EBARC Programs

Radio Theory - Sunspots & RF Propagation, Circuits, SDR,...
Antennas - design and building
Microcontroller (Arduino/Raspberry Pi) projects - soldering, coding, home brewing, etc.
Digital modes - PSK, RTTY, FT-8, Olivia, FreeDV,...
Shack design and building - solar power, proper grounds, correct wire and cable size,...
Gear for the shack - radios, test equipment, the latest ham gear
Putting up a tower
Working satellites and moon bounce
Over 50 MHz - AREDN, VHF contesting
Six meters - the magic band
Homebrew show and tell night
RTL-SDR applications
Mini-Field Day or operate from meeting parking lot
Field trips - to commercial radio stations or emergency radio center
Contesting
Vintage gear and tubes
Movie night

What’s a RTL-SDR?

Ultra cheap software defined radio

What is the RTL-SDR?

A very cheap RX software defined radio

2.4 MHz bandwidth, tuning range 24 MHz – 1.7 GHz. Some go down to HF.

Originally (and still is) a DVB-T TV Tuner

Highly mass produced in China – very cheap

Hardware hackers found the SDR feature for FM radio reception. Opened up a whole new world of experimentation. New (and old) blood returning to the radio scene.

Cheapest versions are ~$8

What’s Under The Hood

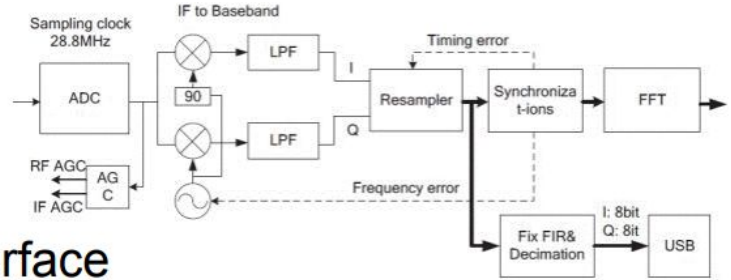
Two Parts: USB Interface & Tuner Chip

USB Interface - Realtek RTL2832U

Tuner Chip originally Rafael Micro R820T2, than E4000, FC2580,...

Other brands sport better tuners, TXCOs, HF via direct sampling, Bias Tee Power

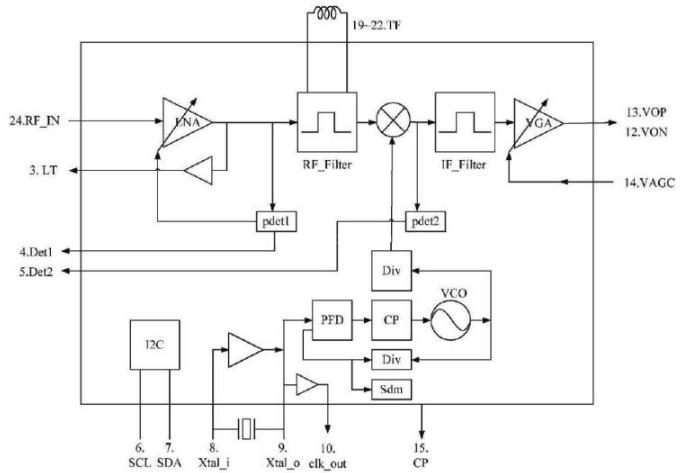
Realtek RTL2832U



- USB 2.0 interface
- high-performance DVB-T COFDM demodulator.
- supports tuners at IF (Intermediate Frequency, 36.125MHz), low-IF (4.57MHz), or Zero-IF output using a 28.8MHz crystal, and includes FM/DAB/DAB+ Radio Support
- 8-bit ADC for RF signals level measurement
- Eight general purpose I/O ports, plus IR port

Rafael Micro R820T2

- Support all digital TV standards: DVB-T, ATSC, DTMB and ISDB-T
- On-chip
  - LNA,
  - mixer,
  - fractional PLL,
  - VGA,
  - LDO



Problems with “Generic” Dongles

Drifting oscillator (unstable frequency)

No shielding Many spurs

Problems with L-band reception

Uncommon MCX RF connector

Redesigned RTL-SDR V3 ($22 on Amazon)

RTL-SDR.com V3 fixes and added features

TCXO Oscillator

Metal case shielding

Redesigned PCB, and additional noise filtering

Thermal pad to metal case heat sink

SMA connector

Bias tee

HF reception via direct sampling

Some other dongles

Generic dongles DVB-T (25Mhz-1.7GHz, 8 bit ADC, 2.8 Msps <$25)

Knock-off dongles ($Beware)

NooElec (25MHz -1.7GHz, TCXO, Metal Case, SMA ~$22)

SDRplay (1KHz-2GHz, 14 bit ADC, 10 Msps $109)

HackRF One (1Mhz-6GHz, 8 bit ADC, 20 Msps, Transmits $299)

LimeSDR Mini (10 MHz-3.5GHz, 12 bit ADC, 30 Msps, Transmits $159)

Airspy (24 MHz-1.8GHz, 12 ADC, 10 Msps $199)

Big List of SDRs

Software Support

Works on Windows, Linux, Raspberry Pi's/Odroids etc, MacOS

Windows: SDR#, SDR-Console, HDSDR, MultiPSK, MATLAB, UHR

Raspberry Pi: Command line tools, Direwolf, GQRX, APRS I-Gate

Linux/MacOS: GQRX, gnuradio

Cloud/Raspberry Pi: OpenWebRX (sdr.hu)

Android: SDR Touch

Chrome: Radio Receiver

Applications

Monitoring Your Transmission Quality

Lab Equipment - test filters with a noise source

Scan UHF/VHF FM repeaters, aircraft voice radio, trunked radio systems

APRS, ADS-B, AIS, P25, DMR, WSPR, DRM, ACARS, VOR

NOAA Weather & Other Satellites, NOAA Radiosondes, ISS

OuterNet, Jupiter Noise Bursts,...

Accessories

Filters

Low noise Amplifiers

Noise Sources

Antennas/Baluns

Attenuators

Scanning Software

https://www.sigidwiki.com/wiki/Signal_Identification_Guide

Demo

ADS-B (Automatic Dependant Surveillance-Broadcast)

Chrome browser

SDR#

Filter curve with noise generator with HackRF

ACARS (Aircraft Communications Addressing and Reporting System)

GQRX

UHR (Universal Hacker Radio)

Questions?