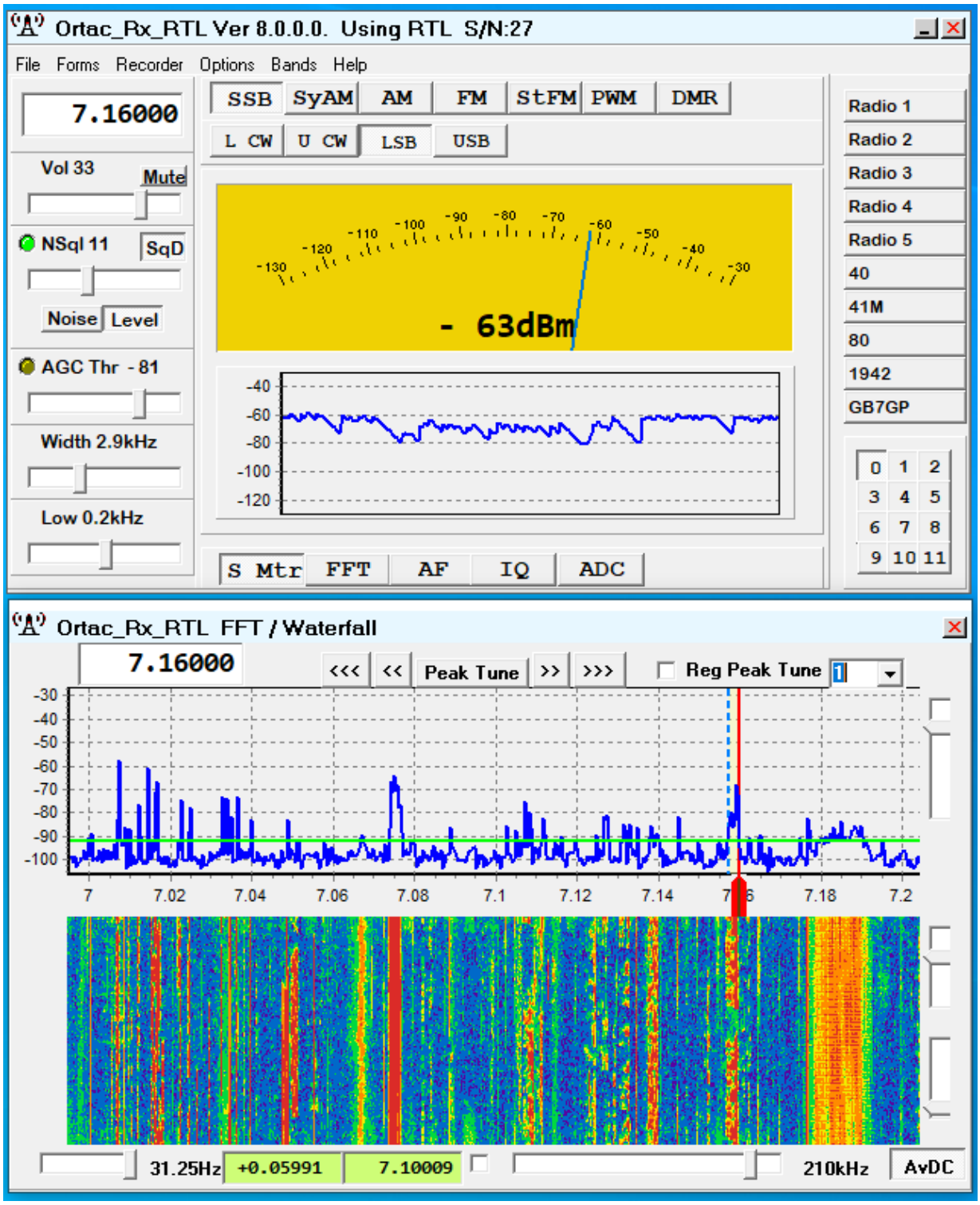


Ortac _Rx Manual

A 32 bit Windows DSP receiver

RFBits.com

Issue 8.0 October 22th 2025

CONTENTS

1 COMPATIBLE HARDWARE AND INSTALLATION

1.1 RTL2832u R820T2 Dongles

Examples are :-

RTL-SDR BLOG V3

NooElec com NESDR SMArt v4

Ortac_Rx_RTL requires the RTL2832u device to have the Rafael Micro R820T, R820T2 or R860 RF tuner, the programme is not compatible with devices using alternative now less common tuners such as the Elonics E4000.

Ortac Rx uses the libusb-1.0.dll, which in turn requires the WinUSB hardware device driver. The RTL2832u dongle will initially default to a device driver that does not work with lib-usb-1.dll. There are many places on the web that describe the process to change the default driver to WinUSB using the "Zadig" utility, some examples are:-

https://www.rtl-sdr.com/rtl-sdr-quick-start-guide/

https://zadig.akeo.ie/

Once the correct driver has been configured all that is necessary to install Ortac Rx is to run the installer Setup_Ortac_Rx_RTL_Iss_p_p_.exe.

By default Ortac_Rx_RTL will install to:-

C:\Program Files (x86)\RFBits\Ortac_Rx_RTL

It will store its ini file, channel memory files and any recordings at:-

\Users\UserName\AppData\Roaming\RFBits\Ortac_Rx_RTL

1.2 AirSpy Receivers

AirSpy Mini

AirSpy R2

Ortac_Rx_ASpy will work with either the AirSpy mini or the AirSpy R2, it does not support the Airspy HF versions.

Ortac Rx uses the airspy.dll which in turn uses the libusb-1.0.dll and Pthreadvce2.dll, all of which are installed in the program directory during the install.

The radio uses the WinUSB hardware device driver, AirSpy have arranged that the correct driver is installed, there should be no driver installation required.

This means that to install Ortac_Rx_ASpy, all that is needed is to run the installer Setup_Rx_ASpy_Iss_p_p_.exe.

By default Ortac_Rx_ASpy will install to:-

C:\Program Files (x86)\RFBits\Ortac_Rx_ASpy

It will store its ini file, channel memory files and any recordings at:-

\Users\UserName\AppData\Roaming\RFBits\Ortac_Rx_ASpy

1.3 SDRPlay RSP receivers

RSP1

RSP1A

RSPdx

RSPduo

Ortac_Rx_SPlay 'plays' with the SDRPlay RSP1, RSP1A, RSPDx and RSPDuo.

It uses the SDRPlay_api.dll, which in turn uses the 'SDRPlayAPIService'. A copy of the sdrplay_api.dll is installed in the Ortac_Rx_SPlay directory, but the SDRPlayAPIService must be also be installed.

The SDRPlayAPIService is installed by the SDRPlay SDRuno software, please ensure that SDRuno is installed before running Ortac_Rx_Splay.

With SDRuno is installed, but not running, to install Ortac_Rx_SPlay, all that is needed is to run the installer Setup_Rx_SPlay_Iss_p_p_.exe.

By default Ortac_Rx_Splay will install to:-

C:\Program Files (x86)\RFBits\Ortac_Rx_Splay

It will store its ini file, channel memory files and any recordings at:-

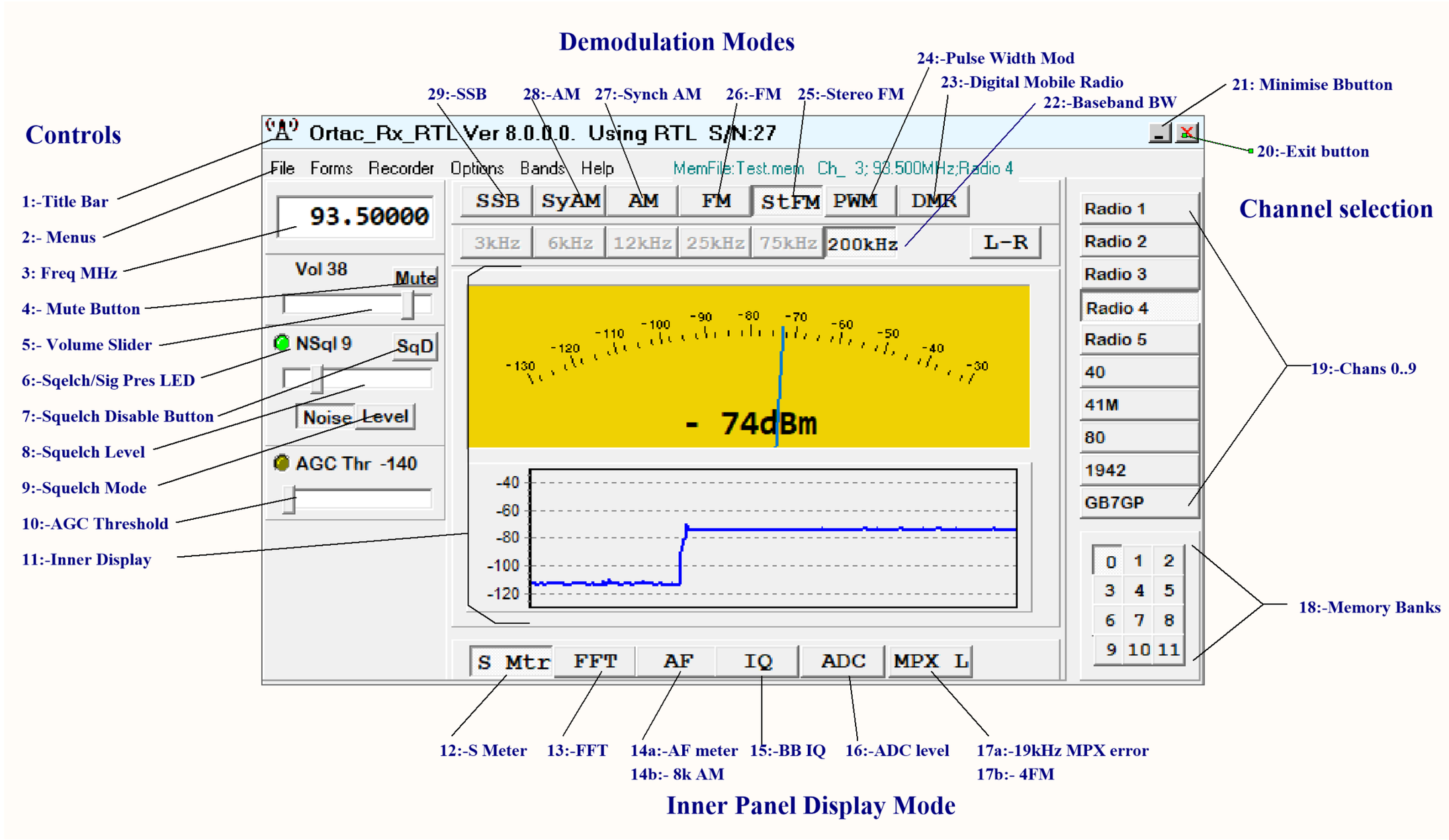
\Users\UserName\AppData\Roaming\RFBits\Ortac_Rx_SPlay

2.0 MAIN RECEIVER FORM (RxForm).

The main receiver form is designed to present a compact display of the main radio setting and functions.

The functions of the buttons and displays are shown within the programme by pop-up hints.

The annotated graphic below is used to further describe their functions, the numbers relate to the following paragraphs numbering.



2.1 **Title Bar**

Displays programme name and version number, with S/N of Rx and Chan if not manually tuned.

2.2 **Menus.**

The options given by the Menu are many, they are detailed in the next section.

2.3 **Freq MHz.**

Direct entry MHz from the keyboard. Use the return key to enter the value.

2.4 **Mute Button**

Depress to mute all audio output from the programme, any live audio recordings not affected.

2.5 **Volume Slider.**

There are 0..44 positions of the slider, each one is an increment of 1dB.

2.6 **Squelch LED – Signal Present**

This 'lights' when the squelch is open and the audio from the demodulator is not muted. When squelched the LED is dim and the audio is muted.

This signal can also be used by the Audio recorder to 'auto-record' only when signal is present.

2.7 **Squelch disable button.**

Depressing this button disables squelch, there will always be a signal present.

2.8 **Squelch Level**

This slider adjusts depending on the squelch mode either the noise squelch threshold or the level squelch threshold. Note the level squelch is calibrated in dBm and is also shown as the horizontal green line in the FFT form.

2.9 **Squelch Mode.**

Select the current operational mode of the squelch.

Noise squelch looks at the ratio of the high frequency noise to the low frequency audio from the demodulator. Compares this ratio to the adjustable threshold to make a signal present decision.

Level squelch uses the current dBm level, compares this to the adjustable squelch level to make the signal present decision.

2.10 AGC threshold.

Stops the AGC falling below this level, the level is shown above in dBm.

Only useful for AM and SSB modes, primarily on the HF bands. For AM it can stop deep fades of the signal outputting loud distortion, for SSB it is particular useful to stop the noise bursts between gaps in transmissions.

Makes no difference for other modes, but it can interfere with the level squelch and dBm readings if left high.

When the AGC is being held at the threshold level the LED will light.

2.11 Inner Display.

The Inner display is controlled by the buttons on the bottom of the form.

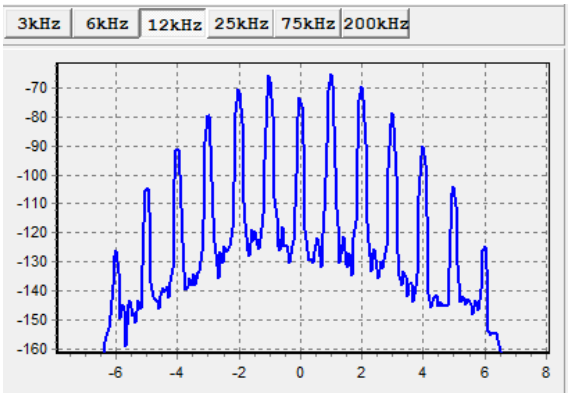
2.12 S Meter.

The S meter shows the current signal level in dBm. The calibration can be adjusted in the RF gain control form.

The lower panel show a history of the last 25 sec of the dBm level.

2.13 FFT

This displays an FFT run on the filtered baseband. The FFT and display are scaled depending on the current bandwidth, if there is no signal you can see the edges of the baseband filter.



This shows a FM signal with 2Khz deviation of 1kHz AF sinewave. The bottom axis is calibrated in kHz, the left in dBm.

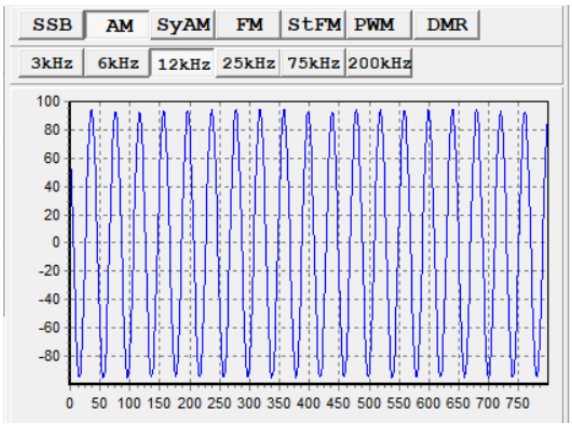
When the FFT panel is displayed, the mouse wheel will fine tune the frequency.

2.14 **(a) AF.**

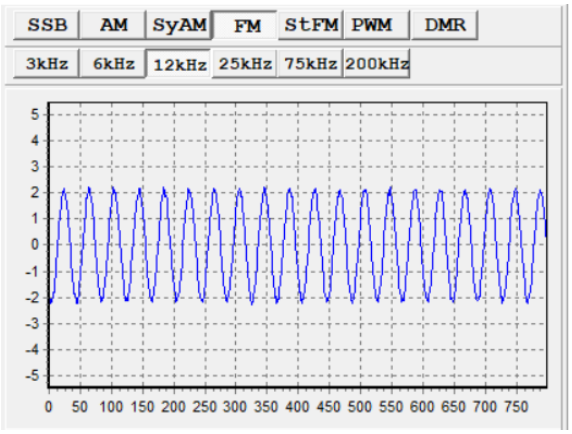
The AF panel displays the demodulated audio.

In AM mode the left axis is calibrated in % modulation depth.

In FM mode the left axis is calibrated in kHz deviation.



99% AM @400Hz

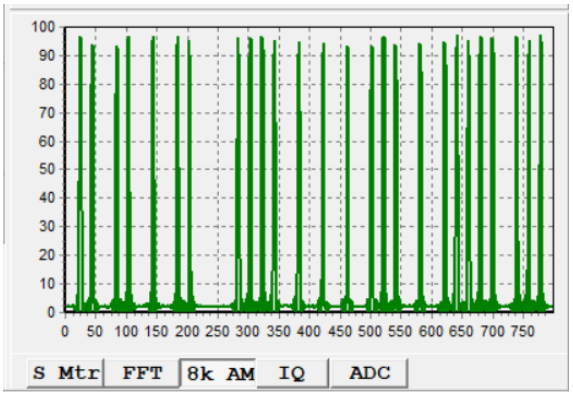


2kHz dev @400Hz

In Stereo FM mode, the two audios are shown.

2.14 **(b) 8k AM (PWM mode)**

The 8k AM panel shows the audio for the special 8k PWM mode.

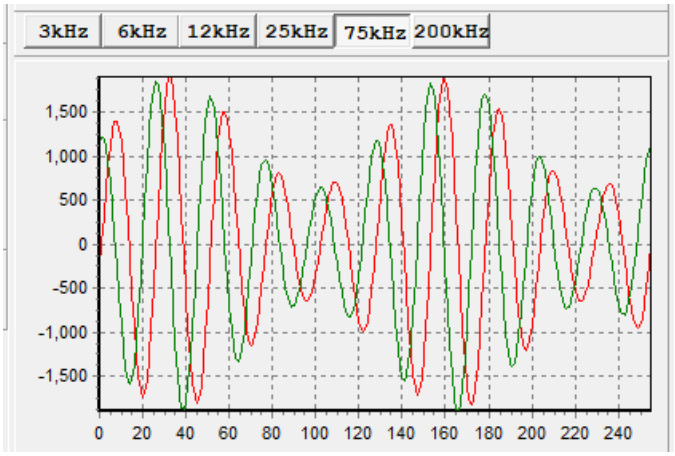


In this mode the AF sample rate is 8kHz no matter what the selected bandwidth. Further because the width of the PWM signals are so short, there is not time for an AGC to adequately settle, so in PWM mode there is no AGC and there is no DC block.

2.15 **Baseband IQ.**

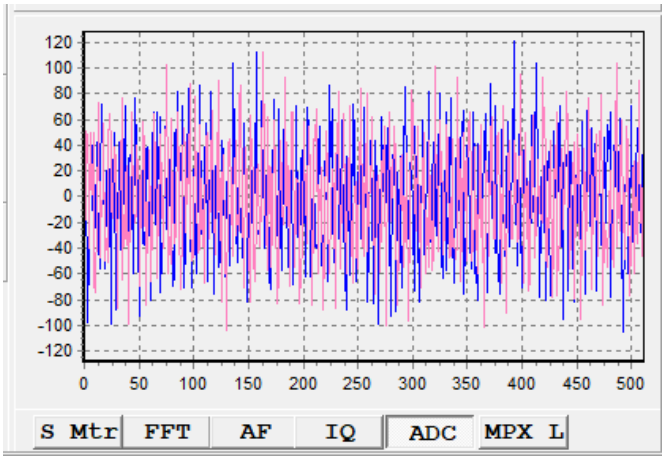
This displays the filtered baseband IQ before AGC, the scale auto adjusts.

It is of interest only, showing the IQ signals that the demodulator is working with.



2.16 **Level.**

This panel shows a sample of the raw ADC IQ signal brought in from the USB.



For the RTL the range is -127 to +128, which corresponds to the 8 bit samples.

For the SPlay the range is ±32768, corresponding to the 16 bit returned on the USB.

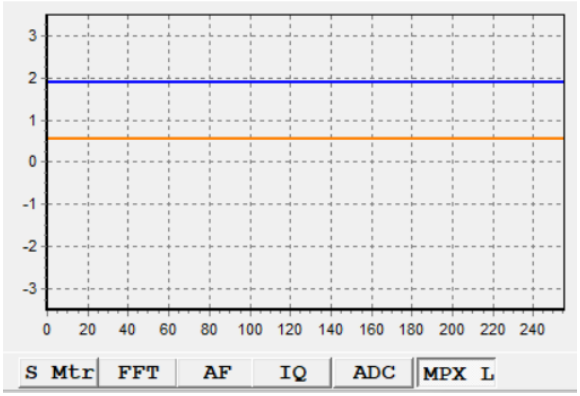
The ASpy has the range ±0.35, corresponding to the range of the floats returned on the USB.

For the RTL and ASpy, this raw ADC signal is used to control the 'Front End' AGC, which is designed to keep the ADC signal at optimum level. This is further described in section …

The SPlay has its own AGC, which is tied up with its gain reduction report which is used to keep the dBm calibration.

2.17 (a) MPX L (Only present in Stereo FM mode)

This shows the frequency error of the 19kHz pilot tone, it is for information only.

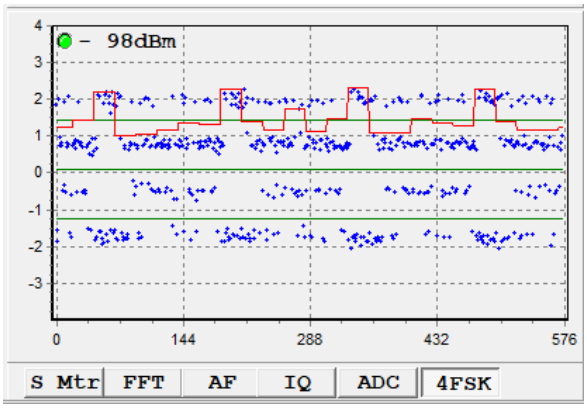


It does show that some stations have a considerable error in the frequency of the 19kHz tone, it looks like some are free running oscillators. It is also strange that the 57kHz sub carrier for the RDS is often not locked to the 19kHz tone at all.

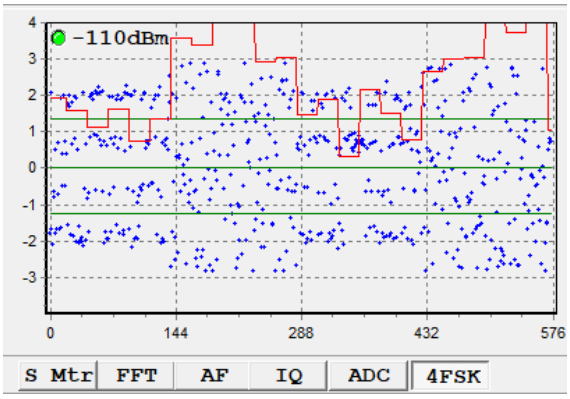
2.17 (b) 4FSK (Only present in DMR mode)

This panel shows the recovery of a 4FSK signal.

Ortac_Rx is specifically tuned to the DMR signal timings. A base DMR signal is continuous, but a mobile consists of 30ms bursts.



-98dBm repeater DMR signal



-110dBm mobile DMR signal

The blue dots show the deviation at the sample point, the vertical axis shows kHz deviation, the x-axis is sample number, there are 144 samples per DMR frame. This can be useful tool to setup the deviation on a DMR hotspot.

DMR FSK offsets are -1.94kHz, -0.65kHz, +0.65kHz and +1.94kHz, this is clearly seen to be the case for the continuous repeater DMR signal. For the on/off signal from the mobile, it is not so clear because of the noise burst between each pulse, but synchronisation is maintained.

The three green lines show the symbol thresholds, Ortac_Rx will attempt to optimize these thresholds so that frequency errors are tolerated, but the mouse-wheel can also be used to centre the signal.

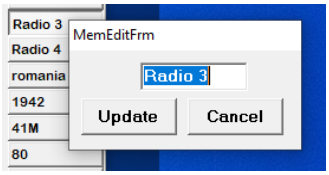
The green LED (top left) will 'light' when DMR frame synch has been achieved.

2.18 Memory Banks

Ortac_Rx gives immediate access to 12 banks of 10 channels. When the bank is changed, the Chan button captions are updated together with their hints.

2.19 Chan 0..9

The channel buttons provide direct tuning to the programmed channel. Hover the mouse over each button will pre-view what is stored. To program a channel, use a mouse right click, this will bring up a small MemEdit form, here enter text to label the button then press update.



Note each channel stores :-

1. Channel Text, as displayed in the chan button.
2. Mode, 'AM','FM', 'sFM', 'lrFM', 'PWM', 'syAM', 'syAML', 'syAMU', 'lCW', 'uCW', 'LSB', 'USB' or 'DMR'.
3. Tuned Frequency, resolution is 10Hz.
4. DSP offset.
5. Bandwidth.
6. Which inner display to show,
7. Volume including mute.
8. Noise Sq value
9. Level Sq value
10. FFT Spectrum Zoom
11. FFT Spectrum Top
12. WaterFall Gain
13. WaterFall Base
14. AGC threshold

The idea being that selecting a channel will just about restore the complete radio setup.

2.20 Exit button.

This will close the programme.

2.21 Minimise button.

This will send all programme windows to the task bar.

2.22 Baseband BW.

Ortac_Rx has 6 selectable baseband bandwidths. Not all BWs are available for all demodulators, eg stereo FM requires the 200kHz bandwidth and the other BWs are disabled.

Changing bandwidth actually changes the decimation and final sampling rate, this alters the FM gain, the inner panel AF and FFT scales and the sample rate sent to the sound card or the ACM audio recorder.

The FFT form is not affected by the main receiver bandwidth.

2.23 DMR Digital Mobile Radio

The DMR demodulator is designed to recover amateur un-encrypted mobiles and repeaters.

Use the 4FSK inner panel to view the synchronisation of the FM samples. If Frame synch has been achieved the green 'LED' in the panel will light. If audio frames are recovered then the Squelch / Sig_Pres 'LED' will also light. In DMR mode, the normal squelch functions are not active.

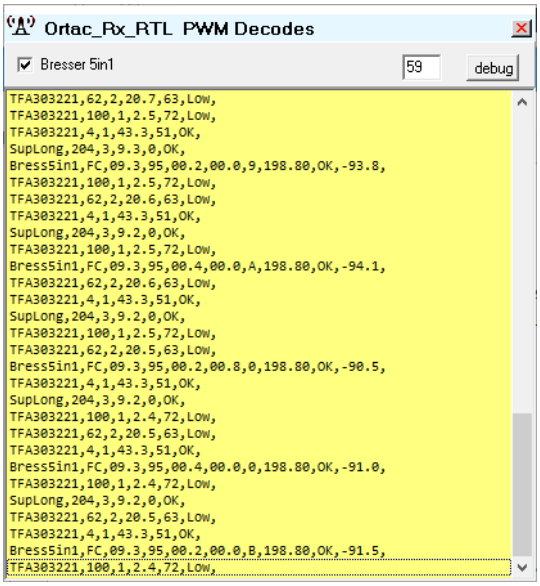
Note the DMR bandwidth is fixed at 12kHz. Ortac_Rx seems to be able to work with DMR signals down to ~ -115dBm.

At this time there is no DMR audio output due to the AMBE CODEC patents. However, if there is interest, an interface to the DVMEGA USB could be implemented.

2.24 PWM, Pule Width Modulation mode.

PWM mode is designed to decode various temperature sensors, door bells, weather stations and remote controls.

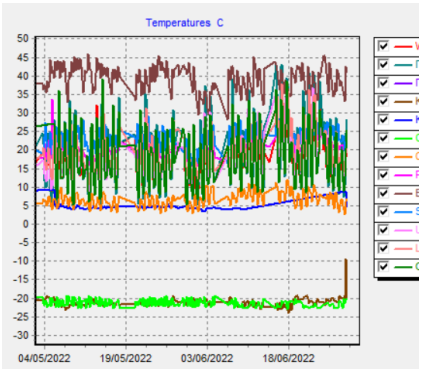
In PWM mode the final sampling rate is fixed at 8kHz, no matter what bandwidth selected. There is no AGC, the audio output is un-squelched but should normally be muted.



The decode algorithm uses a block averaging system to detect and count pulse widths, these are then tested against known device signatures. If a match is found then a decoded sentence is output to the PWM decode form.

It is also possible to log the decode to a text file and output these sentences via UDP to another programme for real-time plotting etc. The 'PWM Options' are found under the 'Options' menu item.

An example of what a programme could do is shown here :-



This logging programme is a work in progress, logging 12+ temperature sensors located in various places like freezers, greenhouses and lofts.

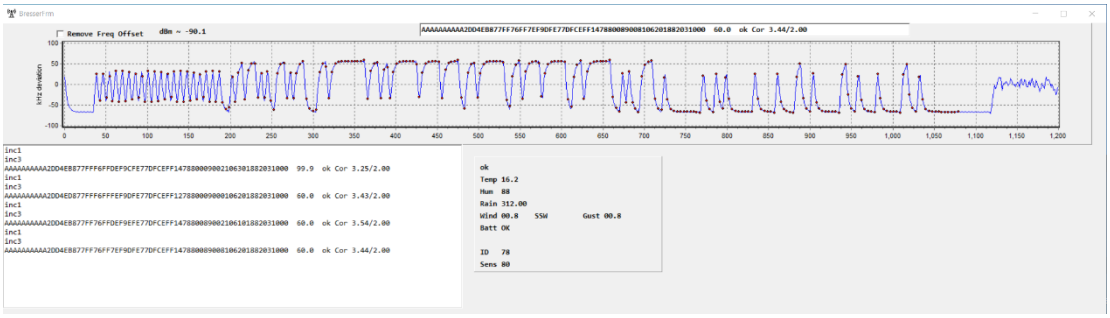
Bresser 5 in 1 mode.

My trusty Weather Station died, so I bought a new one. Unfortunately, this new Bresser weather station not only transmits on the 868MHz band, it also uses FSK. To log this weather station a Bresser 5in1 mode was added to the programme.

To activate the Bresser 5in1 mode,

1. Programme the frequency of the Bresser weather station into chan 8 in bank11. This is nominally 868.300MHz, set the channel mode to FM and select the 200kHz BW, the modulation is ±50kHz FM.
2. Check the Bresser 5in1 checkbox in the PWM form shown above.
3. Leave the time between Bresser tunes set to 59 secs.

Now when running normal PWM decodes on channel 9 in bank 11, every 59 seconds the radio will retune to channel 8 in bank 11. It will wait until a decode is made on the Bresser frequency, then hop back to normal PWM operation. The debug button brings up a from showing the FSK Bresser demod.



2.25 Stereo FM

The stereo FM demodulator has been designed to recover the highest quality audio possible. It requires a signal strength of at least -80dBm for a reasonable amount of noise quieting. At that level the RDS decoder should also pop up. Here the RDS messages are collected, along with the stations ID, genre and time information.

2.26 FM.

WBFM broadcast stations require 200kHz bandwidth, whilst amateur radio NBFM should use the 12kHz or 6kHz bandwidth.

The FM demodulator changes sensitivity with the chosen bandwidth as the demodulator sample rate changes, this is reflected in the FFT and Audio inner display panels' kHz calibrations. Ortac_Rx uses a software phase locked loop for FM demodulation.

The FM demodulator runs in all modes, it is used for the noise squelch even when using the AM demodulator. With adjusted time constants the FM PLL also provides the synchronous carrier for the SyAM mode.

2.27 AM

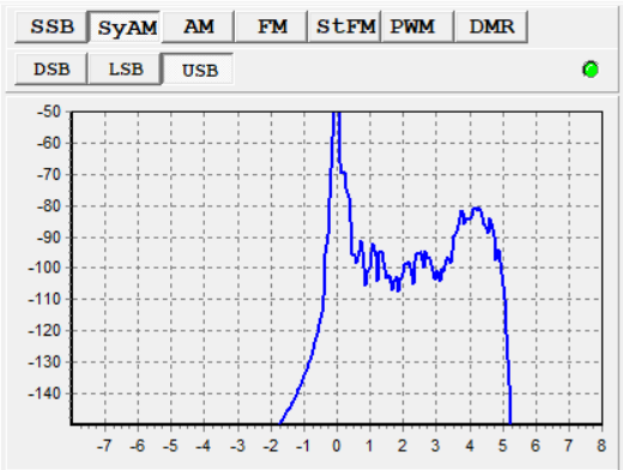
For AM most aircraft reception use 12kHz BW, to cope with the diversity sytem that some ground stations use the 25kHz BW may be necessary.

The audio BW of the AM demodulator varies with the baseband BW. AGC is optimized for each BW. The Audio panel is calibrated in % modulation and is fairly accurate for AF mod above 100Hz, below that AF frequency the AM AGC tends to distort the audio.

2.28 SyAM.

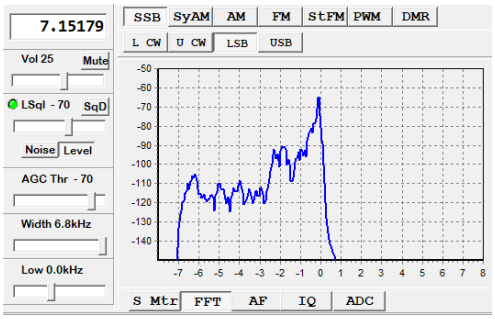
The Synchronous AM detector is designed to improve the selective fading distortion of HF signals. It employs a PLL with a relatively slow locking characteristic to hold the AM carrier for the duration of the fade. An LED indicates when the PLL is active.

Ortac_Rx also allows the SyAM selection of either upper or lower sideband, with adjustable BW, which can be useful again on HF where only one sideband has interference.



2.29 SSB

SSB has sub modes of LSB and USB.



Operation in all sub-modes is the same, the CW sub-modes differ only in setting a default width.

The 'Width' Control adjusts the lower LSB bandwidth edge, (or upper for USB), adjusting the high frequency AF response.

The 'Low' control adjusts the other edge, adjusting the low frequency AF.

In SSB modes, the AGC threshold control becomes useful. It can be used to stop the AGC from falling between transmissions, thus stopping the noise bursts in the gaps.

If the FFT inner panel is selected, the mouse-wheel will fine tune.

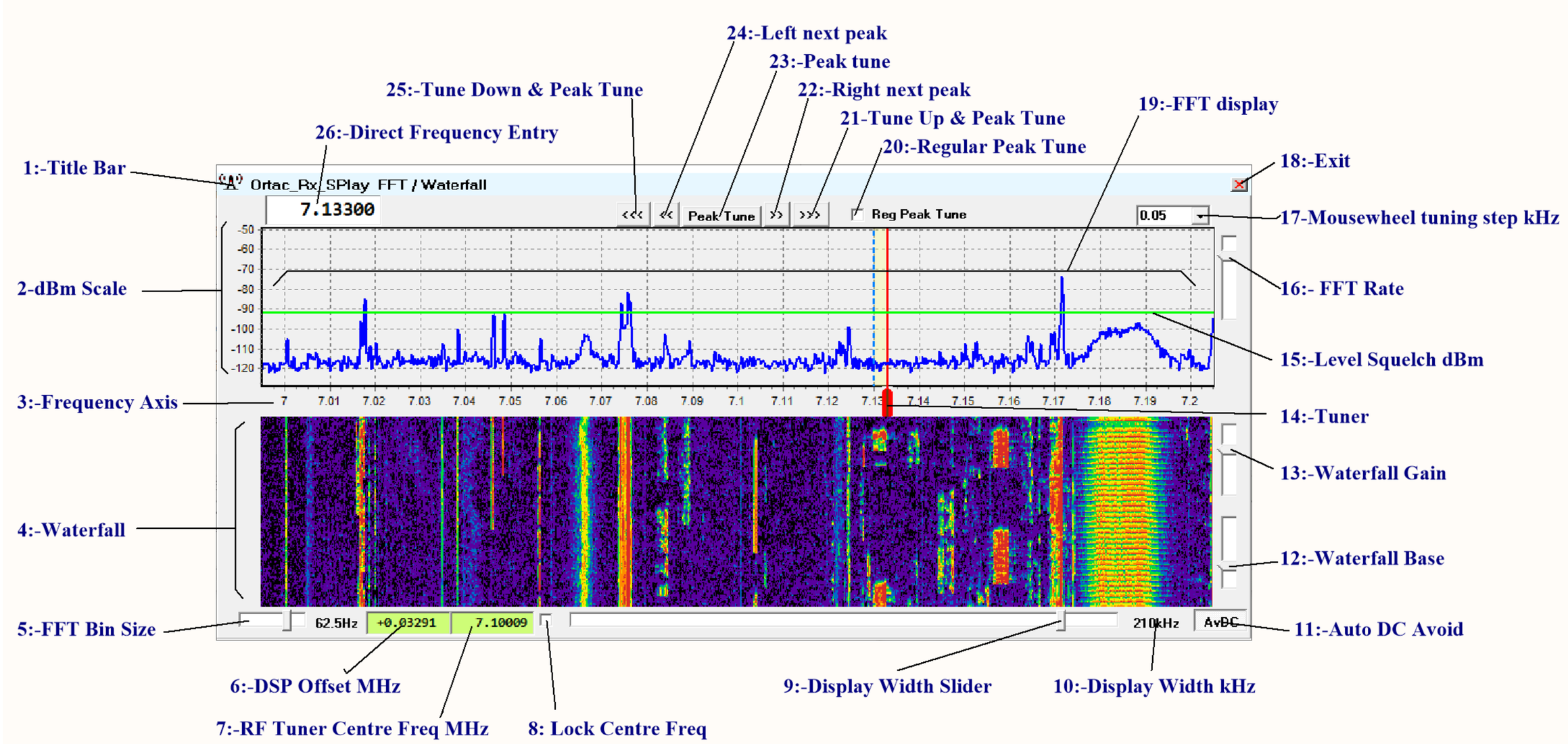
3.0 FFT FORM (FFTForm)

The FFT form displays up to 2MHz of bandwidth. It is closely tied to the Main Rx form.

It consists of two sections, the top section shows a 'calibrated' FFT, the lower section shows a waterfall display representing ten seconds history of the signals.

The annotated graphic below shows the FFT form when using an SDRPlay RSP1A, tuned to the 40-meter amateur band. The numbering in the figure corresponds to the numbering in the following paragraphs.

This form can be re-sized within limits and should remember its last size and position next run.



3.1 Title Bar

Displays programme and form name with version number.

3.2 dBm Scale

The vertical axis showing the RF power seen in the FFT bins at shown frequency.

The dBm scale can be moved up and down by dragging with mouse

3.3 Frequency Axis

This is the horizontal axis showing frequency in MHz for both the FFT bins and the waterfall.

The frequency axis can be dragged by the mouse, the tuned frequency will follow to keep the same frequency.

The horizontal display width can be 2.048MHz max, 200kHz min. The width is adjusted by the width slider item 8.

3.4 Waterfall

The waterfall shows the amplitude history of the FFTs over the last 10 seconds. It shares the same horizontal frequency axis with the FFT. The colour of the waterfall pixels relate to the dBm amplitude of the FFT bins, there are 7 colours used representing increasing amplitudes.

Lowest dBm Highest dBm

The colour dBm scale can be adjusted by the waterfall base control (10) and the waterfall gain control (11).

Double clicking the mouse on the waterfall will tune to that frequency.

3.5 FFT Bin Size

Orat_Rx uses a 2.048MHz IQ sample rate, this is native to the RTL and SDRPlay devices, for the AirSpy Ortac_Rx uses a re-sampler to work with the same 2.048MHz IQ rate. Ortac_Rx has options of 4096, 8192, 16384, 32768 or 65536 point FFTs which result in FFT Bin sizes of 500Hz, 250Hz, 125Hz, 62.5Hz or 31.25Hz.

The narrower the bin, the more detail can be seen of the signal. Note that the noise floor will fall by 3dB each time the bin size is halved.

For most signals the 62.5Hz bin size is suitable.

3.6 DSP Offset MHz

This shows the internal software 1st mixer frequency. If you move the Tuner (12), you will see this frequency move over the range ±1.024MHz. You can also enter the DSP offset frequency directly, which will move the Tuner. Note that the final tuned RF frequency is always shown top right as the direct entry Frequency (24) and also on the main Rx_Form.

If the DSP offset is shown as red, this means that the centre DC line lies within the IF bandwidth. This may be a problem as it can interfere with the signal. To correct this, use the mouse to drag the frequency axis to the left or right, until the DC line is outside of the IF bandwidth.

If the DSP offset background is green, the Auto DC avoidance is active, see (10).

3.7 RF Tuner Center Freq MHz

This shows the frequency that the USB radio is tuned to. The RTL and AirSpy can tune form ~26MHz to 1800MHz, they use the same R820T (or R860) tuner. SDRPlay radios can tune from DC to 2000MHz, it uses a MSi001 tuner, which has an inbuilt upconverter to enable it to tune below 30MHz.

Ortac_Rx uses a sample rate of 2.048M IQ samples per second, this gives the ability to tune up to ±1.024MHz either side of the tuner frequency. This sampling rate is native to the RTL and SDRPlay radios, the AirSpy samples are re-sampled.

It is possible to enter the Centre frequency directly, the final tuned frequency will be recalculated and shown as the top right direct entry frequency (24).

If the Centre Freq background is green, the Auto DC avoidance is active, see (10).

3.8 Centre Freq Lock

Checking this box locks the centre frequency, the frequency that the USB radio is tuned to. This means that you can only tune ±1.024MHz form this frequency and the functions that can change the centre frequency, such as direct tune are disabled.

When playing back or recoding IQ files, the centre frequency is locked automatically.

When closing the FFT form the centre freq lock is cleared.

3.9 Display Width Slider

This controls the frequency span shown by the FFT and the waterfall. The maximum span is 2.048MHz, the minimum is 100kHz. As the span is decreased, the centre and DSP frequency may be automatically adjusted to keep the tuned frequency within the span.

3.10 Display Width kHz

This shows the current width of the FFT and waterfall display in kHz.

3.11 Auto DC Avoid

The DC line that may appear at the centre frequency is caused by IQ in-balance within the USB radio. It is most noticeable with the RTL radio, when the RF gain is reduced. The AirSpy does not often show the DC line, it seems to use an IQ balancing algorithm to keep it minimized. However even if not visible it does seem to cause distortion if the tuned bandwidth covers DC. The SDRPlay seems least affected.

If the FFT display width is 1Mhz or less, Ortac_Rx can provide an optional automatic DC avoidance. The Tuner Centre frequency is increased by 500kHz and the DSP frequency is lowered by 500kHz to compensate. The DSP offset MHz(6) and Tuner Centre Freq(7) backgrounds are changed to green when DC avoid is active, although their frequencies do not show the added offsets.

3.12 Waterfall Base

This adjusts the level which corresponds to the 1st colour of the waterfall.

3.13 Waterfall Gain

This adjusts the range of RF levels that correspond to the set of waterfall colours.

3.14 Tuner

Move the tuner by the mouse to change the DSP frequency. The final tuned frequency is always shown top right (24). You can also grab the red tuner line in the FFT.

The current bandwidth is also shown by the yellow shaded area outlined by the green vertical dashes. IF you change the bandwidth by the RxForm the yellow region width will change.

3.15 Level Squelch dBm

This shows the current value of the level squelch. It can be adjusted either by the control in the Rx_Form or by dragging the green line up and down by the mouse.

This level is also used by the 'right next peak'(20) and 'left next peak'(22) tune buttons.

Note that this level is the total power in the DSP bandwidth, shown by the yellow shading around the Tuner. If the sum of the powers of the FFT bins within the DSP bandwidth is greater than the squelch level, the squelch will open, although the FFT may appear to be several dB below the green line.

3.16 Mouse wheel tuning step kHz

Use this drop down box to select the mouse-wheel tuning steps, you can also enter text.

3.17 FFTRate

This slider adjust the refresh rate of the FFT. CPU effort is reduced for slower rates.

3.18 Exit button

Will close the FFTForm, not the whole programme.

3.19 FFT Display

The FFT displays the value of the power in the FFT bins that correspond to X axis frequency. Because there are more FFT bins than pixels, it is the peak value of the FFT bins that correspond to the frequency that is displayed.

Use the mouse to double click a signal of interest, Ortac_Rx will tune to the FFT peak found within the current bandwidth around the clicked frequency.

3.20 Regular Peak Tune

Checking this will make Ortac_Rx perform a 'Peak Tune'(21) every 100mS.

It is useful for tracking drifting signal or hunting local transmission.

3.21 Tune up & Peak Tune

This will move the centre frequency up by half the FFT display width, then perform a peak tune over the whole FFT display.

3.22 Right next Peak

This will tune to the next right FFT peak that is over the green squelch level line, if none is found it will stop at the extreme right and will start again at the left edge.

3.23 Peak Tune

This will tune to the highest peak currently displayed by the FFT.

3.24 Left next Peak

This will tune to the next left FFT peak that is over the green squelch level line, if none is found it will stop at the extreme left and will start again at the right edge.

3.25 Tune down & peak tune

This will move the centre frequency down by half the FFT display width, then perform a peak tune over the whole FFT display.

3.26 Direct Frequency Entry

Direct entry MHz from the keyboard. Use the return key to enter the value, this display is repeated on the Main_Rx form. Frequency resolution is 10Hz.

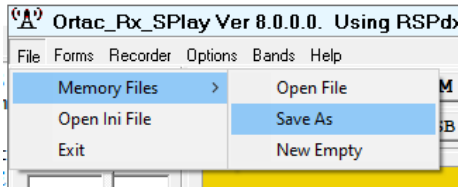
Mouse wheel also works.

4.0 MENUS

Only the Main RxFrom has a menu.

Here are some notes on the more interesting Menu items.

4.1 File Menu



4.1.1 Ortac_Rx Memory Files

Ortac_Rx gives immediate access to 120 channels held in 12 banks of 10. By default Ortac_Rx creates a 'ChMem1.mem' file, stored in '\Users*User*\AppData\Roaming\RFBits'. The file is a CSV text file. Ortac_Rx will remember the selected memory file for next run.

There are options to open an existing .mem file, save the current memories to a new file name or to create a new empty channel file (filled with 121.5MHz).

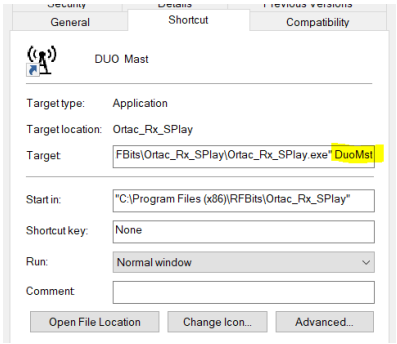
4.1.2 Ortac_Rx Ini files

Ortac_Rx uses an ini file to save its current configuration, it is stored in '\Users*User*\AppData\Roaming\RFBits\Ortac_Rx_XXX'.

You can view the current ini file via this menu item.

4.1.3 Ortac_Rx Ini files and Windows Shortcuts

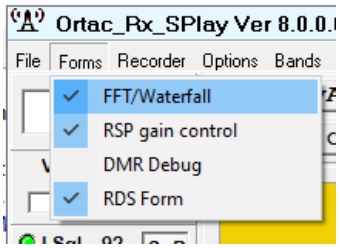
If you start Ortac_Rx with a filename parameter, it will create/use an ini file of that name. This can be achieved by appending the parameter to the target in a windows shortcut :-



Here the parameter ' DuoMst' has been added to the shortcut, Ortac_Rx will then use an ini file named 'Ortac_Rx_SPlayDuoMst.ini', (note the space in front of the parameter is required). That ini file can specify which radio serial number to use, allowing multiple copies of Ortac_Rx to run, each with its own specific radio and ini file configuration.

This also has the advantage that if multiple instances of the programme are run, via separate shortcuts with different parameters, Windows will give each instance a separate icon on the taskbar, rather than all the sub-windows of multiple instances merging into one taskbar icon.

4.2 Forms Menu

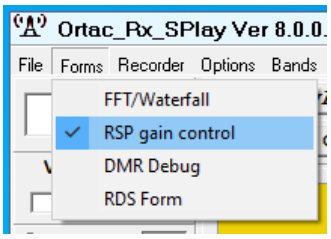


4.2.1 FFT Form

The FFTForm is the most important sub form. Its function is described fully in section 2.0.

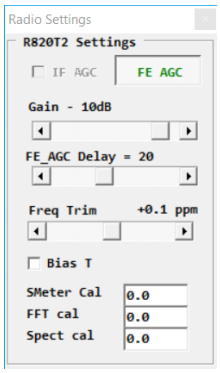
4.2.2 RF Gain Control

The RF gain control form is found from the Forms/RF Gain control menu item:-



Because each radio control is so different there are three basic forms:-

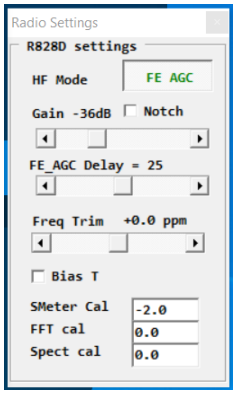
4.2.2.1 RTL



If FE_AGC is selected, Ortac_Rx automatically adjusts the tuner gain, to maintain the ADC in range. Depending on the speed of the PC, the FE_AGC delay may need to be increased to stop instability. With FE_AGC selected, the dBm report is fairly accurate to 0dBm input.

If FE_AGC is selected the IF AGC is not active.

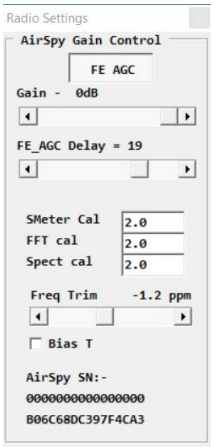
If FE_AGC is not selected the operator must select a suitable tuner gain. The gain steps are ~10dB, note that the noise figure is hardly affected by a 10dB gain reduction, as the gain change is initially made in the IF stages of the tuner.



If a RTL-SDR Blog Ver4 is detected then the RF controls include a Notch filter switch.

Also for frequencies below 26.5MHz a new HF mode will operate using the built in down converter.

4.2.2.2 AirSpy

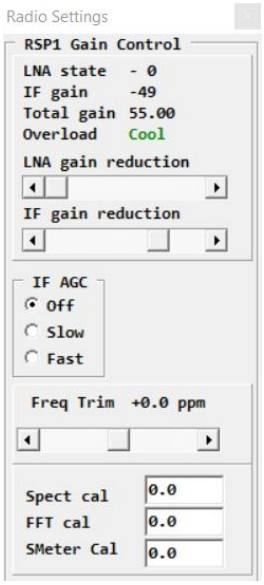


The AirSpy uses a similar FE_AGC, although it does not seem work as well as on the RTL.

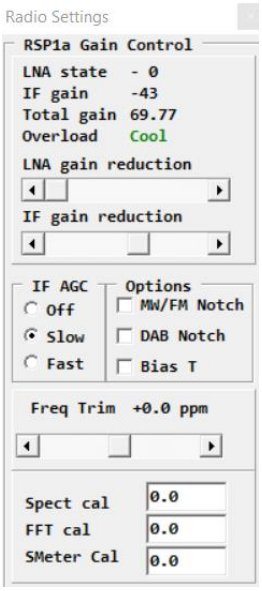
If FE_AGC is not selected the operator must select a suitable tuner gain. The gain steps for the AirSpy are ~4dB. Depending on the speed of the PC, the FE_AGC delay may need to be increased to stop instability. With FE_AGC selected, the dBm report is fairly accurate to 0dBm input.

4.2.2.3 SDRPlay

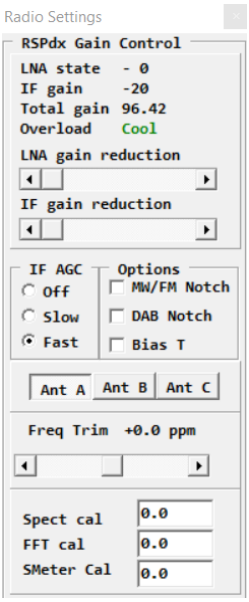
There are 6 variants of the RF gain control form for the SDRPlay radios



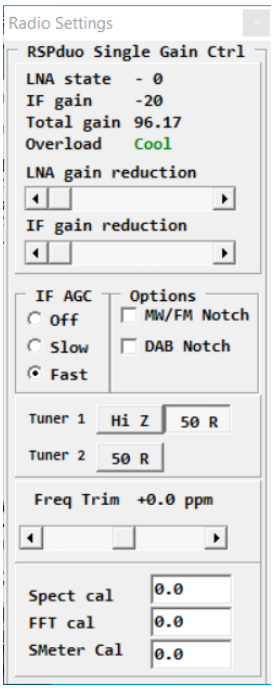
RSP1



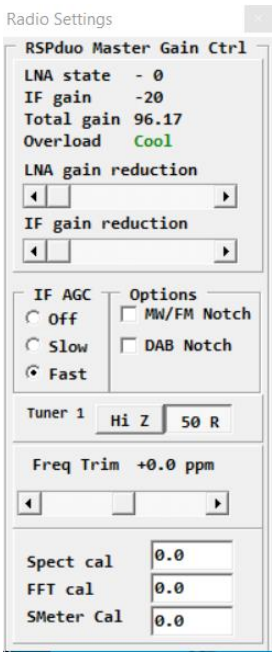
RSP1a



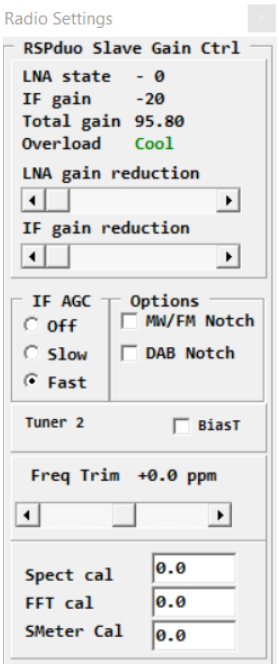
RSPdx



RSPduo Single



RSPduo Master



RSPduo Slave

The SDRPlay forms are basically the same, just the options such as BiasT, notch filters and antenna switches are tailored for the different radio features. The RSPduo has three variants depending on how the radio was opened as a single radio or master/slave option.

The SDRPlay RSPs have their own 'front end' IF AGC, which helps to stop the ADC being overdriven. Instead of Ortac_Rx controlling the gain within the RSP, the RSP adjusts itself and tells Ortac_Rx what gain reduction is being used, this allows the dBm to be calculated.

Note that the LNA (RF) gain is not adjusted by this AGC and if needed must be adjusted manually. The LNA gain steps are however compensated for in the dBm report shown by Ortac_Rx.

There is an overload flag from the radio which is also reported here, this is repeated on the RxForm.

The AGC can be set to fast, slow or turned off. It turned off then the gain must be adjusted manually. I generally prefer to run with the RSP AGC turned off and maximum IF gain reduction (fully to the right), this does not seem to affect the SNR and avoids the RSP AGC fighting with the Ortac_Rx AGC, which can causes audio clicks.

4.2.2.4 Common Controls

The following controls are common to all radio types:-

Bias T control, if checked then +5V will be output on the RF connector of the radio, which can be used to power a pre-amp or band converter.

SMeter Cal, entries here will adjust the S Meter calibration.

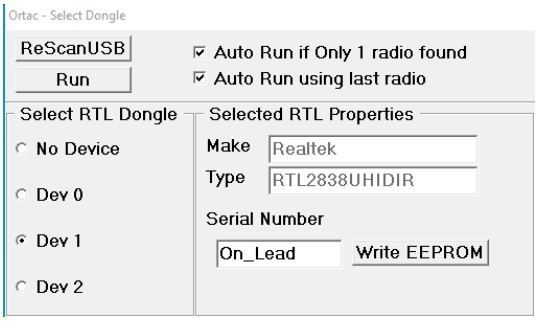
FFT Cal, entries here will adjust the inner panel FFT display calibration.

Spect Cal, entries here will adjust the FFT form calibration.

Freq Trim, this can be used to correct for small frequency offset of the Radio's Xtal reference.

4.2.3 Select RTL

This is only present in Ortac_Rx_RTL.



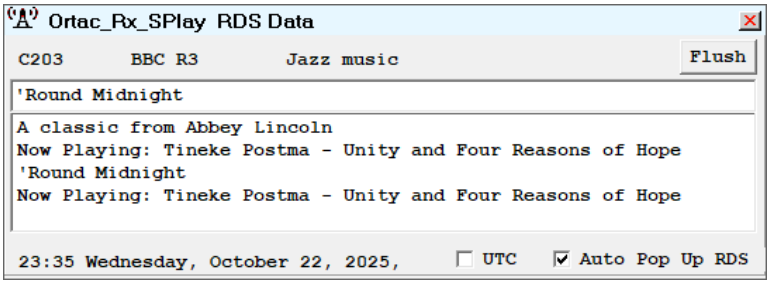
This sub form allows selection of which RTL dongle to use. It also allows 'Christening' of the device, so that they can be easily identified. To close the form, press the run button, Ortac_Rx_RTL should then continue now using the selected device.

4.2.4 DMR Debug

The DMR debug form has been left in for interest, as the name suggests it was used to debug the DMR function.

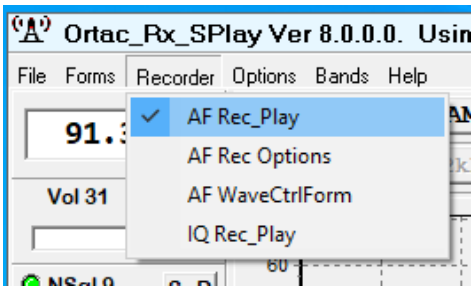
4.2.5 RDS Form

RDS will be decoded in the Stereo FM mode only. The form will auto pop-up on receiving an RDS signal, although this can be stopped by unchecking the Auto pop up check box in the form.



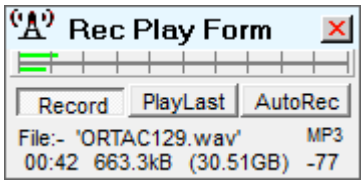
The form not only shows the current text, but it attempts to collect a short history of texts. This text is 'grabbable', if you want to copy it.

4.3 Recorder Menu



4.3.1 AF Rec_Play

This small stay on top form controls the immediate functions of the audio recorder.



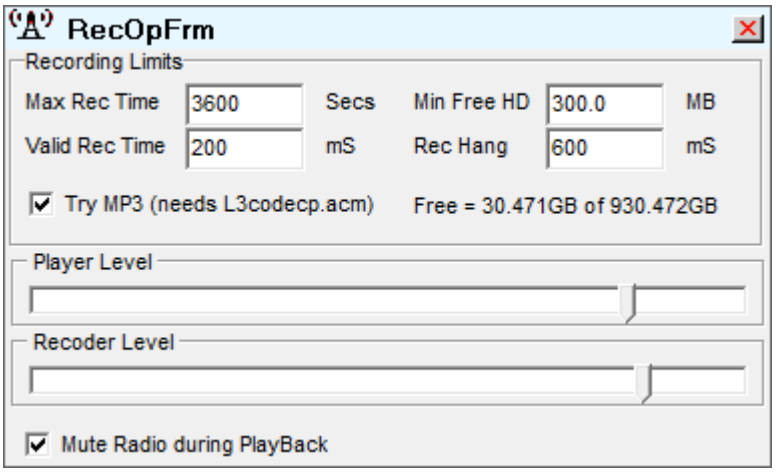
When recording it shows the file name, recording length, file size, (free disk space) and signal level dBm. The bitrate of the recording depends on the current DSP bandwidth. The files produced are Microsoft standard wav files and can be played in any player.

The AutoRec function will start and stop recordings according to the signal present status.

If the form is closed recording/playback will stop.

4.3.2 AF Rec Options

This form controls the recorder settings.



Max Rec time is the max time any single recording will be allowed to run.

Min Free HD, is the free disk space limit which if reached will stop all recordings.

Valid Rec Time, if a recording is less than this, it will be deleted. This is to reduce the number of files triggered by the squelch breaking due to static etc.

Rec Hang, this is the time that the signal present can drop out before the file is closed and a new file is started.

Try MP3, if this is checked Ortac_Rx will try to use the windows MP3 codec to make MP3 recordings. Windows 7 and onwards come with both L3codecA.acm and L3codecP.acm, however only the L3codecA seems to be enabled for record. This is limited to low bit rates; If you want to make stereo mp3 recordings at high bitrates you need a properly registered L3codecP.acm. Or you can replace the L3codecA.acm in the Windows\SysWOW64 directory, with a renamed copy of the L3codecP.acm from the same directory.

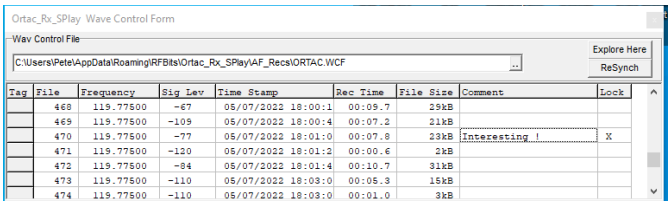
Player Level, this sets the player output level to the sound card, the receiver volume control does not affect the player level. The player will only output to the default sound card.

Recorder Level, this controls the recording level. The level can be seen by the horizontal bars in the recorder when recording. The receiver volume control does not affect the recoding level, neither does the receiver audio mute.

Mute Radio during Playback, if checked the audio from the radio is muted during audio playback.

4.3.3 AF Wav Control Form

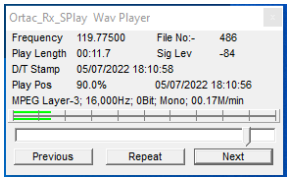
This form is about managing the recorded files and the storage location.



The **Wav Control File** (WCF) collects a history of recordings, the recordings will be placed in the same directory as the WCF. To change the recording directory press the small .. button, and navigate to a new folder. You can also change the default WCF name from Ortac. Recordings will take the name of the WCF with an added sequence number, eg 'ORTAC1023.wav'.

The default WCF file is :-
'\Users*User*\AppData\Roaming\RFBits\Ortac_Rx_*R1*\AF_Recs\ORTAC.WCF' this is the standard place to put user files, but you might want to place the files in a shorter path, or even on a different drive.

Opening the Wav Ctrl Form will disable the AF recorder. Instead, you can play any of the listed files by double clicking on the entry in the list. This will bring up the more detailed Wav Player form.



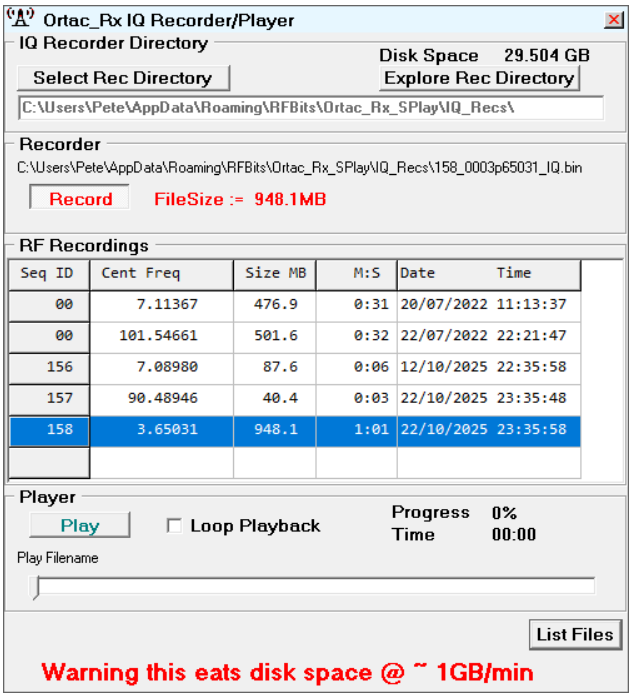
This form lets you play previous, repeat or next. It also shows the full details of the file. You can move the position slider to find a particular point in the recording.

Pressing the '**Explorer Here**' button will open an Explorer in the WCF directory. If you delete files in the explorer, press the '**ReSynch**' button to remove the files from the WCF, you cannot add files to the WCF list.

Closing the WCF will re-enable the AF recorder window.

4.3.4 IQ Rec_Play

The IQ recorder-player will record and playback the 2.048MSPs IQ data stream to disk. The RTL uses 8bit samples which equates to ~1GB per 4 minutes, whilst the AirSpy and SDRPlay radios uses 32bit samples which equates to ~1GB per minute. These are very high data rates and will soon fill a disk.



The default IQ recording directory is :-
'\Users*User*\AppData\Roaming\RFBits\Ortac_Rx_*R7*\IQ_Recs'

It is recommended to move this away from the system disk. The recorder will stop when the free disk space is less than 1GB or when the file size is >32GB.

To start a recording, press the record button, file statistics then start to update.

To stop a recording, press the record button again, or press the play button, closing the form will also stop the recording.

Pressing the play button will start the player. The IQ stream from the USB radio is then replaced by the IQ stream from the disk file. You can now tune the radio over the whole 2MHz IQ bandwidth, it will feel the same as live RF, but you cannot change the centre frequency. The centre frequency at the time of the recording is part of the filename eg:- '32_0100p0677_IQ.bin', indicates file no 32, centre frequency 100.677MHz.

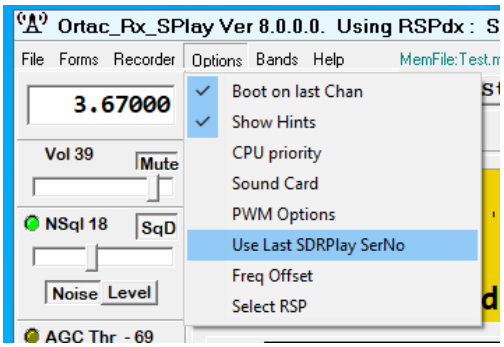
To play files shown in the grid, double click the required row.

To delete these very large files, press the 'Explore Rec Directory button', this will open an explorer at the IQ recording directory. From here you can delete the IQ.bin files. When you come back to Ortac_Rx, press the 'List Files' button, this will update the displayed list of recordings.

`

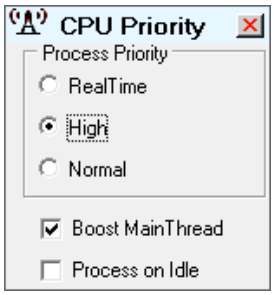
4.4 Options

Most of the options are self-explanatory.



4.4.1 CPU Priority.

This menu item opens a small form, giving options on processor priority.



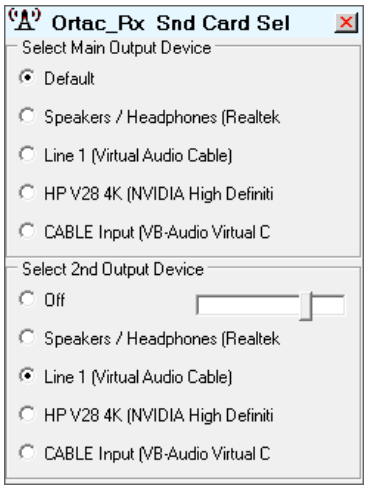
If the programme seems to be running slow in windows updating or possibly the sound stuttering, it may be worth raising the processor priority from normal. This will make Windows possibly give more processing time to Ortac_Rx. (Note unless running at Admin level, Windows will not allow the real time option.)

The process on Idle option, makes the programme immediately start to process messages once it has emptied its message queue.

These setting will be remembered on next run.

4.4.2 **Sound Card.**

This menu item opens a form that lists the sound output devices found on the computer.



The default device is Windows normal audio output device, Ortac_Rx will initial use this device, but you may change it to any of the listed devices. Next run Ortac_Rx will try to use this device, if it is no longer there it will fall back to the default device. If there is no sound card found then there will be no audio output.

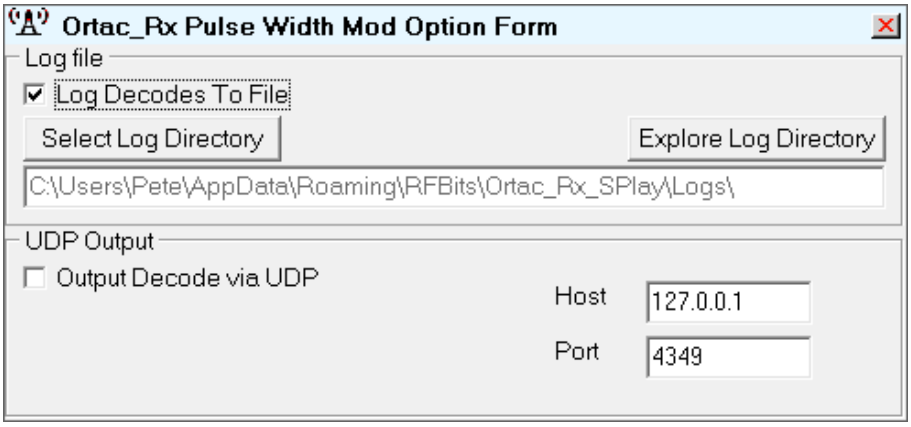
Note the Wav player will always output independently to the default device.

A 2nd audio output has been added. This is designed to send the audio to a decoder programme for digital modes or CW via a virtual audio cable, whilst still being able to listen to the receiver. The slider independently adjusts the AF output level for the 2nd output and the 2nd output is never squelched.

4.4.3 **PWM Options.**

Here are options to save PWM decodes to a text file, a new text file is opened at midnight every day.

You can also opt to send the data as text strings via UDP.



The log files are simple CSV text files, that consist of the decoded data followed by a time stamp.

4.4.4 Freq Offset

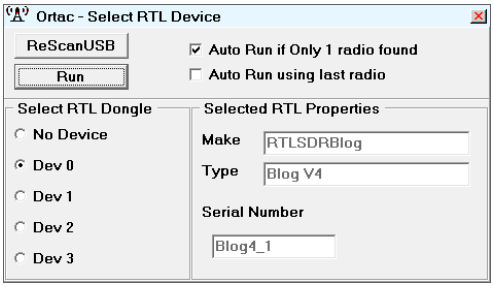
Entering an offset frequency and pressing the Active button, will add this value to the displayed frequency. The displayed frequency in the main form and the FFT form is displayed italicised and discoloured when a frequency offset is active.

This is intended for use with band converters.

4.4.5 Select RSP/RTL

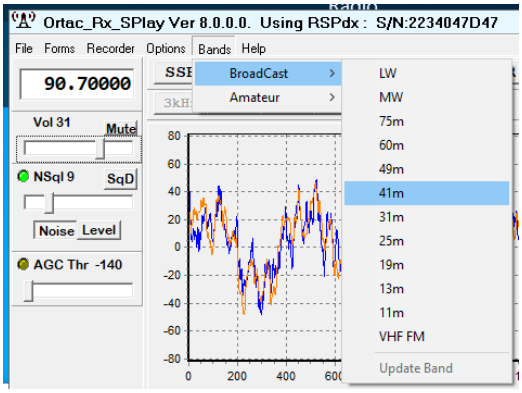
Ortac_Rx_Splay has the following form to select from multiple RSPs connected to the USB:-

Ortac_RTL has the following form to select from multiple RTLs connected to the USB:-



These forms are shown at the start of the programme if multiple radios are detected.

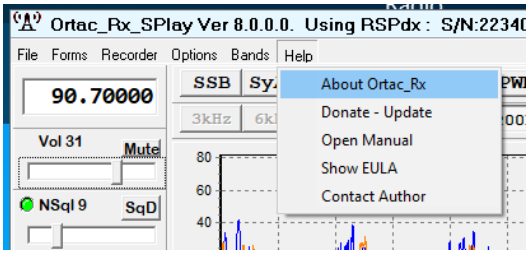
4.5 **Bands Menu**



This Menu gives access to pre-programmed broadcast and amateur bands. Note that only the SDRPlay and RTL Blog4 radios tune natively to below ~ 26MHz.

If using an RTL_SDR_BLOG, Oratc_Rx_RTL will use the direct sampling mode below 26MHz, this allows some access to the HF spectrum.

4.6 Help Menu



4.6.1 About Ortac_Rx

This displays a brief note describing the programme.

4.6.2 Donate – Update

Will try to open the relevant RFBits Web Page in your browser.

4.6.3 Open Manual

This should open this document.

4.6.4 Show EULA

This re-opens the End User License Agreement (EULA), that must have been accepted for the programme to run.

4.6.5 Contact Author

Should open an email client, with address field populated.

5.0 KEYBOARD SHORTCUTS

Ortac_Rx is primarily mouse driven, there are however a few keyboard shortcuts provided to aid operation with only a trackpad.

5.1.1 RXForm

Ctrl F	Direct frequency entry.

5.1.2 FFTForm

Ctrl F	Direct frequency entry.
Ctrl J	Tune Left next FFT peak over Sq
Ctrl L	Tune Right next FFT peak over Sq
Ctrl I	Cent Freq down by half display then peak tune
Ctrl M	Cent Freq up by half display then peak tune
Ctrl K	Peak tune over display range.
J	Freq down by mouse step / 10
L	Freq up by mouse step / 10
I	Freq down by mouse step
M	Freq up by mouse step
K	Peak tune over IF bandwidth

Ortac