

MDSR Spectrum Analyzer V1.6 for Windows
and for Linux (Raspberry PI 3+)

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<http://groups.yahoo.com/group/mdsr/>

FREWARE

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MDSR SA

Introduction

The new spectrum analyzer is written 100% in Java – including the DSP – and enhances the capabilities of MDSR. It will also work with the existing MDSR installation in Windows.

One of the issues with viewing an IF spectrum from an analog transceiver via a sound card interface is the inconsistency between the IF amplitude and the narrow bandwidth. This makes the spectrum look like a hump with no signals on either side. Therefore we have developed a new feature called SAC (spectral amplitude correction) which measures the attenuation of the IF and applies a correction factor which greatly flattens the spectrum.

This document will also explain how to install and run the software in the abovementioned operating systems. A detailed manual is also provided.

As an added feature since the V1.4 SA software there is now a Scanning RF Seismograph for long-duration noise measurements. The current limit is 24h of monitoring at a collection interval of 52s. After that the last data point drops off, providing a graph of the last 24h of band conditions. With a viewable area of 6h the graph can be moved via a scroll bar and the band conditions can be reviewed. This function is not available on commercial radios yet, which is unfortunate because even during the development of this feature, the RF noise monitoring has proven to be very interesting.

It permits monitoring of band openings even during times when the operator is not at her/his radio. The analysis of the noise/time graph will help to understand the propagation and the interference at your location.

Local noise sources that cause the noise level to go up will be visible in the graph. By providing the exact time when the noise occurs, it allows the operator to investigate and find noise-creating devices.

The RF noise is also affected by the radio waves and CMEs generated by the sun. During testing we measured a C2 solar flare in real time that was later confirmed on NOAA's website.

There is also a solar eclipse coming up in Aug. 2017 in North America. This eclipse will block the UV radiation that affects the ionosphere. The RF- Seismograph will be able to measure the effect on the noise level during such an event and record it. This has been implemented in the RF-Seismograph V1.6 (Solar Eclipse) release.

Features implemented with V J1.7 for Linux only

The newest update of the RF-Seismograph can now be installed and downloaded for Linux. The installation procedure now uses fl-rig to communicate with the transceiver. The audio hat has to be configured and working before this will work. For now we recommend the **Pi Audio V 1.4** sound hat. This is a very versatile sound hat and it performs very well. It is also easy to set up.

The Linux version differs slightly from the Windows version on the way the center frequency is calibrated. Since this software is stand alone and does not require the MDSR for now.

Follow these instructions for setting up on Linux:

<http://www3.telus.net/public/bc237/MDSR/SetupRF-SesimographLinux.pdf>

After installation start and configure fl-rig first and then start the RF-Seismograph. The RF-seismograph requires fl-rig to be working and running first.

Tracking and monitoring NOAA Solar Alerts

The new release features a message alert system that queries the NOAA alert server every 10min. If the file has been updated it will set up an alarm and automatically place the alert message on the graph window just above the propagation indicator. The alert text includes the NOAA alert and the time it was

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released in UTC time. The system can only handle one message at the time and the messages expire after a set time or if there is a new alert.

Storing and uploading of the Special Events Data

Release V1.6 is also the “Solar Eclipse” edition. It has the capability to upload the measured noise data to the MDSR ftp site for later inspection and possible sharing of the information with scientists over the world.

Sharing your Propagation with the World

While the solar experiment runs on August 21, the RF-Seismograph will collect data and also upload the measurement graphics to the MDSR ftp site. From there it can be used to display the images on any website.

Note: If you are planning to monitor with the RF-Seismograph, please join our MDSR Yahoo user group for updates on the event.

In order to make your propagation data available to your radio amateur neighbors that do not have their own "RF-Seismograph" running, the propagation graph and the data can be shared on the internet. By configuring and using the file upload feature, the two files containing the graphic and the propagation listing can be uploaded to our web server. From there, they can be accessed by adding code to your website.

A sample setup is provided in the help text.

Restoring last recorded Data

This new release stores the propagation data in a temp file. So when the software is shut down the noise measurement is stored on the computer. When the program is reactivated the last 24h of data will be displayed. The data will also recover to the last data point in case the computer is shut down accidentally.

This is a working document which will grow in size as we explore the possibilities of this new software. If you would like to join us and work on the continuing project, please register at the MDSR Yahoo user group here:

<https://groups.io/g/MDSRadio>

Information on how to connect a receiver or transmitter to the soundcard can also be found at our website hosted by Guy Roels (ON6MU):

<http://users.skynet.be/myspace/mdsr>

Acknowledgement:

Special thanks go to Phil Burk for providing the Jsyn FFT sound interface free of charge for this project. Many thanks go to the David H. Freese (W1HKJ). Dave and his associates maintain a whole set of interesting programs that can run on Linux, Mac and Windows.

Installing on Windows with MDSR already installed.

Download the “Spectrum Analyzer. jar” file from the Yahoo user group. Look in the file section in the “New SA for MDSR” folder. Copy the file into “MDSR” directory. Create a desktop shortcut. The program is started by double-clicking the file or shortcut.

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Note: The new features will only work with MDSR V3.1. MDSR V3 can be upgraded manually by downloading the V3.1 files from the group (in the files section). Unzip the file and follow procedure as described in the “Upgrade.txt” file. There also will be an installation file available in the near future. In this document MDSR refers to V 3.1.

Note: If the spectrum analyzer is used without the MDSR, additional library files are required. Create a “lib” folder inside the folder containing “Spectrum Analyzer.jar”. This “lib” folder and its contents can also be downloaded from the group.

Setting up the Soundcard or Device

The sound setup of the “New MDSR Spectrum Analyzer” is identical to the setup of the MDSR software. It always uses the default audio device, and can share it with other software at the same time. For more information on how to install and configure the LIF converter, go to the MDSR website or user group. If you have already set up the MDSR software, all the audio settings are identical. Both programs can work simultaneously without mutual interference.

Minimum Requirement to run the Java SA in Windows

The MDSR software is not required to run the Java SA, but the MDSR-SA needs to be working and CAT to be configured to control the radio. A LIF port and converter is required to feed to IF to the sound card. For more info see the MDSR-SA manual.

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Functionality of the Spectrum Analyzer

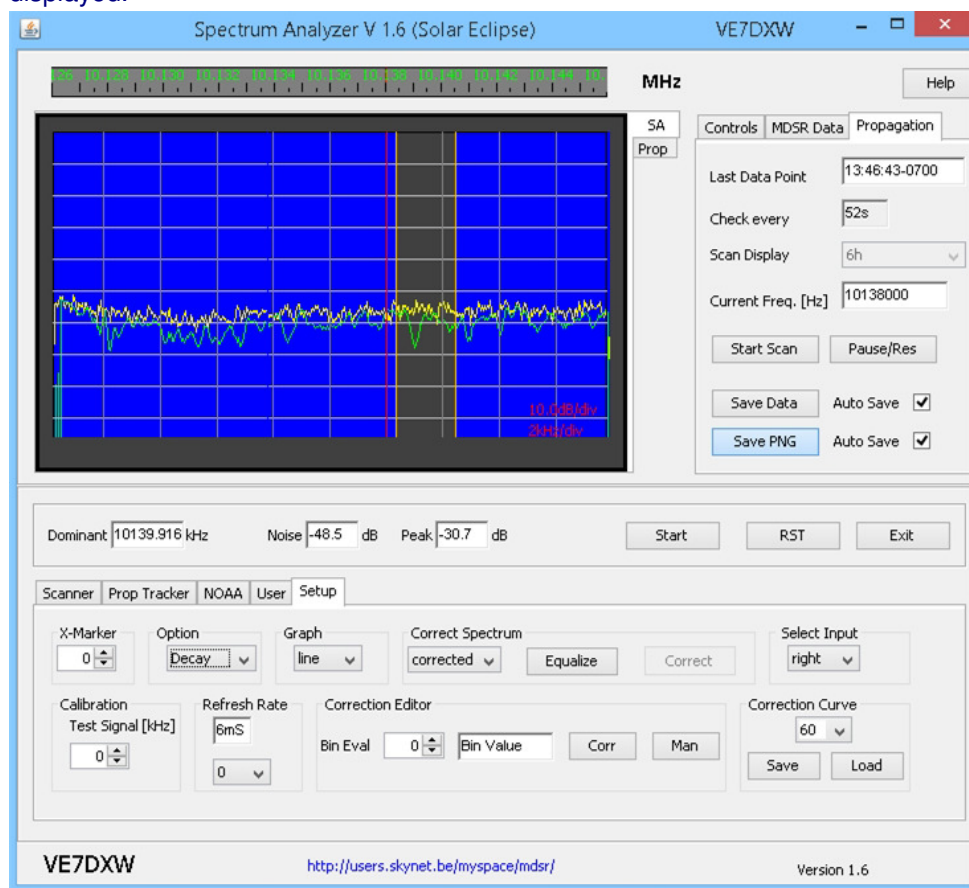
Introduction

This spectrum analyzer provides a span of spectrum for the audio spectrum of a sound card. It is designed to work with the MDSR software, but can also be useful for analyzing the audio spectrum. It has a peak hold feature and a slow decay indicator.

The SAC (spectral amplitude correction) feature and instructions for its use will also be covered in this manual. No additional hardware or operating system setup is required to have the MDSR and the MDSR-SA work together.

The new MDSR Spectrum Analyzer V1.6

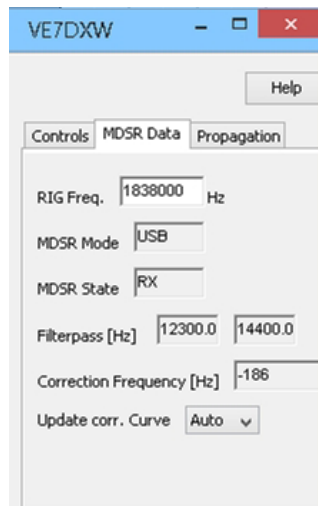
Below is the graphical user interface (GUI) for the new MDSR spectrum analyzer with the corrected display. The DSP removes the filter skirts which cause the spectrum to appear bent downwards at the edge of the filter passband. A flat spectral trace – like the one on a high-end lab spectrum analyzer – is displayed.



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The MDSR Data Tab for Windows Users

The MDSR Data tab displays the information that is passed from the MDSR and OmniRig to the MDSR-SA. The information is then processed and used in the SA to enhance its functionality. No additional calibration has to be performed on this data.



Rig Freq.: Displays the RX frequency as received from the CAT interface. It always matches the frequency display of the transceiver. The RX frequency is always centered on the spectrum.

MDSR Mode: Displays the mode of the MDSR software. This is not always the mode to which the transceiver is set, but always in sync with the MDSR.

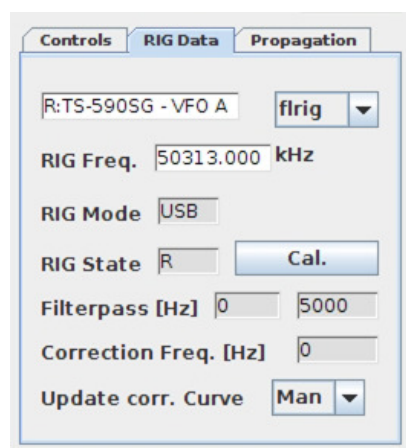
MDSR State: Displays the state that the transmitter and the MDSR are in. They are always the same unless there is an issue with the CAT interface to the transmitter. The MDSR state affects the display of the spectrum. The correction curve is only needed for RX and is therefore disabled during TX.

Filterpass: Displays the upper and lower edge of the bandpass filter. This information comes from the MDSR and reflects the DSP filter frequencies.

Correction Frequency: This is the correction factor used in the MDSR for the BFO synchronization with the LIF PCB. It corrects the displayed frequencies to display the RX frequency accurately.

The RIG Data Tab for Linux Users

The Rig Data tab has additional functionality to accommodate the frequency center setup for the Java SA. There is also a selection box that selects between MDSR data and fl-rig data. The MDSR data is currently



not used until the MDSR software is released for Linux. The selector-box has to be set to fl-rig for now. The field left to it shows the rig that is connected to fl-rig. The Java SA is sending data requests to fl-rig so fl-rig should be running before launching the Java SA.

Rig Freq.: Displays the RX frequency as received from the CAT interface. It always matches the frequency display of the transceiver. The RX frequency is always centered on the spectrum.

Rig Mode: Displays the mode of the receiver that is connected to fl-rig.

MDSR State: Displays the state of the transmitter only if the transceiver was keyed using fl-rig.

Filterpass: Displays the upper and lower edge of the bandpass filter of the connected unit.

Correction Frequency: This is the correction factor used in the Java-SA for the BFO synchronization with the LIF PCB. It corrects the displayed frequencies to display the RX frequency accurately.

Calibration Procedure to center the filter-box to the BFO = 0Hz line

Depending on the crystal LO frequency the 0 BFO line can vary from 11 to 18kHz. This feature was put in, because of the large variance of crystal oscillators which can vary +/-5kHz. Pulling the frequency with a variable capacitor only yields about +/-200Hz of adjustment. So the only way to do this calibration is by letting the software select the BFO line. After that all DSP functionality is referred to this calculated BFO line.

To calibrate, tune the receiver to a strong and stable carrier to BFO 0. Press the Cal. button. If the filterbox moved to - right or left - of the peak displayed the calibration is done.

Note: Depending on what mode the receiver is in the filter box is left or right. Left is usually LSB and right is USB.

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Correcting the filter skirts to obtain a flat spectral response

Introduction

After the input signal of the soundcard has been processed by the FFT (Fast Fourier Transform) processor, the signal consists of individual spectral lines about 47Hz apart. Each line has its amplitude value which is basically a decimal number corresponding to the input signal. All these data points are called *bins*, and this specific FFT creates 1024 bins for each data sample. In this application, only the first 420 bins are used. The first bin contains the spectral contents of 0Hz, the second 47Hz and so forth all the way to bin 420 which holds 20.000 kHz.

By measuring the filter response curve of the IF signal (using only band noise), it is assumed that the noise coming in to the receiver is flat. The filter response can therefore be calculated and corrected by the DSP. By performing a peak measurement for each bin, it can calculate the value required to equalize the spectrum display.

Once all the correction factors have been calculated and stored, the individual bins are multiplied by the corresponding correction factor values before they are displayed in the spectral display window.

Update corr. Curve: This selector box select the auto update function of the correction curves in the spectrum display. If this is set to Auto the correction curves are automatically updated as the transceiver changes bands. This function only works when the MDSR-SA and MDSR are communicating properly.

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Correction Procedure

The correction procedure is a two-step process, where the filter noise response is captured and stored in the computer. Once the curve had been captured, it is applied to the spectrum and a normalized spectral display results. The filter noise response depends on the noise loading and the band to which the transceiver is set. The noise response can be saved and recalled for each band separately.

How to calibrate and correct the filter response in the MDSR SA

Depending on the speed of the computer used, this calibration will take about 10s or longer.

1. Tune the receiver on the specific band in use to an area that has no signals. Set the attenuators to 0dB and the preamps to OFF.
2. Under the **“Corrected Spectrum”** heading set the selector box to **“normal”**. The spectrum changes back to the real display with the filter skirts (Fig. a).
3. Press the “Equalize” button and a display similar to that seen below appears (Fig. b). The white dots indicate the flat response of the corrected spectrum. The green line represents the correction factors. If the green line is not visible, move the “y-Gain” and/or “Ref.Level” controls until it becomes visible. If there are signals present, they will be seen as large spikes on the filter curve. Tune to another spot without signals and repeat the measurement starting at 1. Small spikes, like the ones below, will be filtered out and a flat spectrum will be displayed.
4. Press the “Correct” button to verify the correction line and to display the corrected flat display. Use the “y-Gain” and/or the “Ref.Level” control to adjust for best visibility.
5. If the spectral line is not flat, repeat the process.
Note: The measurement has to be done with the antenna connected, so as to obtain band noise to measure the filter response.

Calibrate and correct the filter response in the MDSR SA using a white noise generator

The spectrum display correction curves can also be generated with the use of a wideband white noise generator, such as the MFJ-5014. To get the best results, the antenna noise level and the generated noise level have to be identical.

The output of the generator is connected to a step attenuator such as the MFJ-762 and then to the antenna input of the receiver. If the receiver has a dual Antenna input the RF noise can be connected to Ant 2, while the regular antenna is connected to Ant 1.

1. Connect the Antenna to the receiver and set the attenuators to 0dB and the preamp to OFF (Ant 1).
2. At the receiver, select the band to be measured.
3. In the level [dB] box (bottom left) note the displayed level in the “noise” field.
4. Connect the receiver to the noise source (Ant 2).
5. Adjust the attenuator so that the displayed noise level is the same as that from the antenna.
6. Continue the above procedure at #2.

How to store the filter response in the MDSR SA for later recall

Once a flat filter response correction curve has been calculated and the corrected spectrum is flat, it can be stored on the computer’s hard-drive. Since the flatness of the display is dependent on the band and the noise loading, the MDSR SA has the capability to save individual correction curves per band. Currently the MDSR SA stores curves for 160, 80, 60, 40, 20, 17, 15, 12, 10 and 6 meters.

After a flat spectrum has been achieved by following the above procedure for a specific band, the correction curve can be saved as follows:

1. Under the “Correction Curve” heading, select the band that is currently in use.
2. Press the “Save” button. This will store a file containing the correction factors.

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3. Repeat the above procedure until correction curve files have been saved for all bands.

How to recall the filter response in the MDSR SA

1. Under the “Correction Curve” heading, select the band that is currently in use.
2. Press the “Load” button. This will recall a file containing the correction factors.
3. The displayed spectrum is now corrected and should be flat.

Note: Use the auto-update correction feature once you have created all curves and are using the MDSR software.

Fig. a.) Spectral Display without correction (line mode)

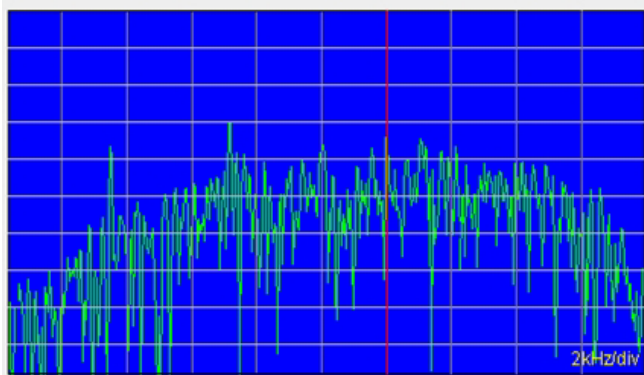
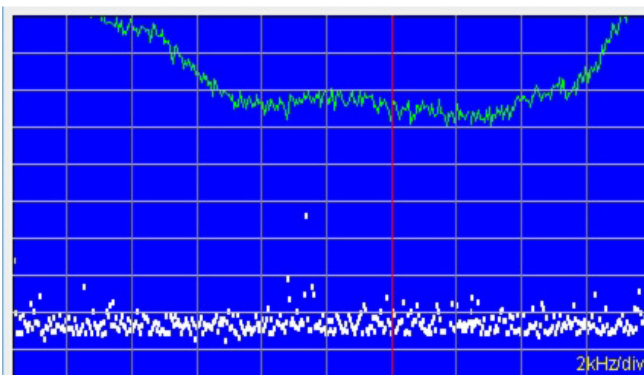
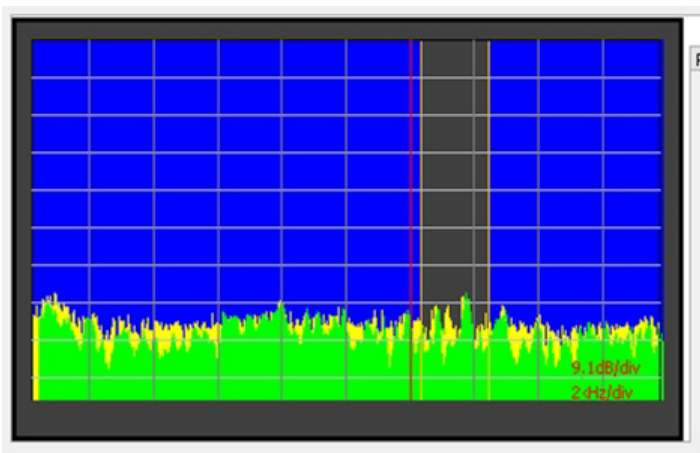


Fig. b.) Spectral Display while calibrating (line mode)



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Fig. c.) Spectral Display after correction (bar graph – decay option on)



Functionality of the Scanning RF Seismograph

Intro:

The scanning RF Seismograph allows monitoring the local noise and propagation conditions on 6 different bands or frequencies. This can be done without the need to be connected to the Internet (except when uploading images and data to the internet). The scanner has a pause function that stops scanning and allows the user to operate the transceiver normally. After completion of the manual task or TX operation the scan can be resumed.

Setup is easy because the monitor frequencies are preset for most calling channels and digital modes. The frequencies can also be manually entered and the bank can be saved.

Being able to monitor up to 6 different bands gives a good insight into how the local ionosphere is reflecting radio waves. As general rule the band noise decreases as the monitored frequency goes up. Due to local conditions and antenna performance this is not always the case. Very often change occurs within a few minutes, as it can be seen in the graphs.

The standard models that predict propagation use the sun, the solar flux, seasonal changes and the variation of the earth's magnetic field to predict if a band is open or not. This prediction is done on a global scale. It will not take local D-Layer variations into account; these can open up an amazing range of DX activity. There is also an increase of propagation after thunderstorms and other unknown processes which can not predicted with any propagation tool today.

The RF Seismograph is a tool that allows the user to find and work DX propagation even if the standard model indicates that there is no opening.

Why use JT-65 for propagation monitoring

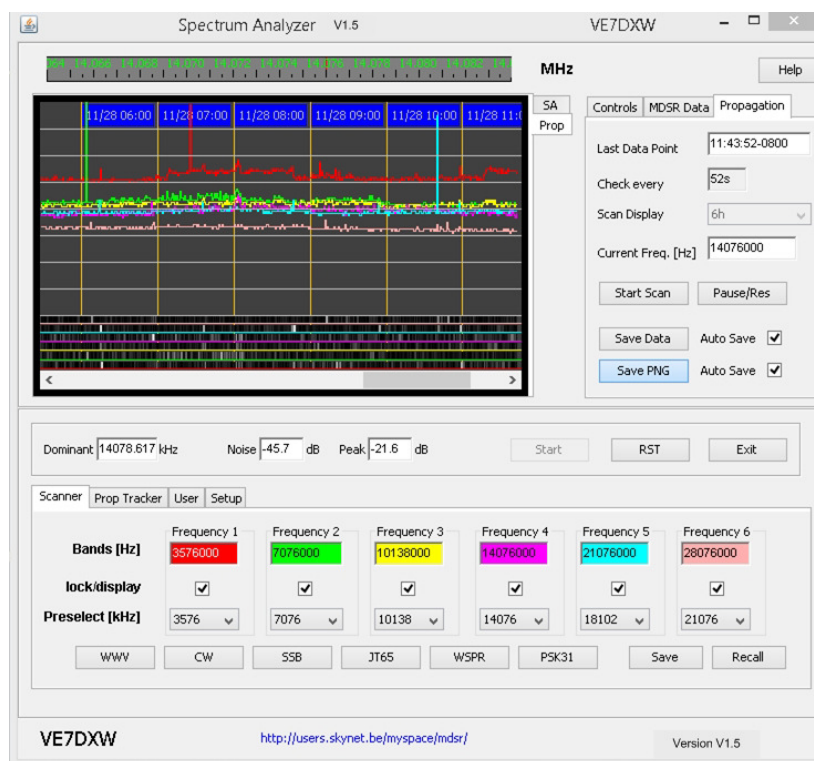
JT-65 signals are present almost any time of the day. If a band is open regardless of the signal path the RF-Seismograph will detect it. Beacons are only received when the specific path between the transmitter and the local station is active. JT-65 gives a more global result to propagation.

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The Scanning RF-Seismograph V1.6

The image below is the GUI for the Scanning RF-Seismograph. The graph shows the noise level of the scanned frequencies. The vertical lines (green) indicate JT-65 traffic on the 40m band between 6AM to 9AM. At the same time 30m (yellow) and 20m (magenta) show some activity. The long vertical spikes are static crashes. The blue boxes indicate the time marker's actual local time.

The black area on the bottom of the graph indicates propagation as per color code. The gray scale indication bars become more visible as propagation increases. Sporadic activity can be seen on the 15 and 10m propagation display. The area above the green line shows strong propagation for 40m before and after the 08:00 AM local time.



Setting up Bands / Frequencies to scan

The setup procedure for the Scanner is very simple, and the preset buttons make it even easier to scan the calling frequencies of your choice. Once the mode of interest is selected by pressing the corresponding preset button, the frequencies are listed in the drop down menu boxes. To make it easier they are already sorted. To make changes in the "Bands" field, the lock/display checkbox has to be unchecked. If it is unchecked the fields are updated every time a preselect button is pressed or the value is updated using the drop down boxes. Once the correct frequency is entered, check the lock /display checkbox and the frequency will be locked. The "Bands" fields can also be updated using the keyboard, and they will scan and update the transceiver as long as they contain a valid frequency in Hz. (MDSR-SA needs to be configured for CAT.)

Save and Recall

The Save button saves the current bank of frequencies. Once saved, they will load automatically once the Java SA is launched and started. The Recall button reloads these values too, but only if the lock/display checkbox is unselected.

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Starting a Scan

Once all frequencies are set up, click on the Prop tab on the right top of the spectrum display. This will start the propagation single frequency fast scan. To verify that everything is set up correctly, let the fast scan run. Make sure that the displayed graph matches the noise loading of the SA and follows it as it changes. (You can change the noise loading by changing bands manually on the receiver and observing the resulting graph)

Now press the Scan button in the Propagation tab and the scanning process will begin. The receiver will start to change frequencies as per selected scan every 8s. The display will update after the second scan (about two minutes) displaying channel #1 only. To make more traces visible, select the lock/display checkbox for each channel. For better visibility the traces can be turned on and off with the lock/display checkboxes.

Note: If the RF-Seismograph has previously recorded data it will recall the last 24h of operation.

Note: Once a scan is in progress, the transceiver cannot be used for anything else. The scanner is designed to run indefinitely on the computer and the graphic display will always show the last 24h of monitored noise levels.

Pause/Res

The Pause/Res button stops the scan and stops the recording of the measured noise level. Now the transceiver can be used for other tasks like QSOs. To resume scanning, deselect the Pause/Res button and the scanner continues and noise levels are recorded again.

Save Data

Pressing this button saves the collected data into a CSV (comma delimited data) file that can be used for further analysis. Prop<date><time>.csv files can be located in the User/home directory /MDSR_SA.

Auto Save (Data)

Checking auto will automatically save the collected data every 24h at midnight. Prop<date><time>.csv files can be located in the User/home directory /MDSR_SA.

Save PNG

Pressing this button will save a PNG image file of the graphics window into the User/home directory /MDSR_SA. Set the image with the scroll bar to display the last 6h every time you use the SA display. If the display is not set to display the last 6 hours the window will not auto-scroll. If the FTP User tab has been configured the data will be uploaded to the FTP server (see "Setting up the User parameters and FTP access" help options).

Auto Save (PNG)

Checking auto will automatically save the collected data every 24h at midnight. Prop<date><time>.csv files can be located in the User/home directory /MDSR_SA.

Changing Preselect Frequencies (for advanced users only)

The preselect frequencies are stored as text files in the User/home directory /MDSR_SA. The file names are CW.cfg, JT65.cfg, PSK31.cfg, SSB.cfg, WSPR.cfg, WWV.cfg. To change them, open them in a text editor and change the values representing kHz frequencies. A maximum of 10 lines is allowed.

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Operating the RF Seismograph

When the "New SA" is started the RF Seismograph is in standby. Selecting the "Prop" tab will start it, and to confirm functionality it will measure once a second with time indicators at one minute intervals. This allows a quick test of the surrounding noise with a maximum display time of about the last 7 min.

Long Time RF Seismograph measurements

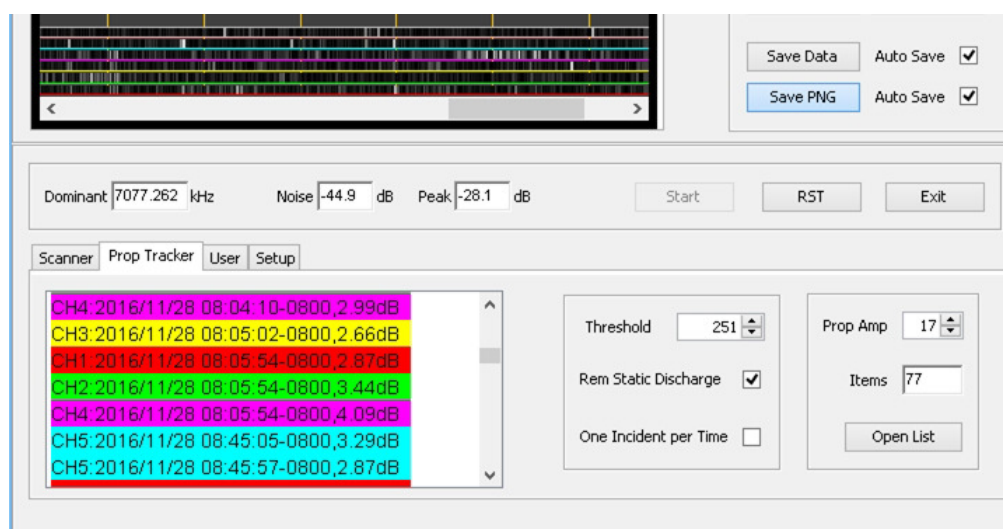
The long time measurement measures the band every 52s and creates a graph that will display the last 24h rolling over the last measurement once 24h of data has been collected.

Select the "Propagation" tab and press the "Start Scan" button. The "Check every" field will indicate that the update time has changed to 52s. Also the "Last Data Point" indicator will slow down and only update every 52s. Once this is all set up, the station and the computer have to be left on. The graph will get longer as time progresses. Also see: Hints on running the RF-Seismograph for long periods of time.

Propagation Measurement

The Propagation Measurement works almost without any need to do more configuration. Select the "Prop Tracker" tab and if the RF-Seismograph has been running for at least 1h usable propagation indication can be achieved. The individual events are displayed as a color-coded listing that lists channel number, date - time (UTC offset) and the actual measured signal to noise ratio.

Note: in this display the order is last event at the bottom



The highlighted colors represent the colors that were selected in the scan window.

Setting the Threshold data filter

The Threshold data filter selects the amount of incidents which are displayed in the propagation text box. It works like a squelch control. The higher the value the stronger the signal has to be before it is considered propagation. The total count can be seen "Items" field on the right. The SN indication at the end of each line is equivalent to 1/100 of the threshold setting (1.00dB = 100). This indicator has to be adjusted to allow for low signals to create a propagation log as well as limiting the amount of incidents that are created. A balance has to be found.

Note: As a general rule the quantity of listings will vary between night and day. On a good propagation day there should be up to 200 listings for the last 6h. During the early hours of the morning, the propagation will go down to just a few listings.

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Rem Static Discharges

Static Discharges create spikes in the graph display, and because of their nature they can be interpreted as propagation. These events are very strong and therefore they can be filtered to only show true propagation events.

Note: If the checkbox is de-selected, static discharges will be listed as "SD" events.

One Incident per time

If there are multiple propagation incidents that occur at the same time but on different bands; selecting this option will limit the propagation list, because each event is time-distinct. Only the lower channel incident is displayed.

Pro Amp

Propagation Amplifier affects the propagation display below the noise graphs. The higher the value, the more white gain will be visible. Choose a value that provides the best gray scale resolution (~20). Black is no propagation and white is best propagation.

Note: If this value is 0 there will be no propagation display

Items

This number is the total count of all the propagation incidents that the Propagation Monitor has detected in the last 6h. Changing the Threshold setting will affect how many items are on the list.

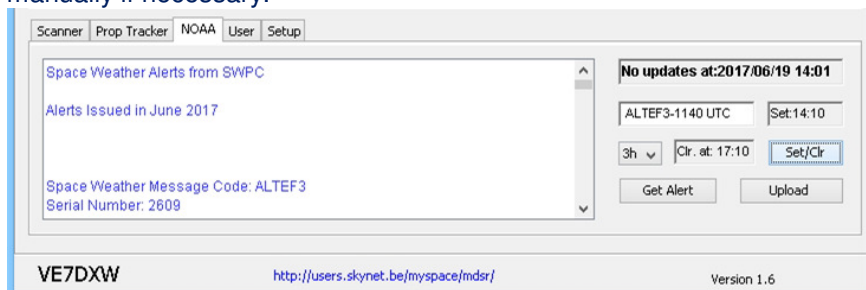
Open List button

This button will display the auto generated propagation html code in your web-browser. It allows you to confirm that all the information that is uploaded to the web has been configured correctly. It uses a local file that is displayed on the browser. No file will be uploaded to the Internet.

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The NOAA Information and Alert Window (new)

The new NOAA tab gives the user access to the NOAA Alert and Warning system on an almost real time bases. The RF-Seismograph will automatically check for updates every 10min and can also be queried manually if necessary.



NOAA Alarm Window

The big window contains the actual message that NOAA puts out whenever their instruments detect adverse space weather conditions. This document can be quite long; use the scroll bar on the right to scan through the document. It is a very detailed document and it has synopses for each alert. The latest alert is always on top and contains the “Space Weather Message Code” as well as a “Serial Number” and the issue date/ UTC time.

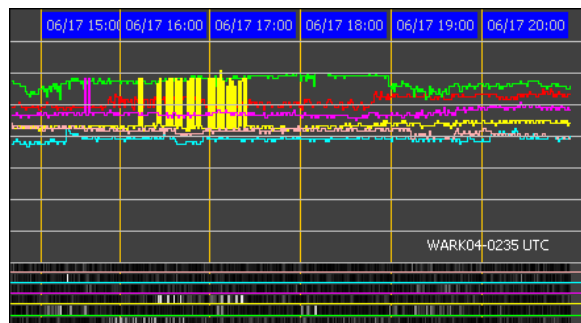
“No updates at:”

This text field keeps track of the remote connection and if there is a new alert message. It queries the server every 10min for an update and if none are available it will state “No Updates at: *<current date and time>*”. If there is a new alert issued it will state “NOAA Alert: *<current date and time>*” and it will also schedule the alert to be displayed on the graphics window.

ALTEF3-1140UTC

This is the alert message that contains the specific alert and the time it was issued in UTC. There are a large amount of warnings and alerts that the system issues. If the message starts with: ALT = alert,

WAR = warning, WAT = watch. For more info and to understand the alert codes please go to the NOAA website and download the glossary;
<http://www.swpc.noaa.gov/content/space-weather-glossary>



Set: *<alarm time>* received

When a new Alarm is received from NOAA it is automatically scheduled. This means that the message will be displayed in the graphics window to left to let everyone know that there was an alarm and that it is an active alert.

Alarm duration selector switch

This selector switch allows keeping the alarm displayed in the graphics window for the selected time displayed in the “Clr. at: *<time>*” text field. If this is updated manually by changing the “Alarm duration time” the “Clr.at *<time>*” changes by adding or subtracting time from the alarm duration selector.

Note: It is always referenced to the current time so the alert display time can be extended past alert time + 3h at any time.

Set/Clr Button

Pressing this button changes the state the alarm system is in. If there was an alert issued that does not need to be displayed, clicking this button will reset the alarm and clear the scheduler.

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Note: By typing in a custom message (i.e: “Sporadic F”) the alarm system can be used to alert others who look at your web published propagation information about the conditions that you experience currently. **Note:** The alarm system is slow to respond to changes; when scheduling an alert, allow 1 to 2 minutes for the software to respond and display the alarm text in the graphics window.

“Get Alert” Button

Pressing the “Get Alert” will refresh the Space Weather Alerts by downloading the latest copy of the document. In case there was an update since the last query request it will issue an alarm and schedule the alert message and time on the graphics window.

“Upload” Button

The “Upload” button is used to upload the measurement of the solar eclipse to our FTP server. While uploading the file its name is changed to include your call sign for later identification.

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Setting up the User parameters and FTP access

Under the "User" tab the station specific parameters can be entered. This information is used to identify the specific station not only by its user name, but also gives the grid square. For a better understanding of the working conditions also enter the antenna used and the elevation of the station in meters or feet.

Note: if you upload images you automatically agree that they can be displayed on our website

Refresh error: Sometimes when the "User" tab is selected the data fields do not show up. To get the graphics processor to re-render, make the main window bigger by dragging one of the sides with the mouse.

The screenshot shows the 'User' tab of the software interface. At the top, there is a spectrum display and a control panel with buttons for 'Start Scan', 'Pause/Res', 'Save Data', 'Auto Save' (checked), 'Save PNG', and 'Auto Save' (checked). Below this, a status bar shows 'Dominant: 3577.636 kHz', 'Noise: -25.7 dB', and 'Peak: 1.5 dB', with 'Start', 'RST', and 'Exit' buttons. The 'User' tab is selected, showing fields for 'Station' (Call Sign: VE7DXW, Grid Square: 89CNli, Antenna: 18HTjr, Elevation: 130m) and 'FTP Upload' (FTP Server: www3.telus.net, Directory: /public_html/MDSR/, User Name: bc237, Password: masked). A log window on the right shows a successful login and file uploads. At the bottom right are 'Upload' (checked), 'Save', and 'Clear' buttons.

Station

Call Sign: Enter the station's call sign. This entry also is used to identify the uploaded file on our FTP server (www3.telus.net). The call sign is also used to identify the station on the propagation web page. The call sign links to the QRZ.com call sign listing.

Grid Square: enter the 6-digit grid square so that the location is displayed on the propagation web page.

Antenna: Enter the antenna type and/or model in this field. It is also displayed on the propagation web page.

Elevation: Enter the elevation either in m or ft. (130m = 400ft)

FTP Upload

FTP Server: Unless it is required that a different FTP server is used for the user setup the FTP server is always "www3.telus.net". If the path is invalid or the FTP server does not exist, the request will time out and no returns will be visible in the FTP communication log (blue font).

Directory: the directory for the upload is set up on the telus server and it is "/public_html/MDSR/". If the directory path is invalid the FTP dialog will give an error. The slashes are required.

User Name: The user name is "bc237" (lower case)

Password: The password is "propagation" (lower case)

If the password and/or the user name are incorrect the FTP server will return a logon failure.

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Upload (check box): If selected the noise graphic and the propagation html file will be uploaded to the ftp server.

Save (button): Saves the user and FTP logon parameters to the computer. Once saved the parameters will be restored every time the program is stated.

Clear (button): Clears the FTP dialog window

Testing the FTP upload

After all the parameters have been entered press the "Save" button to store all the information on the computer. This will make sure that the program remembers the user and the FTP setup on the next start up.

Testing the Upload function

- check the "Upload" box
- press the "Save PNG" button

If the logon information is correct, the FTP dialog will look very similar to the one displayed above. Each upload starts with a request to the Telus server, a successful login, the upload of the two files (<callsign>_RF_Seismo.png, <callsign>_propList.htm) and the closure of the connection.

Automation of the "Upload" function

By checking the "Save PNG" check box the files are uploaded every 10 minutes. The FTP dialog text area displays the progress of the uploading process and displays the connect, upload and disconnect process every 10 minutes.

Hints on running the RF-Seismograph for long periods of time

There are several issues that need to be addressed before the RF-Seismograph will run in a stable manner on the Windows OS. If the computer goes into standby, the data collection stops as well. If the video card is in standby, the image capture will not work.

- Turn off automatic update to prevent automatic OS restarts. Update the computer manually so that the MDSR and Java - SA can be exited and after restart launched manually.
- Turn the monitor power setting to "Never turn off". Power off the monitor by using the on-off button of the monitor.
- Turn the sleep mode feature to "Never".
- Always make sure the graphics window of the RF-Seismograph is completely visible on the screen. If it is covered up it will capture what ever is in front of it.

Automatic HTML Propagation page and Noise Graph images

The propagation monitor creates an automatic <callsign>_propList.htm file which also can be uploaded to a FTP sever. It also can be used to be displayed on your website. (replace VE7DXW (red) with your call sign).

By adding the code below to your webpage a link to your propagation page can be created.

```
<p><strong>
<a target="_blank"
href="http://www3.telus.net/public/bc237/MDSR/VE7DXW_propList.htm">RF
Propagation List</a> (updated every 10 minutes)</strong></p>
```

Propagation list URL: http://www3.telus.net/public/bc237/MDSR/VE7DXW_propList.htm

By adding the code below to your website you can display the image and the legend. You have to replace my call sign with yours only in the first image (red text). The current legend should be the same if you keep the monitored bands the same. Currently there is no way of automatically update the legend image.

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```

</p>
```

Graphics URL: http://www3.telus.net/public/bc237/MDSR/VE7DXW_RF_Seismo.png

Legend URL: http://www3.telus.net/public/bc237/MDSR/VE7DXW_RF-Seismo%20Legend.png

The files are updated on the FTP server, and if a user views them they will always be the last uploaded file.

It is also possible to display the link and the images on "Social Media" sites and logging web sites.

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[Sample of the Propagation page](#)

Created: 19:35:54-0800 (last 6h) Entries: 10

Scanning RF - Seismograph

provided by: [VE7DXW](#) - Grid Location: 89CNli

Antenna: 18HTjr - Elevation: 130m

Band Propagation Count

| Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 |
|------|------|------|------|------|------|
| 83m | 42m | 29m | 21m | 14m | 10m |
| 7 | 12 | 13 | 12 | 22 | 2 |

Propagation List (latest on top)

| Frequency | Event Date/Time/Zone | S/N |
|-----------|--------------------------|--------|
| 21076kHz | 2016/11/28 18:57:08-0800 | 3.75dB |
| 21076kHz | 2016/11/28 18:56:16-0800 | 6.14dB |
| 28076kHz | 2016/11/28 18:48:25-0800 | 3.06dB |
| 7076kHz | 2016/11/28 18:47:33-0800 | 2.54dB |
| 10138kHz | 2016/11/28 18:45:49-0800 | 5.81dB |
| 7076kHz | 2016/11/28 18:45:49-0800 | 15.2dB |
| 10138kHz | 2016/11/28 18:42:49-0800 | 5.81dB |
| 10138kHz | 2016/11/28 18:41:38-0800 | 3.61dB |
| 3576kHz | 2016/11/28 18:40:04-0800 | 2.52dB |

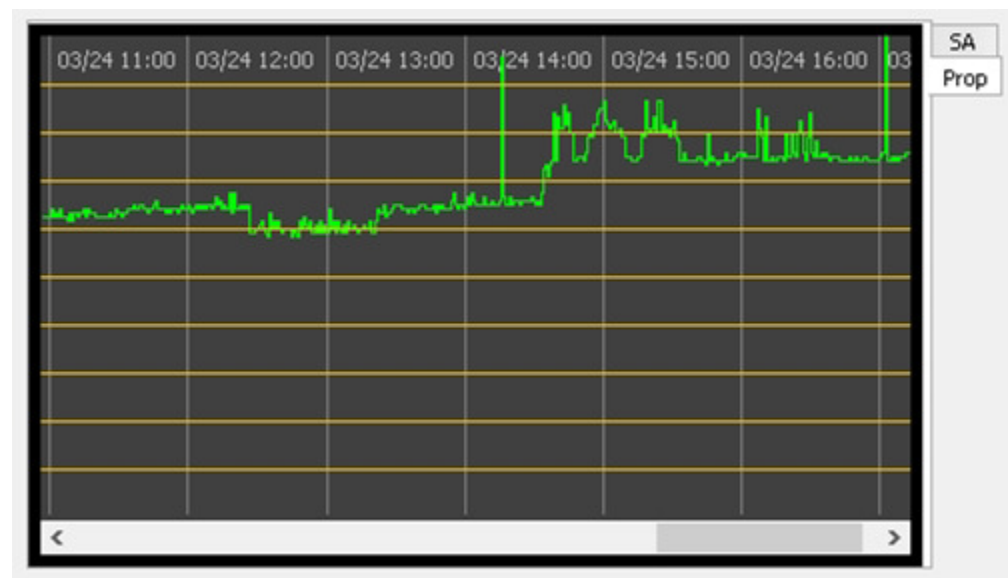
[MDSR-BILIF](#)

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Discussion:

The graph displayed below shows some of the different band conditions that can occur during a day.

- Section from 11:00PST to 12:30: Band is open indicated by the zigzag of the green graph.
- Section from 12:30PST to 13:20: Best DX conditions due to low noise level.
- Section from 13:20PST to 14:30: Band is open but noise level has increased.
- At 14:15PST: A static crash creates a signal spike.
- Section from 14:30PST to 16:15: Local interference and high noise wipe out all signals.
- Also interesting are the transition points between the different segments. If the transition is fast (e.g. at 12:30), the noise is generated by a local source. As in the change at 13:20 and then at 14:30 again the change is more gradual indicating a phase-distorted noise wave from a DX source.



As we explore this new tool, we will discover even more interesting features of the noise level that surrounds us. Since a lot of these processes are recurring, it will allow the operator to predict the best operating times for the station.

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Description of the user functions. (SA only)

Introduction

This section describes all the individual user controls and how they affect the displays and functionality of the MDSR SA software. Familiarization with their use and effects will allow you to adjust the display properly and to get the most out of this program.

Start Button

The “Start” button initializes the DSP and turns the spectrum analyzer on.

RST button

During operation, some sound devices build up a delay over time. This occurs, because the clocks of the FIFO data exchange buffers are not synchronized (a hardware issue). If there is noticeable delay, the “RST” button can be pressed to reset and clear audio buffers for lowest lag time.

In order to save processor time the marquee display is only updated when the frequency changes. Sometimes the video processor does a redraw and drops the graphics in this window. Pressing RST will also force a redraw.

Exit Button

The “Exit” button stops and removes the DSP engine from the computer, and closes the program.

Dominant

The “Dominant” field displays the frequency value of the spectral line with the highest value. When the spectrum is corrected, the highest amplitude may not be the dominant frequency.

Note: When the MDSR is connected to the MDSR the displayed frequency is corrected to the received RX frequency.

Option (selector box)

The “Option” selection box has three options.

- Normal: (default) displays the spectrum as a single graph.
- Peak hold: displays the graph including its highest value. The highest value is held on the display indicating its frequency position.
- Decay: displays the normal graph including a time-lagged, delayed decay graph. This makes it easier to spot intermittent carriers.

Graph (selector box)

The “Graph” selection box allows choosing the line display or the bar graph display. The “line” setting is the default start up parameter.

Y-Gain

The “Y-Gain” slider changes the amplification of the displayed spectrum. It acts like a volume control and makes the spectral peaks longer or shorter depending on the setting.

Ref. Level

The “Ref. Level” control shifts the displayed spectrum up and down so that it can be placed properly in the grid display for easy readability. The control acts similarly to a fader on a stereo system. “Ref. Level” does not change the amplification of the display, but only its position.

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BW (selector box) – this function has been disabled for V1.3

The “BW” selection box provides three settings

- 20 kHz (default) provides a spectral display with 420 points at a resolution of 47 Hz. For the MDSR or IF spectrum the 20 kHz selection has to be used to allow for proper placement of the red BFO line. The displayed spectrum is 0 – 20 kHz.
- The 10 kHz option can be used for audio processing and analysis. The spectrum displayed is 0 – 10 kHz. It will not center on the BFO line on the IF signal. It also has 420 display points with a spectral resolution of about 23 Hz.
- The 5 kHz option can be used for audio processing and analysis. The spectrum displayed is 0 – 5 kHz. It will not center on the BFO line on the IF signal. It also has 420 display points with a spectral resolution of about 12 Hz.

V-Filter (selector box)

The “V-Filter” (video filter) processes the spectral data and acts like a low-pass filter to make the displayed spectrum smoother. There are five levels of filter intensity; 1 is the weakest and 5 the strongest. In the lowest setting (1) all the individual spectral lines are displayed. In the strongest setting the display lines are combined making it easier to see the spectral intensity of a SSB or broadcast signal. Default setting is 3.

X-Marker (spinner selector)

X-Marker allows to measure specific frequency points along the spectrum. When the value of the box is not 0 (zero), a red vertical line is displayed in addition to the BFO line. This line can be moved up and down the spectrum to measure and highlight frequencies offset to the BFO. Additional information about the highlighted area is displayed.

- Marker at: this is the uncorrected frequency of the selected spectral line in kHz
- Delta Frequency: measures the frequency offset based on the BFO center
- RX Frequency: displays the corrected RX frequency of the selected spectral line in kHz
- Level: indicates the absolute level of the spectrum as measured on the soundcard input

Test Signal [kHz]

The “Test Signal” selector allows adding an internal noise source and sine wave oscillator to the input of the spectrum analyzer. The test signal can be used to simulate the input for display or calibration purposes.

0 will turn the test signal off. Now the DSP is set to accept input from the audio default device.

Refresh Time

The “Refresh Time” default setting is “0”. This setting is the fastest, and if a P4 or higher processor is used the spectrum refresh rate is high enough to provide a nice, dynamically flowing spectral display. The FFT process needs a lot of processor time and it can easily consume 60% CPU resources or more. This may affect other applications, and therefore a refresh time throttle is needed. Set the refresh time lower if other applications start to hang or are otherwise affected during the operation of the spectrum analyzer program.

The refresh time indicator displays the time in mS for each sweep. Newer processors can be as fast as 1 to 2 mS.

Equalization (selector box)

The “Equalization” selector has three options.

- normal: the displayed spectrum is not corrected
- corrected: the display is normalized using the loaded correction curve.
- calibrate: this is used only during the calibration procedure – do not select manually.

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Equalize button

The “Equalize” button should only be pressed after the receiver has been tuned to a section of the band without signals. During this operation the DSP measures the filter response curve which can be viewed on the display.

Correct button

The “Correct” button activates the currently active (loaded) correction curve and corrects the spectral display.

Select Input

The input selector chooses the input channel of the default sound card. Three options are available (both, left, right).

Level [dB]

Under the “Level” label there are actually two fields that display the average noise level and the peak level per scan. Both in dB with the 0 reference point at $1V_{pp}$. These two variables are used to determine the bin with the highest amplitude to calculate the dominant frequency value. The noise level indicator is also used for correction curve measurements.

Bin Value Evaluator

The “Bin Value Evaluator” consists of the bin value field and the bin number selector. The bin value field displays the correction factor of the bin selected. This allows the user to view and edit stored correction factors.

Note: A red marker bar is displayed in bar graph mode indicating the position of the displayed correction factor.

Corr Button

The “Corr” (correct) button calculates the current displayed bin correction factor by taking the adjacent values and averaging its position. This can fix miscalculated values which can cause holes or peaks in the spectrum.

Man Button

The “Man” (manual) button updates the manually entered correction factor for the displayed bin.

Correction Curve

In the correction curve box, the option box selects the band that either saves or loads the correction curve data into the DSP. The “Save” button saves the currently active correction data. To recall correction data, the “Load” button is pressed. The display is updated immediately.

Congratulations! Now the new Spectrum analyzer for the MDSR is working and calibrated. Please follow the instructions and tune the new MDSR SA for best performance. We hope that you will have a great experience with the new spectrum display. If you have any questions or recommendations regarding this software or would like to get involved, please join us at the Yahoo user group:

<https://groups.io/g/MDSRadio>

Thank you for using the MDSR and the RF-Seismograph. Please tell your friends about this project.

All the best,
MDSR Team
Jun. 2018