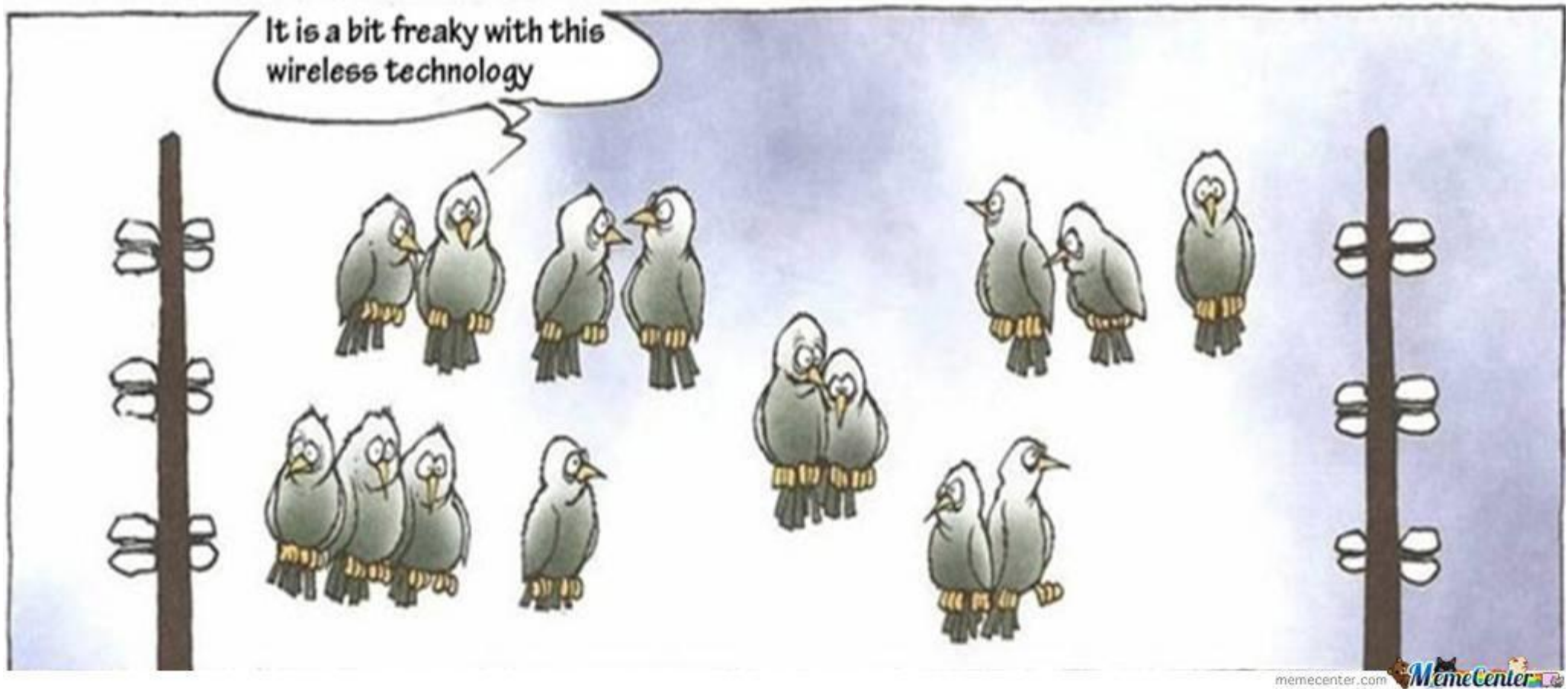


# Radio Hacking with Software Defined Radio





“ If you can’t see doesn't mean that it is not there... ”

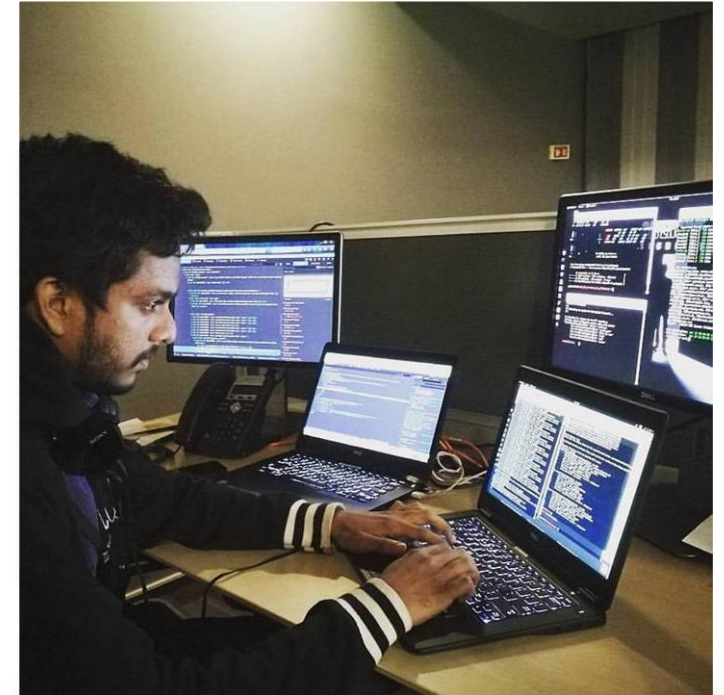
- VU3TFQ



CQ...CQ... Who is on this frequency ?

### **Thoufeeque N S**

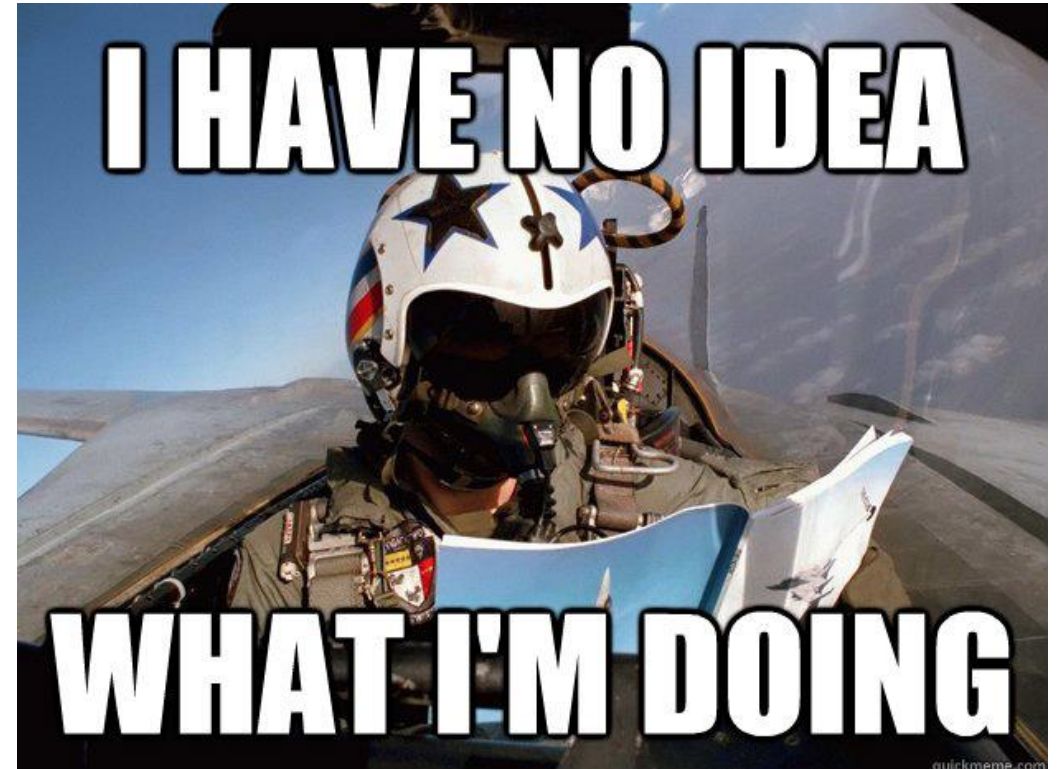
- Security Analyst in EY
- Hacking web applications for living
- Loves to play with Radio toys
- Licensed Ham Radio operator





What is going on here ?

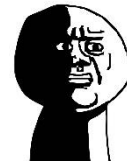
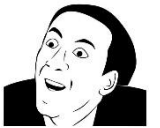
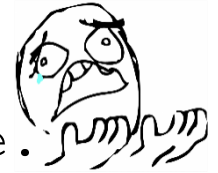
- What is SDR ?
- Type of Attacks
- Radios to use
- Software to use
- Antennas
- Demo\*





## Why Radio

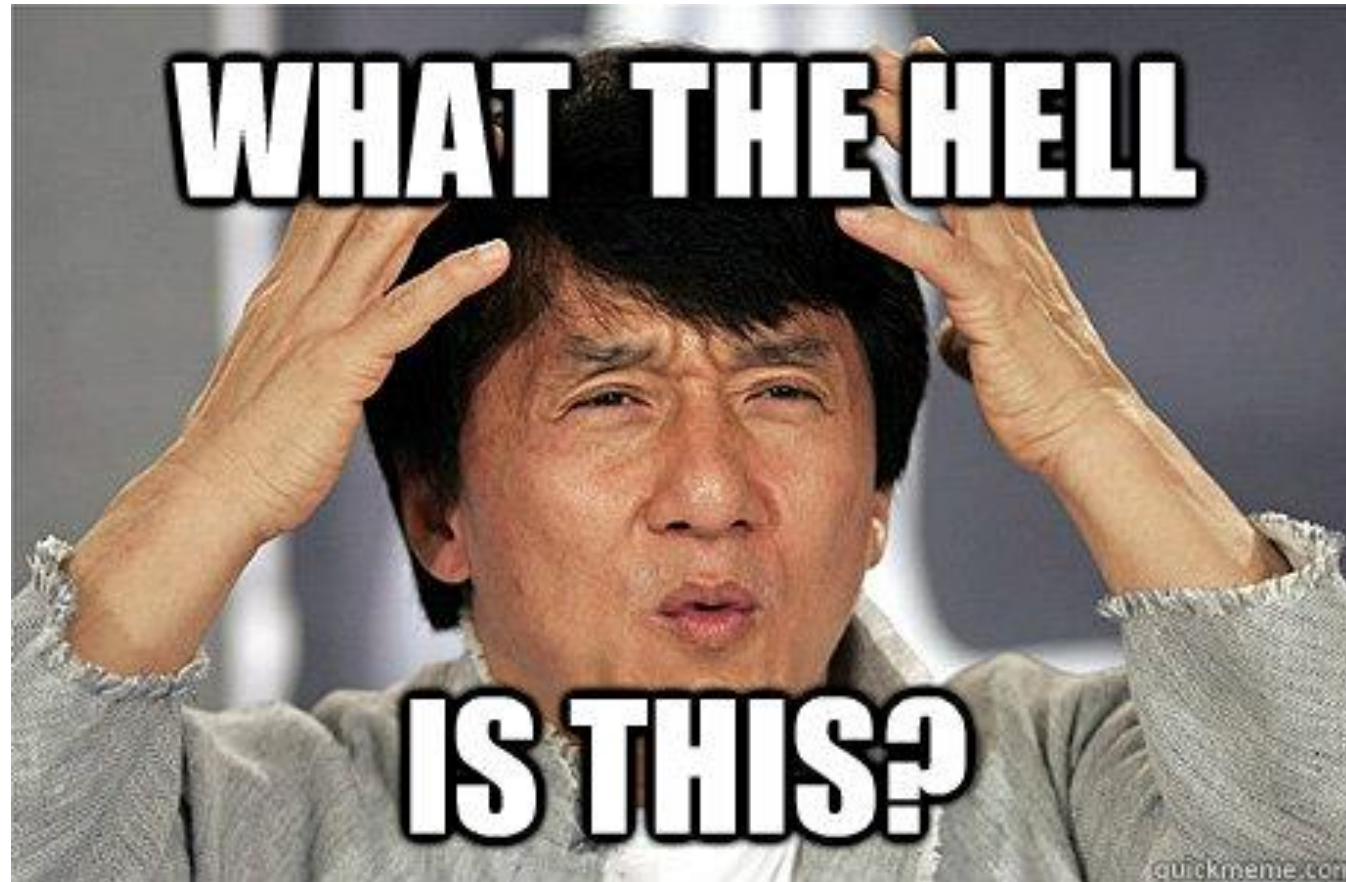
- Radio doesn't get much focus from a security perspective.
- Radio is one of the core component on almost all IoT devices.
- You don't need physical access to exploit the device.







So... software defined radio, right ?



# Software defined radio!

Software-defined radio (SDR) is a radio communication system where components that have been traditionally implemented in hardware (e.g. mixers, filters, amplifiers, modulators/demodulators, detectors, etc.) are instead implemented by means of software on a personal computer or embedded system.[1] While the concept of SDR is not new, the rapidly evolving capabilities of digital electronics render practical many processes which used to be only theoretically possible.

-Wikipedia 😊



## Possible attacks

- Reply attacks
- GPS Spoofing
- Sniffing GSM Signals
- Key fob attacks





# USRP

- Product by Ettus Research
- 1 TX, 1 RX, Half or Full Duplex
- Coverage from 70 MHz–6 GHz RF
- 2 SMA-Bulkhead Cables



<https://www.ettus.com/>

Cost you around \$2000

# HackRF

- 1 MHz to 6 GHz operating frequency
- half-duplex transceiver
- open source hardware
- compatible with GNU Radio, SDR#, and more

<https://greatscottgadgets.com/hackrf/>

Somewhere between \$300-\$400



# bladeRF

300MHz - 3.8GHz RF frequency range

Independent RX/TX 12-bit 40MSPS quadrature sampling

Capable of achieving full-duplex 28MHz channels

<https://www.nuand.com/blog/product/bladerf-x40/>



50000 INR !



Don't you see a problem here ? Over!



Wait... We have a solution.

It's called RTL-SDR!

How much it cost ?

\$20

No. I don't believe!.

Trust me.. It's only \$20.



Yeah, This is true. We have an SDR that will set you back \$20.

## RTL- SDR

- Meant to be a TV tuner card
- Converted it as an SDR
- RX b/w 24 - 1766 MHz
- Listen to AIS, ADS-B, GPS, GSM communications...

Below 1000 INR







## Some cool things you can do with RTL-SDR

- Receive aircraft signals (ADS-B).
- AIS (Ship transition) can be received.
- You can sniff most protocols in the air.
- Sniff radio communication between IoT devices.
- Once you received the data you can decode the it (It requires a lot knowledge and effort)





Now we have the hardware... What's next ?

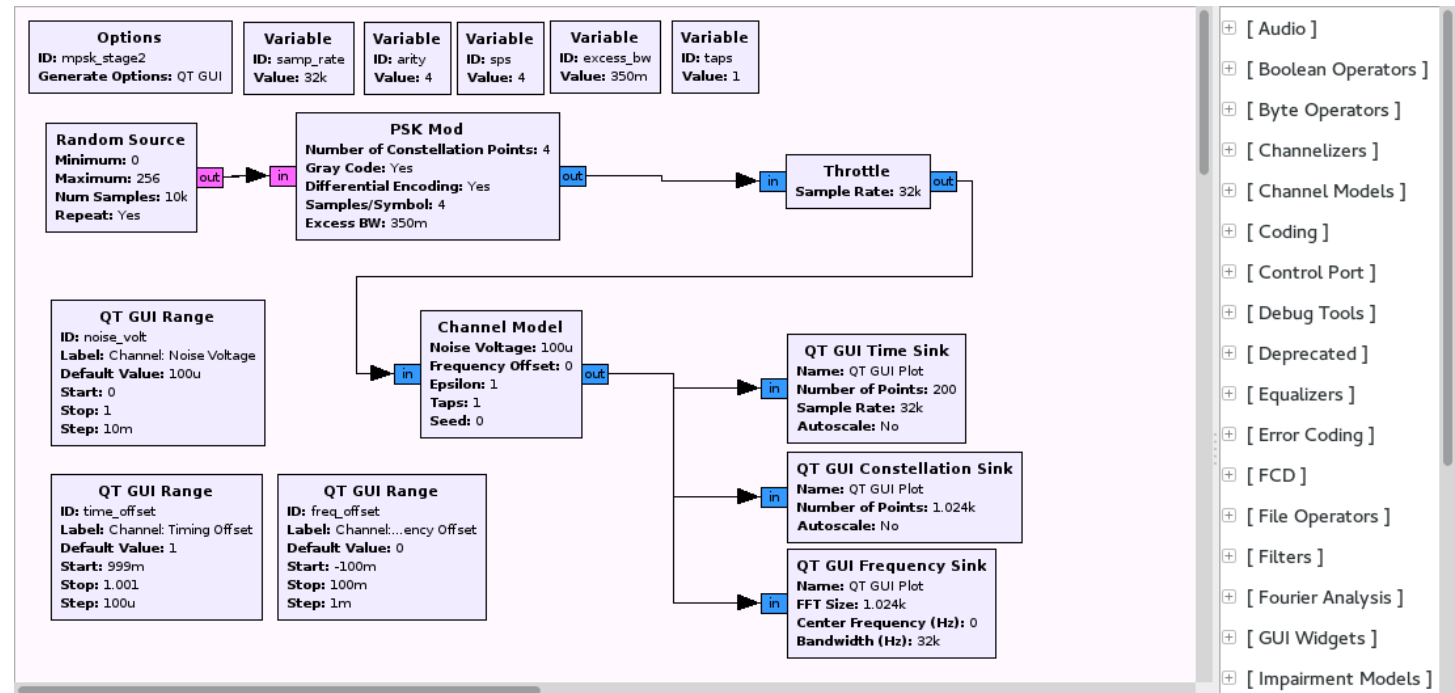
The software... What else!



# GNU Radio

GNU Radio is a free software development toolkit that provides signal processing blocks to implement software-defined radios and signal-processing systems. It can be used with external RF hardware to create software-defined radios, or without hardware in a simulation-like environment. It is widely used in hobbyist, academic, and commercial environments to support both wireless communications research and real-world radio systems.

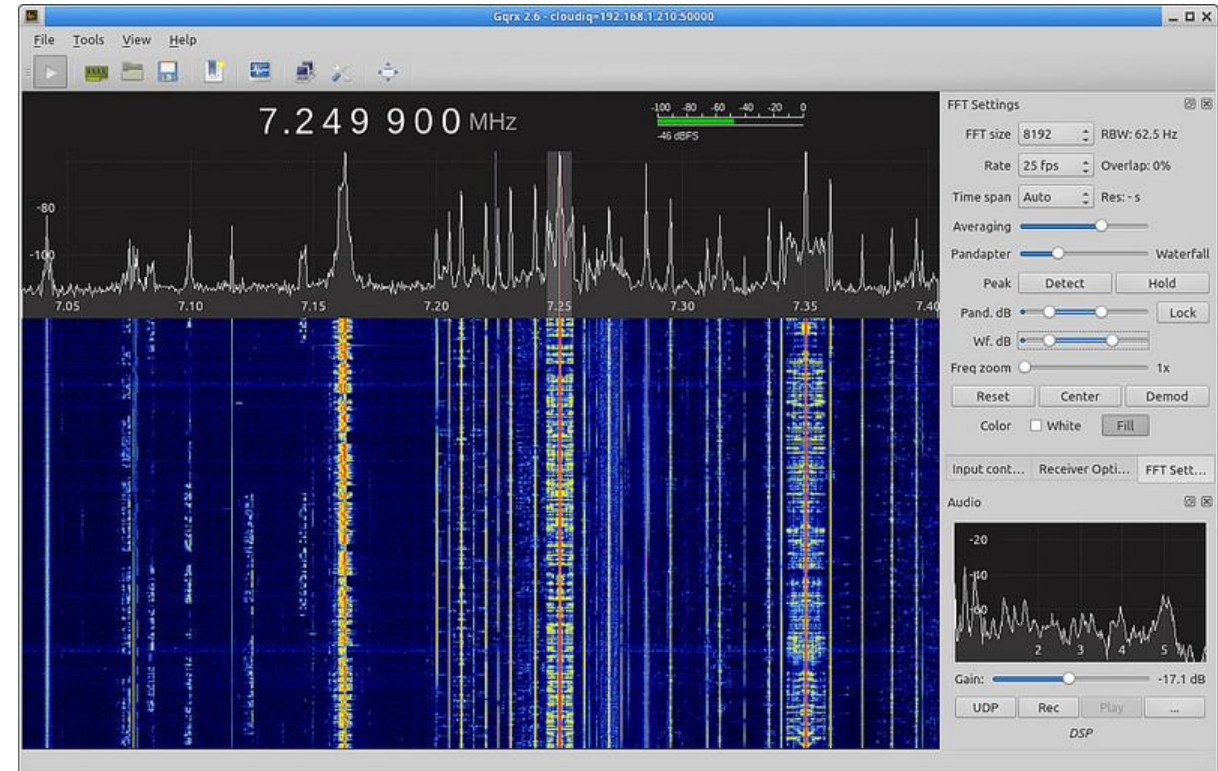
- wikipedia



# gqrx

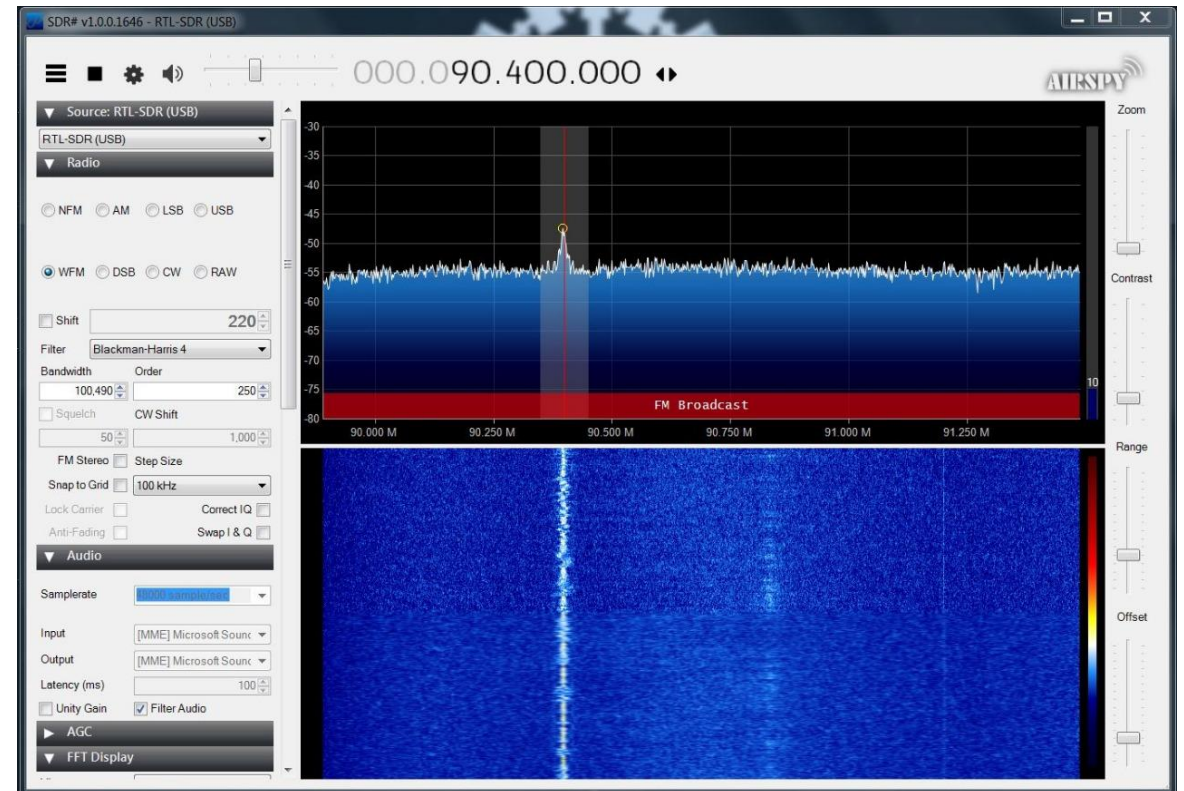


- For linux and osx
- Best to view the waterfall diagram
- GUI



# SDR Sharp

- Spectrum Display
- Waterfall Display
- Recording
- Windows tool
- GUI





# Rtl\_sdr

- Linux package
- Command line tool
- Can be used to record signals with rtl sdr

```
root@kali:~# rtl_fm -h
rtl_fm, a simple narrow band FM demodulator for RTL2832 based DVB-T receivers

Use:  rtl_fm -f freq [-options] [filename]
      -f frequency to tune to [Hz]
          use multiple -f for scanning (requires squelch)
          ranges supported, -f 118M:137M:25k
      [-M modulation (default: fm)]
          fm, wbfm, raw, am, usb, lsb
          wbfm == -M fm -s 170k -o 4 -A fast -r 32k -l 0 -E deemp
          raw mode outputs 2x16 bit IQ pairs
      [-s sample_rate (default: 24k)]
      [-d device_index (default: 0)]
      [-T enable_bias-T on GPIO PIN 0 (works for rtl-sdr.com v3 dongles)]
      [-g tuner_gain (default: automatic)]
      [-l squelch_level (default: 0/off)]
      [-p ppm_error (default: 0)]
      [-E enable_option (default: none)]
          use multiple -E to enable multiple options
          edge:  enable lower edge tuning
          dc:    enable dc blocking filter
          deemp: enable de-emphasis filter
          direct: enable direct sampling
          offset: enable offset tuning
      filename ('-' means stdout)
          omitting the filename also uses stdout

Experimental options:
      [-r resample_rate (default: none / same as -s)]
      [-t squelch_delay (default: 10)]
          +values will mute/scan, -values will exit
      [-F fir_size (default: off)]
          enables low-leakage downsample filter
          size can be 0 or 9. 0 has bad roll off
      [-A std/fast/lut choose atan math (default: std)]

Produces signed 16 bit ints, use Sox or aplay to hear them.
rtl_fm ... | play -t raw -r 24k -es -b 16 -c 1 -V1 -
            | aplay -r 24k -f S16_LE -t raw -c 1
      -M wbfm | play -r 32k ...
      -s 22050 | multimon -t raw /dev/stdin
```



We got hardware and software... What is next ?

**Antenna !**







# Antennas..... Antennas everywhere !



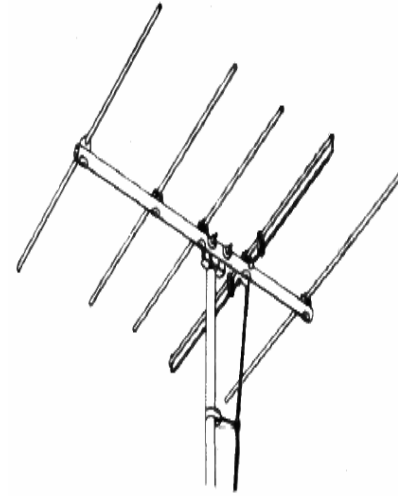
Ground plan antenna



Rubber ducky antenna



Turnstile antenna



Yagi-Uda antenna



Hardware, Software, Antenna...





So what is next ?





**This is just a beginning.**

- There are much more tools available for radio research.
- We are planning to conduct a series of Practical radio hacking session in the future events of DC0471.
- So stay tuned for more cool stuffs.





Q&A time...



Just kidding... :D



Over... Over...

# Thank you!

 /thoufeequens

 /thoufeequens

 /thoufeequens