

More ways to waste time with cheap SDRs

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Some notes to accompany the KARC talk on Thursday February 3, 2022. Any questions or suggestions please contact me at rsadams@telus.net or via the club webpage.

Definition of an SDR

The following is from an article by Larry van Horne in the November 2021 issue of *Spectrum Monitor*. <https://www.thespectrummonitor.com/>

“A software defined radio is one where the radio frequency signal is converted to a digital bit stream and all of the demodulation of the signal is done with digital signal processors (i.e., software). An SDR performs significant amounts of signal processing in a general-purpose computer or reconfigurable piece of digital electronics.”

Larry van Horne frequently compiles annual guides to current SDRs that can be found in various publications. They are good place to see a survey of current models.

What is a *dongle*?

From *Wikipedia*

“A small piece of computer hardware that connects to a port on another device to provide it with additional functionality”

In common usage usually refers to software protection dongles or devices of similar appearance. With SDRs usually used to refer to the small TV tuner-based units like the RTL-SDR and NOOElec units.

Inexpensive (less than \$300 US) and where to get them

RTL-SDR v3, one of the original dongles based on the R820T2 - RTL2832 Digital TV tuner chips. \$30 US. 8-bit ADC. This version can be used for HF using direct sampling but is designed for VHF-UHF. There are many knock-offs and many of them have issues with drivers and stability,

the official version has a TCXO and heatsink. I got mine from the RTL-SDR website (<https://www.rtl-sdr.com/>) ordered from the Chinese warehouse and it arrived 2 weeks later, postmarked Ontario.

NOOELEC NESDR SmartTee XTR. \$42 US. 8-bit ADC. Similar to above but includes an always on 4.5V bias T power supply at 200mA (see note below about SDRPlay bias Ts). 65-2300MHz, but note that it has a dead-spot around 1100MHz which makes it unsuitable for ADS-B. NOOELEC also make a series of *Sawbird* SAW filters combined with LNAs for various applications like 137MHz weather satellites, Hydrogen line, and GOES geostationary satellites. Best place to get them seems to be Amazon.ca.

FlightAware Prostick. \$30 US. 8-bit ADC. As above but specifically made for ADS-B decoding, includes membership in FlightAware system for collecting and reporting aircraft spots. Can be purchased from RTL-SDR site.

SDRPlay RSP1a. \$100 US 12-bit (10MHz spectrum sample) or 14-bit (2MHz) ADC. 500Hz to 2GHz. Made in England by a group of Engineers associated with the Mirics Company which produces the DTV tuners chips the RSP units are based on. <https://www.sdrplay.com/> This is the first SDR I bought and I love it. It has been responsible for me getting into amateur radio. They also make the RSPdx and the RSPduo. The RSPdx (\$199 US) is similar to the RSP1a but it is modified to improve reception on shortwave and MW bands. The RSPduo includes two coherent receivers and three antenna ports as well as external clock connections. It is able to be used for diversity reception using the SDRUno software (\$280 US). There are lower quality knock-offs around. I bought mine from GPS Central in Calgary <https://www.gpscentral.ca/>, it arrived in three days. RadioWorld also stocks them. One thing to note is that the software selectable bias T power supply on the SDRPlay units will only source 120mA. That is not enough to power the NOOELEC SAWbird series of filter/LNAs. There is a self-healing fuse that prevents damage (I accidentally tried it) but take care.

Airspy HF+ Discovery. \$200 US. I do not own one of these but it is similar to the RSPdx and is very highly regarded in the SWL and MWDx communities. I have not found a Canadian distributor but it appears that you can get it from the US at <https://v3.airspy.us/>

What else do you need?

Apart from the obvious, a computer and an antenna, all the units above use SMA connections for the antennas. Remember to get some adapters if you are only set up for SO-239 or N connectors. Also note that many consumer items like routers use reverse polarity SMA connectors so pick up a few SMA to rp-SMA adapters.

Spectrum Recording

There is lots of information on the web about using an SDR to record spectrum for later review. I first read about it on the London Shortwave blog at <https://blog.londonshortwave.com/>

There are also many articles that have appeared in the Spectrum Monitor eZine. <https://www.thespectrummonitor.com/>

If you are considering using an SDRPlay SDR note that the latest version (last December) of the SDRUno software (1.4.1) has greatly enhanced the recording scheduler function. You can now schedule recurring top-of-the-hour recordings of entire bands for later review. The recordings are in wav format and are large, about 1GB per minute, I use a 256GB SD card in the Galaxy book I use for portable work and it works well.

My setup consists of an RSP1a, a W6LVP active loop antenna, a 5-year-old Samsung Galaxy Book with a 256GB SD card inserted, a 5Ahr LiFePO4 battery and a Buddipole PowerMini to supply power the various components. It can be carried in a daypack and takes less than 5 minutes to set up.

Survey and Tracking of RFI

There is lots of information on using small direction-finding loops and SDRs to track down RFI sources, but the idea of using the slow waterfall feature in HDSDR to perform of surveys of RFI over days and entire swaths of spectrum appears to be the idea of NK7Z. He has a wealth of information at <https://www.nk7z.net/sdr-rfi-survey-p1/>

Diversity Reception

I first started to understand the potential of this technique after listening to a Ham Radio Workbench podcast on the subject where the guest was John Fallows VE6EY. His site has an amazing amount of information on both RFI and how to counteract it with diversity reception (<http://play.fallows.ca/wp/>). If nothing else go look as the YouTube clip he has of tuning in All India Radio one morning and then phasing his antennas to drop the noise.

Update: After the talk I discovered that VE6EY had recently given a presentation at Baycon, it can be found at:

<http://play.fallows.ca/wp/radio/shortwave-radio/modern-diversity-reception-at-baycon-2022/#more-9672>

The Knob issue

One of the differences between an analog receiver and an SDR is that all buttons and knobs are replaced with mouse or keyboard input. The mouse wheel is the normal method of tuning across a band. Many people dislike the lack of "buttons and knobs". I found I quickly got used to using the mouse, but there is certainly no comparison with a heavy tuning knob with bearings. However, this has been handled. Elad make a device called a TMate for their SDR receivers that has three knobs, a set of switches and a small LED display, nearly all the receiver control can be done from the T-mate. SDRUno has built in support for the T-mate so the SDRPlay receivers can also be used with the TMate. I do not know if other SDRs can be used.

A description of the TMate can be found at the Elad website at:

<https://shop.elad-usa.com/tmate/elad-tm2-usb-tuning-system-tmate/>

and as YouTube video of it used with SDRUno at:

<https://www.youtube.com/watch?v=yUm0qfurCaM> and at

<https://www.youtube.com/watch?v=Or7R0-agGTY>

Another option for the SDRPlay receivers is the Contour Shuttle, a USB device that is apparently used in Video and Audio editing. The SDRUno software includes a plugin which allows the "jog-dial" to be used to tune and assign functions to the various buttons. There is a video showing the Contour Shuttle in use on the SDRPlay YouTube Channel.

https://www.youtube.com/watch?v=Ec_jw9SGpzc

Panadapters

One of the common uses for the SDRPlay RSP1a is get a panadapter onto an older transceiver that does not have one, or to get a much larger one onto rigs like the IC-7300. I have not done this but here are some links to videos which describe how to do it.

<https://www.youtube.com/watch?v=n96ZgDQa77Y>

<https://www.youtube.com/watch?v=vUyMntkBz4g>

<https://www.youtube.com/watch?v=ErZVNMM8gtg>

And here is a link showing the RTL-SDR dongle being used with a Kenwood transceiver and HDSDR software: <https://www.youtube.com/watch?v=DgIIP4p6UAo>