








ATV on 5.6, 10 and 24 GHz

Dave G8GKQ







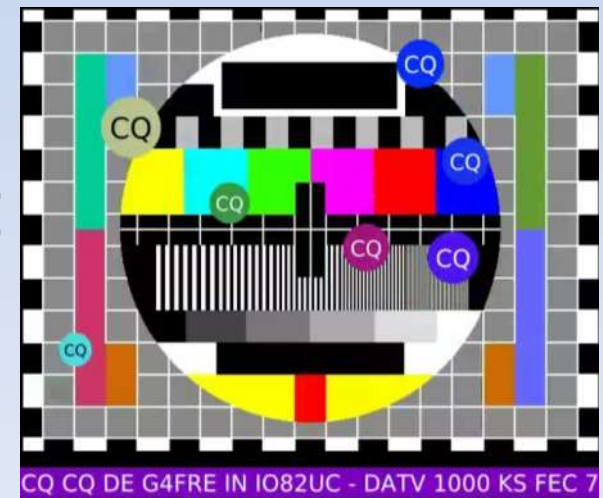
Topics

-  What is ATV?
-  Transmission Modes
-  Current Trends
-  FM ATV on 5.6 GHz
-  Digital ATV
-  Transverting to 10 GHz and 24 GHz
-  Satellite ATV








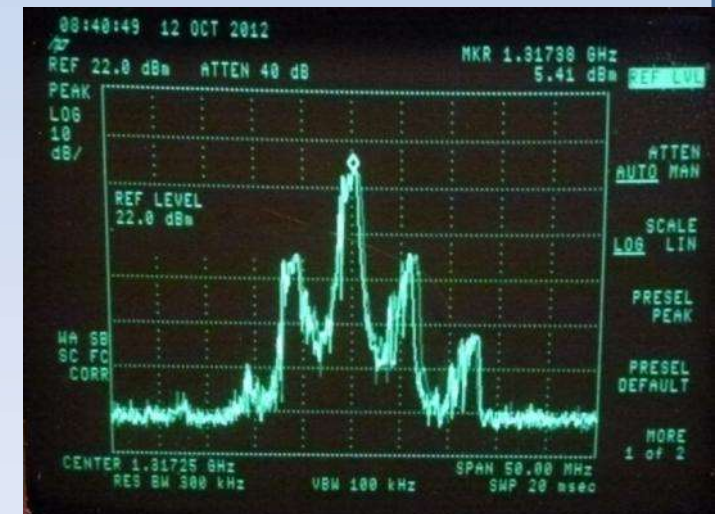
What is Amateur Television?

-  Includes video production, editing and transmission
-  Covers classic camera restoration right through to transmitting live pictures from a Raspberry Pi on a tethered drone.
-  Real freedom to experiment
-  ATV generally refers to fast-scan TV









Transmission Modes

-  Amplitude modulation (DSB/VSB)
 - Now rarely used due to bandwidth
-  Frequency Modulation
 - Lower Deviation still used on 23cms and 3cms
 - Higher Deviation used on 6cms
-  Digital DVB-S and DVB-S2
 - All bands, various bandwidths
-  Digital DVB-T and GMSK
 - Rarely used in UK
-  Internet Streaming











Current Trends

-  More home-built Digital Equipment
-  Use of Digital to “add” path gain
-  Use of drone FPV FM TV equipment
-  High Definition digital (Pi Cam or Webcams)
-  Existing Analogue and Digital Repeaters
-  Repeater and personal streaming



Band-by-Band

-  71 & 146 MHz
 - The “new” ATV bands
 - RB-TV
-  70cms
 - Digital only on 437MHz
-  23cms
 - Analogue and digital
 - Activity on repeaters and simplex
-  13cms
 - Still room after PSSR!
 - Repeaters and simplex

-  3.4 GHz
 - Digital only
 - Excellent results
-  5.6 GHz
 - FM ATV for under £20
 - Repeater inputs
-  10 GHz
 - Repeaters and simplex
 - FM and DATV
-  24 GHz
 - DATV
 - 120 kms is the goal







5.6 GHz FM ATV

-  Why
-  What kit?
-  How
-  Aerials
-  Enhancements
-  Operating
-  Next steps?
-  Q & A





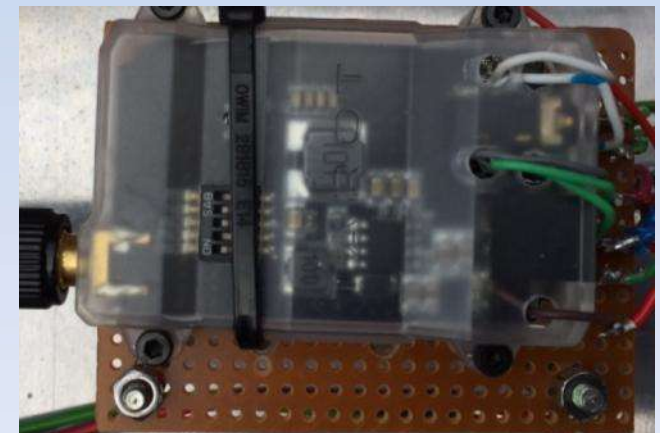
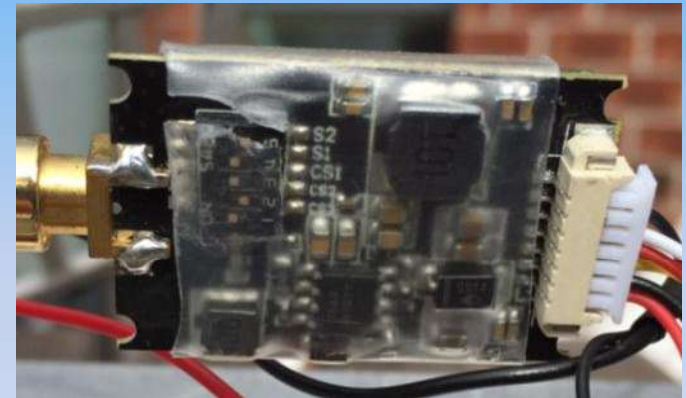
Why

-  Cheap kit available for drone FPV use
-  New technical challenge
-  Easily accessible
-  Very simple






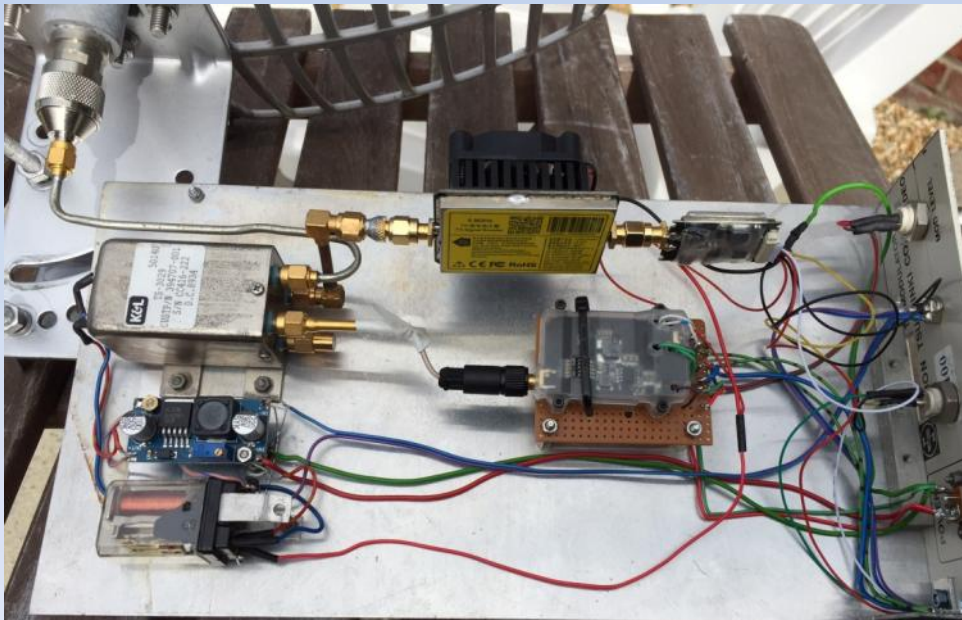
What Kit

-  Transmitters typically 600mw output
-  Video + Audio in, RF out
-  Preset Channels
-  Receivers have preset channels
-  RF in, video and audio out
-  All runs from 12v








How

-  Wire up power, video and audio
-  Connect aerial
-  Changeover relay?



How

-  Wire up power, video and audio
-  Connect aerial
-  Changeover relay?
-  Point aerial
-  Analogue monitors



Aerials

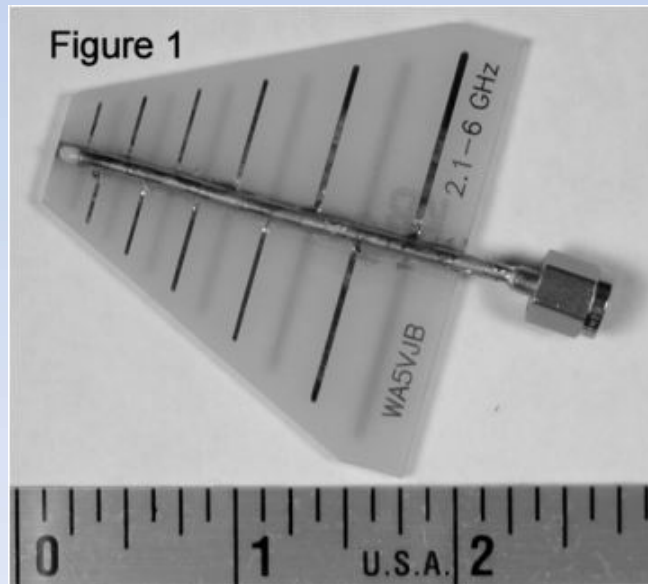
- Good selection of WiFi aerials available
- Sky dish with a WA5JVB feed
- Dipole at feedpoint of 10 GHz dish?



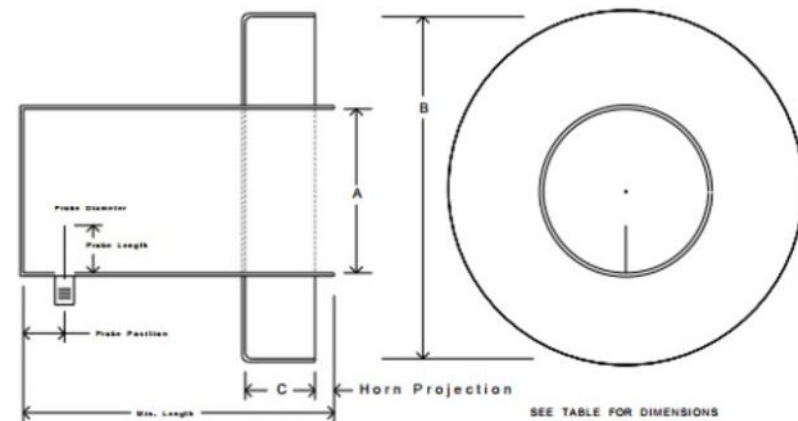
Dish Feeds



G4NNS



WA5VJB



Frequency	A	B	C	Reference
1296 MHz	178 mm	419 mm	121 mm	3,9
2304 MHz	100 mm	240 mm	62.5 mm	3,9
3456 MHz	66 mm	160 mm	42 mm	10
5760 MHz	39 mm	90 mm	26.5 mm	11,12
10368 MHz	20.5 mm	50 mm	12.5 mm	13

Figure 6.3-6 VE4MA (Kumar) Feed

Enhancements

- Power Amplifiers available on eBay
- 600mW to 2.25 W for £20



Enhancements



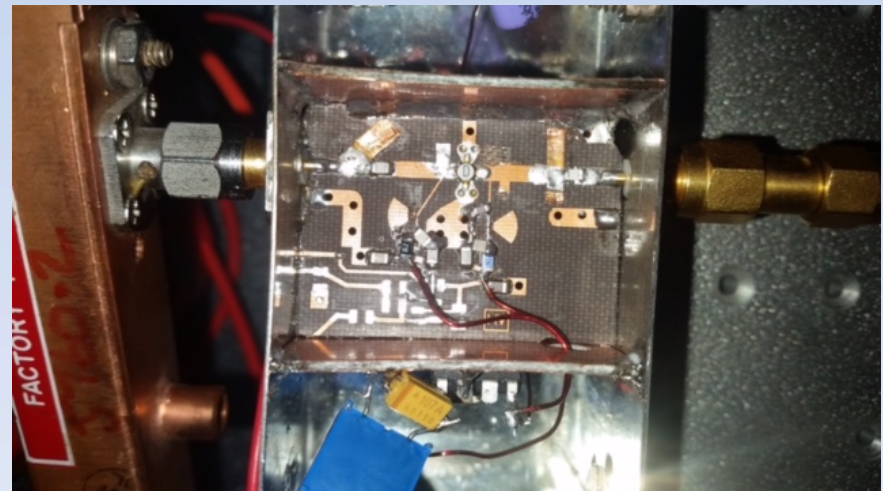



-  Receive preamps
-  Franco's finest

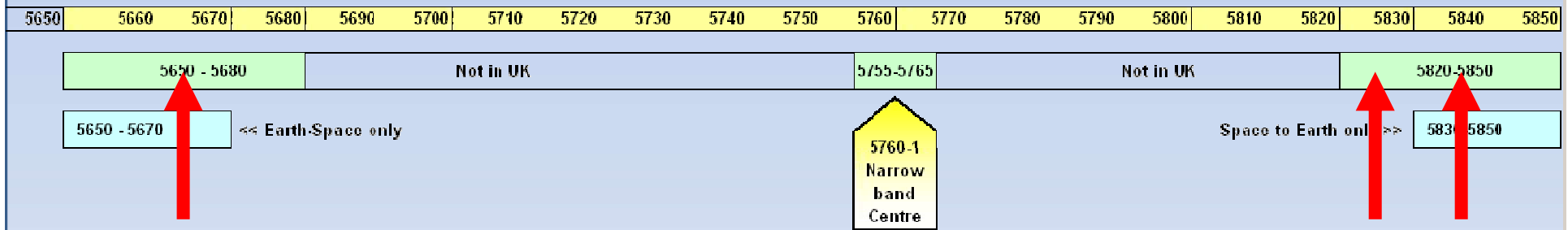


PHOTO 1: G4DDK's 5.7GHz preamp made from a 'Franco' board.






Operating

-  Frequency: 5665 MHz
-  Audio WB-FM using 5825 and 5840 MHz
-  Some modules do not cover 5665



-  No 5.6 GHz amateur satellites yet

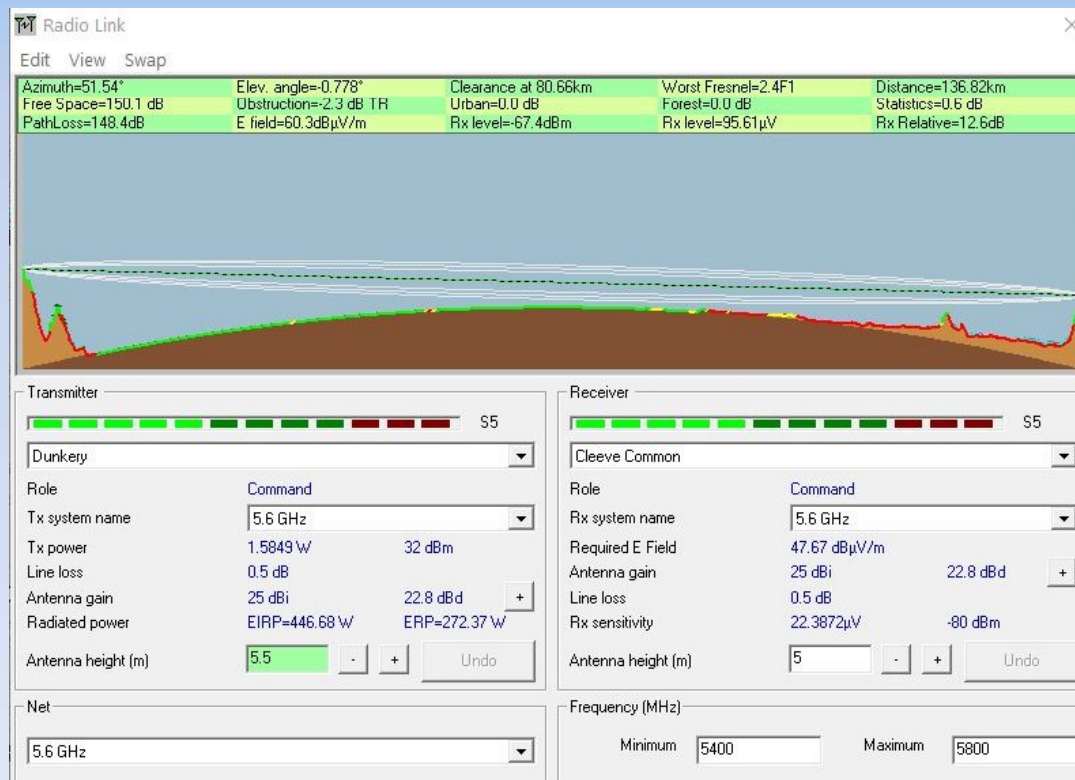
Operating

-  Horizontal Polarity
-  Dishes typically 4 – 8 degrees beamwidth
-  Peak on sound subcarrier quieting?



Paths

Dunkery to Cleeve Common
136 km LoS










Paths





Blorenge to Win Green
111 km obstructed



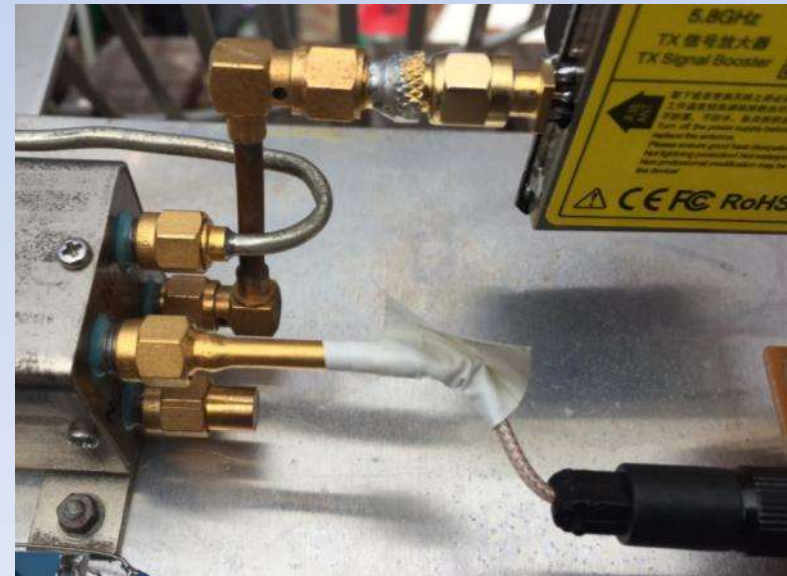
Known Users/Builders

-  G8GKQ, G8GTZ, G0UHY, G8XZD, G4UVZ, G3VPF, G8VPG, G4FRE
-  GB3KM, G1LPS, M0DTS, G8PEF, G8VAT, G8AGN, G0RPH, M1EGI, M0MLJ, G1ZIM
-  G0LGS, M0RKX and G4NSV
 - WBFM Audio around Cheltenham
-  G4JLG, M0UFC, MW1FGQ, G6GVI
 - Bolton Wireless Club and PW "Siren" Article
-  G8XYJ (Hereford) and G8BYN (Yorks)
-  G0HIK, M0KPW - Furness Radio Club
-  Northern Ireland





Next Steps

-  Digital: ADALM Pluto or up-conversion
-  Linear amplifiers for digital?
-  Check inter-carrier sound: 6.0 and 6.5 MHz
-  Don't forget: RP-SMAs

	SMA	RPSMA
Male		
Female		



ATV is going Digital

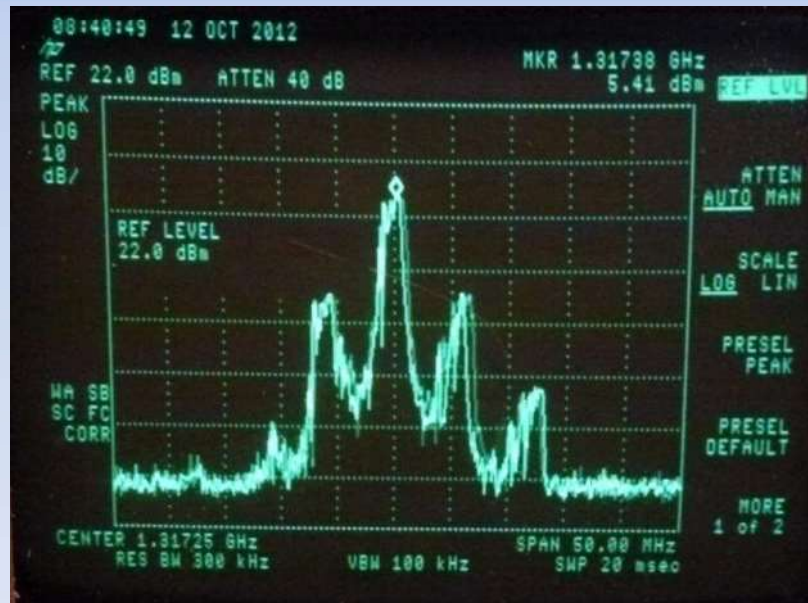
-  The move to digital is happening
 - Experiments for over past 12 years
 - Pressure on spectrum eg 13cms
 - More modern image and new challenge
-  Broadcast standards are being adopted and adapted
-  DVB-S at 66KS > 4 MS
 - 100 KHz > 6 MHz Bandwidth
-  Significant bandwidth gains and better pictures – when it's there!



Analogue vs Digital ATV

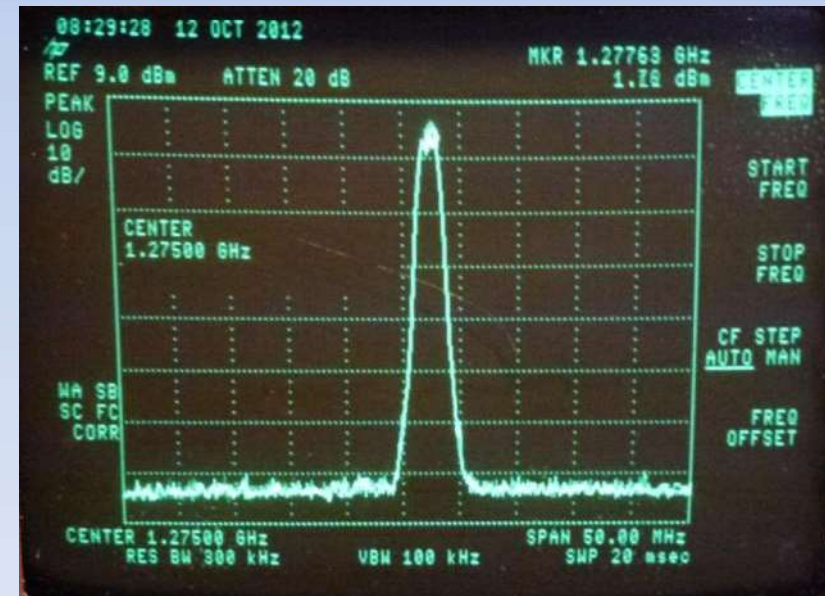
FM analogue

- 16 MHz deviation
- ~ 16 MHz



DVB-S QPSK,

- 1.6 MS, 1/2 FEC
- ~ 2 MHz



Analogue vs Digital ATV



Reduced Bandwidth (RB-TV)

- Not enough space for "normal" DVB-S on the lower bands so we invented RB-TV
- RB-TV is "normal" fast scan DATV at < 1 MS
- Live TV in ~ 450 KHz bandwidth (333 Kbit/s video)
- Based on DVB-S standard BUT...
 - Benefits from MPEG-4 (or H265) encoding for transmit
 - "Normal" satellite RX won't work below 1 MS
- So the ATV community has developed TX and RX products
 - MiniTiouner RX
 - Portsdown DATV TX
- RB-TV will go when FM signals are S9



Generating DATV

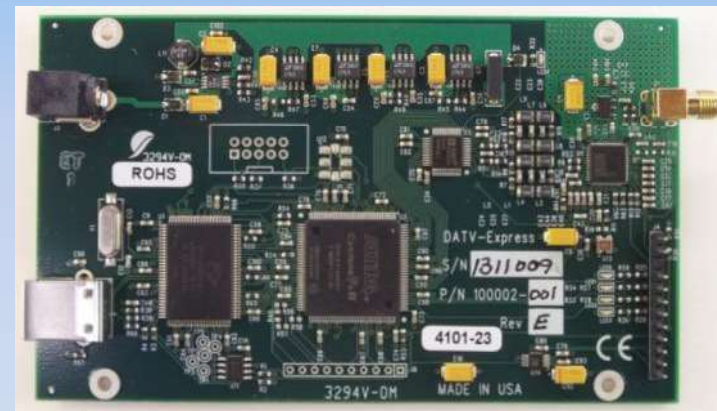
 Ex-commercial encoders

 Amateur Market:

- SR Systems Equipment
- DATV Express
- BATC DTX-1

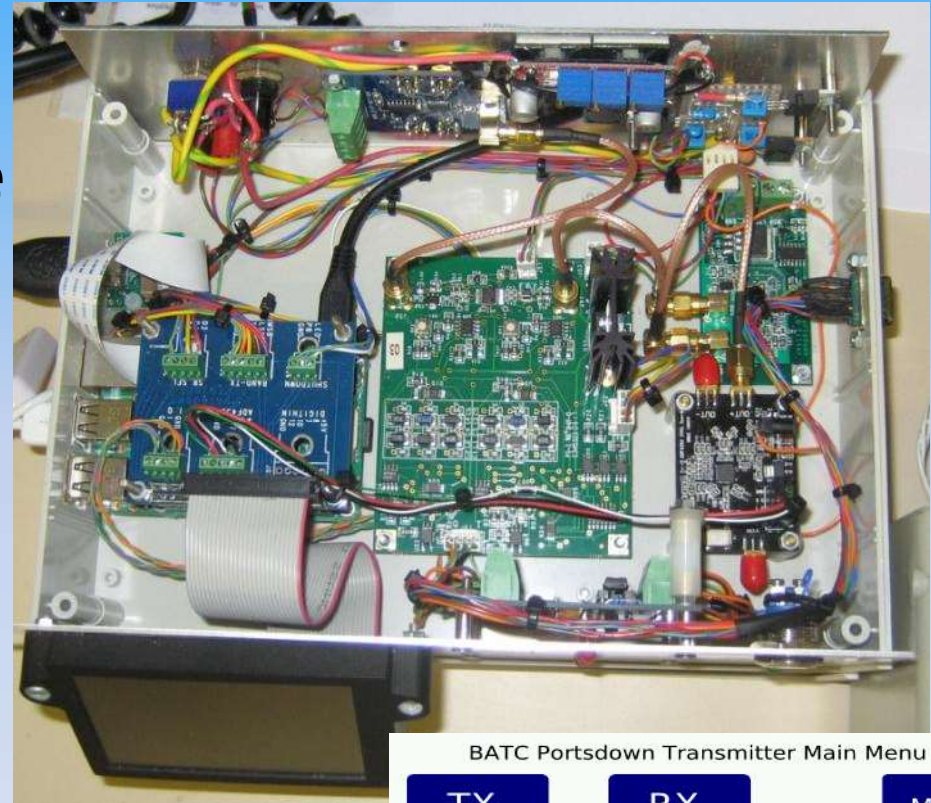
 “Homebrew”

- DigiLite – PC-based, external modulator
- DigiThin – RPi-based RB-TV only
- Portsdown – RPi-based, full bandwidth



Portsdown DATV project

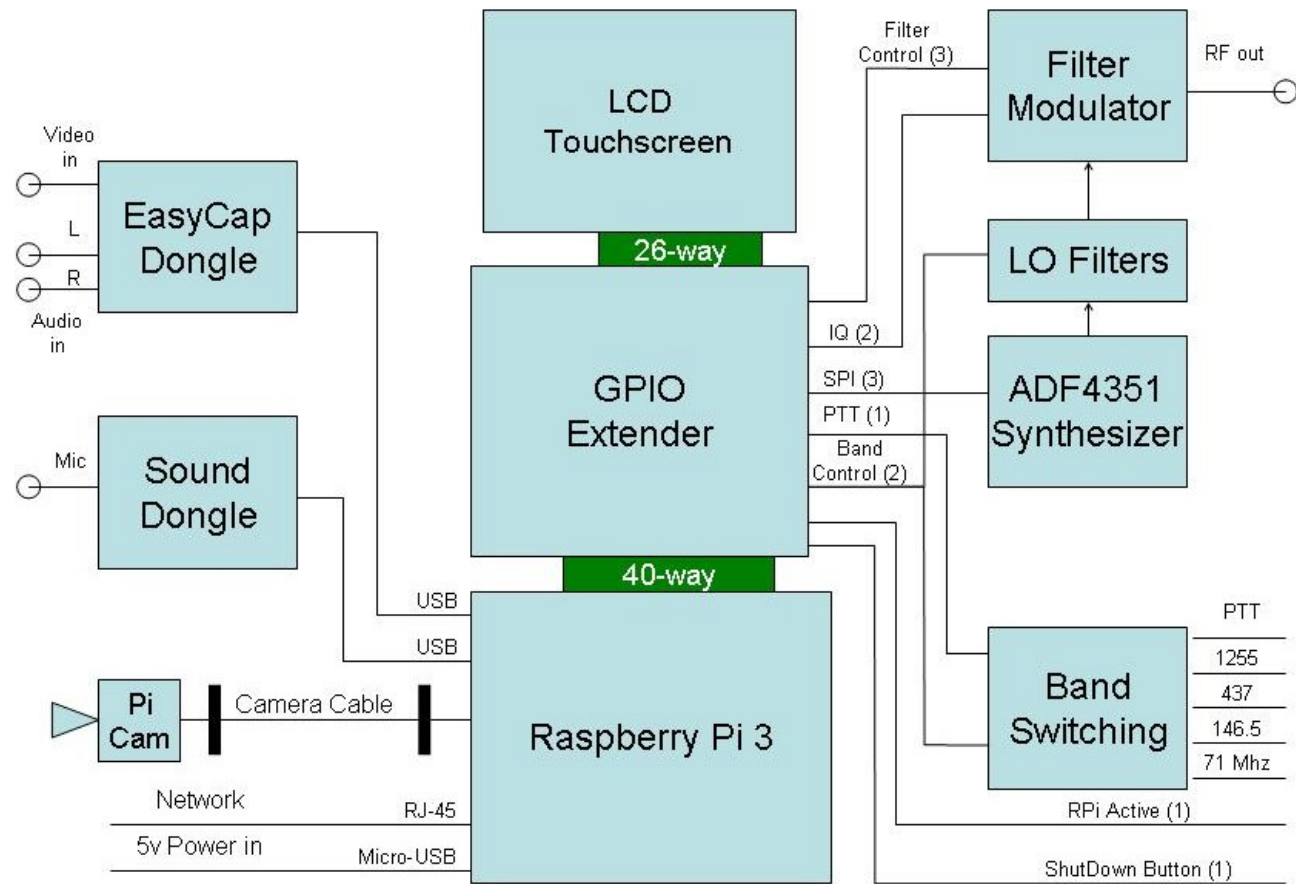
-  The BATC project to bring DATV to everyone
 - All the common modes and bandwidths
-  Based around a RPi3
 - MPEG encoding
 - Touch screen control
-  Requires some hands on construction
 - "I made that!"
-  Easy way to get on air at low cost



BATC Portsdown Transmitter Main Menu

TX		RX		M2
Modulation	Encoder	Output to	Format	Source
DVB-S	MPEG-2	UGLY	4:3	PI Cam
Freq	Sym Rate	FEC	Band/Tvtr	Att Level
1255 MHz	4000	7/8	23_cm	-10.00
EasyCap	Caption	Audio	Atten	
Comp Vid	On	Auto	NONE	
Preset 1	Preset 2	Preset 3	Preset 4	Store
146.5_333	437_1MS	1255_HD	437-Ugly	Preset





Portsdown DATV system

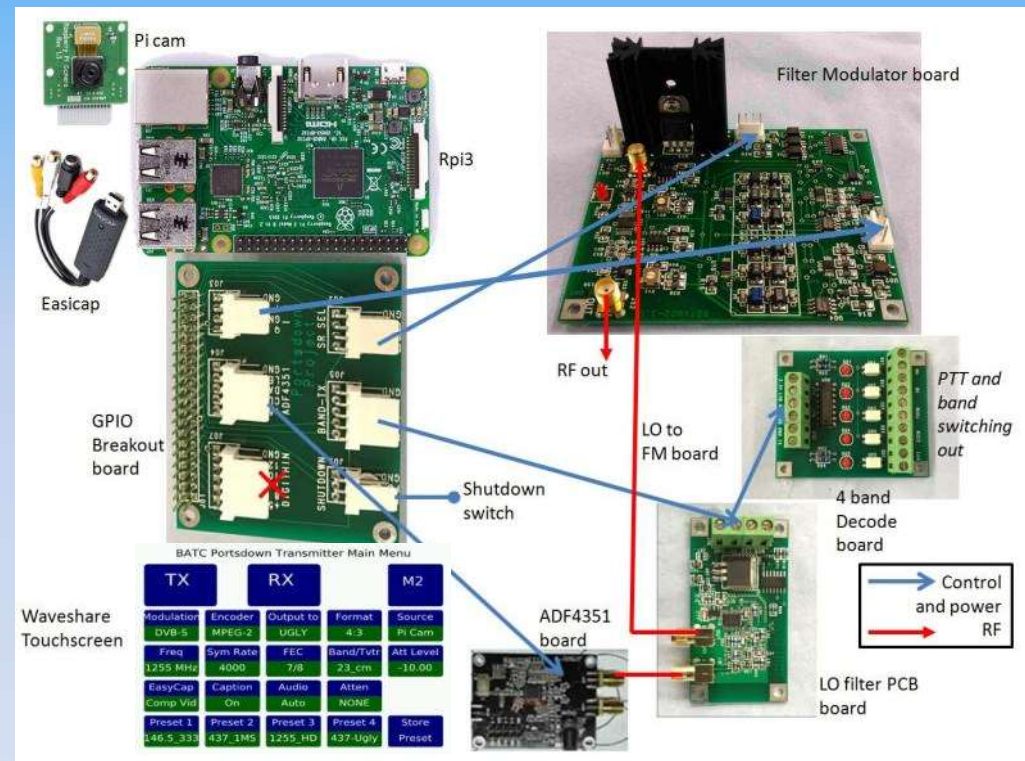


The Portsdown ATV Transmitter








G8GKQ 4 Feb 17

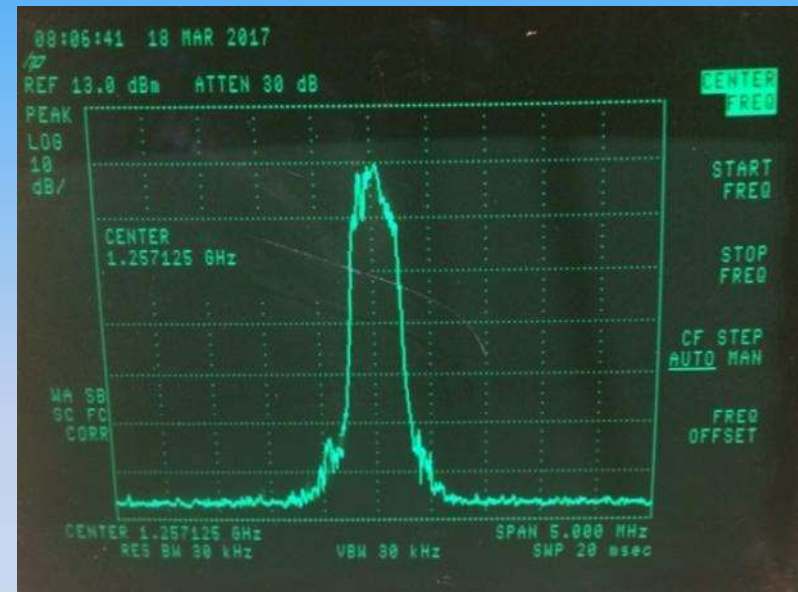
Portsdown made easy

-  All hard to get or critical components in BATC shop
-  Full set of PCBs from BATC shop
-  Main SMD board is available pre-built
-  Pre-programmed SD Card from BATC shop or self-build



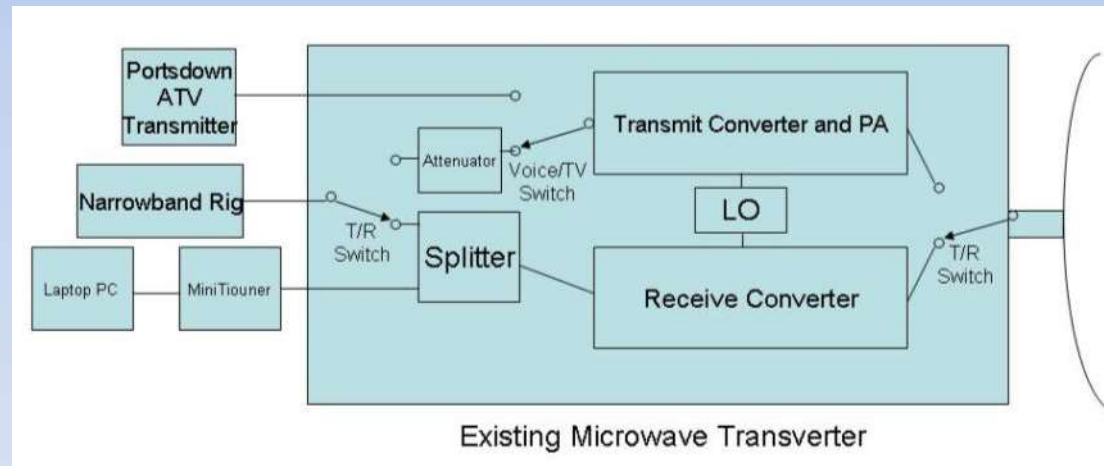
Portsdown Specs

-  71 MHz to 2400 MHz
 - ~ 5dBm output
 - -7dBm at 2400MHz
-  DVB-S only
-  88KS to 5 MS
-  MPEG-2 and MPEG-4 encoding
-  Touch screen or PC control
-  PTT and band switching control
-  Analogue Video out with test patterns



Transverting to 10 GHz and 24 GHz

- ❶ Encoders typically output 5 dBm at 146 MHz or 437 MHz
- ❷ Easy to modify existing transverters to accept







- ❸ MiniTioune Receiver will tune from 144 - 2600 MHz, so RX IF can be the same.

MiniTiouner

-  Satellite TV tuner with USB interface
-  PC software by F6DZP
-  Latest version tunes 144 – 2600 MHz
-  Symbol Rates 66 KS – 20 MS
-  Kit or ready-built



Phase Noise





-  DVB-S is vulnerable to phase noise
-  Our initial assumption that SSB was more critical proved to be incorrect
-  Readable SSB, but no-go on DVB-S
-  Using ADF5355 (x2) as a 24 GHz LO works, but it needs:
 - Internal supply smoothing with 2000uF +
 - High Reference frequency
 - High charge pump current

ATV is Looking Up

- Es'Hail-2 will be the first amateur geo-stationary satellite
- Es'Hail-2 wideband is an "8 MHz bent pipe" transponder
 - 2.4 GHz up, 10.49 GHz down
 - No spot beams – covers 1/3 of the earth!
 - Dedicated to DATV use
- DVB-S2 is preferred modulation
 - Occupied bandwidths could be 500 KHz – 8 MHz
- Es'Hail-2 is a fantastic opportunity for amateur TV experimentation



The New Golden Age for ATV

-  ATV is undergoing a revival
-  Real amateur radio
 - Limited commercial equipment
 - You have to build and experiment
 - Open source
-  Covers all skill levels from beginner to seasoned professional
 - Propagation, antennas, RF design, studio, video editing, video encoding, software
-  BATC is thriving
 - 25% increase in last 3 years
 - Growing a real ATV community
 - Sharing the knowledge and growing together



More information



 BATC wiki: [https://wiki.batc.tv/BATC Wiki](https://wiki.batc.tv/BATC_Wiki)

 5.6GHz: [https://wiki.batc.tv/5.6 GHz](https://wiki.batc.tv/5.6_GHz)

 Portsdown: [https://wiki.batc.tv/The Portsdown Transmitter](https://wiki.batc.tv/The_Portsdown_Transmitter)