Software Defined Radio

Listening to the Bleeps and Bloops around you
Software Defined Radio in a nutshell

- Like a FM radio, but can receive a wider radio spectrum range

by Mesinton

Price: $8.50 & FREE Shipping on orders over $35. Details

In stock.

Next Sunday, Jan. 10? Order within 10 hrs 26 mins and choose Two-Day Shipping at checkout. Details

Sold by NooElec and Fulfilled by Amazon. Gift-wrap available.

- Digital Terrestrial Video and Radio Programs Recording
- Real Time Digital Video Recording, Still Image Capture, PIP (Picture in Picture)
- One touch channel auto-scan at 6/7/8 MHZ
- On-Fly Decode software technique
- Multi-Language in stallation and application program
Quick Peek at Radio Frequencies

High Freq: 3MHz to 30MHz
AM Radio, 'Shortwave', Fire Departments

Ultra High Freq: 30MHz to 300MHz
FM Radio, Pagers, Air Traffic, Amateur Radio, Broadcast TV

Very High Freq: 300MHz to 3GHz
Weather Satellites, Amateur Radio, Cell Phones, WiFi, Internet-Of-Things

Super High Freq: 3GHz to 30GHz
WiFi, Satellite, Military Radar, Dish TV, XM Radio

Extremely High Freq: 30GHz to 300GHz
Communications, Military, and Medicine

Tremendously High Freq: 300GHz to 3THz
Amateur radio, Military, Lasers

FM Radio is here
Out-of-the-Box SDR Coverage
You can receive...

- **HF (3-30MHz)**
  - AM Radio
  - Morse Code
  - ‘Shortwave’ stations from other countries
  - Numbers Stations
- **Broadcast FM (88-108MHz)**
  - Standard FM radio, like in your car
- **Satellite transmissions (130-150MHz)**
  - NOAA Weather
  - International Space Station
- **FCC Registered Comms (130-160MHz)**
  - Mall Security
- **IoT Devices (433MHz & 915MHz)**
  - Tire Pressure Monitoring System
  - Wireless Temperature sensors
- **Amateur Radio (Varies)**
- **Aircraft Tracking (1090Mhz)**
- **Ship Tracking (161MHz)**
- **Pager Messages (Varies)**
- **Baby Monitors (Varies)**
Other applications include...

- Tracking and receiving meteorological agency launched weather balloon data.
- Tracking and receiving rocket launch telemetry.
- Tracking your own self launched high altitude balloon for payload recovery.
- Sniffing GSM cell phone signals.
- Receiving GPS signals and decoding them.
- Spectrum analyzer.
- Radio astronomy.
- Receiving RADAR signals like over the horizon (OTH) radar, and HAARP signals.
- Monitoring meteor scatter.
- Decoding taxi mobile data terminal signals.
- A high quality entropy source for random number generation.
- A noise figure indicator.
- Reverse engineering unknown protocols.
- Triangulating the source of a signal.
- Searching for RF noise sources.
- Characterizing RF filters and measuring antenna characteristics.
Make a simple FM Radio frequency viewer
POCSAG

Pagers are still a thing, apparently.

Pipe signal through GQRX multimon-ng via nc

Decode POCSAG messages

Lots of hospitals, sometimes drug dealers

```
nc -l -u -p 7355 | sox -t raw -esigned-integer -b16 -r 48000 -esigned-integer -b16 -r 22050 -t raw - |
multimon-ng -t raw -a SCOPE -a POCSAG512 -a POCSAG1200 -a POCSAG2400 -f alpha -
```
POCSAG1200 Messages

- Name + SSN
- Very personal medical info
- Names + Email Addrs
Automatic Dependent Surveillance / Broadcast

Decode Mode S, Mode A, and Mode C

Not mandatory until 2020

Aircraft Communications Addressing and Reporting System (ACARS)
ISM Band

Industrial Scientific Medical band

- 433MHz
- 915Mhz
- 2.4GHz
- 5.8GHz
- Thermometers
- Energy meters
- Tire Pressure Monitoring System
- Wireless security cameras
Amateur Radio / Ham Radio

Greybeards talking about illnesses from three states away

Need a license from FCC to transmit

- Continuous Wave (CW - Morse Code)
- Digital Packet Radio
  - APRS
  - RTTY
- Phone/Voice
- Images/Video
- Data/Satellite
HAM Band - GQRX

Greybeards talking about illnesses from three states away

Highly regulated for transmission, but also most flexible

- Continuous Wave (CW - Morse Code)
- RTTY (yes, the same as Linux TTY)
- Interesting reading about Baudot (baud rates)
- Phone
- Images/video
- Data/Satellite
Amateur Radio / Ham Radio

Greybeards talking about illnesses from three states away

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Satellite

Thousands of satellites, most encrypted

Interesting ones that are not encrypted:

- **NOAA 15/18/19**
  - Weather
  - Search-and-Rescue

- **International Space Station**
  - NFM voice
  - SSTV images

- **Iridium/InMarSat**
  - Global telecom
  - Airplane Tracking (ADS/B via Satellite)
NOAA Weather Satellites

Extremely easy to receive
Provides real-time(ish) images of the planet

Various Satellites:
- NOAA 15, 18, 19
- GOES
- METEOR M2

Various Protocols:
- Automated Picture Transmission (APT)
- Low-Resolution Picture Transmission (LRPT)
- High-Resolution Picture Transmission (HRPT)
Radio Astronomy

Super Inexpensive Radio Astronomy
(Comparatively)

Point at a direction in the sky, let the Earth’s rotation do the scanning for you

Use old DirecTV dish
The blimp!

Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System
Army based project to ‘monitor for threats`

Narrow FM, several signal fingerprints

- Early: Simple encoded messages
- Some RTTY
- Call-Response
- RADAR
TRY IT OUT NOW!
http://websdr.org
Going Further...

- Start listening right now: [http://websdr.org/](http://websdr.org/)
- Fancier antennas
  - Pizza pans? ‘Long Wire’ Antennas? Yagi?
- Low Noise Amplifiers
- Up/Down-converters
  - Ham-It-Up
    - [https://www.nooelec.com/store/ham-it-up.html](https://www.nooelec.com/store/ham-it-up.html)
  - SUP-2400: DirecTV Up/Down converter:
    - $5 gets you 2.4GHz range
- Better SDR hardware
  - AirSpy- $100
  - LimeSDR- $250
  - USRP- $2,500
- Pair your SDR with a Raspberry Pi to transmit: [https://github.com/F5OEO/rpitx](https://github.com/F5OEO/rpitx)
- Get your ham license
  - $15 for the test, allows to transmit on licensed frequencies
NOAA 19 Demo

Come see a live demo of NOAA Weather satellite capture!

4:10 PM to 4:30 PM
(Just after the Closing Keynote)
Thank you!

Twitter: @tswartz07
GitHub: https://github.com/tomswartz07
Slides and other SDR info: https://github.com/tomswartz07/CPOSC2017