USB	0x01
CW, CW SH+, CW SH-	0x02
AM, SYNC AM	0x04
FM, WB FM	0x06
DRM	0x07

Command 0x07 - Set operation mode: the first byte contains the operating mode that is encoded as follows:

Mode	Value
LSB	0x00
USB	0x01
CW	0x02
AM	0x04
WB FM	0x08
FM	0x88

The command returns 1 byte set to **[00]**.

Command 0xBB - Read EEPROM Data: this command returns 2 bytes. To simulate the behavior of the FT-897, the software replies to “EEprom read” request as follows

Address	Data 1	Data 2
0x006A	0xC4	0x20
0x00A9	0x00	0x05
0x006B	0x20	0x59
0x008C	0x00	0x00
0x00A8	0x00	0x18
0x008E	0x40	0x00

For example, if the software receive the command **[00] [6A] [00] [00] [BB]** the answer must be **[C4] [20]**.
Command 0xBD - Read TX Metering: This command returns 1 byte set to **[00]** when receive mode is enabled, while it returns 2 byte set to **[00] [00]** when transmit mode is enabled.

Command 0xE7 - Read Receiver Status: This command returns 1 byte. The 4 least significant bits indicate the current reading of S-METER. Some examples are reported in the following table

Retuned Byte	S-METER
0x00	S0
0x04	S4
0x09	S9
0x0A	S9+10
0x0B	S9+20
0x0F	S9+60

Command 0xF7 - Read Transmitter Status: This command returns 1 byte. If "*keyed*" the byte is set to **[7f]** otherwise **[ff].**

In addition to the controls derived from the command set of FT-897, the CAT protocol include specific commands for the FDM-SW2:

Command Description	Data 1	Data 2	Data 3	Data 4	Command	Remarks
Set operating mode SW2	Mode Byte	X	X	X	0xC7	See following command description
Read Tuning Frequency and mode	X	X	X	X	0xC8	This command returns five bytes (see following command description)
Set Tuning Frequency	100/10MHz	1MHz/100kHz	10/1kHz	100/10Hz	0xC9	This commands sets the current frequency (see following command description)
Read Locked Mode	X	X	X	X	0xCA	See following command description
Set Locked Mode	Locked Mode Byte	X	X	X	0xCB	See following command description
Read FDM-SW2 Status	X	X	X	X	0xCF	This command returns 10 bytes containing the FDM-SW2 status. (See following command description)

Command 0xC7 - Set operating mode SW2: the first byte contains the operating mode that is encoded as follows:

Mode	Value
CW	0x00
CW SH+	0x01
CW SH-	0x02
USB	0x03
LSB	0x04
AM	0x05
FM	0x06
DRM	0x07
WBFM	0x08
SYNC AM	0x09
DSB	0x0A

The command returns 1 byte set to **[00]**.

Command 0xC8 - Read tuning frequency and mode: this command returns 5 bytes. The first four bytes contain the tuning frequency in the same format of the command **0x01** (4 BCD bytes), while the last byte contains the operating mode encoded as in command **0xC7**.

Command 0xC9 – Set Tuning frequency: the tuning frequency is set by the transmission of 4 Binary Coded Decimal (BCD) bytes For example, to set the frequency at 435.12345 MHz the bytes to be sent are: **[43][51][23][45]** followed by the byte command **[C9]**. The command returns 1 byte set to **[00]**.

Command 0xCA – Read Locked Mode: this command returns 1 byte containing the receiver locked status

Mode	Value
Unlocked	0x00
Locked to CF	0x01
Locked ABS	0x02
LOCK	0x03

Command 0xCB – Set Locked Mode: this command returns 1 byte.

Mode	Value
Unlocked	0x00
Locked to CF	0x01
Locked ABS	0x02

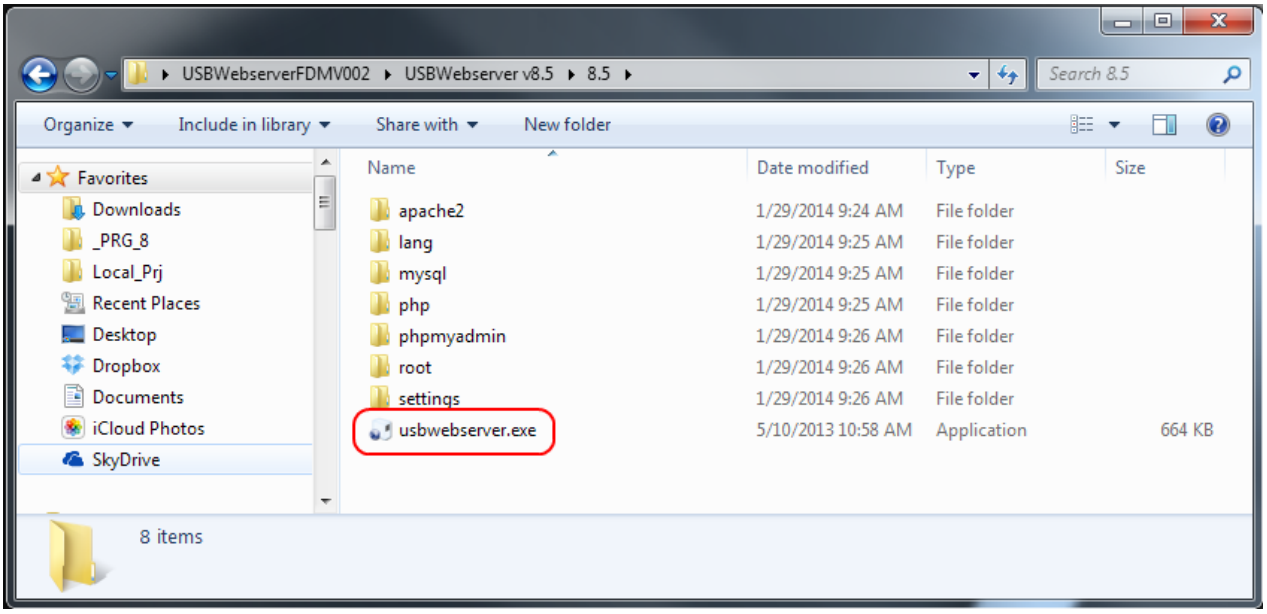
Command 0xCF - Read Global Status FDMSW2: this command returns 10 bytes containing the status of the FDM-SW2

- **Byte 0:** Locked Mode (encoded as in command **0xCA)**
- **Byte 1 – Byte 4:** LO Frequency (4 BCD)
- **Byte 5 –Byte 8:** Tuning frequency (4BCD)
- **Byte 9**: Operating mode (encoded as in command **0xC7)**

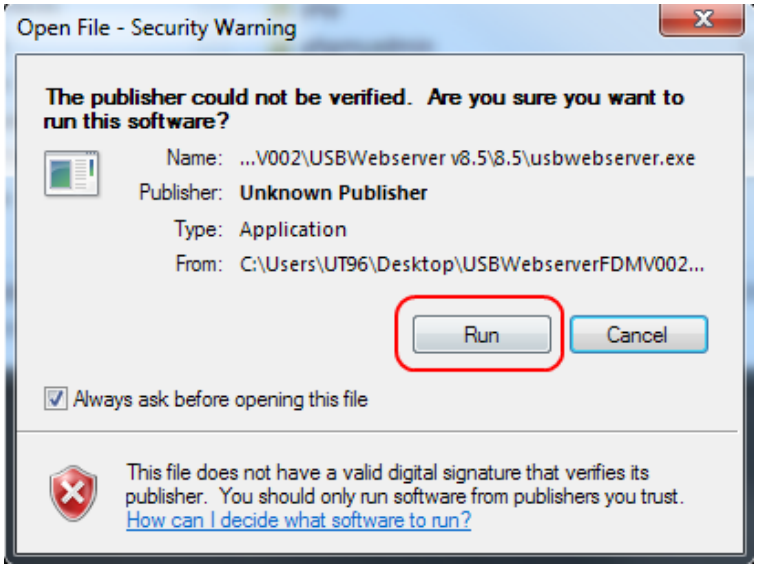
Annex B
Audio Streaming & Web Control

Starting USBWebserver

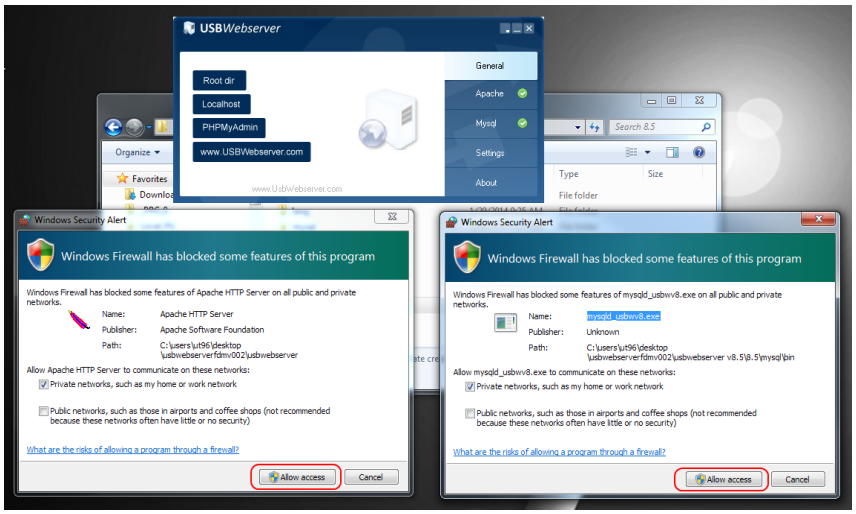
Open the folder USBWebserverFDMVxxx\USBWebserver v8.5\8.5 and launch the file usbwebserver.exe



If a security warning appears, click on “Run”

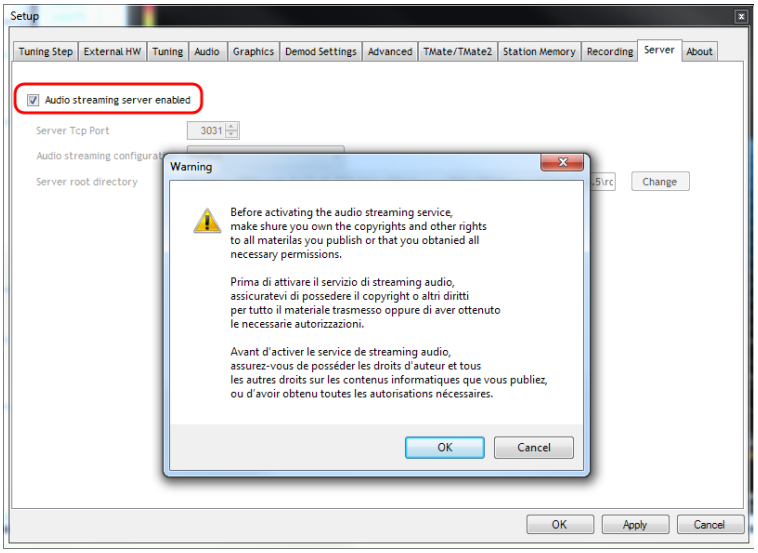


When the web server starts for the first time, two Windows security warning appears, click “Allow access” in both windows.

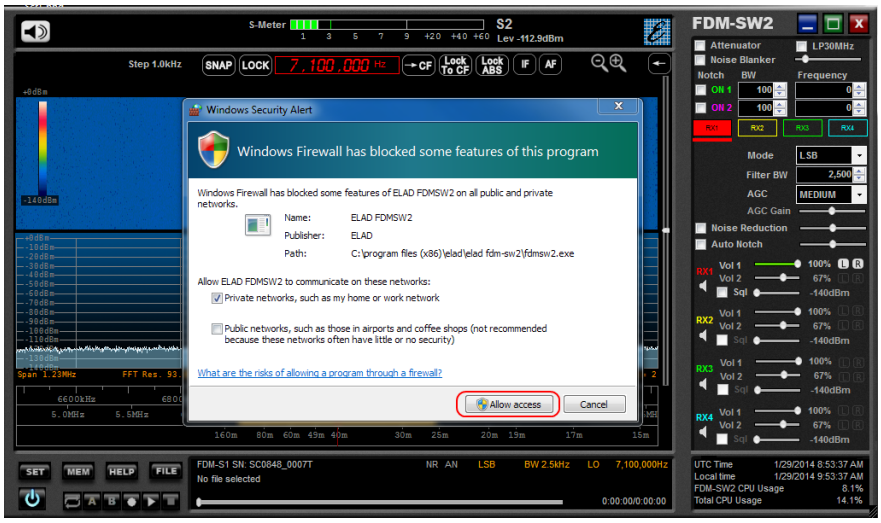


FDM-SW2 software settings

Open the FDM-SW2 software, open the setup widows by clicking on “SET” button and select the tab “Server”. Enable the check box “Audio streaming server enabled”. Read carefully the warning and then click “OK”.

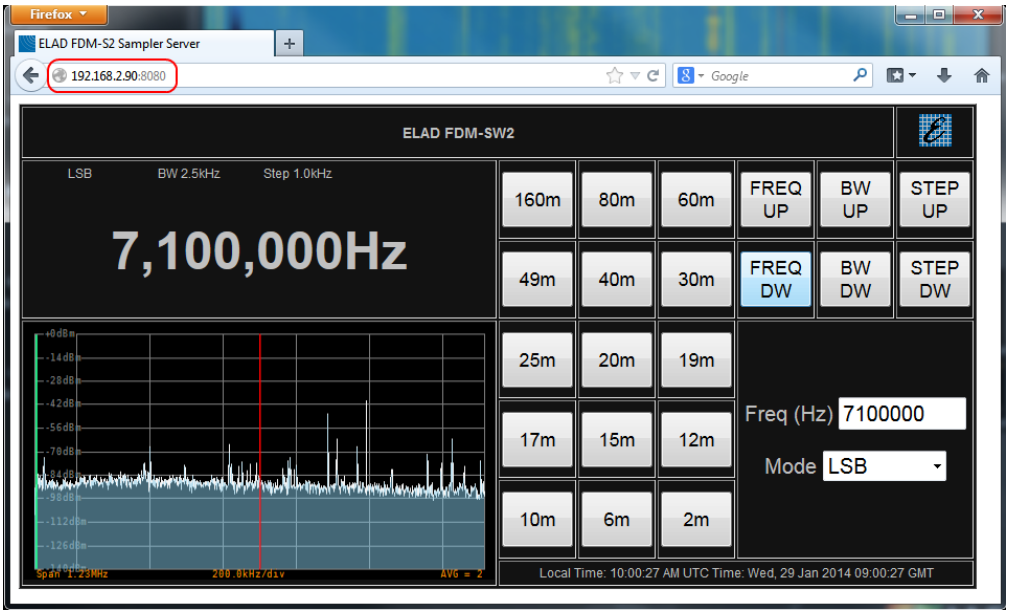


Select the same “Server Tcp Port” used by USBWebServer.
Click on “Change” to select the USBWebserver root directory. Select the folder:
USBWebserverFDMVxxx\USBWebserver v8.5\8.5\root
In the “Audio streaming configuration combo box” select “Conf 0”
Once the setup is saved, when the receiver start the acquisition, a Windows security warning appears, click “Allow access”.



Use with web browser

The Audio Streaming & Web control feature works only with Firefox web browser. Open Firefox and type in the address bar:
"ip address of the PC where FDM-SW2 is running":8080



If you are interested only to hear the audio stream, type in the address bar:
"ip address of the PC where FDM-SW2 is running":1412

Audio Streaming Configuration Description

- Conf 0
  - Codec: OPUS
  - Input Bitrate: 48kHz
  - Bitrate: 32kHz
  - Audio encoding frame size: 2.5ms
  - Maximum band-pass: 20kHz
- Conf 1
  - Codec: OPUS
  - Input Bitrate: 48kHz
  - Bitrate: 6kHz
  - Audio encoding frame size: 10ms
  - Maximum band-pass: 4kHz
- Conf 2
  - Codec: PCM
  - Bitrate: 48kHz
- Conf 3
  - Codec: PCM
  - Bitrate: 8kHz

Annex C
Restore to Factory Default

The FDM-SW2 software settings are stored in some files:

- **FDMSW2SwSetup.xml**: contains FDM-SW2 general settings like main windows position and size, graphics settings, default directory for save the recordings …
- **FDMSW2SwSetup_*XXXXX:*** specific settings for the connected receiver (where *XXXXX* is the FDM-Sx serial number, Offline for the offline mode)
- **FDMS2RxSetup_*XXXXX***: specific settings for the virtual receiver
- **FDMDS1Config.xml**: frequency related settings

If the files are corrupted or contains invalid data, the software can stop working correctly. However it is possible to restore the FDM-SW2 software in a stable state.

- Close the FDM-SW2 Software
- Open the FDM-SW2 configuration file directory:
  "local drive"\Users\"your user name"\Documents\ELAD\FDM-SW2
- Move the following files in another directory the setup files.

  Attention: by moving these files, you will lost all the user settings as last tuning frequency, demodulation mode, frequency related settings etc…

- Restart the software