

SDRuno User Manual v1.31



Overview

SDRuno is an advanced Software Defined Radio application platform which is optimized for use with SDRplay's range of Radio Spectrum Processing receivers. This means that the specific features of a particular SDRplay RSP receiver model are enabled automatically within SDRuno.



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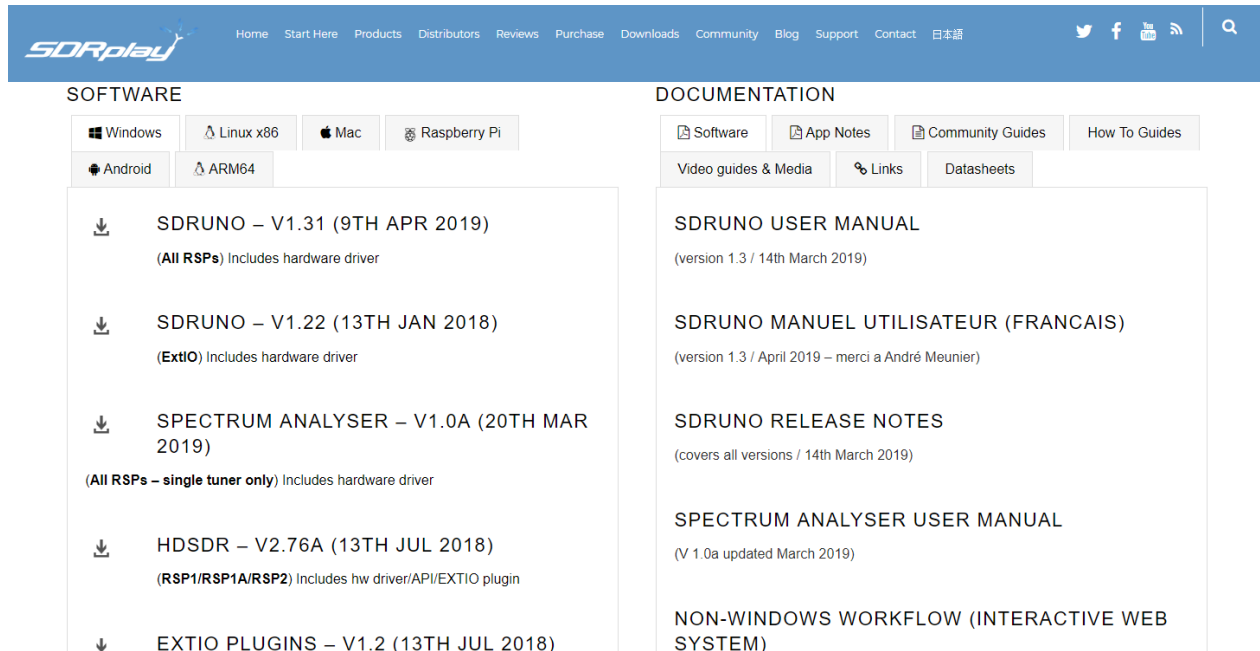
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It may be necessary to temporarily disable your Antivirus software to allow the installation to install uninterrupted. **Remember to reenable your Antivirus after installation.**

1 Installation

Download the SDRuno installer from the SDRplay website (<https://www.sdrplay.com/sdruno>) which is also linked to from our downloads page, shown below.



The screenshot shows the SDRplay website's navigation and content. The top navigation bar includes links for Home, Start Here, Products, Distributors, Reviews, Purchase, Downloads, Community, Blog, Support, Contact, and 日本語. Below the navigation bar, there are two main sections: SOFTWARE and DOCUMENTATION.

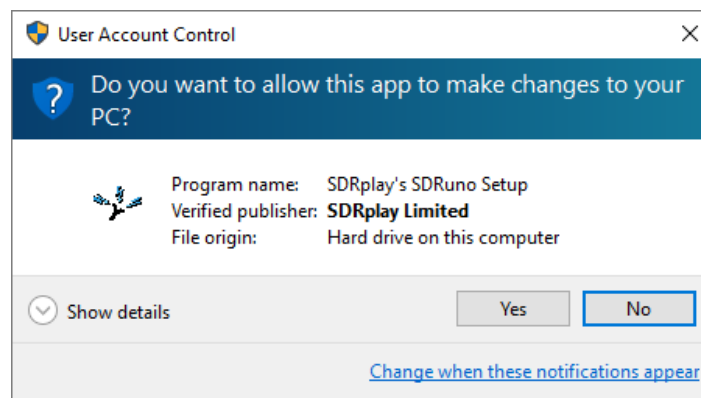
SOFTWARE

- Windows, Linux x86, Mac, Raspberry Pi, Android, ARM64
- SDRUNO – V1.31 (9TH APR 2019) (All RSPs) Includes hardware driver
- SDRUNO – V1.22 (13TH JAN 2018) (ExtIO) Includes hardware driver
- SPECTRUM ANALYSER – V1.0A (20TH MAR 2019) (All RSPs – single tuner only) Includes hardware driver
- HSDR – V2.76A (13TH JUL 2018) (RSP1/RSP1A/RSP2) Includes hw driver/API/EXTIO plugin
- EXTIO PLUGINS – V1.2 (13TH JUL 2018)

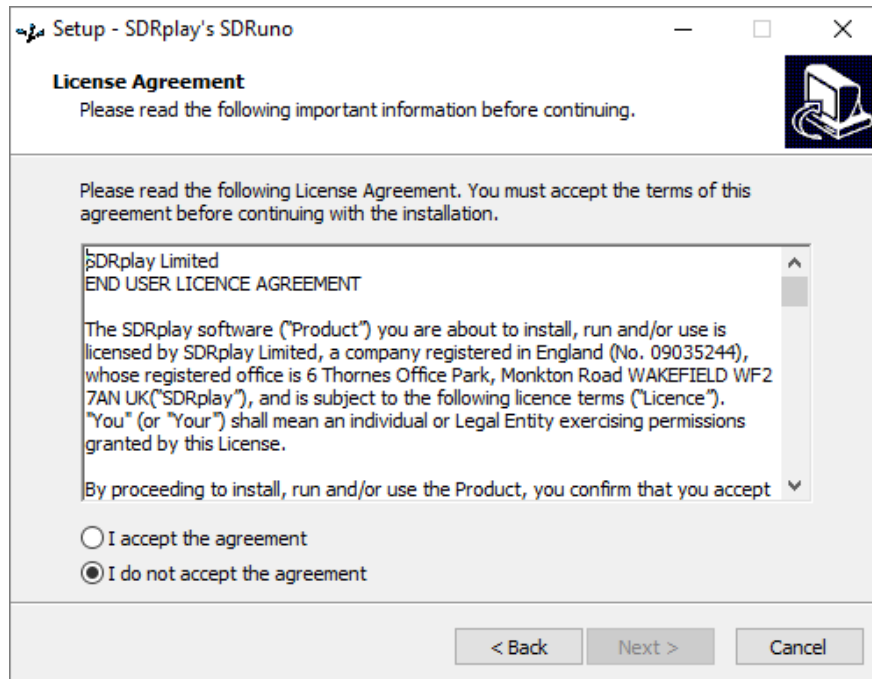
DOCUMENTATION

- Software, App Notes, Community Guides, How To Guides
- Video guides & Media, Links, Datasheets
- SDRUNO USER MANUAL (version 1.3 / 14th March 2019)
- SDRUNO MANUEL UTILISATEUR (FRANCAIS) (version 1.3 / April 2019 – merci a André Meunier)
- SDRUNO RELEASE NOTES (covers all versions / 14th March 2019)
- SPECTRUM ANALYSER USER MANUAL (V 1.0a updated March 2019)
- NON-WINDOWS WORKFLOW (INTERACTIVE WEB SYSTEM)

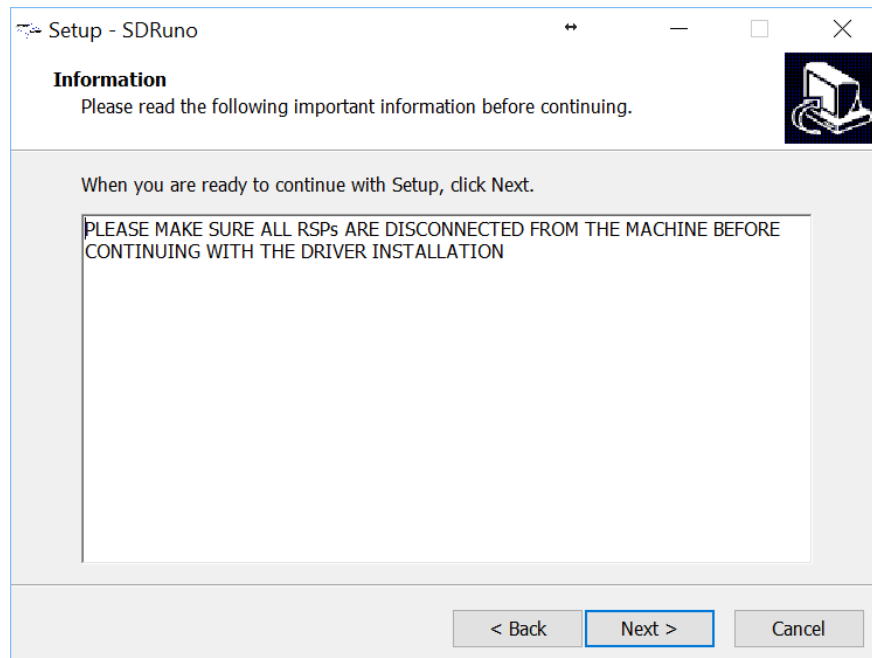
Run the downloaded installation file and you will see this, click Yes to continue.



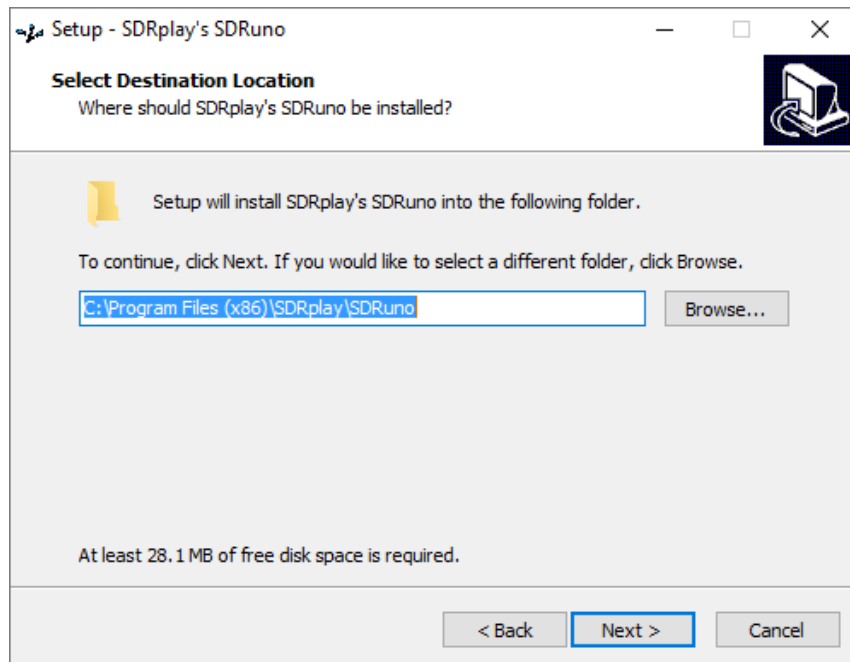
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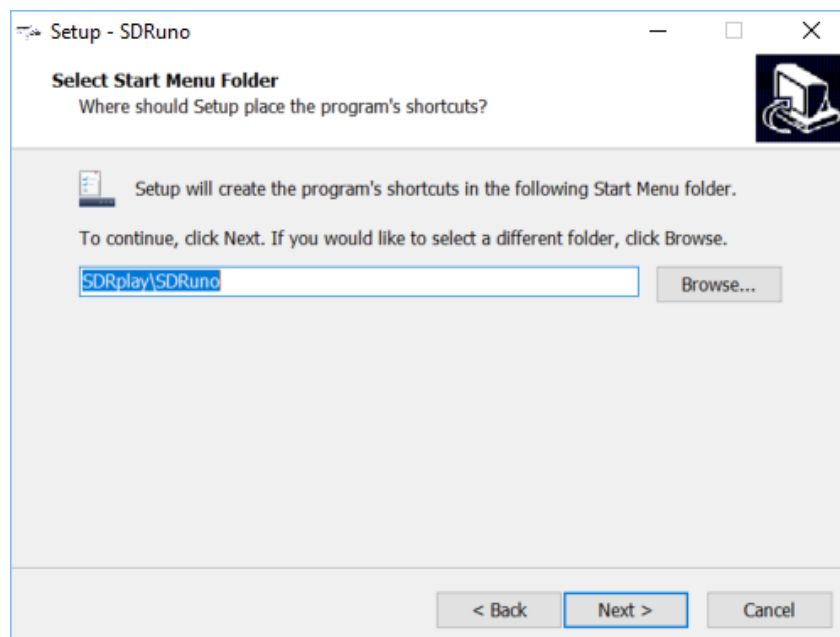
The next screen will display important information. Read and then click Next.



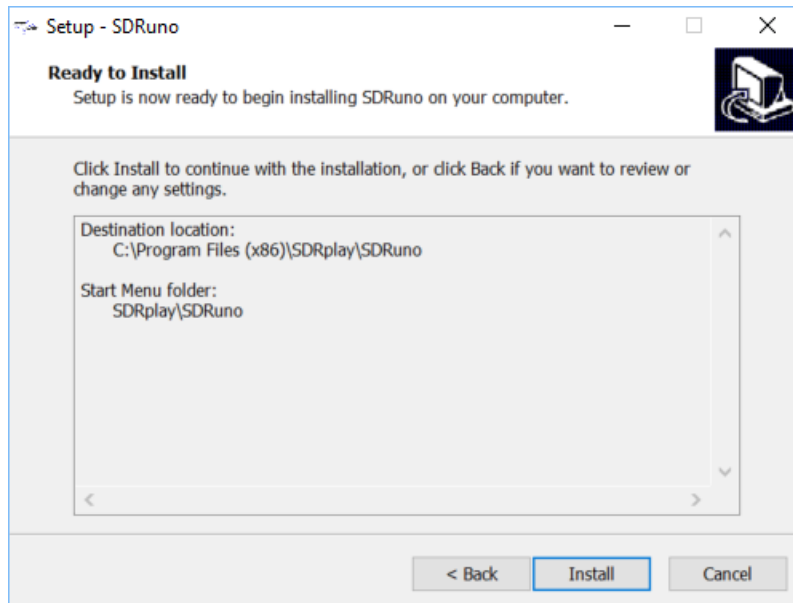
The next screen shows the installation directory. Check that you have enough disk space and then click Next



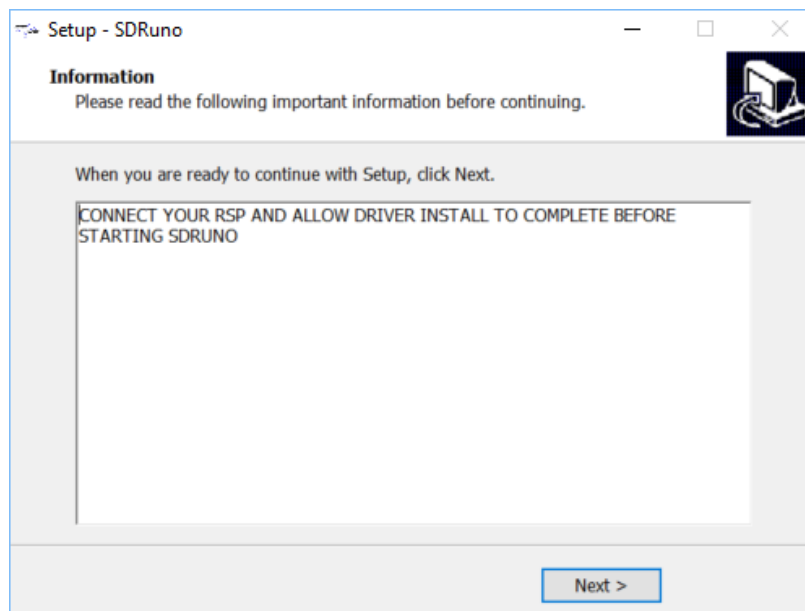
The next screen allows the Start Menu folder to be changed if needed.



The next screen confirms where the software will be installed to. If correct, click Install.



Check the next window for important information about installing the hardware drivers.



This completes the installation. Clicking Next will close the installer. Now connect the RSP(s) and wait for the hardware driver(s) to install before starting SDRuno.



App Note catalogue for further general information on using RSPs.

<https://www.sdrplay.com/apps-catalogue/>

Guide for the RSP-1.

<https://youtu.be/xBGHB0oMXHU>

Guide for the RSP-2.

https://youtu.be/92Ijh_NAEfc

Guide for the RSP1A

<https://youtu.be/qUZerxeHJvc>

Guide for the RSPduo

<https://youtu.be/LxUJ5NGuX8o>



DO NOT directly connect an RSP to the same antenna as your transmitter, or to an antenna in the near field of a transmitting antenna, as this is likely to result in irreversible damage to your RSP. Simply unplugging the USB cable from the RSP does not protect it from possible damage.

In order to streamline support requests and better serve you, we utilize a support ticket system. Every support request is assigned a unique ticket number which you can use to track the progress and responses online. For your reference we provide complete archives and history of all your support requests. A valid email address is required to submit a ticket.

Please check your spam or junk email folders for replies from support.



Open a New Ticket

Please provide as much detail as possible so we can best assist you. To update a previously submitted ticket, please login.

[Open a New Ticket](#)



Check Ticket Status

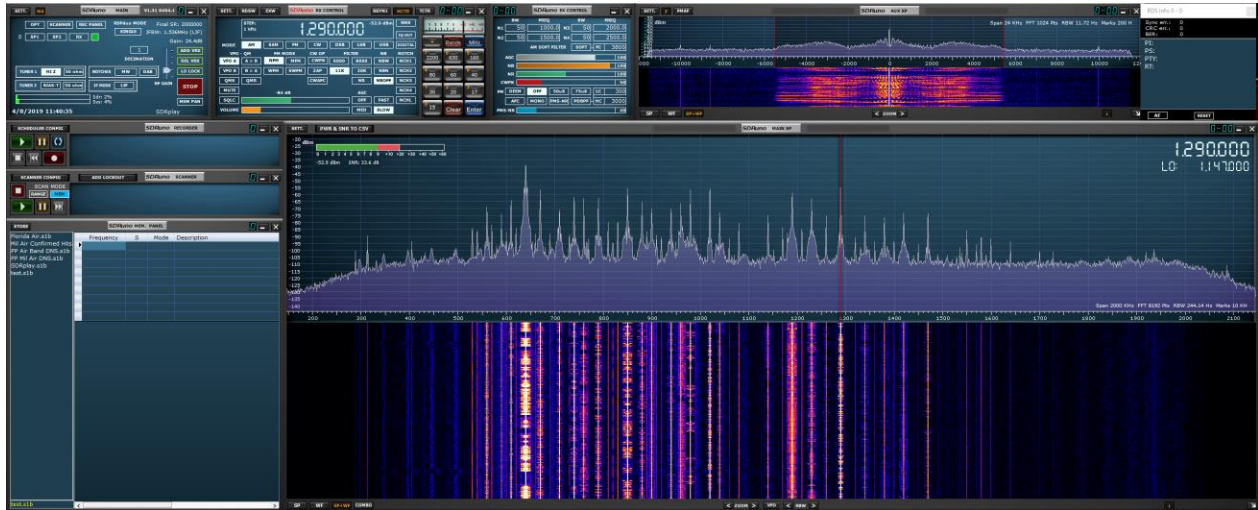
We provide archives and history of all your current and past support requests complete with responses.

[Check Ticket Status](#)

<https://www.sdrplay.com/support>

https://www.sdrplay.com/docs/SDRplay_SDRuno_Release_Notes.pdf

2 The SDRuno Panels.



2.1 Main.



Different RSP buttons will appear depending on which RSP is being controlled by this instance of SDRuno. These can be seen in section 3.3

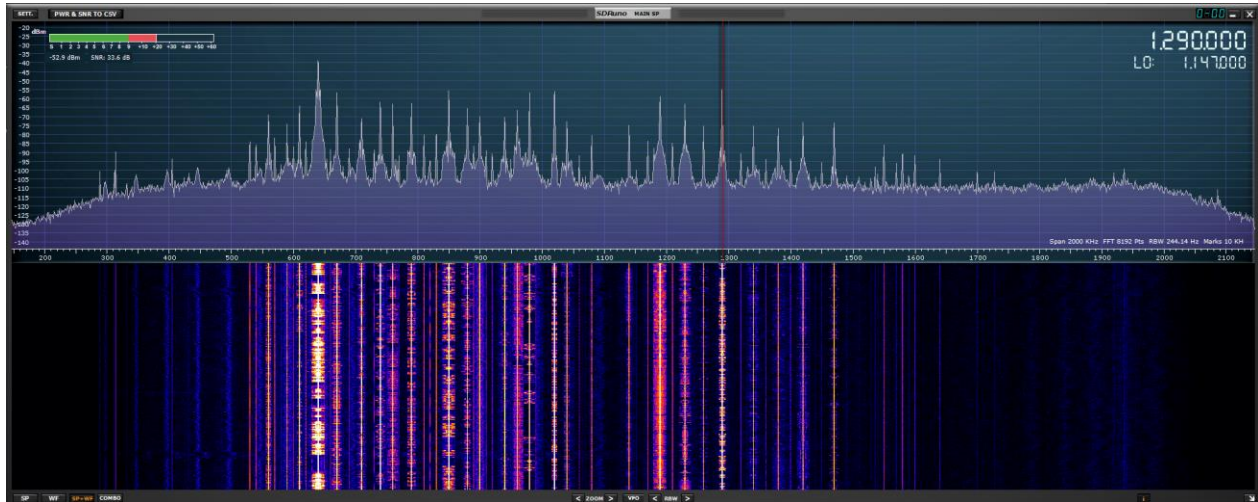
- SETT**- Shows the MAIN settings panel.
- MA**- Enables the minimize & maximize feature of displayed panels.
- OPT**- Shows additional SDRuno functions.
- SCANNER**- Displays the SCANNER panel.
- REC PANEL**- Displays the Recording panel.
- SP1**- Displays the MAIN SP panel.
- SP2**- Displays the AUX SP panel.
- RX**- Displays the RX CONTROL panel.
- IF MODE**- Switch the IF mode (from Low IF to Zero IF mode and vice-versa).
- ADD VRX**- Adds a VRX.
- DEL VRX**- Deletes the last added VRX.
- LO LOCK**- Locks the LO
- PLAY/STOP**- Starts and Stops the SDRuno stream.
- MEM PAN**- Displays the Memory panel.
- WORKSPACES**- Displays available workspaces.
- RF GAIN**- Increases or decreases the low-noise preamplifier.
- ADC OVERLOAD**- It is simply a warning provided to indicate that it may be necessary to reduce the RF or IF gain.

2.2 RX Control.



- SETT** - Shows the RX CONTROL settings panel.
- RDSW** - Shows the RDS data panel.
- EXW** - Shows the EX CONTROL panel.
- RSYN1** - Enables external application OMNIRIG for rig control.
- MCTR** - Enables memory tuning from the MEM. panel.
- TCTR** - Enables T-Mate controller.
- 0-00** - 00 denotes what VRX is in use, the leading 0 specifies what SDRuno instance is in use.
- RMS** - Sets the S-Meter mode.
- AM** - Amplitude Modulation. Sub bandwidth filter sizes can be selected.
- SAM** - Synchronous AM. Sub bandwidth filter sizes can be selected.
- FM** - Frequency modulation. Sub bandwidth filter sizes can be selected.
- CW** - Continuous wave. Sub bandwidth filter sizes can be selected.
- DSB** - Double sideband. Sub bandwidth filter sizes can be selected.
- LSB** - Lower sideband. Sub bandwidth filter sizes can be selected.
- USB** - Upper sideband. Sub bandwidth filter sizes can be selected.
- DIGITAL** - Disables internal AF filtering. Used for decoding applications. Sub bandwidth filter sizes can be selected.
- IQ OUT** - IQ output up to 192 kHz to the selected Audio Output device.
- FREQUENCY DISPLAY** - Shows the current tuned frequency, step size and dBm. Right clicking the display will allow you to change the tuning step size per mode.
- VFO A** - Selects VFO A.
- VFO B** - Selects VFO B.
- A>B** - Copies VFO A frequency to VFO B.
- B>A** - Copies VFO B frequency to VFO A.
- QMS** - Quick memory save.
- QMR** - Quick memory recall.
- MUTE** - Mutes the audio output.
- SQLC** - Enables the squelch. Adjustable via the green slider.
- VOLUME** - Adjusts the AF output via the orange slider.
- NFM** - Changes the FM sub mode to Narrow FM.
- MFM** - Changes the FM sub mode to Medium FM.
- WFM** - Changes the FM sub mode to Wide FM.
- SWFM** - Changes the FM sub mode to Stereo wide FM.
- CWPK** - Enables the CW PEAK filter. Adjustable via the EX CONTROL panel.
- ZAP** - Selects the strongest signal in AUX SP filter bandwidth.
- CWAFC** - CW automatic frequency control.
- NR** - Enables noise reduction. Adjustable via the EX CONTROL panel.
- NBW** - Noise blanker wide. Adjustable via the EX CONTROL panel.
- NBN** - Noise blanker narrow. Adjustable via the EX CONTROL panel.
- NBOFF** - Disables the noise blanker.
- AGC OFF** - Turns the automatic gain control to off.
- AGC MED** - Sets the audio automatic gain control to medium.
- AGC FAST** - Sets the audio automatic gain control to fast.
- AGC SLOW** - Sets the audio automatic gain control to slow.
- NCH1** - Enables notch filter 1. Adjustable via the EX CONTROL panel.
- NCH2** - Enables notch filter 2. Adjustable via the EX CONTROL panel.
- NCH3** - Enables notch filter 3. Adjustable via the EX CONTROL panel.
- NCH4** - Enables notch filter 4. Adjustable via the EX CONTROL panel.
- NCHL** - Locks the notch filters.
- BANDS** - Allows selection of predetermined Ham and Shortwave bands.

2.3 Main SP.



SETT - Shows the MAIN SP settings panel.

PWR & SNR to CSV - Enables the recording of power and SNR signal measurement. Adjustable via the MAIN SP SETT. button.

SP - Shows only the spectral display.

WF - Shows only the waterfall display.

SP+WF - Shows the spectral and waterfall display with divider.

COMBO - Shows the spectral and waterfall display combined without separation.

< ZOOM - Zooms out of the spectral and waterfall tuned frequency.

> ZOOM - Zooms into the spectral and waterfall tuned frequency.

VFO - Centers the tuned frequency when zoomed into the spectral and waterfall display.

< - RBW Decreases the resolution bandwidth and FFT size shown on the spectral and waterfall display.

> - RBW Increases the resolution bandwidth and FFT size shown on spectral and waterfall display

i - Toggles the display of Span, FFT, RBW and Marks in the waterfall display.

-> - Right clicking selects pre-set resolutions that the MAIN SP can be displayed.

2.4 Scanner.



Scanner Config- Sets the scanner variables.

Add Lockout- provides a 1 click lockout function when scanning.

Play- Starts the scanner.

Pause- Pauses the scanner.

Advance- Resumes scanning when stopped on a signal

Stop- Stops the scanner.

Range- Allows a custom ranged scan defined via the Scanner Config button.

Mem- Selects memory bank scanning.

2.5 EX control.



(Select the EXW button in the Rx Control to display this panel)

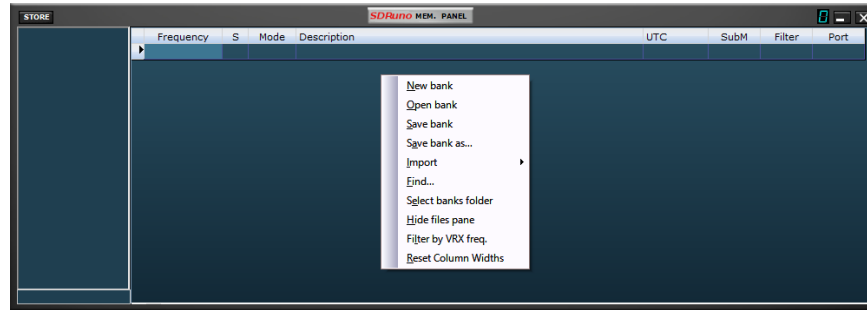
- BW** - (mouse wheel adjustment): Set the bandwidth of notch filters 1-4. Use the mouse wheel to adjust the value.
- FREQ** - (mouse wheel adjustment): Set the center frequency of the notch filters 1-4 in Hz. Use the mouse wheel to adjust the value
- N1-N4** - This corresponds to each notch filter NCH1 - NCH4 (notch filters 1-4).
- AM SOFT FILTER** - (button): Clicking the "SOFT" button to activate the AM mode soft filter.
- FC** - (mouse wheel adjustment): Specify the cut-off frequency of AM soft filter. Use the mouse wheel to adjust this value.
- AGC** - (slider): Adjust the AGC threshold by sliding to the left and right.
- NB** - (slider): Adjust the threshold of the noise blanker by sliding to the left and right.
- NR** - (slider): Adjust the threshold of noise reduction by sliding to the left and right.
- CWPK** - (slider): Adjust the threshold of CWPK (the function that automatically tunes to the peak of CW) by sliding to the left and right.
- FM DEEM** - (button): Clicking the "DEEM" button to activate the de-emphasis function. Select 50 uS or 75 uS: (50 uS for non-US regions and 75 uS for US regions).
- AFC** - (button): Clicking the "AFC" button enables the automatic frequency tuning function.
- MONO** - (button): Clicking the "MONO" button switches to mono reception mode.
- FMS-NR** - (button): Clicking the "FMS-NR" button to activate Noise Reduction algorithm for FM stereo.
- FMS-NR** - (slider): Adjust the FMS-NR threshold by sliding to the left and right.
- PDBPF** - (button): Click to enable Pure Data Band Pass Filter.
- LC & HC** - (mouse wheel adjustment): You can adjust the low cut-off "LC" frequency value and the high cut-off "HC" frequency value. Use the mouse wheel to adjust the value.

2.6 Recorder.



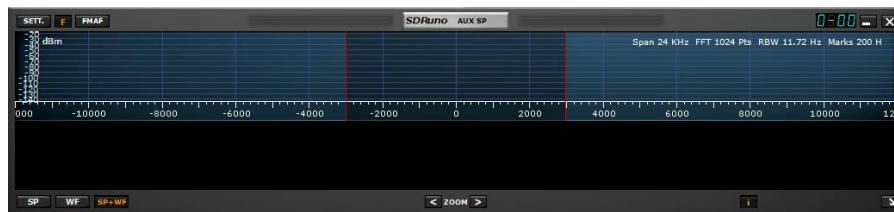
- Scheduler Config**- Sets the scheduled date and time of a IQ recording.
 - Play**- Plays back the pre-recorded IQ stream.
 - Pause**- Pauses the playback of the pre-recorded IQ stream.
 - Loop**- Loops the playback of the pre-recorded IQ stream.
 - Stop**- Stops the recording or the playback of the pre-recorded IQ stream.
 - Back**- Plays the pre-recorded IQ stream from the beginning of the recording.
 - Record**- Starts the recording of a IQ stream.
- Additional options are available from right clicking the mouse inside the Recorder panel.**

2.7 Mem. Panel.



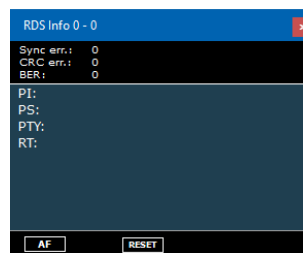
STORE- Places the tuned frequency into the current bank selected.
Additional options are available from right clicking the mouse inside the MEMORY panel.

2.8 Aux SP.



SETT - Shows the AUX SP settings panel.
F - Toggles between filtered and nonfiltered display of the filter passband.
FMAF - Enabled FM DirectBand display.
SP - Shows only the spectral display.
WF - Shows only the waterfall display.
SP+WF - Shows the spectral and waterfall display with divider.
< ZOOM - Zooms out of the spectral display.
> ZOOM - Zooms into the spectral display.
i - Toggles the display of Span, FFT, RBW and Marks in the spectral display.
-> Resizes the AUX SP panel.

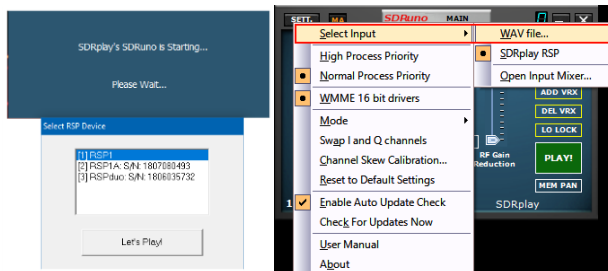
2.9 RDS Info.



Sync err. - Displays Synchronization errors
CRC err. - Displays Cyclic Redundancy Check errors
BER - Displays Block Error Rate.
PI - Displays Program Identification code.
PS - Displays Program Service name.
PTY - Displays Program Type code
RT - Displays Radio Text.
AF - Displays alternative frequencies if available from the RDS stream.
RESET - Resets the RDS decoder.

3 Getting Started.

3.1 Application instance.



SDRuno can run in multiple instances using multiple RSP devices. The default device is always the RSP but the input device can also be a pre-recorded IQ file (Wave file). Each SDRuno instance stores and recalls its own setting known as a Workspace.

3.2 Resetting SDRuno.



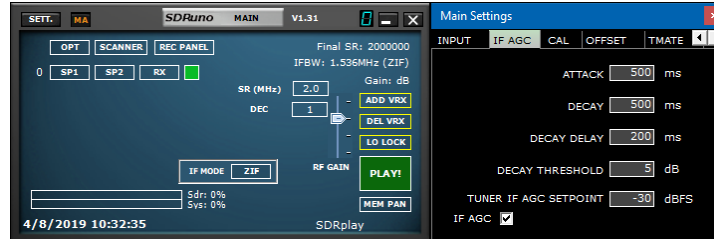
Resetting SDRuno back to a default state is done within the Main panel, click the OPT button and selecting Reset to Default Settings. Resetting SDRuno can't be undone. All settings will be cleared and all instances of SDRuno will be shut down.

If SDRuno is unable to be launched, you can perform a reset by navigating to the SDRuno installation folder and double clicking the batch file named "Removelni"

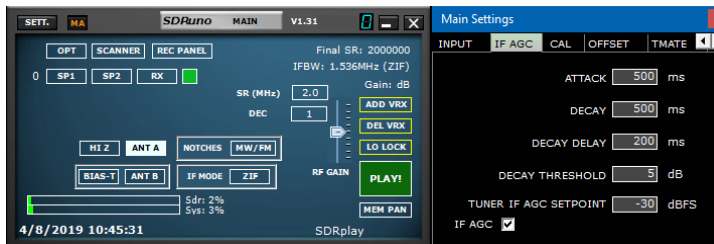
SDRuno stores its settings in %appdata%\SDRplay\SDRuno.ini after SDRuno has been closed down, this ini file can potentially be shared for people to recreate specific settings or workspace layouts. Please note that RSP settings (except RSP1) are stored by serial number so by default sharing ini files will not share RSP settings.

3.3 SDRplay RSP devices.

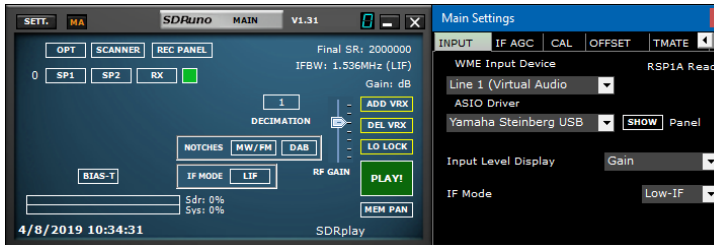
The RSP1, RSP2/2PRO & RSP1A all have specific features. These features can be selected via the MAIN panel. Further controls for specific models are available by clicking on the SETT. Button within the MAIN panel.



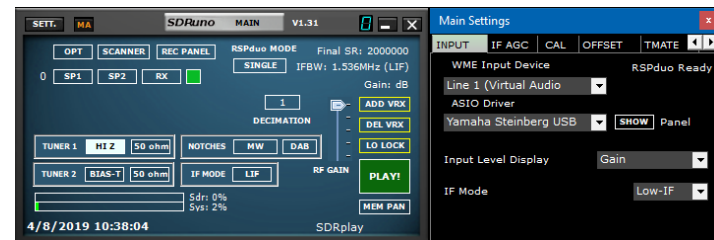
RSP1



RSP2/RSP2pro



RSP1A



RSPduo-Single tuner mode



RSPduo- Master/Slave mode

3.4 Starting the RSP stream.



Starting the RSP in SDRUno is done by clicking on the green PLAY button within the MAIN panel. The PLAY button will become red and relabelled STOP. Clicking STOP will stop the SDRuno stream.

3.5 Selecting an output device.



Each VRX can have its WME output device. More VRX can share the same WME device. Output device can be selected in RX Control->Settings->Out Tab. If no device is selected (default) the VRX will use the system default (sound mapper). SDRUno must have an output device. For more details on Virtual Receivers (VRXs), please refer to section 4.11

3.6 Setting the RX frequency.



You have multiple choices for inputting a frequency value:

- Clicking on one of the band buttons (under the S-meter in the RX Control panel).
- Moving the cursor to a specific digit in the frequency display (inside the RX Control panel or inside SP1 if the dial is enabled) and turning the mouse wheel.
- Using the current tuning step turning the mouse wheel (when the cursor is outside any control and one of the VRX panel is selected).

- Entering the frequency directly with the mouse and/or the keyboard.
- Clicking on the Main Spectrum panel (spectrum or waterfall); the actual selected frequency is the nearest multiple of the current tuning step.
- Using the Memory Banks features.
- Using a dedicated hardware controller (Tmate – Tmate 2).
- Using CAT control and/or Omnirig.



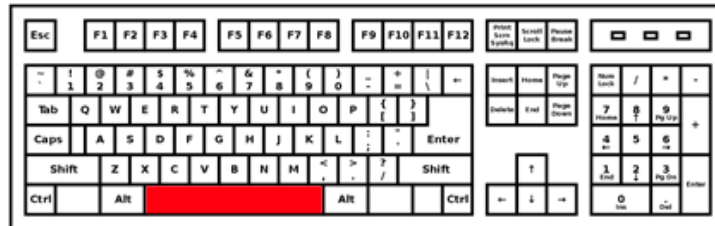
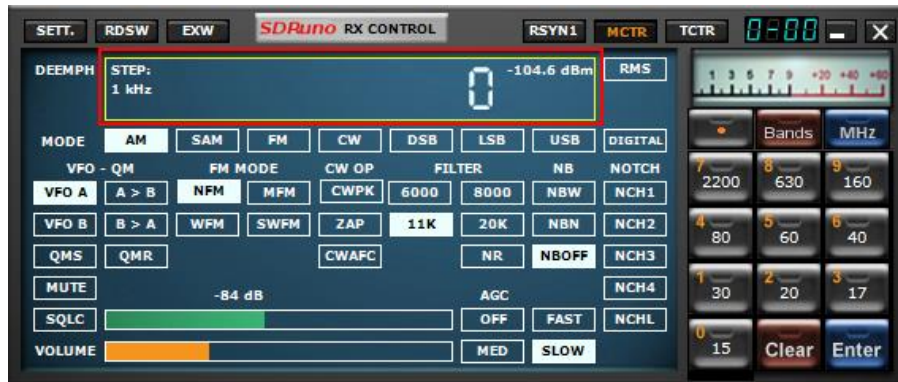
SDRuno displays the frequency Hz.

3.7 Step Size.

If you wish to change the step size. Select the mode. Right click on the frequency readout. Select the new step size.



3.8 Entering frequency directly.



If you wish to use the keyboard, one of the VRX panels must be selected. In order to enter a frequency directly with the keyboard and/or mouse:

- Press the SPACE bar or click on the RX Control frequency dial; this will start the input sequence. The Rx Control Frequency Display will display 0 and the white frame around the dial will turn to yellow. In order to abort the input sequence, press the ESC key or click on the Clear button in the RX Control panel.
- Enter the frequency in kHz using the numeric keys and/or clicking on the band buttons. If you wish to enter Hertz values, use the decimal separator of your system. For example, if you wish to enter 1455202 Hz type in 1455.202 (or 1455,202 depending on the system). Note: you can use whatever decimal separator you wish; the program will replace it automatically (if needed) with the correct one.
- Enter the frequency in MHz using the numeric keys and/or clicking on the band buttons. If you wish to enter Megahertz values, use the decimal separator shown in the RX Control. For example, if you wish to enter 146.520 MHz type in 146.520 & hit the MHz button.
- Press Enter or click the Enter button in the RX Control panel. If the value has been accepted the dial will show the new frequency.
- Press Enter or click on the Enter button in the RX Control panel. Type in the frequency in MHz and hit M on your keyboard

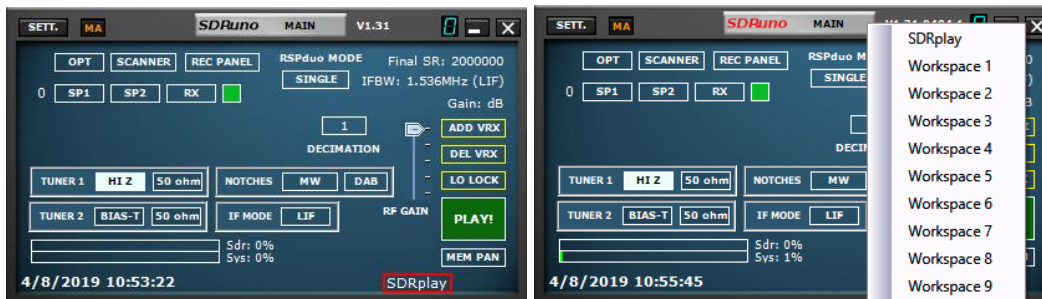
3.9 Workspace

Once you have started SDRuno you will have predetermined workspace based on the monitor resolution in use. You can still customize and build a custom workspace.

| | | | |
|-------------------------------|--------------------------------|-------------------------------|--------------------------------|
| | | | |
| Default Workspace 1024x768 | Default Workspace 1280x1024 | Default Workspace 1366x768 | Default Workspace 1920x1080 |

In SDRuno a workspace is a data set of visibility information (position, size and show/hide status) relative to all the VRX, Main and Recorder panel used in an instance. The parameters of each VRX are also saved. Ten workspace memory positions are available in each instance (0 – 9). A workspace can be renamed. The first time you run SDRuno, you will have the workspace #0 recalled; its default name is “Default Workspace”. The last used workspace in each instance is stored at program exit and recalled at the next start-up. Once you are satisfied with your work you can save the workspace.

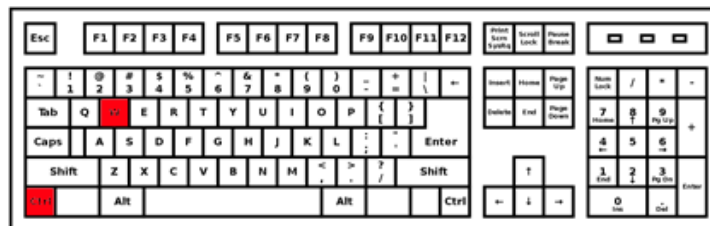
3.10 Managing Workspaces.



In order to manage workspaces, you have the following options:

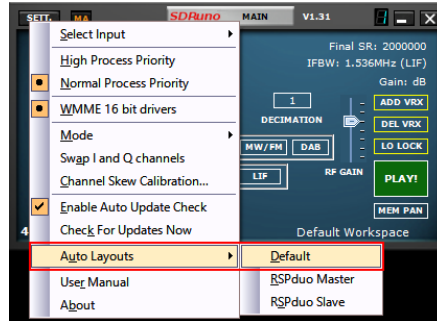
Save the current panels set to a workplace memory position.

1. Press CTRL+W, the workspace selection dialog will open
2. Click on the Workspace location you want to use.
3. A workspace saved message will appear, click OK.
4. The workspace you just saved will have the same name as the workspace that was active when you set up the new panel placements. To rename your new workspace right click on the workspace label name and input your new name. Press return.



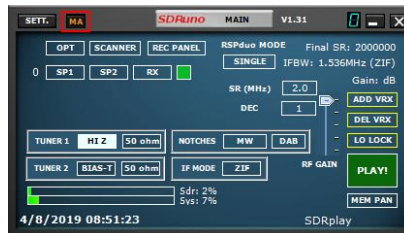
Recall a workspace (making it the current workspace): Left-Click on the workspace name to popup the workspace list and Left-Click on the workspace you want to recall.

Rename the current workspace: Right-Click on the workspace name label in the Main panel, enter the new name then press Enter to confirm or ESC to abort.



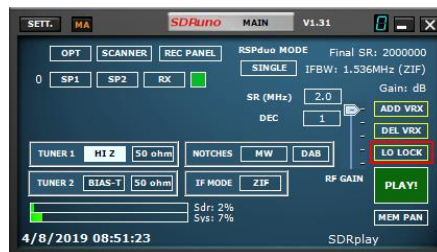
SDRuno allows you to revert workspace 0 back to the predetermined workspace at any time by choosing Default in the main panel option dropdown menu.

3.11 Minimize/Restore All option.



As the SDRplay GUI is made of many independent panels, an option to minimize or restore all the panels of an instance with a single action can be very handy sometime. The “minimize-restore all” option is controlled by the small “MA” button located in the upper left of the Main panel. When enabled, minimizing or restoring the RX Control or the RX EX Control panel will result in minimizing or restoring all the opened wind panels in the relative SDRplay instance.

3.12 Temporary LO Lock.



Changing the hardware LO has the effect of changing the tuning frequency of all the active VRX. This happens when you change the tuning frequency of VRX #0 (the master RX). If you wish to change the frequency of VRX #0 without changing the hardware LO you can use the LO LOCK button in the Main panel. But if you need only a temporary lock simply press the SHIFT key while tuning.

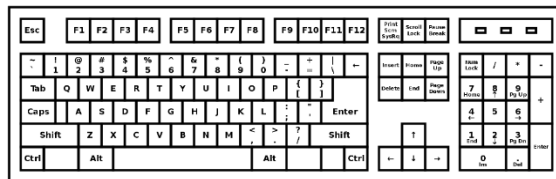
3.13 Frequency calibration.

In SDRuno the hardware frequency calibration can be done manually in Main panel ->Settings->Cal or automatically in the VRX Control panel ->Settings->Cal. For manual calibration, you can input a value in Parts Per Million; that value will be positive if the hardware oscillator is lower than its nominal frequency or negative otherwise. You can perform the calculation of the compensation value at any frequency, but best accuracy is achieved using the upper tuning range of the hardware. You need a reference signal whose frequency is known and accurate (for example in HF could be WWV on 15000 KHz).

For automatic calibration, follow the instructions within the VRX control panel ->Settings->Cal tab.



3.14 Keyboard shortcuts.



RX control panel

| | |
|-----------|-------------------------------|
| ↑ | Up frequency step |
| ↓ | Down frequency step |
| CTRL-S | Save frequency to memory bank |
| Space Bar | Start frequency edit |
| ESC | Aborts direct frequency input |
| A | AM |
| C | CW |
| D | DSB |
| E | DIGITAL |
| F | FM |
| L | LSB |
| M | Medium band FM |
| N | Narrow band FM |
| O | Stereo wideband FM |
| S | SAM |
| T | Toggle RX<->TX |
| U | USB |
| W | Wideband FM |

SP1 panel

| | |
|---|---------------|
| V | Center on VFO |
| + | Zoom in |
| - | Zoom out |

Main panel

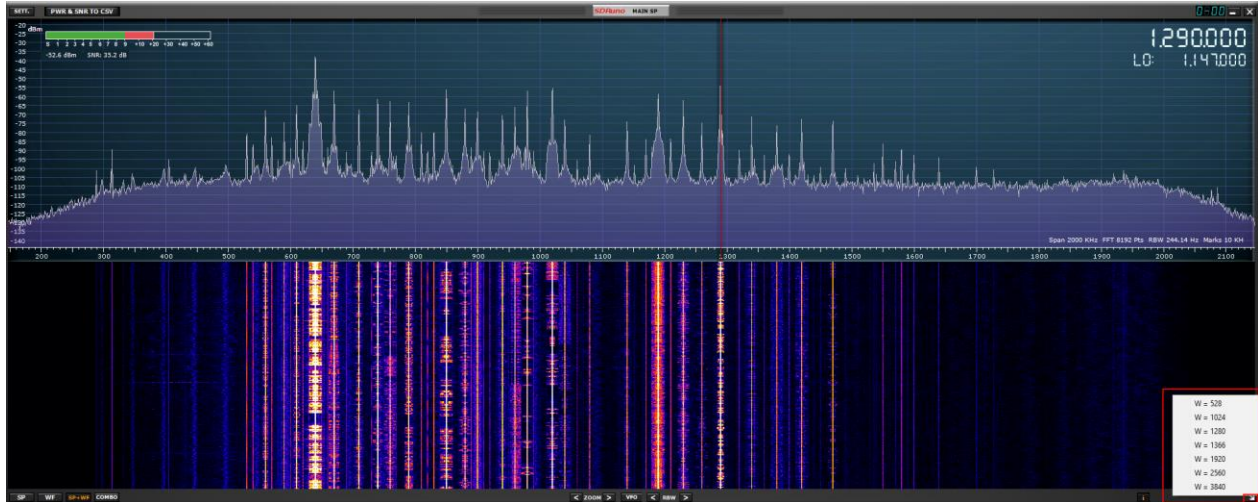
| | |
|--------|-------------------------|
| * | Start/Stop Recording |
| B | Open/Close Memory panel |
| K | Toggle LO LOCK |
| CTRL-W | Save Workspace |

Memory panel

| | |
|--------|-------------------------------|
| F2 | Edit current cell. |
| CTRL-F | Show/hide files pane |
| CTRL-S | Save frequency to memory bank |
| B | Open Memory panel |
| Ins | Inserts a new row |
| Del | Deletes the current row |

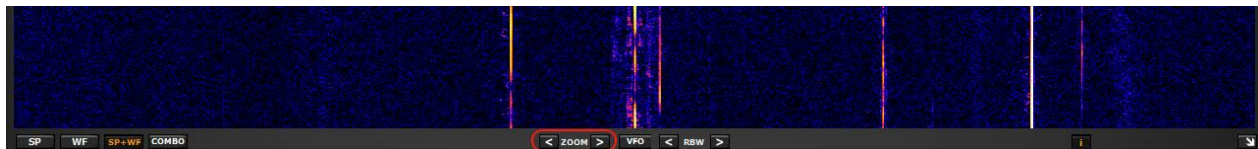
4 SDRuno Functions.

SP1 or “Main spectrum” panel : Shows the spectrum of the signal from the input device. This panel is resizable, and its settings are stored and recalled together with the relative VRX. Also, it can be closed or minimized to the task bar.



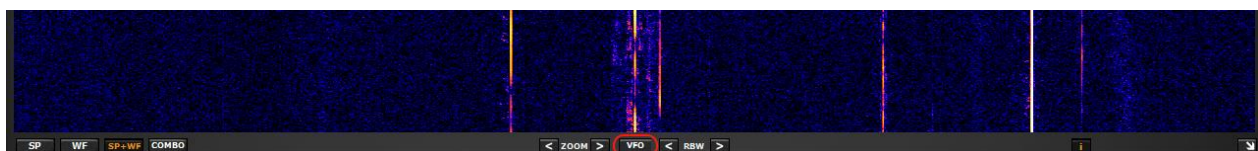
The Main SP can be freely resized or a preset resolution width can be select by right clicking on the arrow on the lower right corner of the Main SP.

4.1 Zoom.



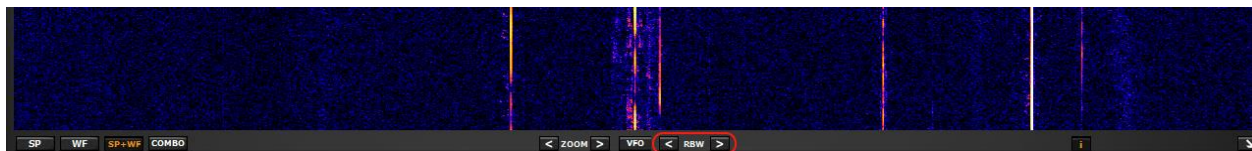
< Zoom > Zooming in and out on the MAIN SP is done by clicking on the < > icons. SDRuno has 9 zoom steps and will auto center on the current signal selected by the VFO

4.2 VFO.



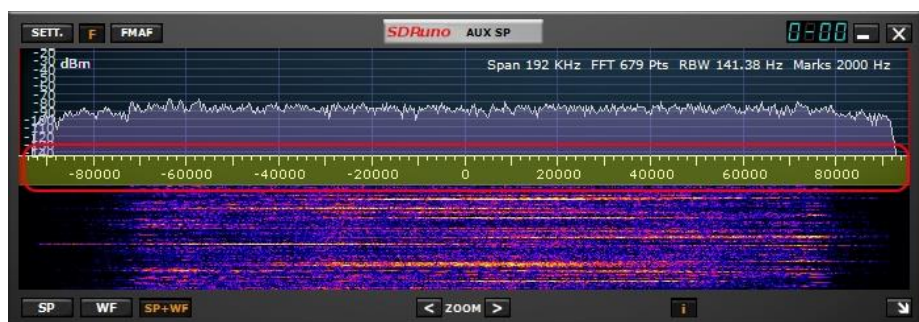
When zooming in and out of the MAIN SP you can have the VFO center within the MAIN SP by pressing the VFO button.

4.3 Resolution bandwidth.



RBW is the detail of the spectrum display. It determines how much ‘resolution’ is displayed. Very fine frequency resolution can be achieved with smaller values. There is no optimum value. It depends on modulation and how much detail you wish to observe. Lowering the RBW will tend to increase CPU load.

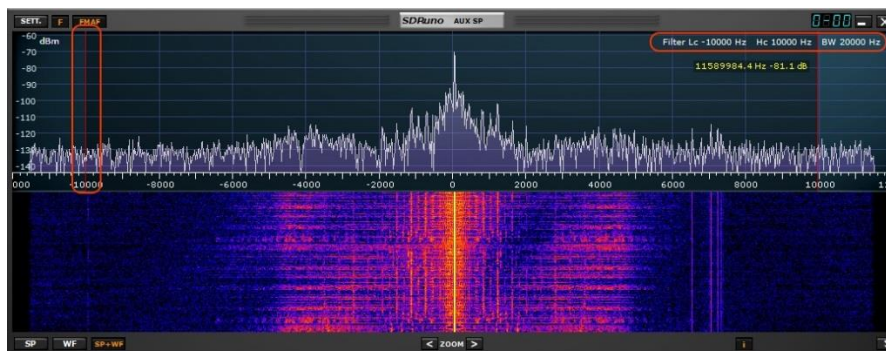
4.4 The spectrum “quick browser”.



Sometimes in the spectrum panel you need a high zoom factor and at the same time you need also to move quickly to another part of the spectrum; as the shown spectrum portion is small in comparison to the total it would take ages to reach the wanted position dragging the frequency scale. SDRplay has the “quick browser” function:

- Place the cursor inside the frequency scale.
- Press the SHIFT key, a yellow overlay will appear on a portion of the scale: here the size and position of this overlay indicates the currently shown portion of the spectrum relative to the total (the whole frequency scale).
- Click and drag the above overlay until the panel shows the spectrum portion you wish.

4.5 SP2 filter adjustments.



Besides the usual dragging of the selectivity filter edges (the red cursors) in the SP2 panel there are other some useful features available.

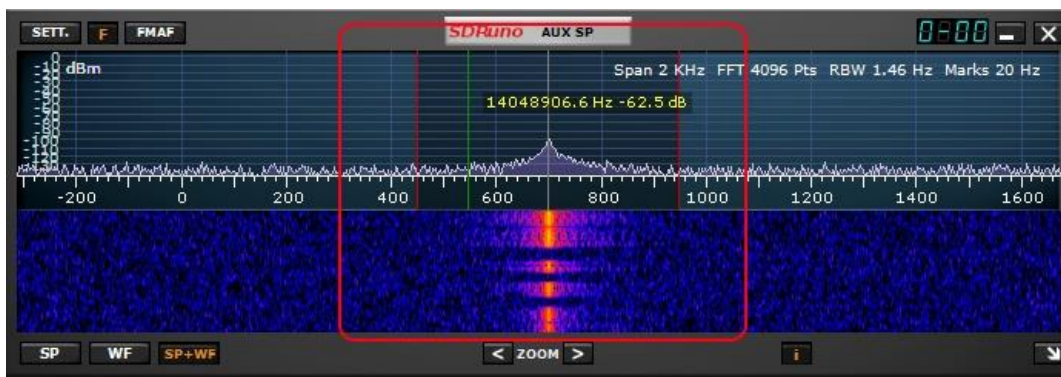
4.6 Asymmetrical adjustment.

Usually in AM, SAM (DSB) and FM mode, dragging one edge has the effect of controlling simultaneously the other in order to create a symmetric filter (around 0). In SDRuno the selectivity filter high and low frequency parameters can be different. If you wish to set up an asymmetrical filter drag one edge while pressing the CTRL key.

4.7 Pass band Tuning.

Put the cursor in between the filter red cursors. Right-click and drag: this will have the effect of moving both the filter edges (pass band tuning).

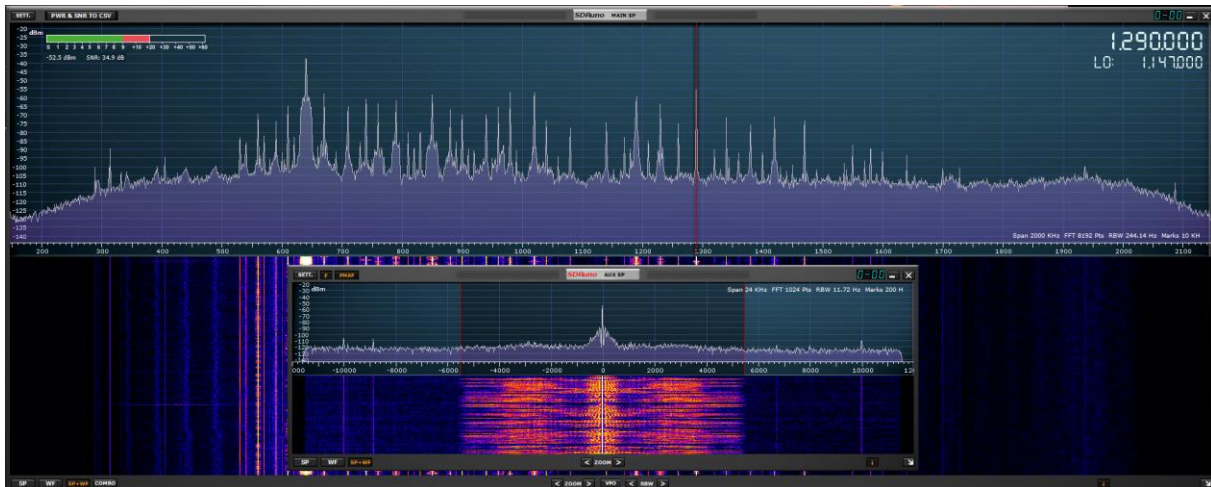
4.8 CW pitch (CW shift).



In CW receiving mode a VRX uses a frequency offset in order to obtain a CW tone. This offset can be set as follows:

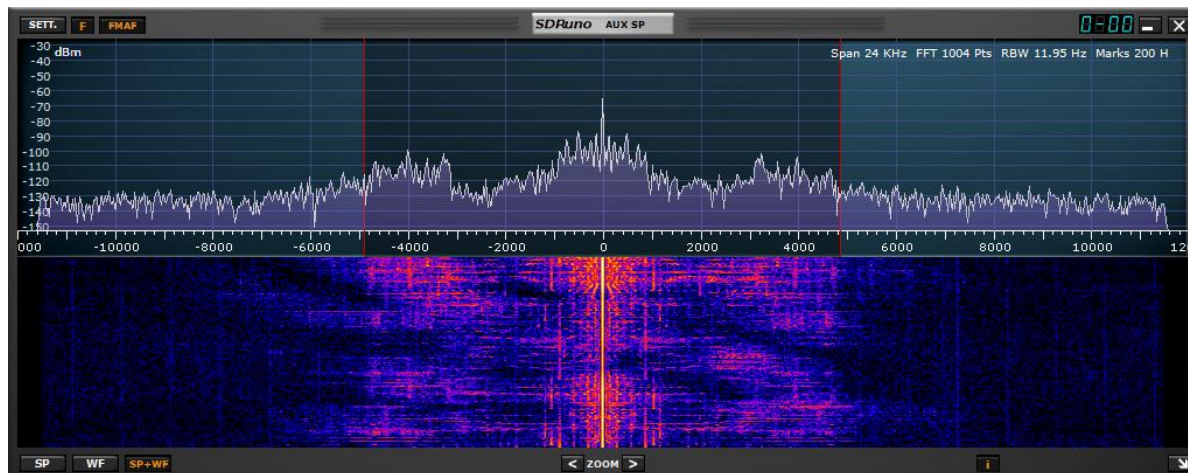
- Make sure you have the DSP engine running (so to have the spectrum panel updated).
- Select CW receiving mode.
- Place the cursor in the spectrum part of the Aux Spectrum panel (SP2); a green vertical line will be shown at cursor position.
- Choose your new CW pitch moving the above line to the corresponding mark on the frequency scale; a positive value will set a "lower than carrier" offset (USB-CW) while a negative value will set a "higher than carrier" offset (LSB-CW).
- Assign the new offset by Left-Click while pressing the CTRL key.

4.9 Adjusting the proportion of spectrum and waterfall displays.



Inside SP1 and SP2 panel, for the SP+WF display mode you can alter the proportion of the SP vs. WF by right-clicking the frequency scale and dragging it vertically to the desired position.

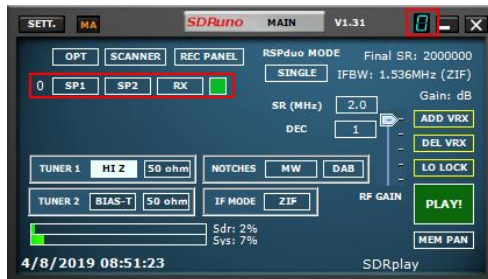
4.10 Aux Spectrum Display.



SP2 or “Aux spectrum” panel: shows the spectrum in the down-converted bandwidth. Here you can modify the selectivity filter, place notches etc. This panel is resizable, and its settings are stored and recalled together with the relative VRX. Also, it can be closed or minimized to the task bar.

4.11 VRX.

A VRX is a receiver implemented in software. Each VRX takes the signal from the defined sample rate processes it and will output the demodulated signal to an output device available of your choice.

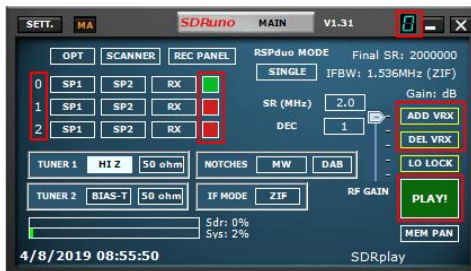


SDRuno can create and run multiple VRX inside the same application instance. When you run an instance of SDRUno, a single VRX is always created: it is the “master” VRX or VRX #0. VRX #0 has some peculiarities:

- can't be disabled or deleted
- it is the only VRX that can change the LO of the RSP

4.12 Adding and removing a VRX.

SDRuno must be stopped to add or remove a VRX.

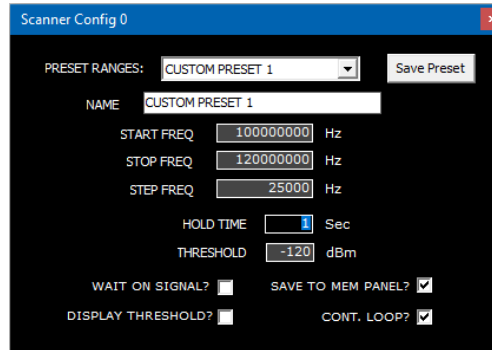


ADD VRX – This allows you to add an additional VRX, this can only be added if the RSP is stopped. The additional VRX must be in the selected bandwidth you have selected (SR MHZ).

DEL VRX – This allows you to delete the last VRX on the list. The VRX can only be deleted if the RSP is stopped

Each VRX includes four default panel: **SP1**, **SP2**, **RX Control** & **RX EX Control** panels.

5 Scanning.



SDRuno scanning has two modes. It can either scan a list of frequencies that already exist in the memory panel or it can perform a 'blind scan' of a region of spectrum with a defined step size and either stop when it finds a signal and remain on signal for as long as the signal is present or remain on signal for a user defined period of time. It also can save frequencies found via the blind scan to the memory panel and allow you to manually skip forward, manually pause the scan or lockout a frequency using the lockout button. When frequencies are tuned to from the memory panel during a memory panel scan, the mode, submode and filter bandwidth fields are also used.

PRESET RANGES – Displays the assigned and custom ranges.

Selecting one of the eight custom preset ranges (1-8) allows editing of the following fields

- Name** – Editable custom preset text entry
- START FREQ** – Starting Frequency in Hz.
- STOP FREQ** – Ending Frequency in Hz,
- STEP FREQ** – Step size in Hz.

The "Save Preset" button also stores the currently selected demodulation mode and filter bandwidth.

HOLD TIME – Time in seconds to hold on a signal.

THRESHOLD – The frequency scanner uses the power meter to determine whether a signal is greater than the specified threshold value or not. The power meter measures the total power within the SP2 filter bandwidth. It is important to understand that the noise floor measured by the power meter is not the same as the visual indication of the noise floor shown on the SP1 display. This is because the visual indication of the noise floor is determined by the resolution bandwidth (RBW) of the SP1 FFT which is typically a lot lower than the SP2 filter bandwidth. To set the Threshold value correctly to provide accurate scanning, firstly, set the VFO to a quiet region (no signals) of the spectrum that you want to scan and note the noise level (in dBm) as indicated by the power meter. The power meter reading can be found in the SP1 display and to the right of the Frequency display in the Rx Control panel. Set a threshold value that is around 6-10 dB greater than the noise floor as indicated by the power meter. For example, if the power meter indicates a noise floor of -110 dBm, then set a threshold value of between -100 dBm and -104 dBm. This should minimise the chances of the frequency scanner falsely locking in regions where there are in fact no real signals.

DISPLAY THRESHOLD - Shows a horizontal visual marker on the SP1 display.

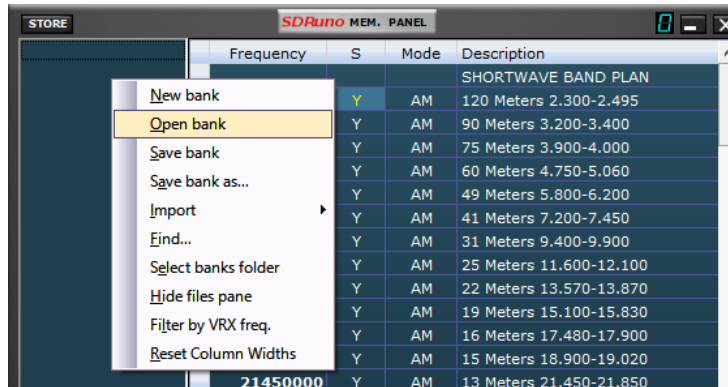
SAVE TO MEMORY PANEL - Stores found frequencies into a selected bank within the memory panel.

CONT. LOOP – Continue a scan until the Stop button is pressed.

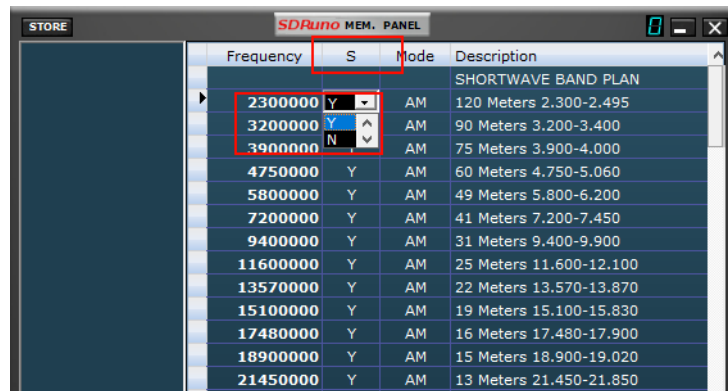
5.1 Scanning a list of frequencies.



1: Open the memory panel (Main panel, MEM PAN)



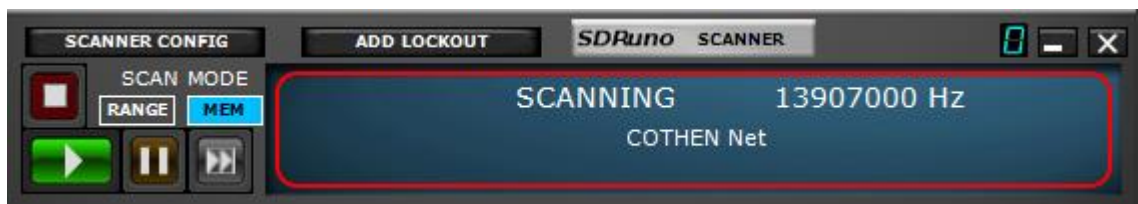
2: Open a prepopulated memory bank file (right-click within the memory panel)



3: Within a loaded memory bank you will see a cell labelled with S. You can mark each frequency in the list with a Y or N (Yes or No) This will instruct the scanner to include or bypass that frequency in a memory bank scan.

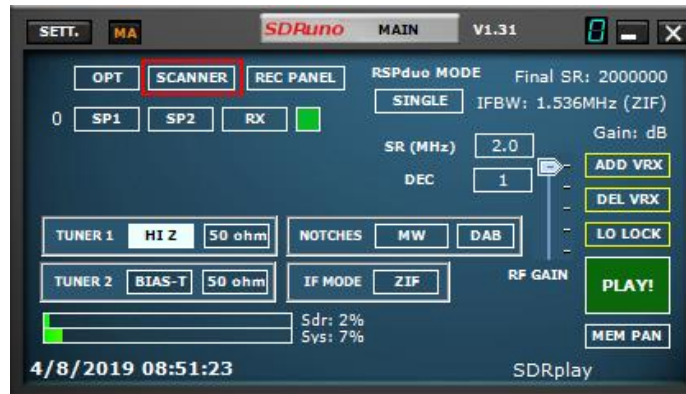


4: Open the Scanner panel. (Main panel, SCANNER)

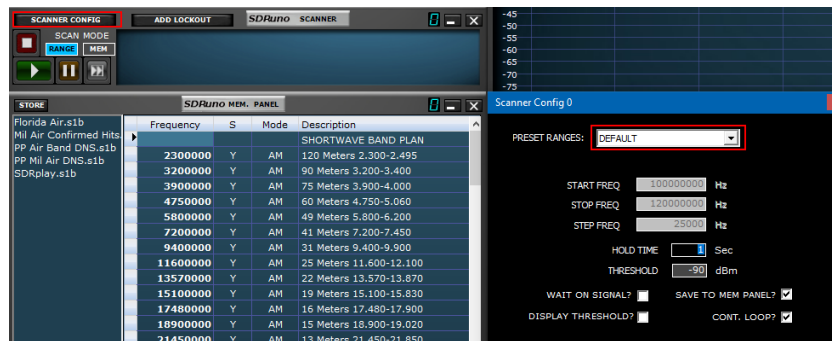


5: Click the MEM button followed by the Green Play button. Please note, when scanning a memory bank you can pause or stop the scan via the pause and stop buttons within the Scanner panel.

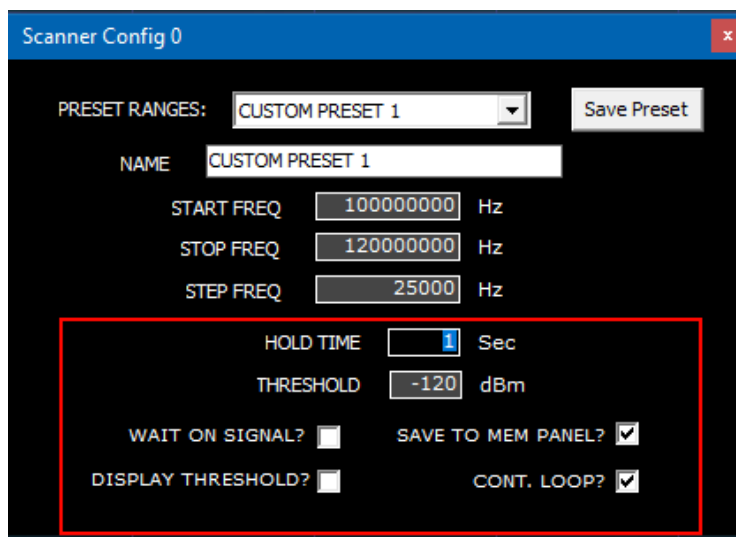
5.2 Blind preset Scan.



1: Open the Scanner panel. (Main panel, SCANNER)



2: Click the RANGE button followed by the SCANNER CONFIG button. Select one of the preset ranges within the drop-down menu.

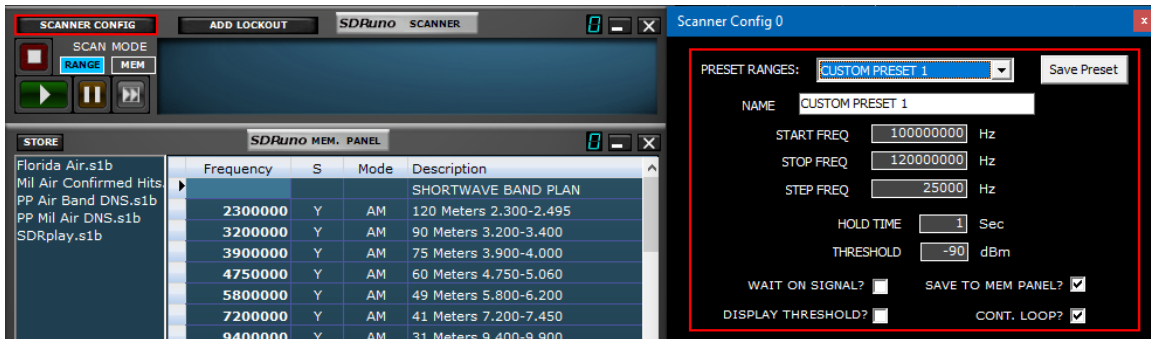


3: You can adjust the following parameters when scanning a preset range. HOLD TIME, THRESHOLD, WAIT ON SIGNAL, DISPLAY THRESHOLD, SAVE TO MEM PANEL and CONT. LOOP.

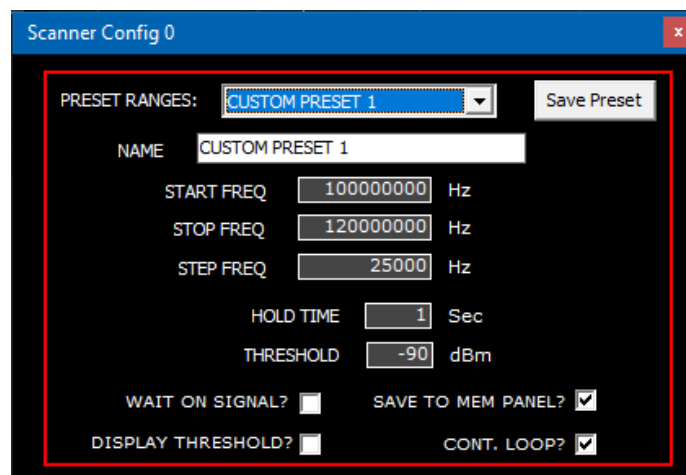
5.3 Blind Custom Scan.



1: Open the Scanner panel. (Main panel, SCANNER)



2: Click the RANGE button followed by the SCANNER CONFIG button. Select one of the user preset ranges (CUSTOM PRESET 1-8) within the drop-down menu. Edit the custom preset name.



3: Enter the start and stop frequency range in Hz. Apply the correct step frequency and adjust the threshold and wait time as needed. You can also adjust the following parameters when scanning a custom preset range. HOLD TIME, THRESHOLD, WAIT ON SIGNAL, DISPLAY THRESHOLD, SAVE TO MEM PANEL and CONT. LOOP.

6 IQ Audio Output.



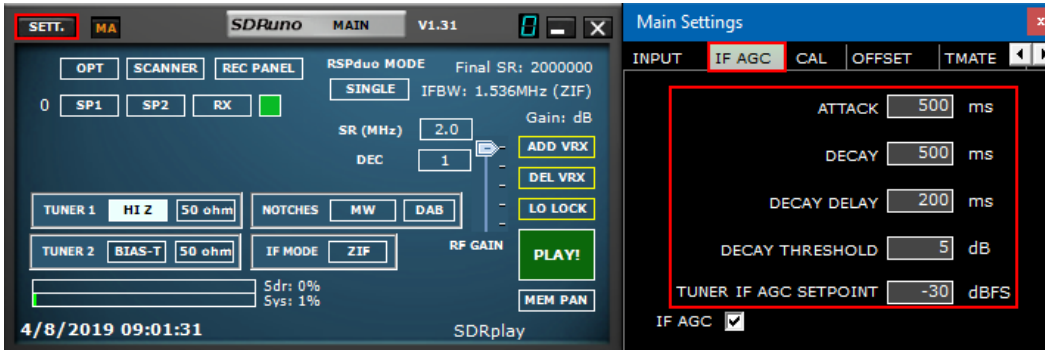
IQ OUT mode is a special mode whereby the filtered I/Q signal selected by the VFO is piped directly to the audio output bypassing the demodulation function. This function can be useful for interfacing to third party decoding applications such as CW Skimmer. The I-channel is piped to the Left Audio channel and the Q-channel is piped to the Right Audio channel. Preset sample rates of up to 192 kHz are possible via the WFM bandwidth sub-mode option and as low as 10 kHz are possible via the NFM bandwidth sub-mode option. It is not possible to set I/Q output rates that are greater than the input 'Final SR' as indicated in the top right hand corner of the Main Panel. The most effective use of IQ Out is when used in conjunction with a third party Virtual Audio Cable such as VAC or VB Audio HIFI to route the I/Q data to the third party decoding program.

7 Audio Limiters.



The SDRplay audio system is optimised for the best sound quality. This implements a number of filters and limiters in the audio path. If measurements of the audio path are needed, the filters and limiters can be disabled by unchecking this option. Care will be needed as the audio level is now no longer limited, however measurements can now be made at the audio output.

8 IF AGC controls.



SDRuno 1.3 saw the introduction of an updated API with an improved IF AGC scheme. This has more configuration and allows you to better condition the IF AGC to their signal environment. Further improvements to better align the gain change with the correct point in the IQ stream has also helped to remove the bouncing effect that was seen in previous versions

Attack ms - Time taken for the AGC to reach 95% of the target value after an increase in the signal power

Decay ms - Time taken for the AGC to reach 95% of the target value after a reduction in the signal power

Decay Delay ms - Amount by which the power level has to fall before the decay delay timer is activated

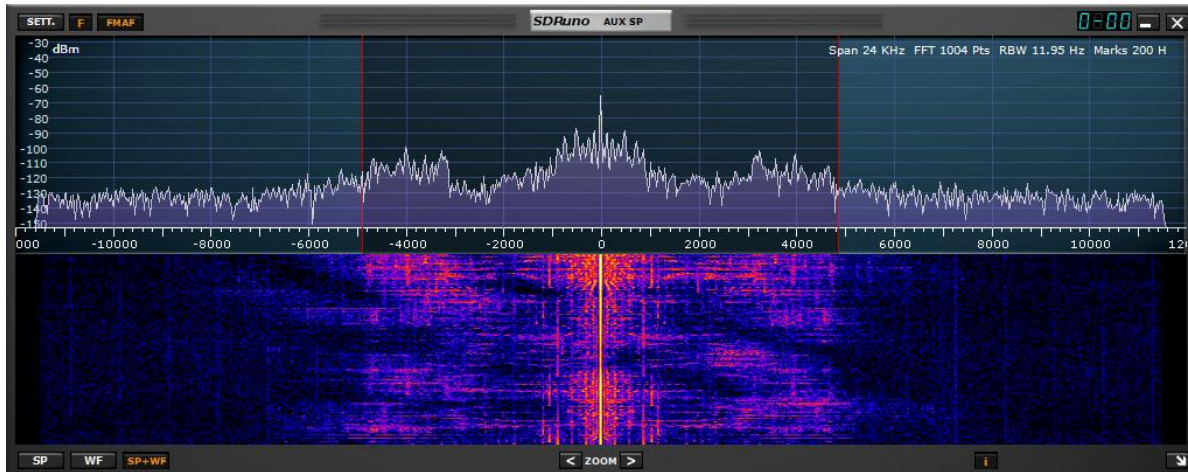
Decay Threshold (dB) - Time after the power levels has reduced by an amount \geq to the decay threshold, before the AGC loop starts the decay process.

Tuner IF AGC Setpoint (dBfs) - Sets the target level power at which AGC routine will attempt adjust the power on the ADC input. A larger value will position the signal near the top of the ADC range. A lower value will reduce the signal power and hence levels at the ADC input.

9 PWR & SNR to CSV.

| | A | B | C | D |
|----|-------------------|---------------|-------------|----------|
| 1 | Date Stamp | VFO Freq (Hz) | Power (dBm) | SNR (dB) |
| 2 | 10/13/2017 2:01:4 | 9580000 | -65.7 | 33 |
| 3 | 10/13/2017 2:01:5 | 9580000 | -65.8 | 33.6 |
| 4 | 10/13/2017 2:01:5 | 9580000 | -68 | 31.1 |
| 5 | 10/13/2017 2:02:0 | 9580000 | -67 | 23.3 |
| 6 | 10/13/2017 2:02:0 | 9580000 | -59.5 | 33.2 |
| 7 | 10/13/2017 2:02:1 | 9580000 | -59.2 | 33.5 |
| 8 | 10/13/2017 2:02:1 | 9580000 | -63.6 | 28.1 |
| 9 | 10/13/2017 2:02:2 | 9580000 | -59.7 | 33.1 |
| 10 | 10/13/2017 2:02:2 | 9580000 | -61.9 | 25.7 |
| 11 | 10/13/2017 2:02:3 | 9580000 | -62 | 26 |
| 12 | 10/13/2017 2:02:3 | 9580000 | -64.7 | 23 |
| 13 | 10/13/2017 2:02:4 | 9580000 | -67.6 | 19 |
| 14 | 10/13/2017 2:02:4 | 9580000 | -74.8 | 12.5 |
| 15 | 10/13/2017 2:02:5 | 9580000 | -63.8 | 20.2 |

Power and signal to noise ratio measurements of the signal selected by the current VFO can be output to a standard CSV file for external processing by clicking on the PWR & SNR TO CSV button. The timing of each reading of the signal selected by the current VFO can be defined from the Time Mark Interval (in seconds). The location of the recording can be defined from the CSV filename box. Both variables can be changed from the MAIN SP settings button.



SP2 or “Aux spectrum” panel: it shows the spectrum in the down-converted bandwidth. Here you can modify the selectivity filter, place notches etc. This panel is resizable, and its settings are stored and recalled together with the relative VRX. Also, it can be closed or minimized to the task bar.

10 Automatic Ham band & Broadcast band Framing.



When pressing one of the Ham band or Broadcast band framing buttons in the RX CONTROL the band button selected will light up orange enabling the following. Locking of the LO, auto adjustment of the sample rate and decimation value along with the proper mode picked for the band selected. The MAIN SP panel will now “frame” the complete frequency range of the band chosen.

Unframing the Ham band or Broadcast band is done by simply click on the band framing button you selected. The orange band framing light will go off and the sample rate will be restored 2 MHz and decimation will be 1. Unframing a band also unlock the LO.

Decimation is not available when a band is framed. Bands wider than 10 MHz cannot be framed, so in this instance, the LO LOCK is disengaged and the VFO is set to the centre of the band.



Left or Right clicking on the “Bands” button will bring up the additional band segment presets.



Ham Lower populates the preset band buttons with 2200m, 630m, 160m, 80m, 60m, 40m, 30m, 20m, 17m & 15m.

Ham Upper populates the preset band buttons with 12m, 10m, 6m, 4m, 2m, 1.25m, 70cm, 33cm, & 23cm.

Broadcast populates the preset band buttons with 75m, 60m, 41m, 31m, 25m, 22m, 19m, 16m, LW & MW

11 Other SDRuno Features and Functions.

11.1 Synchronous AM.



SDRuno implements a high-performance SAM mode. When you select SAM the last used sub-mode is also recalled (LSB, USB or DSB). Once SAM is engaged you can switch to the desired sub-mode by clicking the relative buttons:

- LSB: lower sideband SAM
- USB: higher sideband SAM
- DSB: double sideband SAM

LSB and USB SAM sub-modes share the same selectivity filter settings while DSB has its own settings. Some common filter settings are available as a preset in the RX Control panel. Of course, you can set the filter manually as indicated in 4.4.

Automatic volume compensation is performed while switching from LSB or USB to DSB. To leave SAM mode you can either click on the SAM button again (this will select the last used SSB mode) or select any other reception mode.

In SDRuno the SAM PLL has its own AGC and selectivity filter.

There are many advantages in using this configuration:

- The demodulation AGC timing can be optimized for listening while a much faster PLL AGC can cope with fast, deep fading
- The PLL selectivity filter can be made very narrow in order to allow only the wanted carrier passing thru; this way little noise reaches the PLL and the lock on noisy signal is much improved

The PLL step response can be set to two different modes:

- **FAST:** this is the default mode; in "fast" mode the PLL can track phase-modulated carriers that contain embedded data streams (for example BBC on 198 KHz), avoiding the demodulation of those noisy unwanted signals. Lock time is fast even if you are off-tune but the PLL is also more sensitive to noise given the wider loop bandwidth.
- **SLOW:** this is definitely the DX choice; lock time is slower and the PLL is much more immune to noise. This mode combined with a narrow PLL BW filter setting gives exceptional lock stability on very noisy signals.

Locking range is limited with this setting: if this is a problem, first select FAST mode then switch to SLOW if required.

The pre-PLL pass-band filter can be adjusted from +/- 50 Hz to the full bandwidth available. Please note that this setting also limits the range in which the PLL can achieve lock: for example, if you are using a 500 Hz setting (default) and you tune outside the +/- 500 Hz from the carrier, the PLL will never lock as the carrier is filtered out.

All the PLL AGC parameters are pre-fixed for best results minus the release time. This parameter can be optimized for the specific reception condition; usually the default value works well.

All the SAM settings are available in RX Control->Settings->SAM/HP Tab.



11.2 S-Meter function.



When used with any RSP the S-Meter is accurate calibrated. In order to change the S-Meter function to FM tuning meter and vice versa, simply click on it. By default, the IARU region 1 settings are used. In this mode, S9 = -73 dBm for frequencies up to 30 MHz and S9 = -93 dBm for frequencies above 30 MHz. This setting can be changed in the RX Control Panel Settings menu

11.3 Quick notch frequency setting and the notch-lock function.



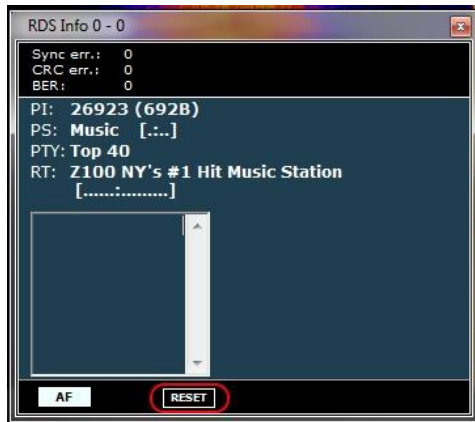
Each VRX offers four notch filters to suppress unwanted signals, placed before the AGC. Each notch filter can be enabled/disabled by the relative button in the RX Control panel. The notch filters BW & Frequency settings are available in the RX EX Control panel. For notch filters 1 & 2 the frequencies can be quickly set “on the fly” as follows:

- Place the cursor in the spectrum part of the Aux Spectrum panel (SP2); press and hold the SHIFT key: a yellow vertical line will be shown at cursor position.
- Move the above line next to the signal you wish to suppress.
- Assign that frequency to Notch 1 by Left-Click or Notch 2 by Right-Click.
- Release the SHIFT key.
- For each enabled notch the relative frequency is marked in the spectrum by a dotted vertical line, light-blue for Notch 1 and light-pink for Notch 2.

The **NCHL** button in the RX Control panel enable/disable the notch-lock feature. When notch-lock is active, the notch filters frequencies are updated when the receiving frequency is changed.

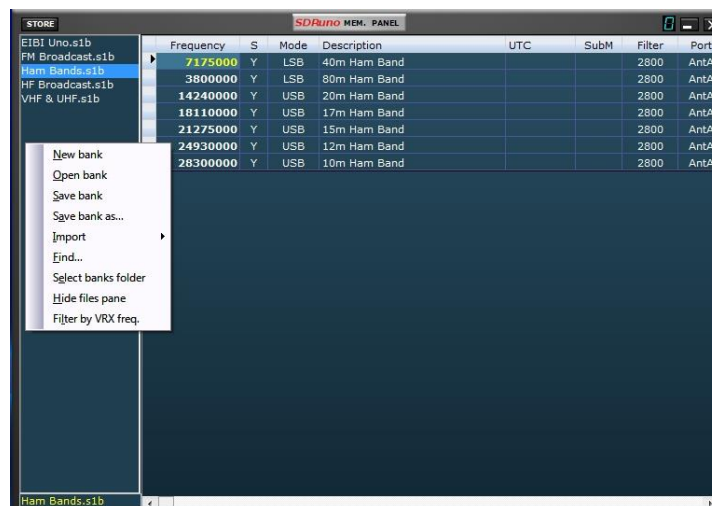
Let’s see the purpose of the Notch Lock function in a typical usage scenario: you are following a SSB QSO where some operators are each other slightly off frequency, requiring retuning for good audio. At the same time you are using a notch filter to kill a heterodyne tone caused by a nearby emission. Without notch-lock you should re-adjust the notch filter(s) frequency every time you retune; notch-lock does this for you automatically.

11.4 RDS "DX-mode".



RDS data is transmitted in pieces called "RDS groups" and each group is composed of four "RDS blocks". To obtain valid data the RDS decoder must achieve "synchronization" first; this means that a correct sequence of blocks "A" to "D" must be validated by the embedded error correction system. In very poor S/N ratio (approximately below 11-12 dB) this is impossible. In normal use this is usually not a great concern but for DX enthusiast it is, as the main goal is the identification of the broadcaster by the RDS PI data. PI data is embedded at least in all "Block A" of any RDS groups so it is one of the more redundant pieces of information transmitted. In RDS "DX-mode" SDRplay tries to extract the PI by attempting a partial synchronization, then the relative PI data is shown in red. The level of confidence is very high (> 99.5%). The RDS decoder exits "DX-mode" once full synchronization is achieved, and the PI label returns to its normal state. In order to re-enter DX-mode you have to reset the decoder by the RESET button in the RDS Info panel. For marginal signals DX-mode can be a very useful tool.

12 Memory banks.



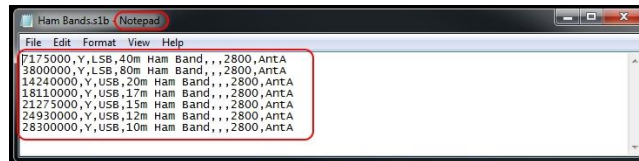
SDRplay supports its own memory banks. Considerable efforts have been put into the development of such an important feature, in order to provide a powerful yet easy to use and efficient implementation.

12.1 Basic concepts.



In SDRuno each memory bank consists of a number of “memory locations”. Each memory location is composed of a number of data fields about a “reception channel” like frequency, description, RX mode and so on. Physically a bank is saved as a disk file and loaded in memory when needed.

12.2 The memory bank file format.



SDRuno uses its own extension (.s1b) for memory bank files but the file format itself is not proprietary: it is a common CSV text file, a format that can be easily handled by many software tools. Warning: reading a s1b file into SDRuno with the incorrect format is likely to cause problems.

GUI items added for memory banks management.



In order to implement memory banks, some GUI items have been added:

- A new panel, the “Memory” panel that is the control center of all memory related operations.
- A new button on the “Main” panel labelled “MEM PAN”.
- A new button on the “RX Control” panel labelled “MCTR”.
- Some new keyboard shortcuts.

These controls are described in the following chapters.

12.3 The "Memory" Panel.



The **Memory panel** is an instance resource: you can have one for each instance of SDRuno (you actually need two of them in order to perform some advanced operations, more on this later); the panel is resizable, and its visibility parameters are stored in the workspace. To show the Memory panel click on the **MEM PAN** button on the **Main** panel or press the **B** key from any panel of the program.

The Memory panel is functionally split in two parts: the left part, also called the **files pane** and the right part also called the **data grid**. The files pane shows all the bank files in the current **banks folder**; you can quickly open one of the listed banks by double-clicking its name. On the bottom of the list a label shows the name of the currently loaded bank. The files pane can be hidden/shown with the **CTRL+F** keyboard shortcut or from the panel context menu (mouse right-click); this setting is persistent (saved in the registry).

The **data grid** is the key control: here the current bank data are showed in **cells** organized in **rows** (the memory locations) and **columns** (the data fields), much like some spreadsheet programs you have probably used.

12.4 Memory data fields.



Currently each memory location includes 5 data fields:

Frequency

This is the most important field of course; frequency is expressed in Hertz up to 10 digits. If left blank the program will not change the tuning frequency of the relative VRX upon recalling.

S (scan mode)

Its purpose is to instruct the Frequency Scanner whether to demodulate or skip the specified frequency. Allowed values are Y to demodulate the frequency and N to skip it.

Mode

This field indicates the **RX mode** for that memory location. Allowed values are: **blank, AM, SAM, FM, CW, DSB, LSB, USB, and USER**. If left blank the program will not change the RX mode of the relative VRX upon recalling.

Description

This field include an optional alphanumeric description of the memory location. The maximum length is undefined; however, the grid editor for this field limits the input to a maximum of 255 characters.

UTC

This field can optionally include a description of when the relative channel is on-air, a feature usually included in many frequency databases. The format is XXXX-YYYY where XXXX is the start time and YYYY the stop time (UTC time); for example, 0000-2400 means that the station is on air 24 hours a day.

SUBM

Used if the selected mode has a sub mode (e.g. FM can be either NFM, MFM, WFM or SWFM).

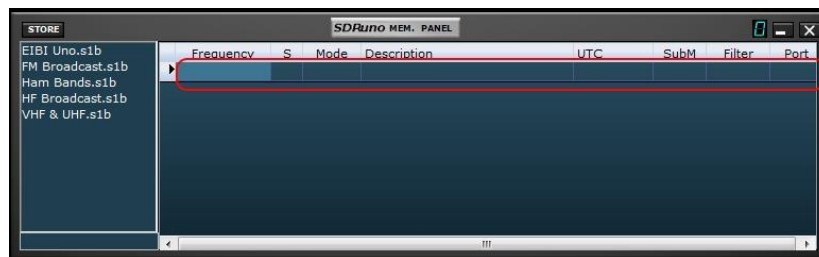
FILTER

At the time that the frequency is stored from within SDRuno, the selected filter bandwidth is also stored.

PORT

If a multi-port RSP has been in use when the frequency was stored, it will be filled in here.

12.5 The data grid.



The data grid has the main purpose of showing data, but it also provides many ways for editing. Inside the grid you can:

- Scroll the bank data with the mouse wheel, scrolling bars or up-down arrow keys.
- Customize the columns order.
- Insert (add), delete, move and copy/paste rows.
- Manually edit single cells.
- Copy-paste single cells and cell selections.
- Perform row sorting (ascending/descending) with a single click.
- Search for specific data (incremental search).
- Filter data

Selected data fields are shown in yellow.

The current active cell is highlighted with a brighter background.

The current active row is shown by a small arrow marker shown in the row header.

12.6 Basic operations in the data grid.

Customizing the columns order.

By default the grid shows the columns in the same order as the relative data fields are stored in the bank file. However you might want to change the columns display order. To move a column to a new position click and drag the relative column header to the new position (a green arrow shows you the insertion point), then release the mouse button. Columns order is persistent (it is saved in the registry).

12.7 Manual editing of cells.



In order to start manual editing of a cell you have two options:

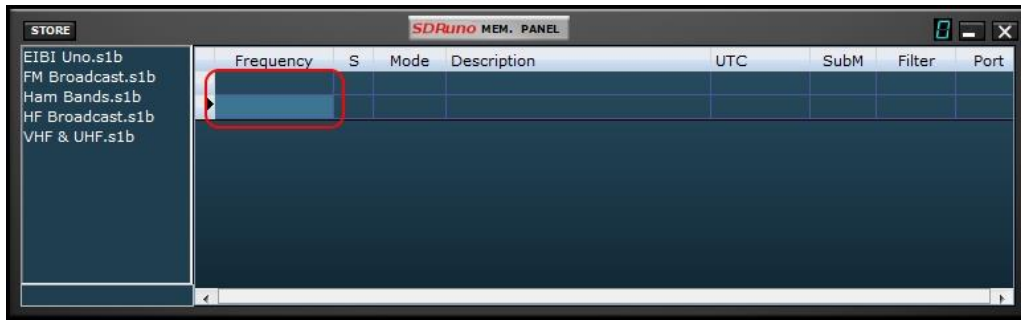
- **Click** on the relative cell then press **F2**.
- **Double-click** the cell.

The above operation starts the specific editor for that cell:

- The Frequency field editor allows up to 10 numeric characters.
- The Description field editor allows up to 255 alphanumeric characters.
- The Mode and S field editors are of the combo-list kind: upon pressing the combo button you are allowed to select one of the values in the drop down list.
- The UTC field editor allows up to 9 alphanumeric characters.

To close the editor, press the Enter key (combo-list editors close automatically upon selection). If the entry is invalid the cell shows the previous data.

12.8 Manually inserting a new row.



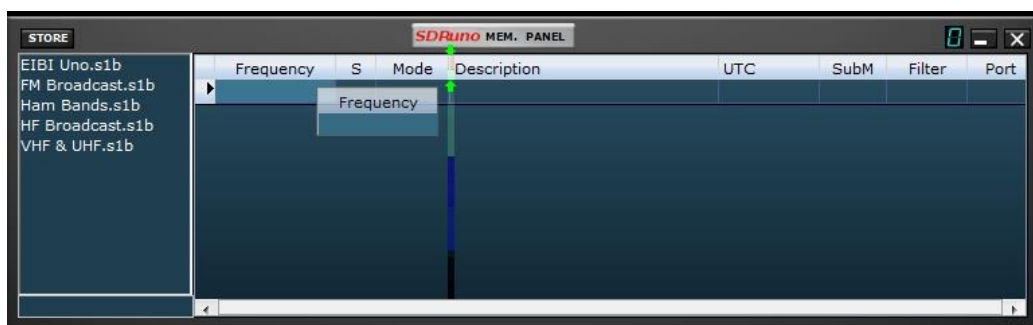
New rows are always inserted after the current one. To manually insert a new (blank) row press the **Ins** key.

12.9 Deleting a row.



To delete the current row, press the **Del** key.

12.10 Moving a row.



To move a row to a new location, click and drag its header to the new location (a green arrow shows you the insertion point); finally release the mouse button.

12.11 Copying a row.

If you don't want to overwrite a previous row, first insert a new blank row to be used as the destination one.

- Select the source row by clicking its header.
- Copy to clipboard by **CTRL+C** shortcut.
- Now click the row header of the destination row.
- Paste from clipboard by **CTRL+V** shortcut.

12.12 Copying a single cell.

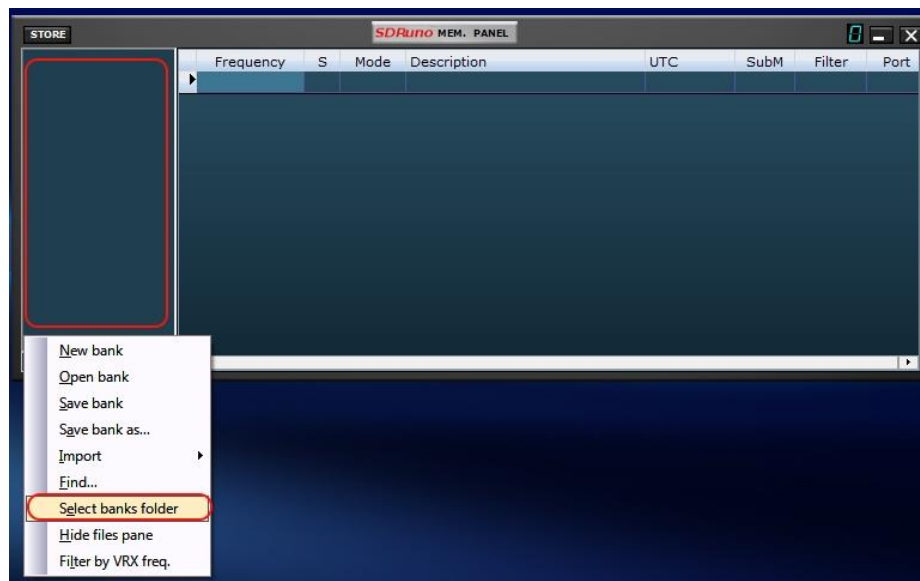


| STORE | Frequency | S | Mode | Description | UTC | SubM | Filter | Port |
|------------------|-----------|---|------|--------------|-----|------|--------|------|
| EI BI Uno.s1b | | | | | | | | |
| FM Broadcast.s1b | 7175000 | Y | LSB | 40m Ham Band | | | 2800 | AntA |
| Ham Bands.s1b | 3800000 | Y | LSB | 80m Ham Band | | | 2800 | AntA |
| HF Broadcast.s1b | 14240000 | Y | USB | 20m Ham Band | | | 2800 | AntA |
| VHF & UHF.s1b | 18110000 | Y | USB | 17m Ham Band | | | 2800 | AntA |
| | 21275000 | Y | USB | 15m Ham Band | | | 2800 | AntA |
| | 24930000 | Y | USB | 12m Ham Band | | | 2800 | AntA |
| | 28300000 | Y | USB | 10m Ham Band | | | 2800 | AntA |
| | 28300000 | | | | | | | |

- Click on the source cell; copy to clipboard by **CTRL+C**.
- Click on the destination cell; paste from clipboard by **CTRL+V**.

Bank file operations

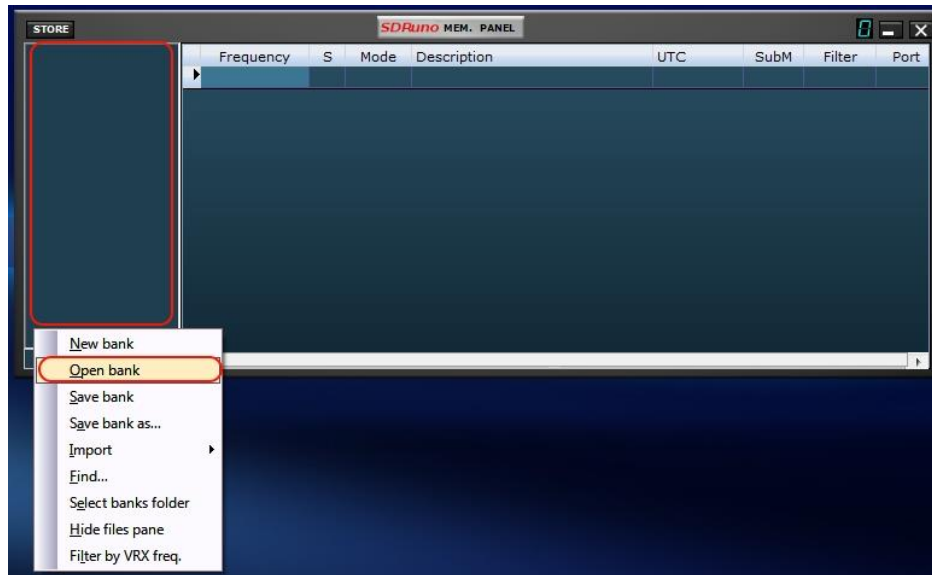
12.13 Changing the current Banks Folder.



The default Banks Folder is My Documents\Mem_banks.

To change the **Banks Folder**, pop up the context menu (right-click on the files pane or the grid) then choose **Select banks folder**; navigate to the new folder then click **OK**. The Banks Folder is persistent (it is saved in the registry).

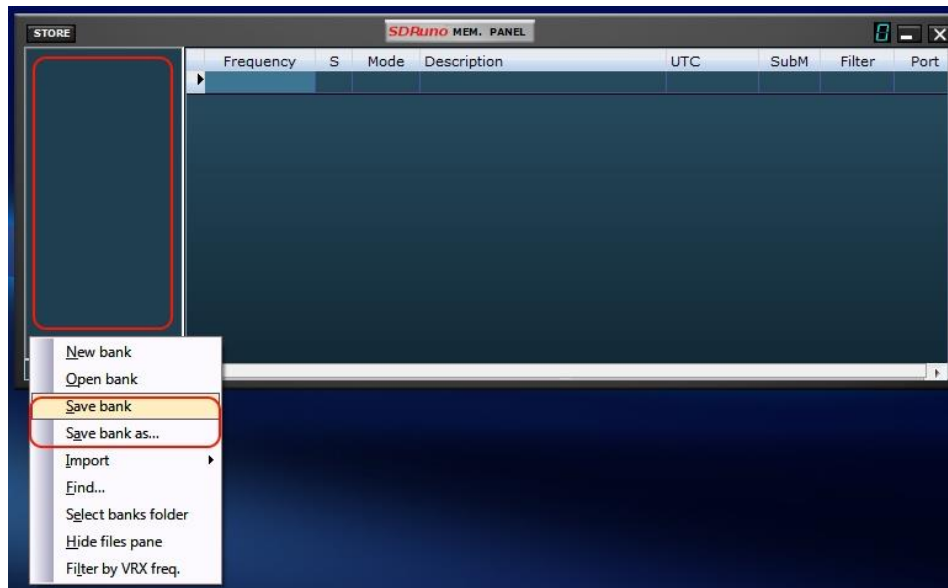
12.14 Opening a bank file.



The quick way to open a bank file is by **double-clicking its name in the files pane**. Another option is by the context menu **Open bank** option.

The last used bank is automatically reloaded at the next program start-up.

12.15 Saving a bank.

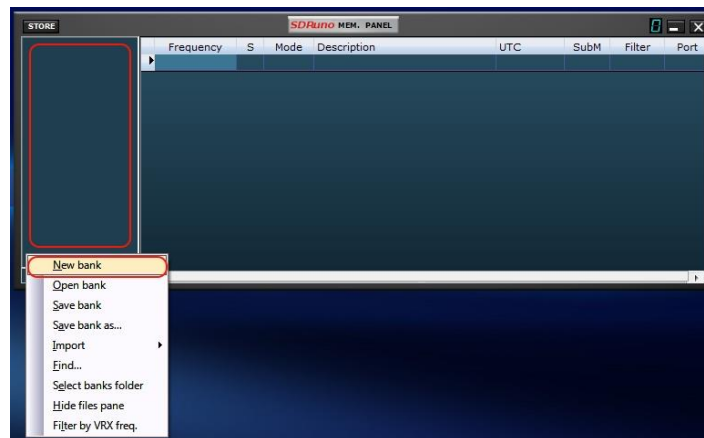


To save an already named bank choose **Save bank** from the context menu. If the bank is new (unnamed), Save bank starts a **Save bank as...** operation instead (see below).

12.16 Saving a bank with a specific name.

This is the usual Save as operation: choose **Save bank as...** from the context menu. A save window lets you name the file; if the file already exists a warning window pops-up.

12.17 Creating a new blank bank.



To create a new, blank bank choose **New bank** from the context menu.

Caution: as for the Open bank option in order to speed up operations, SDRplay will not bother you with pop-up dialog asking if you have saved your data. So if you made modifications to the current bank make sure to save it before creating a new one.

12.18 Recalling a memory location.



In this context recalling a memory location means assigning its Frequency and Mode parameters to a SDRuno VRX. As an instance of SDRuno can have more than one VRX you need a way to tell the Memory panel which is your “target” VRX: this is the purpose of the **MCTR** button on the RX Control panel. The MCTR button “connects” a specific VRX to the Memory panel for some operations. A mutual exclusion logic is implemented: only one VRX can be assigned at a given time (inside the same application instance). Once a VRX is “connected” recalling a memory location is straightforward: simply click on any cell of the wanted memory location (row).

12.19 Storing to a memory location.



Storing to a memory location imply first inserting a new blank row after the current one, filling some fields automatically and finally making that row the current one in preparation for the next operation. The program fills the Frequency and Mode fields with data from a specific VRX. You have different options to perform the above operation:

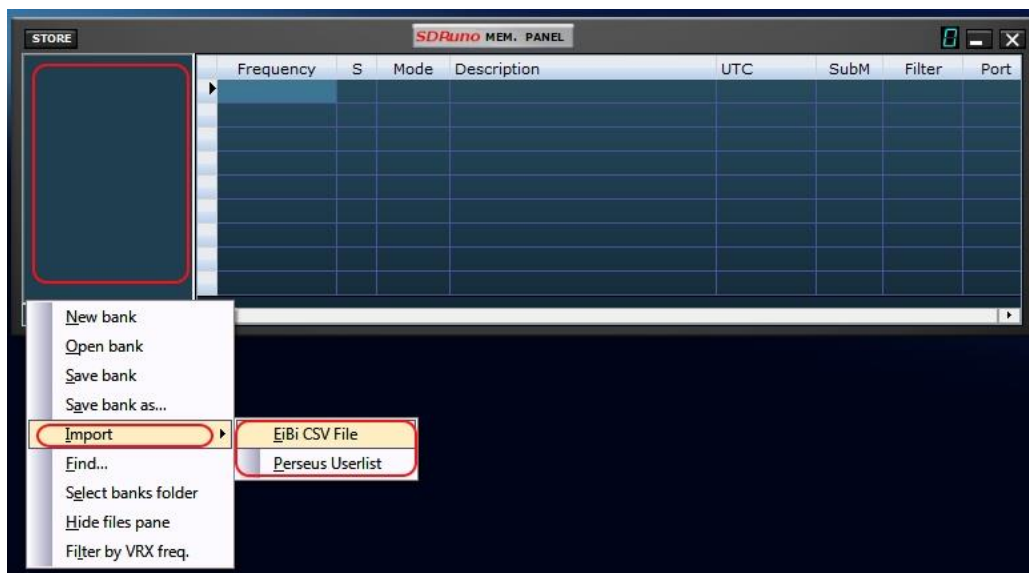
Storing from a VRX with the **MCTR** button active

- Click on the STORE button on the Memory panel.
- Alternative way: use its keyboard shortcut CTRL+S (the Memory panel must be selected).

Storing from a VRX that has been selected regardless of the MCTR button status

- Use **CTRL+S** (one of the VRX panels must be selected).

12.20 Importing from other database formats.



In the future SDRuno will be capable of importing data from all the most used frequency databases. Currently the Import feature only works for **EiBi** database files (CSV format) and **Perseus "Userlist"** (*.txt) files. In order to import from a database chose **Import** from the context menu, then select one of the import options. Locate the source file and click Open. The import process takes a couple of seconds (depending on the length of the database and your PC processing power).

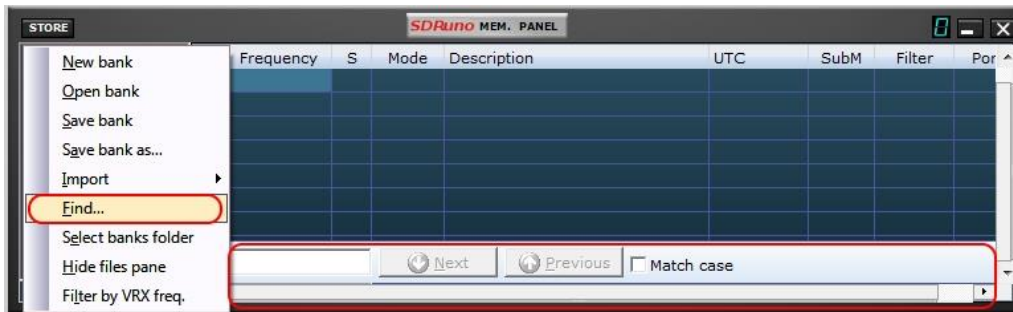
The bank thus created can be saved as a SDRuno regular bank file.

Advanced editing operations.



You can sort the loaded memory bank using any of the **data fields** as the main **sorting key**. To perform ascending sorting, click on the column header of the field you wish to use as the key. Click again to perform descending sorting. A further click undoes the sorting. An arrow indicator shows up in the column header used for sorting; it points upward to indicate an ascending sort and downward for a descending sort. A sorted bank can be saved in its state if needed.

12.21 Searching the memory bank.



Sometimes you might have to search a large bank for a specific word occurrence. To activate the search function choose **Find...** from the context menu; a search footer appears. The search footer provides you with familiar functions to perform incremental search; as you type your text in the search edit box the search process refines. Use the **Next-Previous** buttons to navigate among multiple occurrences of the same word. Unless the Match case option is checked search is case-insensitive.

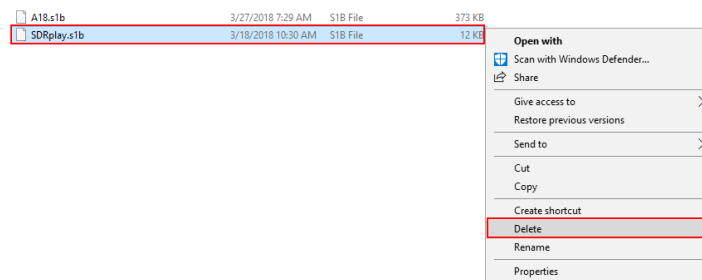
12.22 Selecting and copying multiple cells.

It is possible to copy multiple cells at a time; to perform a multi-cell selection click on the upper left cell and drag to the right lower cell of the selection area (selected text turn to yellow). Then you can copy and paste the entire selection using the clipboard shortcuts already seen (**CTRL+C**, **CTRL+V**).

12.23 Creating a composite bank from several source banks.

You can copy-paste from the Memory panel of a given SDRuno instance to the one of another instance; this capability allows complex editing operations like the composition of a bank including data from different "source" banks, without the need of a specialized tool. You only need another Memory panel from a second SDRuno instance. Simply apply all the editing operation already seen but this time using one Memory panel instance as the source and the other as the destination.

12.24 Deleting banks.



Navigate to the directory assigned for saving SDRuno banks. Delete the bank that is no longer needed.

12.25 Filtering data.



Filtering a data bank means showing only the rows that match filtering criteria. Currently you can only **filter by VRX frequency**. To enable this options, choose Filter by VRX freq. from the context menu. The data grid is updated after every frequency change; since filtering a large data bank is a CPU intensive operation, the program waits until it detects that the tuning operation has ended, and then performs the filtering. If no VRX is assigned to the Memory panel, no filtering occurs. Filtering is disabled when choosing one of the following options:

- New bank
- Import

13 IQ Recording.



The Recorder panel can be shown by clicking on the “REC” button inside the MAIN panel.

Selecting the recording folder



Left-click on the recorder panel the Main panel or on the Recorder panel: this will pop up the folder selection tree. The factory default is to use your “My Documents” folder.

13.1 Playback of IQ Recording.

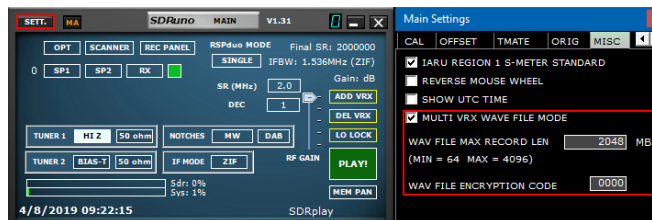


Launch SDRUno. Before clicking PLAY on the MAIN panel. Click on the OPT button in the MAIN panel. Select Input and select WAV file. Playback is controlled via the RECORDER panel.

13.2 Using multiple VRX while playing IQ files.



SDRUno allows the use of multiple VRX while playing IQ files. Main panel ->SETT.->MISC->MULTI VRX WAVE FILE MODE. This option is enabled by default; if you wish to use only VRX#0 uncheck the option. IQ Wav files maximum length and custom encoding



You have an option to define a custom file length up to 4 gigabytes which is the limit of the wav format itself. In fact, in the Wav file header size is stored as a 32 bit unsigned integer so the storable maximum size is 2^{32} bytes. In the future SDRUno will offer the option to store IQ data in another format, without the above limitations. Please note that the advantage of keeping the wav format is compatibility: SDRUno files can be opened with any tools that support that file format. To change the default file size (2048 megabytes) go to Main->SETT.->MISC, double click on the "WAV FILE MAX RECORD LEN" and enter the new size, then press Enter to confirm.

You also have an option allowing a custom encryption code of the recorded IQ file. This code be used to secure the IQ file. This will prevent playback without the proper encryption code entered. The default is 0000 and allows playback without restriction.

13.3 Scheduled IQ recorder.



Unattended IQ recording can be configured via the Scheduler Config button within the RECORDER panel. The stream will be started/stopped by the scheduler if it isn't already running

13.4 Quick recording.

SDRplay includes a feature to put a SDRplay instance in recording mode "on the fly", without opening the Recorder panel. When you wish to start recording simply press "*" on the keyboard (the relative SDRplay instance must be selected).

14 Using the custom controls.

SDRplay implements some custom controls specifically created for it.

14.1 Sliders.



Sliders are used for some parameters such audio level, squelch level etc. You have several options to modify a slider value:

- For quick, large changes simply click in the new position of the slider
- For continuous variations click and drag.
- For fine, precise control put the cursor inside the slider and turn the mouse wheel

14.2 Wheel Edit Dials.



These controls are easily recognizable as their background turn to purple as you place the cursor above them; some examples are the notch filters BW and Freq. controls in the “RX EX Control” panel . In order to change the value of one of these controls, you must place the cursor inside it, then you have several options (here is an example for a notch Freq. control – actual steps depend upon the specific function):

- Turning the mouse wheel will change the value in +/- 1 Hz steps
- Turning the mouse wheel while pressing the SHIFT key will change the value in +/- 10 Hz steps
- Turning the mouse wheel while pressing the CTRL key will change the value in +/- 0.1 Hz steps
- Right-clicking will change the value in + 100 Hz steps
- Left-clicking will change the value in - 100 Hz steps
- Right-clicking while pressing the SHIFT key will change the value in + 1000 Hz steps
- Left-clicking while pressing the SHIFT key will change the value in - 1000 Hz steps
- Right-clicking while pressing the CTRL key will change nothing (not used in this case)
- Left-clicking while pressing the CTRL key will change nothing (not used in this case)

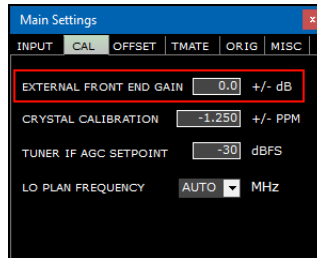
14.3 The I/O Sample Rate difference issue..



Using different physical input and output devices means that there is no synchronization between the I/O sample rates; furthermore, a small deviation (in the order of less of ten to some hundreds of PPM) from the theoretical rates exists. SDR programs (including SDRplay) use memory buffers as “dampers” that absorb those differences; however, sooner or later the buffers will be all filled (overflow) or all empty (underflow), depending upon the sign of the combined input and output deviations. With typical hardware this can happen after several hours of continuous processing. At that point the program will re-establish the correct buffering, trashing some data and creating a small “gap” in the output stream. Of course, there is a way to prevent this, implementing a complex closed loop servo system that monitors the buffering and controls an output fractional resampler. SDRplay can do this and it works very well, ensuring that no data are lost at any time. However, when the above system is enabled a small frequency modulation of the output signal occurs (in the order of a fraction of Hz when the servo has settled down). In some sensitive applications (APT & other critical signal post-decoding), this small modulation can sometime cause problems; in SDRplay there is an

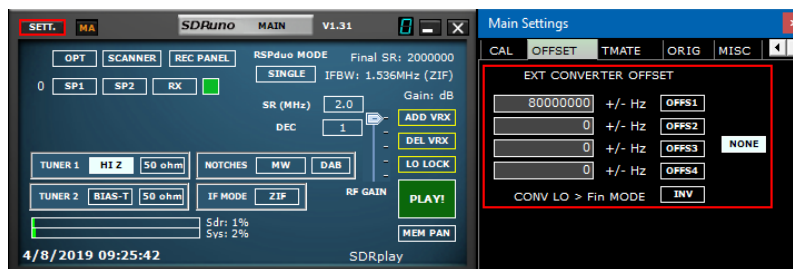
option to disable the output resampler: RX Control ->SETT.->OUT->Lock Output Fractional Resampler. By default, the output fractional resampler is enabled.

14.4 Setting to allow for external front end gain or loss.



Any additional loss or gain specified here will not affect the calibrated measurements made in SDRuno

15 External converters offset.



Up to four converter offsets can be stored in each instance of SDRuno. Offset settings are available in Main panel ->Sett.->OFFSET.

15.1 Changing a converter frequency offset.

Enter the new frequency in the edit box to the left of the relative button then press the ENTER key.

15.2 Enabling a converter offset.

Click on the relative offset button.

15.3 Disable any active offset.

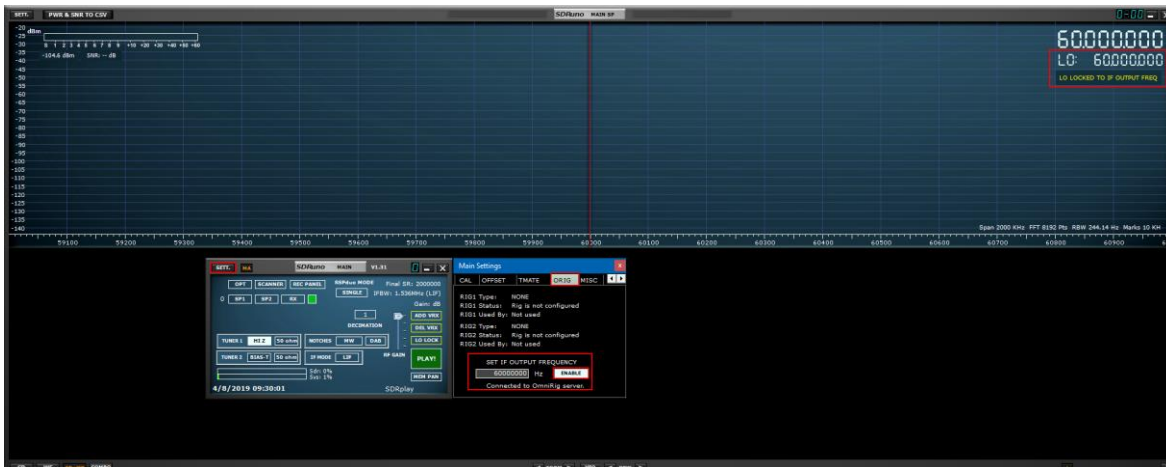
Click on the **NONE** button.

15.4 Inverted spectrum mode.



Some converters are designed so that its LO frequency is greater than the input signal frequency; because of this the output spectrum is inverted. In such case the inverted spectrum mode must be activated, clicking the INV button. Also, the I and Q channels must be swapped (Main panel ->OPT->Swap I and Q Channels).

16 IF Output Mode.



The IF output from a transceiver rig can be used as the signal source for the RSP. In this mode the LO frequency needs to be locked to the transceiver's IF frequency, whilst allowing the VFO to be tuned to within the transceiver's limits. Specify the IF output frequency in the settings panel and press the ENABLE button to engage the system. A message is displayed in the SP1 panel to remind you that SDRuno is in this mode.

17 CAT.



CAT control has been around for at least 25 years so it is a well-known technology: there is no need to review the basics here but a little refresh may be useful to understand how CAT has been implemented in SDRUno.

Whatever CAT protocol we choose, there is always a controlling device and a controlled one. In origin controlling devices were PCs and controlled devices were physical radios (receivers or transceivers) and accessories (rotors, switches, amplifiers etc.). Physical communication ports (serial ports for example) were used for the data exchange.

Per definition, in a CAT session only the controlling device can initiate a transaction. For example, the PC might send a “give me the VFO A frequency” while the radio might reply “the VFO A frequency is 3561230 Hz”. The logical roles can’t be exchanged.

Now that we have software radios (like SDRUno) a CAT session can be no more necessarily only between a program inside a PC and an external device but can be also between different programs inside the same PC (and even in different PCs).

In order to achieve this, we need a way to interconnect programs; one common solution is using special software tools to create “virtual com ports” pairs interconnected with “virtual null modem” cables. Then applications can see the virtual com ports as real ones, using them for communication. More on virtual ports later.

Another requirement we need is that the software radio must “impersonate” a controlled device and react the same.

17.1 How SDRUno implements CAT.

CAT has been designed in SDRUno so that the application can act as a controlled device and a controlling one at the same time. More precisely, each VRX can be seen as a separate radio on a different com port while at the same time it can control a physical external device via Omnirig.

For CAT radio emulation we chose a sub-set of the extensive Kenwood command set. The following VRX parameters can be set and read:

- VFO A Frequency
- VFO B Frequency
- Active VFO (A – B)
- RX Mode
- AF level
- Squelch level



- S-meter (read only)

Several commands are implemented in a dummy way just to make some controlling programs happy (HRD for example).

17.2 VRX CAT parameters.

VRX CAT parameters are accessible here: RX Control->SETT.->CAT.

17.3 COM Device.

This combo box allows you to select / enter the serial communication device. It is possible to choose among COM1 -> COM20 using the drop-down list. If the desired device has a name that it is not listed, enter it directly as follows:

- select the text inside the control (double click on the text)
- enter the device name by the keyboard
- press the Enter key on the keyboard

Default: COM10

17.4 Baud Rate.

This combo box allows you to select the speed for the serial device. This setting must match that of the controlling program, the higher the better. It is relevant only if the emulated virtual port has the “emulated baud rate” option enabled, otherwise it can be ignored.

17.5 RX Mode CTRL.

This option let you to choose if the controlling program can set the VRX RX mode.

Default: enabled

17.6 Enable & Connect.

This option enables CAT and starts the connection to the selected com device. Once enabled, the connection is effective until disabled or until the deletion of the relative VRX; also the connection is performed automatically every time the VRX is created. The status of the connection is indicated by the label placed on the bottom of the panel (STATUS: CONNECTED – NOT CONNECTED). To save system resources, do not enable unused connections.

17.7 Example: connecting to Ham Radio Deluxe.

Start creating a pair of virtual com ports named COM10 – COM11; do not select the “emulated baud rate” (you need to do this only once).

Launch SDRuno; assuming we wish to control VRX#0, open the CAT settings of that VRX. COM10 is selected per default; check “ENABLE & CONNECT”, the status should change to “CONNECTED”. Close the RX Settings panel.

Launch HRD; click on “Connect”. The first time you need to create a new radio connection: select “Kenwood” as “Company” and TS-440S (for basic controls) or TS-480 (for additional AF gain, squelch level and S-meter controls) as radio type. Select COM11 as “COM Port” and click “Connect”.

Once the connection has started you can try to change frequency, mode etc.

In other programs select a generic Kenwood as radio or the above models.

18 SDRuno as the controlling device – Omnirig.



SDRuno can control other devices (via CAT) thru the Omnirig COM server, a brilliant utility developed by Alex Shovkopylas, VE3NEA of Afreet Software, Inc. The main purpose (and advantage) of Omnirig is to provide a common “transparent” interface to applications; the controlling application doesn’t have to deal with a specific radio but instead sends and receives commands to Omnirig that in turn acts as a “bridge”. Omnirig can be “instructed” to work with a specific radio by “rig description” files that are relatively simple to create. There is already a huge list of supported devices and others can be added when needed, without the need to modify the code of neither Omnirig nor the application using it. In the past, Omnirig has become a standard and a huge list of applications relies on it: it is freeware, reliable and easy to install and set-up. For details please see the Omnirig web site <http://dxatlas.com>

18.1 Omnirig installation and set-up.

You may already know about Omnirig and you may have already installed it on your system: if not please download Omnirig from <http://www.dxatlas.com/omnirig/> . Installation is straight-forward: just launch the installer and follow the instructions. Omnirig can control up to two devices at once (and so SDRuno, see below), RIG1 and RIG2; both must be configured in the Omnirig control panel. If your rig is not listed among the available rig types, do a search on the web for a suitable rig description file, then add it to the “Rig” folder, located inside the Omnirig installation folder. Some setup tips: for best responsiveness use the higher baud rate your rig supports and set the polling interval to 100 mS. Please note that Omnirig can also see non-physical devices thru virtual COM ports (other applications for example).

18.2 How SDRuno handles Omnirig.

As you know SDRuno is a multi-instance environment; for better control and efficiency SDRuno filters all the traffic from/to its VRX(s) to/from Omnirig thru an internal own “server”. The latter is created in the SDRuno instance #0. Omnirig can control up to two devices at once; at a given time only one VRX, of whatever SDRuno instance is allowed to connect to an Omnirig device (RIG1 or RIG2); a mutual exclusion logic prevents overlaps. In short, up to two VRX can connect to Omnirig at the same time, one per device.

18.3 Monitoring Omnirig status from SDRuno instance #0.

A monitoring feature is available from SDRuno instance #0; go to Main->SETT->ORIG. Look at the bottom label first: this is the status of the connection to Omnirig; if Omnirig is correctly installed the label must show "Connected to OmniRig server". If there are problems "Can't connect to the OmniRig server" is shown instead: if this is the case recheck Omnirig installation. For each Omnirig device, additional information is shown (only RIG1 is described, the same applies for RIG2):

RIG1 Type:

Shows the RIG1 device type currently configured in Omnirig.

RIG1 Status:

Shows the RIG1 status reported by Omnirig; if there is an active working connection, the status is "On Line". Other statuses include "Rig is not responding" and "Rig is not configured".

RIG1 Used By:

Shows which SDRuno VRX is currently connected to RIG1 (instance # and VRX #).

18.4 Which parameters are synchronized?.

The following parameters are sent/received from SDRuno to/from the controlled device:

| Omnirig | SDRuno | Note |
|-----------------|---------------------|---|
| VFO A frequency | VFO A frequency | If the controlling device has only one VFO, VFO A is used |
| VFO B frequency | VFO B frequency | |
| VFO selection | VFO selection A - B | |
| Modulation mode | Modulation mode | Optional |
| RX-TX status | RX-TX status | Mute the VRX in TX, see below |

Note: if the controlled device is a transceiver or transmitter, putting it in TX mode causes the VRX to enter a special mode: a yellow label "RF MUTE" shows up in the RX Control panel, the MUTE button (AF muting) is activated and a 60 dB attenuation is applied to the signal after the SP1 display (so that real input levels are still shown) to facilitate AGC recovery. As the device exits TX mode the VRX returns to normal mode. you can use the key shortcut "T" to toggle the RX-TX modes of a synchronized transceiver/transmitter (provided that the "SYNC VRX -> RIG" option is enabled, see below); this feature can be useful also if there isn't a synchronized device as it also toggles the RF MUTE status in the relevant VRX.

18.5 Omnirig related VRX options.

Several options control the VRX/Omnirig connection; they are VRX parameters and must be set on a VRX basis. To access these parameters, go to RX Control->SETT->ORIG.

18.6 RIG Selection.

These buttons select the target device, RIG1 or RIG2. This setting also changes the name of the RSYN button on the RX Control panel to reflect the selection (RSYN1 or RSYN2). Default: RIG1.



18.7 SYNC VRX->RIG.

If checked, the controlled device is synchronized to the VRX.
Default: checked.

18.8 SYNC RIG->VRX.

If checked, the VRX is synchronized to the controlled device (the VRX reflect changes made on the controlled device). You must enable this option to use the muting on TX feature.
Default: unchecked.

18.9 SYNC Center FREQ. (LO).

If checked, the frequency information is relative to the VRX "centre frequency" (the SDR hardware local oscillator). You must enable this option if the controlled device is also the front-end of the receiving chain that includes SDRuno.
Default: unchecked.

18.10 SYNC RX Mode.

If checked, the modulation mode is also synchronized.
Default: checked.

18.11 The RSYN button.

The RSYN button on the RX Control panel activates the synchronization of the relative VRX with the selected Omnirig device. A mutual exclusion logic avoids multiple VRX accessing the same device at the same time. The status of this button is persistent between sessions.

19 Tmate and Tmate 2.

SDRuno natively supports the Tmate and Tmate 2 controllers. SDRuno makes full use of the controllers in the "multi instance" environment: this has been achieved by implementing a "Tmate server" and using inter-process communication (IPC).

What do I need to use Tmate (and Tmate 2) with SDRuno?

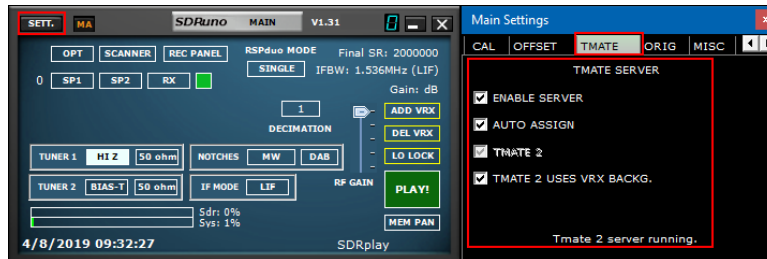
First you need to connect the Tmate to a free USB port. For Tmate you need also to install its driver while for Tmate 2 this is not necessary (Tmate 2 is a HID device so it uses a system standard driver. The following files (supplied with SDRuno) must be included in your SDRuno folder(s):

- For Tmate: ELAD_Encoder.dll.
- For Tmate 2: Tmate2_DLL.dll.

19.1 The Tmate server.

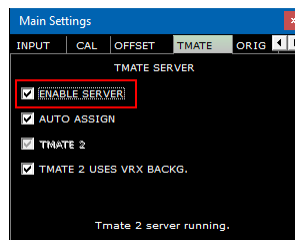
The Tmate server implements bi-directional communication between the Tmate and whatever VRX you like, even across multiple application instances (more on this later). Think of the Tmate server as a “global resource”; it is created (if needed) by the SDRuno instance #0. The process is of course entirely transparent to you.

19.2 Tmate server options.



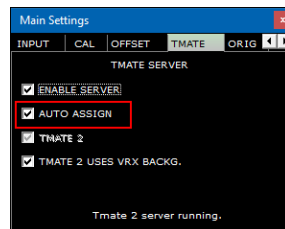
The Tmate server options are accessible only from the SDRuno instance #0 from here: Main panel ->SETT.->Tmate.

19.3 Enable Server.



This checkbox enable/disable the Tmate server; the server status is reported on the bottom: once enabled, if everything is ok you should read “Tmate server running.”. If the program reports an error, first check that no other application has allocated the Tmate (remember, Tmate is “single client”).
Default: disabled

19.4 Auto Assign.

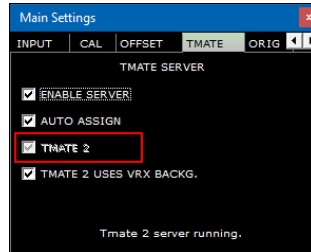


This checkbox let you choose between two “assigning” options for the Tmate controller.

If AUTO ASSIGN is checked, the VRX controlled by the Tmate is the one that currently has one of its **SP1**, **SP2**, **RX Control** or **RX EX Control** panel selected (the “SDRuno” label in the panel is red). This is the simplest and fastest way to assign the Tmate controls to a VRX.

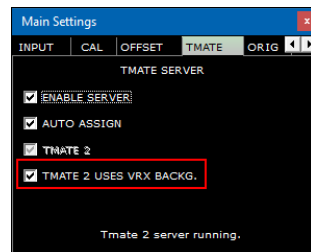
If AUTO ASSIGN is unchecked, you have to assign the Tmate to a specific VRX by the “TCTR” button located on the upper-right border of the relative RX Control panel. To avoid confusion, a mutual exclusion logic is implemented: only one VRX can be assigned at a given time.
 Default: enabled

19.5 Tmate 2.



This checkbox let you choose between the two Tmate models. You can have both a Tmate and a Tmate 2 controllers connected to the system at the same time. In order to change this setting, the Tmate server must be stopped (uncheck ENABLE SERVER).
 Default: disabled (controller type is Tmate)

19.6 Tmate 2 USES VRX BACKG.



The Tmate 2 controller features an LCD display with a RGB backlit. This checkbox let you choose between two backlighting modes:



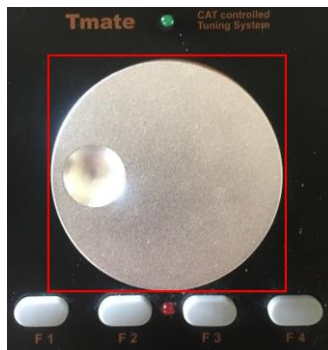
If checked, the LCD backlighting colour follows the assigned VRX background colour.
 If unchecked, the LCD backlighting is set to a fixed neutral colour.
 Default: enabled

19.7 Tmate Controls.



Currently the Tmate controls are implemented as follows:

19.8 Tuning Knob.



Tmate employs a 128 steps/turn optical encoder. Each step corresponds to a given increment/decrement of the VRX tuning frequency and it is the same used for the mouse wheel (see 2.7 – 2.8). The current tuning step is shown in the RX Control panel to the left of the frequency dial. When the spinning speed exceeds a certain threshold, a multiplying factor of 5X is applied to the current step; this feature is quite common in traditional (hardware) receivers and transceivers. The knob can be locked (see below).

19.9 F1 – Decrease Step.



Decreases the tuning step to the next lower value (if available).

19.10 F2 – Increase Step.



Increases the tuning step to the next higher value (if available).

19.11 F3 – Knob Lock.



Locks/unlocks the tuning knob; the locking status is indicated in the RX Control panel, to the left of the frequency dial.

19.12 F4 – Mute.



This button has the same effect of the MUTE button inside the RX Control panel. Please note that the tuning step, lock and mute options are independent for each VRX.

19.13 Tmate 2 Controller.



Currently the Tmate 2 controls are implemented as follows:

19.14 Tuning Knob.



Tmate employs a 32 steps/turn encoder. Each step corresponds to a given increment/decrement of the VRX tuning frequency and it is the same used for the mouse wheel. The current tuning step is shown in the RX Control panel to the left of the frequency dial and also in the Tmate 2 display. When the spinning speed exceeds a certain threshold, a multiplying factor of 5X is applied to the current step; this feature is quite common in traditional (hardware) receivers and transceivers. A further increment in speed triggers a 10X multiplying factor. The knob can be locked (see below). Pushing the tuning knob selects the current VFO (A – B).

19.15 E1 Encoder.



The function of this control can be selected by you: pushing the knob and selecting the current function among the five available:

- VOL adjust the VRX audio level (AF level or volume).
- RFG adjust the AGC gain (if AGC is enabled) or the RF gain (if AGC is disabled).
- SQL adjust the squelch threshold.
- NR adjust the amount of Noise Reduction
- NB adjust the threshold of the Noise Blanker

19.16 E2 Encoder.



The function of this control can be selected by you: pushing the knob and selecting the current function among the two available:

- HIGH adjust the selectivity filter high frequency limit.
- LOW adjust the selectivity filter low frequency limit.

Pushbuttons:

19.17 F1 – Decrease Step.



Decreases the tuning step to the next lower value (if available).

19.18 F2 – Increase Step.



Increases the tuning step to the next higher value (if available).

19.20 F3 – Knob Lock.



Locks/unlocks the tuning knob; the locking status is indicated in the RX Control panel, to the left of the frequency dial and by the LOCK LED on the Tmate 2 window.

19.21 F4 – Assignable Button.



The function of this button depends upon the current parameter controlled by the E1 encoder:

- VOL MUTE on/off.
- RFG AGC on/off.
- SQL squelch on/off.
- NR Noise Reduction on/off.
- NB Noise Blanker on/off (NBW only).

19.22 F5 – RX Mode.



Selects the current receiving mode.

19.23 F6 – VRX Selection.



Assigns the Tmate to the next VRX of the same instance.

19.24 LED & LCD display.



19.25 USB LED.

This LED is lit when there is connection with the Tmate server.

19.26 Lock LED.

This LED is lit when the tuning knob is locked (see F3 button).

19.27 LCD Display.

The Tmate 2 display shows many VRX parameters; the tuning frequency field also doubles as parameter value indicator. When the frequency exceeds the 9 digits capability of the display, the entire field is shifted one digit to the right (10 Hz resolution).

20 Abbreviations and Acronyms.

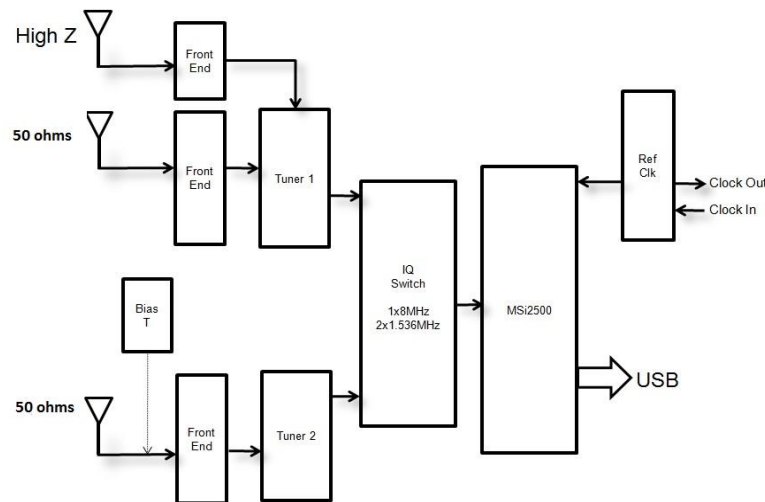
| | |
|------------|---|
| AGC | Automatic gain control |
| AM | Amplitude modulation |
| A/D | Analog to digital |
| ADC | Analog to digital converter or analog to digital conversion |
| AF | Audio frequency |
| ANF | Automatic notch filter |
| CAT | Computer aided transceiver |
| CPU | Central processing Unit |
| CW | Continuous wave |
| D/A | Digital to analog |
| DAC | Digital to analog converter or digital to analog conversion |
| dB | Decibel a way of representing numbers in a logarithmic scale. |
| dBFS | Signal level compared to the full-scale level, expressed in dB. |
| DLL | Dynamic link library |
| DSB | Double side band |
| DSP | Digital signal processing |
| FFT | Fast Fourier Transform |
| FM | Frequency modulation |
| GUI | Graphical user interface |
| HF | High Frequency |
| Hz | Hertz |
| IF | Intermediate frequency |
| IQ | Refers to the I and Q data streams treated as a pair of signals |
| kHz | Kilohertz |
| LF | Low Frequency |
| LNA | Low noise amplifier |
| LO | Local Oscillator - the frequency that the SDR is tuned to. |
| LSB | Lower sideband transmission. |
| MHz | Megahertz |
| NFM | Narrowband Frequency Modulation |
| NR | Noise Reduction |
| Panadapter | A spectrum display of a section of spectrum |
| RDS | Radio data system |
| SAM | Synchronous amplitude modulation |
| SNR | Signal-to-Noise Ratio in dB. |
| USB | Universal serial bus |
| USB | Upper sideband transmission. |
| WFM | Wide Frequency Modulation |

21 Appendix 1 Using the RSPduo with SDRuno.

RSPduo overview.

The RSPduo is a radical new product from SDRplay. Architecturally, it is different from any previous RSP in that it features dual independent tuners, both piped through a single USB 2.0 interface. Superficially the RSPduo will look virtually identical to the RSP2pro and will be able to operate in a very similar way, but it also allows a completely new and unique set of usage scenarios.

The Basic block diagram of the RSPduo is:



The MSi2500 contains dual ADCs. This allows the sampling of I/Q analog baseband signals when the tuner is used in Zero IF mode. However, the tuner can also operate in a Low IF mode, where a single ADC is used to sample the output from the tuner. This opens up the possibility of having two independent tuners operating simultaneously, but this is **ONLY POSSIBLE IF BOTH TUNERS ARE OPERATING IN LOW IF MODE**. In Low IF mode, the maximum flat pass-band bandwidth of the IF filters in the tuner is 1.536 MHz, whereas in ZIF mode, it is possible to widen these filters to 8 MHz.



This is the approach used in the RSPduo. The receiver can either operate each tuner individually (one at a time) in zero IF mode with a displayed bandwidth up to 10 MHz or both tuners simultaneously with a maximum displayed bandwidth of 2 MHz.

The simultaneous use of two independent tuners (albeit with reduced bandwidth) makes certain key usage scenarios possible:

1. Simultaneous monitoring of two widely spaced bands – e.g. 40m and 2m
2. Mixing and matching applications simultaneously – e.g. ADS-B and ATC scanning
3. Phase and time coherent demodulation of two receivers

Scenario 3 is very difficult to achieve with two separate USB devices because of the uncertainty of USB latency. So whilst it is possible to phase lock the clocks of multiple RSP2s, the uncertainty of USB latency meant that the timing of the two units would not be aligned when it came to demodulation. The only way to overcome this was to apply timing correlation in software which requires a 'training sequence' to be simultaneously applied to both devices. The RSPduo overcomes this limitation because all traffic goes through a single USB interface.

Operating with two tuners simultaneously – The Master/Slave Concept

Whilst the tuners can be controlled completely independently in terms of gain and frequency, there is one common factor that cannot (indeed should not) be separated and that is the ADC sample rate.

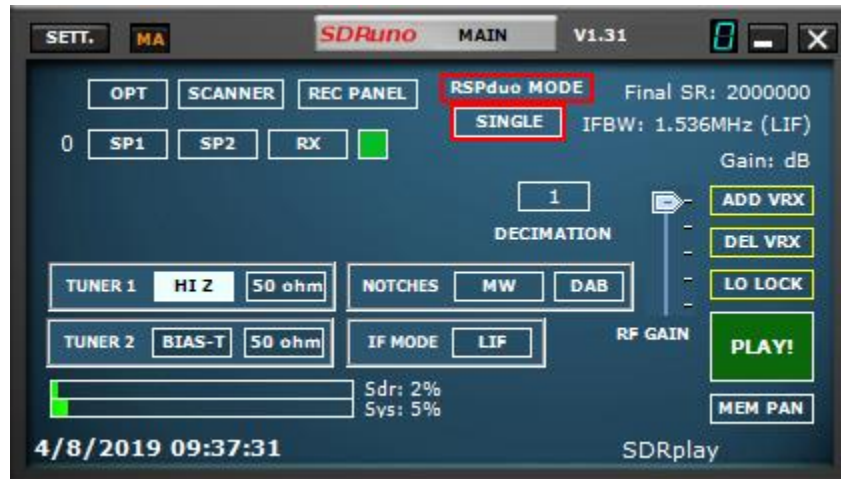
Because of this, whichever tuner is set up first will dictate the sample rate of the second receive path. To make it clear, we designate the first receiver to be set up as the 'Master' and the second one the 'Slave'.

A Windows Service based API for Device Management

From SDRuno release 1.23, a new way of managing RSP devices has been introduced. This is a requirement for handling the two tuners in the RSPduo.

Instead of the API either being embedded within the application (such as with SDRuno) or a separate DLL (as with HSDR and SDR Console), it is necessary to operate the API as a background 'service' within Windows. The service constantly monitors what is available in terms of receiver hardware and communicates this to the application at start-up. This way, it is possible to avoid the application attempting to configure a tuner on start-up into a mode that is simply not possible because another tuner is already designated as the 'Master' by a different application.

The Main Panel



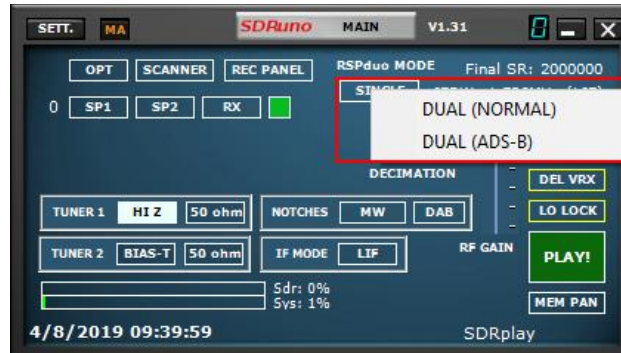
When using the RSPduo, the Main Panel will indicate the operating mode of the device.

As long as no other application (e.g. ADS-B) is already using one of the tuners within the RSPduo, upon start-up, SDRUno will always initially configure the device in “Single” tuner mode. In Single Tuner Mode, either tuner can be operated individually but not both tuners simultaneously. In Single Tuner Mode, each tuner can be configured in Zero IF (ZIF) mode or in low IF (LIF) mode.

Selecting either the Hi-Z port or the 50 ohm port associated with Tuner 1 will automatically configure Tuner 1 for use. Selecting the 50 ohm port associated with Tuner 2 will automatically configure Tuner 2 for use. In Single Tuner Mode, the RSPduo will operate in a very similar way to the RSP2/RSP2pro.

Dual Tuner operation (simultaneous operation of both tuners)

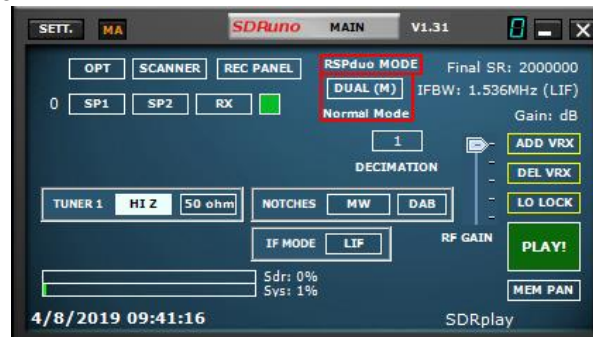
When switching to Dual Tuner, firstly determine which tuner you wish to be designated as the 'Master Tuner' and select one of the antenna ports for this tuner. Then select the RSPduo Mode button and two options will appear:



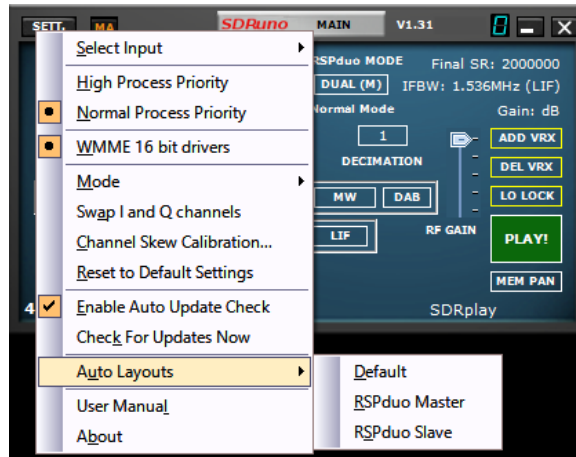
DUAL (NORMAL) - Select this mode unless you intend to run ADS-B using the Slave Tuner

DUAL (ADS-B) – This is ADS-B Compatibility Mode and is required if you intend to run ADS-B (dump1090) using the Slave Tuner. If you plan to use this mode, ensure that Tuner 1 has been selected BEFORE selecting this mode. This is because ADS-B (dump1090) uses Tuner 2 by default.

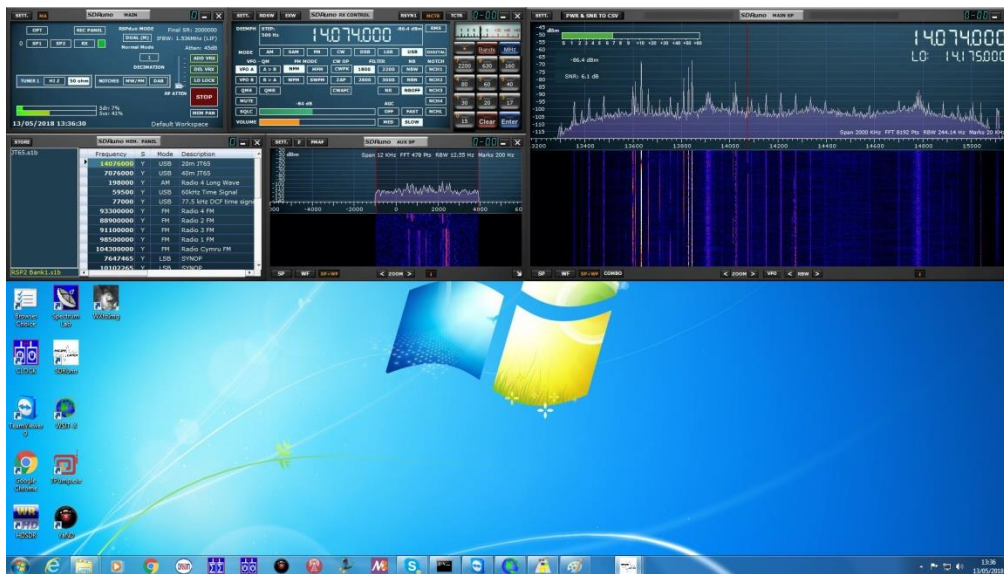
After selecting one of these two options the selected tuner will be the 'Master Tuner' and DUAL (M) will be the indicated RSPduo Mode:



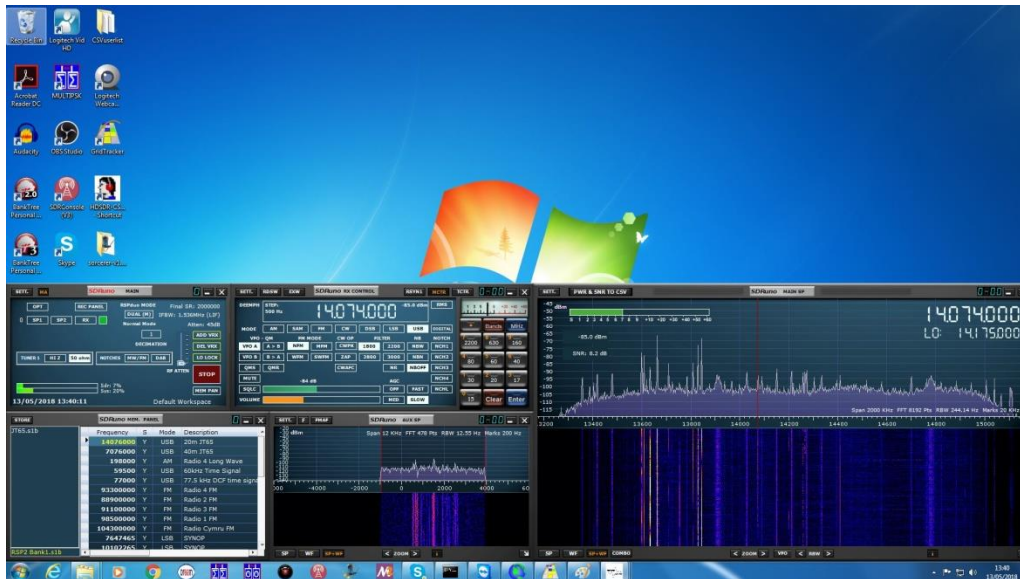
If you intend to run both tuners with SDRuno using a single monitor, you can select the Auto Layout feature from the Options Panel:



If you select the RSPduo Master option, the panels will be re-configured to fill the top half of the screen in an optimal way:

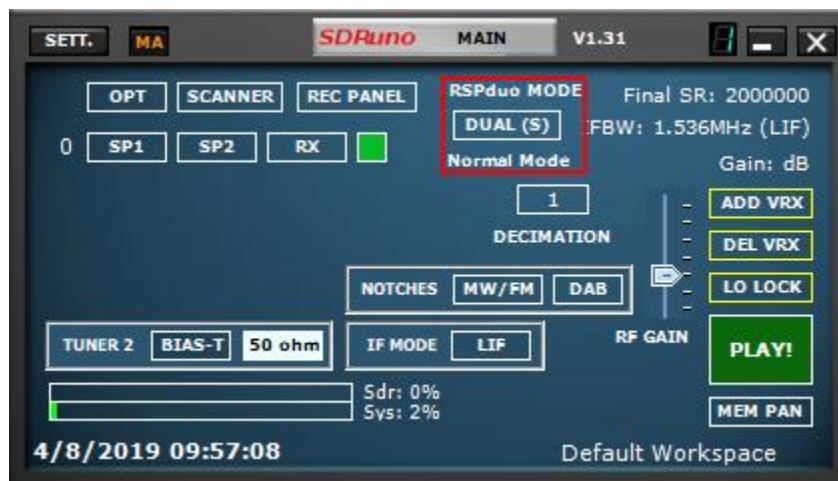


If you select the RSPduo Slave option, the panels will be re-configured to fill the lower half of the screen in an optimal way:

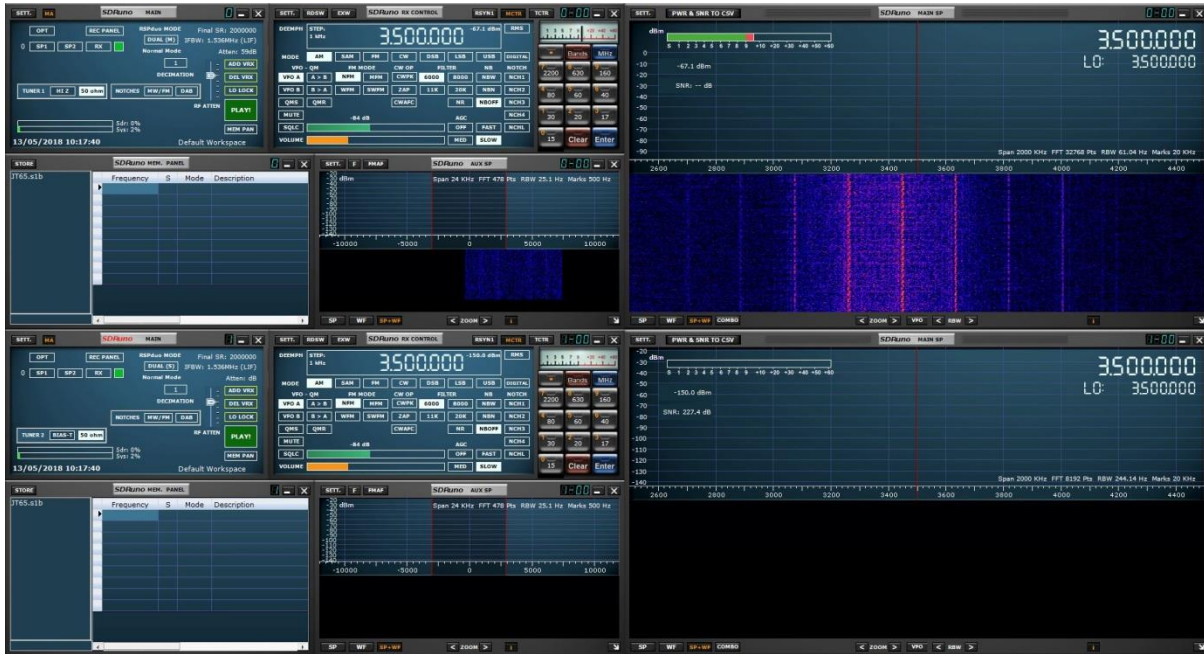


Either of these workspaces can then be saved so that they will open by default.

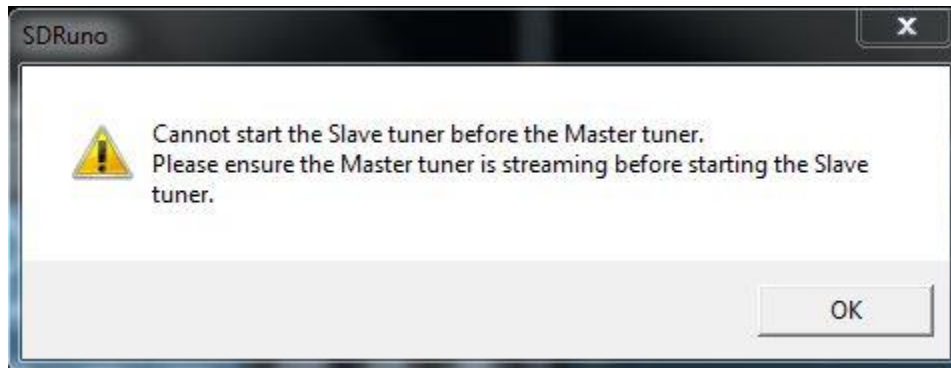
Having designated one of the tuners as the Master Tuner, to use the second tuner at the same time, it is now necessary to start a second instance of SDRuno. This second instance of SDRuno will automatically recognise that the second tuner is operating in 'Slave mode' and the Main Panel RSPduo Mode will indicate DUAL (S):



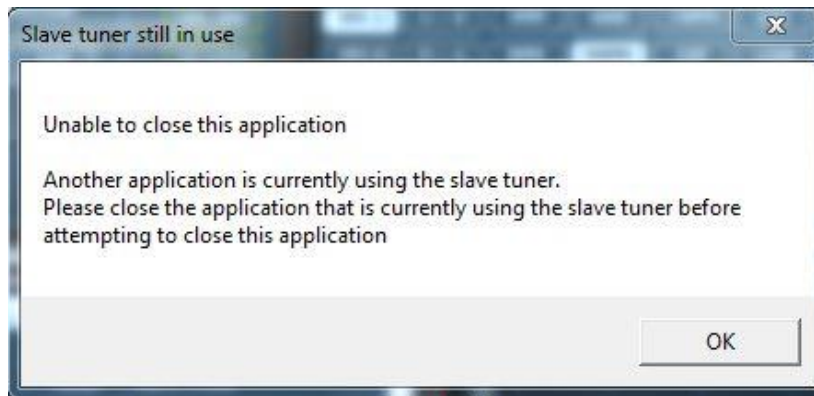
Using the Auto Layout Feature (OPT button), it is now possible to have both instances of SDRuno fill the screen in an optimum way:



Before starting the stream for the Slave Tuner, it is first necessary to start the stream for the Master Tuner. If you attempt to start the Slave Tuner before first starting the Master Tuner, you will receive the following error message:



Having started the Slave Tuner via a second instance of SDRuno, if you attempt to close down the instance of SDRuno that is running the Master Tuner, you will see the following message:



The Master can only be closed after the Slave has been closed.

If a different application (e.g. ADS-B) is already using one tuner in Master Tuner mode, SDRuno will automatically open the remaining tuner as the Slave.

Viewing more than 2 MHz of Spectrum (Single Tuner, ZIF mode only)

When the RSPduo is operating in Dual Tuner mode (Master or Slave), it will ONLY operate in Low IF mode with a maximum viewable bandwidth of 2 MHz. If you wish to have a viewable bandwidth of greater than 2 MHz, then it will be necessary to close the Slave Application and switch SDRuno back to Single Tuner Mode using the RSPduo Mode button on the Main Panel. After switching from Dual Tuner Mode back to Single Tuner mode, the device will still be in Low IF mode, so it will be now necessary to switch to Zero IF Mode via the Setting Panel:



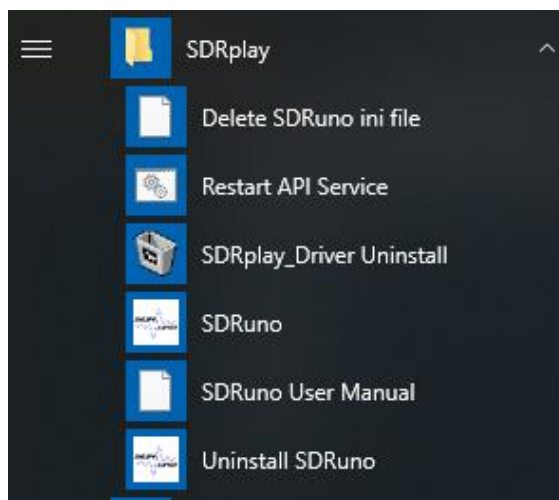
The Main Panel should now show that the device is operating in ZIF (Zero IF) mode and the amount of viewable spectrum can be changed by selecting a different sample rate:



Troubleshooting

If an application using the RSPduo crashes, the Windows API Service may not be informed that the tuner has been released and is therefore available when the application is restarted. If the Windows service does not recognise that the device is present, yet the device is present in the device manager, it may be necessary to restart the Windows API Service.

This can be done from the Windows Start Menu by navigating to the SDRUno 1.31 installation directory and selecting "Restart API Service"



From V1.31, SDRUno will create an error log file (%appdata%\SDRplay\error.log) if an error is caught and can be used by the SDRplay software team to identify potential issues.



22 Legal Information.

For more information see

<https://www.sdrplay.com/>

For support see

<https://sdrplay.com/support/>

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