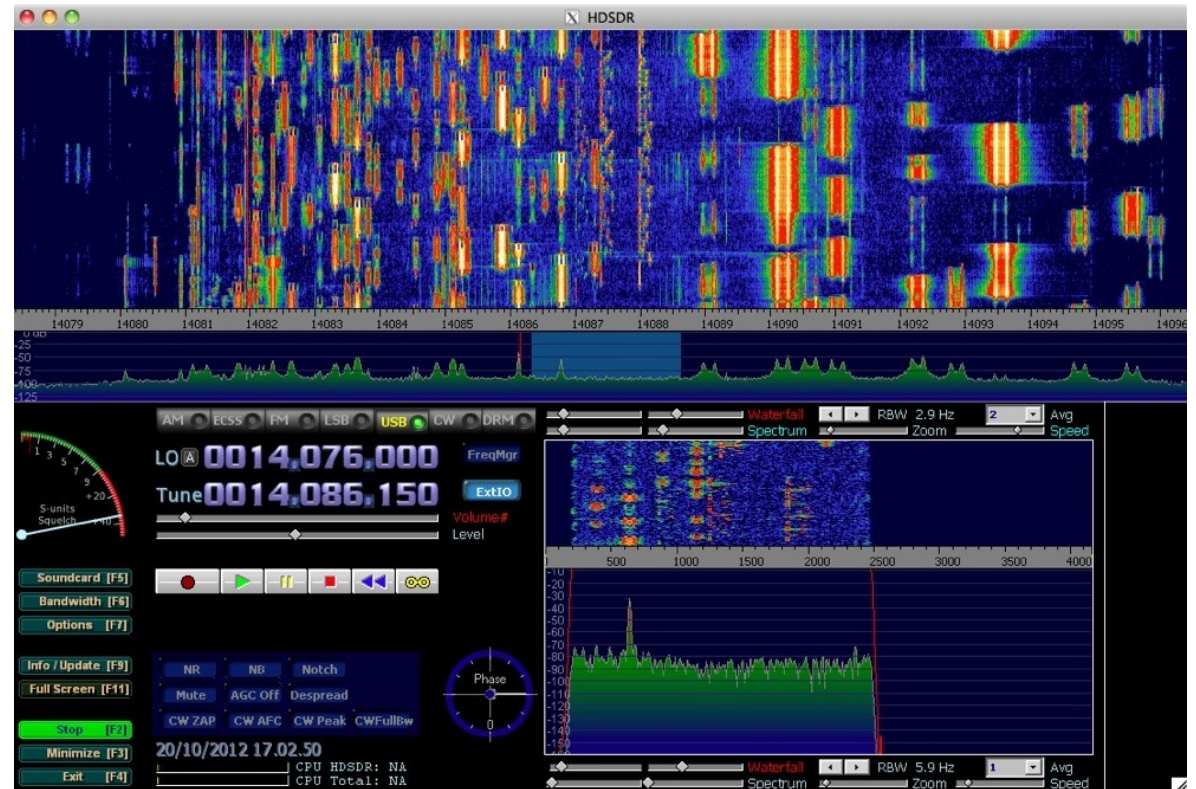# What is SDR?

Software Defined Radio

We're using software to define the capabilities of our radio rather than using manufacturer-chosen designs for frequency range(s), filters, etc.

Why SDR?

- Undesirable manufacturer limits

- Additional functionality

- Ultra wide bandwidth

- A picture is worth 1000 words

- We're tinkerers!

Why not SDR?

- Good hardware is pricy, plus the PC… excellent radios coming down in price

- Radio manufacturers are good at what they do and pack radios with hardware matched to the function

- Most SDR is RX-only, TX (qrp) with an even higher price… and up… and up…

- Portable operation can be cumbersome with multiple pieces of gear, pigtails/adapters, and PC power

What hardware is involved?

- Typically, you'll have a dongle or small box connected to a USB port on your PC

- The SDR device has a broadband receiver, tuner, other ancillary circuitry, at least one antenna interface and USB interface

- Antenna – I've had some success, and lots of failures, so will defer antenna talk to someone who knows

- USB connection to PC – a shielded cable is highly recommended

Available SDR Hardware

- RTL2832U-based receivers
  http://www.rtl-sdr.com/buy-rtl-sdr-dvb-t-dongles/

- SDRPlay
  http://www.sdrplay.com/

- FunCube Dongle Pro Plus (FCDPP)
  http://www.funcubedongle.com/

- AirSpy
  http://airspy.com/

- Red Pitaya
  http://store.redpitaya.com/hamlab.html

- HackRF
  https://greatscottgadgets.com/hackrf/

- ...many more for any depth of pocket
  http://www.rtl-sdr.com/roundup-software-defined-radios/

I've used...

- NooElec RTL with R820T tuner

  - Plus upconverter for HF coverage (ugh)

- FunCube Dongle Pro+

- DX Patrol RTL with onboard upconverter

- SDRPlay RSP1

- RTL-SDR v3 with R820T2 tuner, TCXO, etc.

NooElec NESDR

- My first SDR receiver, very low cost entry into SDR fun

- VHF/UHF only, need upconverter for HF

- I rarely used this for HF because shortly after buying the upconverter I acquired the FCDPP

- Huge array of software support, often open source, and broad operating system support

FunCube Dongle Pro+ (FCDPP)

- Much more costly (10x) than cheap RTL dongle

- HF coverage without upconverter hassle (yay)

- Often plug-and-play since dongle mostly appears as a sound card to operating system

- Since lots of functions built into dongle, not as purely SDR as RTL

- Relatively low bandwidth (192k)

- SMA antenna connector, easier to adapt to than MMCX and other janky connectors on early RTL receivers

DXPatrol

- RTL-based receiver with typical broad RTL driver & operating system support

- On-board upconverter for HF coverage

- Separate VHF/UHF and HF SMA antenna connectors

- All the good and bad of RTL, without headache of upconverter hassle

- Same temperature drift issues as non-TCXO RTL receivers

SDRPlay RSP1

- A new beast entirely, but not a panacea
- Very wide, up to 10MHz bandwidth, for huge spectrum visibility
- Like FCDPP, lots of on-board filters (a good thing?)
- Closed-source drivers (horrible) – no Pine64+Soapy joy :-(
- For Windows users, a real treat to own and use

RTL-SDR v3

- Again, broad operating system and software support
- TCXO – low, if any, drift and typically zero PPM adjustment required
- SMA antenna port – yay, no more MMCX foolishness
- R820T2 tuner – much improved over original R820T
- Bias-tee powered from USB
- HF direct sampling via Q branch – no upconverter required (YAY)
- Aluminum case for improved shielding over all others I own and use

Software

- Depends on operating system, but options are many

- Windows users enjoy HDSDR, SDR# (AirSpy controlled now), SDRConsole among others

- Linux options are fewer, but rising, including GQRX and CubicSDR

- Linux users can use Wine for support of Windows options, but as usual, YMMV with Wine!

- Driver support for Windows is broad

- Driver support for Linux is good ***for open-source drivers!***

  - My own trials and tribulations with SDRPlay and Ubuntu on ARM-based Pine64 SoC board :-(

Real SDR?

- Filters in FCDPP and SDRPlay are potentially useful, depending on application, but not strictly SDR is it?

- Can functionality of those filters be replicated in software (S in SDR) with lower-cost RTL receivers?

- Enough of me blabbing, let's see some action!

More links

- A must view for understanding IQ of SDR
  #170: Basics of IQ Signals and IQ modulation & demodulation - A tutorial

  #171: IQ Signals Part II: AM and FM phasor diagrams, SSB phasing method

- Lots of RTL SDR and DVB projects with Raspberry Pi, including ADS-B
  https://www.youtube.com/user/CWNE88