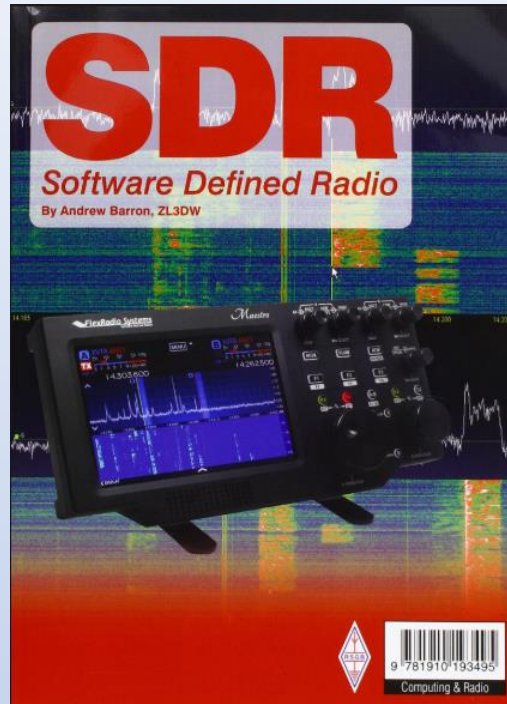Andrew Barron, author of bestselling RSGB
publication "Software Defined Radio"

reviews the SDRplay RSP1A and SDRuno

Having already purchased the excellent SDRplay RSP2 software defined radio receiver, I jumped at the chance to review the new RSP1A model. The RSP1A has replaced the earlier RSP1 receiver. Any evaluation of a 'black box' type SDR inevitably includes an evaluation of the portion of the radio that is supported by the computer software. In the case of the RSP1A, this is the very rich featured SDRuno program which is available as a free download from the SDRplay website. I found that the RSP1A did not work with the old version of SDRuno software that I had been using with the RSP2, so I downloaded the latest version, (always a good idea). Not only did it support the new radio, but I was pleased to see some major improvements which I will go into later. The website has had a recent upgrade as well. I tried the radio out with HDSDR and SDR Console V3.0 and it worked well with those applications as well. The RSP1A is supported by CubicSDR on Linux, Windows, OSX and the Raspberry Pi. SDRplay supplies a complete image for the Raspberry Pi with Cubic pre-built for users to download to save them having to compile the software themselves.

The SDRplay receivers are far better than RTL-dongle receivers and they are the logical 'next step' up from one of those radios. As well as coverage up to 2 GHz, you gain full coverage of the HF (high frequency) MW (medium wave) and LF (low frequency) bands without having to buy an up-converter. The RSP1A receiver also has front-end filter banks and a much higher dynamic range. It has its own free software and setup is simple. Getting an RTL-dongle to work with your PC can often be quite a challenge.

The new receiver is slightly larger than the old model and is now exactly the same size as the RSP2 receiver. Performance has been improved with the addition of a 14-bit ADC and more importantly the addition of more bandpass filters in the receiver front end. The filters are switched in automatically depending on the frequency band that the radio is on. The LF range is extended down to 1 kHz with a new low pass filter for operation below 2 MHz. The band from 250 to 420 MHz is now divided by three bandpass filters instead of one on the old model.

Most importantly are the addition of notch filters to eliminate interference from high power MW and FM broadcast band transmitters. The reference clock is now a 0.5ppm 24 MHz TXCO and the new radio has RF shielding on the inside of the plastic case. Previously these features were only included on the more expensive RSP2 and RSP2-pro models. All the RSP models include a Bias-T to send DC up to a masthead low noise amplifier.

There is a wealth of information about the RSP1A on the SDRplay website. As well as comprehensive specification sheets there are large tables showing the sensitivity for various modes and frequencies, and the gain, noise figure, and linearity figures for various RF Gain Reduction settings and frequencies. There are also plots of the DAB, MW, and FM broadcast band notch filters and the low pass and bandpass filter responses.

Sensitivity is excellent, with MDS (minimum discernible signals) better than -140 dBm above 60 MHz with the LNA on. Sensitivity below 60 MHz is still very good ranging from 125 to -132 dBm across the HF band.

The RF gain control on SDRuno can be displayed as an 'RF Gain,' control with the highest gain at the top of the slider control, or as 'RF Gain Reduction' control with the radio at its most sensitive when the slider is at the bottom of the range. In either mode, the best way to set the control is to start at the least sensitive end and increase the gain until the noise floor stops improving or you start to see intermodulation products appear on the panadapter. There is no point setting the gain any higher than that as there will be no further improvement in the signal to noise ratio after that point. Low RF Gain Reduction / high RF Gain settings also make the radio more susceptible to ADC gain compression which is the effect that causes the noise floor right across the panadapter to jump upwards when a strong signal appears on the band.

On the air traffic control band at around 118 MHz and on the 2m amateur band I experienced significant intermodulation distortion from FM broadcast stations. But this is easily cured by engaging the MW/FM

notch filter on the SDRuno 'Main' window. Alternatively, just reduce the RF Gain until the panadapter becomes flat.

With SDRuno you are able to set the ADC sampling rate in 1 Msps (million samples per second) steps from 2 Msps to 10 Msps. This results in maximum panadapter bandwidths ranging from 2 MHz to 10 MHz. The documentation states that the radio reduces the number of bits per sample at higher sampling rates. The ADC provides 14-bit samples, but at high sample rates, the resulting data stream would exceed the capacity of the USB 2.0 data channel to the PC software. So the bitstream is compressed or reduced in order to make sure that the data traffic can be carried to the PC software. At sampling rates from 2 – 6 Msps the data stream contains the full 14 bits. Between 6 and 8 Msps the data stream is reduced to 12 bits per sample. Between 8 and 9 Msps, the data stream is reduced to 10 bits per sample and between 9 and 10 Msps, the data stream is reduced to 8 bits per sample. A change to the USB 3.0 standard would eliminate the need for this data management. The effect is a small reduction in the dynamic range of the receiver at the higher sampling rates. You can see this as a slight increase of about 4 dB in the level of the noise floor on the panadapter when changing from 6 Msps to 10 Msps. The difference in dynamic gain is not significant unless you are receiving very, very, weak signals that are only a few dB above the noise floor. However, if you are doing very weak signal reception, it is recommended that you reduce the sampling rate to 6 Msps or less.

SDRuno is much improved. The program has a high level of configurability compared to other SDR software and this means that with some experimentation you can get excellent results. For example, the radio has a better audio frequency response than most FM handhelds and mobiles, so I was clearly able to hear the CTCSS control tone on the local 2m amateur repeater. This can be eliminated by turning on the PDBPF and increasing the LC (low cut) frequency to 250 Hz. I found it interesting that you can very clearly see the tone modulation on the AUX SP (audio spectrum) display. The program supports an unlimited number of memories and they can be arranged into as many groups as you wish. The MCTR setting on the active receiver must be turned on for the memory selection to work. The selected memory frequency will appear at the current marker position of the panadapter. This is good because it avoids the centre spot on the panadapter. Locking the local oscillator frequency (LO LOCK on the 'MAIN' window) will allow you to jump to different channels within the current panadapter bandwidth. The best improvement is the new 'Bands' selection. Previously the band buttons were limited to the HF amateur radio bands. That made them completely useless above 30 MHz. Now you have a choice of three settings for the band buttons. The 'Ham Lower' setting gives you a choice of the amateur radio bands from the 2200 metre band up to the 15-metre band. The 'Ham Upper' setting covers the ham bands from the 12-metre band up to the 23-centimetre band and the 'Broadcast' setting provides choices of the long wave, medium wave and shortwave broadcast bands. You can also directly enter a frequency. Each band selection sets the panadapter to display the full band and while the band is selected the frequency range of the receiver and panadapter is limited to frequencies within the band. The LO LOCK is activated to allow you to select channels across the band without the panadapter moving out of the band. If you turn the LO LOCK off or click the band button again to deselect it, the radio is no longer constrained. I like this feature a lot, but I would still like to have the capability of defining my own band edges and saving them in a 'user band' selection of band switches.

Try selecting the MW/FM filter while looking at the MW broadcast band or the FM broadcast band and you can see how effective the filters are! Other useful SDRuno settings include a date and time display in either local time or UTC and an automatic frequency calibration mode. You should calibrate the receiver soon after you purchase the radio. Calibration only needs to be performed once.

One of the major advantages of SDRuno and the RSP receivers is that they support multiple receivers. Most SDR receiver software only supports one panadapter and one receiver. On SDRuno you can have up to 16 receivers within the selected sampling rate bandwidth. Each new receiver, or 'VRX,' has its own spectrum and waterfall display window, a receiver window complete with band buttons that don't add any value, an EX CONTROL window, and its own 'Aux SP' or 'SP2' audio spectrum and waterfall display window. The reason that I said that the band buttons on the second and subsequent receivers don't add

any value is that all receivers must be within the bandwidth of the radio as a whole, i.e. a maximum of 10 MHz. Clicking a band button on any receiver other than VRX-00 has no effect unless both bands are within the passband. You can have one receiver on the 80m ham band and another on the 40m ham band since both are within 10 MHz. But the software makes it difficult to select that option and most of the time the band buttons on the additional receivers do nothing. I find all the windows rather confusing and difficult to place on my two PC screens. If you ran all the windows on all sixteen receivers, plus the Main and Mem windows, you could have 66 windows open. Since the panadapter is able to display the full bandwidth, why not show all of the receivers on the same panadapter? I don't believe that you need separate receivers for the audio spectrum display either. A single window that can easily be switched to show the audio from each receiver would probably be sufficient. The same applies to the EX CONTROL windows. One window that could be switched between the active receivers would be enough. I guess my complaint is that the software might be too configurable. "Wash my mouth out with soapy water!"

I tried the FM stereo on the local stations. Pretty cool to see them arranged across a 10 MHz panadapter. Stereo quality sounds good and the RDS decoder quickly decodes the embedded station information.

SDRuno also supports the Tmate control knob, CAT control using a subset of the Kenwood command set, and OmniRig control. CAT control allows each VRX receiver to be controlled from PC software. OmniRig allows the SDRuno software to control another radio and vice versa. You might use this if you are using the receiver as an IF or RF SDR / panadapter add-on to another receiver or transceiver. Clicking on the panadapter will tune the connected radio.

Overall, I like the RSP1A receiver and companion software SDRuno very much. The new radio has several notable improvements especially the front end and broadcast band notch filters. The new release of SDRuno is a huge improvement over the earlier versions. I like that you can click a band button and see the whole band and it has many features that are not included in other software such as Stereo FM with RDS, Tmate, CAT, and OmniRig control. The RSP1A is excellent value for money and probably the best wideband SDR on the market.

Andrew Barron ZL3DW
October 2018

Andrew Barron is the author of "Software Defined Radio – for amateur radio operators and shortwave listeners," and "Amsats and Hamsats" Both available from the RSGB bookshop, Amazon, and Kindle.