

# Software Defined Radio for VHF and UHF applications

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# What is SDR?

- “Software Defined Radio”
- Signal processing in the digital domain
  - Filtering
  - Modulation/Demodulation
- Endless possibilities

# Analog Domain vs Digital Domain

## Analog

- Antenna/Coax
- Tuner
- Basic Filtering
- Amplification

## Digital

- Advanced Filtering
- Modulation/  
Demodulation

# What does an SDR look like?



# Why use SDR?

- Blank canvas for signal processing
- Not constrained by hardware
- See the spectrum
- Receive multiple signals simultaneously
- Decode/demodulate many different modes

# Software Defined Radios - The Hardware

RTL-SDR (RTL2832u + R820T2) - \$13

- 24MHz-1.8GHz, up to 3.2MS/s
- Receive Only

FUNCube Dongle Pro+ - ~\$150

- 150KHz-1.9GHz, up to 192Ks/s
- Receive Only

AirSpy One (LPC4370 + R820T2) - \$199

- 24MHz-1.8GHz, up to 10MS/s
- Receive Only

HackRF One - \$328

- 10MHz-6GHz, up to 20MS/s
- TX & RX, >5dBm TX (Half Duplex)

BladeRF - \$420

- 300MHz-2.8GHz, up to 40MS/s
- TX & RX, 0dBm TX (Full Duplex)

Ettus B200 - \$675

- 70MHz-6GHz, up to 56MS/s
- TX & RX, >10dBm, Full Duplex

Ettus N210 w/ WBX Board -  
\$2DamnMuch

- 50MHz-2.2GHz, up to 40MS/s
- TX & RX, >20dBm, Full Duplex
- Standard hardware in many labs

WiNRADiO - Starting at \$999

- Unobtainium

# RTL-SDR Dongle

- Cheap - \$13 + \$6 Adapter
- MCX Connector
- USB 2.0
- Receive up to 2.4MHz at once
- Weak front-end, subject to overloading

# What Can I Receive?

- Broadcast FM
- Amateur Repeaters
- Land Mobile Systems
- APRS Traffic
- NOAA WX (162MHz)
- ADS-B
- Gas & Power Meters
- Amateur Satellites
- NOAA Satellites (137MHz)
- Spectrum Analyzer
  - Well, sort of
- Digital Systems
  - P25
  - MotoTRBO/DMR
  - Some trunked systems
  - [No D-Star/Fusion, yet]



# Demodulating an Analog Signal

- Open SDR#
- Select Modulation  
[AM/FM/WFM/CW/USB/LSB/DSB]
- Tune to Approximate Frequency
- Click on Signal
- Adjust?
- Enjoy

# Demodulating Digital Signals

## Windows:

- SDR# to Virtual Audio Cable
- Virtual Audio Cable to:
  - DSDPlus (P25/DMR/more)
  - Unitrunker

## Linux:

- rtl\_fm to stdout
- stdin to multimon-ng

## Useful for:

- DTMF
- AFSK1200 (APRS)
- AFSK9600
- POCSAG (Pagers)
- Many More

# Where to go from here?

- Purchase SDR Receiver (RTL-SDR = \$13)
- Download SDR Program
  - SDR# (easy to use)
  - SDR-Radio (powerful)
  - HDSDR (easy to interface with rig)
  - GQRX (ideal for Linux/OSX)
  - GNURadio (*advanced*)
- Receive cool things