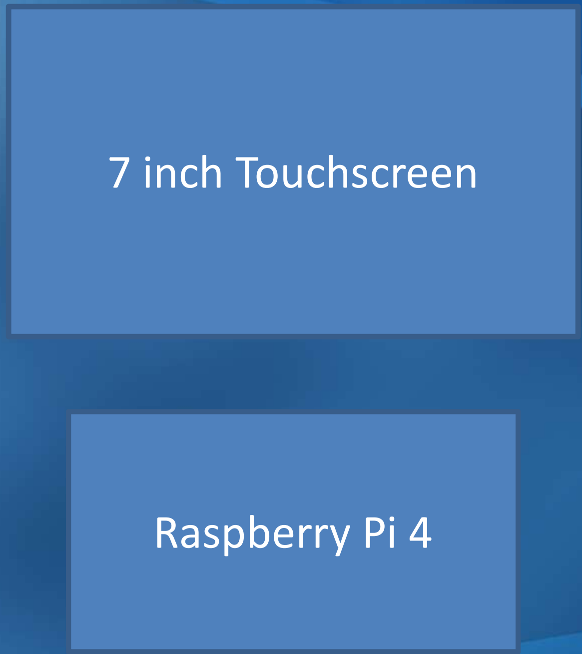
Using the Raspberry Pi for Digital ATV

Dave G8GKQ

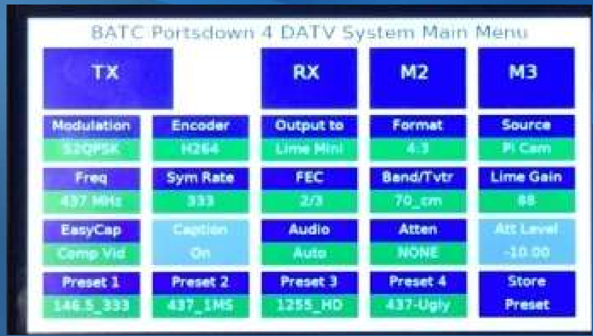
Topics

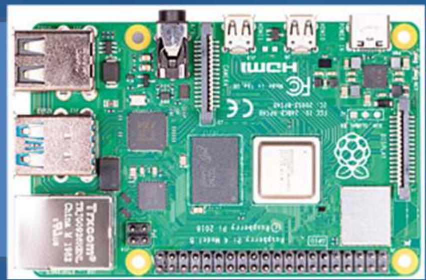
- Portsdown TX/RX
- Ryde Receiver
- WinterHill Receiver
- HDMI Video Source
- ATV Repeater Controller
- Portsdown Test Equipment and Extras
- RPi Availability

Portsdown 4 Concept

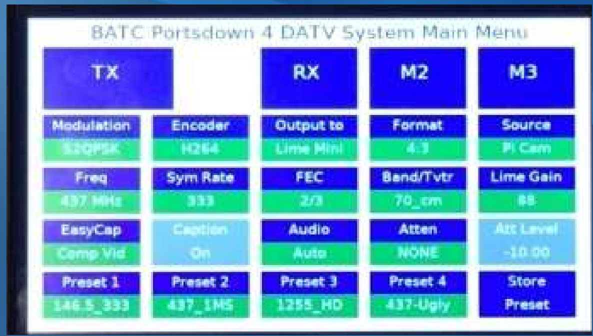


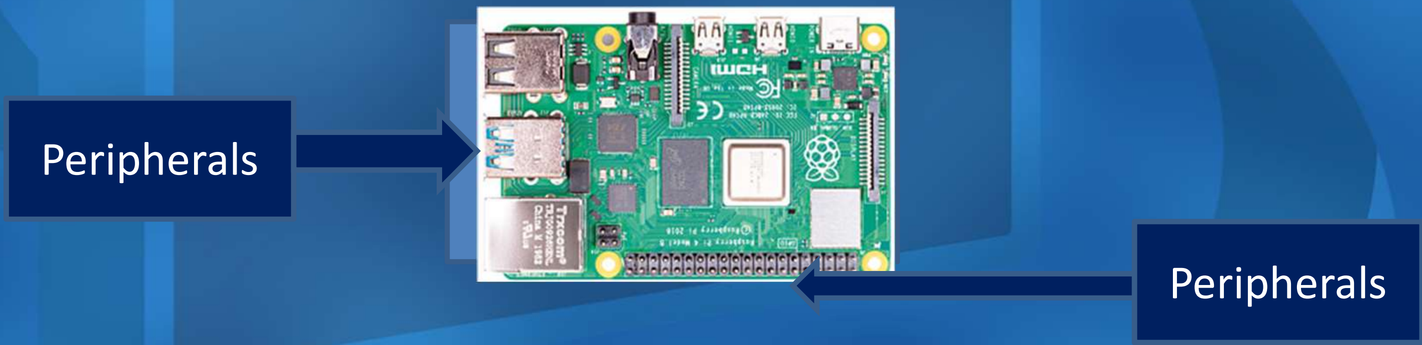
Portsdown 4 Concept





Portsdown 4 Concept





Portsdown Builds

The Portsdown Transceiver

Transmitter

- Drives Lime or Pluto
- DVB-S, DVB-S2, DVB-T
- MPEG-2 or H264
- SD or 720p
- 125 kS to 1 Ms

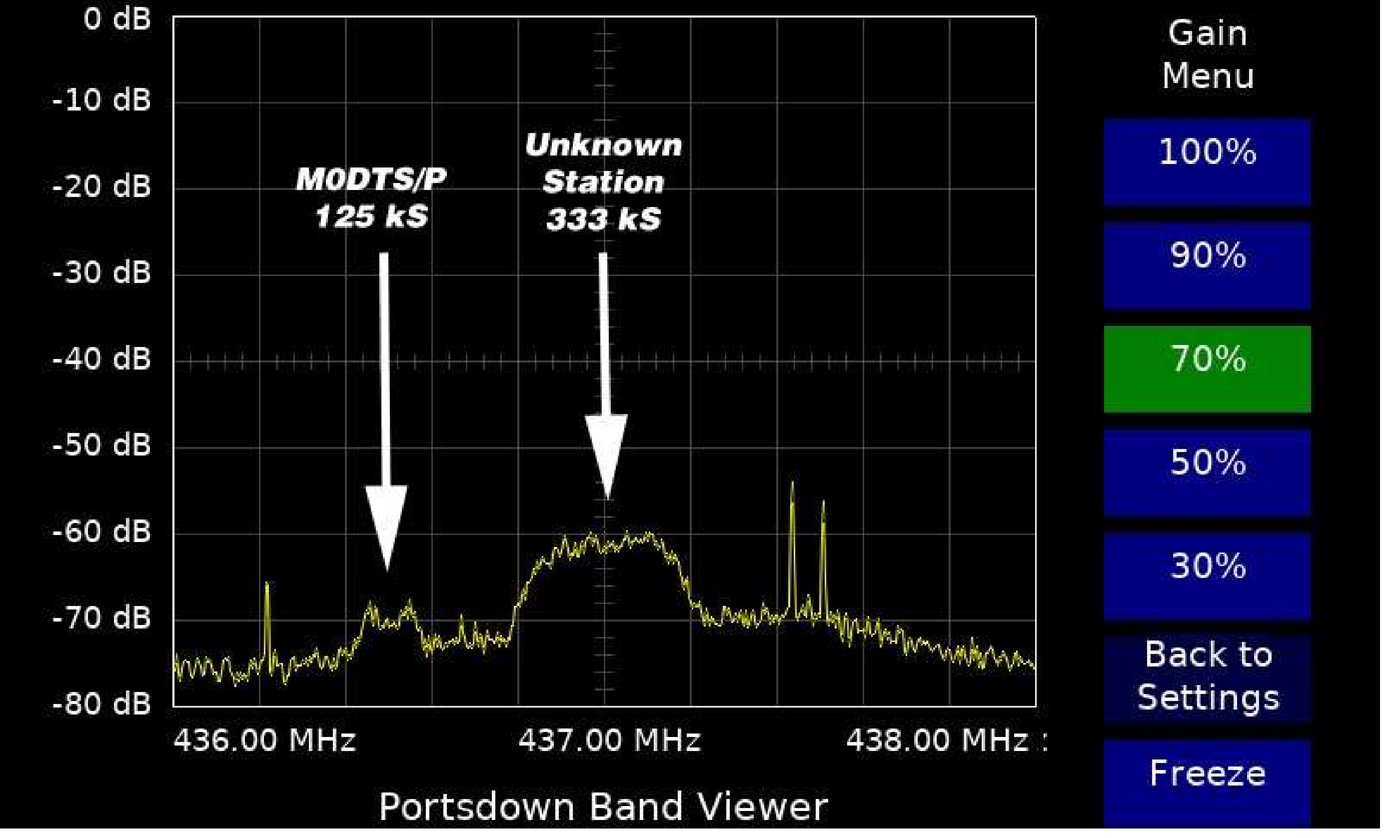
Receiver

- Connects to MiniTiouner
- DVB-S, DVB-S2, DVB-T
- MPEG-2, H264 or H265
- 480 x 800 display
- 125 kS to 4 Ms

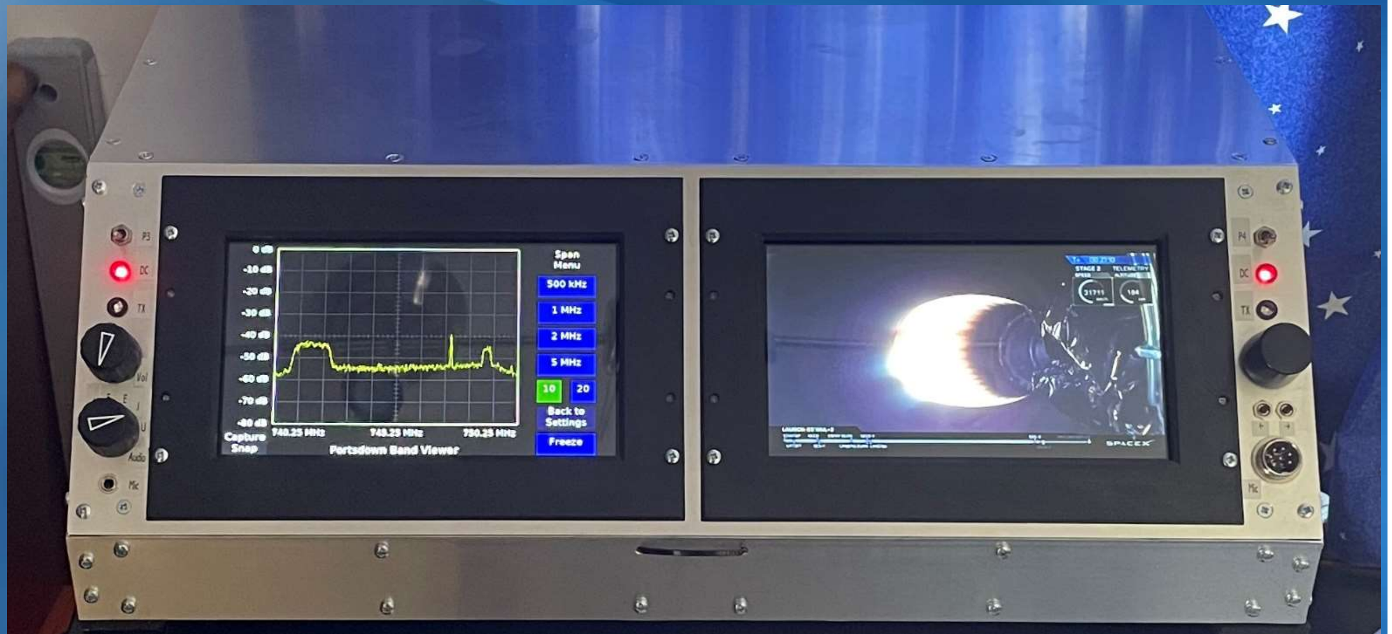
Band Viewer

- Portsdown 2020 and Portsdown 4
- LimeSDR, Airspy R2 and RTL-SDR
- Pluto on Portsdown 4 (with x5 mode)
- Intended as a “Panadapter”
- Accurate relative levels
- Dynamic Range Limited by SDR

Weak Signal Work



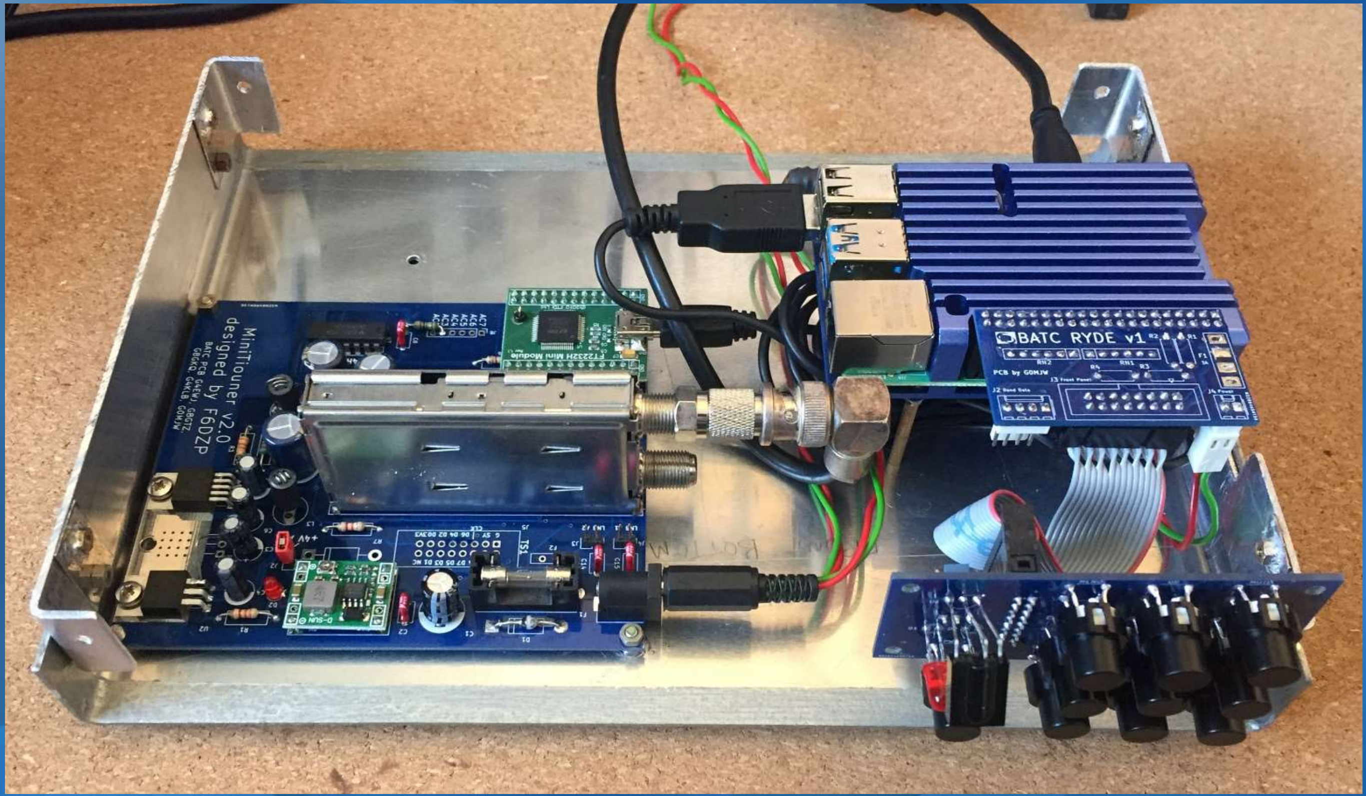
DATV Weak-signal Use



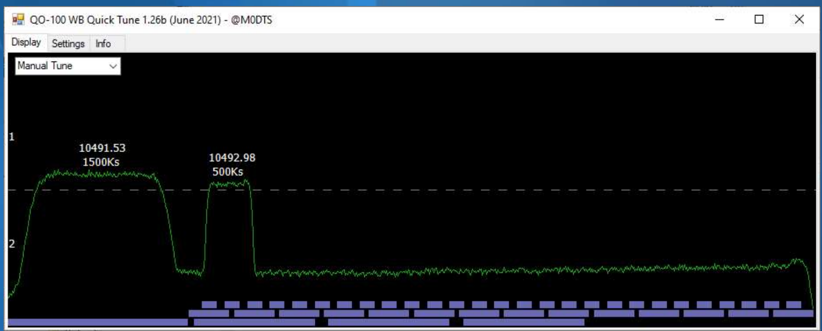
Ryde Receiver

- Set-top Box DATV Receiver - IR Remote
- Uses a Raspberry Pi 4 and a MiniTiouner
- 125 kS to 4 MS
- HDMI output (inc 4k)
- Can be network controlled

Hardware


MiniTiouner v2.0
designed by F6DZP
BATC RYDE v1
FT2232H Mini Module

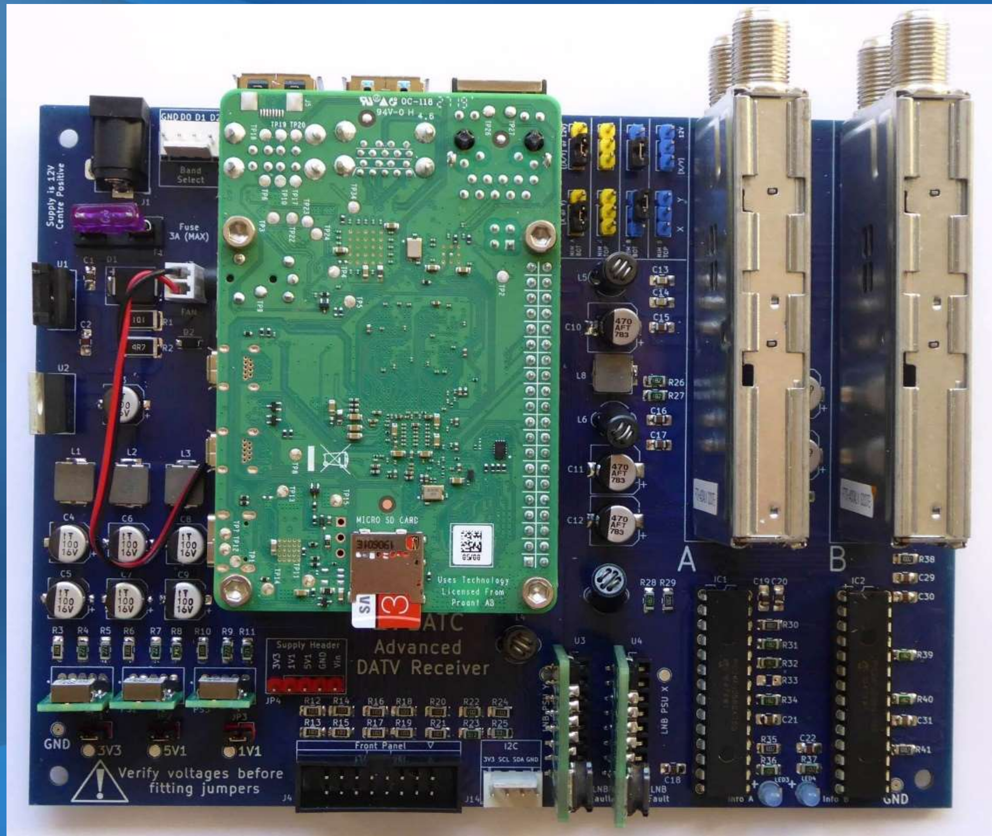
Remote Control



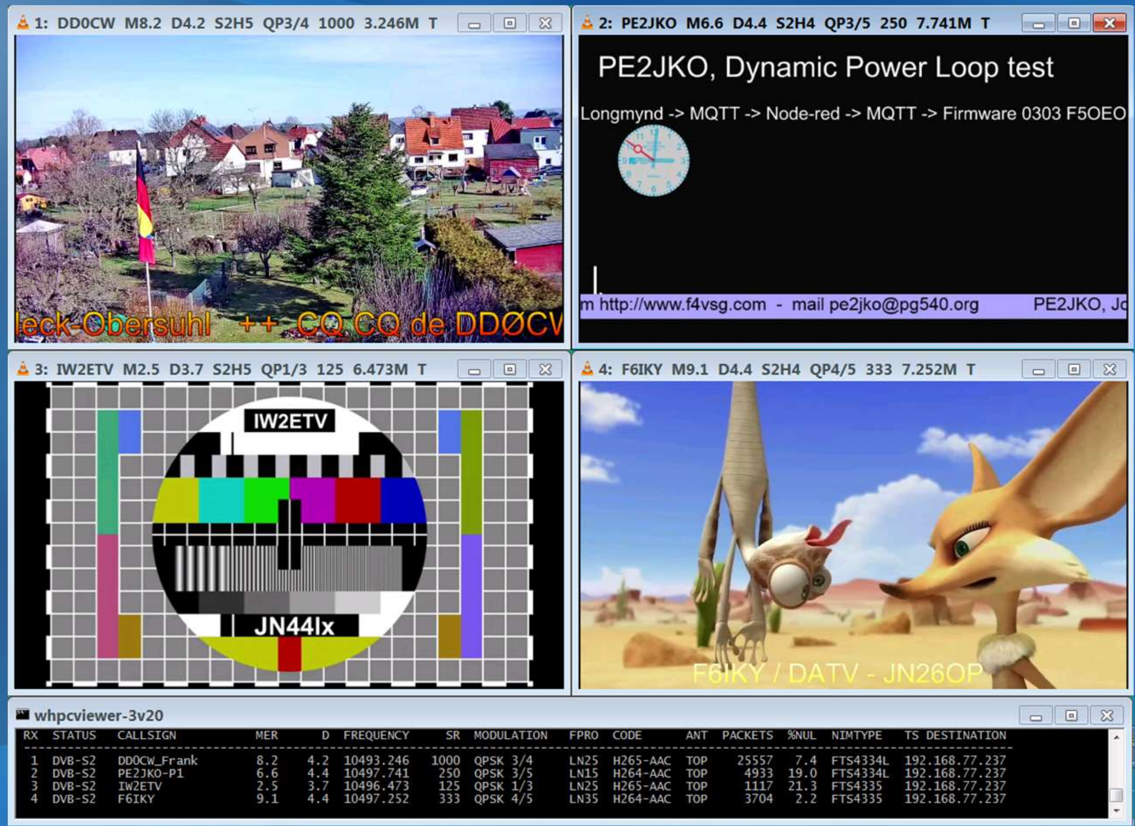
WinterHill Receiver

- Integrated RPi 4 and 2 tuners
- 4 channel display on RPi desktop or networked PC

WinterHill Hardware



Four Channel Receive

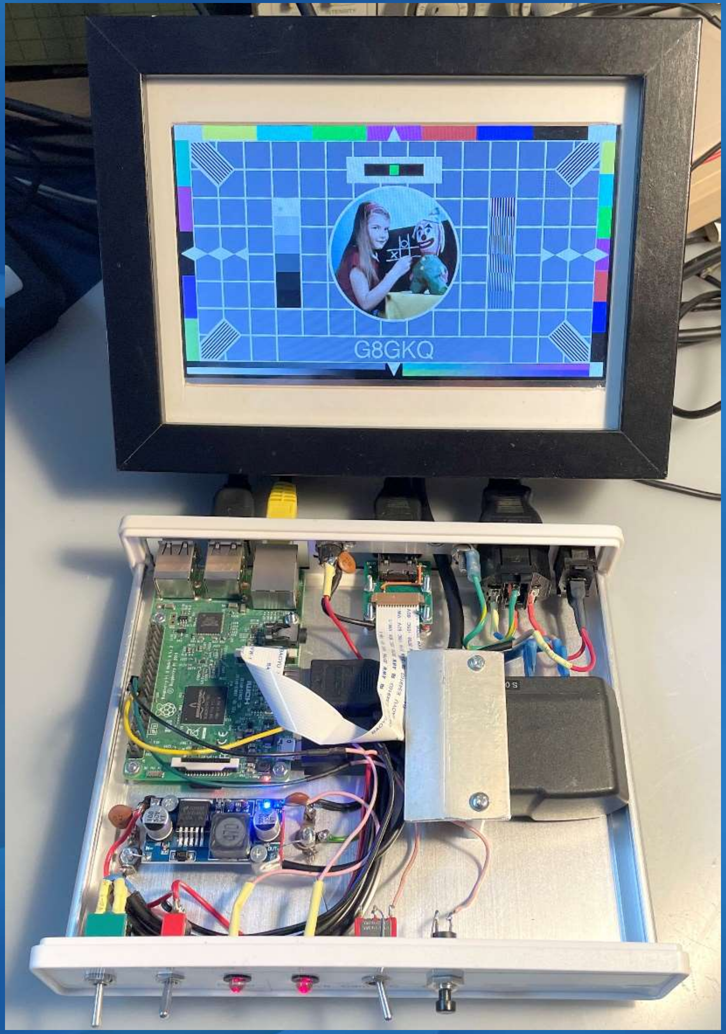


HDMI Video Source

- Pi Cam, WebCam and Test Cards
- HDMI out
- Ideal for driving an ATEM Mini
- Can be set for specific HDMI Standards

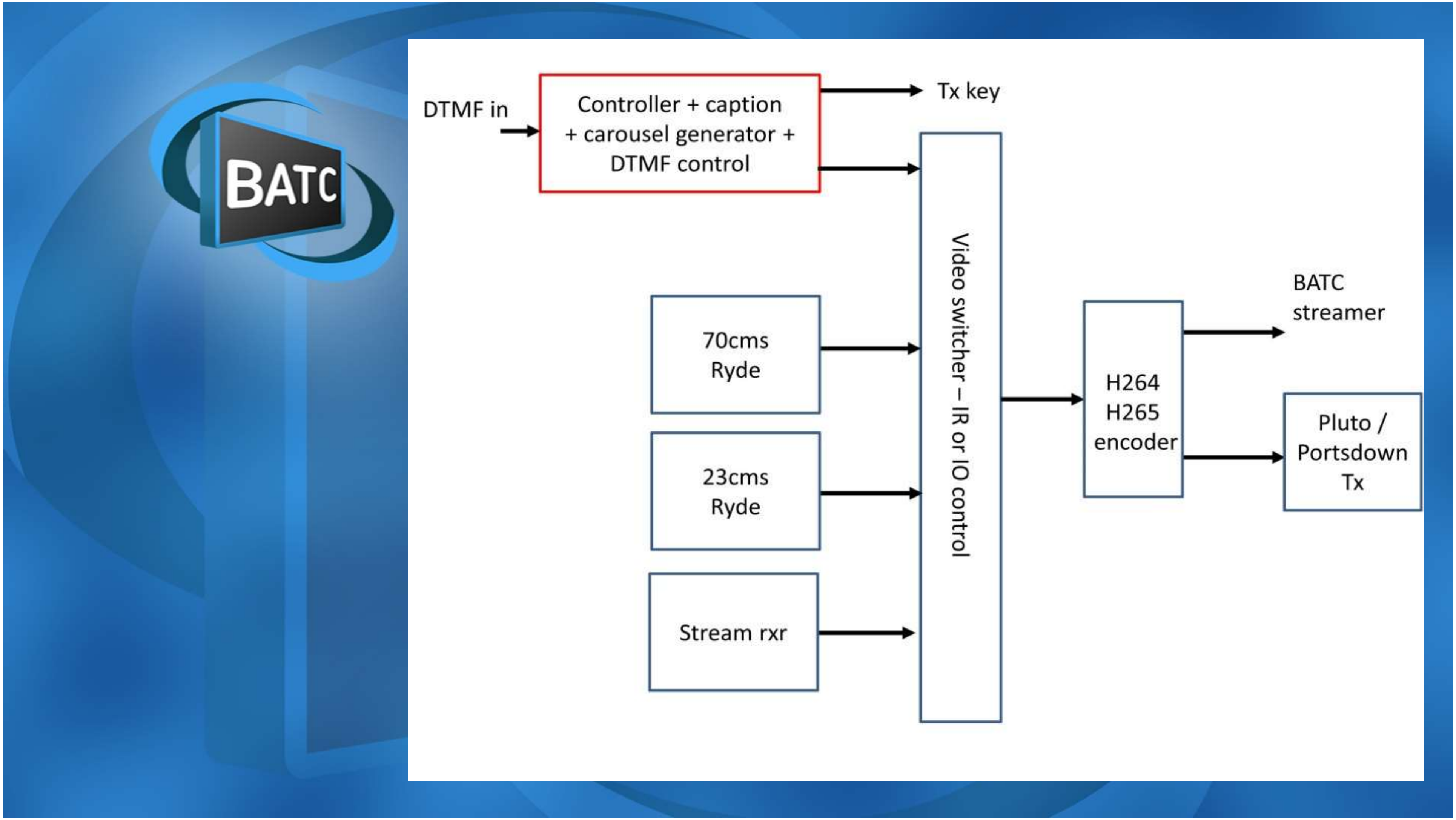
Cameras

- Pi Cam V1, V2 & HQ
- C920 (Early version)
- Polycom Eagleeye USB



ATV Repeater Controller

- RPi based DATV Repeater Controller
- All control and timing functions
- Single text configuration file
- HDMI Test Cards, Captions
- Audio Ident, K and signal beep
- DTMF (and Network) Control
- IR control of HDMI Switch (or i2c or network)


DTMF in
Controller + caption + carousel generator + DTMF control
Tx key
Video switcher – IR or IO control
70cms Ryde
23cms Ryde
Stream rxr
H264 H265 encoder
BATC streamer
Pluto / Portsdown Tx

Portsdown Extras

- Range and Bearing
- Signal Generator
- XY Display
- Power Meter
- Langstone SSB/CW
- Noise Figure Indication
- Frequency Sweeper
- DMM Display/logger
- Noise Meter
- Jetson Nano Control

Range and Bearing

From G8GKQ	IO91CC	Bearing	Range
G8GTZ/P	IO91GI	039 deg	36 km
G1LPS	IO94EQ	001 deg	398 km
M0DTS/P	IO94MJ	008 deg	370 km
M0DTS/P	IO94DF	000 deg	347 km
G8LES	IO91LC	089 deg	52 km
F9ZG	IN98JW	169 deg	244 km
G8ADM	IO91TO	059 deg	112 km
G8LES	IO91LC	089 deg	52 km
G0MJW	IO91IO	031 deg	65 km
G4CPE	IO91SW	044 deg	130 km

Touch Screen to Continue

Signal Generator

- Simple Interface to Multiple Sources
- Approximate Amplitude Calibration using Look-up tables
- Some sources not clean
- Covers 1 Hz to 30 GHz

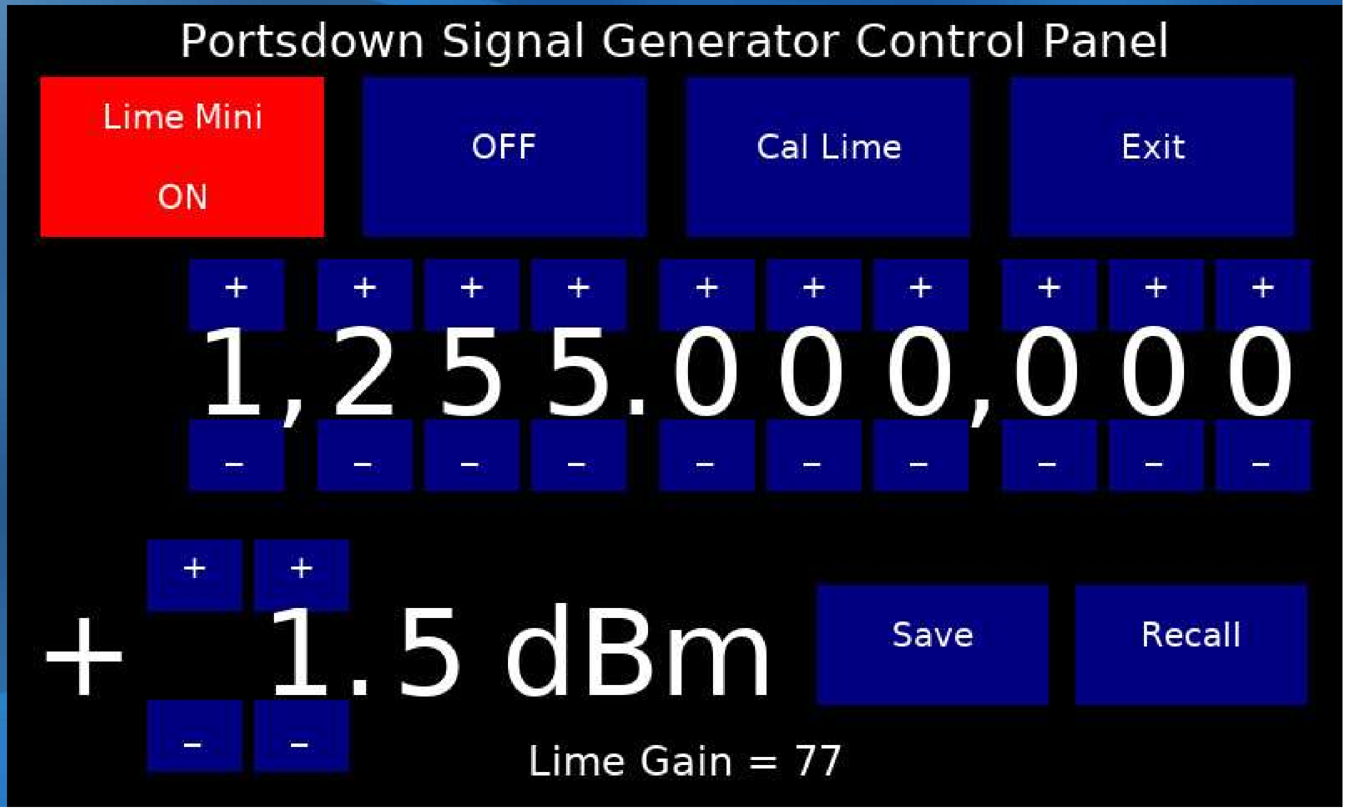
Signal Generator

- Sources
  - Pluto SDR - 6 GHz
  - Pluto SDR x5 - 30 GHz
  - LimeSDR Mini - 3.5 GHz
  - ADF4351 - 4.4 GHz
  - ADF5355 - 13.6 GHz
  - AD9850 – 1 Hz to 50 MHz

- Elcom Source

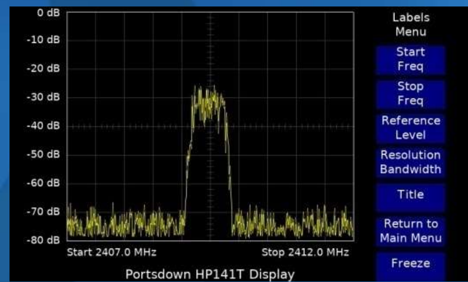
- Nort SLO

Sig Gen Control

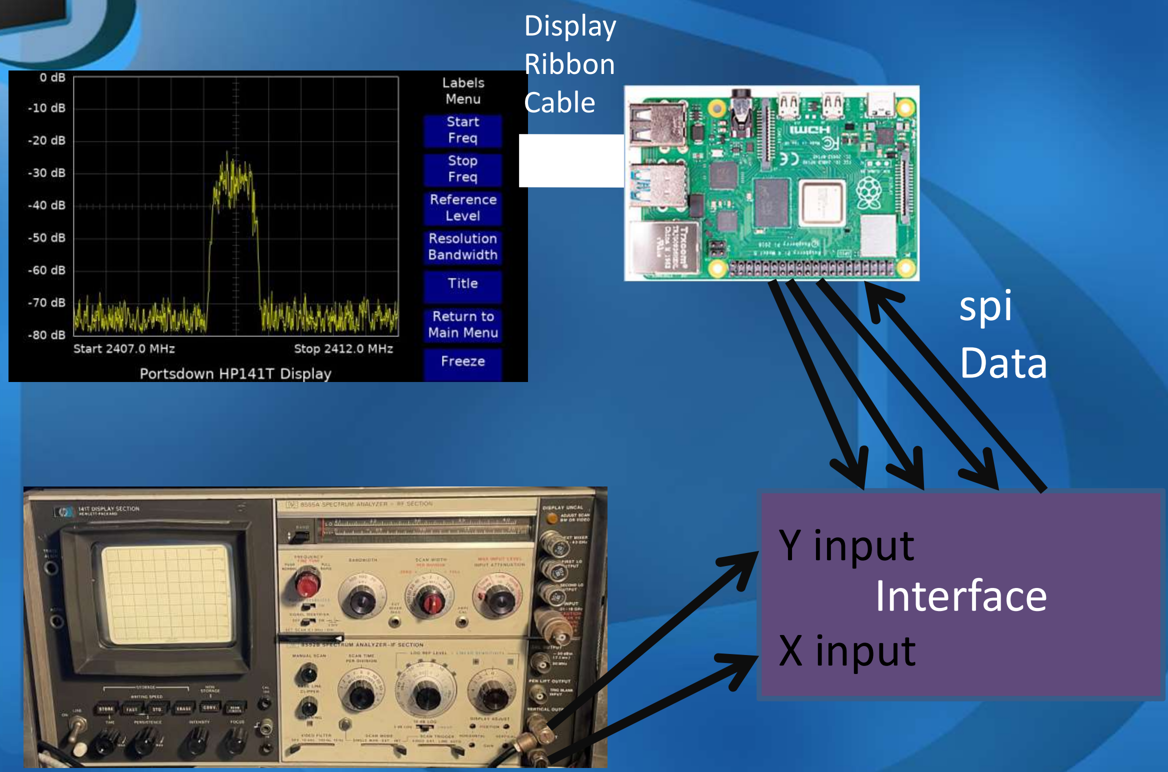


XY Display

- For use with HP141T or HP8559
- Portsdown with added 2 IC interface
- Provides
  - 500 x 400 pixel image
  - Screen Capture and Freeze
  - Normalisation

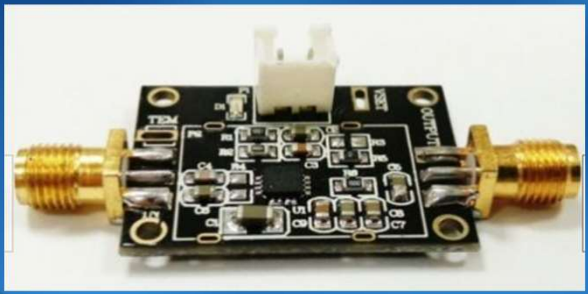


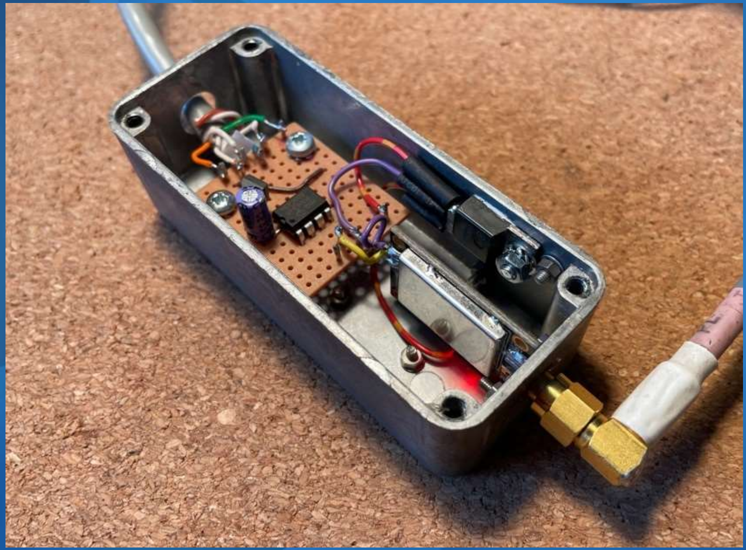
XY Display – How?



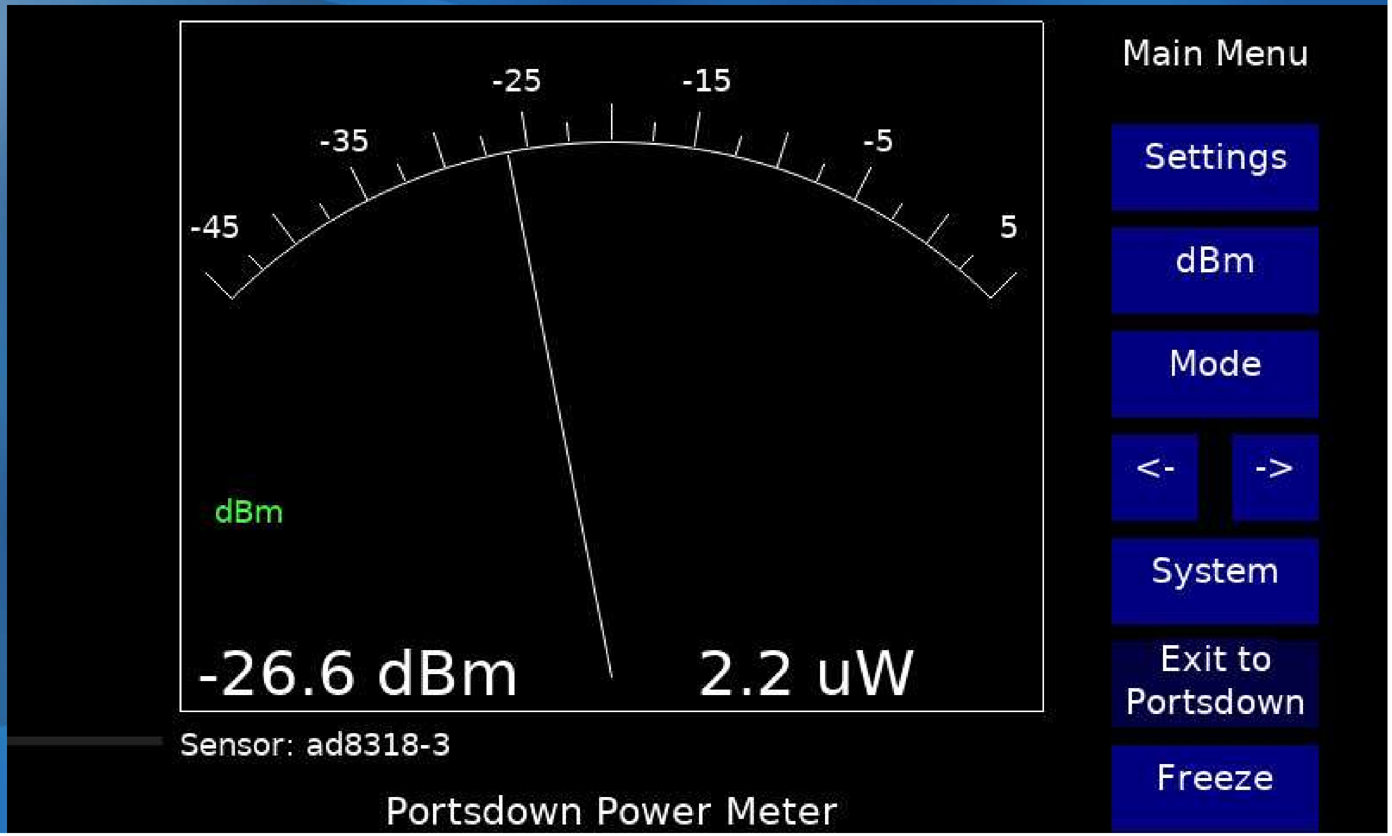
Power Meter

- Needs external sensor
- AD8318
- MCP3002 A-D
- More sensors in future





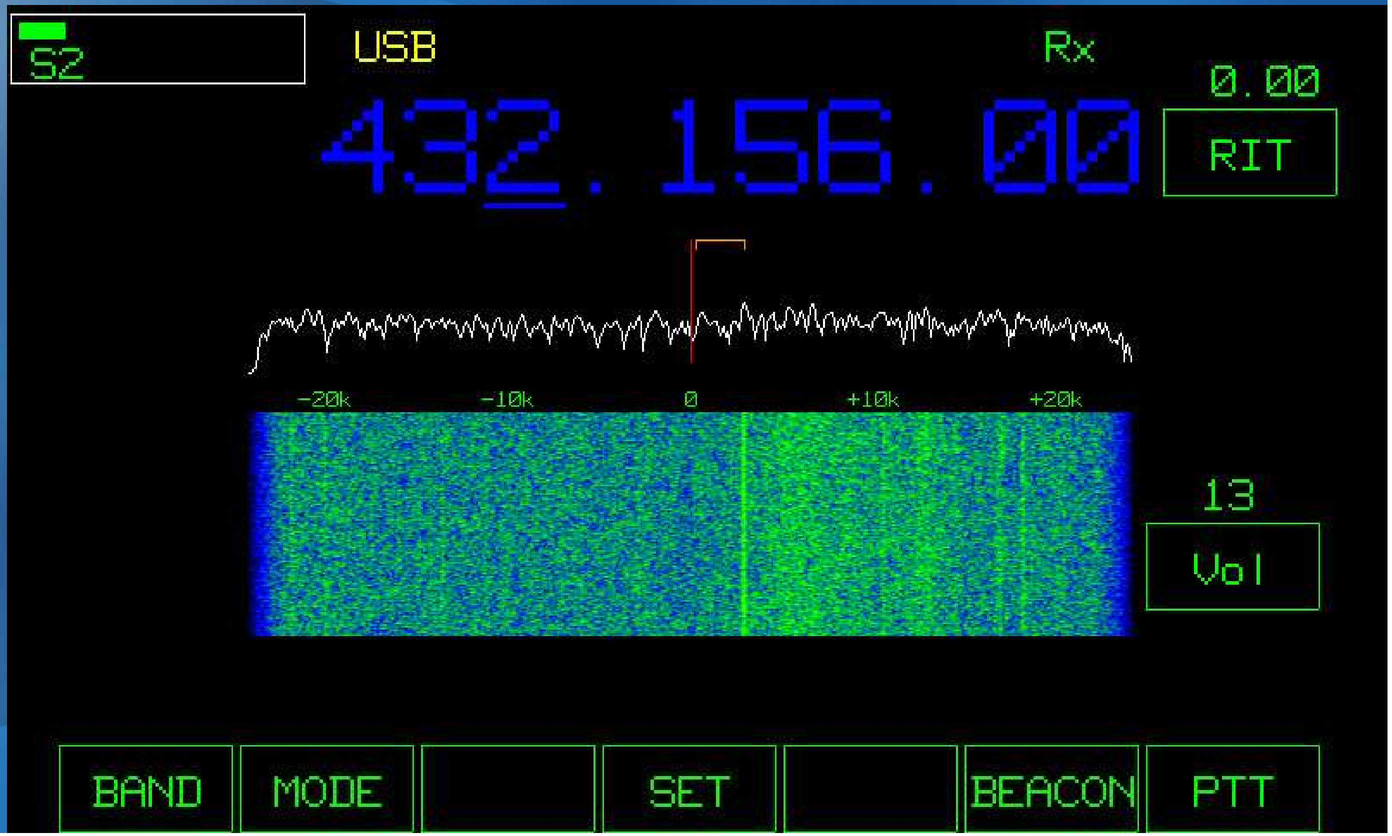
Meter Face



Main Menu
-25
-15
-35
-5
-45
5
Settings
dBm
Mode
<-
->
dBm
System
Exit to Portsdown
-26.6 dBm
2.2 uW
Sensor: ad8318-3
Freeze
Portsdown Power Meter

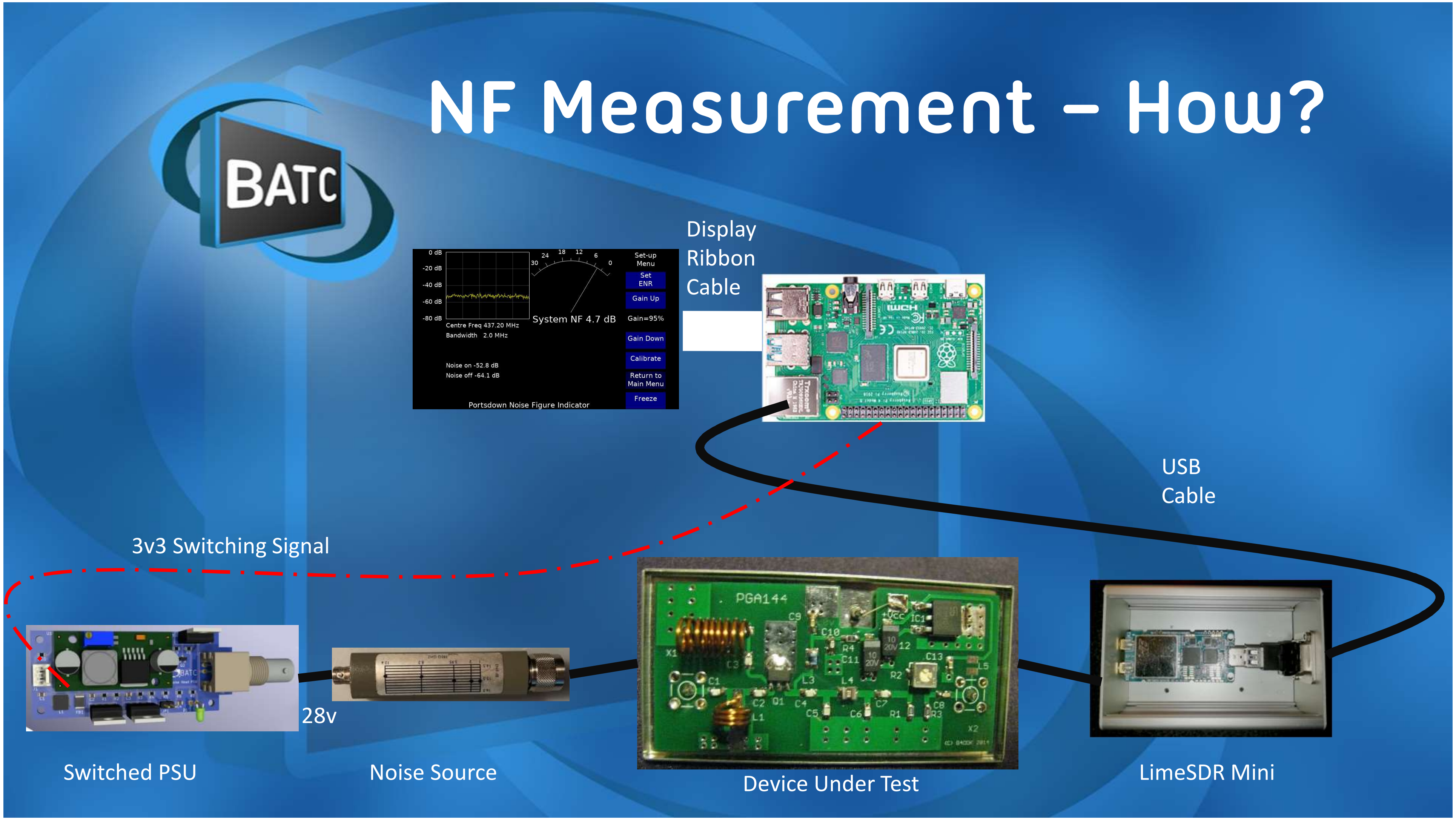

Voice/CW Capabilities
BATC
RPi 4 and Touchscreen with Pluto or LimeSDR
Langstone Microwave Transceiver by G4EML – 70 MHz to 6 GHz
Needs Compatible USB Sound Dongle
Optional Mouse-based Tuning Control

Langstone Interface

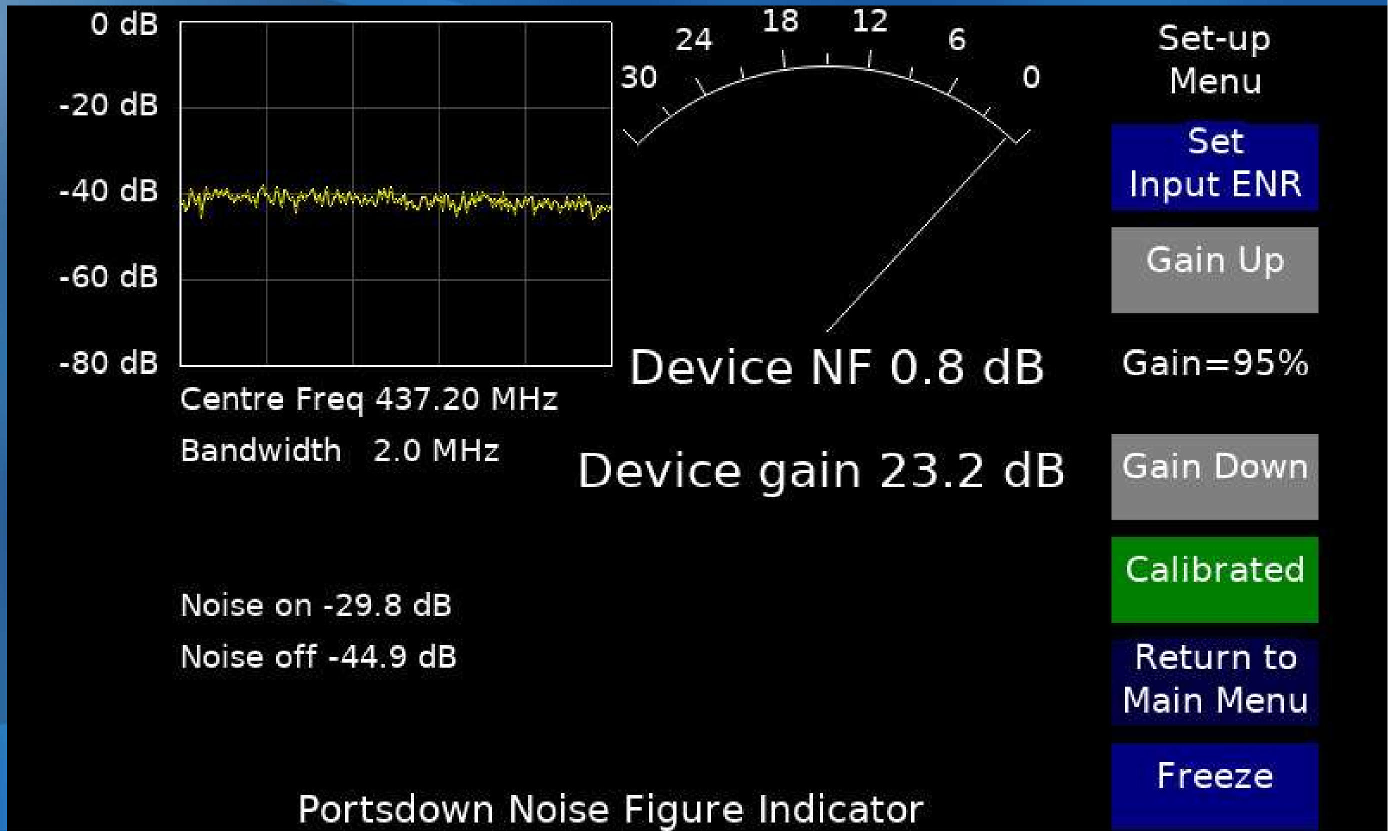


Noise Figure Indication

- Use a Noise Source switched at ~ 4 Hz
- Measure Average Noise Power On & Off
- Calculate Noise Figure
- After calibration, calculate gain
- BATC Design for Noise Source PSU

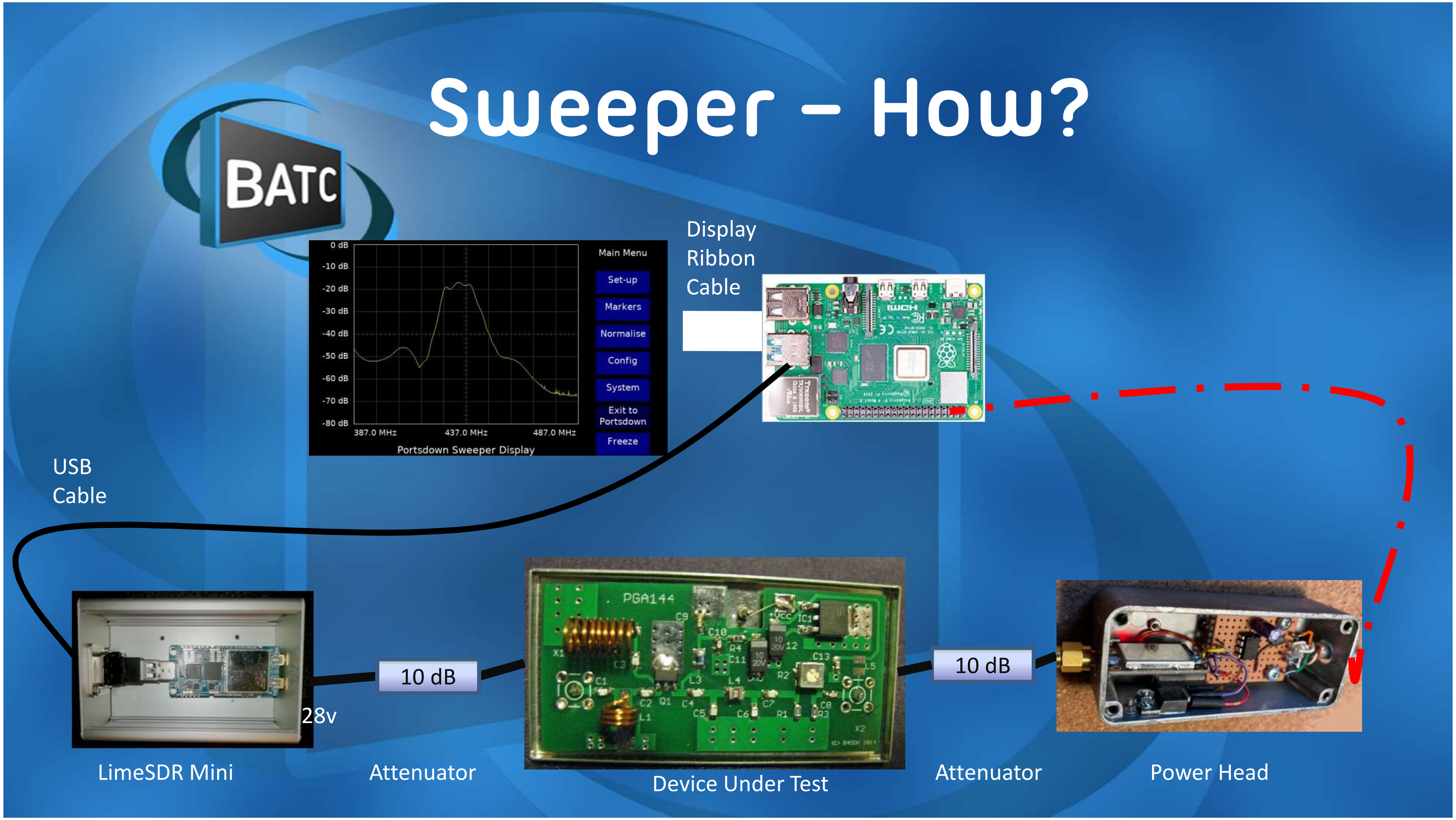

NF Measurement – How?
BATC
Display
Ribbon
Cable
0 dB
-20 dB
-40 dB
-60 dB
-80 dB
Centre Freq 437.20 MHz
Bandwidth 2.0 MHz
System NF 4.7 dB
Noise on -52.8 dB
Noise off -64.1 dB
Portsdown Noise Figure Indicator
Set-up Menu
Set ENR
Gain Up
Gain=95%
Gain Down
Calibrate
Return to Main Menu
Freeze
USB
Cable
3v3 Switching Signal
28v
PGA144
Switched PSU
Noise Source
Device Under Test
LimeSDR Mini

Device Gain and NF

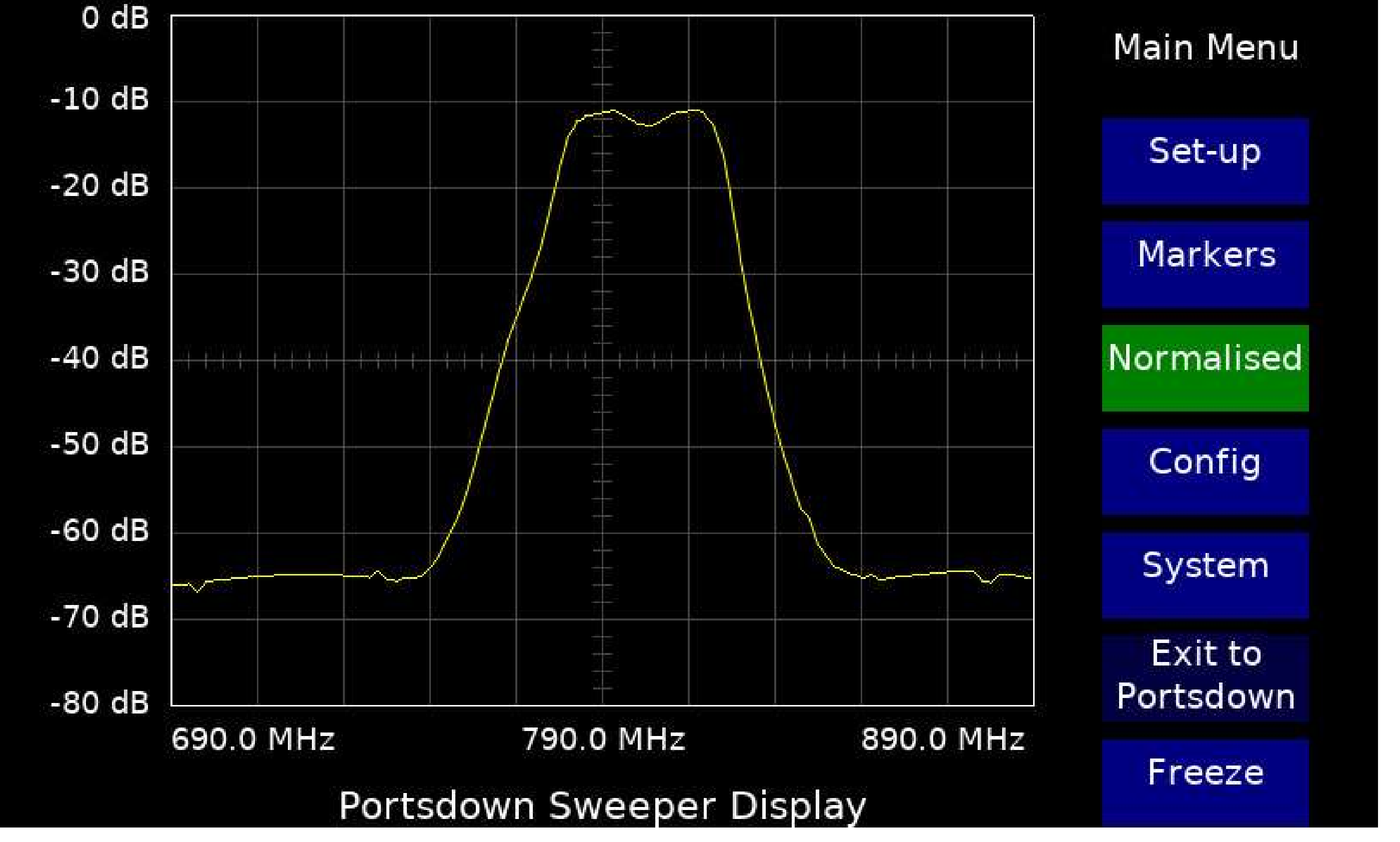


RF Sweeper

- Combine the Signal Generator with the Power Meter
- Add some automation
- Frequency Response Sweeper


Sweeper – How?
BATC
Display Ribbon Cable
Main Menu
Set-up
Markers
Normalise
Config
System
Exit to Portsdown
Freeze
0 dB
-10 dB
-20 dB
-30 dB
-40 dB
-50 dB
-60 dB
-70 dB
-80 dB
387.0 MHz
437.0 MHz
487.0 MHz
Portsdown Sweeper Display
USB Cable
28v
10 dB
10 dB
PGA144
LimeSDR Mini
Attenuator
Device Under Test
Attenuator
Power Head

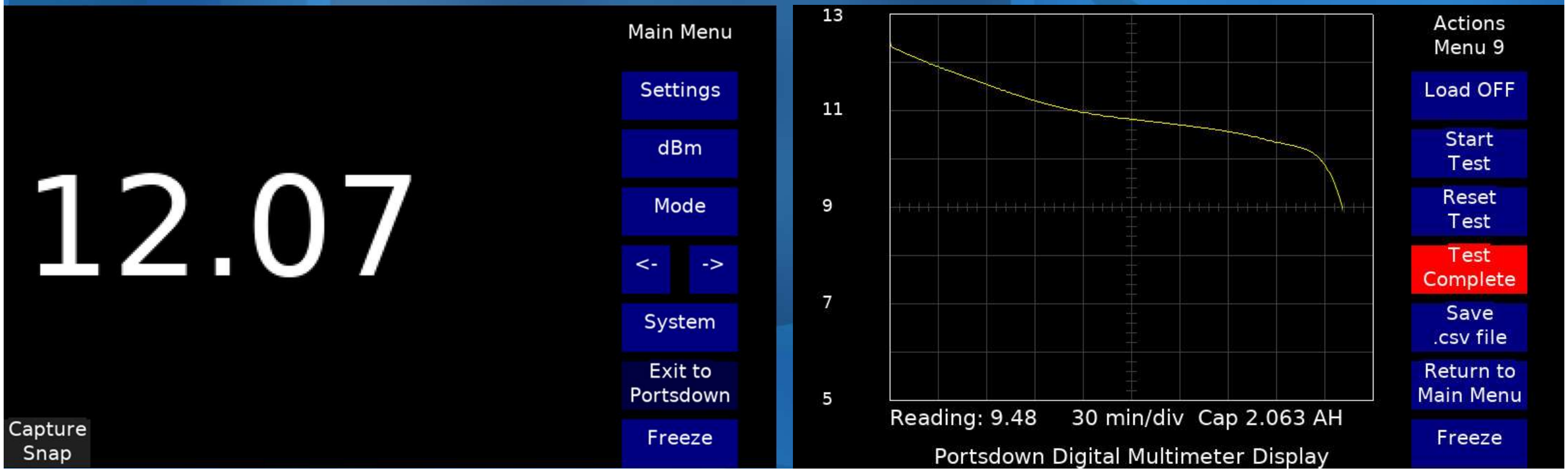
Checking a Filter



DMM Display

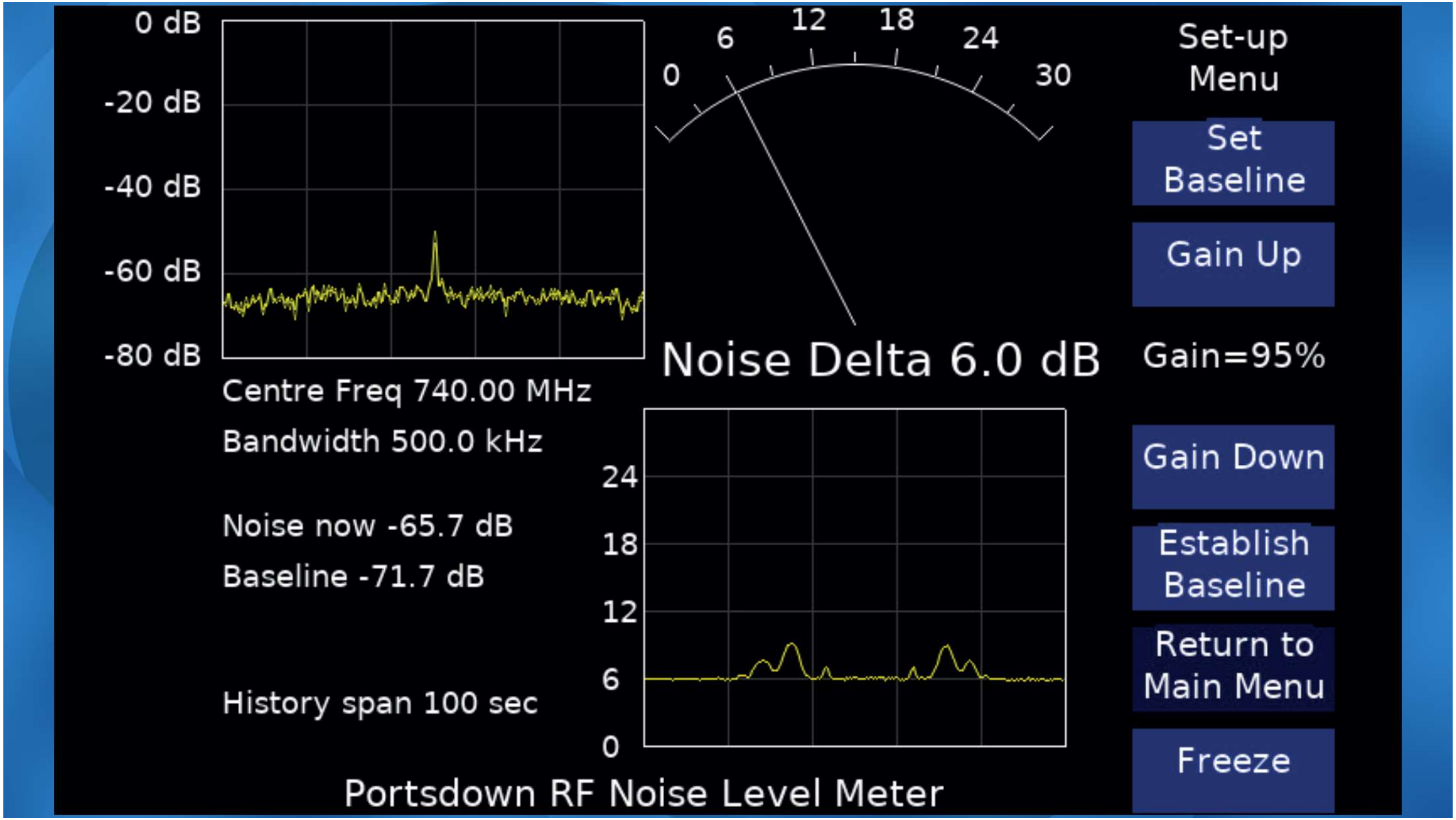
- Uses Parkside PDM300 Meter (£11.99 Lidl)
- Add an opto-isolator on serial output
- Display and Logger

DMM Display

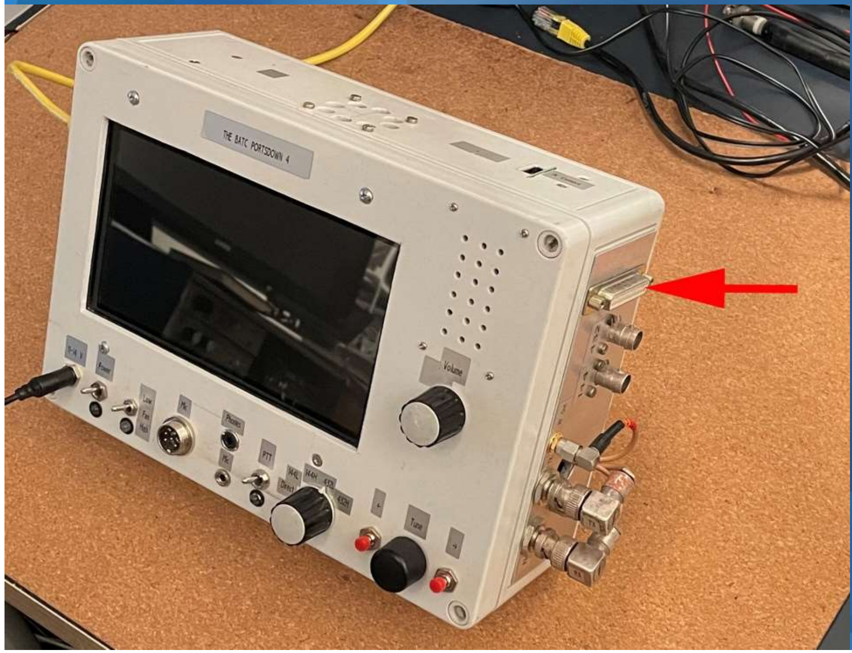

12.07
Main Menu
Settings
dBm
Mode
<-
->
System
Exit to Portsdown
Freeze
Capture Snap
13
11
9
7
5
Reading: 9.48
30 min/div
Cap 2.063 AH
Portsdown Digital Multimeter Display
Actions Menu 9
Load OFF
Start Test
Reset Test
Test Complete
Save .csv file
Return to Main Menu
Freeze

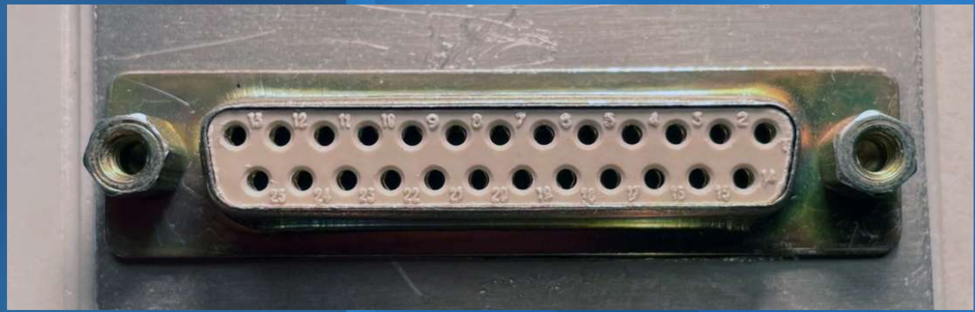
Noise Meter

- Measures
  - Average noise power in set bandwidth
  - Differential noise power
  - Peak carrier against average noise
- Use for Sun noise measurements
- Other uses being developed


0 dB
-20 dB
-40 dB
-60 dB
-80 dB
Centre Freq 740.00 MHz
Bandwidth 500.0 kHz
Noise now -65.7 dB
Baseline -71.7 dB
History span 100 sec
0
6
12
18
24
30
Noise Delta 6.0 dB
Set-up
Menu
Set
Baseline
Gain Up
Gain=95%
Gain Down
Establish
Baseline
Return to
Main Menu
Freeze
Portsdown RF Noise Level Meter

Portsdown Interface





- Single interface for spi Power, Serial and Data
- Defined in CQ-TV

Raspberry Pi Availability

- Improving
- Due to improve even more in Q3 2023
- Use rpilocator.com

rpilocator @rpilocator · Oct 17
Stock Alert (DE): RPi 4 Model B - 1GB RAM is In Stock at Welectron
rpilocator.com/?instock #PI4

- Do not buy from eBay!

Summary

- Raspberry Pi, Touchscreen and peripherals provide a very capable platform to support DATV
- Peripherals MUST be the exact type – its not like Windows
- Open source (with one exception – DVB-T RX)
- BATC Wiki is primary information source
- Go and play with the applications and hardware

Questions