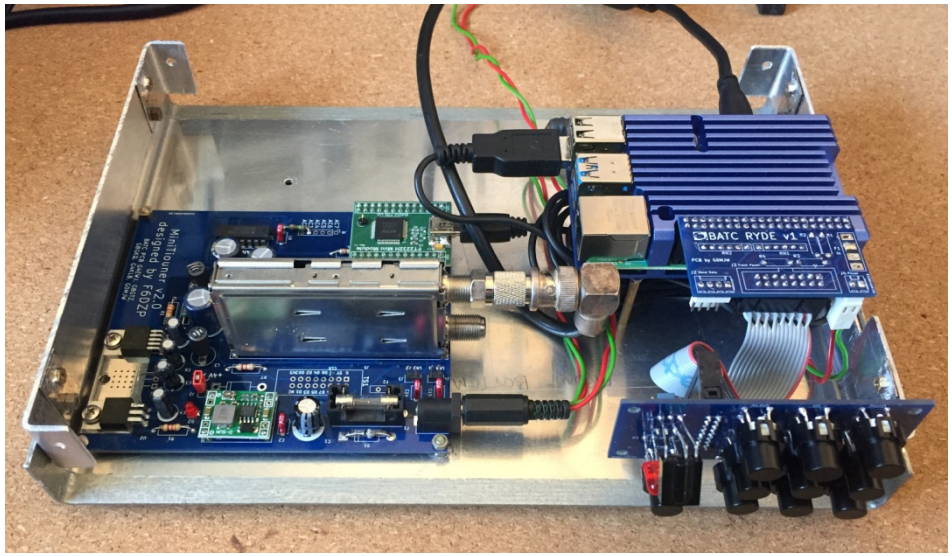
Multi-Channel DATV Receiver

Intro - Dave, G8GKQ

Technical – Brian, G4EWJ

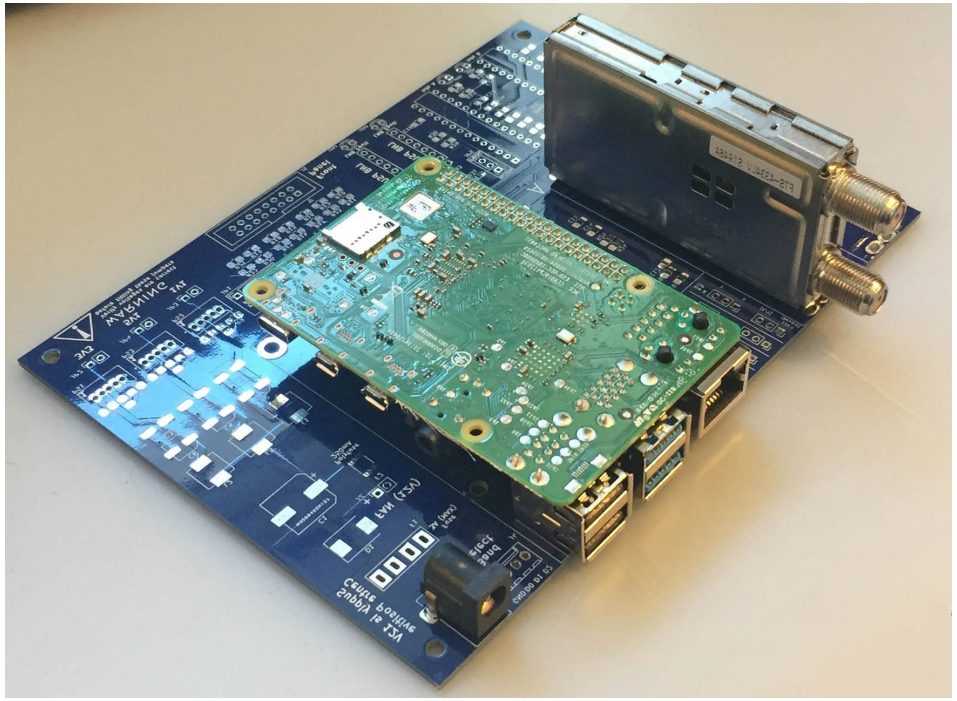
The Linux Receiver Story So far

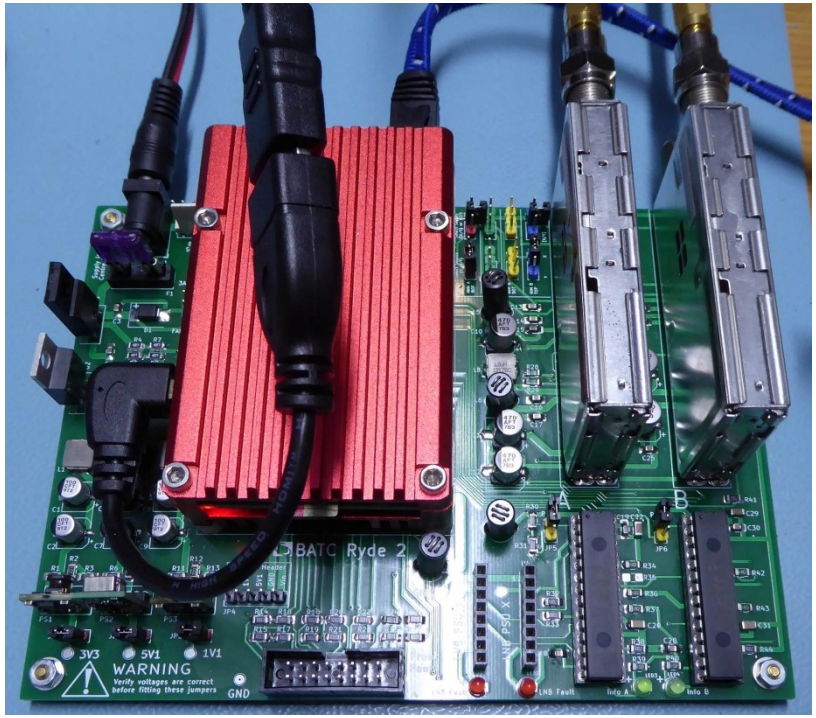
- MiniTiouner and USB
  - LongMynd as a Linux App
  - LongMynd in Portsdown
  - Ryde (Mk 1) Set-top Box



The Linux Receiver Story continues

- Single PCB with Tuner and RPi
  - Ryde Mk 2 (single channel)
  - Winter Hill (4 channel, 2 tuner)





The WinterHill Project

Interfacing the Serit FTS4334L NIM to a Raspberry Pi

Brian Jordan, G4EWJ
BATC CAT20

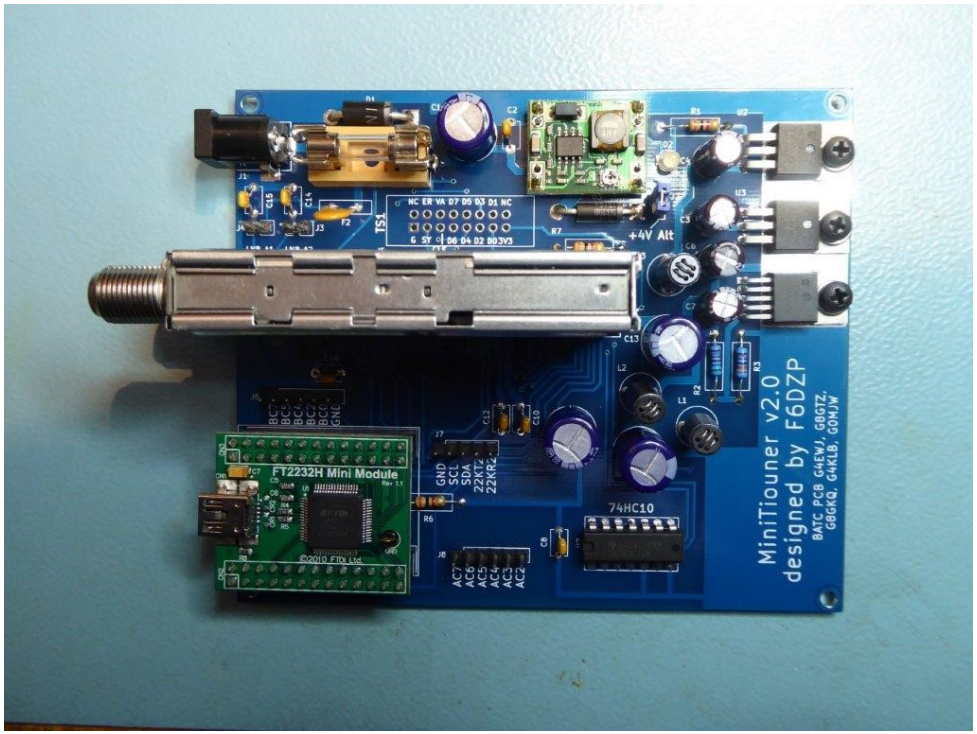
MiniTiouner

Designed by F6DZP

Serit FTS4334L NIM

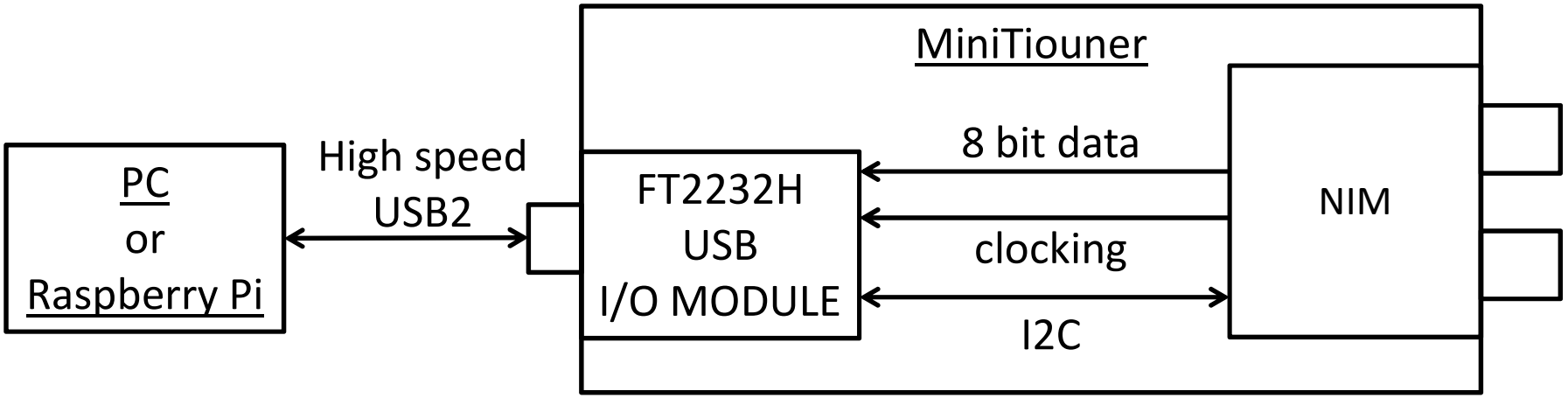
FT2232H USB Interface

PCB by G0MJW



- The Serit FTS4334L NIM (network interface module) is the most popular front end device for receiving DATV
- It has 2 completely independent receivers
- Each receiver is capable of symbol rates from 35k to 45M
- The tuning range for DATV use is 144-2450MHz
- Receive software is available from F6DZP (PC) and M0HMO (Linux)
- To interface to Windows or Linux via USB, the NIM is built into a MiniTiouner, designed by F6DZP

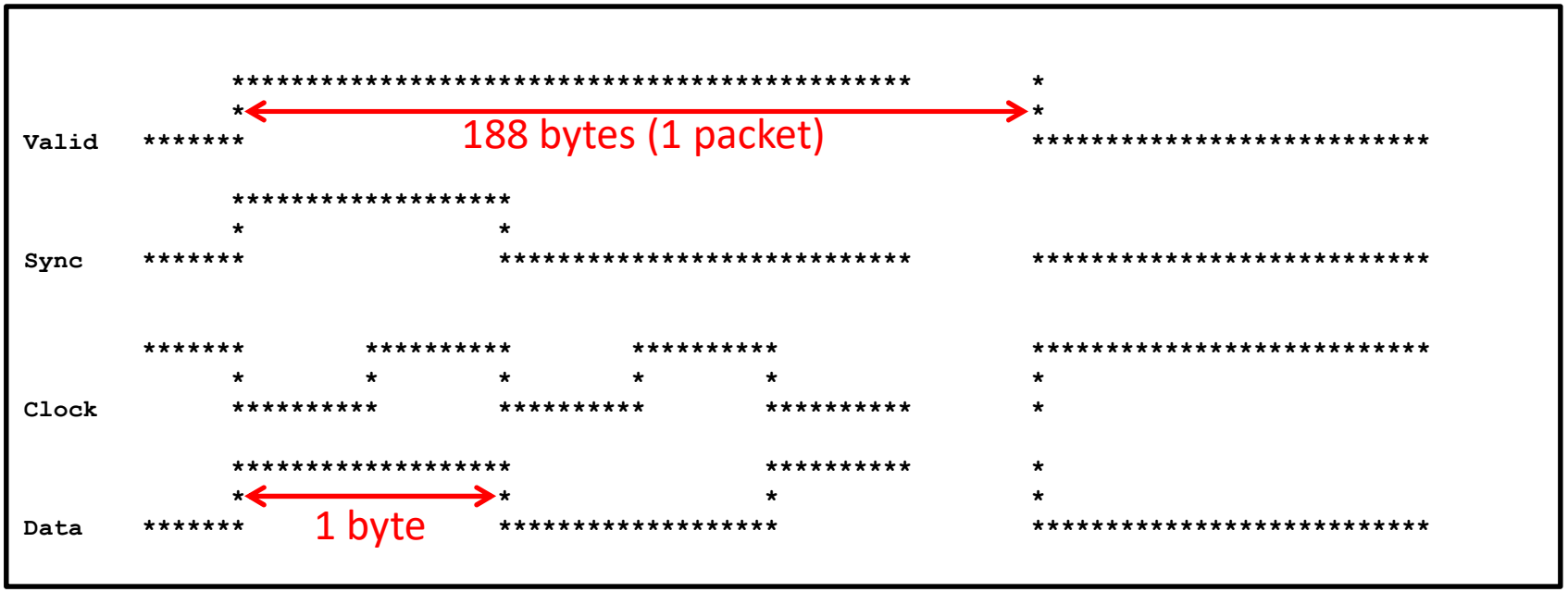
MiniTiouner Data Connections



- FT2232H USB Input / Output Module
- Can be configured to several types of port
- Quite expensive – about £25
- Available much cheaper as a chip, but very small and not suitable for homebrew

Can it be replaced by something cheaper?

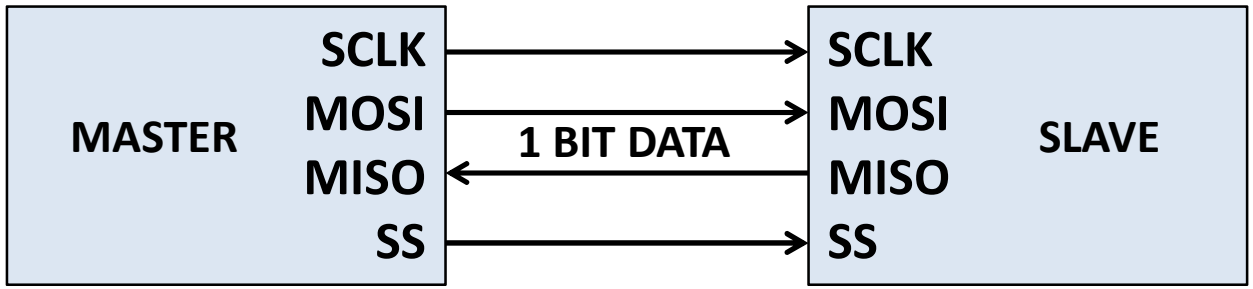
Waveforms between NIM and FT2232H in a MiniTiouner



- This is very similar to the master side of the SPI master-slave protocol
- By inverting the VALID signal and sending 1 bit at a time, we can use SPI
- Can the NIM do this? YES, it is very configurable

SPI Protocol

- SPI is a single bit master-slave protocol, used by many peripheral chips.
- It works on a ‘pulley’ system, where the master sends a byte and receives a byte at the same time.
- The master enables the slave via the SS select line and provides the clock.
- Each slave must have a separate SS line, but can share the other lines.

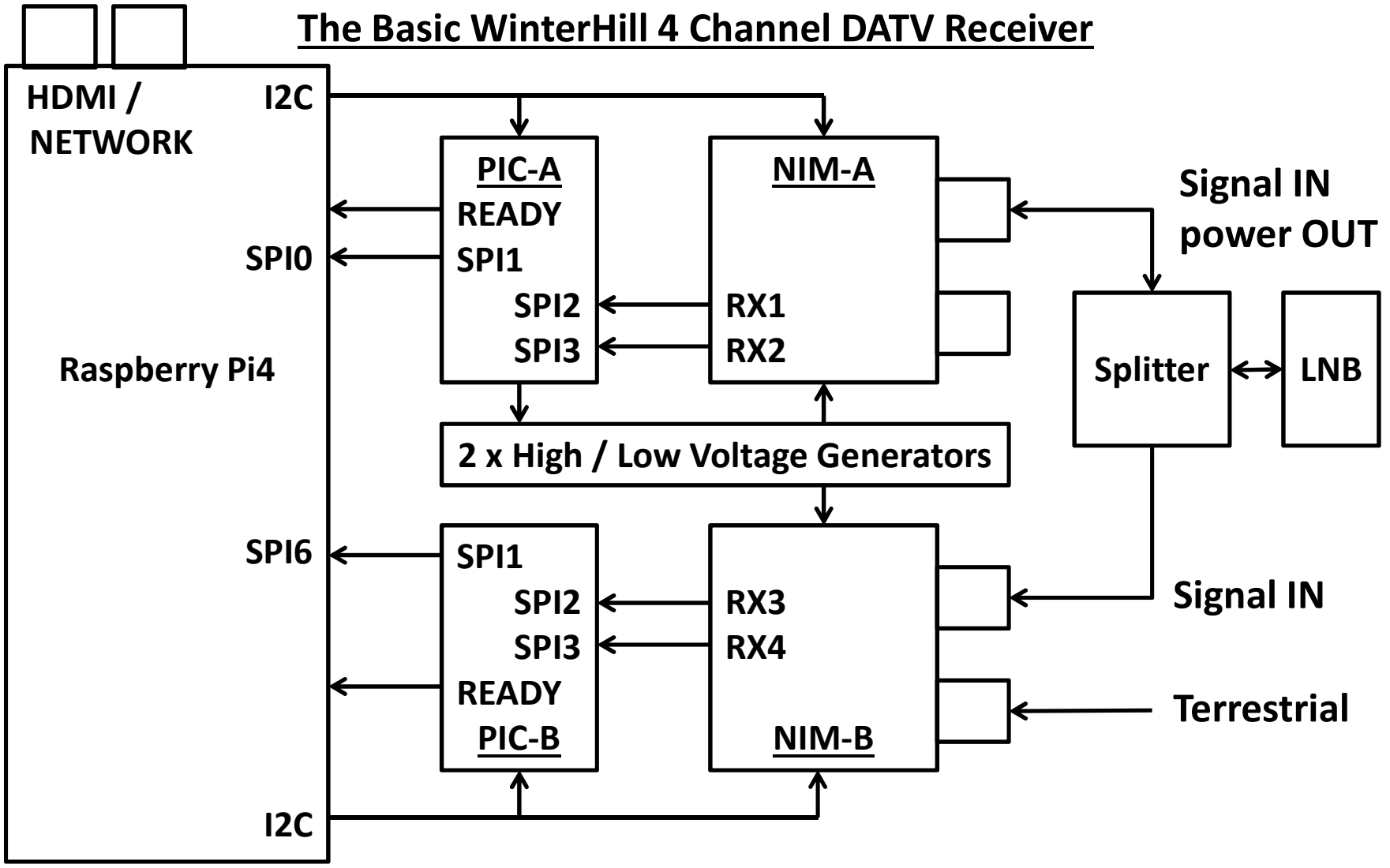


Connecting the NIM to a Raspberry Pi using SPI

- The RPi4 has 5 enhanced SPI ports, although they cannot all be used at once
- They have interrupt and DMA (direct memory access) capability, which reduces the software overhead
- So we just connect the NIM directly to the RPi and the rest is software? Unfortunately NO. Like the NIM, the RPi SPI ports operate only in master mode and 2 masters cannot transfer data to each other
- We still need something (cheap) to interface between the NIM and the RPi
- A PIC24FJ256GA702 microcontroller costs £2:

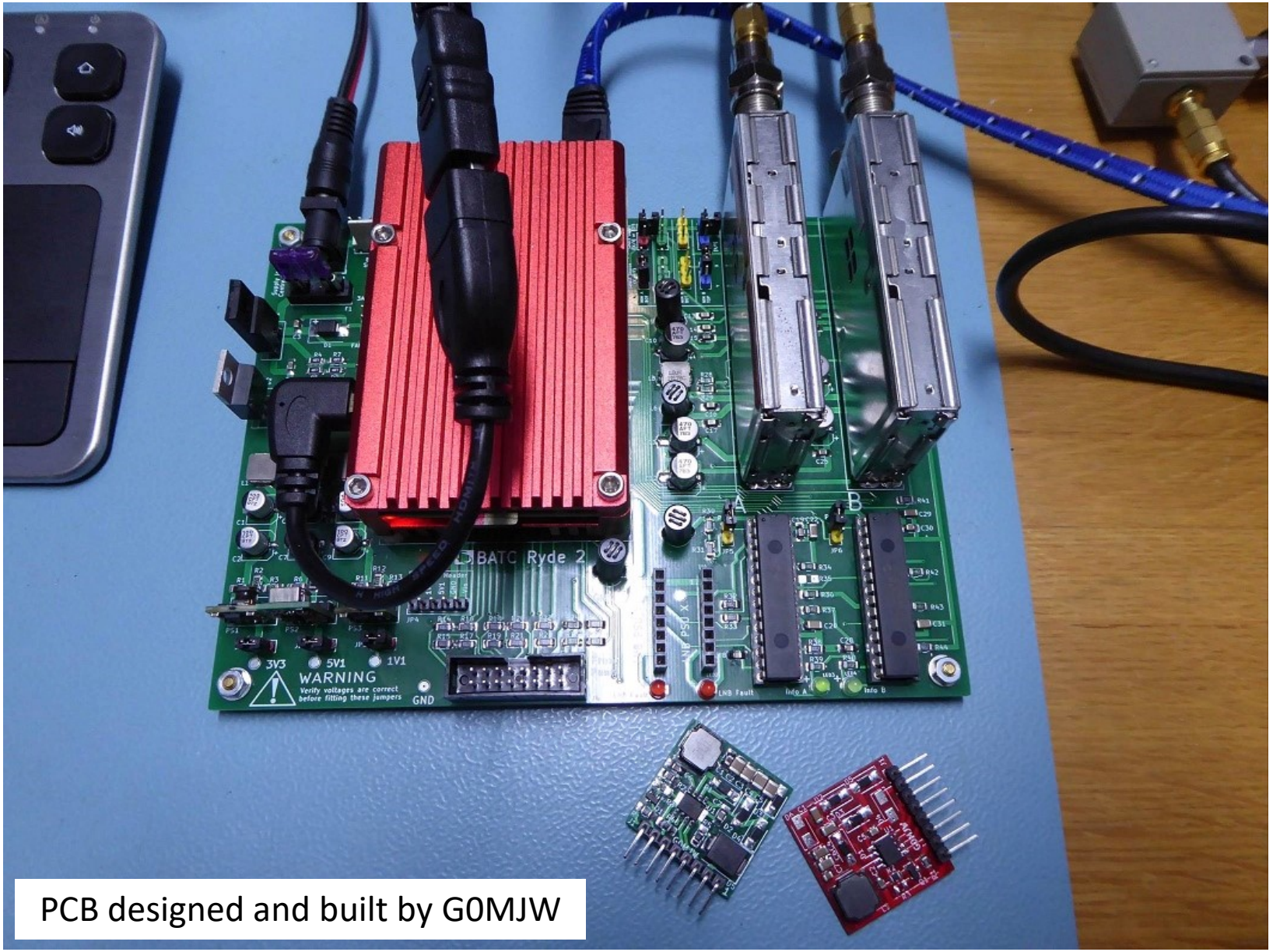
  3 x SPI master/slave ports with interrupt and DMA capability
  Maximum SPI speed is around 20MHz
  Can interface to both receivers in the NIM and combine them
  16k bytes of ram for buffering
  Available in 28 pin DIP format, so can be socketed

The Basic WinterHill 4 Channel DATV Receiver



Either RX in a NIM can be connected to either F socket by software commands, so the top 2 F sockets can be used for QO-100, leaving the lower 2 sockets available for terrestrial. The PICs can be programmed in-circuit by the RPi.

Ryde / WinterHill PCB



PCB designed and built by G0MJW

WinterHill Network Operation

The WinterHill Raspberry Pi4 software is based on the LongMynd software by M0HMO, adapted by G4EWJ for SPI connections and multiple NIMs

All command, status and transport streams are via network UDP protocol

It can display locally on the Raspberry Pi with VLC, or just act as a network receiver server

The software is given a base IP port number and all port usage is relative to this

E.g. Base port = 9900:

port 9911: listen for RX1 QuickTune commands
port 9914: listen for RX4 QuickTune commands
port 9921: send transport stream from RX1
port 9924: send transport stream from RX4
port 9931: send LongMynd format status for RX1
port 9902: send extended Longmynd format status for all receivers
port 9904: send a summary of parameters for all receivers
port 9910: listen for pseudo QuickTune commands (with an RX number)
port 9910: listen for scan information from extended QuickTune

Raspberry Pi VLC Display

WinterHill can receive and output 4 transport streams at the same time. These can be sent to one or more PCs, displayed on the RPi4 Desktop, or both.

There are some limitations displaying with VLC on the RPi:

The hardware H.264 and H.265 decoders are very efficient, but will not display some signals, most noticeably the QO-100 beacon.

The hardware H.265 decoder exhibits a colour plane slip on some signals.

VLC locks up when trying to display more than one H.265 signal when using the hardware decoder.

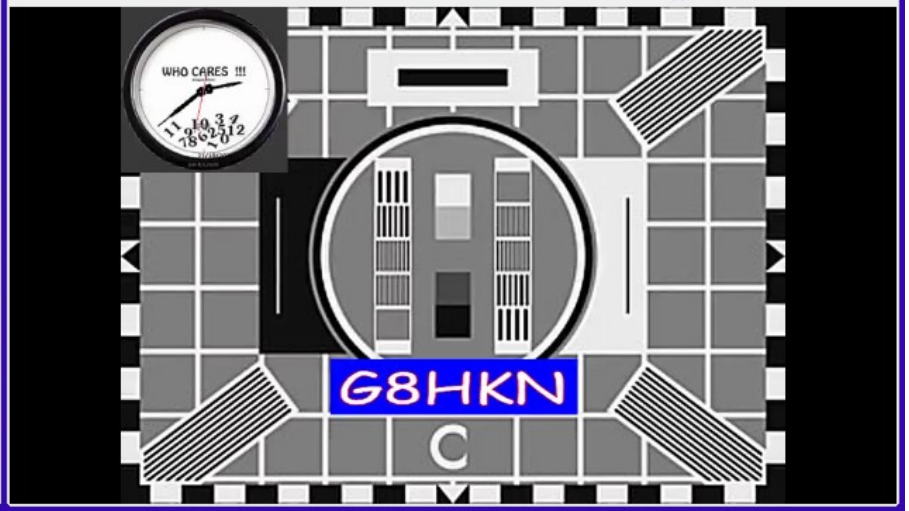
The FFMPEG software decoder can be used, but it consumes a lot of cpu power.

The RPi SPI interface software needs to be improved, as it takes more cpu power than it should. If the system gets very busy, SPI data can be lost.

An integrated QuickTune, terrestrial tune and quad display application for the PC is under development.

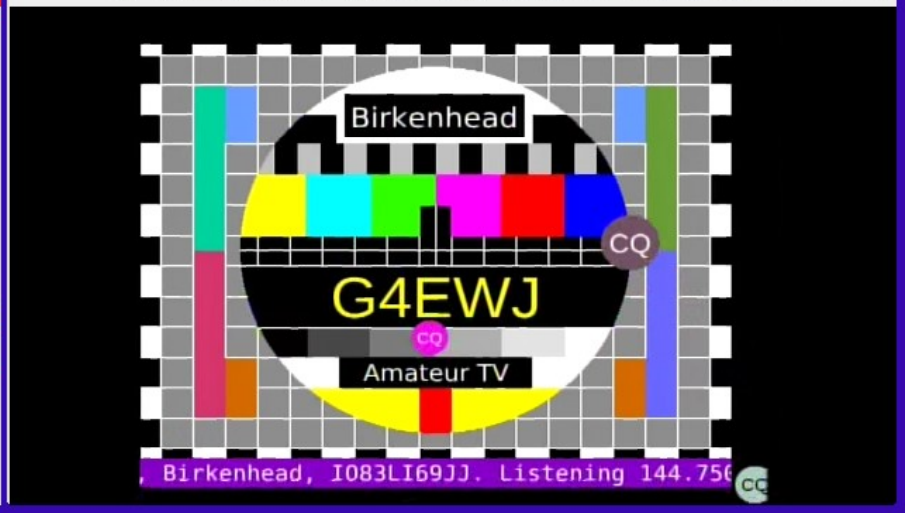
1: A71A M10.6 D5.9 S2H4 1.500M 1500 QP4/5 T

2: G8HKN M8.4 D5.3 S2H4 7.732M 332 QP2/3 T



3: F6BIG M6.7 D3.6 S2H5 9.224M 332 QP2/3 T

4: G4EWJ M26.7 D20.7 SH2 9.024M 1500 QP3/4 B



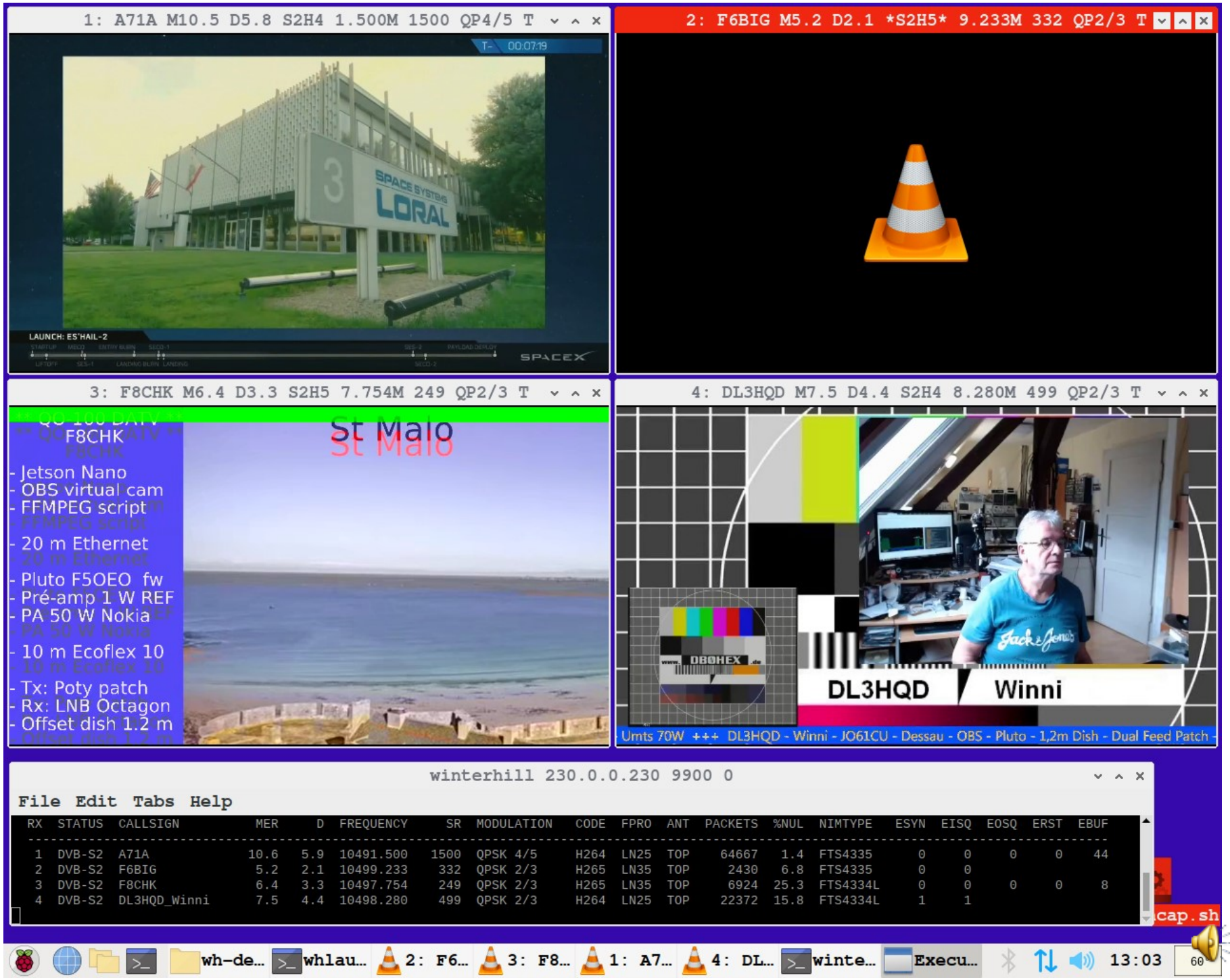
winterhill 230.0.0.230 9900 0

File Edit Tabs Help

RX	STATUS	CALLSIGN	MER	D	FREQUENCY	SR	MODULATION	CODE	FPRO	ANT	PACKETS	%NUL	NIMTYPE	ESYN	EISQ	EOSQ	ERST	EBUF
1	DVB-S2	A71A	10.7	6.0	10491.500	1500	QPSK 4/5	H264	LN25	TOP	276719	1.2	FTS4335	2	2	2	0	63
2	DVB-S2	G8HKN	8.4	5.3	10497.732	332	QPSK 2/3	H264	LN35	TOP	50135	8.1	FTS4335	2	2			
3	DVB-S2	F6BIG	6.7	3.6	10499.224	332	QPSK 2/3	H265	LN35	TOP	10947	11.0	FTS4334L	0	0	0	0	10
4	DVB-S	G4EWJ	26.7	20.7	1249.024	1500	QPSK 3/4	H262		BOT	169219	6.7	FTS4334L	0	0			

cap.sh

wh-de… whlau… 1: A7… 2: G8… 4: G4… 3: F6… winte… Execu… 14:33 65


1: A71A M10.5 D5.8 S2H4 1.500M 1500 QP4/5 T
T- 00:07:19
SPACE SYSTEMS
LORAL
LAUNCH: ES'HAIL-2
SPACEX
2: F6BIG M5.2 D2.1 *S2H5* 9.233M 332 QP2/3 T
3: F8CHK M6.4 D3.3 S2H5 7.754M 249 QP2/3 T
F8CHK
- Jetson Nano
- OBS virtual cam
- FFMPEG script
- 20 m Ethernet
- Pluto F5OEO fw
- Pré-amp 1 W REF
- PA 50 W Nokia
- 10 m Ecoflex 10
- Tx: Poty patch
- Rx: LNB Octagon
- Offset dish 1.2 m
St Malo
4: DL3HQD M7.5 D4.4 S2H4 8.280M 499 QP2/3 T
DL3HQD
Winni
Umts 70W +++ DL3HQD - Winni - JO61CU - Dessau - OBS - Pluto - 1,2m Dish - Dual Feed Patch
winterhill 230.0.0.230 9900 0
File Edit Tabs Help
RX STATUS CALLSIGN MER D FREQUENCY SR MODULATION CODE FPRO ANT PACKETS %NUL NIMTYPE ESYN EISQ EOSQ ERST EBUF
1 DVB-S2 A71A 10.6 5.9 10491.500 1500 QPSK 4/5 H264 LN25 TOP 64667 1.4 FTS4335 0 0 0 0 44
2 DVB-S2 F6BIG 5.2 2.1 10499.233 332 QPSK 2/3 H265 LN35 TOP 2430 6.8 FTS4335 0 0
3 DVB-S2 F8CHK 6.4 3.3 10497.754 249 QPSK 2/3 H265 LN35 TOP 6924 25.3 FTS4334L 0 0 0 0 8
4 DVB-S2 DL3HQD_Winni 7.5 4.4 10498.280 499 QPSK 2/3 H264 LN25 TOP 22372 15.8 FTS4334L 1 1
wh-de...
whlau...
2: F6...
3: F8...
1: A7...
4: DL...
winte...
Execu...
13:03

Credits

F6DZP:	FT2232H MiniTioune hardware and PC software
M0HMO:	LongMynd software for USB NIM control on Linux
M0DTS:	QuickTune QO-100 spectrum display and MiniTioune commander
G0MJW:	BATC MiniTiouner MK2 pcb, WinterHill pcb and power supplies
G4EWJ:	SPI NIM interface, PIC software and LongMynd software mods

The system is named in memory of Brian G3SMU, who was a huge presence in ATV and narrowband operation on VHF to microwave from his Winter Hill QTH in Lancashire, north-west England.

The WinterHill Project

Interfacing the Serit FTS4334L NIM to a Raspberry Pi

Brian Jordan, G4EWJ
BATC CAT20