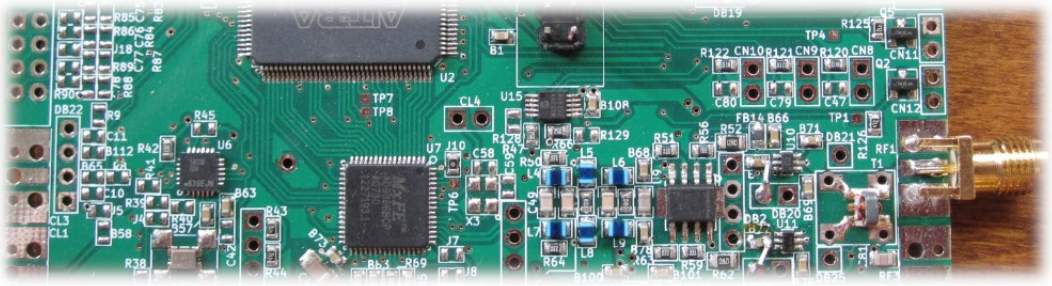
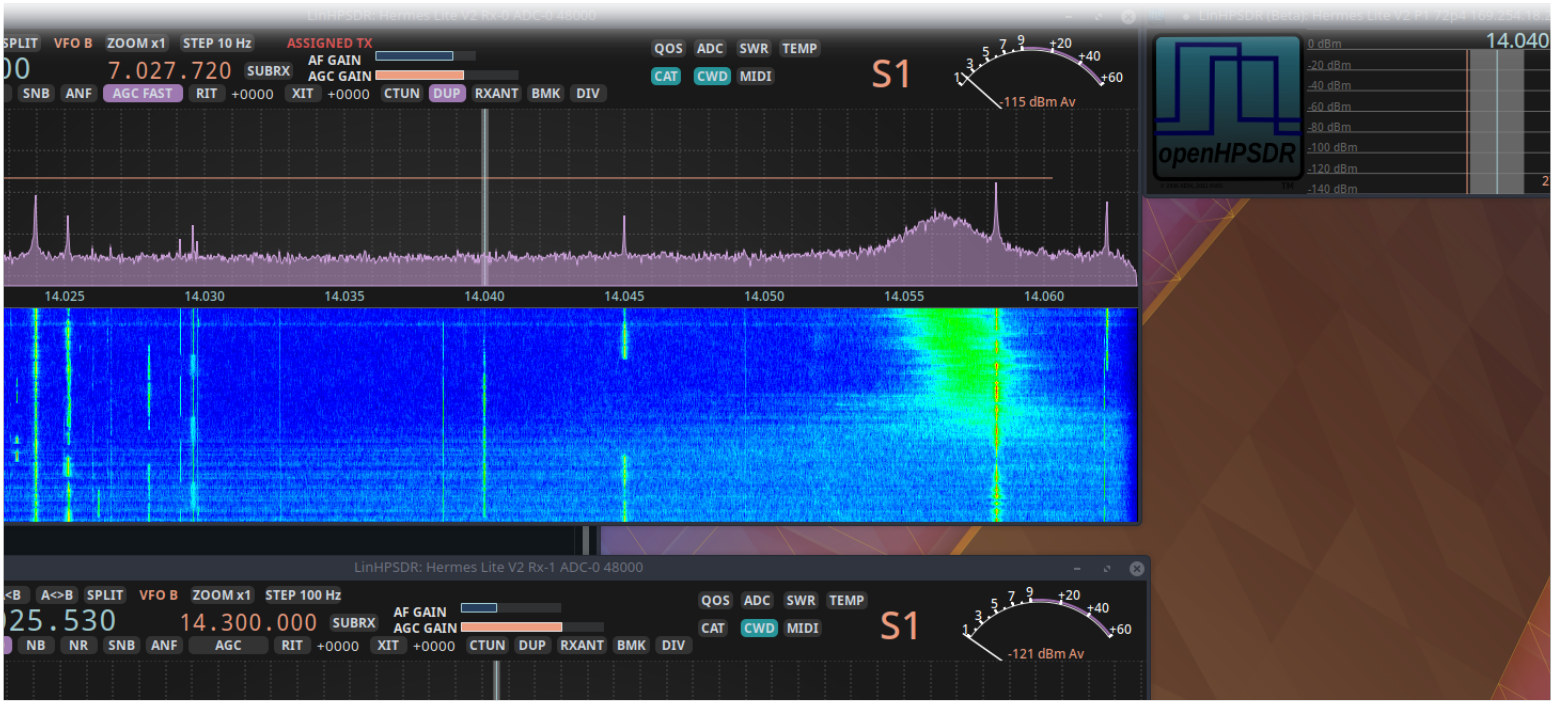
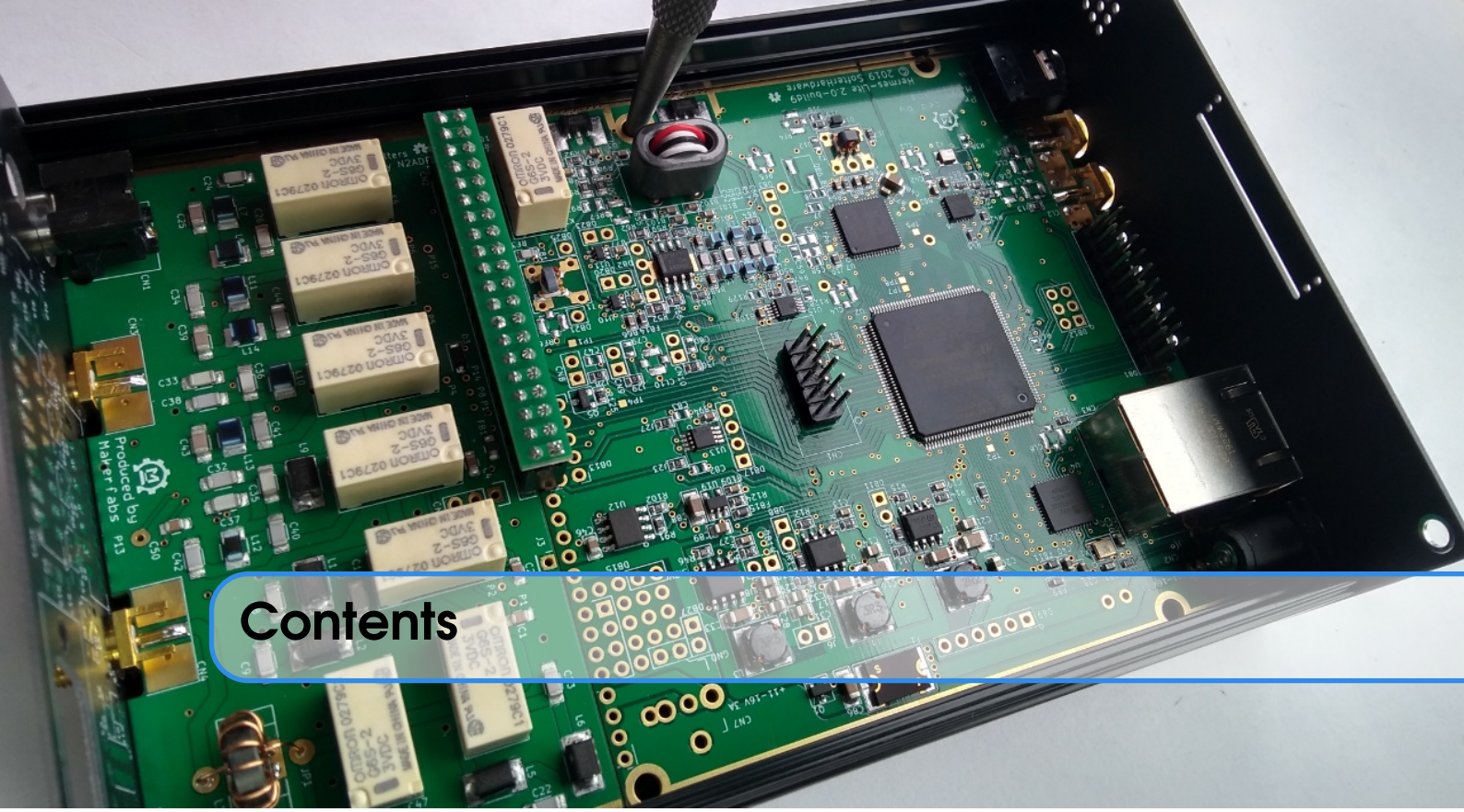


linHPSDR and the Hermes-Lite 2

User guide

by m5evt





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1. Installation

1.1 Introduction

linHPSDR is a Linux based SDR application developed by John Melton G0ORX see `https://github.com/g0orx/linhpsdr`.

This document describes the M5EVT fork of linHPSDR (`https://github.com/m5evt/linhpsdr`) which has features and tweaks especially for the Hermes-Lite 2 SDR.

This guide is based upon the original guide by G0ORX, see:

`https://github.com/g0orx/linhpsdr/blob/master/documentation/linhpsdr-user.pdf`

R The code must be built from source. The deb package is very out of date and will not work as expected.

1.2 Prerequisites

To build from source start with the prerequisites:

```
sudo apt install libfftw3-dev
sudo apt install libpulse-dev
sudo apt install libsoundio-dev
sudo apt install libasound2-dev
sudo apt install libgtk-3-dev
sudo apt install libsoapysdr-dev
```

1.3 WDSP

Next install WDSP:

```
git clone https://github.com/g0orx/wdsp.git
cd wdsp
make
sudo make install
```

1.4 CW options

To take advantage of CW features described in this manual the following additional options are required:

```
sudo apt install libtool
git clone https://github.com/m5evt/unixcw-3.5.1.git
cd unixcw-3.5.1
autoreconf -i
./configure
make
sudo make install
sudo ldconfig
```

1.5 Compile and install

First, get the source code:

```
git clone https://github.com/m5evt/linhpsdr.git
cd linhpsdr
```

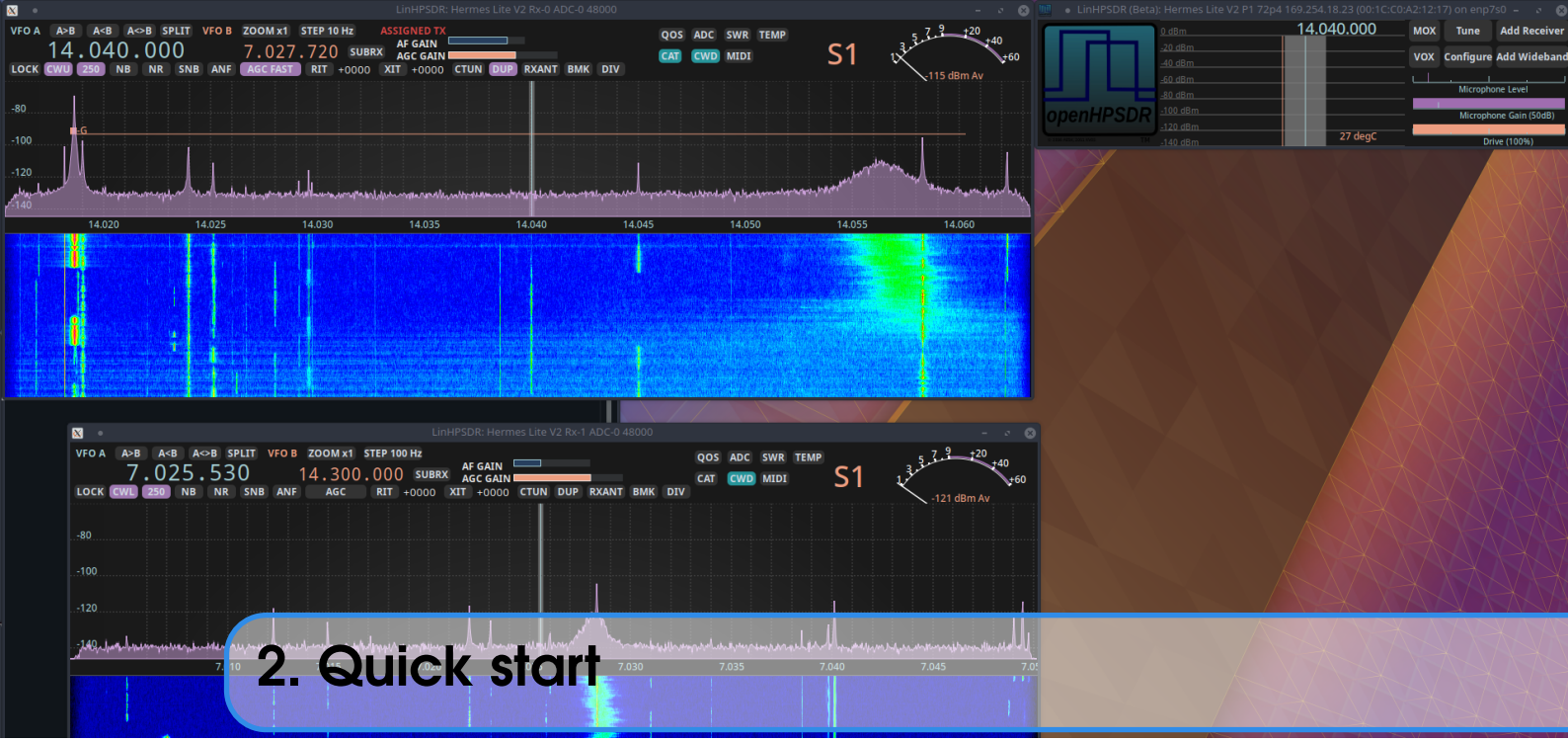
If CW support is not needed the following lines in the Makefile can be commented out (as shown below):

```
#CWDAEMON_INCLUDE=CWDAEMON

#ifeq ($(CWDAEMON_INCLUDE),CWDAEMON)
#CWDAEMON_OPTIONS=-D CWDAEMON
#CWDAEMON_LIBS=-lcw
#CWDAEMON_SOURCES= \
#cwdaemon.c
#CWDAEMON_HEADERS= \
#cwdaemon.h
#CWDAEMON_OBJS= \
#cwdaemon.o
#endif
```

Finally, compile and install linHPSDR:

```
make
sudo make install
```



2.1 Wisdom file

The first time linHPSDR is run an FFT wisdom file must be created. Depending on CPU this may take some time.

R Once the Wisdom file has been created, it will not need to perform this calculation again.

```
Planning COMPLEX FORWARD  FFT size 64
Planning COMPLEX BACKWARD FFT size 64
Planning COMPLEX BACKWARD FFT size 65
Planning COMPLEX FORWARD  FFT size 128
Planning COMPLEX BACKWARD FFT size 128
Planning COMPLEX BACKWARD FFT size 129
Planning COMPLEX FORWARD  FFT size 256
Planning COMPLEX BACKWARD FFT size 256
Planning COMPLEX BACKWARD FFT size 257
Planning COMPLEX FORWARD  FFT size 512
Planning COMPLEX BACKWARD FFT size 512
Planning COMPLEX BACKWARD FFT size 513
Planning COMPLEX FORWARD  FFT size 1024
Planning COMPLEX BACKWARD FFT size 1024
Planning COMPLEX BACKWARD FFT size 1025
Planning COMPLEX FORWARD  FFT size 2048
Planning COMPLEX BACKWARD FFT size 2048
Planning COMPLEX BACKWARD FFT size 2049
```

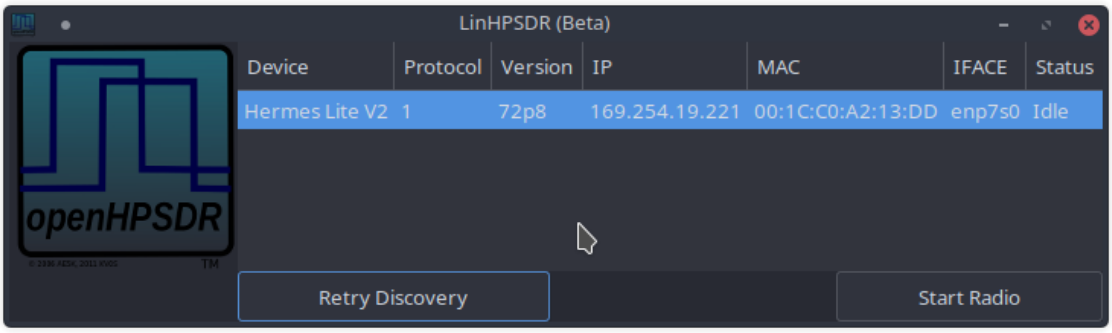
LinHPSDR: Creating FFTW3 wis...

Optimizing FFT sizes through 262145:

(Please be patient. This will take several minutes.)

2.2 Discovery

The first window displayed by linHPSDR is the radio discovery window. Note in the window below, a direct connection to the HL2 is used and no DHCP server is in use (this is denoted by the APIPA ip address). However, the HL2 will likely work better on a network with a DHCP server.

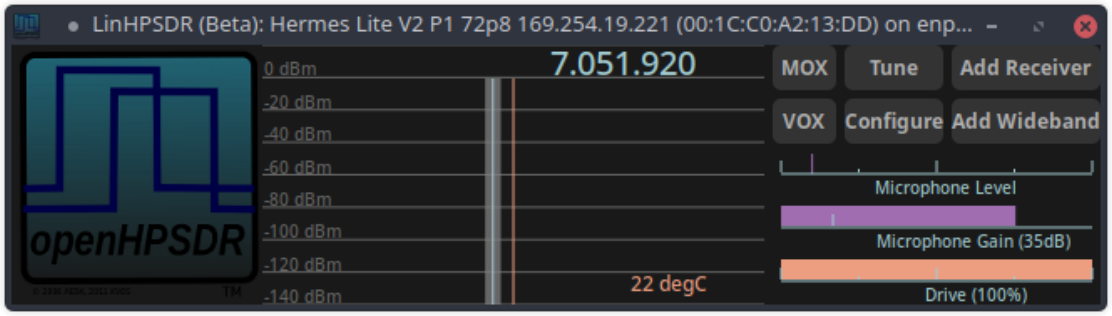


The HL2 gateware version is noted as 72 patch 8.

To start the radio, click on the Start Radio button on the bottom right corner.

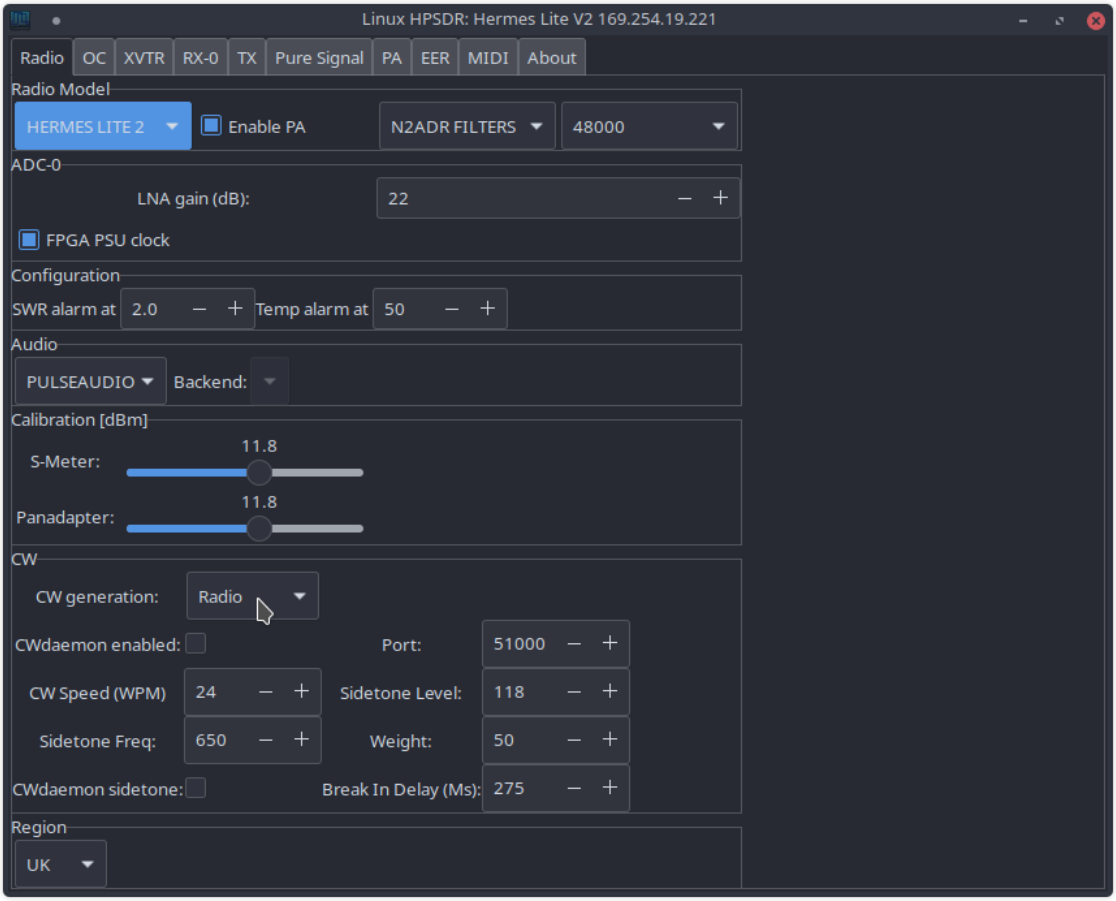
2.3 Setting up sound

linHPSDR will always have at least one receiver window active. With a fresh install, linHPSDR will default to one receiver. Two windows will be displayed; RX window and the main window.



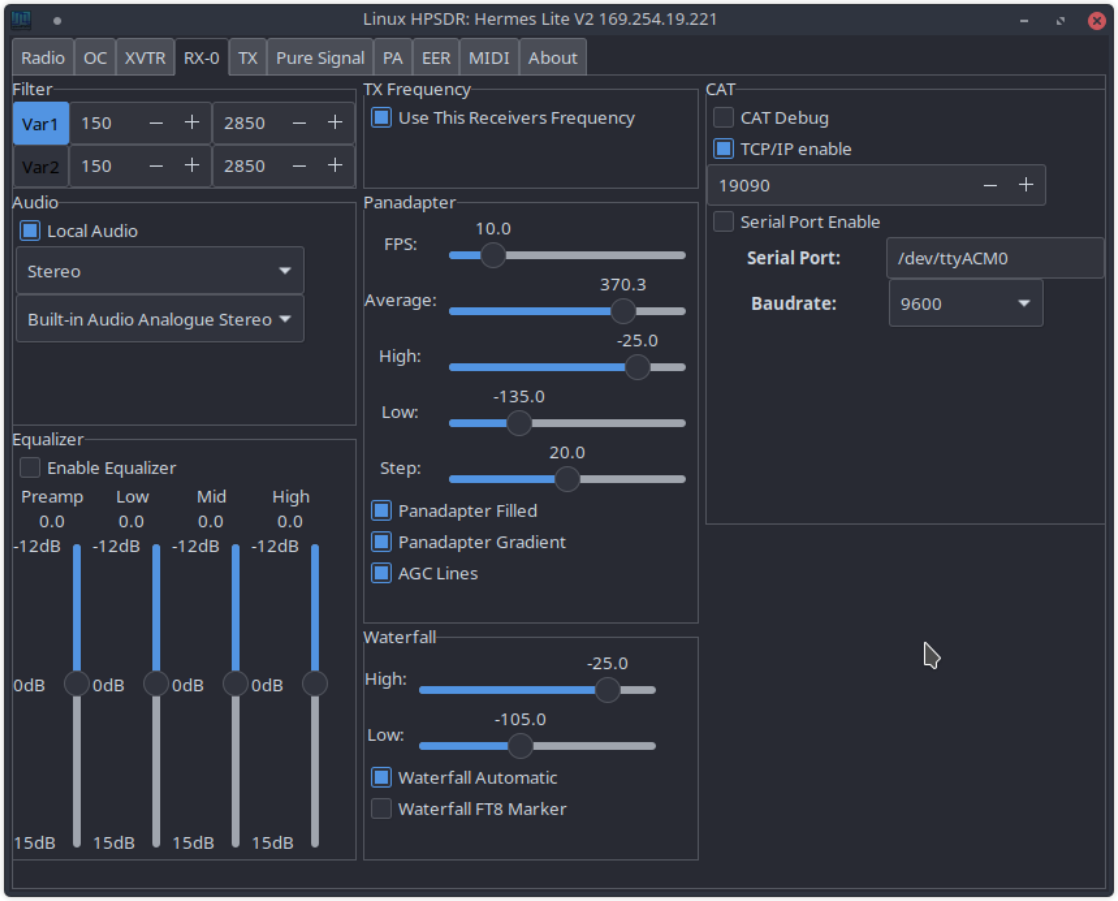
Main window

To get started the audio must be setup. Click configure on the main window. The radio dialogue tab will be displayed.



Select audio about half way down the tab window. There are three options; SoundIO, Pulseaudio and Alsa. SoundIO must be used for OS X. Alsa may need to be used for the Raspberry Pi. However, it is recommended to use Pulseaudio to make best use of some of the features described in this document.

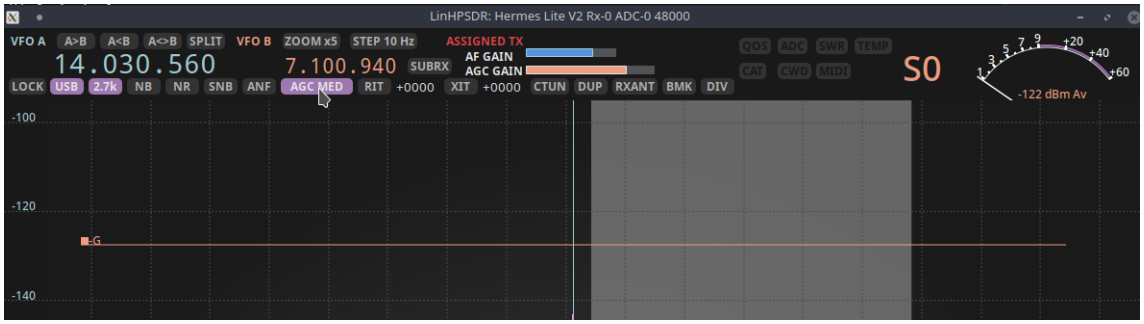
Next, select the RX-0 tab.



The audio settings for each RX can be different, so each RX must be configured separately for the chosen audio options.

Ensure local audio is checked.

The second of the two audio drop down boxes will be blank, select this and search for a device (likely *Built-in Audio Analogue Stereo*). Receiver audio should then be heard. If not, close the configure dialogue box. Select the RX0 window and click on the AGC button and select a desired AGC mode (slow, medium or fast). Then increase the AGC gain on the slider. The AGC gain level is noted by an orange line across the RX panadapter.



II Main features

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3.2 Radio info
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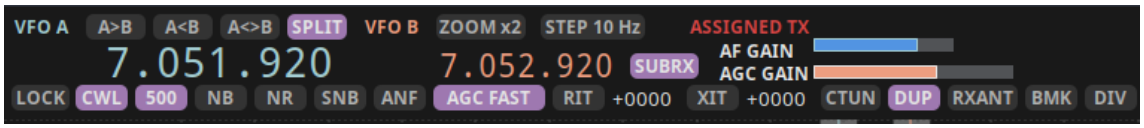
3. Receiver window

R linHPSDR will always have at least one receiver window open. With only one receiver, this receiver window cannot be closed. To exit linHPSDR, click the cross on the top right corner of the main window.

3.1 VFO controls

3.1.1 Bottom row buttons



The buttons across the bottom of the VFO screen will now be discussed. When a button is enabled, the background is purple. If the button is disabled, the background is grey. The buttons are described left to right.

The LOCK button will lock the VFO and not allow the frequency to be changed.

The current MODE is displayed and can be changed by clicking on it and selecting another mode.

The current RX FILTER is displayed and can be changed by clicking on it and selecting another filter.

NB (noise blanker) can be enabled/disabled by clicking on it and selection either OFF, NB or NB2.

NR (noise reduction) can be enabled/disabled by clicking on it and selection either OFF, NR or NR2.

SNB (spectral noise blanker) can be enabled/disabled by clicking on it.

ANF (automatic notch filter) can be enabled/disabled by clicking on it.

AGC (automatic gain control) can be enabled/disabled by clicking on it and selection either OFF, LONG, SLOW, MEDIUM or FAST.

RIT and XIT can be enabled/disabled by clicking on it. Right clicking on the RIT/XIT button allows the RIT/XIT step to be changed. Using the scroll wheel of a mouse hovered over the RIT/XIT value changes the offset.

CTUN (click tune) can be enabled/disabled by clicking on it. Click tuning means that the HL2 RX frequency does not change and linHPSDR changes frequency by apply a frequency translation within the RX passband (as set by the sample rate).

DUP can be enabled/disabled by clicking on it. With DUP enabled the transmitted audio is monitored at the RX panadapter and waterfall are update with this signal.

RXANT can be enabled/disabled by clicking on it. This toggles the GP7 bit on the HL2 N2ADR filter board. This is used by the HL2-MRF101 100 W Power Amplifier to toggle between a dedicated RX antenna and the TX antenna.

With just the N2ADR filter board extra hardware is needed to make use of RXANT.

The BMK button allows the user to add or select a bookmark.

DIV can be enabled/disabled by clicking on it. This enables diversity reception with 2 hardware synchronised Hermes-Lite 2 receivers.

The AF GAIN can be adjusted by putting the mouse cursor over the slider and using the scroll wheel to move up or down. Alternatively, by clicking on the slider.

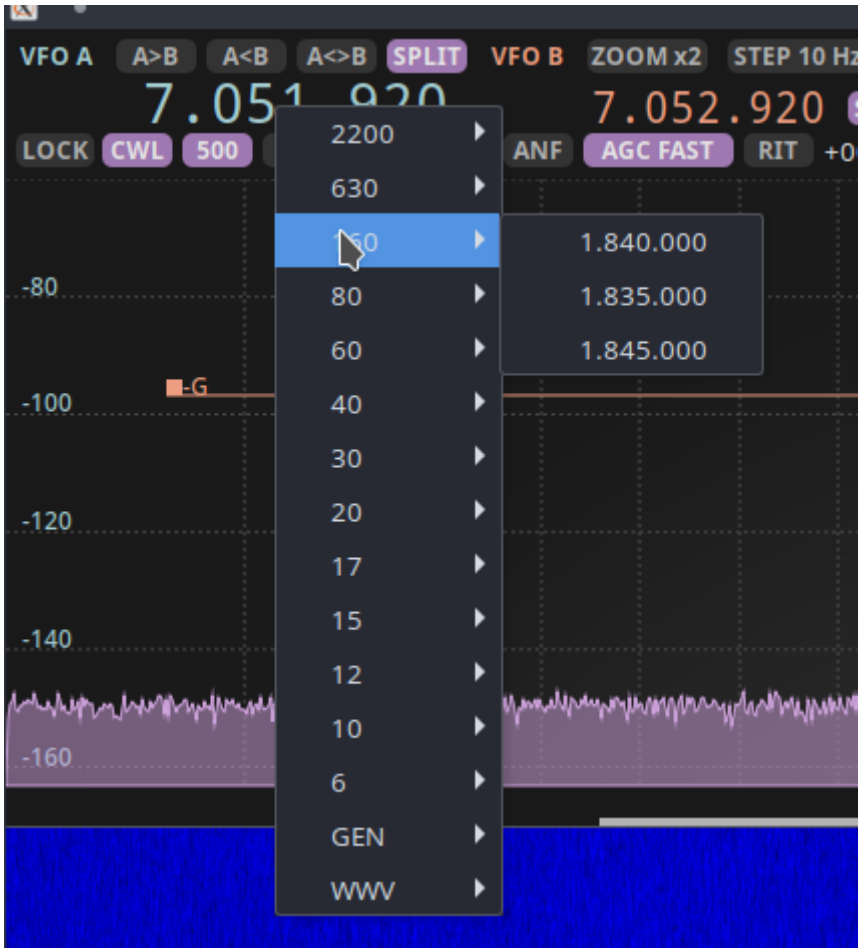
The AGC GAIN can be adjusted by putting the mouse cursor over the slider and using the scroll wheel to move up or down. Alternatively, by clicking on the slider.

3.1.2 VFOs

Each receiver has a VFO A and VFO B. VFO A is on the left hand side of the VFO. VFO B is on the right hand side. To change frequency, hovering the mouse over the desired digit and using the scroll wheel allows the frequency to be changed. Frequency can also be changed by clicking or scrolling within the RX panadapter.

In all modes except CWL or CWU, clicking on the RX panadapter sets the zero IF frequency.
In CWL or CWU, clicking at the centre of a CW signal sets the correct CW TX/RX frequency.

To change band, right click on VFO A and select the band.



The chosen TX frequency and mode are displayed by the received that is ASSIGNED TX.

Along the top row there are three buttons A>B, A<B and A<>B. These move A to B, B to A and swap A and B respectively.

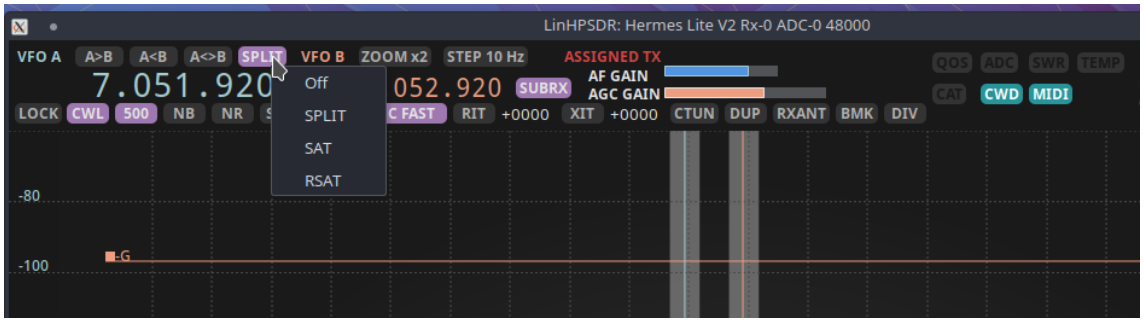
ZOOM changes zoom on the RX panadapter and waterfall display. Note, when changing radio sample rate, the zoom may need to be changed.

STEP changes the step size of the VFO increment. If a mouse hovers over the RX panadapter and the scroll wheel is used, this step is set by this button. For voice modes 100 Hz is preferable, for CW 10 Hz is preferable.

3.1.3 Split and Subrx

SUBRX allows a virtual receiver within the receiver passband. This subrx is controlled by VFO B. When using subrx VFO B should remain within the VFO A passband (the VFO A passband can be visualised by setting the zoom to x1). VFO A is panned to left audio channel, VFO B is panned to right audio channel. The subrx frequency is best changed by hovering the mouse over the VFO B frequency and using the scroll wheel.

There are a couple of different modes for SPLIT. These can be selected by right clicking on the SPLIT button.



SAT and RSAT are for satellite modes and will not be discussed in this document. By default (and no need to right click on the SPLIT button) SPLIT mode will:

- Enable SUBRX;
- Set VFO B to up 1 kHz of VFO A for CW, up 5 kHz of VFO A for USB/LSB;
- Pan VFO A left audio channel, panel VFO B right audio channel;
- Transmit on VFO B frequency.

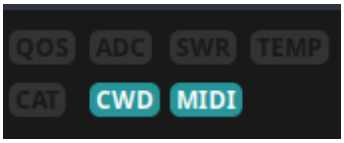
To change VFO A frequency, either use the scroll wheel on the RX panadapter or scroll wheel hovering over the VFO A frequency.

To change VFO B frequency, click on the RX panadapter for the desired transmit frequency or scroll wheel hovering over the VFO B frequency.

R The transmitter panadapter tx frequency colour follows the VFO being used for TX. If VFO A is used, the colour is blue. If VFO B is used, the colour is orange.

3.2 Radio info

To the right of the VFO screen is the radio info. This has information, alerts and warnings.



QOS this warning is set if the HL2 is experiencing a poor quality-of-service over the network and within the buffers of linHPSDR. Occasional warnings are generally acceptable, however, if there are sustained warnings it is best to check CPU load and network latency.

ADC this warning is set if the HL2 ADC is reporting clipping of the input signal. If this occurs, it is best to reduce the LNA gain (in the radio dialog tab within Configure).

SWR this warning is set if the HL2 reported VSWR is above the valued configured in the radio dialog tab (VSWR 2:1 by default).

TEMP this warning is set if the HL2 reported temperature is above the valued configured in the radio dialog tab (50 deg C by default).

CAT this shows the the CAT server is enabled *and* a client has connected (see RX-n tab in Configure to enable CAT).

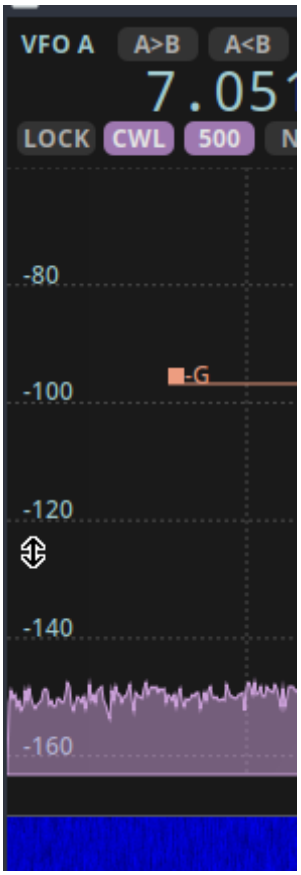
CWD this shows the cwdaemon is enabled.

MIDI this shows the MIDI server is enabled.

3.3 Misc

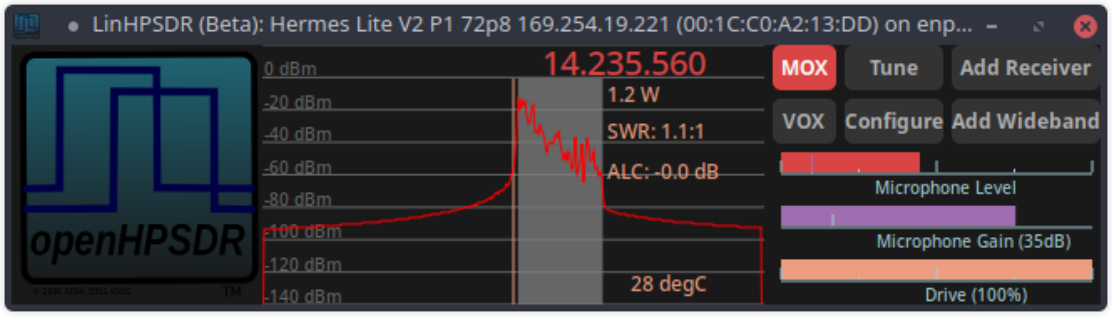
A shortcut to get to the RX dialog tab can be found by right clicking on the RX panadapter window.

The RX panadapter scale can be adjusted by hovering the mouse over the left hand side of the RX panadapter and using the scroll wheel on a mouse.



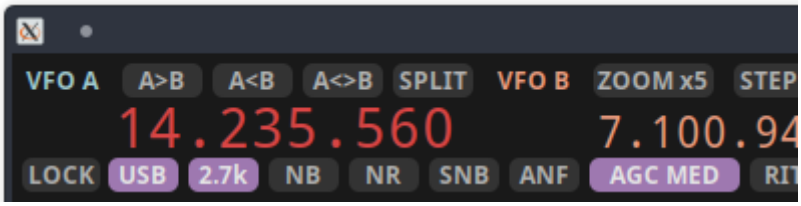
3.4 Transmitter info

When the MOX/VOX is enabled, the main window will display the HL2 reported VSWR and forward power. Note, the red microphone level shows that audio is routed to linHPSDR (regardless of whether the HL2 is transmitting or not).



For all modes except CW, the transmitted waveform leaving linHPSDR (after signal processing) is displayed in red.

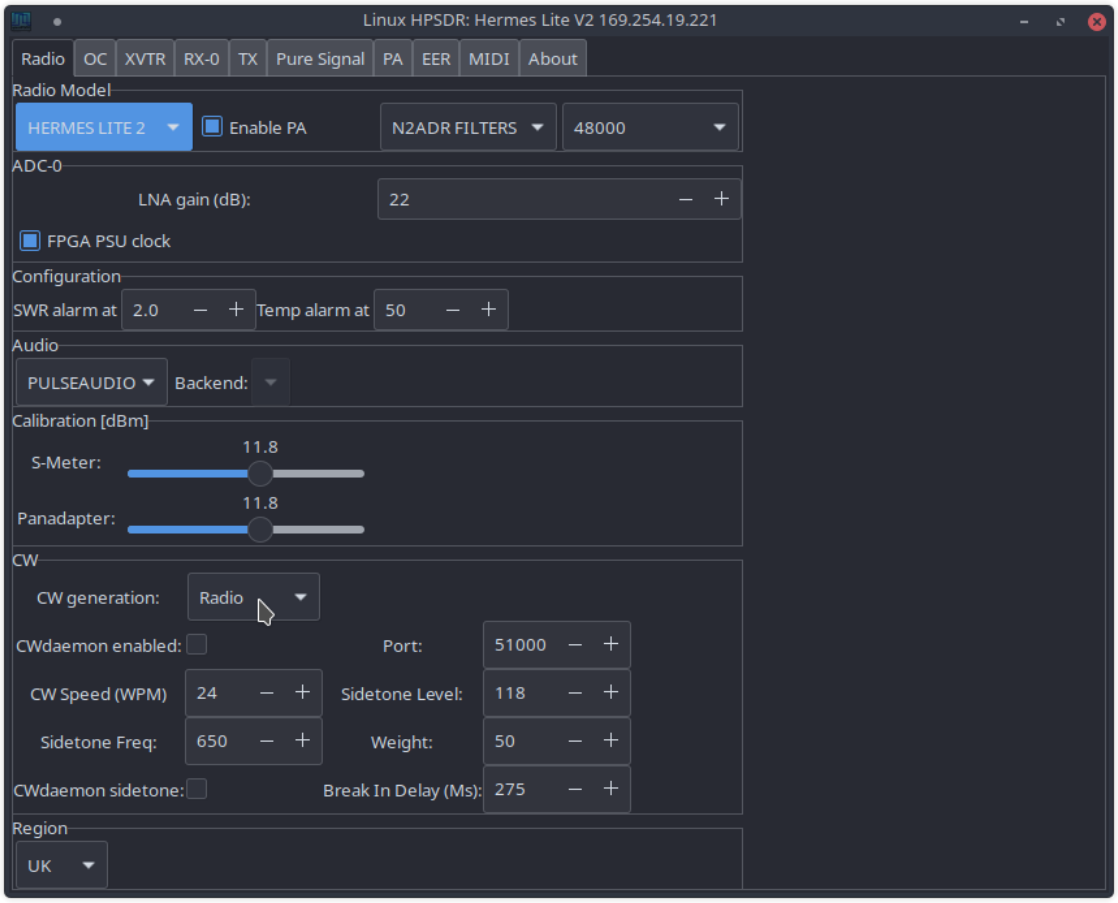
Note the colour of the TX frequency changes to red when transmitting. Also, the VFO being used for TX will change to red in the VFO window.



R The drive level is the main power output control for the HL2. However, note that for first time users, the PA tab within Configure will need attention. The default values within this tab will result in low power output from the HL2.

4. Configuration dialogue

4.1 Radio



Some users have tried linHPSDR over the years and maybe infrequently come back to it. For these users, there may be saved settings that aren't perfectly compatible with the current version. For example, the radio model may show as HERMES LITE rather than HERMES LITE 2. In this instance, it is recommended to close linHPSDR and make a backup of the .props file and then remove it with:

```
rm ~/.local/share/linhpsdr/*.props
```

Then re-open linHPSDR.

Features of note in this window are as follows:

Enable PA with this selected the main 5 W PA is enabled on the HL2. If the low power output is desired (for transverter use for example), un-check this.

FILTERS most users likely are using the N2ADR FILTERS. Selecting this in the drop down box will automatically change the OC tab settings. The HL2-MRF101 PA filter settings are also supported.

Sample rate can be changed between 48000 and 384000.

With 4 receivers enabled and high sample rates, Pulseaudio will likely struggle. It is recommended to use 48000 if 4 receivers are used.

FPGA PSU clock with the N2ADR filter board on 160m, some noise has been observed. With this box enabled, the noise should disappear.

Alarm thresholds VSWR alarm limit and temperature alert threshold (in deg C).

Calibration the values given are considered reasonably accurate.

From time to time different gateware revisions can change these calibration values.

4.1.1 CW

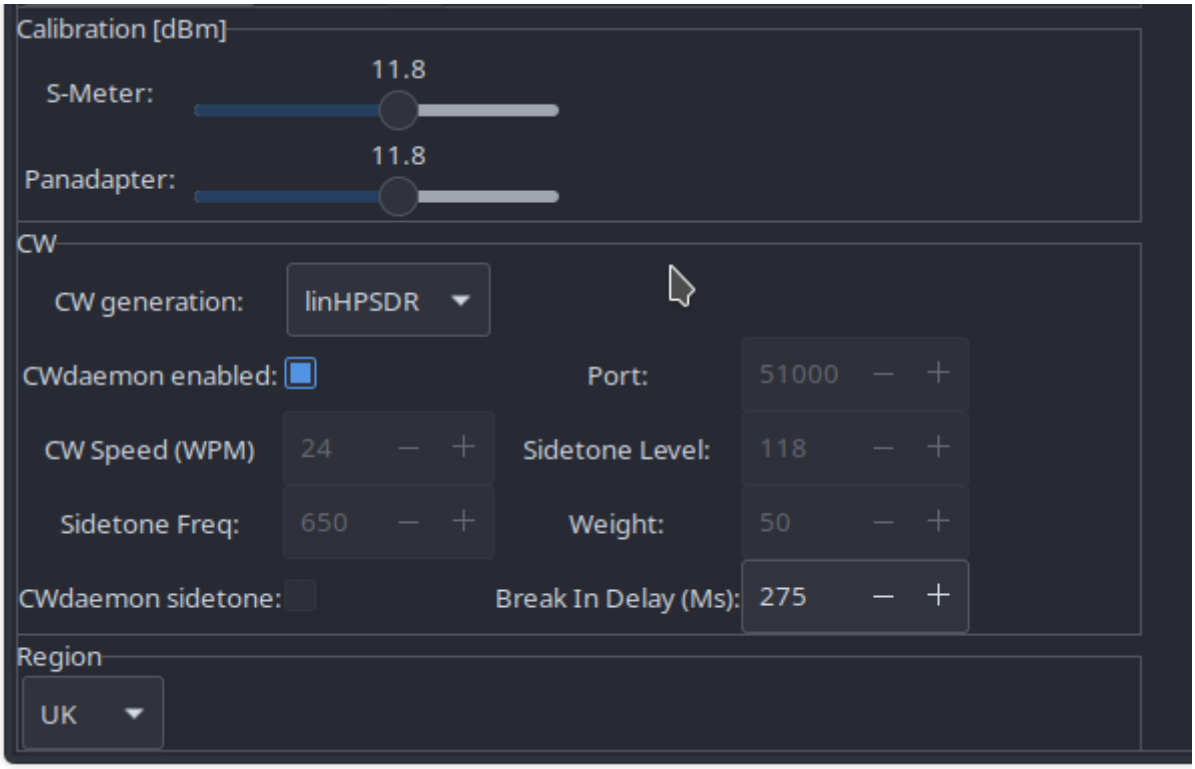
linHPSDR can support CW handled in the radio hardware and also generate CW within linHPSDR. This is configured in the radio tab at the bottom.

linHPSDR has a cwdaemon server built-in. This allows Linux logging software (that supports cwdaemon) to key linHPSDR (via keyboard/macro based CW). For example, tlf can talk directly to linHPSDR and no winkeyer is needed. To select this option, select linHPSDR in the CW generation drop down.

Before starting the cwdaemon server, a decision must be made regarding sidetone. To have no sidetone created by linHPSDR, ensure the CWdaemon sidetone box in unchecked. For contesting using keyboard macros in logging software, it is often beneficial to select duplex (DUP button) for the given receiver. This allows monitoring of the transmitted signal (with a slight delay).

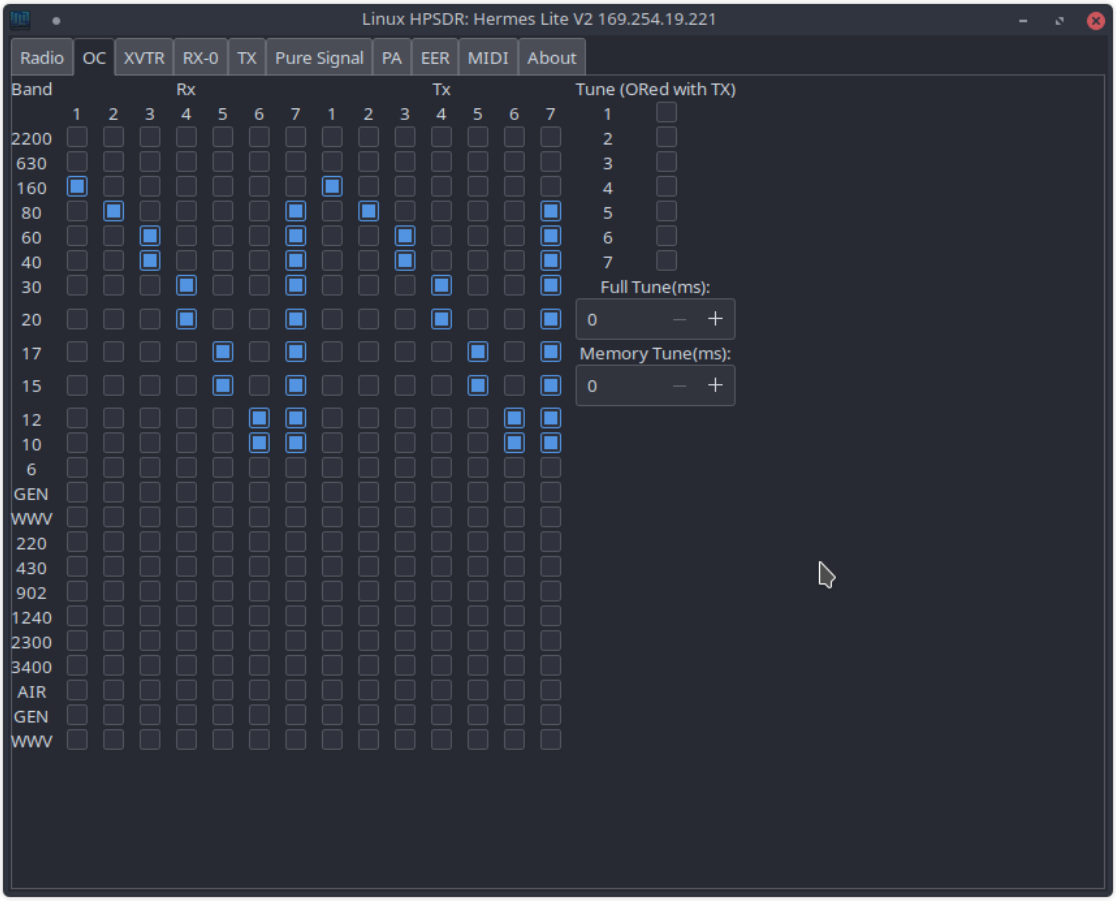
This fork of linHPSDR does not support CWX anymore and all cw generation is achieved by IQ packet manipulation within the transmitter code in linHPSDR. A raised cosine profile with a rise/fall time of 8 ms is used.

The final option is to use linHPSDR to generate the CW sidetone and CW IQ waveforms. This option is used to MIDI based keying. To use this configuration, ensure that CWdaemon sidetone is selected before enabling CWdaemon. The MIDI server must also be enabled and configured. This is discussed in a seperate section of this document.

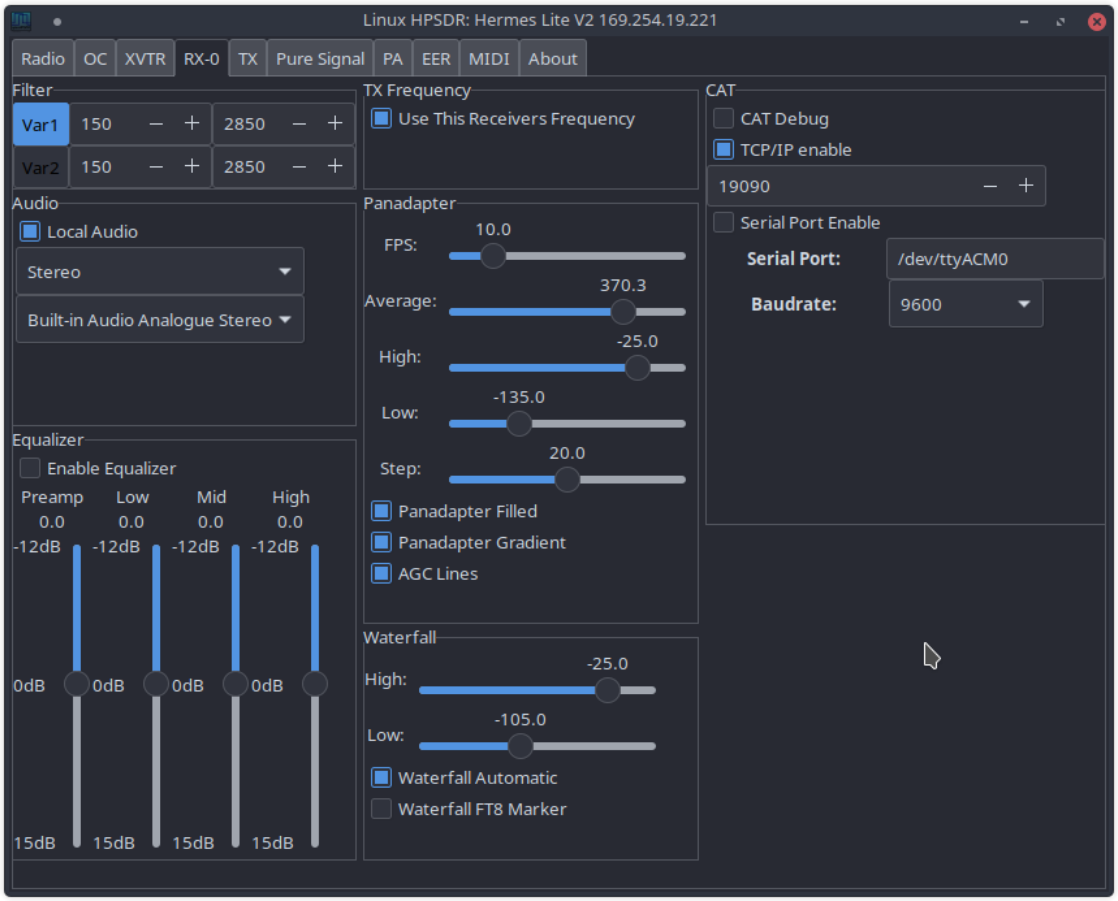


4.2 OC

The OC tab should not need any tweaking if the correct filter board has been set in the Radio tab.


Linux HPSDR: Hermes Lite V2 169.254.19.221
Radio
OC
XVTR
RX-0
TX
Pure Signal
PA
EER
MIDI
About
Band
Rx
Tx
Tune (ORed with TX)
1 2 3 4 5 6 7 1 2 3 4 5 6 7
2200
630
160
80
60
40
30
20
17
15
12
10
6
GEN
WWV
220
430
902
1240
2300
3400
AIR
GEN
WWV
1
2
3
4
5
6
7
Full Tune(ms):
0
Memory Tune(ms):
0

4.3 RX-n



Local Audio must always be checked.

CAT control is per receiver. To enable CAT on a given receiver, ensure that TCP/IP enable is selected

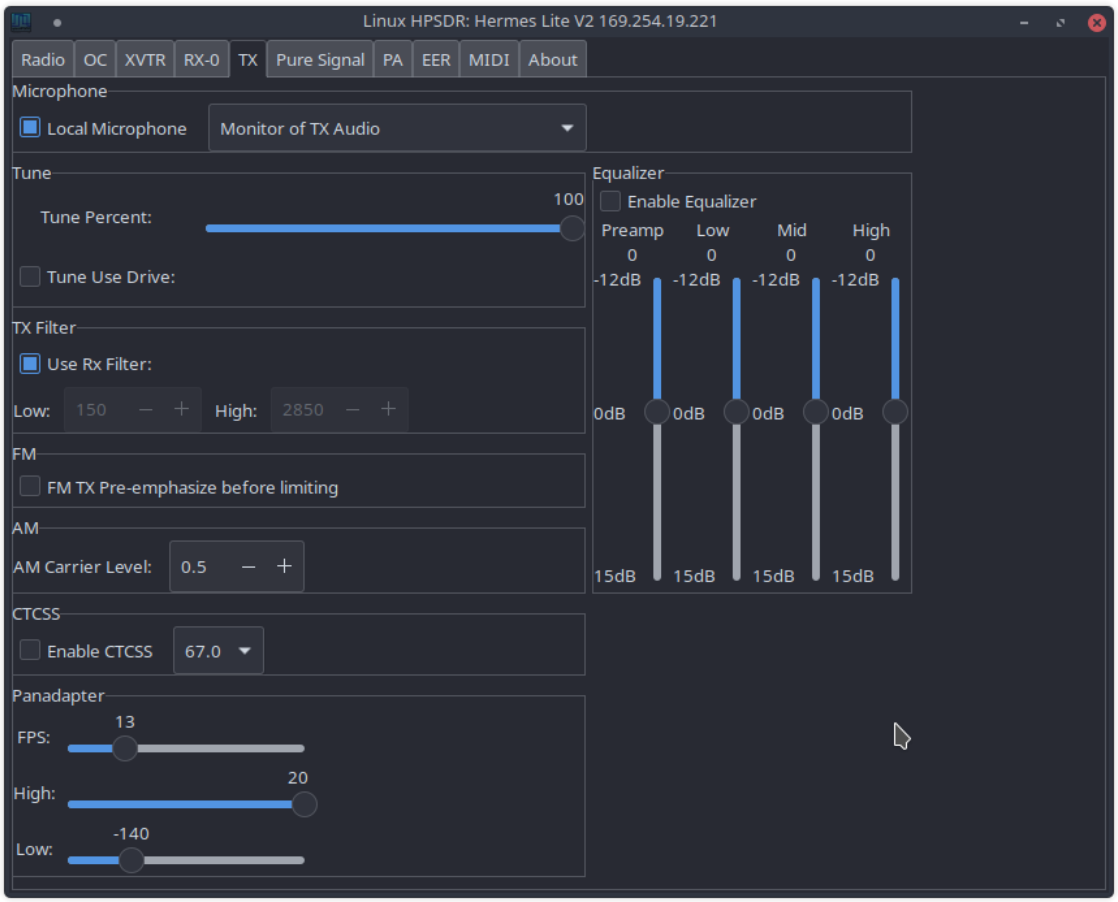
R The panadapter FPS (frames per second) and Average will likely need changing depending on mode and radio sample rate.

Waterfall automatic will set blue for the lowest signal levels and red for the highest signal levels.

R If strong signals appear on the band the contrast will automatically change, so this feature can sometimes falsely make the user thing noise levels have changed.

R Take care when undertaking comparisons between antennas etc. to uncheck Waterfall automatic.

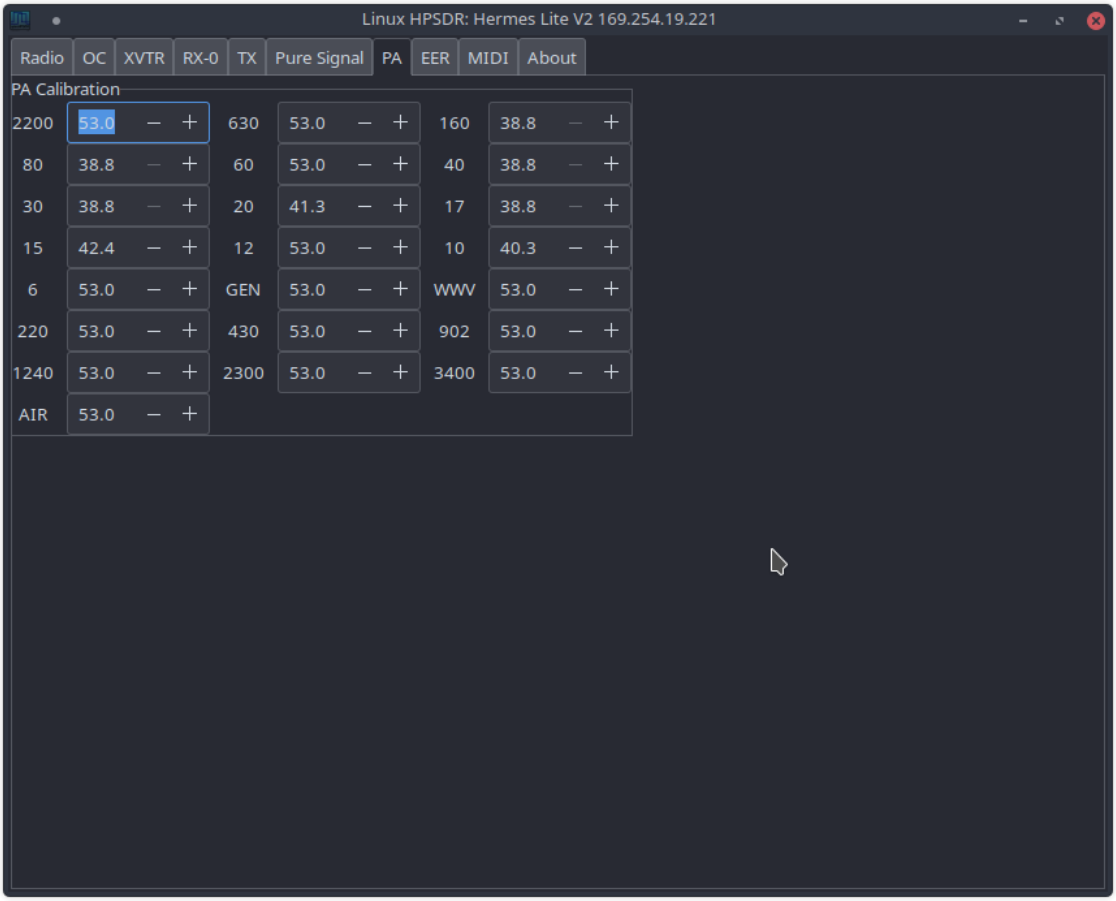
4.4 TX

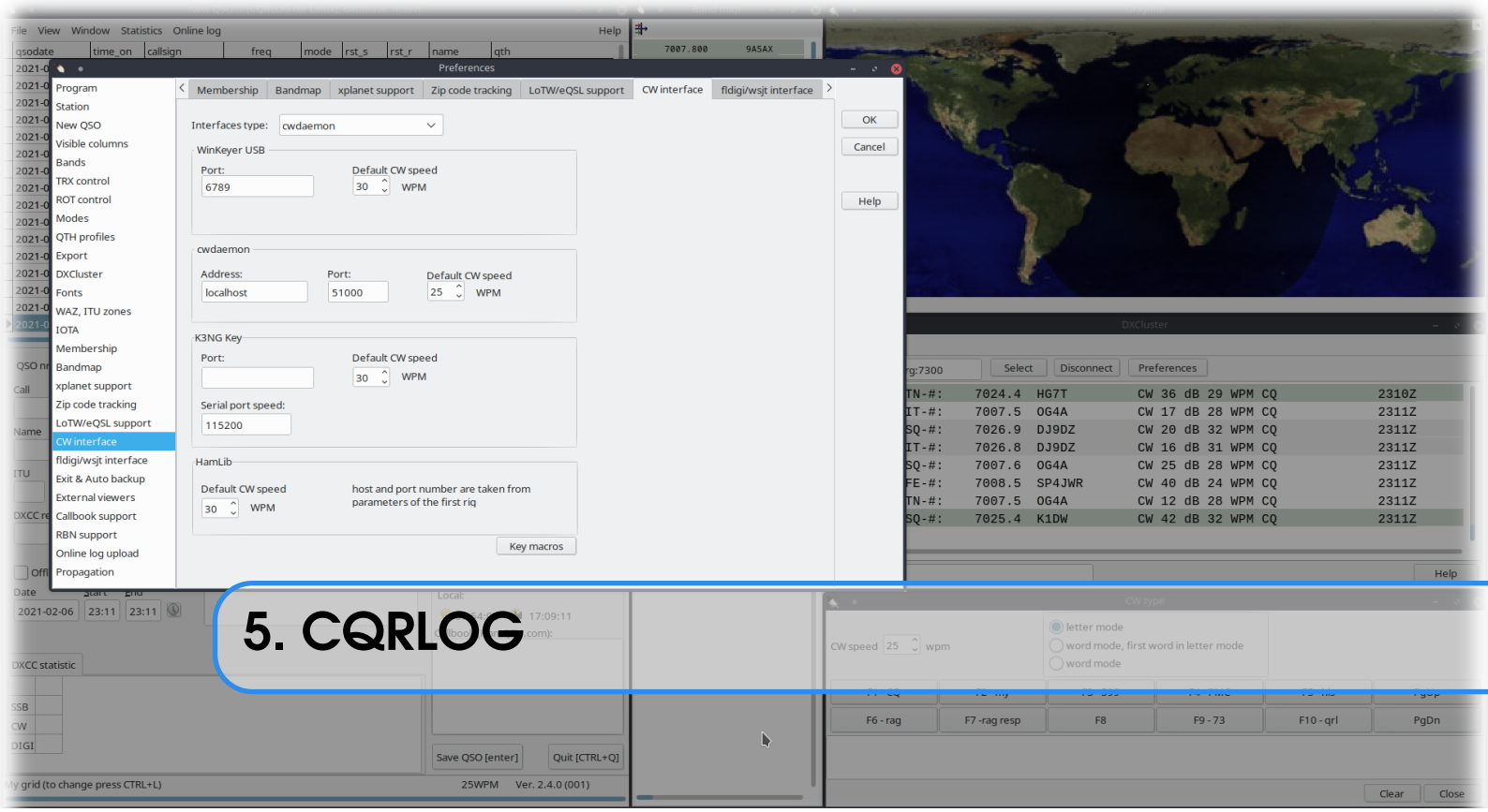


Ensure that (Local Microphone is selected.

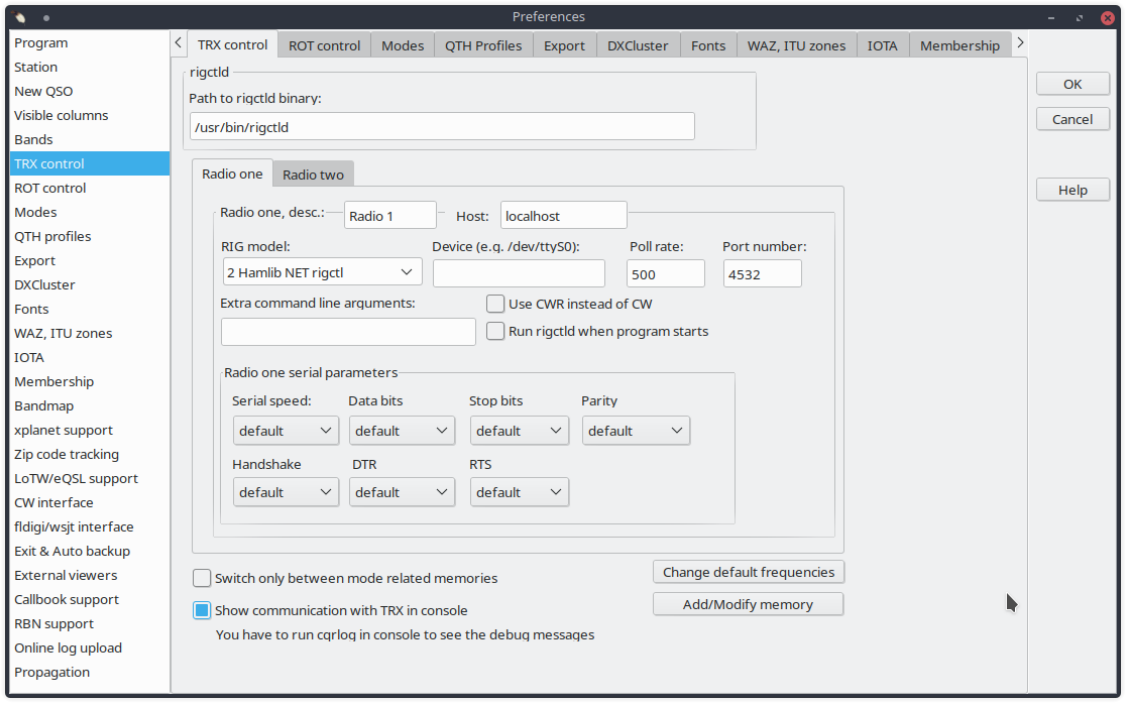
4.5 PA

The HL2 power output is not the same for every band. The PA tab allows tweaking of the power output per band. The values all default to 53.0. This will likely result in low power out from the HL2. The optimum values are likely somewhere between 39.0 and 43.0 (lower number is higher power output, with a minimum value of 38.0)


Linux HPSDR: Hermes Lite V2 169.254.19.221
Radio
OC
XVTR
RX-0
TX
Pure Signal
PA
EER
MIDI
About
PA Calibration
2200 53.0 630 53.0 160 38.8
80 38.8 60 53.0 40 38.8
30 38.8 20 41.3 17 38.8
15 42.4 12 53.0 10 40.3
6 53.0 GEN 53.0 WWV 53.0
220 53.0 430 53.0 902 53.0
1240 53.0 2300 53.0 3400 53.0
AIR 53.0



5.1 CAT



Ensure linHPSDR is running. From a command prompt, type the following:

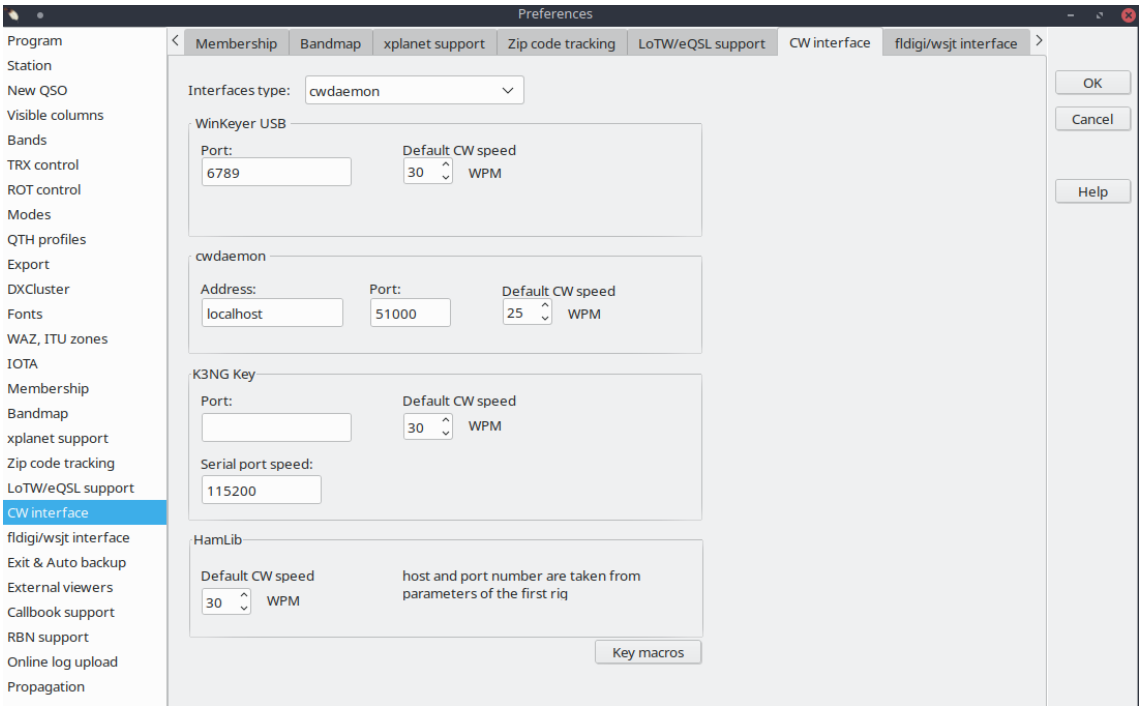
```
rigctld -m 240 -r localhost:19090
```

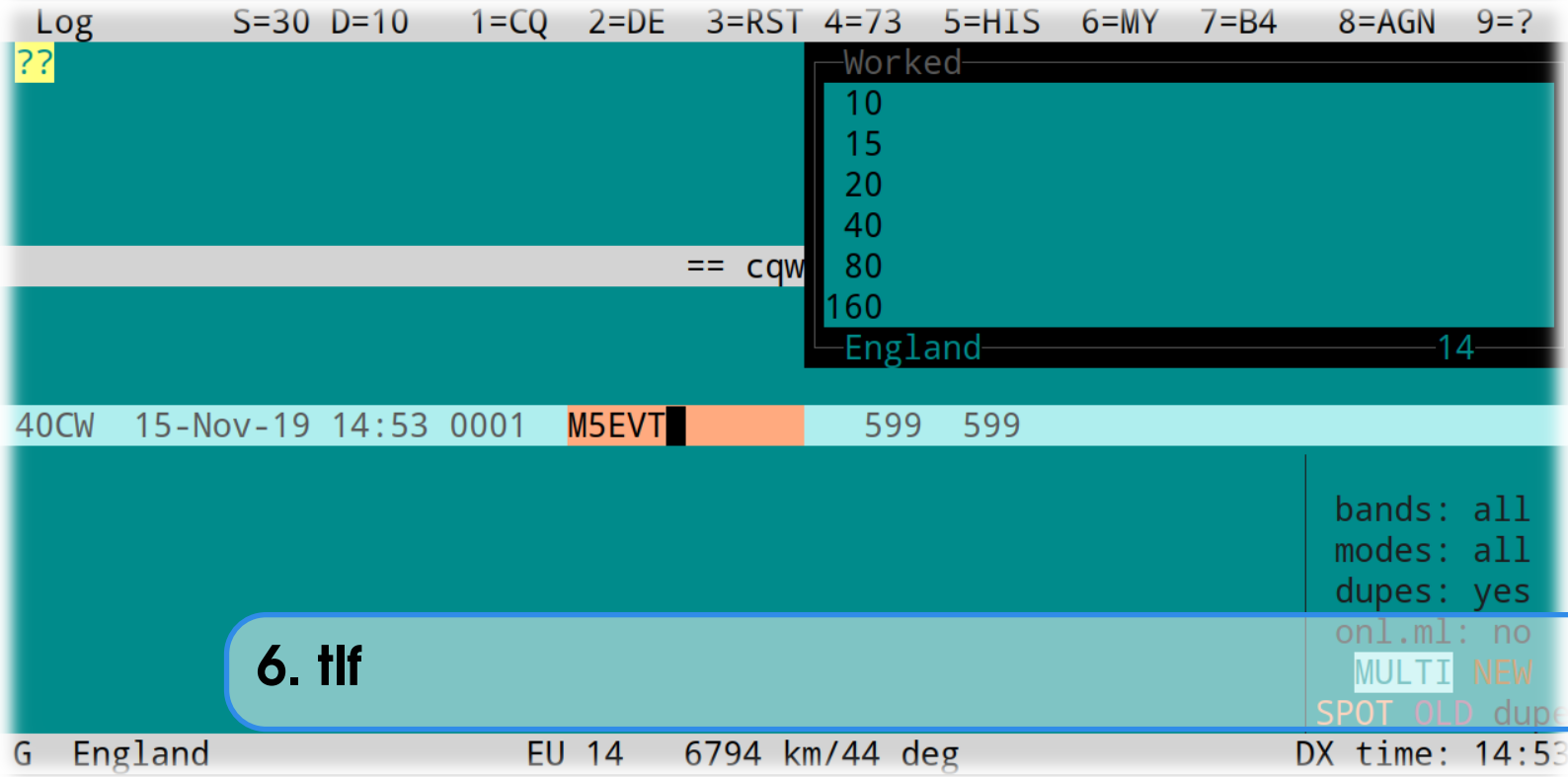
Configure CQRLOG as shown in the image above.

Finally, from the within CQRLOG select File -> Refresh TRX/Rot control

5.2 CW

The setup from macro/keyboard CW from CQRLOG is shown below.





6.1 Setting up tlf

tlf is a great keyboard driven Linux contest logger. It can be downloaded from:

`https://github.com/Tlf/tlf/tags`

6.2 logcfg.dat

The following settings should be added to a logcfg.dat file to use cwdaemon:

```
NETKEYER
NETKEYERPORT=51000
NETKEYERHOST=127.0.0.1
```

and for CAT:

```
RADIO_CONTROL
RIGMODEL=240
RIGPORT=localhost:19090
RIGPTT
```

Different options may have been set by the user in linHPSDR resulting in different port numbers to those shown above.