W5HN

North Texas NTMS Microwave Society

# SDR and GNU Radio for Microwave

Cowtown

January 19, 2019

N5BRG

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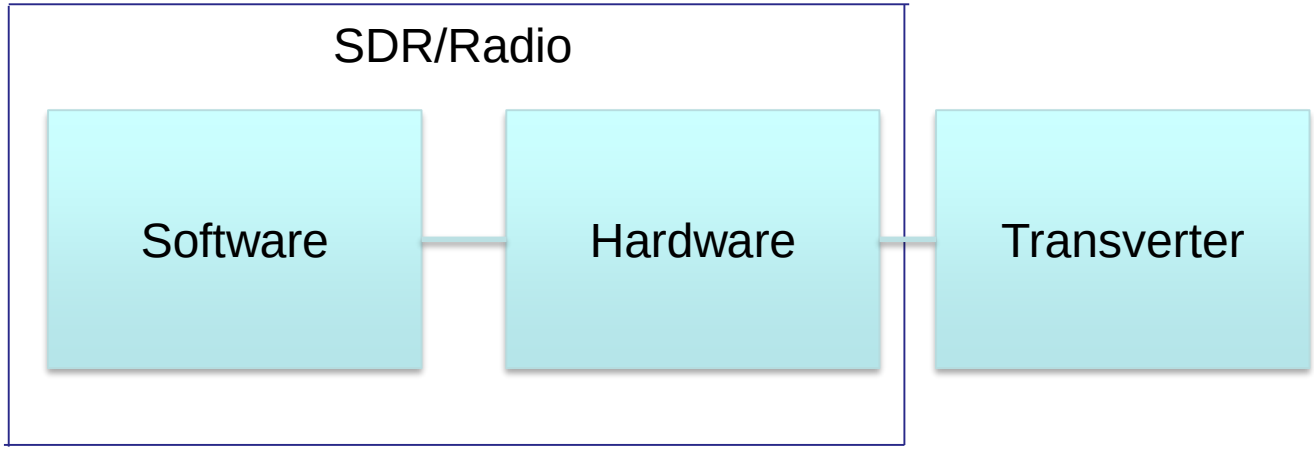

# SDR on the Raspberry Pi

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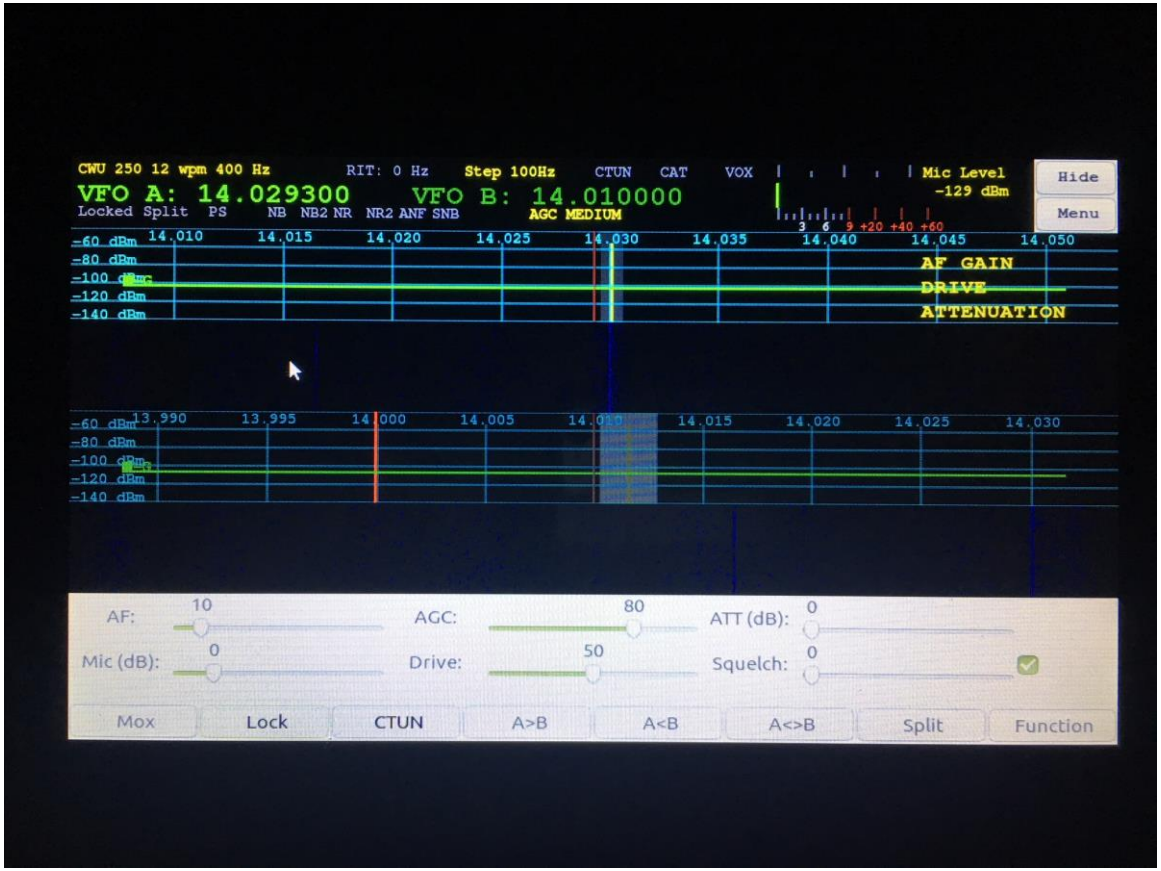



## PiHPSDR

Program runs on Ubuntu and other Raspberry Pi operating systems. Connects to a Software Defined Radio - HPSDR – Hermes – Many Others

Credit John Melton G0ORX/N6LYT

# TAPR / OpenHPSDR-Firmware

FIRMWARE V1.5 Current 1/2019

Code | Issues 0 | Pull requests 0 | Projects 0 | Insights

Branch: master ▾ OpenHPSDR-Firmware / Protocol 2 /

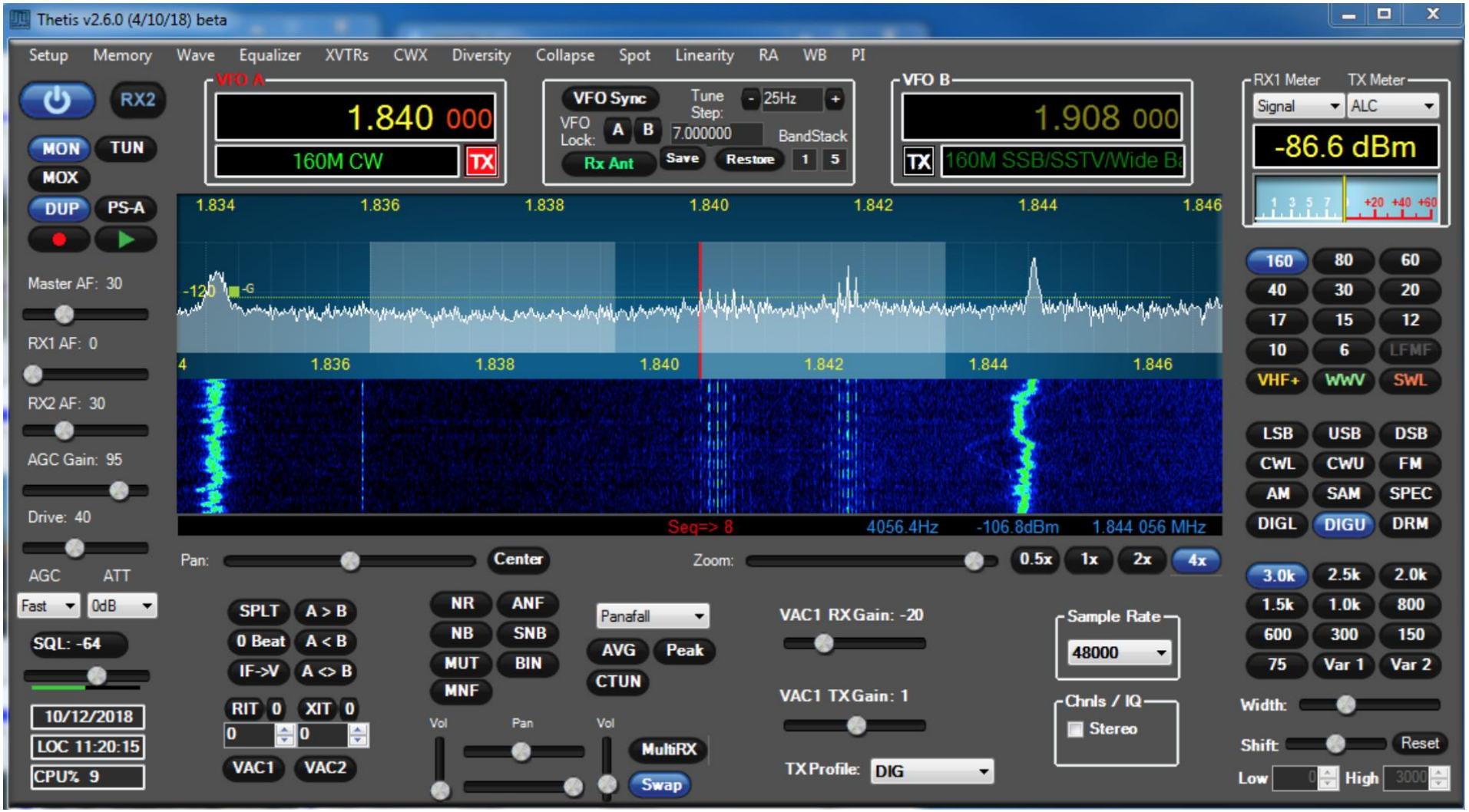
mh Adding v1.5

Types of SDR Hardware Available

| | |
|---|---|
| .. | |
| ANAN-10E & 100B | Added Protocol 2 code for ANAN-10E & 100B |
| Angelia (ANAN-100D) | replaced release notes, modified Orion_MkII folder name |
| Documentation | Add files via upload |
| Hermes (ANAN-10 and 100) | replaced release notes, modified Orion_MkII folder name |
| Orion (ANAN-200D) | Adding v1.5 |
| Orion_MkII (ANAN-7000DLE-8000DLE) | Adding v1.5 |

# Thetis v2.6.2 Most current Beta in Early 2019
# Skin view





# Example of two Receivers using Thetis

# Another SDR Option
# Analog Devices Pluto

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# GNU Radio on a DVD

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## GNU Radio Live SDR Environment

The GNU Radio Live SDR Environment, produced by Corgan Labs, is a bootable Ubuntu Linux DVD or USB drive image, with GNU Radio and third party software pre-installed. It is designed for quick and easy testing and experimentation with GNU Radio without having to make any permanent modifications to a PC or laptop. It does not, however, provide for permanent installation.

It is supplied as an ISO image to be downloaded and burned onto a recordable DVD disc or copied to a USB flash drive using a utility such as the Ubuntu Startup Disk Creator (Ubuntu Linux OS) or Unetbootin (Windows, MacOS, Linux). Creating a USB drive from the image will provide much faster booting and operation, and allow making changes and storing files. Finally, the ISO image may be booted within a virtual environment such as VirtualBox, QEMU/kvm, VMware, or Parallels.

Link to download on next page

GNU Radio 3.7.11
(Note current release now 3.7.13.4)

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# Current Stable Release

This version of the ISO image is based on the latest stable release of GNU Radio, 3.7.11, and the stable releases of third party software at that time:

http://s3-dist.gnuradio.org/ubuntu-16.04.2-desktop-amd64-gnuradio-3.7.11.torrent

The use of Bittorrent reduces the load on the GNU Radio web server and lowers project bandwidth costs.

If a Bittorrent client is not available or its use is restricted, you may download the ISO image file by choosing from one of the following mirror sites:

http://s3-dist.gnuradio.org/ubuntu-16.04.2-desktop-amd64-gnuradio-3.7.11.iso
http://eu1-dist.gnuradio.org/s3/ubuntu-16.04.2-desktop-amd64-gnuradio-3.7.11.iso
http://eu2-dist.gnuradio.org/ubuntu-16.04.2-desktop-amd64-gnuradio-3.7.11.iso

MD5 sum:

```
001a31c924f91665eb34b4b3502564c2  ubuntu-16.04.2-desktop-amd64-gnuradio-
3.7.11.iso
```

# GNU Radio SDR Blocks Available

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## Pre-Installed SDR Hardware Drivers

Drivers for these GNU Radio-compatible SDR peripherals have been pre-installed:

- Ettus Research UHD `release_003_009_006`
- Great Scott Gadgets HackRF products
- Nuand bladeRF products
- osmoSDR RTL-SDR driver
- AirSpy http://airspy.com/":http://airspy.com/

Each of these provides its own set of utilities and files. Please consult the manufacturers' documentation for more information.

Adalm-Pluto by Analog Devices @ Mouser for $150

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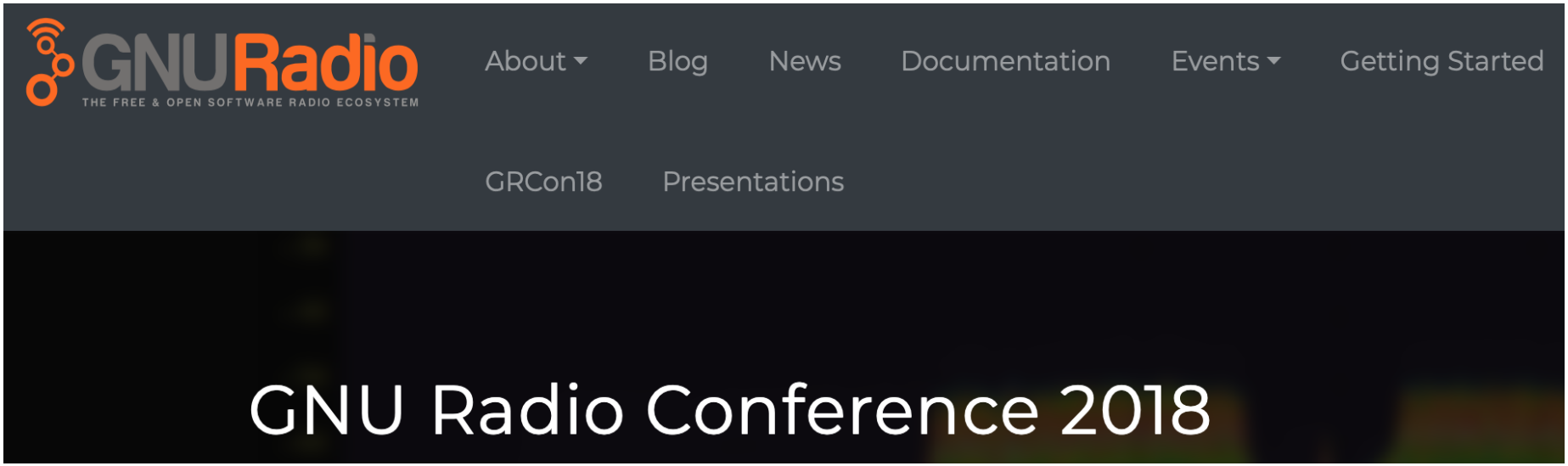
https://www.gnuradio.org

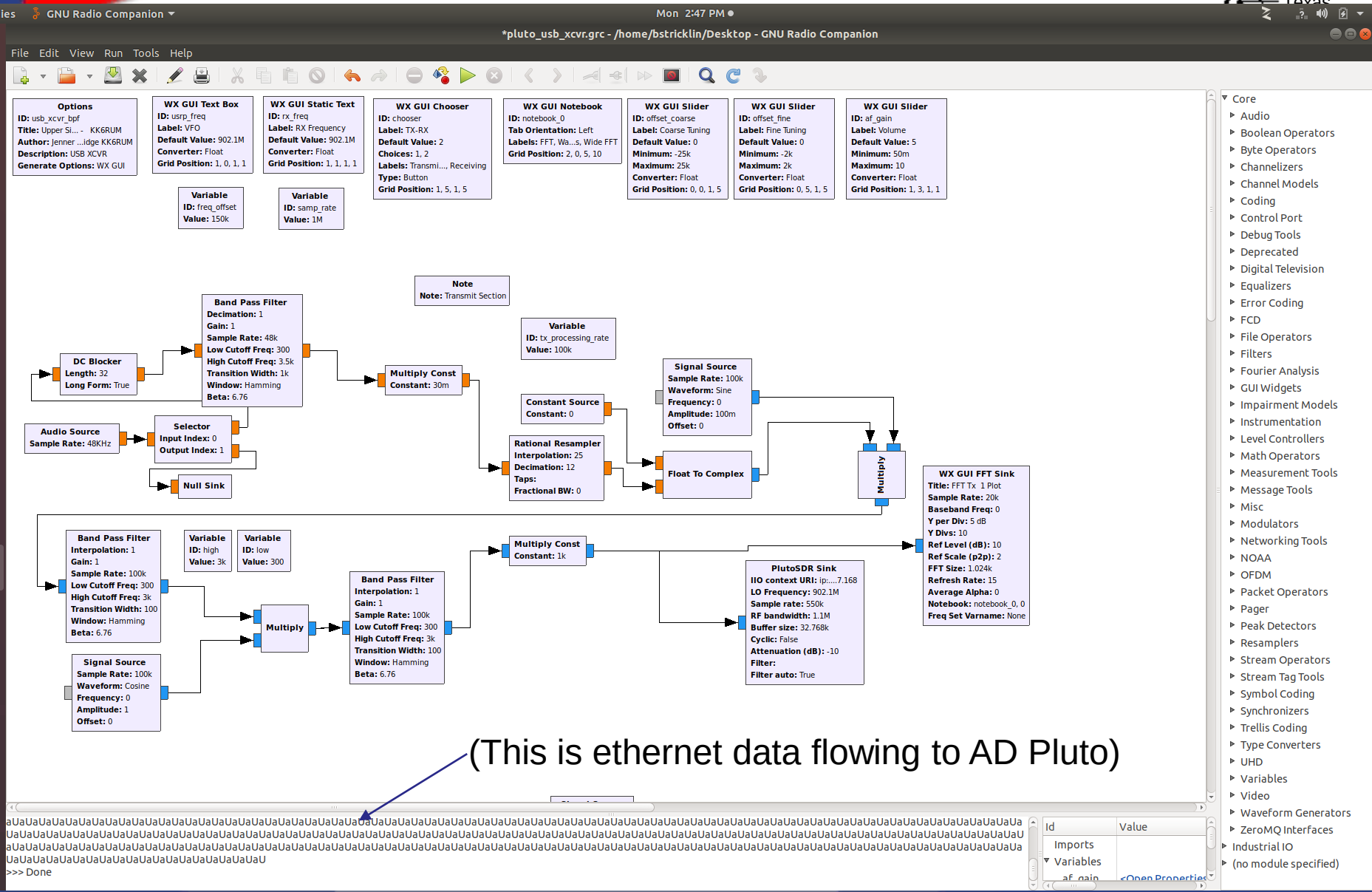
https://www.gnuradio.org/grcon/grcon18/




Many Youtube type Videos about GNU Radio

# Example of GNU Radio Flow Chart running for Transmit by KK6RUM

North Texas



# Example of GNU Radio Flow Chart for Receive

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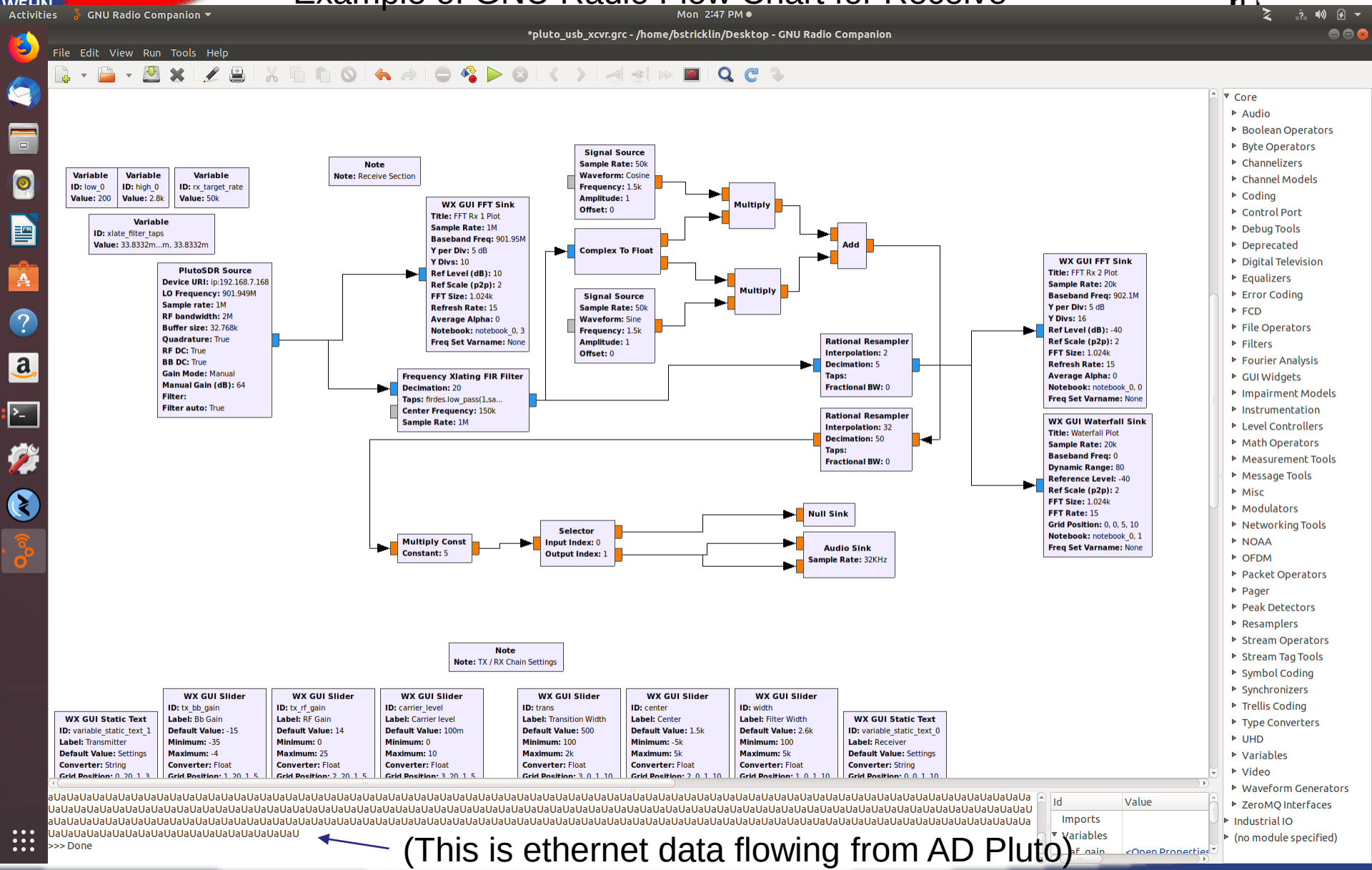


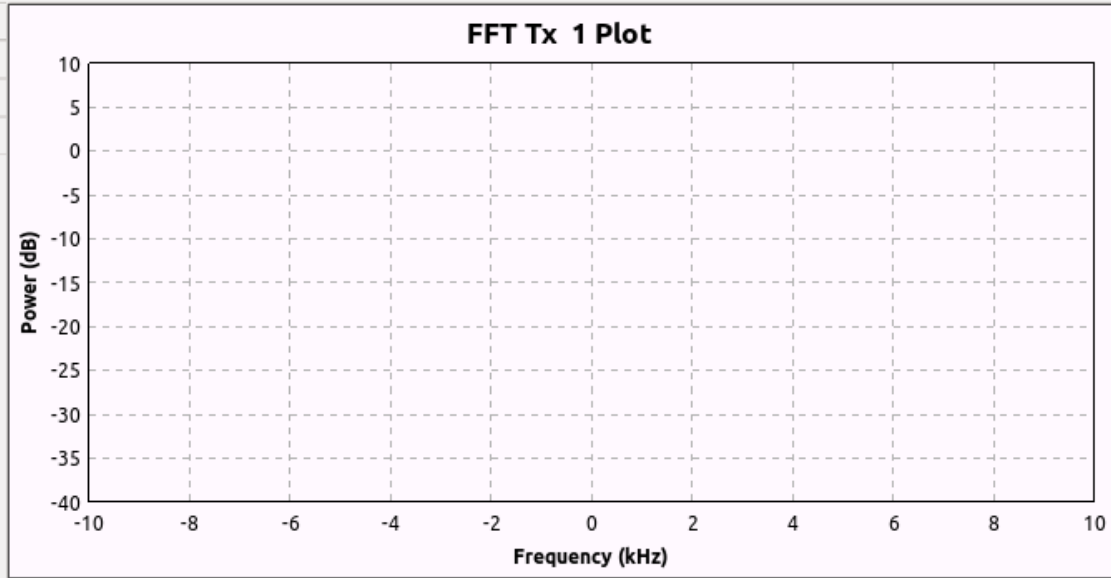

(This is ethernet data flowing from AD Pluto)

Upper Sideband XCVR - KK6RUM

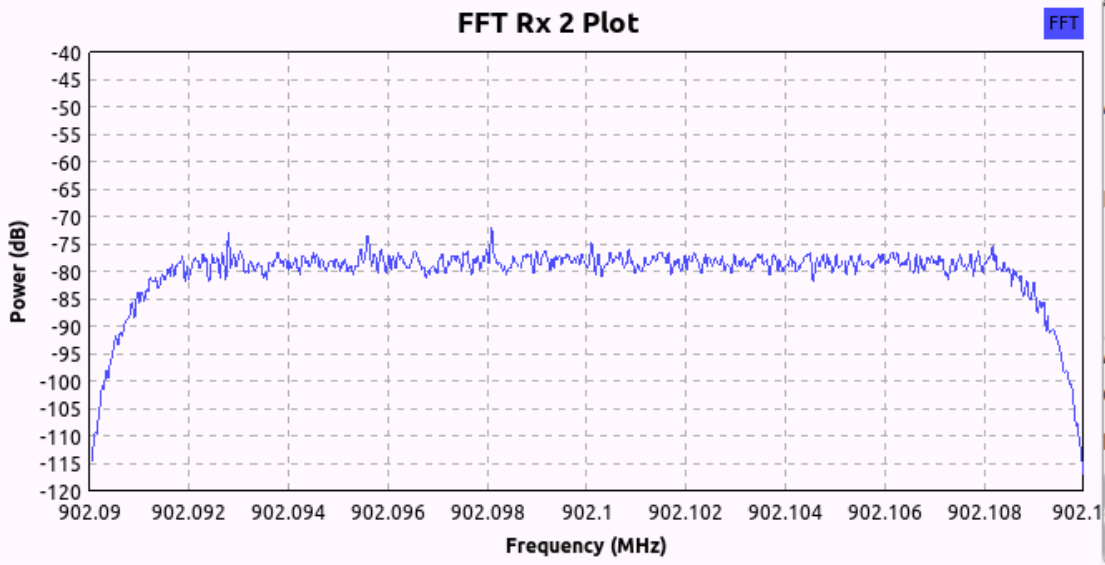
Coarse Tuning: 0.0 Fine Tuning: 0.0

VFO: 902.1M RX Frequency: 902,100,000 Volume: 5.0 TX-RX: Receiving

FFT
Waterfall
Gain Settings
Wide FFT




Trace Options
Peak Hold
Average
Avg Alpha: 0.1333
Persistence
Persist Alpha: 0.1486
Trace A Store
Trace B Store
Axis Options
dB/Div: + -
Ref Level: + -
Autoscale
Stop




Trace Options
Peak Hold
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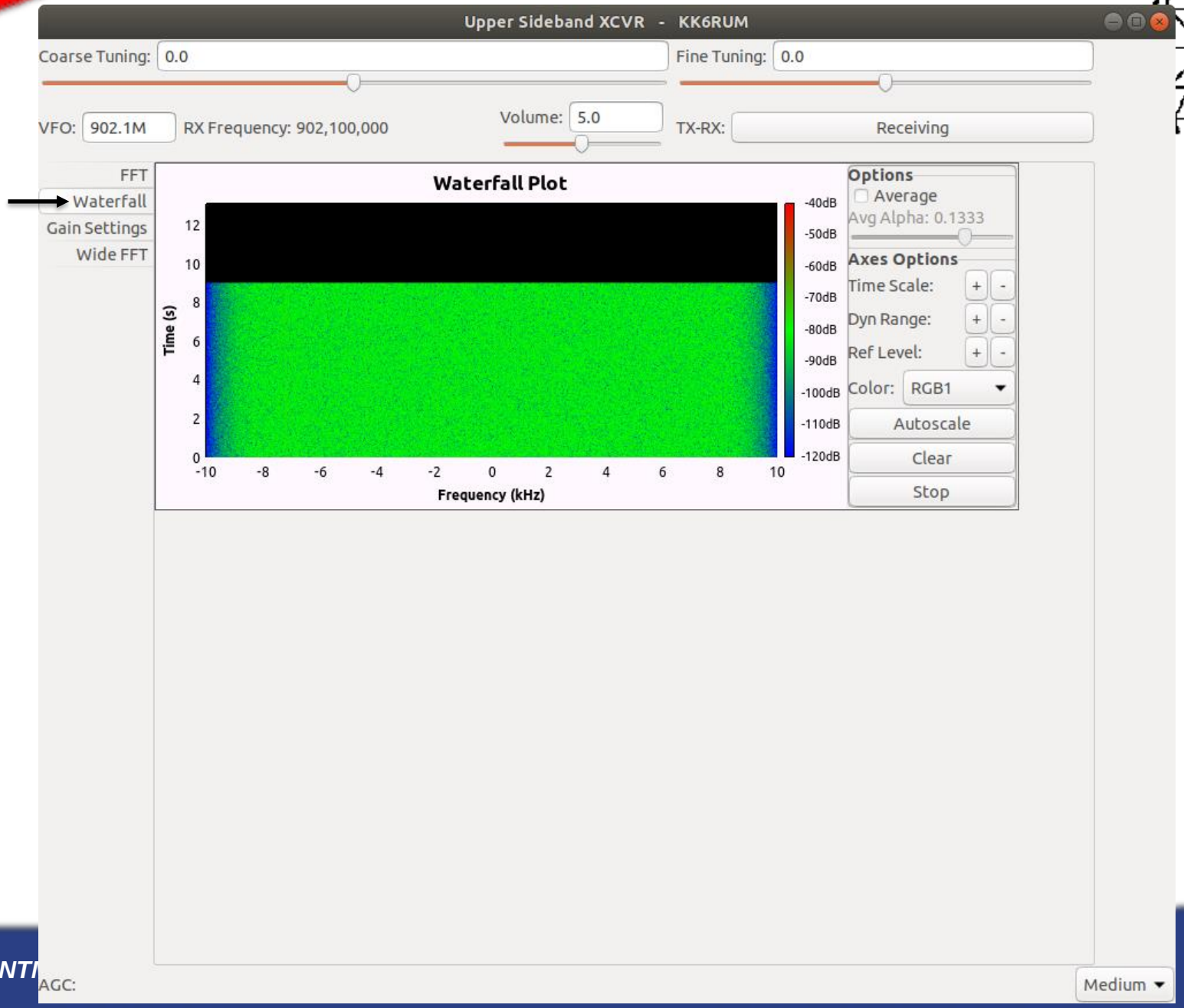
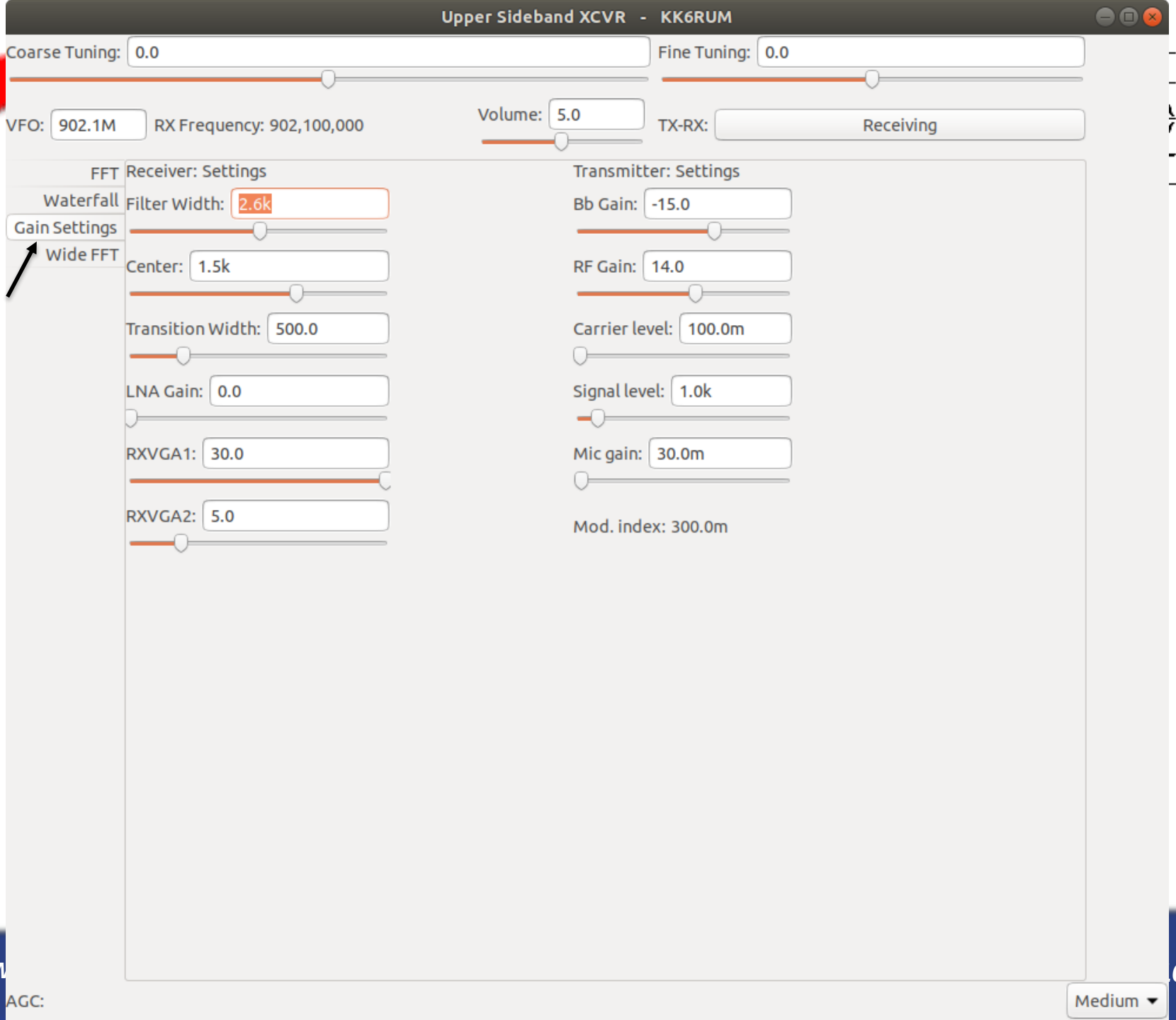
Avg Alpha: 0.1333
Persistence
Persist Alpha: 0.1486
Trace A Store
Trace B Store
Axis Options
dB/Div: + -
Ref Level: + -
Autoscale
Stop

AGC: Medium

# Example of the waterfall module output






Upper Sideband XCVR - KK6RUM
Coarse Tuning: 0.0
Fine Tuning: 0.0
VFO: 902.1M
RX Frequency: 902,100,000
Volume: 5.0
TX-RX: Receiving
FFT
Waterfall
Gain Settings
Wide FFT
Receiver: Settings
Filter Width: 2.6k
Center: 1.5k
Transition Width: 500.0
LNA Gain: 0.0
RXVGA1: 30.0
RXVGA2: 5.0
Transmitter: Settings
Bb Gain: -15.0
RF Gain: 14.0
Carrier level: 100.0m
Signal level: 1.0k
Mic gain: 30.0m
Mod. index: 300.0m
AGC:
Medium

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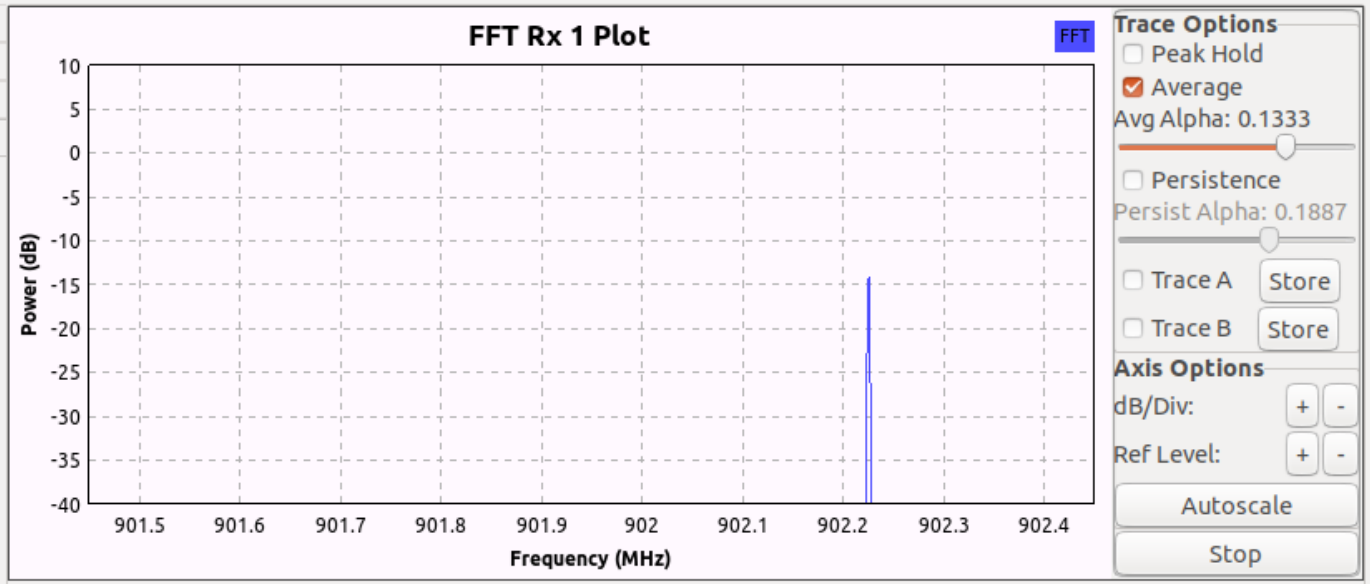
Upper Sideband XCVR - KK6RUM

Coarse Tuning: 0.0 Fine Tuning: 0.0

VFO: 902.1M RX Frequency: 902,100,000 Volume: 5.0 TX-RX: Receiving

FFT
Waterfall
Gain Settings
Wide FFT




Trace Options
Peak Hold
Average
Avg Alpha: 0.1333
Persistence
Persist Alpha: 0.1887
Trace A Store
Trace B Store

Axis Options
dB/Div: + -
Ref Level: + -
Autoscale
Stop

AGC: Medium

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# W5HN Beacons on August 5, 2018

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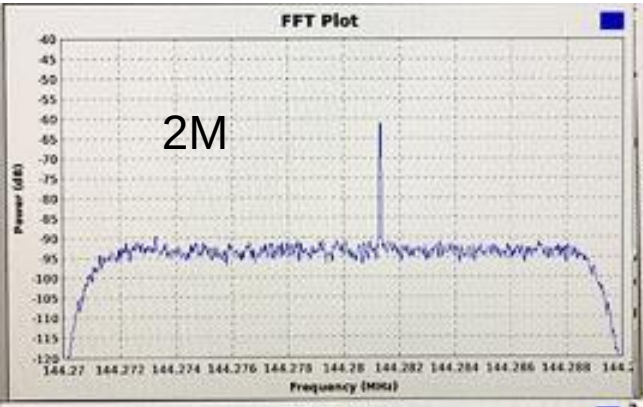


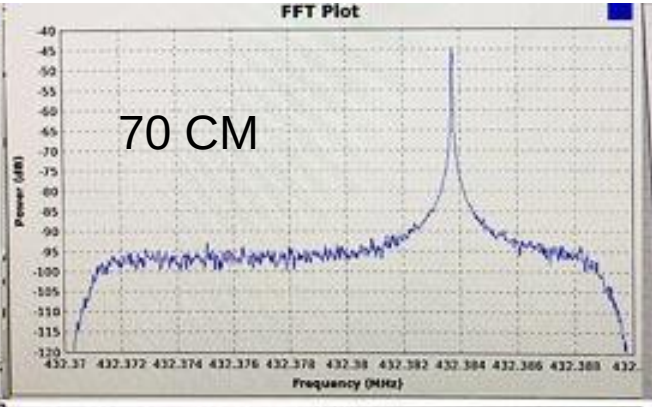


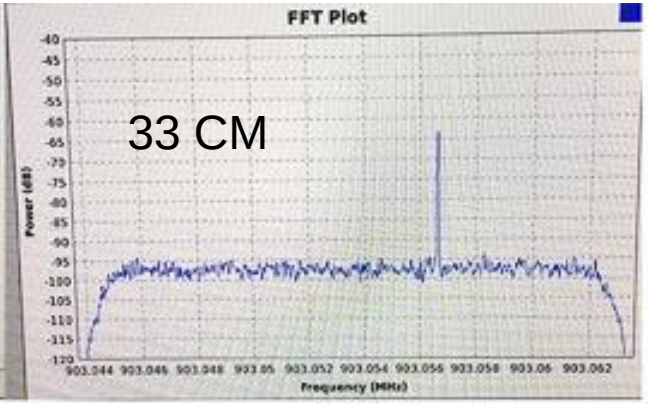


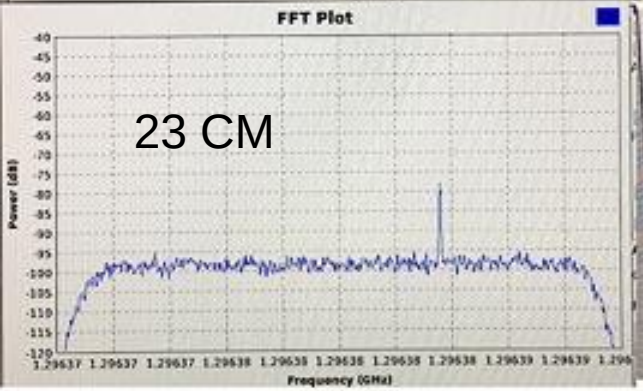


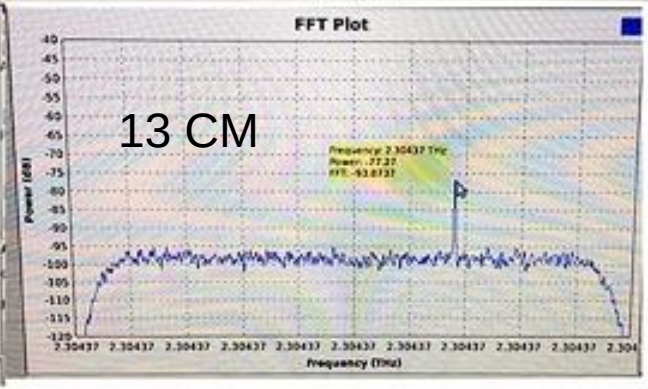


Noise Floor ~ -95 dB

# GNU Radio Block available for RTL-SDR

SMA Connector

USB Connector

## Dongle Example

Note: SMA connector with a Bias Tee option for preamp power.

# General Comments



For best performance of GNU Radio you need a good computer. I have installed GNU Radio on Raspberry Pi 3 and it functions but t work well I have a Intel 7 Motherboard with 16 GB of memory.

GNU Radio install and runs best on linux. It is difficult to get the package installed. Again a good computer speeds up this process.

A saved flow chart in GNU Radio produces a Python program that you can execute and run directly.

If you find this topic interesting join us at the NTMS meetings and At Microwave Update 2019.

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# Links for more info:

- http://sdr.osmocom.org
- http://www.hermeslite.com
- http://www.rtl-sdr.com/big-list-rtl-sdr-supported-software/
- https://www.gnuradio.org