SDRplay RSPdx Review
by Mike Richards

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SDRPlay RSPdx

The SDRPlay RSPdx is the latest iteration of the SDRPlay range of low-cost, wide-band Software Defined Radios.

The new RSPdx is a multi-antenna port, 14-bit SDR with a continuous tuning range from 1kHz to 2GHz and a maximum spectrum bandwidth of 10MHz. The receiver has three software selectable antenna ports, all of which are usable down to 1kHz, **Figure 1**. Port A operates from 1kHz to 2GHz, whilst Port B covers the same frequency range, but includes a switchable Bias-T feed of 4.7V at up to 100mA. Both ports A and B use SMA connectors. The final antenna port employs a BNC connector and covers 1kHz to 200MHz. Housed in a sturdy metal box, the RSPdx uses a USB-B cable for power and communications with the host PC. A TCXO internal reference clock runs at 24MHz and provides 0.5ppm accuracy that can be trimmed to 0.01ppm. There is also an external reference socket on the rear panel that can be used to lock the RSPdx to an external 24MHz frequency standard such as the popular Leo Bodenar units from SDR-Kits. The filtering and operating modes of the RSPdx have been customised for improved LF performance without compromising the performance of the higher bands. One of the key additions is a new 500kHz low pass filter and the provision of notch and preselection filters on all three antenna inputs. There is also a new HDR (High Dynamic Range) operating mode that can be selected for frequencies below 2MHz.

Inside the RSPdx

SDRPlay have been developing their receivers over the past five years and refining the range in response to user feedback. At the heart of all

FIGURE 1: RSPdx has 3 antenna ports.

the SDRPlay receivers is the Mirics chipset that comprises the MSi001 wideband tuner and the MSi2500 combined Analogue to Digital Converter (ADC) and USB interface, **Figure 2**. Originally designed for set-top boxes, the SDRPlay team have worked wonders to get the best out of the Mirics chipset. As with all, low-cost, wideband SDR receivers, the secret to success is getting the filtering right. The LF through to MF bands

are a particular challenge because we have weak signals adjacent to high power broadcast stations. Examples of this can be seen on 7.0MHz in the evenings and the LF amateur bands on 136kHz and 436kHz. Without good quality band filtering, the receiver gain would need to be reduced to stop the broadcast stations from overloading the tuner or the ADC. That, in turn, would push weak signals below the noise floor. Just to make matters
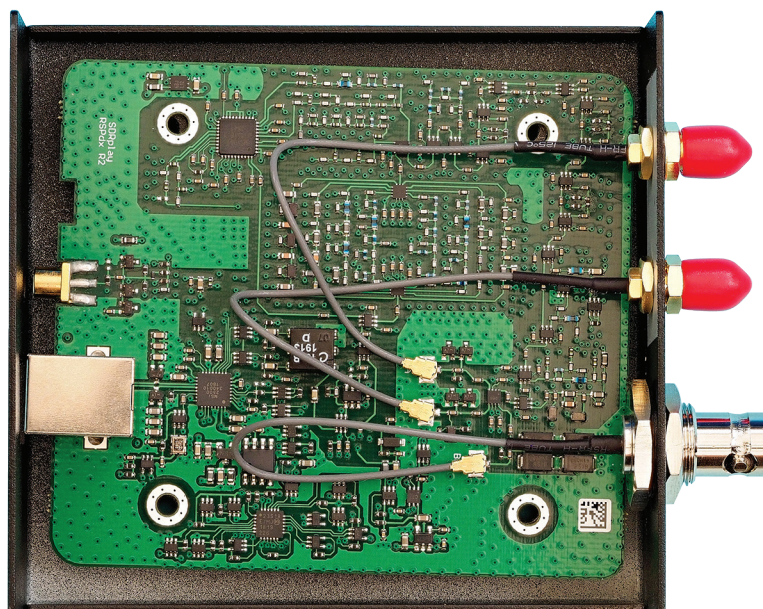
TABLE 1: RSPdx HDR bands.

Band	Frequency range
2200m	104-165kHz
630m	444-504kHz
160m	1.79MHz to 2.01MHz
LOW	-20Hz to + 520kHz
Full	1kHz to 1.75MHz
LFER	144kHz to 205kHz
NDBL	174kHz to 200kHz
NDBH	486kHz to 586kHz
LW	145kHz to 295kHz
MW	450kHz 1.75MHz

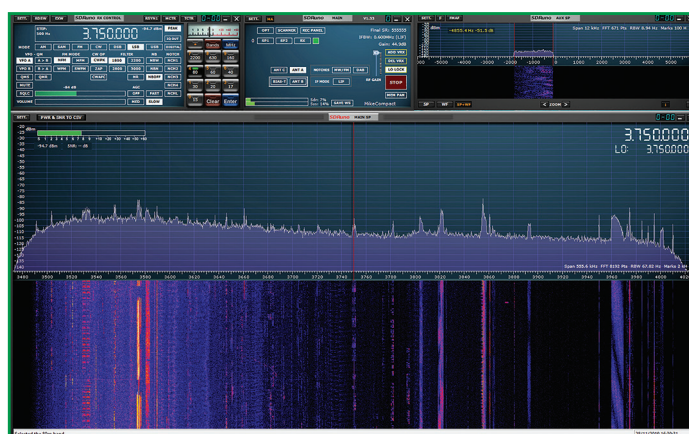
FIGURE 2: Internal view of the RSPdx.

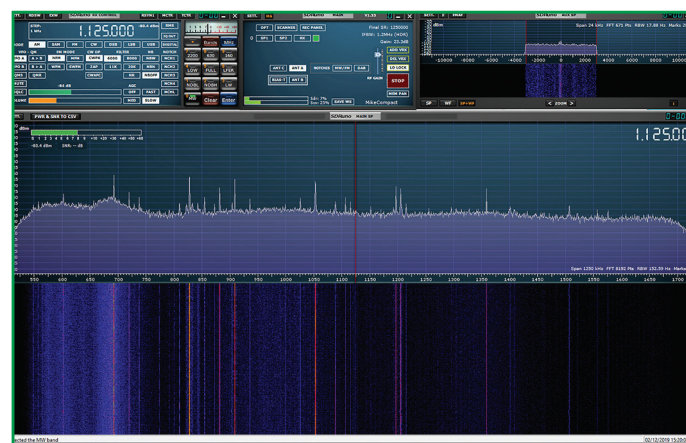FIGURE 3: SDRuno version 1.33 running with RSPdx.

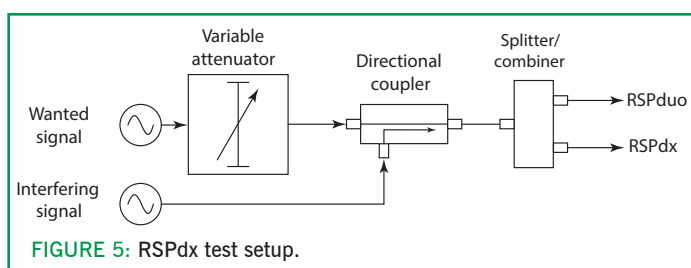

FIGURE 4: SSDRuno and RSPdx in HDR mode.

FIGURE 5: RSPdx test setup.

more complex, radio users have a wide range of interests so whilst one group may be interested in amateur band performance, another will be following broadcast stations. As a result, many receivers settle for a compromise. For the RSPdx, the SDRPlay team have concentrated on beefing-up the LF performance with changes to the antenna inputs, on-board filtering and the addition of a new HDR mode. The first important change has been the introduction of a 500kHz low-pass filter to help supress medium wave broadcast signals. The RSPdx also features a new receive mode that they're calling HDR (High Dynamic Range) that can be used below 2MHz.

Unfortunately, SDRPlay have decided to stop publishing block diagrams and operational details of their receivers. This is to protect their designs from those unscrupulous cloners! However, SDRplay have explained that the HDR mode uses the hardware in a new way, which when combined with the new SDRuno software and revised filtering, gives improved performance below 2MHz (ie when the HDR mode is enabled via the 'HDR' band buttons). As part of the testing, I also checked the accuracy of the signal strength reporting and this was excellent on all bands and modes except 630m in HDR mode. I passed this observation to the SDRplay team and they have assured me that the calibration error will be corrected in the next SDRuno release. The new HDR modes also get a separate menu entry in SDRuno with ten HDR bands listed. I've shown these along with their frequency coverage in **Table 1**.

SDRuno

At the time of writing, the only SDR software that fully supports all the features of the RSPdx is SDRuno version 1.33 or later, **Figure 3**. SDRuno is a very capable software package but it does have a fragmented graphic user interface that comprises several panels that can be resized and moved to create your preferred layout. Once you've found the ideal setup, you can save that configuration for recall at a later date. Personally, I find a docked layout much tidier and easier to manage. As you can see from **Figure 4**, the Main and Rx control panel contain all the important receiver controls and in this screenshot the RSPdx is set for HDR reception. If you look at the Main panel you will see that this provides access to the antenna switching along with the important band notch filters and decimation control.

Performance

To evaluate the performance of the new RSPdx, I ran a comparison between an RSPduo and the RSPdx. Both receivers used the same antenna and were fed via a Mini-Circuits power splitter/combiner. The antenna feed also passed through a directional coupler to allow for the injection of a controlled interfering signal, **Figure 5**. On the HF bands and above, there was minimal difference in performance between the two models, which is as I expected. However, I did notice that the RSPdx AGC appeared to be more aggressive when a strong in-band interferer was present. Moving to the lower frequency bands, below 1.6MHz, the performance of the RSPdx was slightly better and produced results that offered a few dBs SNR improvement over the RSPduo. I then moved on to see how the RSPdx performed on LF when presented with strong MW blocking signals. For this test I set both receivers to maximum gain and produced a modulated 476kHz signal as the wanted signal. I then used a second signal generator to inject a 611kHz modulated signal to act the medium wave blocker. I first set the level of the wanted signal to achieve a 6dB SNR. I then added a MW interferer on 611kHz and increased its level whilst observing the SNR of the wanted signal.

When testing the RSPduo, ADC overload occurred with an interference level of -23dBm. As the interferer level was increased up to the maximum of 0dBm I had to continually reduce the gain of the RSPduo to avoid ADC overload. As a result, the wanted signal was soon lost in the noise. When using the RSPdx the results were very much improved and the 600kHz interferer had no obvious effect, right up to the maximum RF input level of 0dBm. It's not possible to say how much of the improvement was due to the 500kHz low pass filter or the HDR technology but it was a useful improvement for LF band operators.

Summary

The SDRPlay RSPdx is a welcome addition to the portfolio and is likely to have special appeal to those with an interest in the LF bands especially below 500kHz. The combination of the new 500kHz filter and the HDR mode gives a worthwhile improvement. The RSPdx is available from SDRPlay and other popular radio dealers. It is expected to retail at approximately £159 and my thanks to SDRPlay (www.sdrplay.com) for the supply of the review model.

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