DATV-Red Release-V4.9

User Manual

github pages of Ohan ZS1SCI

collected by Rolf DJ7TH

May-June 2024

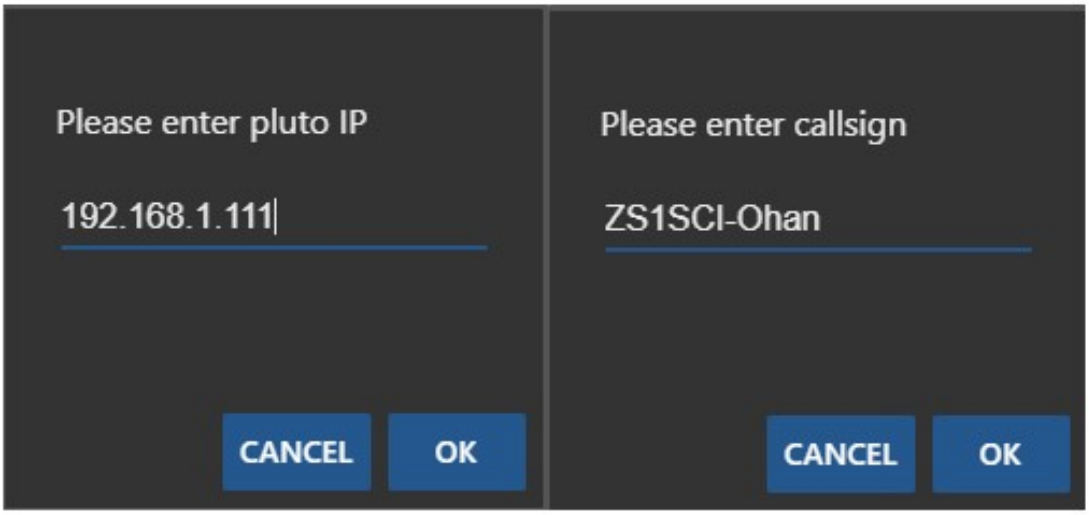
Prerequisite

- Latest PlutoDVB2 firmware
- Please see flashing steps

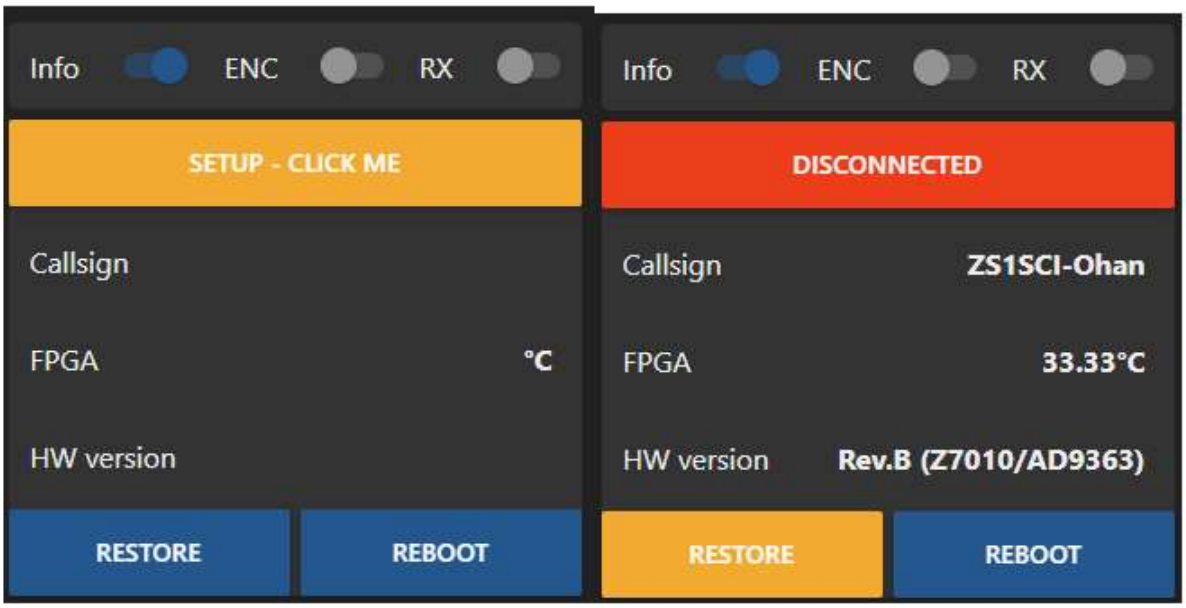
Setup and use

1. Download latest release and extract to folder `DATV-Red`
2. Open the `DATV-RED.exe` on windows or `./DATV-Start-Linux.sh` on Linux

3. Fill in pluto IP and callsign when prompted



- If you missed this prompt or cancelled, please click the setup button afterwhich the mqtt paths will be set and the pluto will restart, wait about 15s



4. Please refer to the Wiki for more setup details (see below)

5. You will see the default view, please toggle the radio buttons to enable and disable UI components to your liking.

Thanks

Batch files previously used in this project were from DL5OCD Michael and his [DATV-NotSoEasy project]

Node Red flows inspired by project from PE2JKO [from this post]

Supporting my hobby

If you'd like to say thanks, please feel free to buy me some [coffee] or [time]

Welcome to the DATV-Red wiki!

- The South African German army knife of all things DATV

This project was build out of curiosity and brute force will by Ohan ZS1SCI :)

If there is a problem

Please raise an issue and include a copy of `device.json` and `settings.json` from the settings directory in the project.

Motivation

DATV transmissions normally have the following programs open:

1. OBS (Presentation layer)
2. DATV-Easy/FreeStreamCoder/ your own scripts (encoder)
3. Browser page for PlutoSDR
4. OpenTuner / Minitioune
5. QuickTune / Chat

DATV-RED tries to combine most of these functionalities into one interface.

Capabilities of DATV-Red

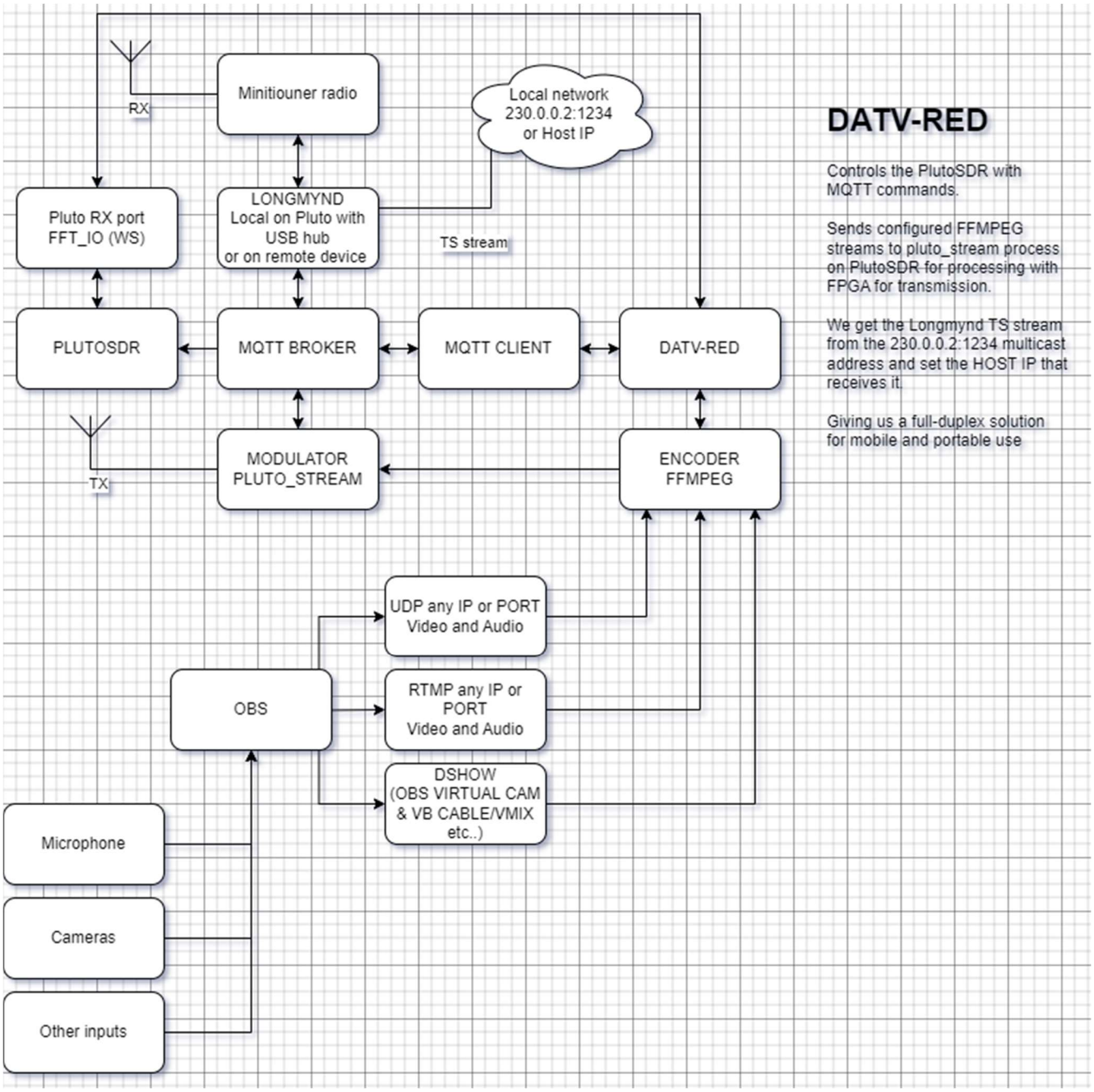
- Encoding of TS data (Tx)
- Tuning of onboard longmynd server
    - Requires `USB hub` or `Longmynd mqtt` on local network connected to pluto broker.
    - Refer to wiki (Rx)
    - Further eliminates software dependencies
- Operation of PlutoSDR RF modulator parameters (Tx)

- **DVB-GSE** (Tx & Rx)
    - You can view each others dashboard on tunnel IPs
    - AV1 QSO's using SRT

- (**Windows**) Sends UDP payload to `Minitioune` software control address (Rx)
    - Tunes Minitiouner radio using `Minitioune` software
    - Tunes `WinterHill` too
    - OpenTuner support pending
- Optional chat (QoL)
- Optional SONOFF tasmota support (QoL)
    - HTML and MQTT support
        - Switch must be connected to pluto mqtt broker
- Cross-platform

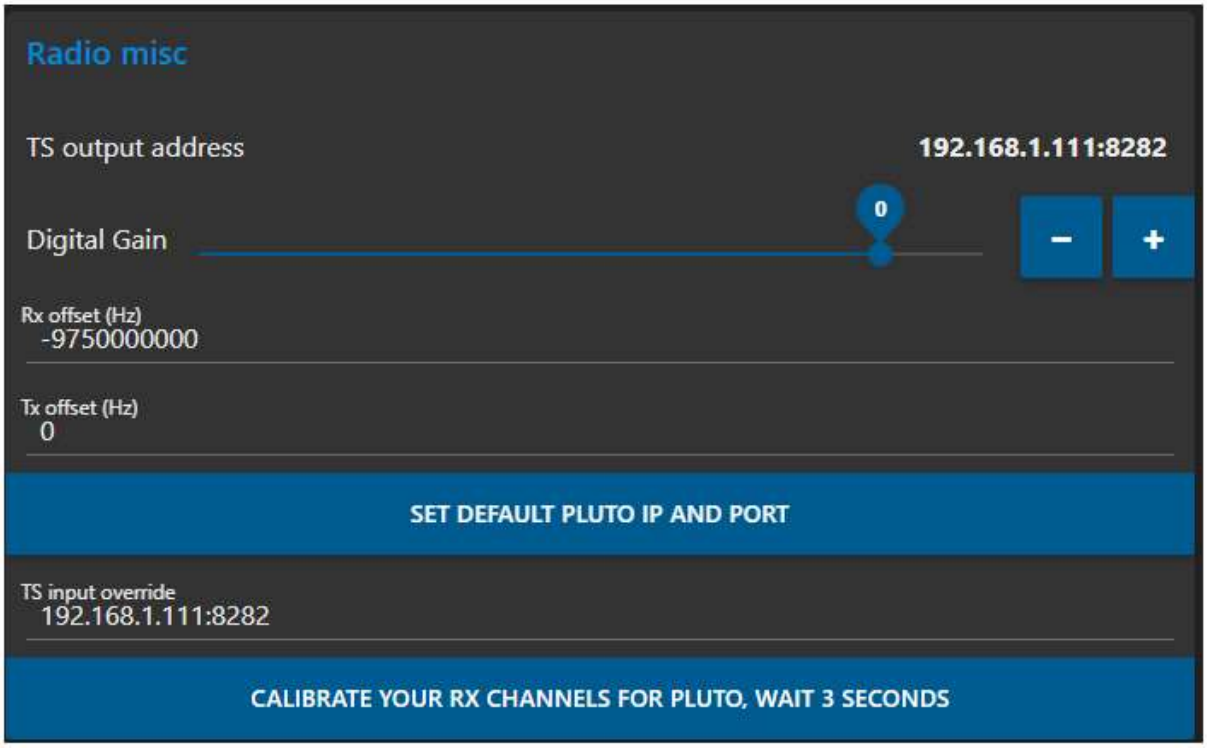
- **No internet needed** also supports `FFT` from pluto rx port
    - Use onboard spectrum from pluto to tune to signals
        - Enables simple mobile operation of DATV
    - Supports separate BATC spectrum sources
        - Requires that you have a `Raspberry Pi 4` and an `Airspy R2`
        - Please see Tom ZR6TG's post on setup

DATV-Red visual flow chart



First steps

- Calibrate the rx table, so that if you click on the spectrum bars it has the right frequencies in modulator channel dropdown



  - It take about three seconds, stepping through all known frequencies

SSH host key checking

add to .ssh/config the following, my pluto IP is `192.168.1.111`

```
Host 192.168.1.111
  HostName 192.168.1.111
  User root
  StrictHostKeyChecking no
```

- Windows
  - `ssh -o UserKnownHostsFile=\\.\NUL 192.168.1.111`
- Linux
  - `ssh -o UserKnownHostsFile=/dev/null 192.168.1.111`

Flashing steps

- Always find the latest firmware here
- Use the update script like this using pluto `IP Address` and `path` to FW file

```
.\scripts\update_firmware.cmd 192.168.1.111 '.\pluto.frm'
```

```
PS F:\Radio\QO-100\DATV-Red\scripts> .\update_firmware.cmd 192.168.1.111 '.\pluto.frm'
Warning: Permanently added '192.168.1.111' (ED25519) to the list of known hosts.
root@192.168.1.111's password:
pluto.frm                                                    100%   22MB   7.5MB/s   00:02
Updating firmware
Warning: Permanently added '192.168.1.111' (ED25519) to the list of known hosts.
root@192.168.1.111's password:
350+1 records in
350+1 records out
Done
Rebooting pluto
Press any key to continue . . .
PS F:\Radio\QO-100\DATV-Red\scripts>
```

- If coming from firmware lower than `0303` please first upgrade to `0303`
- If you're unfamiliar with the procedure please see my [0303 to latest FW flashing walk through video]

Multicast support for pluto

- Change `config.txt`
- This is so that onboard `longmynd` can send to `230.0.0.2:1234`.

```
# Analog Devices PlutoSDR Rev.B (Z7010-AD9363)
# Device Configuration File
#   1. Open with an Editor
#   2. Edit this file
#   3. Save this file on the device USB drive
#   4. Eject the device USB Drive
# Doc: https://wiki.analog.com/university/tools/pluto/users/customizing

[NETWORK]
hostname = pluto
ipaddr = 192.168.2.1
ipaddr_host = 192.168.2.10
netmask = 255.255.255.0

[WLAN]
ssid_wlan =
pwd_wlan =
ipaddr_wlan =

[USB_ETHERNET]
ipaddr_eth =
netmask_eth = 255.255.255.0
gateway_eth = 192.168.1.1

[SYSTEM]
xo_correction =
udc_handle_suspend = 0

[ACTIONS]
diagnostic_report = 0
dfu = 0
reset = 0
calibrate = 0
```

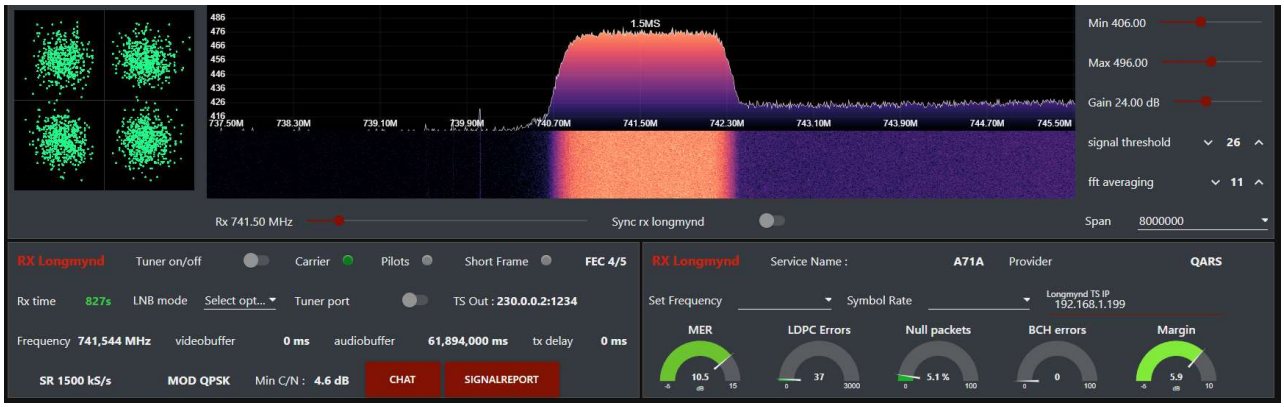
- Add `gateway_eth = x.x.x.x` with your internet gateway IP
- Then reboot pluto

DATV Red pages

Transmission and profiles

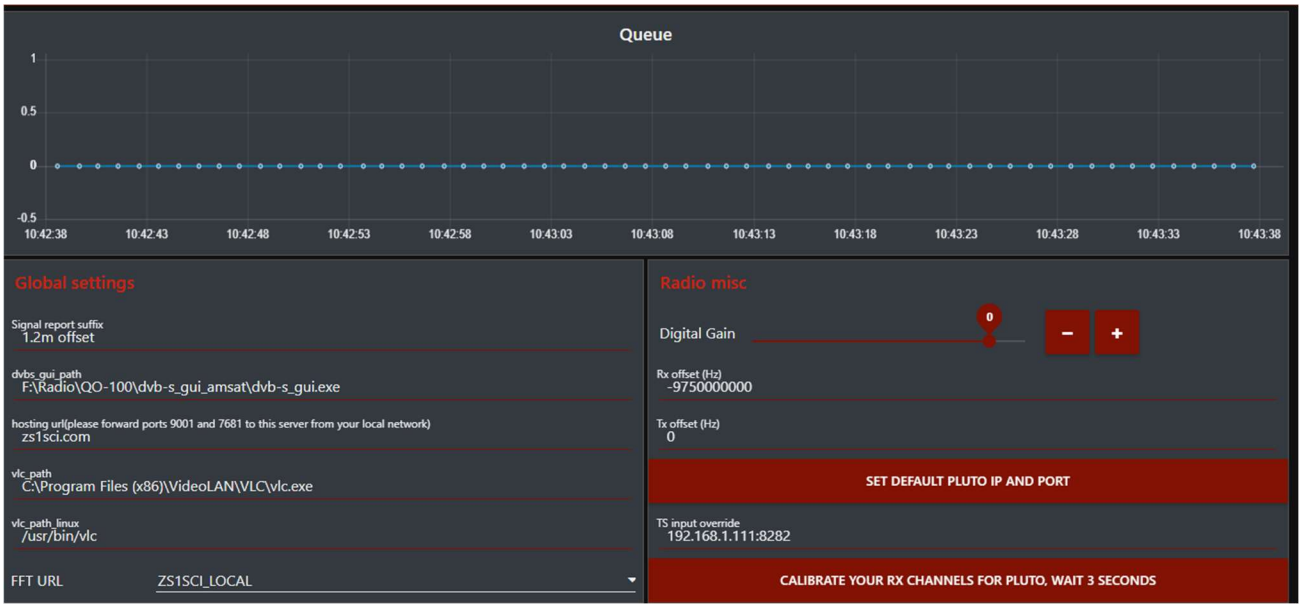
- Transmission section
  - All settings related to encoding and transmitting a DATV signal
  - Clicking on signals in the spectrum tunes your setup receivers
  - Bottom signal is `longmynd`
  - Top of signal is for setup receivers
  - Left in modulator settings(radio)
  - Right is encoder settings(ffmpeg)

- Reception section
  - You can manipulate the spectrum with
  - Frequency, span, min/max, gain and averaging
  - Click on signals to tune onboard `longmynd`
  - Set the Host IP for receiving TS stream from `230.0.0.2:1234`



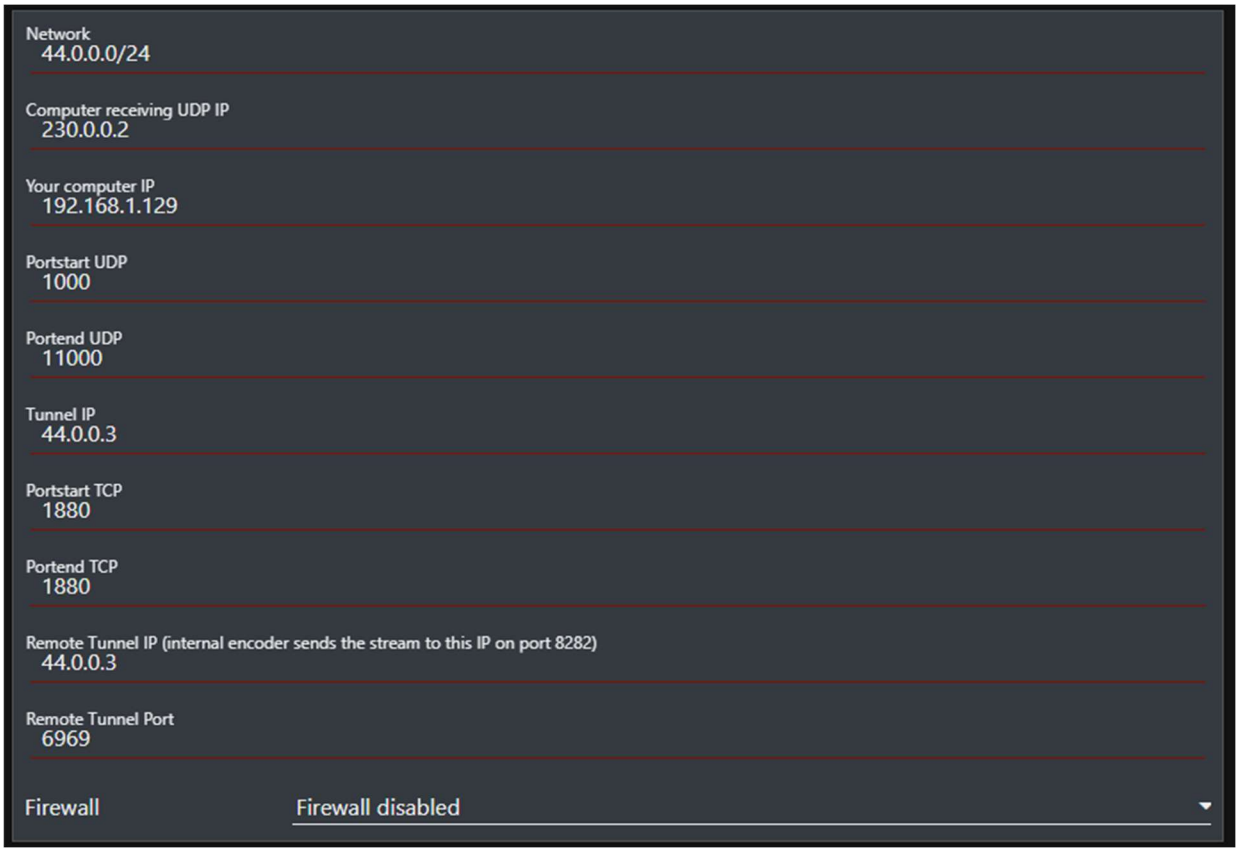
Stats and settings

- Signal report suffix
- Application paths for Windows and Linux
- Hosting URL (`http://zs1sci.com:1880/ui`)
    - Please port forward pluto IP address's `9001` and `7681` to this domain(`http://zs1sci.com:1880/ui`) on your network
    - Our remote browser instance (`http://zs1sci.com:1880/ui`) must be able to get the MQTT (9001) and FFT (7681) from pluto at this domain
- FFT spectrum source
- Radio miscellaneous
    - Rx offset
    - Tx offset
    - Override pluto TS input IP
    - Calibrate Tx channel frequencies



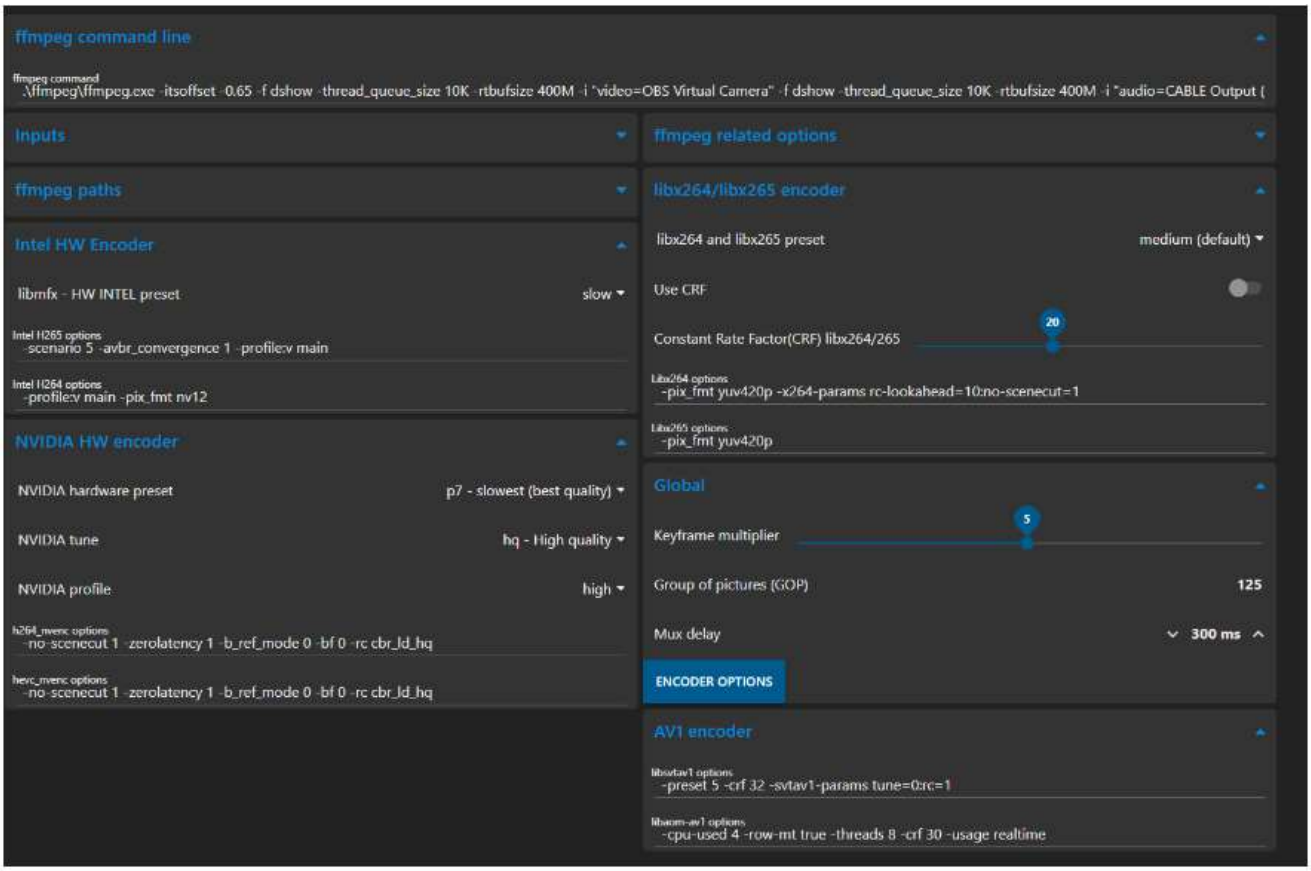
GSE

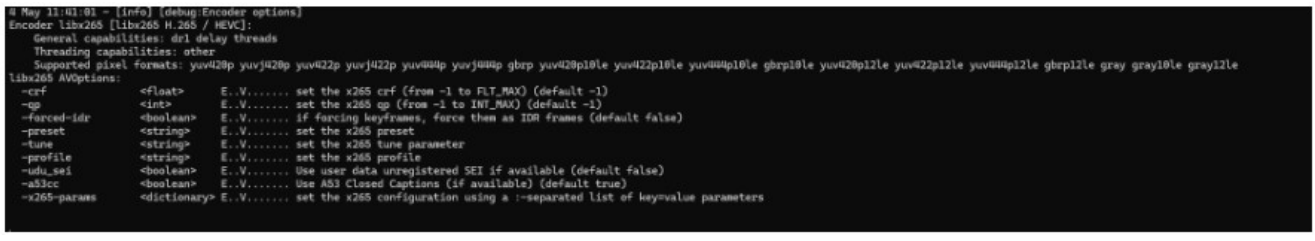
- Setting for `DVB-GSE` operation



Encoder advanced v4

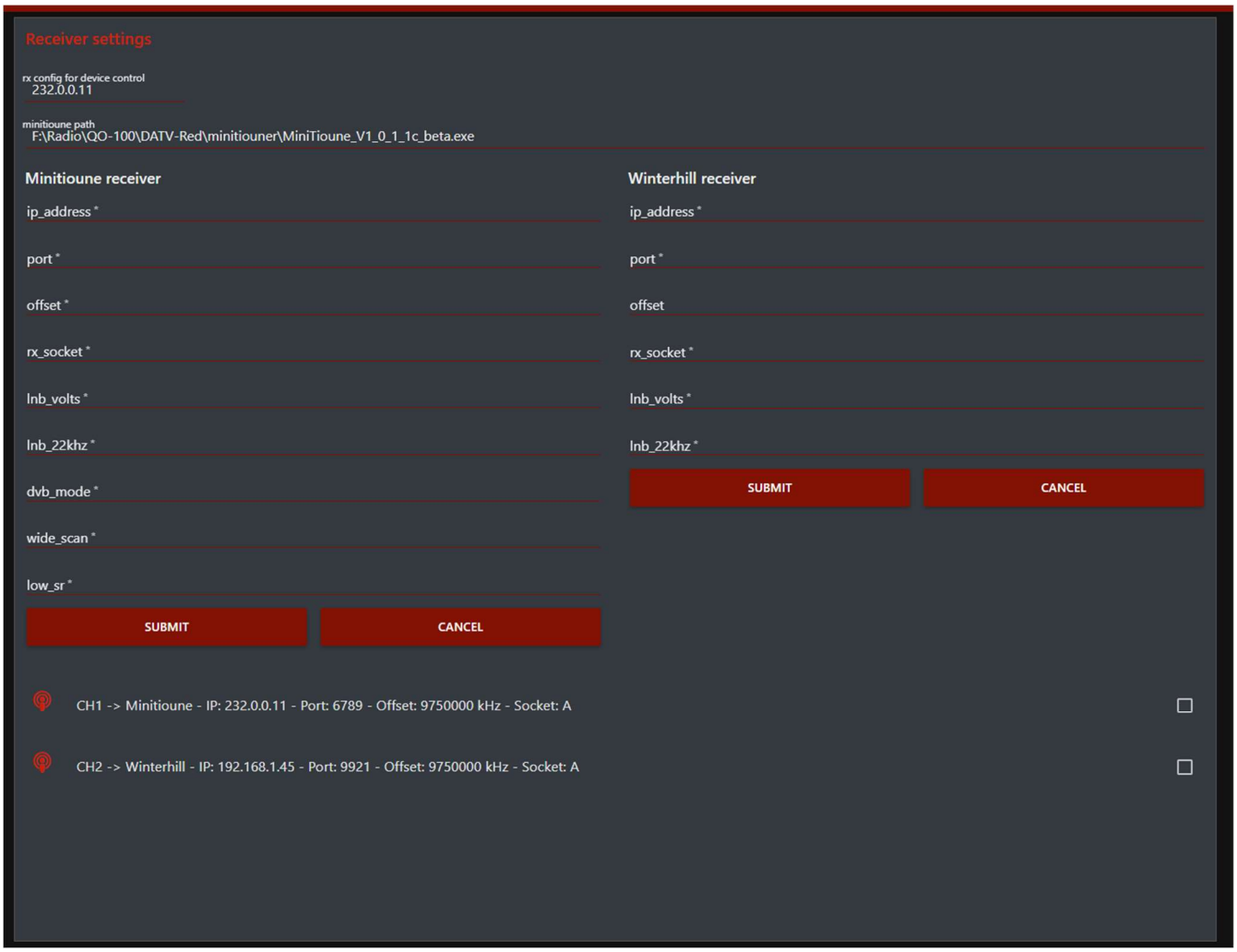
- This is all settings relevant to your setup
- Please change accordingly
- Codec options are available in the terminal with the `Encoder options` button

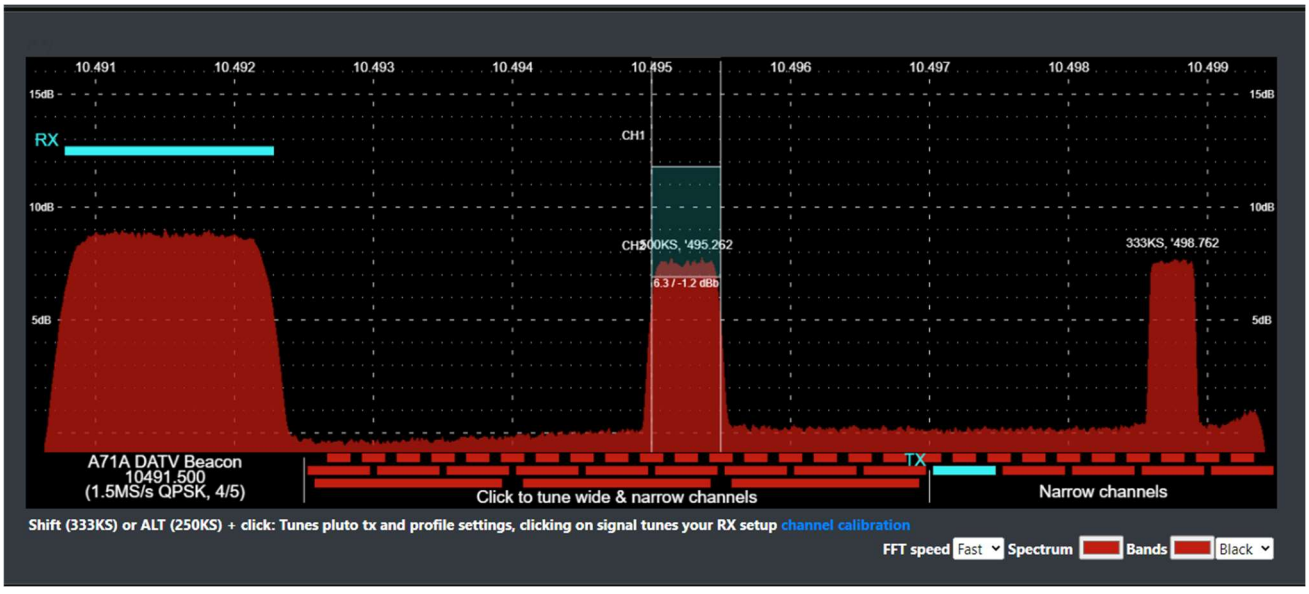




Receiver setup

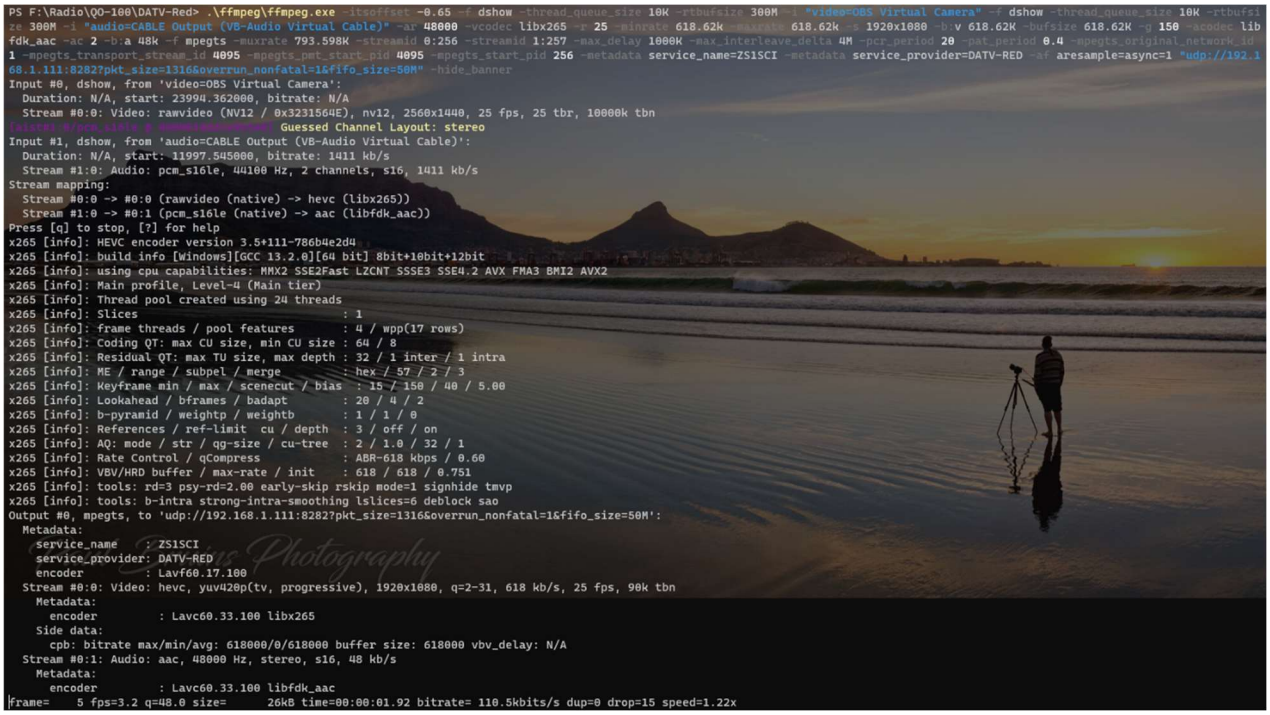
- Receiver channels galore
- This is a `proof of concept`, we need to be able to drive as many receivers as possible from a particular spectrum
- Is driven by





FFmpeg debugging

- `ffmpeg` command for debugging why it might not work, copy and paste in `project root` to see `ffmpeg` error...
- the command output in GUI clears when you press `stop` profile button

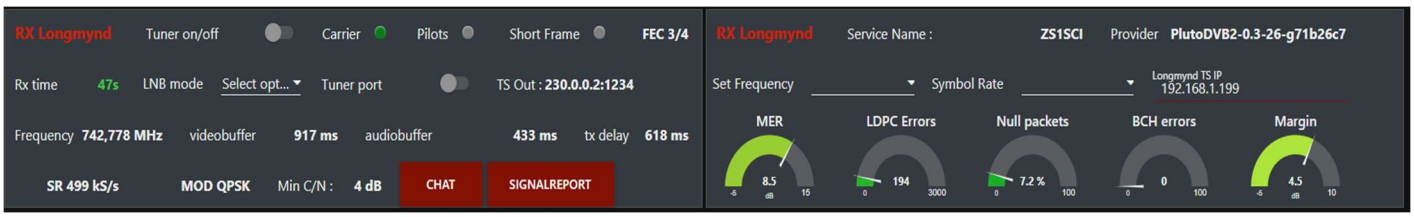


Linux specific

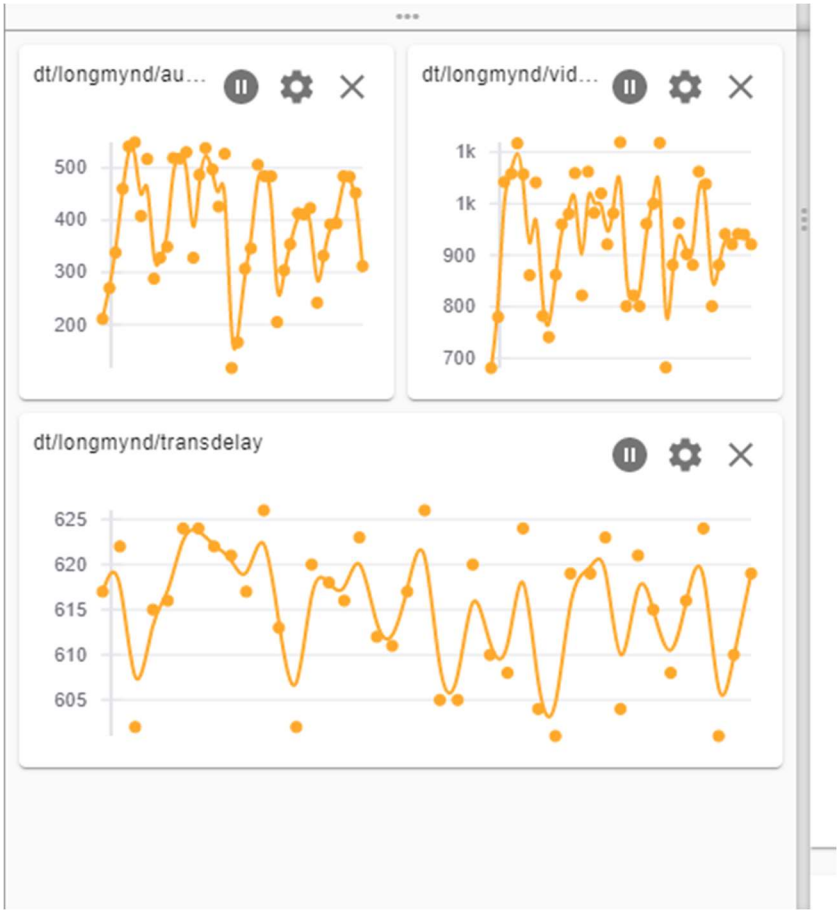
- run `sudo ./scripts/install.sh` script
- run `./DATV-Start.sh`
- Then use `RTMP` or `UDP` under ffmpeg settings `INPUT CHOICE`

Onboard longmynd controls and analysis information

- Click signal report and `CTRL+V` paste it in chat
- `SigReport: ZS1SCI/PlutoDVB2-0.3-14 - D3.4 - QPSK 4/5 (8.0 dB) - 499 - 10494.773 1.2m offset`
- Set your PC's IP address for receiving the multicast TS from `longmynd` whilst enabled
- Audio and video buffer delays for decoded signal



- If signal has pluto sending NTP synced timestamps, we can calculate tx delay



We can do this by running this script

```
.\set_NTP_pluto.cmd 192.168.1.111 192.168.1.127
```

```
PS F:\Radio\QO-100\DATV-Red\scripts> .\set_NTP_pluto.cmd 192.168.1.111 192.168.1.127
Setting up NTP server on pluto
Warning: Permanently added '192.168.1.111' (ECDSA) to the list of known hosts.
root@192.168.1.111's password:
Stopping ntpd: OK
server 192.168.1.127
server ntp.metas.ch
server swisstime.ethz.ch
server chronos.cru.fr
server ntp.univ-lyon1.fr

# NTP via GPS
server 127.127.28.0
fudge  127.127.28.0 time1 0.183 flag1 1 refid GPS
server 127.127.28.1 minpoll 4 prefer
fudge  127.127.28.1 refid PPS
tinker panic 0
 1 Jan 05:53:08 ntpd[20956]: ntpd 4.2.8p15@1.3728 Fri Jun 30 08:31:48 UTC 2023 (1): Starting
 1 Jan 05:53:08 ntpd[20956]: Command line: ntpd -gq
 1 Jan 05:53:08 ntpd[20956]: ----------------------------------------------------
 1 Jan 05:53:08 ntpd[20956]: ntp-4 is maintained by Network Time Foundation,
 1 Jan 05:53:08 ntpd[20956]: Inc. (NTF), a non-profit 501(c)(3) public-benefit
 1 Jan 05:53:08 ntpd[20956]: corporation.  Support and training for ntp-4 are
 1 Jan 05:53:08 ntpd[20956]: available at https://www.nwtime.org/support
 1 Jan 05:53:08 ntpd[20956]: ----------------------------------------------------
 1 Jan 05:53:08 ntpd[20956]: proto: precision = 2.118 usec (-19)
 1 Jan 05:53:08 ntpd[20956]: basedate set to 2023-06-18
 1 Jan 05:53:08 ntpd[20956]: gps base set to 2023-06-18 (week 2267)
 1 Jan 05:53:08 ntpd[20956]: Listen and drop on 0 v4wildcard 0.0.0.0:123
 1 Jan 05:53:08 ntpd[20956]: Listen normally on 1 lo 127.0.0.1:123
 1 Jan 05:53:08 ntpd[20956]: Listen normally on 2 eth0 192.168.1.111:123
 1 Jan 05:53:08 ntpd[20956]: Listen normally on 3 gse0 44.0.0.2:123
 1 Jan 05:53:08 ntpd[20956]: Listening on routing socket on fd #20 for interface updates
 1 Jan 05:53:08 ntpd[20956]: 127.127.28.0 local addr 127.0.0.1 -> <null>
 1 Jan 05:53:08 ntpd[20956]: 127.127.28.1 local addr 127.0.0.1 -> <null>
 1 Jan 05:53:08 ntpd[20956]: refclock_newpeer: clock type 28 invalid
 1 Jan 05:53:08 ntpd[20956]: refclock_newpeer: clock type 28 invalid
21 Dec 10:39:21 ntpd[20956]: ntpd: time set +1703133966.494401 s
ntpd: time set +1703133966.494401s
Starting ntpd: OK
     remote           refid      st t when poll reach   delay   offset  jitter
==============================================================================
 192.168.1.127   .GPS.            1 u    1   64    1    1.037   +0.046   0.002
 195.176.26.215  .INIT.          16 u    -   64    0    0.000   +0.000   0.002
 81.94.123.17 (n .INIT.          16 u    -   64    0    0.000   +0.000   0.000
 dns.univ-lyon1. .INIT.          16 u    -   64    0    0.000   +0.000   0.002
Thu Dec 21 10:39:24 UTC 2023
Press any key to continue . . .
```

Software client

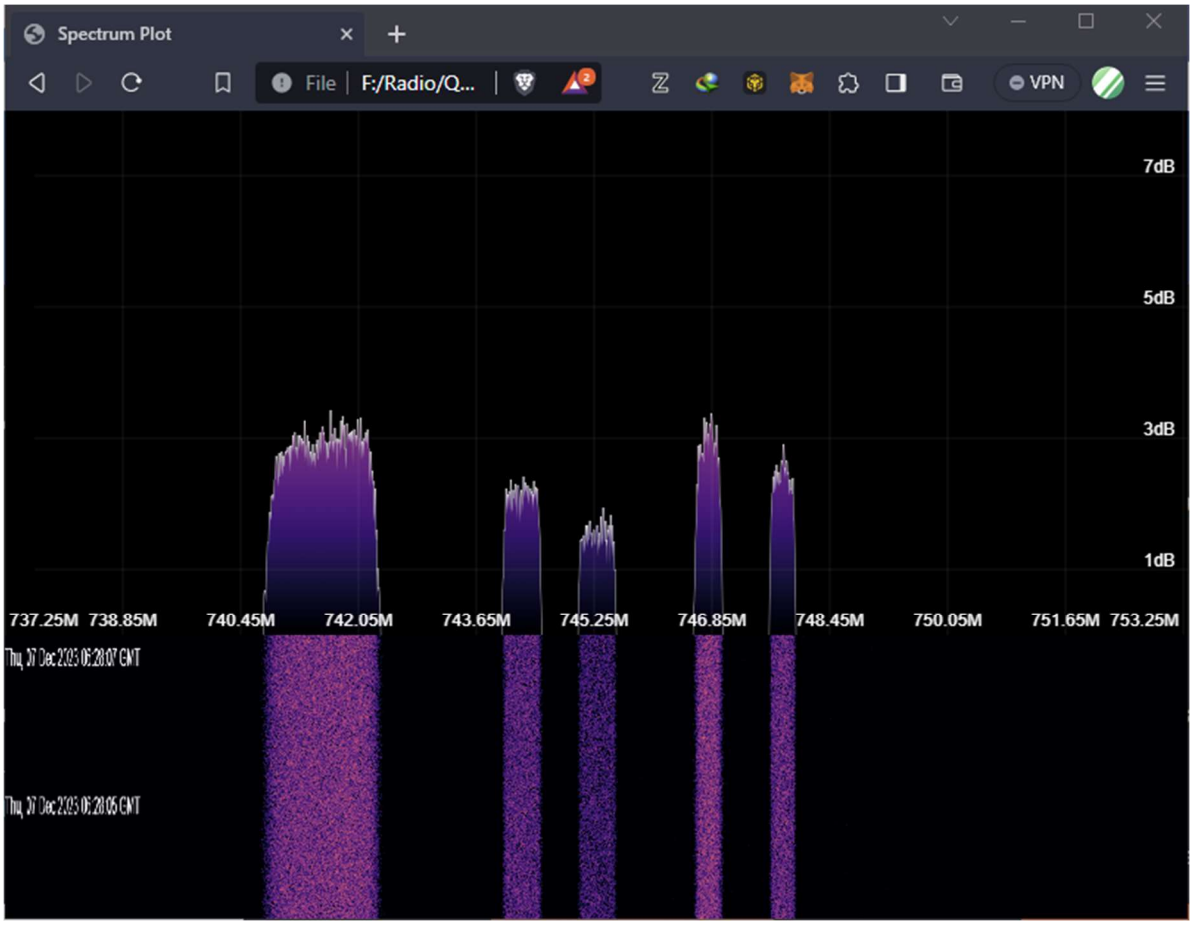
- You can also set up the longmynd on another local pc and have it connect to pluto broker
- This way the pluto only has network adapter connected, for remote pluto setups.
- So the pluto still controls the minitiouner radio since its connected to its mqtt topic and doesn't mind the different IP address
- Please see [mqtt longmynd repo]

Hardware

- USB hub used

Static html files

- `web/pluto_spectrum/index.html` can be ran locally by adding you pluto address and callsign to the `URL`
    - `index.html?url=192.168.1.111&call_sign=ZS1SCI`



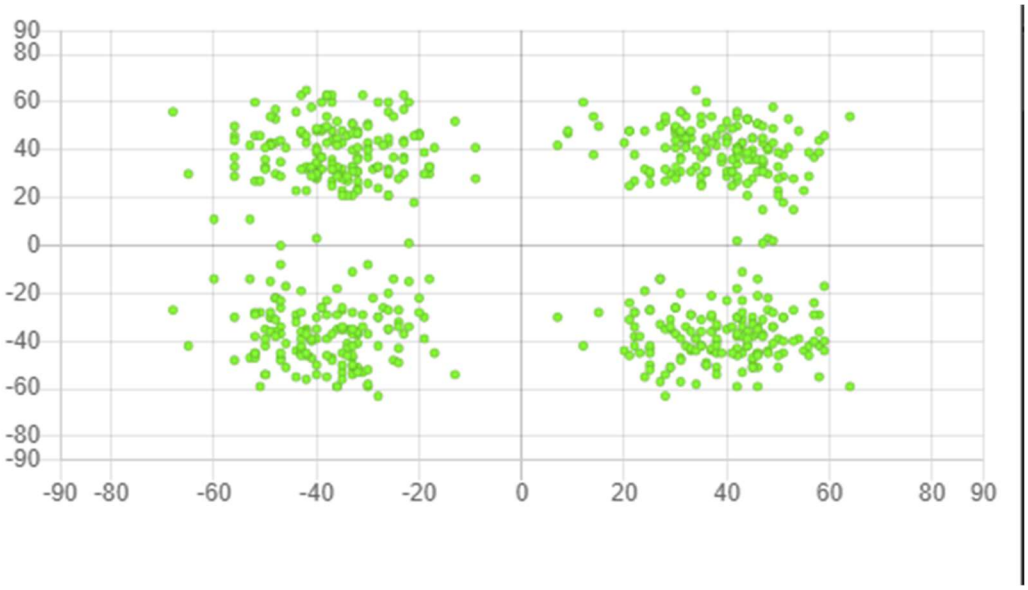
- `web/internet_spectrum/spectrum.html`
    - works separately in a browser

- If `DATV-Red` is running, it acts as a sperate spectrum for tuning, setting tx etc., so you may disable the one in `DATV-Red` if you plan on moving things around.

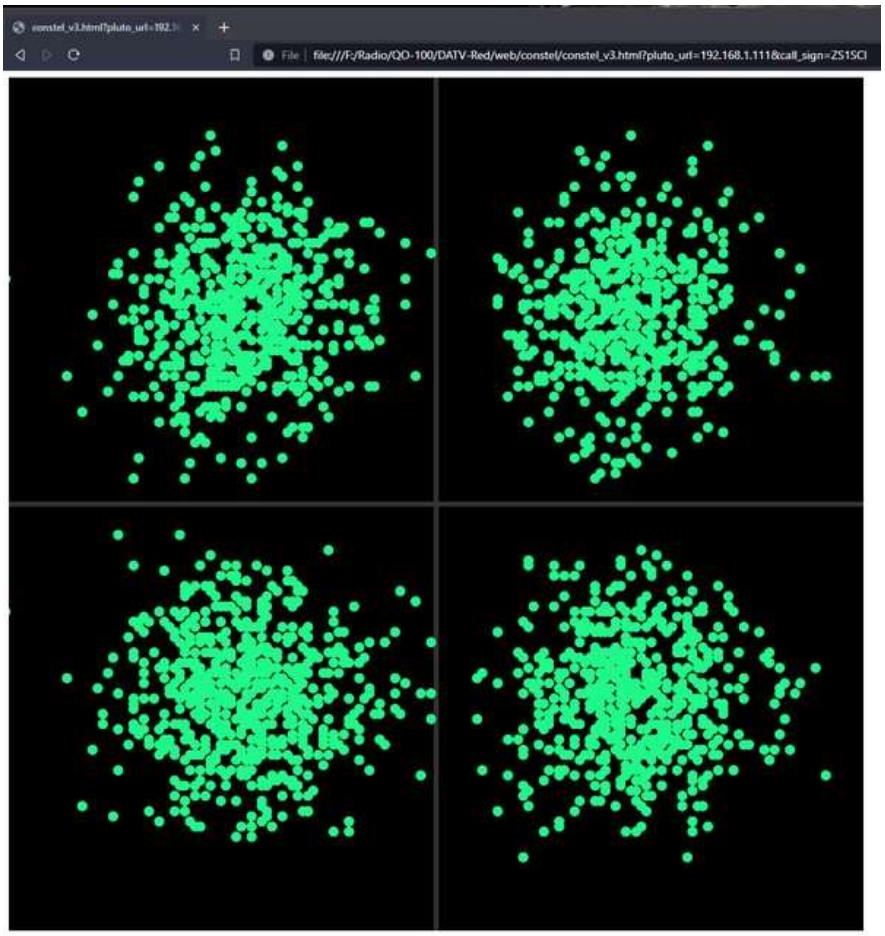
- `web/chat.html`
    - portable chat file

- `web/constel_v2.html` can be ran locally by adding you pluto address and callsign to the `URL`

    - `constel_v2.html?pluto_url=192.168.1.111&call_sign=ZS1SCI`



`web/constel/constel_v3.html?pluto_url=192.168.1.111&call_sign=ZS1SCI`



    - somethings work better when built from scratch