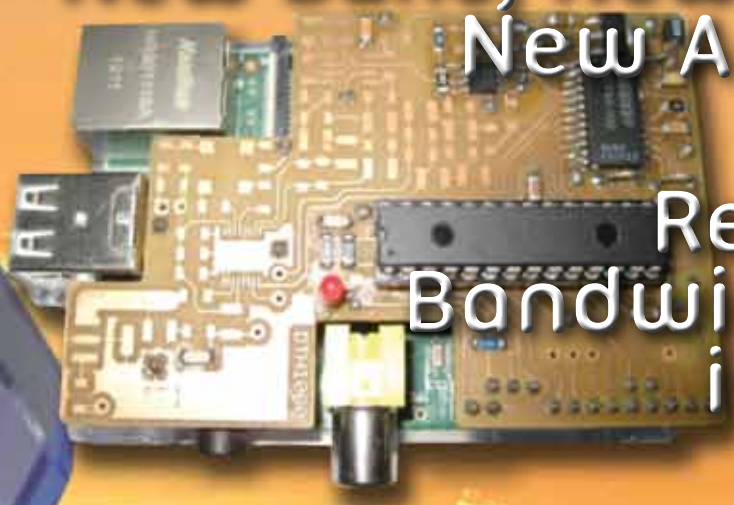
The British Amateur Television Club

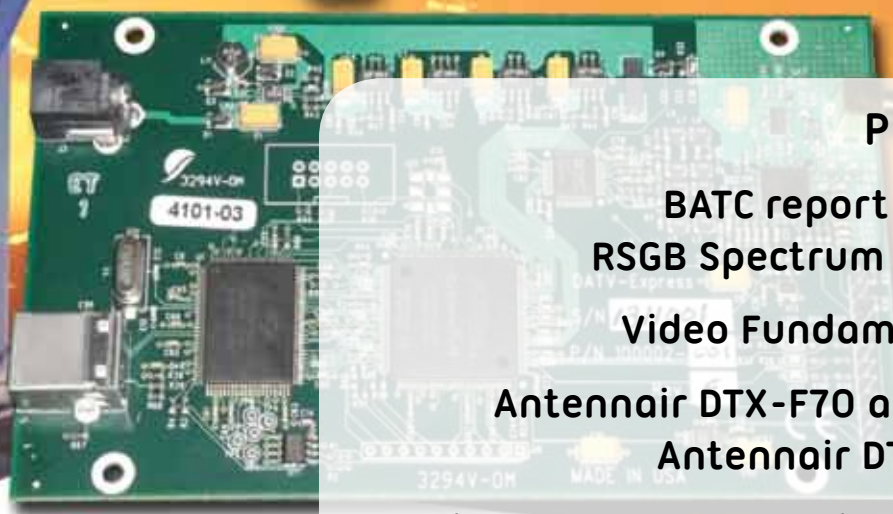
# CQ-TV

No. 246 – December 2014

## New Band, New Mode, New Award...

## Reduced Bandwidth TV is here!




Ofcom

WIRELESS TELEGRAPHY ACT 2006
VARIATION OF AMATEUR RADIO (FULL) LICENCE FOR THE PURPOSE OF OPERATING BETWEEN 146 MHz AND 147 MHz

1. Introduction

Ofcom, in exercise of the power conferred by Schedule 1, paragraph 6 of the Wireless Telegraphy Act 2006 (as amended, "the Act"), hereby varies the Amateur Radio (Full) Licence ("the Licence") identified below, in accordance with Schedule 1, paragraph 7 of the Act, as detailed below.

Name of Licensee:

Licensee's main station address:

Plus...

- BATC report to the RSGB Spectrum Forum
- Video Fundamentals
- Antennair DTX-F70 and the Antennair DTX-F23
- RPiDATV RB-TV transmit system
- Digital-ATV - Using ODROID with the DATV-Express board
- GoPro Hero 4
- MAX On-Screen-Display Generator
- ... and all the regular columns

# BATC DTX1 Digital TV Transmitter


## MPEG-2 encoder and DVB-S modulator

- Self contained unit - computer not required.
- Composite and S-video input
- 2 audio channels
- Single PCB design
- Plug in option for 2nd video & audio channels
- Size: 165mm wide; 120mm deep; 55mm high
- Tunes the 70cm and 23cm bands. Tuning range from 150Mhz - 2Ghz
- -5 dBm output
- Power 500mA at 12 volts
- LCD front panel and keypad control
- RS232 control port

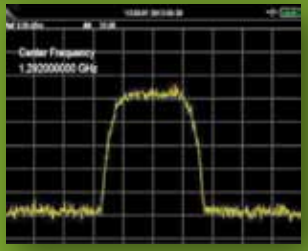
*Specification subject to change without notice*

### Available from BATC shop

- DTX1 DATV transmitter PCB complete with case and front panel **£459** *including postage*
- 2nd encoder channel **£125** *or* **£99** *if bought with a DTX1*

## Digital Amateur TeleVision Exciter/Transmitter now available from

# DATV-Express

- A more affordable DATV exciter; fully-assembled & tested PCBA
- DVB-S protocol for DATV (using QPSK modulation)
- Can operate all ham bands from 70 MHz to 2450 MHz
- RF output level up to 10 dBm (min) all bands (DVB-S)
- Software Defined Radio (SDR) architecture allows many variations of IQ modulations
- "Software-Defined" allows new features to be added over the next few years, without changing the hardware board
- As extra bonus, the team has been able to get the board to transmit DVB-T 2K mode, however we cannot guarantee the performance of that protocol. Caveat Emptor!
- Requires PC running Ubuntu Linux
- User Guide at ***www.DATV-Express.com***
- Price is £215.00 - includes shipping in Europe

**For more details and ordering**
***https://BATC.org.uk/shop/***

**Register on the web site to be able to order on the HARDWARE and KITS page**

BATC

# CQ-TV 246

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## Contributions

The preferred method of communication is by email, all email addresses are shown above.

You can also telephone 01400 414 243 You will then hear a menu that will allow you to be connected to the correct person if they are available.

Alternatively you can write to us at: BATC, Silverwood, South View Road, Pinner, HA5 3YA, United Kingdom

We aim to publish CQ-TV quarterly in March, June, September and December.

The deadlines for each issue are:
March - Please submit by January 31st
June - Please submit by April 30th
September - Please submit by July 31st
December - Please submit October 31st

Please send your contributions in as soon as you can prior to this date. Don't wait for the deadline if you have something to publish as the longer we have your article, the easier it is for us to prepare the page layouts. If you have pictures that you want including in your article, please send them, in the highest possible quality, as separate files. Pictures already embedded in a page are difficult to extract at high quality but if you want to demonstrate your preferred layout, a sample of your finished work with pictures in place is welcomed. Please note the implications of submitting an article which are detailed on the contents page.

# From the Chairman…

*Noel Matthews - G8GTZ*

***First, may I wish you all a happy new year and hope 2015 is a good year for you. 2014 certainly saw some interesting developments in the world of ATV particularly in the last 3 months. In the UK we have seen the release of the 146 MHz band with 500 KHz being put aside for DATV and data applications and there is potential for the same in the new 2302 MHz band.***

This new spectrum and the increasing interest in the potential for Reduced Bandwidth DATV (RB-TV) on other bands including those below 100 MHz has triggered several projects to develop a new generation of DATV equipment for amateur use. The BATC believes it is our role to encourage innovation and we are therefore very supportive of these initiatives. This edition of CQ-TV includes an overview of the RB-TV developments and an article showing how a Raspberry Pi can be used to generate DATV signals down to 250 kSymbols – more articles are planned for future editions and we are already planning to stock the hard to get components for RB-TV projects in the shop.

As we start the new year, your committee has been looking at what the future of the BATC should be. Based on feedback from members, it seems you expect us to continue to support the ATV community worldwide with projects such as RB-TV and the web based services such as the streamer and on-line shop. As such we are going to try and re-develop our web presence and one area we would like to grow is our support of the ATV community in Europe – we have developed good relations with the ATV community in Holland, France and Germany and we will be joining the AGAF on their stand at HAMRADIO 2015 in June and we are helping to organise a 4 hour conference session dedicated to DATV on Friday afternoon.

Also, we have just agreed with Finningley Radio Club that we will be holding CAT15 at their Club house on the weekend of September 5th and 6th – we will be making plans over the next few months but if you have any thoughts on what you would like to see just let us know.

Finally, you will see that we are introducing a small increase in BATC subscriptions on January 1st – the printed subscription increases are to compensate for escalating postage costs and the cyber subscription has been increased by £2 a year to cover increased bandwidth consumption as the streamer usage grows and also to provide funding for the new website development.

Even with these small increases we believe the BATC is still very good value for money and we are committed to supporting the ATV community to develop and innovate over the next few years and we welcome your input, ideas and feedback.

# Editorial…

*Frank Heritage - M0AEU*

***Thank you for all the articles and news items for this edition of CQ-TV. Please keep them coming, they are very welcome, and without contributions from the members it's very difficult to fill the pages with relevant content.***

Unfortunately due to the constraints of a printed magazine we have to generate multiples of four pages, so I'm afraid it's not always possible to include all the material submitted for a particular edition - however we do aim to publish those items that are time dependent. If an article doesn't get into this edition, it should be in the next!

Please note, due to a bug in the software a URL that's split over two lines doesn't link properly in the pdf…

# Overseas News

*Dave Crump – G8GKQ*

## The Netherlands

The December edition of Electron, Dutch Amateur Radio Magazine, reports continued success on 70 cm bandwidth-limited AM using an RTL SDR stick and TV Sharp. The screenshot below shows how this mode is perfectly adequate for contest operation.

## France

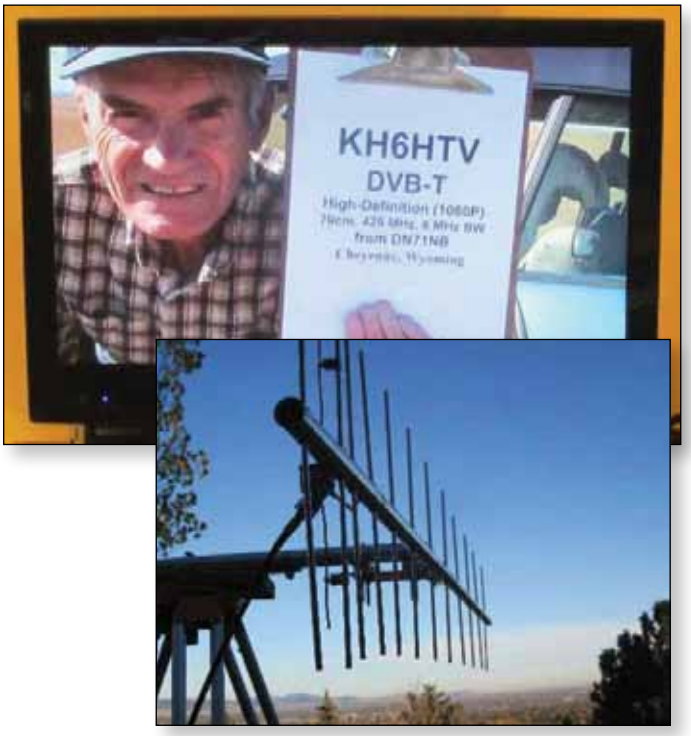
The French National Association of Television Amateurs (ANTA) publish a 6-monthly magazine, B5. The latest issue showcases French construction of equipment for transmitting and receiving digital transmissions in the 70cm, 23cm, 13cm and 3cm bands. They list the French ATV Repeaters on their website at ***http://anta-asso.fr/***.

## USA

Jim Andrews KH6HTV in Boulder, Colorado, reports that he and a number of other operators in the area are using the Hi-Des equipment to generate DVB-T on 70 cm. Best DX so far has been 77 miles using just 10 watts output.

Jim's website has a wealth of information on his tests of various digital TV modes; interesting reading: ***http://kh6htv.com/application-notes/***


It is planned that the W0BCR TV Repeater will be rebuilt in 2015 to include the options for DVB-T 23 cm inputs (in addition to analogue AM & FM-TV) and also for a selectable 70 cm output of either analogue AM or DVB-T (both 6 MHz BW).




▶ *Live, high-definition, 1080P, image received by N0YE in Boulder, Colorado from KH6HTV in Cheyenne, Wyoming, and an image of N0YE's yagi. Images from KH6HTV.com*

*Do you have more overseas news? If so, please send it to me at* ***contests@batc.org.uk***

## Stop Press... Stop Press... Stop Press...

### 30/12/2014
### The First (probably) DATV transmission in the 2m band.

**Transmitting:** Arthur, G4CPE, North of Luton
**Receiving:** Don, G0WFT, Toddington at 2.3 miles.
**Frequency:** 146.5 MHz
**Tx Power:** 4W with shoulders at -60dB
**Symbol Rate:** 543 KS/sec
**FEC:** 7/8
**Encoding:** MPEG II with no B frames.
**Receiver:** Tutioune PC Monitoring software with type 3200 card


▶ *The picture was relayed to GB3TZ, further relayed by GB3BH and streamed via* ***www.batc.tv***

# Members News

*Dave Mann – G8ADM*

## Rallies

This year the BATC was represented at quite a few rallies: Kempton Park (2), Dunstable Downs, Newbury, Frome, McMichael, Dorset, Hamfest – Lincoln, CAT14 – Basingstoke and Rochdale that is a new venue for us supported by Laurence and colleague who make the DTX1. In 2015 we expect to be at these rallies again and also the biggest European rally in Friedrichshafen, Southern Germany. The dates will be published in the next CQ-TV. We are very keen to expand our attendance at rallies in the UK or overseas to promote the club and hopefully increase our membership. If you can support us at your local rally please let us know. We can supply the kit as shown in the picture below.


## ISS Ham TV – Update

Several members have asked what's happening to the DATV system on board the ISS known as Ham TV. This has been installed for over a year now. The first transmission tests were very successful with stations in the USA, Europe and Australia receiving very good pictures. In all cases the performance was better than expected with up to 6dB improvement over the predicted signal strength. Before any regular transmission can take place there are a number of government organisations that have to give their approval. This inevitably takes time. In November 2015 astronaut Major Tim Peake from the UK joins the ISS crew. He is very interested in amateur radio and in activating the Ham TV station on the ISS so we hope that his enthusiasm will smooth the way forward with the necessary approvals. We anticipate seeing regular TV transmissions during the course of 2015.

## Norman G3UXR

Norman was born in 1929 and sadly passed away, peacefully at home, on Tuesday, 4th November 2014 following an operation on his knee. Norman was very enthusiastic about amateur television. He was a member of Bournemouth Radio Society (BRS) for many years and also a Founder Member of Bournemouth Amateur Television Group (BATG) where he would usually join the Club net on Sunday evenings using his home made digilite transmitter. He was also a keen member of the Solent Club for Amateur Radio and Television (SCART). The picture below shows Norman in his shack. For a more complete tribute to Norman see the Bournemouth Club website: ***http://www.brswebsite.org.uk/***


## 2m DATV?

The band 146 to 146.9 MHz has now been released for full licence holders who have requested an NOV from OFCOM. This creates an opportunity for us to experiment with various types of narrow band DATV transmissions on the 2m band although the power is limited to 25W ERP (Not transmitter power). The technology is developing fast and the best way to keep up with developments is to monitor the BATC Forum ***http://www.batc.org.uk/forum/*** or the two Yahoo Groups relating to digital ATV, these groups are: Digital-ATV and DigitalATV. See: ***https://groups.yahoo.com/***

*Please send any news for CQ-TV 247 to me by the end of February:* ***secretary@batc.org.uk***

## Members News Continued...

### Keith G3OXH

We are very sorry to announce that **Keith, G3OXH,** passed away in November. Keith started with ATV on 70cms in the 1970s from Gravesend. On retiring he moved to Rainham and with his wife ran the Cats Protection League sanctuary. On his second retirement Keith moved to Eastchurch on the Isle of Sheppey and continued to be active on 23mcs ATV, simplex and through the repeater.

▶ *Off-air capture of Keith G3OXH, courtesy of G4AYT*

# Contest News

*Dave Crump – G8GKQ*

### International ATV Contest

It's a shame, but after all the activity in the June Summerfun contest, I did not receive any entries for the September International Contest. I know that G8ADM, G8LES and G8GTZ were all active, but perhaps not at the same time as each other! Propagation conditions were widely reported to be below average, despite earlier good predictions from the Hepburn forecast web site ***http://www.dxinfocentre.com/tropo_eur.html***. It will be interesting to see if our Dutch or German colleagues fared any better. Next year's International Contest will be in June – see below.

### BATC Repeater Contests 21/22 March

Don't forget the BATC Repeater Contest on 21/22 March. This is really simple fun with the aim of getting more people on the air – please give it a try! More details on the BATC website ***http://www.batc.org.uk/contests/contest_news.html***

### New International ATV Contest Rules and Date

The BATC supported a proposal made by VERON to amend the IARU International Contest Rules. The proposed changes were accepted and will be applicable for 2015.

The major change is that the International Contest will be held on the first full weekend in June each year from 1200 UTC on the Saturday to 1800 UTC on the Sunday; so please mark 13/14 June 2015 on your calendars now! Other changes permit the entry of "Rover" stations and clarify the rules on remotely operated stations. The new rules can be found at ***http://www.batc.org.uk/contests/IARU_ATV_contest_rules_version_2015.pdf***

A new Scoring spreadsheet is also being prepared and will be published as soon as it is finalized.

### Contest Calendar

**1200 UTC 21 March 2015 - 1200 UTC 22 March 2015:** *BATC Repeater Contest*

**1200 UTC 13 June 2015 - 1200 UTC 14 June 2015:** *BATC Summer Fun Contest (or International Contest)*

**1200 UTC 12 September 2015 - 1200 UTC 13 Sept 2015**: *BATC Autumn ATV Contest*

**1200 UTC 12 December 2015 - 1200 UTC 13 December 2015** - *BATC Repeater Contest*

# Repeater Roundup

*Clive Reynolds - G3GJA*

Dave, G8ADM, reports that the **Worthing Video Repeater Group** repeaters, GB3VR, GB3RV, and GB3VV may have lost their site. These repeaters have been transmitting for many years and will be missed by the ATV community.

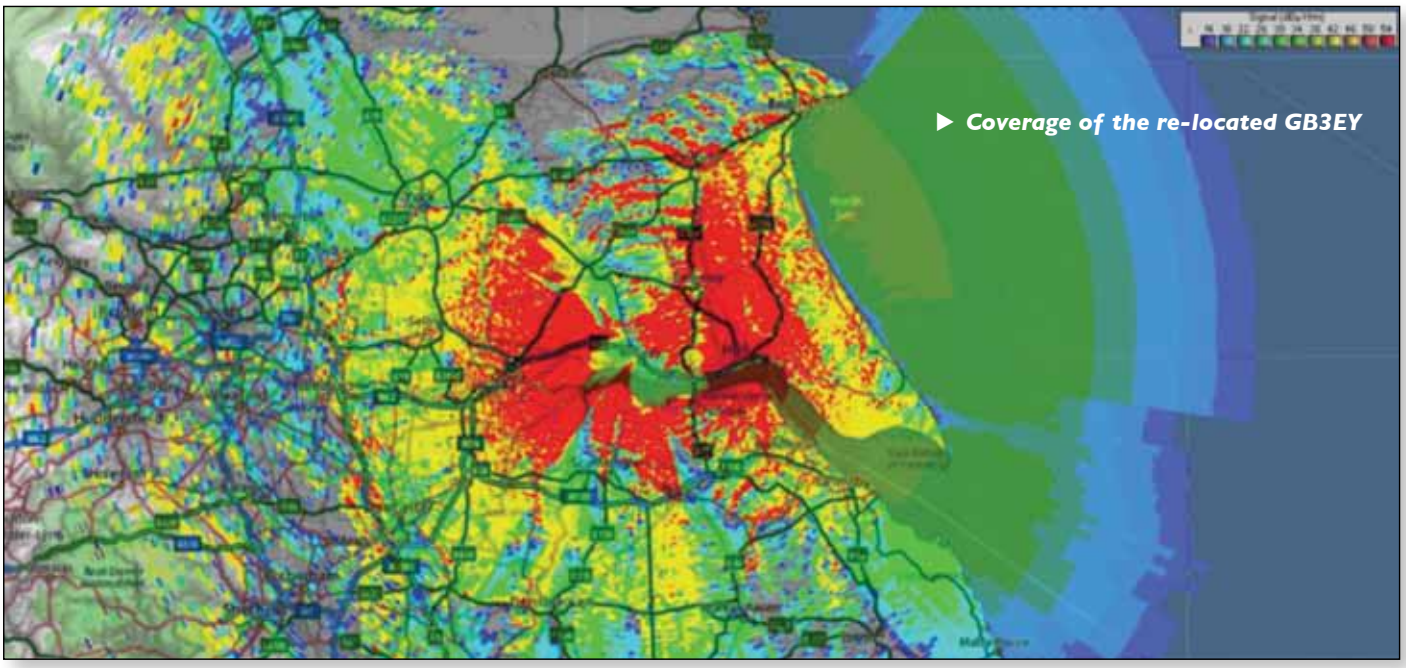
Another ATV repeater under threat of closure due to loss of site is **GB3GG**. This 13cm repeater was going to change bands as a result of the MoD Spectrum Release proposals but now the housing association that owns the block of flats in Grimsby where GG is installed has announced that it wants to pull them down and replace them with new housing.

There is some hope that Grimsby can be covered by **GB3EY** if permission to move it is given. The GB3GG crew have kindly offered assistance to EY's keeper that would ensure that the former GG coverage area would be served.

GB3EY is currently located on the North Sea coast to the east of Hull but gives a poor coverage into North Lincolnshire and Grimsby. An application to move it to the East Yorkshire Repeater Group's professional radio site on the top of the Yorkshire Wolds to the west of Hull was submitted in April this year along with evidence that the new site would not cause any worse interference to the CAA radar at Claxby, Lincolnshire 20 – odd miles to the south. It's unfortunate that the coverage map for the new site on ukrepeaters.net is totally wrong so please refer to the Radiomobile plot reproduced above.

In Hastings, the Repeater and Internet Linking Group of East Sussex (RILGES), have just submitted an application for a new 23cm ATV repeater to be co-sited with GB3HE the Group's 70cm analogue voice repeater, located just north of Hastings on the south coast. **GB3JT** is the proposed callsign chosen to acknowledge the Hastings area's (Bexhill in particular) connection with the Scottish inventor John Logie Baird of Television. The RIGLES forum says that the repeater is planned to eventually allow both digital and analogue input, with digital output. Internet streaming onto the BATC website and linking feed from other ATV repeaters to GB3JT are also to be included. The site offers useful coverage westward towards Eastbourne and eastwards into Ashford, Hythe and all of the Romney Marsh. ATV operators between Eastbourne and Hastings could soon be served with two repeaters, GB3VX analogue near Eastbourne and GB3JT digital!

Bob, G7AVU, reports that **GB3VL** on Lincoln Cathedral is now transmitting in digital on 1310MHz. Its inputs are 1248MHz analogue and 1280MHz digital. He hopes that after Christmas the test-cards will be re-aligned to the proper size and they will be putting both analogue and digital inputs on 1280MHz. Dave, M1CCD, is building a complete new logic system using Linux and SDL which will go in as soon as he has time to finish it. He also needs internet connectivity up on the cathedral, which is taking a long time to sort out.



▶ ***Coverage of the re-located GB3EY***


The 10GHz ATV repeater is still running as usual but it's not used much at all, which Bob feels is a shame because it's so cheap to get going.


▶ *The Lincoln Cathedral repeaters antenna system; they are believed to be the only repeaters situated on a medieval building in Europe. Courtesy of g5fz.co.uk.*

The Kent Television Group lost their site on the Isle of Sheppey in 2011 and **GB3KT** went QRT. However, the website maintained by Chris, G4AYT, reports that the equipment is still in use as a manned 23cm analogue repeater. Early in 2014 Dick, G4UPE, kindly offered to take the repeater at his QTH near Lenham, Kent (JO01IF).

The antenna has been installed and the equipment housed in the dry.

A replacement mains transformer has been fitted to the transmitter along with a new bridge rectifier. The original repeater RX and pre-amp have been replaced by a new more sensitive and stable RX, using a Mobicomm module. The repeater became operational from the new site on 09.04.14. An increase in antenna height is under consideration. Operational time for now is daily, from very approx. 2pm to 9pm. Activity night continues to be Wednesdays at 8pm, check 144.750MHz. GB3KT now operating as manned repeater G4UPE can be found on 1310MHz Analogue (FM) with the input on 1249MHz Analogue (FM).

If the disappointing lack of activity continues the Group will consider disbanding and closing the service; use it or lose it!

## Stop Press... Stop Press...

Notice of Variation were issued on the 1st December 2014 to **GB3NV** in Norwich and **GB3HV** in Farnham both on 3.4 Ghz. NV is located on top of Winchester Tower in Norwich, along with the voice repeater GB3NR.

▶ *Coverage map for GB3NV and its home the Winchester Tower in Norwich*

▶ *GB3HV in Farnham, Surrey*

# Spectrum Matters

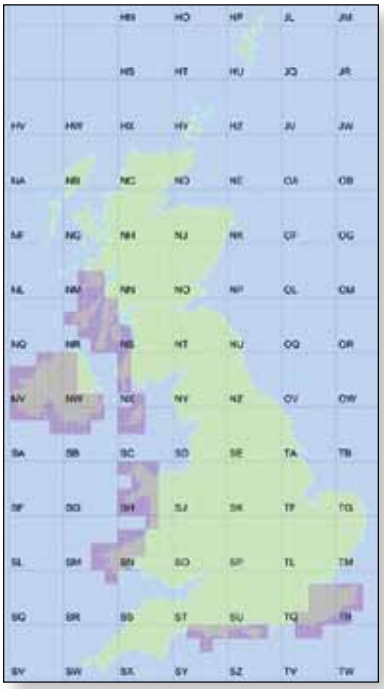
*Noel Matthews - G8GTZ*

***A lot has been happening in the world of spectrum and the BATC continues to be involved in discussions with RSGB, Ofcom, CAA and IARU to ensure the ATV community's interests were represented.***

Firstly, the formal minutes of the IARU region 1 conference which was covered in the previous CQ-TV have been released confirming use of 436 DATV – see seperate report by G3VZV following this article.

Then in October we received the news that full licensees could apply for a 1 year NoV to operate in the 146 – 147 MHz sub band. Of particular interest to ATVers is the quote from the RSGB FAQ:

*"Ofcom's view was that they were not keen on allocating additional VHF spectrum to Amateur radio for 'more of the same'. As the RSGB case was that we needed some additional spectrum for amateurs to experiment and test new digital communications schemes and systems, there will not be any 146 – 147 MHz band plan allocation for CW, SSB, FM or AFSK data.*

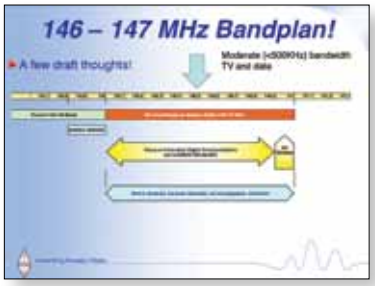


▶ *The 146Mhz NoV is not available in some areas of the UK. The shaded locators show the extent of the limitations.*

And then in November Ofcom announced the allocation of 2300 – 2302 MHz and from November 2014, NoVs are available to access this frequency range for a three year period from fixed locations. Once again BATC has been in discussion with the RSGB spectrum manager and there is the potential of an allocation of a sub band to be used for very narrow band (sub 1 MHz wide) DATV.

A common theme in all the spectrum news is that there are new opportunities for the ATV community but we will need to adopt narrow band techniques to take full advantage and the BATC is supporting the new initiatives to develop very narrow band RB-TV equipment using MPEG-4. – see article in this issue of CQ-TV.

In fact, through negotiations by the BATC with the RSGB VHF manager a 500 KHz sub segment of the new band has been put aside for NB DATV and data applications – this slide from G4SWX at the RSGB convention shows the proposed plan:




And the finalised band plan available from the RSGB website shows the following allocations. … but see note 1.

| 146-147MHz | Necessary Bandwidth | UK Usage |
|---|---|---|
| **146.000-146.900** | 500kHz | **Wideband Digital Modes** (High speed data , DATV etc)<br><br>146.500 MHz Centre frequency for wideband modes (Note 1) |
| **146.900-147.000** | 12kHz | **Narrowband Digital Modes including Digital Voice**<br>146.9000<br>146.9125<br>146.9250 |
| | | 146.9375 **Not available in/near Scotland** (see Licence Notes & NoV terms)<br>146.9500<br>146.9625<br>146.9750<br>146.9875 |

# BATC report to the RSGB Spectrum Forum - October 2014

*Graham Shirville G3VZV & Noel Matthews G8GTZ*

The ATV community is continuing to make the migration to digital operation as the squeeze on spectrum above 400 MHz continues. A self imposed policy of digital only for any newly licensed repeater outputs has been adopted and the use of 2 and 4 Msymbol DVB-S is now accepted as the UK standard for all bands from 437 MHz – 10 GHz. However, a large amount of analogue FM is still in use and it is too early to adopt a digital only policy for repeater inputs as it would disenfranchise too many ATV operators at this stage.

That said, the BATC is continuing to support and promote projects which make DVB-S DATV more accessible and brings the spectrum benefits of DATV to as many stations as possible. Over 100 Digilite systems are estimated to have been sold and BATC has sold more than 50 of the UK sourced DTX1 combined encoder / modulator units at cost price to our members.

The BATC is also actively supporting experimentation with, and the development of, lower bit-rate (sub 500 Kbit/s) digital video transmission for use on the lower bands, including the new 146 – 147 MHz allocation. Currently BATC members are experimenting with MPEG-4 codecs and evaluating suitable modulation schemes and one member is developing an I/Q modulator plug in board for the Raspberry PI. Low bit rate receivers will present a significant design challenge, however the development of wide band SDR modules such as SDRplay may have potential as the basis for a flexible receiver covering a number of bandwidths and modulation schemes.

BATC is also aware of the continuing need to improve the spectral purity of DATV signals, particularly in the area of spectral regrowth. We have published a number of filter designs for both 70cms and 23cms in recent issues of CQ-TV and are in the process of initiating a scheme of regional experts or mentors with the skill and equipment to help other ATV operators ensure their transmissions are within the recommended IARU standards.

### TV Repeaters

Currently 33 TV units are licensed with 2 non-operational. Operation listed by primary transmit band is 1.3 GHz = 22, 2.3 GHz = 4, 3.4 GHz = 1 and 10 GHz = 5.

All TV repeater keepers were contacted during the NoV renewal process and several NoVs were not renewed for units not on air. GB3BA, one of the new 3.4 GHz NoVs, has been returned as the site was lost during the 2 years that it took to get the NoV.

6 new applications are currently in vetting (1.3 GHz = 4 units and 3.4 GHz = 2 units) with the longest delay at 20 months.

Only 1 NoV has been received in the last 12 months. This was for the GB3IV site move.

In theory, the move to digital makes spectrum planning for repeater outputs an easier task, however the need to retain FM inputs in the short term, combined with the impact of the PSSR release makes finding input channels hard. Realistically 23cms is now the only band where it is practical to find room for and gain primary user approval for a 16 MHz wide FM channel.

## The Bands

### 2.3 GHz

As a result of a lot of hard work by RSGB and others, the PSSR announcement resulted in significantly less impact than has been the case in some other countries. It does have an impact on ATV operation, particularly analogue, and 7 TV repeaters will be affected by the programme. The BATC & ETCC is working to co-ordinate changes with Ofcom and with the groups affected.

The 13cm digital video transmitter "HAMtv" onboard the ISS, provided by ESA and coordinated by AMSAT-Italy, has now been commissioned. Ground terminals around the world and monitoring streams have been created using the BATC streamer/server site.

The link budget appears to be slightly better than predicted and good signals have been received using <1 metre dishes.

Its use for actual school contacts is dependent upon agreements being made between the ISS partners.

### 1.3 GHz

John McCullagh (ETCC), Murray Niman (RSGB) and Noel Matthews (BATC & ETCC TV rep) met with the CAA and Ofcom in July to update the CAA on Amateur activities in the 23cms and in particular the adoption of digital modulation schemes for both voice and TV repeaters. We have since written a document outlining activities on the band giving technical details of the systems requiring NoV approval and a draft version has been sent to the CAA.

As a result of the meeting, the CAA agreed to direct contact with the ETCC to discuss NoV applications as and when the need arises and we have recently sent CAA details of the 4 outstanding NoVs. All applications must still follow the agreed ETCC / Ofcom NoV application process but this direct contact will hopefully result in fewer delays for 23cms applications.

## 70cms

The development of 2 MHz wide DVB-S has prompted a revival of 70cms ATV and DX exceeding 600 kms has been worked by UK stations. Prior to the IARU Region 1 conference, BATC liaised with fellow ATV organisations throughout Europe to agree a common approach that was also supported by the RSGB and other national societies. As a result it has been agreed that DATV simplex and repeater inputs can continue on the band but in order to minimise interference to other services, TV repeater outputs should not be licensed on 70cms.

## 146 – 147 MHz

BATC is very pleased with the support received from the RSGB in proposing a 500 Kbit/s allocation for experimental very narrow band DATV in the new 146 – 147 MHz band. As mentioned above, there are already a number of developments being undertaken by members of the ATV community.

## Below 100 MHz

The BATC is aware of the comments attracted by some recent experiments undertaken to evaluate the potential of DATV at 50 MHz. These initial proof of concept experiments were conducted utilising equipment that readily available and used the narrowest standard DVB-S modes that commercially available receivers will support.

The BATC would not support the regular use of transmission modes that go against existing RSGB / IARU band plans. We do however believe that the bands below 100 MHz offer very interesting potential for experimentation and that the ATV community should adopt the very narrow band technologies being developed for use in the 146 MHz band.

**Footnote** – the meeting minutes are available at: ***http://rsgb.org/main/files/2014/11/Spectrum-Forum_Nov-2014_Minutes.pdf***

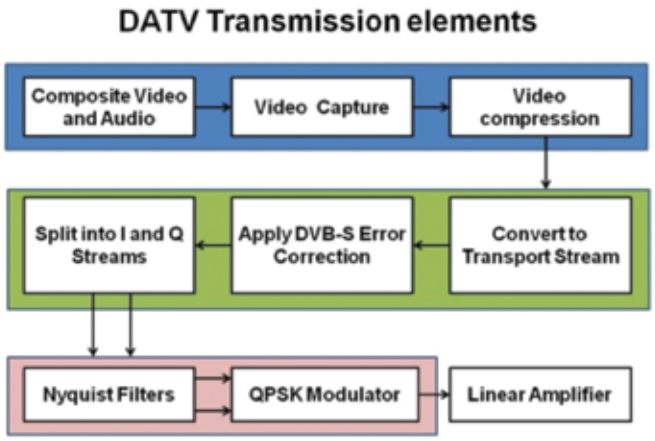
# Reduced Bandwidth DATV (RB-TV)

## The next generation DATV

*Noel Matthews - G8GTZ*

***The allocation of spectrum for very narrow band or Reduced Bandwidth DATV (RB-TV) within the new 146 MHz band in the UK and the increasing interest in using RB-TV on other bands has triggered several projects to develop the second generation of equipment for amateur use.***

The common aim of these projects is to produce fast scan amateur television equipment which will allow operation in less than 1 MHz of bandwidth whilst still producing acceptable picture quality. This article describes the various projects which are in development and tries to lay out the possible options for operators to get on air with RB-TV.




The need to reduce the transmitted bandwidth below 1 MHz impacts on several areas of DATV equipment design and in particular the need for more efficient video coding. The common consensus is that MPEG-2 is unusable below 1 Mbit/s and that we will have to adopt H264 (MPEG-4) coding to achieve the desired quality. Also, to achieve the really low symbol rates required the Nyquist filters in the current range of I&Q modulators such as Digilite and DATV-Express will need to be modified.

Whilst most modern consumer STBs will decode H264, most models are only specified to operate down to .8 – 1Ms/s (Msymbols per second) so new receiver solutions are required and this is proving to be the most difficult technical challange to solve.

### Is H264 good enough?

Brian, G4EWJ, and Jean Pierre, F6DZP, have done some excellent work evaluating the performance of H264 at very low bit rates.

Brian has produced a number of test videos at various frame and bit rates which he showed at CAT14 and are available for download at: ***https://www.dropbox.com/sh/beyc5k1d2qyju7n/AACaa02tsHP6y2cVYu9pwhRKa?dl=0***

F6DZP has examples of the video quality that can be achieved at very low Symbol Rate using DVB-S on his web site at ***http://www.vivadatv.org/viewtopic.php?f=72&t=332***

In particular, there is a recording of his signals using QPSK at 250 kS/s and received by Tutioune software ***http://www.vivadatv.org/images/test%20250kS%20extrait.html***

The results are very subjective and depend on personal preferences but seem to indicate that H264 does produce acceptable results at rates as low as 200 Kbit/s.

### H264 encoding options

Current amateur DATV equipment produces MPEG-2, either by a dedicated encoder such as ex-broadcast equipment or by utilising custom chips as used in the SR systems equipment and the DTX1. The Digilite systems use a Hauppauge capture card such as the PVR150 to do MPEG-2 encoding prior to PC processing. Unfortunately these systems are unable to produce H264 and we must look for new solutions.

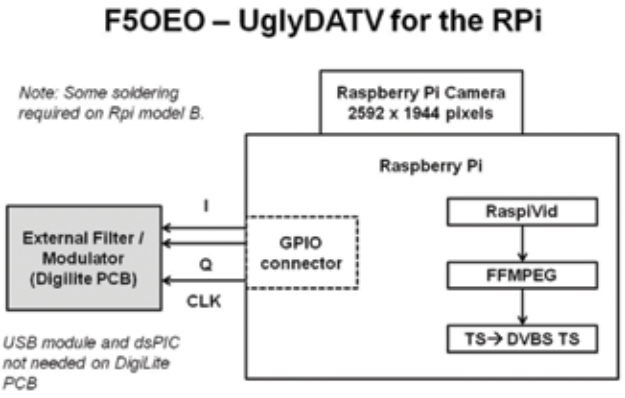
The PVR150 in current Digilite systems could be replaced with the HD-PVR which is H264 capable but may not encode at really low bitrates.

It is possible to encode video at low data rates in H264 in software using a standard PC / Linux system. F6DZP has done a lot of work evaluating the options and further details are available on the BATC forum: ***http://www.batc.org.uk/forum/viewtopic.php?f=71&t=1128***

However, finding suitable cheap reliable composite video input capture devices for PC / Linux platforms is becoming a major problem. For example, the Pinnacle Dazzle DC100 works well on Windows 7 but is not supported on Windows 8.1 and the EzCap devices are a minefield as there are a many types of clones using various cheap chipsets and the most common chipset is not supported by Linux. So maybe it is time we moved away from composite video in the shack and started using a webcam or DV camera where no additional capture hardware is required.

## RPiDATV

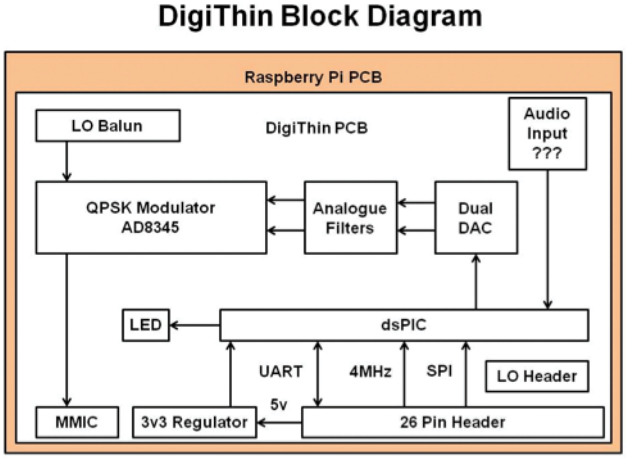
Whilst it is possible to use a PC for H264 encoding, most ATV operators prefer to use dedicated hardware for their ATV station, particularly when out portable. With this in mind, Evariste F5OEO, has developed RPiDATV software for the Raspberry Pi to enable an H264 encoded stream to be generated, either from a TS file on the SD card or from the internal RPI camera for live video. The I/Q data can be taken directly from the GPIO pins on the RPI and used to drive an I/Q modulator such as the Digilite PCB – see below.

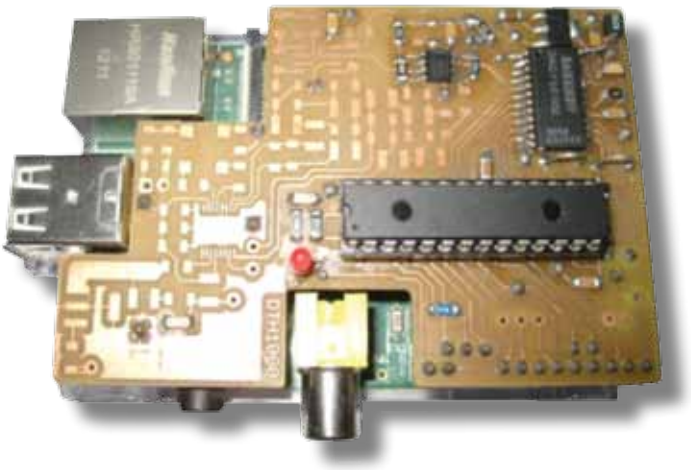



A separate article in this issue of CQ-TV describes this software and includes details on how 437.5 MHz and 23cms DATV can be generated directly by the RPI, although it must be noted that this is for testing purposes only and should never be used "on air" as the design does not incorporate any Nyquist filtering.

## The Digithin modulator card for the RPi

A related development by G4EWJ was described at CAT14 – Brian is developing a plug in card for the Raspberry Pi called Digithin. The RPI would run the RPiDATV software to generate I/Q data and clock on the GPIO port which is fed on to a plug in card containing a modulator / serialiser device. This will process the data



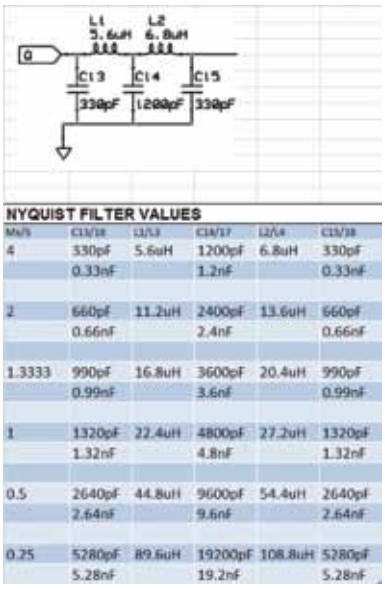



and, using an external local oscillator source, generate the RF. Coupled with a lithium battery, the idea is to make a completely self contained, portable, narrowband DATV transmitter for 146MHz or 437MHz.

Digital filtering of the IQ data will maintain the narrow bandwidth of the RF. The IQ filter roll off for DVB-S is 0.35, using the rule of thumb to be 60dB down at 1.35 times the symbol rate 333k symbols / second at the moment will give a bandwidth of about 450kHz. A full article describing Digithin will be included in a future CQ-TV.

## Using Digilite for RB-TV

As mentioned, the capture card on a standard Digilite system would need to be replaced for an H264 compatible device such as the HD-USB. Also it is possible to take I/Q signals directly from the Raspberry Pi GPIO port and feed it in to the Digilite modulator card to produce an RB-TV signal. See the separate RPiDATV article in this CQ-TV for further details.



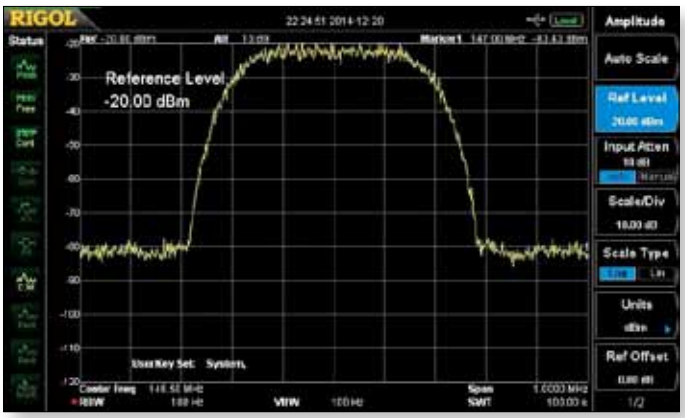

NYQUIST FILTER VALUES

| Ms/s | C13/18 | L3/L3 | C14/17 | L2/L4 | C15/18 |
|---|---|---|---|---|---|
| 4 | 330pF | 5.6uH | 1200pF | 6.8uH | 330pF |
| | 0.33nF | | 1.2nF | | 0.33nF |
| 2 | 660pF | 11.2uH | 2400pF | 13.6uH | 660pF |
| | 0.66nF | | 2.4nF | | 0.66nF |
| 1.3333 | 990pF | 16.8uH | 3600pF | 20.4uH | 990pF |
| | 0.99nF | | 3.6nF | | 0.99nF |
| 1 | 1320pF | 22.4uH | 4800pF | 27.2uH | 1320pF |
| | 1.32nF | | 4.8nF | | 1.32nF |
| 0.5 | 2640pF | 44.8uH | 9600pF | 54.4uH | 2640pF |
| | 2.64nF | | 9.6nF | | 2.64nF |
| 0.25 | 5280pF | 89.6uH | 19200pF | 108.8uH | 5280pF |
| | 5.28nF | | 19.2nF | | 5.28nF |

Whichever video encoding method is chosen, the Nyquist filter values on the Digilite PCB will need to be changed. The following table shows possible values for the lower symbol rates when used on a version 5.9 PCB but these will need confirming before use - see the BATC forum for full details.

## RB-TV with DATV-Express

The DATV-Express is an extremely flexible DATV exciter/ transmitter that will operate over a wide range of symbol rates and frequencies (70 MHz to 2.45 GHz) and is capable of doing narrow band modes.




▶ ***DATV-Express*** *operating at 146.5 Mhz 333KS/s 1 MHz BW*

UDP Code which enables the F5OEO RPiDATV software to work with DATV-Express has been released. However, at the time of writing, the FPGA filtering needs further work to remove some aliases evident at low symbol rates. Announcements when this work is complete will be made on the project website ***www.datvexpress.com***


## Receiving RB-TV

Receiving RB-TV is the hard part! DVB-S2 chipsets are only specified for a minimum symbol rate down to 1Ms/s and therefore most receivers are only guaranteed to work to that rate.

As the signal bandwidth reduces, there is some gain in analogue signal performance but we also see a reduction in MER due to timing and frequency accuracy issues. This means that even the best receivers do not work reliably below 800kS/s and some units even see degraded performance below 1.6Ms/s.

Currently, the only viable way of receiving RB-TV is by using the excellent Tutioune software by Jean-Pierre F6DZP available for download from ***http://www.vivadatv.org***

Tutioune will decode H264 signals down to 250Ksymbols using either the Technotrend S2-1600 or S2-3200 cards. Frequency tuning is critical when operating at such low symbol rates and the very slow baud rate box in expert

▶ ***The various options*** *- the table below shows the options for RB-TV*

| Video device / capture | Bit stream processing | I+Q modulator | Comments |
|---|---|---|---|
| DV camera | Linux / Windows | Digilite | DV only – no capture device required |
| PVR 150 or similar | Windows | DigiLite | Not H264 - unsuitable for RB-TV |
| USB only - PVR USB2 (v24xxx) or HVR-1900 | Linux device incld MK808 | DigiLite | PCR may not be completely correct. Limited PID configuration. |
| PVR 150 or similar | Linux device incld MK808 | DATV Express | Not H264 –unsuitable for RB-TV |
| USB only - PVR USB2 (v24xxx) or HVR-1900 | Linux (incl'd Odroid SBC) | DATV Express | RB-TV requires FPGA filter development |
| RPi camera | RPi | DATV express | Development UDP code only |
| RPi camera | RPi | DigiLite PCB | |
| RPi camera | RPi | DigiThin | Under development |
| RPi camera | RPi | RPi direct RF - F5OEO | For testing only - No Nyquist filtering. |

mode should be ticked when using the S3200 card. Even then performance is not as good as the S2-1600 as the receive frequency needs to be set within 40 KHz meaning it is very difficult to gain and maintain lock except when receiving a local signal.

## Spectral compatibility

RB-TV allows us to operate DATV in bands where we do not have enough bandwidth to operate conventional DVB-S and therefore it follows that we will also be operating much closer to other amateur and more importantly non-amateur services.

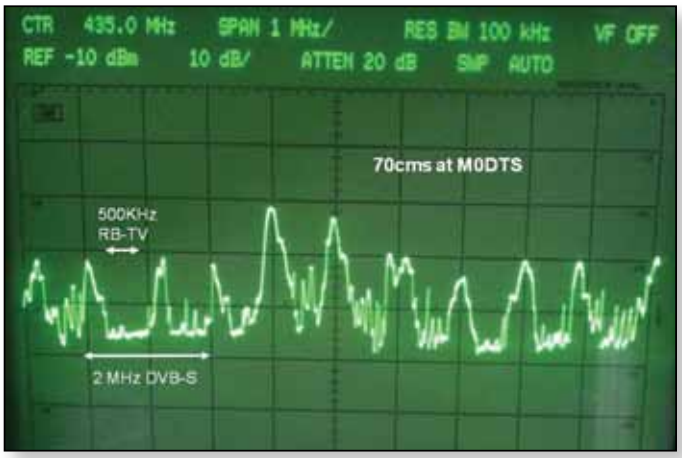
ATV operators are in a unique position that we still construct our own prime movers, drivers and PAs and we need to be very aware of the need for spectral purity and, particularly for digital operation, to avoid spectral re-growth. It is no longer acceptable to just use power and MER as an indication of transmitter suitability and the BATC urges all members to ensure that their equipment meets or exceeds any recommendations. The target for RB-TV should be that the total occupied bandwidth of the transmitted signals, at -65dBc measured at the transmitter output is less than 800 kHz and -50dBc should be regarded as an absolute minimum.

We realise not all members have access to suitable test equipment to measure this and if there is demand BATC will set up a register of people who have the equipment and expertise to help others in their local area.

## The future

RB-TV as described in this article is based around using MPEG transport streams as the transmission container as it has evolved from the DVB-S systems that we use today. This has been proved to work for the initial tests and will enable ATV operators to get on air quickly however, as we go down to very low symbol rates we are no longer compliant with broadcast standards. We will have to develop our own receivers and so maybe it is time we started looking at alternatives such as Internet type streaming protocols.

Indeed, there are already good reasons not to use MPEG TS at these low symbol rates as a lot of the libraries such as Gstreamer do not support Transport streams properly but they do support other containers. And as more projects such as ***http://radio.testa.co*** become available using IP based protocols, we may have to have completely re-think what we are doing in order for us to be able to take advantage of these developments .




## BATC and RB-TV

The BATC is supporting the RB-TV initiatives by publishing articles on the various projects and will be stocking any hard to get components in the BATC shop. We have also decided to set up a series of awards to encourage development and activity using RB-TV. Details of these are published elsewhere in CQ-TV.

## Summary

As well as enabling ATV on the new UK 146 MHz and 2302 MHz bands and operation below 100 MHz, RB-TV has the potential to enable significant distances to be worked on all bands where wider bandwidth DVB-S would fail.

Tests on 437 MHz by 5 French stations during October 2014 have shown that contacts at 250 km or 300 km were possible everyday using 250ks/s. The same paths produced very weak analogue signals or were not possible on most days using DVB-S at 1Ms/s. A full report of these tests can be found on the vivadatv forum.

RB-TV may also make it possible to operate on 70cms in areas where it is not possible to operate the 2 MHz wide DVB-S due to interference. However, there may be sub 1 MHz slots which are relatively free from interference and RB-TV would then be useable.

There is some way to go yet before we have a standard RB-TV system but the building blocks are being put in place and we encourage you to get involved and experiment – but please remember that these projects are being run by people who also have full time jobs so progress may not be as fast as we would wish!

Further information is available on the BATC forum and the following sources:

***http://www.batc.org.uk/forum/viewtopic.php?f=15&t=3982***

***http://www.batc.org.uk/forum/viewforum.php?f=76***

# RB-TV awards programme

To encourage RB-TV development and activity the BATC is delighted to announce the following awards:

- First QSO over 10 km on the new 146 MHz band
- First QSO over 100 km on the new 146 MHz band
- First QSO over 250 km on any band
- BATC grant award for development of RB-TV receiver technologies

## Terms and conditions

- The QSO's have to be two way contacts undertaken after **1st January 2015**
- Please remember that to transmit on the 146/147MHz band requires you have obtained an NOV first! See ***http://rsgb.org/main/operating/licensing-novs-visitors/online-nov-application/146mhz-147mhz-nov/*** and the 25 watt power limit is erp NOT transmitter power.
- RB-TV is defined elsewhere in this edition of CQ-TV and claims for the first QSOs on the 146/147MHz band must include a declaration stating the total occupied bandwidth of the transmitted signals is less than 800kHz (or a spectrum plot could be included).
- Claims should include a full description of the equipment used for the contact.
- The first QSO Awards will be trophies which will be presented at the CAT15 Convention
- The BATC Grant Award will be a cash sum of £500 awarded to the person or people that the BATC committee think have contributed most to solving the problems of receiving NB-TV. The grant will be presented at the CAT15 Convention

# Antennair DTX-F70 and the Antennair DTX-F23

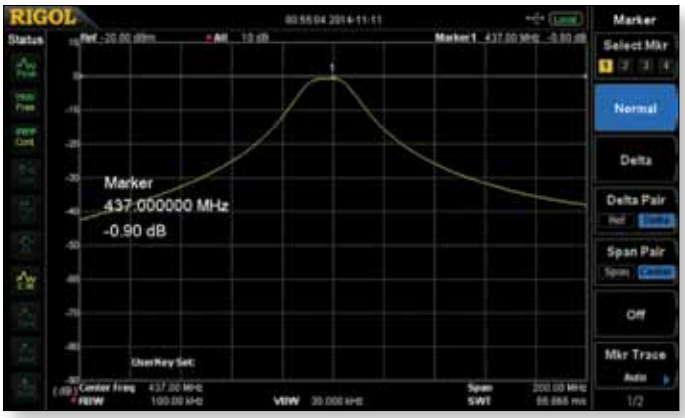
## New Product Review

*Clive Reynolds - G3GJA*

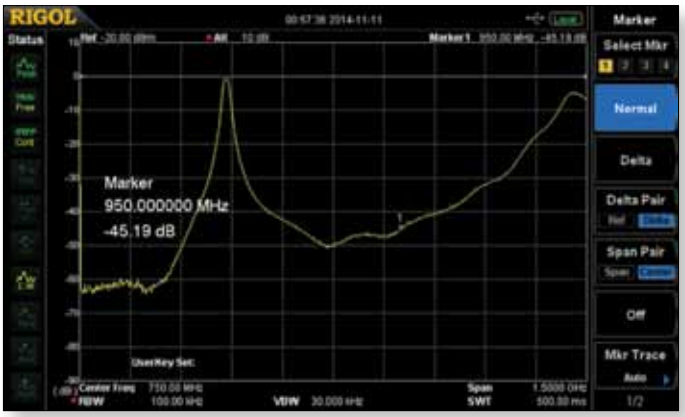
***These filters are designed to be used with the DTX1 DATV transmitter available from the BATC shop. The DTX1 manual states that the transmitter should not be used without a filter and these meet that requirement for 70 and 23cms.***


They are supplied with SMA connectors and are fitted into small tin-plate metal boxes, 58 x 58 x 25mm for 23cm and 58 x 38 x 31mm for 70cm. The barefoot output of the DTX1 is fairly clean close in but there is one frequency that appears below the 23cm output at 820MHz with the other above at 1747MHz; both are around -40dBc. On 70cm, the second harmonic output at 875MHz is also around -40dBc. The filters drop all of these spurious signals into the noise. What these filters do not do is address the other relatively high level harmonics from the DTX1 and other measures should be employed to reduce their level.

### DTX-F70

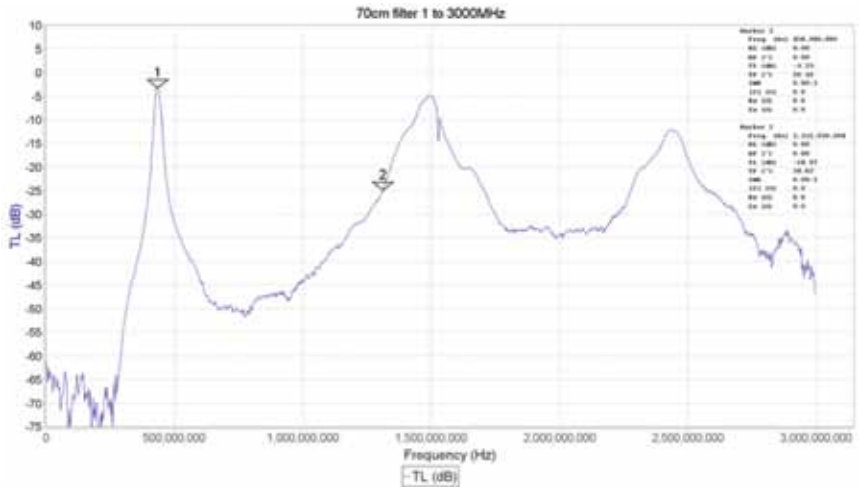



This is a 2 –pole filter using conventional helical resonators and the filter is tuneable over a limited range so peaking on 437MHz is possible. The plot below was taken using the 70cm unit with a SMA 3dB attenuator on both connectors to ensure the analyser's tracking generator output and input were reasonably close to 50 ohms. The display is centred on 437MHz and goes out to +/- 100MHz. The result is pretty much as advertised with the lowest loss at 433MHz but a respectable 0.9dB at 437MHz and the -40dB points at the ends of the scan are at -90MHz and + 100MHz.




The next plot is a DC to 1500MHz scan of the 70cm unit. Here the attenuation of the second harmonic at 874MHz is -47dB which is adequate providing there is further filtering in the transmit chain. However, the third harmonic attenuation is disappointing at only -22dB so additional filtering in subsequent stages would be needed as the third harmonic is only -10dBc at the output.

The small size of this filter and the marker at -45dB on 950MHz suggests another possible use for this filter as it also has 30dB of attenuation at 1850MHz and 2100MHz. My antennas will be just 400m away from a mobile phone mast that has several transmitters running 400 to 800w ERP on the mobile phone systems at 950MHz, 1850MHz and 2100MHz. Current designs of low noise pre-amps have front-ends matched for noise performance that are inherently broadband so it's highly likely that I will get all sorts of horrid mixing and overload from those transmitters when I get around to mounting the pre-amps with the new antenna system .

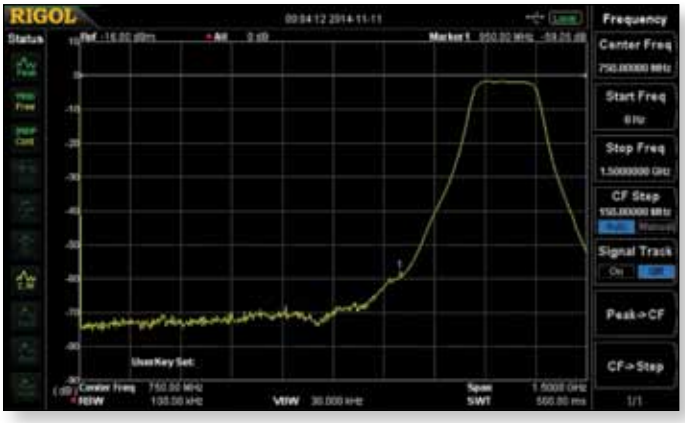



The additional loss caused by putting this filter in front of a wideband pre-amp, such as the one of the G4DDK units, would be far outweighed by the reduction of the unwanted products of overload. Note that the filter would only be of minimal assistance for receiving 70cms while transmitting on 23cms when inserted before the 70cm preamp because of the poor attenuation of frequencies in the 23cm band.

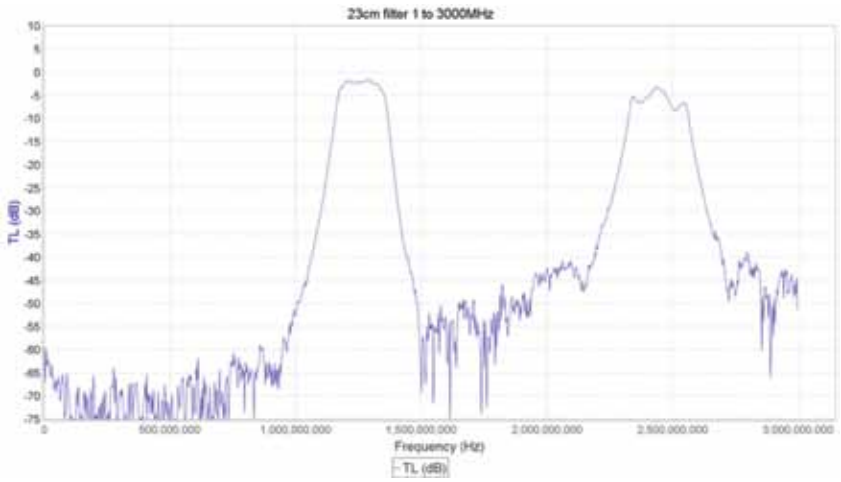
## DTX-F23

This is a 5-pole filter and it uses PCB strip line techniques that are not adjustable. Like the DTX-F70, this filter too has some unwanted responses at a multiple of the intended pass-band which is unhelpful for the purpose of reducing the harmonic outputs of the DTX1 transmitter. The specification of this filter on the dtx1.info website claims a sub 1dB insertion loss across the band of 1240 to 1300MHz but my findings are closer to the data published on the DG0VE website where the indicated insertion loss runs from about 1.3dB at 1220MHz and climbs to around 1.8dB at the top end of the pass-band at 1310MHz.

The steep skirts give good attenuation of the two spurious outputs from the DTX1 when used on 23cm and the broad nose of the pass-band ensures all of the UK 23cm allocation is accommodated. However, the attenuation of the second harmonic of frequencies in the bottom part of 23cms is barely 3dB so other measures are required to get the -30dBc harmonic output down to acceptable levels. The following plot from a VNA shows the poor 2nd harmonic attenuation very well.




The loss at 950MHz and 1850MHz is very respectable at over -55dB. At 2100MHz there's a useful -45dB loss. Using this filter in front of a masthead pre-amp might be acceptable if overload from phone masts is a real problem and other issues such as size and cost are important. If you can stretch to a conventional four pole filter such as those from Bert Modderman, PE1RKI, to be reviewed in a subsequent article, insertion losses can fall to less than 0.5dB with much less impact on the overall system performance.




With the advent of 4G, phone signal overload is going to be more of an issue for those of us operating in urban locations. Another use for this filter could be keeping 70cm transmissions out of 23cm receivers; useful for look-through on 23cm repeaters that have 70cm inputs.

*The Antennair DTX-F70 and DTX-F23 filters cost £43 and £40 respectively including carriage. The filters are manufactured by DG0VE in Germany but Antennair have conveniently made them available under their brand on the DTX1 support website,* ***http://dtx1.info/NewProducts.html*** *where you can use Paypal.*

# Understanding DATV RF Bandwidth for DVB-S

*Ken Konech - W6HHC & Hans Hass - DC8UE*

***In TechTalk 76, Ken W6HHC explained how FEC and Symbol-rate affected the RF Bandwidth for the Digital Video Broadcasting (DVB) standard for satellite communications, called DVB-S. It turns out that defining RF Bandwidth for QPSK deserves some additional explanations in order provide a full understanding. Ken is pleased to be joined by Hans DC8UE for the creation of this month's TechTalk article. Hans had earlier helped Ken to understand the design of the popular DBØDHL DATV Multimedia repeater in Hamburg Germany...and has technical experience as a satellite-communications-engineer in a commercial TV-uplink-station.***

## Confusion about the word "Bandwidth"

When Ken-W6HHC and Robbie-KB6CJZ were talking to hams in Europe about DATV repeater designs, they noticed that sometimes they were given unexpected bandwidths being used by the European repeaters. The Symbol-rates (S/R) being reported by the repeaters were always accurate (symbol-rate is always a setting in the transmitter, so it is well known), but the RF bandwidth reported sometimes had an unexpected relationship to Symbol-rate. A little searching on the internet (love Google and Bing search engines) showed that there are at least three popular ways methods of defining RF Bandwidth for DVB-S.

- "minus 3 dB" bandwidth method
- "occupied" bandwidth method
- "allocation" bandwidth method

So if you were to ask three different hams "what DATV bandwidth are you using?"...you may get three different answers when talking about the same DATV repeater!!

Ken and Hans agree that the most important purpose of describing bandwidth for DATV hams...is to provide a value that can be used for band-plan spacing and frequency coordination to avoid adjacent interference. Now we will look at these three methods of describing RF Bandwidth for DVB-S (QPSK modulation).

## "minus 3 dB" bandwidth method

With this method, the bandwidth is measured at the points that are down 3 dB. This is a typical method for measuring an analog filter bandwidth and represents the "half-power point" if you are looking at voltage on a spectrum-analyzer.

Mathematically, BW-3dB ≈ S/R for this definition.

While the BW-3dB method is very familiar to analog engineers and analog ATVers, it is not very useful for DATV to define the bandwidth of a digital signal transmission link for two reasons.

First, a modulation with a digital-(pulse-)modulationsignal produces a non-Gaussian signal-flank.

Second, you would not want to space several DATV stations "shoulder-to-shoulder" on their 1/2–powerpoints, since significant power would overlap neighboring frequencies. This approach to spacing of stations would create potential receiving interference. Especially, if several DATV repeaters are located together on the same hill-top or tower so that receiving antennas are pointing in the same direction toward adjacent DATV repeaters.

As a note: The bandwidth of the DVB-S carrier at the minus 3.8 dB points is approximately the same as the symbol rate (S/R).

## "occupied" bandwidth method

As defined by the commercial satellite standard, 3GPP TS 34.121 section 5.8, the Occupied Band-Width (OBW) is the bandwidth containing 99% of the total integrated power of the transmitted spectrum, centered on the assigned channel frequency.

Mathematically for hams: BWoccupied = 1.19 x S/R

How is the occupied bandwidth measurement determined? During this measurement, a Gaussian filter with a bandwidth greater than 10MHz and a resolution bandwidth (RBW) of 30 kHz or less is used to measure the distribution of the power spectrum.

First, the total power found in the measured frequency range is calculated.

Then, starting at the lowest frequency in the range and moving upward, the power distributed in each frequency is summed until this sum is 0.5% of the total power. This gives the lower frequency value for measuring the bandwidth.

Next, starting at the highest frequency in the range and moving downward, the power distributed in each frequency is summed until 0.5% of the total power is reached. This gives the upper frequency value. The bandwidth between the 0.5% power frequency points is called the "occupied bandwidth".

While the "occupied" bandwidth spacing of repeater frequencies is better at preventing adjacent interference than "minus 3 dB" bandwidth spacing, it still lacks one feature. The spacing should have a little guard-band to allow for unplanned obstacles ...like signal-path nonlinearity, etc.

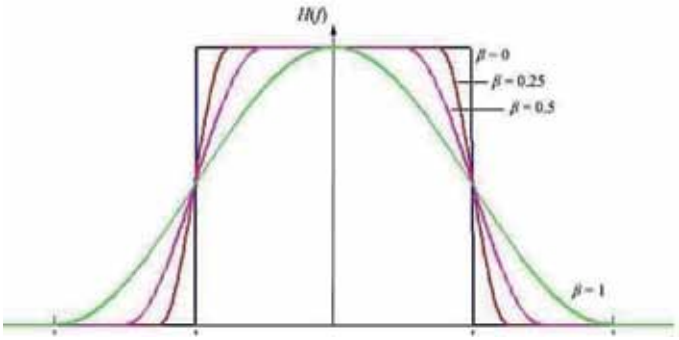
## "allocation" bandwidth method

This method for describing bandwidth provides a little guard-band between adjacent DATV signals.

The allocation bandwidth for DVB-S is calculated as

(1 + Roll-off-Factor) x Symbol-rate
BWallocation = 1.35 x S/R

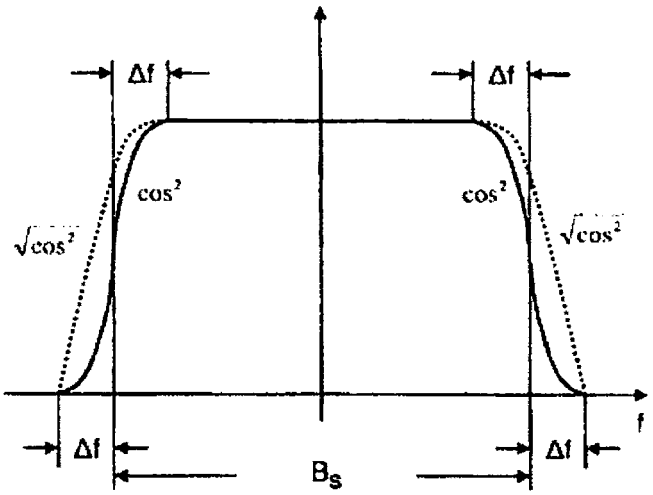
when using a 0.35 Roll-off-factor. The Roll-off-factor (shown in Fig 1) controls the grade of the slope of a DVB-S signal-edge.




▶ *Figure 1 – Different roll-off slopes for different Roll-off-factors*

The "allocation bandwidth" is determined by the big satellite-providers (like inside the Intelsat Earth Station Standard 420: (IESS420e.pdf) as an area, inside that the power-level will be not be lower than –26dB. There will be a filtering necessary on the signal borders (mostly performed by software), which takes care, that the borders rolls out weakly. The grade (slope) of this roll off will be described by the Rolloff-factor. It shows the relationship between half of the roll off area to half of the wanted channel-bandwidth.

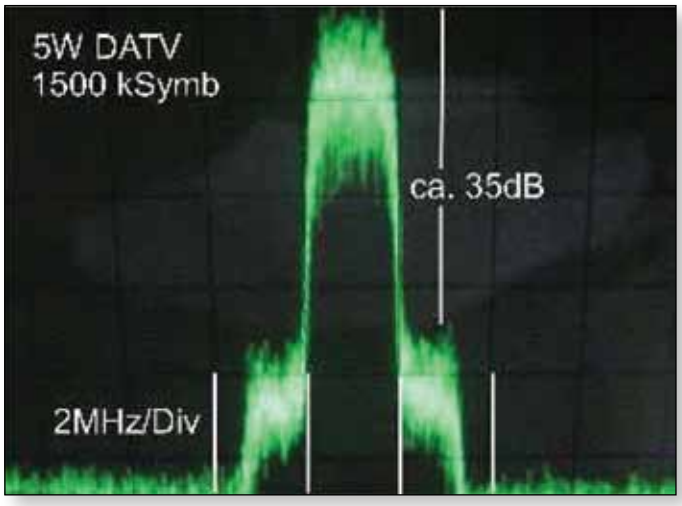
DVB-S specifies the Roll-off-factor at 0.35. A raised cosine filtering at the edge region for the transmission path is required. The used filter generates in a first step only a root raised cosine shape. Only in combination with the same filtering inside the receiver you will get the wanted raised cosine form of the filter shape. After the transmitter, inside the "on the air" signal, you will find the larger signal shape (shown as the dotted line) in Figure 2.




▶ *Figure 2 – "On the Air" DVB-S signal has the shape shown as dotted lines*

The DVB-S Standard uses a Roll-off-factor of 0.35 for video-transmissions and a Roll-off of 0.4 for datatransmission equipment. You may find on newer professional hardware utilize a Roll-off-factor of 0.25.

The new DVB-S2-standard (for high definition TV - HDTV) also utilizes a Roll-off-factor of 0.2. This means, the DVB-S2 used bandwidth is only 20% bigger than the symbol-rate. Hans DC8UE further explained that the DVB-S2 standard is now being used in Europe for transmissions from commercial broadcast-studios and also from an OB-van (outside broadcasting) to the up-link transmission-center.




▶ *Figure 3 – DATV QPSK signal at 1.5 M Symbol/sec produces 2.025 MHz of bandwidth*

Figure 3 shows a D-ATV DVB-S QPSK signal using a 1.5 MSymbols/sec symbol-rate of (generated by a MiniMod). It shows clearly 2.025 MHz of used bandwidth. Below 35dB you can see the additional shoulders, generated by intermodulation on the non-linear characteristic curves

of the equipment being used. A value of 42 dB for the shoulder seems to be normal for the single MiniMod exciter. But, if a power amplifier is driven too hard, then the following PA can increase the power levels of the shoulders to extremely poor values.

The "allocation bandwidth" is in practice really very useful to describe the real used bandwidth for spacing DATV repeater frequencies. For ham radio, Ken W6HHC prefers to "adjust" the allocation formula to

BWallocation ~ = 1.33 x S/R

Ken explains that this "adjusted value" is less than a 2% error and is much easier to calculate in his head. Both Hans DC8UE and Ken W6HHC agree that hams should only use the term BWallocation when they talk about DVB-S.

## Non-Linearity effects on bandwidth

It is extremely important, to avoid compression in the power amplifier and to operate the signal path and PA in a linear mode. As mentioned earlier, the shoulders in Fig 3 (don't you think they look like "shoulders on a human"...on each side of the head??) can continue to grow in strength through non-linearity, including compression. While Fig 3 shows the shoulders down about 35 dB below the carrier, Fig 4 shows that the shoulders on this PA output are only 20dB below carrier.

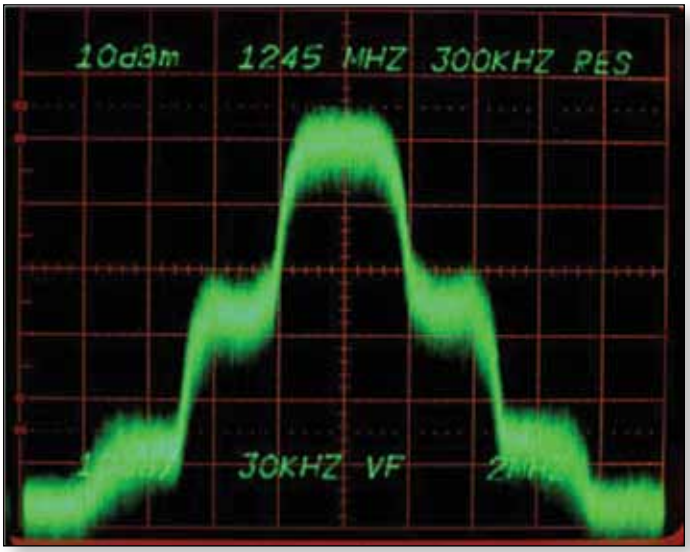



*Figure 4 - Spectral regrowth amplified by different a PA with shoulders now only 20 dB below carrier (Photo courtesy of Art-WA8RMC)*

Hans DC8UE explains that when he made a transmission via a commercial satellite in the old (no longer used) analog FMmode, they used the HPA (high power amplifier) in saturation (class-C). In the digital world with QPSKmodulation, they have to lower the power for class-A linear mode. That reduces the possible output power down to a level 4 to 5 dB below saturation. This reduction is called output backoff (OBO). During a terrestrial transmission (DVB-T RF-link), we have to reduce the OBO to a level 6dB below saturation, in order to hold the shoulders down.

One concept that DATV hams need to understand with DATV amplification....is that the DATV signal has a very Fig 4 - Spectral regrowth amplified by different a PA with shoulders now only 20 dB below carrier (Photo courtesy of Art-WA8RMC) high Peak-to-Average-Ratio, as shown as PAR in Fig 5. So while the average power level may seem low, the peaks can be going into compression (or even flat topping in saturation), hence nonlinearity and hence stronger shoulder power levels.

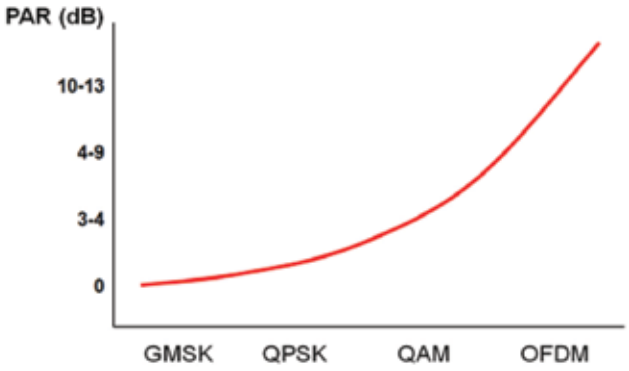



*Figure 5 - PAR for amplifier output power when processing signals with various digital modulation technologies (Graph courtesy of Robert Green - Keithley Instruments, Inc.)*

*Reproduced from the Orange County Amateur Radio Club newsletter,* ***www.W6ZE.org***

**Useful Links:**

- AGAF D-ATV components (Boards) ***www.datv-agaf.de*** and ***www.AGAF.de***
- SR-Systems D-ATV components (Boards) ***www.SR-systems.de*** and ***www.D-ATV.org***
- German ATV portal for streaming repeaters and forum ***www.D-ATV.net***
- Amateur Television of Central Ohio ***www.ATCO.TV***
- Darren-G7LWT site for "DATV Primer" ***www.G7LWT.com/datv.html***
- Ultimate Resource for Digital Amateur Television ***www.D-ATV.com***
- RF Bandwidth online calculator for DVB-S/DVB-S2 ***www.satellite-calculations.com/Satellite/bitrates.htm***

# IARU Region 1 General Conference

## 20-27 Sep 2014, Varna-Albena, Bulgaria

*Graham Shirville, G3VZV*

*This triennial Region 1 Conference took place in Bulgaria where it was hosted by BFRA the Bulgarian amateur radio organisation. As expected, there were three resolutions taken that are of interest to ATV operators in the Region:*

### Recommendation VA14_C5_REC_08

To promote centres of activity and amend redundant usage:

- 144,300 MHz (SSB Calling) - update to SSB Centre of Activity
- 144,525 MHz (ATV SSB talk back) - Delete
- 144,660 MHz – Delete (Editorial correction) – National footnote h to be retained.

As we have not used this ATV calling channel this seems a sensible change.

### Recommendation VA14_C5_REC_25

The rules for the IARU Region 1 ATV contest should be amended as proposed in Document VA14_C5_19.

These can be downloaded from here:
***http://www.batc.org.uk/contests/VA14_C5_19%20VERON%20Amendment%20to%20IARU-R1%20ATV%20Rules.pdf***

### Recommendation VA14_C5_REC_26

(this relates to the paper VA14_C5_35 Protection of amateur satellite service in 435 - 438 MHz range from ATV/broadband data transmissions)

It is recommended that the detailed recommendations provided in Annex 3 to the C5 minutes be implemented in respect of DATV issues and shall be integrated into the VHF Managers Handbook.

(NB –This Annex 3 not been formally published yet and will probably be incorporated in the next update of the VHF Managers Handbook which is expected to be published in January. In the meantime they are shown below so that the intent of the C5 Committee can be understood)

### Recommendations

Changes are required in various parts of the VHF Handbook

**TV Repeater Transmissions** (general recommendation)

In any band where there is serious compatibility issue, TV Repeater Outputs must minimise their overall transmissions to reduce the potential for interference. In such bands, continuous beacon or testcard transmissions

*The delegates who attended the IARU R1 meeting- photo G3VZV*

▶ *All the delegates attending the First Plenary meeting*

are a particular problem and should be phased out in favour of short regular transmissions or transmit-on-demand.

## DATV Technical Recommendation Changes

A 435 MHz entry is added to the technical recommendation table for Digital ATV with 2MHz and 2Mb/s max bandwidths

Add new footnotes (below table)

The bandwidths in the table above are recommended maximums. Development of narrower bandwidths are strongly encouraged as equipment allows.

DATV operators should ensure they transmit 'clean' signals in order to avoid adjacent channel interference. Particular attention is recommended regarding power amplifier linearity and the transmitted output spectrum.

Other frequency bands are permitted if the bandwidth is compatible. Any ATV operation should avoid interference to narrowband frequency centres in the relevant band plan.

## 70cm Band Plan Change

And also add a new general footnote in 1.1:-

ATV Repeater outputs are not permitted in the 435MHz band

## Note-c to be modified

ATV operators should be encouraged to use the microwave allocations where available, but may continue to use the 435 MHz band where permitted by the licensing authority. In case of interference between ATV and the Amateur Satellite Service, the Satellite Service shall have priority.

Any remaining legacy wideband ATV usage in the 435MHz band should be phased out in favour of narrower bandwidth, more compatible, modes such as DATV or SATV.

For ATV transmissions, in the 435 MHz band should take place in the segment 434.000 - 440.000 MHz. The video carrier should be below 434.500 MHz or above 438.500 MHz. national societies should provide guidance to their members on the exact frequencies to be used, with due consideration of the interests of other users.

## Introduce a new footnote to the band plan:- DATV & SATV

As the national 70cm allocations vary considerably, it is not possible in the VHF Handbook to specify exact centre frequencies for DATV/SATV operation – but it should be where its bandwidth is compatible with other uses.

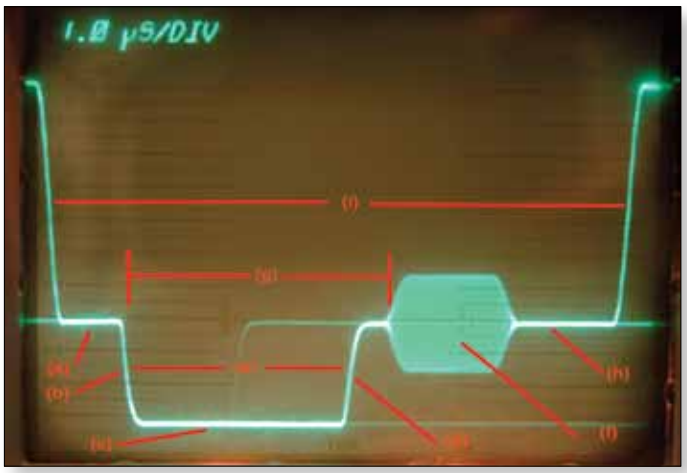
If the 435-438MHz amateur satellite section is used for ATV, it shall be on the following basis:-

- ATV (like Voice) Repeater outputs are not permitted
- ATV Internet gateways are not permitted
- ATV Repeater inputs are permitted (eg for cross band usage)
- ATV Simplex usage is permitted
- Transmission times by ATV users should be as short as possible
- Any usage should also be compliant with the Region 1 Technical Recommendations for DATV/SATV and in particular the maximum bandwidth
- Centre frequencies of ATV usage in the amateur satellite section shall be chosen to place its bandwidth at the upper end of the amateur satellite section

# Video Fundamentals 1
# The Line Sync Pulse

*Brian Summers G8GQS*

***In these days of digital video it is all to easy to loose sight of the underlying principles, in this series of (notes) (monographs?) I hope to cover the basics of analogue signals from which the digital signals are often derived. A good place to start is the PAL waveform, this in it's turn is based on the older monochrome work.***




It is useful to be able to name the parts of the waveform, here is the Line sync pulse and the Burst.

a. Front Porch 1.55µs ±250ns.

b. Leading edge of the line sync pulse, normally taken as the "time reference" point.

c. Sync bottom.

d. Trailing edge of line sync pulse.

e. Line Sync pulse duration 4.7µ/s ± 100ns., amplitude 300mv ±9mv.

f. The PAL Colour Burst 300mv ±9mV amplitude symmetrical about black level 10 ±1 cycles 2.25µs ±230ns duration. Frequency 4.43361875Mhz ±1Hz.

g. Burst start 5.6µs ±100ns from leading edge of the sync pulse.

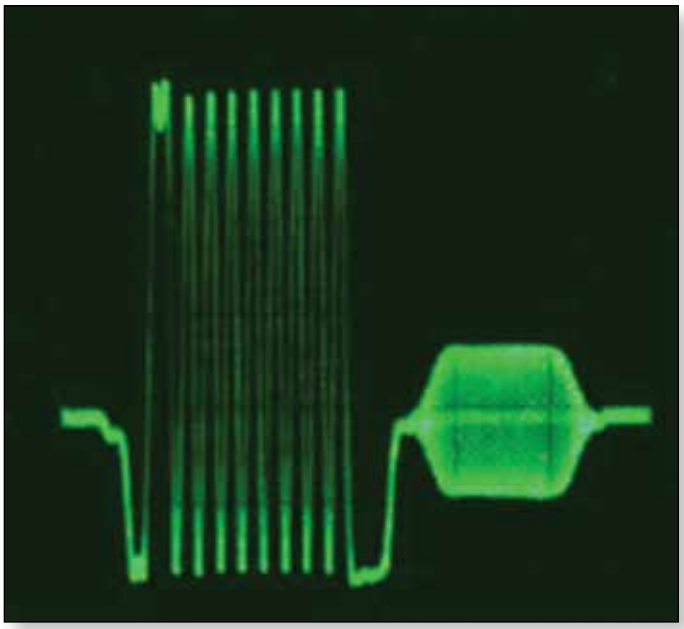
h. Back Porch 5.8µs ±600ns from trailing edge of line syncs.

i. Blanking 12.05µs ±250ns, measured with a white level signal.

**Notes:-**

The Gaussian slopes to all the waveform edges, this ensures that there are no high frequency "out of band" components to the signals. The measurements are taken from the half amplitude points on these waveforms.

The back porch period (h) is normally taken as the black level reference for the signal. It is also important that the Burst (f) is of the correct amplitude, or related to the amplitude of the chrominance information in the picture, as much domestic equipment, TV's and the like will auto-correct the saturation of the picture using the burst as a reference and if the burst is wrong the picture saturation will be affected.



## Sound-in-Syncs

The Sync bottom period (c) was used by broadcasters to carry a sound signal "Sound-in-Syncs". The idea was first described, as an analogue PWM signal, by Lawson, Kharbanda and Lord in 1946. The idea was developed by the BBC research department and Pye TVT into a digital system and it was much used on outside broadcasts, first as mono and then stereo circuit. This reduced the number of circuits needed and was a great cost saving device, it also kept the sound and vision together! It made sync separation difficult and the normal sync pulse had to be re-inserted with a SIS Blanker before any monitoring. It was only used on internal circuits and was never broadcast.

This is the first of an ongoing series of Video Fundamentals;- Next month colour bars and what they mean.

**Further reading:-**

SIS:- BBC Engineering Monograph Number 86
***http://www.bbc.co.uk/rd/publications/bbc_engineering_86***

# BATC Streaming Service

*Dave Mann – G8ADM*

## Background

***Soon after Peter became President of the Club, amongst other things, he encouraged the Committee to consider starting our own Video Internet Streaming Service. There were a variety of free resources such as YouTube that some members were using for streaming but these were hard to find and un-coordinated. The committee were quite reluctant due to the hardware and network charges that we would have to support. So it was agreed to form a separate sub-committee to see what could be done. This sub-committee was able to get some external contributions to buy a dedicated server and some software. Chris Smith who runs our computer system set up our new server and produced an elegant web page that made the system work and was easy to use.***

This new service was to relay the outputs of TV repeaters, provide a streaming video service for individual members and hold an archive of BATC video recordings. More recently dedicated pages for news, live events and the ISS have been added.

This new service immediately became of great interest to club members. It brought the BATC together instead of being a collection of unrelated groups suddenly we could all see what was going on in ATV around the world and also directly interact with other members. It enabled members to see if a repeater was receiving their signals if nobody was around to give them a report. If there was no local repeaters in an area, individuals could stream their personal output for worldwide viewing. The RSGB News is read every Sunday morning by Roy, G8CKN both via the amateur sound repeater network and in sound and vision via the BATC stream. An indication of its success is that we have recorded tens of thousands of individual computers that have accessed the streams. The BATC membership is just below one thousand so this level of interest is quite remarkable.

This success encouraged the committee accepted that streaming was a worthwhile project, the temporary sub-committee was disbanded and the main committee now run the service with Chris' continuing help.

## Setup

To stream your personal pictures or a repeater output you need to be a BATC member. A streaming service in the Members Section can be setup from the Menu when you log in to ***www.batc.org.uk***. For repeaters you need to request this by sending an email to the Chairman, ***chair@batc.org.uk*** The name of your stream or a repeater stream is normally the same as the callsign. To stream the video you need to download Adobe streaming video encoder, this is free. To set up this encoder the details can be found in the BATC Forum: ***http://www.batc.org.uk/Getting_Started/streamguide.pdf***

## What to Stream

For Repeaters the streaming is often left on 24 hrs a day if the repeater club can afford the bandwidth charges. If there is no streaming signal then a BATC logo will be displayed. Members Streaming is normally only sent when the member wishes to do so, this avoids excessive bandwidth charges both to the member and the BATC. For Repeaters that are not in use, please make your streaming video interesting. A fixed test card or nasty caption saying No Signal will not be in the least entertaining. A sequence of captions or a camera shot of the repeater surroundings would be much better. The worst possible thing to stream is white noise, the amount of bandwidth used is proportional to the rate of change in the picture. So, stationary captions don 't use much data but white noise, where every pixel in the picture is constantly changing use the maximum amount of data.


▶ *Not very interesting viewing!.*


▶ *Never transmit Noise, it uses maximum bandwidth*

The BATC pays for the bandwidth used from the members subscriptions so transmitting white noise is a terrible waste of money. For big events it is surprising how many viewers can simultaneously watch a stream. Our modest Server was not designed to provide pictures to a large number of viewers but I have occasionally seen over 400 people simultaneously watching an event, amazing! Remember we have many users, viewers and repeaters around the world using the service so whatever you stream please take care.

## The Future

Your committee is continually thinking of ways to improve all the BATC facilities and this includes the Streaming Service. Currently, when correctly setup the streaming picture is low resolution, 320 x 240, SD Video with a 3:4 aspect ratio. Wide screen 16:9 aspect ratio may be seen if you are using a wide screen computer monitor by pressing the full screen button. This will still be low resolution. To compare this picture size with a wide screen, 16:9 aspect ratio, HD, 1920 x 1080 picture see the image below.

This is why it is much better to receive a repeater off air where the full resolution will be available and not to just rely on the streaming service.

Future developments include using an alternative encoder to the Adobe Media Encoder and using an optional wide screen display. For the streams to use a full resolution wide screen display would use a great deal of bandwidth and be beyond the financial resources of the BATC but we may be able to provide half resolution. We would like to maintain this service without asking for an additional subscription charge so that anyone can watch the pictures.

**The BATC Streaming Service can be found at:**
***http://www.batc.tv***


▶ *Normal repeater display*

▶ *The inset compares the normal streamed picture to full resolution HD*

# RPiDATV RB-TV transmit system

*Evariste Okcestbon – F5OEO*

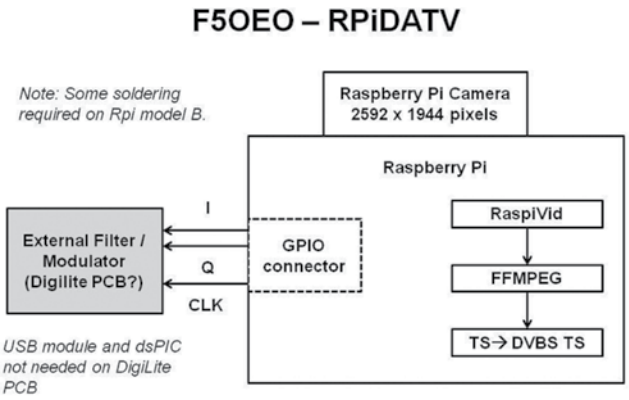
## Introduction

*This article describes a solution to use the Raspberry Pi as the main component of an H264 (MPEG-4) based very narrow band DVB-S transmission system producing I/Q signals to be fed to an external modulator. The system is capable of producing high quality pictures using MPEG-4 compression from either pre-recorded files (test card sequences) or live images from the RPi camera.*

It will it operate from 3 Msymbols/sec down to 250 Ksymbols / sec making it ideal for narrow band operations on the new 146 MHz band available in the UK and other frequencies when used with an external I/Q modulator such as Digilite and DATVexpress.

Two modes are available:

- Output I/Q bit stream compliant ready to feed an external QPSK modulator (I/Q mode)
- A direct QPSK modulator with RF output designed for test purposes only (Ugly mode)




## Hardware required

- Raspberry Pi Model B or B+ with a Micro SD card of 8 GigaBytes minimum
- Raspberry Pi Camera
- External QPSK Modulator and RF amplifier
- RF amplifier and antenna

## Interfacing the Raspberry Pi to an I/Q modulator

The software is designed to enable the GPIO port on the Raspberry Pi to provide a compliant I/Q bit stream which can be used to directly feed an external QPSK modulator.

The connections to an external modulator are as follows:

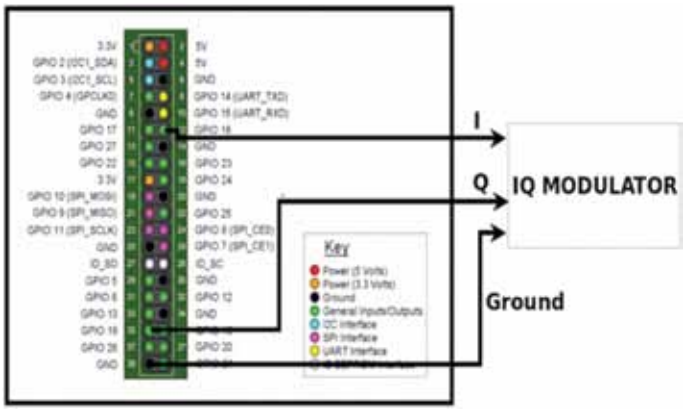
Pin 12 : output I

Pin 35 : output Q

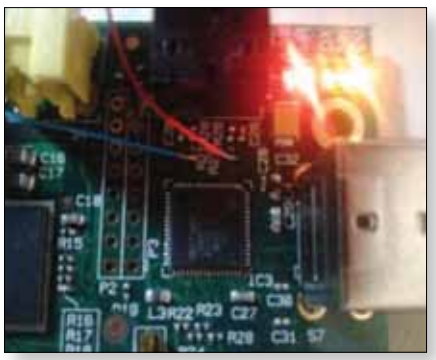
Pin 39 : Ground (you could also take any other ground available on the Header)

Output voltage of I and Q is 0-3.3V.

Take care of pin numbering : PIN #1 is located the closest to MicroSD card on B+

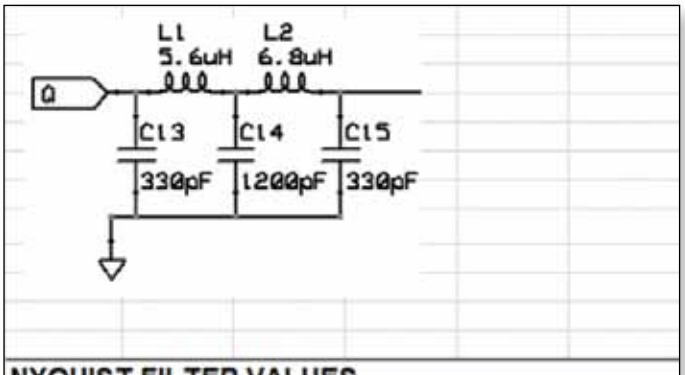



It is possible to use the older Raspberry Pi Model B with the RPiDATV software, however the header has only 26 pins instead of 40 on B+. For I/Q mode, the PWM0 and PWM1 lines provide are I and Q and are taken from R21 and R27. 2 wires need to be soldered on the board:



Clearly this modification is done at your own risk – for further schematics see:

***http://www.raspberrypi.org/wp-content/uploads/2012/10/Raspberry-Pi-R2.0-Schematics-Issue2.2_027.pdf***




**NYQUIST FILTER VALUES**

| Ms/S | C13/16 | L1/L3 | C14/17 | L2/L4 | C15/18 |
|---|---|---|---|---|---|
| 4 | 330pF | 5.6uH | 1200pF | 6.8uH | 330pF |
| | 0.33nF | | 1.2nF | | 0.33nF |
| 2 | 660pF | 11.2uH | 2400pF | 13.6uH | 660pF |
| | 0.66nF | | 2.4nF | | 0.66nF |
| 1.3333 | 990pF | 16.8uH | 3600pF | 20.4uH | 990pF |
| | 0.99nF | | 3.6nF | | 0.99nF |
| 1 | 1320pF | 22.4uH | 4800pF | 27.2uH | 1320pF |
| | 1.32nF | | 4.8nF | | 1.32nF |
| 0.5 | 2640pF | 44.8uH | 9600pF | 54.4uH | 2640pF |
| | 2.64nF | | 9.6nF | | 2.64nF |
| 0.25 | 5280pF | 89.6uH | 19200pF | 108.8uH | 5280pF |
| | 5.28nF | | 19.2nF | | 5.28nF |

## Using the Digilite I+Q modulator

The most obvious application is to drive the Digilite modulator board and a minor modification is required to directly drive the I/Q modulator.

Lift the two 100ohm resistors (R9 and R10), stand them on end on the pads going in to the filter and then solder the wires from the RPi I/Q output on to the free ends of the resistors.

For 5.9 version of Digilite, lift R9 and R10 and plug the I/Q output from the RPi on to Pin 1 and 2 of JP4.

The Nyquist filter values will also need changing. The table shows possible values for the lower symbol rates when used on a version 5.9 PCB but these will need confirming before use.

## The Digithin modulator card for the RPi

Brian G4EWJ is developing a plug in card for the RASPBERRY Pi called Digithin which plugs directly on to the Raspberry Pi GPIO port and contains a modulator / serialiser device and Nyquist filters. This will process the data and, using an external LO source generate the RF. Coupled with a lithium battery, the idea is to make a completely self contained, portable, narrowband DATV transmitter for 146MHz or 437MHz. A full article describing Digithin will be included in a future CQ-TV.

## DATVexpress

UDP Code which enables the RPiDATV software to work with DATV-Express has been released. However, at the time of writing, the FPGA filtering needs further work to remove some aliases evident at low symbol rates. Announcements when this work is complete will be made on the project website ***www.datvexpress.com***

## Other modulators

RPiDATV has also been tested with a number of other I/Q modulators including modulators from F1DOJ, F5LGJ (CPLD based with digital filtering) and F1FAU/F9ZG.

## Installing the software

The software is available for download from ***http://f5oeo.fr/RPiDATV0.1.img.zip*** as a complete image for the Raspberry Pi SD card. Unzip the image with Winzip or 7zip and then use your PC to build an image on the 8 GB SD card using a disk imager program. Full instructions are available here: ***http://www.raspberrypi.org/documentation/installation/installing-images/windows.md***

Connect up the Raspberry Pi in the normal way using a monitor and keyboard or connect remotely via SSH using a program such as Putty – this is the preferred method and full instructions are available here: ***http://raspberrypi4dummies.wordpress.com/2013/03/17/connect-to-the-raspberry-pi-via-ssh-putty/***

## Running the software

Insert the SD card in the Raspberry Pi and power on. (All the `text highlighted in green` should be entered at the RPi command prompt followed by pressing enter or return.)

At the prompt enter `pi` for login and `tv` for the password.

When running the software for the first time you may want to switch keyboard language: type `sudo raspi-config` and in the menu choose local/keyboard and UK (instead of the default French).

For now the software requires a minimum of commands to launch the modulation. In a future release, it will be launch automatically and will not require any action.

To start encoding, type `cd RPiDATV` and then type `sudo ./RPiDATV mire250.TS 2000 7 1 0`

```
pi@UglyDATV0: ~/UglyDATV
eva@eva-Vostro1710:~$ ssh pi@192.168.0.6
pi@192.168.0.6's password:
Linux UglyDATV0.1 3.12.32+ #721 PREEMPT Fri Nov 7 16:50:31 GMT 2014 armv6l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Fri Nov 14 16:06:41 2014 from 192.168.0.2
pi@UglyDATV0 ~ $ cd UglyDATV/
pi@UglyDATV0 ~/UglyDATV $ sudo ./UglyDATV mire250.TS 2000 7 1 0
Board revision = 0x10
Model B+
Output Mode IQ
UGLYDATV (F5OEO Evariste) with loop
Board revision = 0x10
Unmapped 0
Clock Divider=250
Real SR = 2000 KSymbol / Divider =250
Playing File =mire250.TS at 2000 KSymbol FEC=7
TS Bitrate should be 593770 bit/s
END OF FILE OR packet is not 188 long 1
```

The screen should look as follows:

This will produce an I+Q output at 2 Msymbols, FEC 7/8. If you have connected an I/Q modulator you should be able to receive it on a set top box or at least find the channel and service name but video may not be available at this point.

To stop the process, hit any key.

## Changing the transmission parameters

The RpiDATV software transmission parameters can be changed to any DVB compliant modes. Using our first example, where we entered *RPiDATV mire250.TS 2000 7 1 0* the parameters are as follows:

| RPiDATV | mire250.TS | 2000 | 7 | 1 | 0 |
|---|---|---|---|---|---|
| The program name | Transport file name | Symbol rate | FEC | Loop | Mode |

**Transport file** Transport stream file name = either the name of a .ts file already present on the SD card or "videots" to use the Raspberry Pi camera.

**Symbol rate** Rate in Ksymbols (tested from 250 to 3000)

**FEC** 7 = 7/8, 5 = 5/6, 3 = ¾, 2 = 2/3, 1 = ½

**Loop** 1 = loops the input file (useful to have a continuous transmit of short TS File)

**Mode** 0 = external I/Q modulator mode

## Scripts or preset configurations

In order to avoid having to enter a number of parameters every time and also to launch all the required processes, some predetermined scripts are provided in the RPiDATV folder. These scripts can be modified and renamed using a simple text editor.

A number of scripts are provided on the disk image – to launch them enter the following:

```
./script name.sh
```

The following scripts are provided:

1m4375.sh = Transmit the camera at 1 mSymbol/s on 437.5MHz

500k4375.sh = Transmit the camera at 500kSymbol/s on 437.5MHz

2m4375.sh = Transmit the mira.ts file at 2 mSymbol/s on 437.5MHz

## Modifying the scripts

In order to experiment with different parameters you will need to modify the scripts – this is can be done using the Raspberry Pi editor called *nano*. Always remember to save the file before exiting nano.

To modify a script, type `nano script name.sh`

The following will be displayed:

*sudo nice -n -30 raspivid -s -n -w 320 -h 288 -b 300000 -t 0 -pf high -fps 15 -g 12 -ih -o videoes &*

*sudo /home/pi/RPiDATV/RPiDATV videots* ***250*** *7 0 0 &*

*sudo nice -n -30 /home/pi/RPiDATV/ffmpeg -loglevel debug -analyzeduration 0 -probesize 2048 -r 15 -fpsprobesize 0 -max_delay 40000 -i videoes -f h264 -r 15 -minrate 300K -maxrate 300K -bufsize 20K -vcodec copy -bufsize 20K -f mpegts -mpegts_original_network_id 1 -mpegts_transport_stream_id 1 -mpegts_service_id 100 -mpegts_pmt_start_pid 1000 -mpegts_start_pid 1001 -metadata service_provider="F5OEO" -metadata service_name="F5OEO-1" -muxrate* ***403200*** *-y videots &*

To change the symbol rate of the transmission, the 2 numbers in bold have to be changed.

To set the new symbol rate change 250 to 2000 (this sets the symbol rate) and change 403200 to 3225490 (which is the bit rate of the Transport Stream- see below for details of calculation)

We have now changed the output rate of the TS and so we have a bigger transmission pipe, but the video encoding is still at a low bit rate, which means that we will be filling it with padding packets.

In order to avoid bit stuffing, the next example shows how to increase the video quality by changing the resolution.

*sudo nice -n -30 raspivid -s -n -w* ***320*** *-h* ***288*** *-b* ***300000*** *-t 0 -pf high -fps* ***15*** *-g 12 -ih -o videoes &*

*sudo /home/pi/RPiDATV/RPiDATV videots 2000 7 0 0 &*

*sudo nice -n -30 /home/pi/RPiDATV/ffmpeg -loglevel debug -analyzeduration 0 -probesize 2048 -r* ***15*** *-fpsprobesize 0 -max_delay 40000 -i videoes -f h264 -r* ***15*** *-minrate* ***300K*** *-maxrate* ***300K*** *-bufsize 20K -vcodec copy -bufsize 20K -f mpegts -mpegts_original_network_id 1 -mpegts_transport_stream_id 1 -mpegts_service_id 100 -mpegts_pmt_start_pid 1000 -mpegts_start_pid 1001 -metadata service_provider="F5OEO" -metadata service_name="F5OEO-1" -muxrate 3225490 -y videots &*

In this example:

**320** = width of the video
**288** = height of video
**300000** = bitrate of video
**15** = FrameRate
**300K** = bitrate of video
(setting for the transport stream tool)

So as we have plenty of bandwidth we can change the parameters to 720*576 resolution at 25 frame/sec and a video bit rate of 2800000. **Important note: the video bit rate should not exceed 70 % of the total bitrate**

*sudo nice -n -30 raspivid -s -n -w* **720** *-h* **576** *-b* **2800000** *-t 0 -pf high -fps 25 -g 12 -ih -o videoes &*

*sudo /home/pi/RPiDATV/RPiDATV videots 2000 7 0 0 &*

*sudo nice -n -30 /home/pi/RPiDATV/ffmpeg -loglevel debug -analyzeduration 0 -probesize 2048 -r* ***25*** *-fpsprobesize 0 -max_delay 40000 -i videoes -f h264 -r* ***25*** *-minrate* ***2800K*** *-maxrate* ***2800K*** *-bufsize 20K -vcodec copy -bufsize 20K -f mpegts -mpegts_original_network_id 1 -mpegts_transport_stream_id 1 -mpegts_service_id 100 -mpegts_pmt_start_pid 1000 -mpegts_start_pid 1001 -metadata service_provider="F5OEO" -metadata service_name="F5OEO-1" -muxrate 3225490 -y videots &*

Note, the RPi camera enabled by using "videots" in place of the pre-recorded .ts file name.

Other parameters such as the service name and PIDs can be edited in the same way – it is recommended that you save a back up copy of .sh files before editing them!

## How the RPiDATV Software works

The RPiDATV software takes a transport stream input file and it then processes it to transform to a DVB-S I/Q compliant stream according to Symbol Rate (Rate of transmission) and FEC (Error correction).

The effective data rate is calculated by:

Transport Stream effective rate = Symbol Rate * 2 (QPSK=2 bits by symbol) * 188/204 (16 bytes added at each 188 packet ) * FEC

For example for a SR 2000 and FEC 7/8 bit stream:

TS= 2000*2*188/204*7/8 = 3225490 bit/s

The first test uses a pre-recorded file *mire250.TS* – this file has a perfect timing for 250KSymbols FEC 7/8. However, in the Transport Stream file itself, there are clocks which help the set top box to decod properly the video and synchronize it with the sound. If the transport files you play are not calculated for the rate you send in RPiDATV, you could have issues with decoding the video which will be very slow or drop frame.

For a live stream, this Transport Rate should be fed in to RPiDATV at the correct bit rate in order to not have under or over flow.

## RPiDATV UGLY mode

The RaspberryPi has a programmable PLL Clock which can generate frequencies up to 250 MHZ and the output is available directly on the pin 12 of the GPIO header - this doesn't require any other hardware to generate a DATV test signal!

For QPSK, we need to divide the frequency by 4 which means we can only generate a QPSK modulated RF signal at up to 62.5MHZ. However, as the signal is a square wave, we can receive all even harmonics - for example harmonic 7 of 62.5Mhz is 437.5MHZ which is in the 70cms DATV Band. The 17th harmonic of the signal is also present at 1026.5 MHz and can be received by a normal MPEG-4 set top box!

**Note:** this mode is called Ugly because the RF modulation is done with square signals which generate a lot of harmonics and there is no Nyquist filtering thus we have all the Symbol Rate harmonics present on the output. It is recommended that you only use UGLY mode for testing in your shack and do not put it live on air until you made a very effective bandwidth filter!

## Running Ugly mode

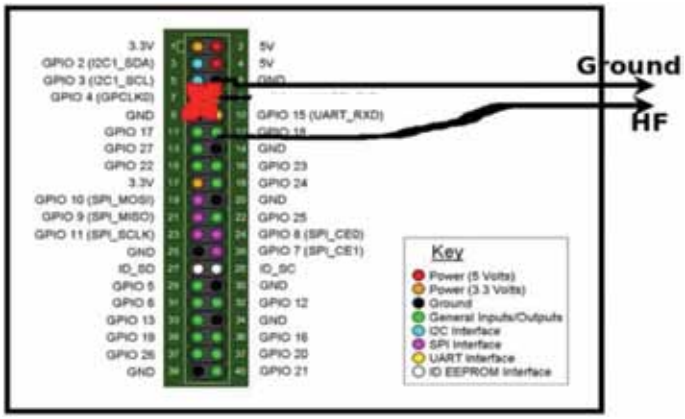
Ugly mode is run from the same software and the mode parameter is used to set the frequency in MHZ of the fundamental output.

```
sudo ./RPiDATV videots 1000 7 1 62.4
```

This command would play the RPi camera at 1Msymbol/sec on 62.4 MHz
(7th harmonic = 437 MHz & 17th = 1026.5MHz).

**Note:** In Ugly mode, the symbol Rate should NOT exceed 1500KSymbol/s

## Ugly mode hardware




The RF signal is on pin 12 of the header (GPIO18) and can either be picked up by loose coupling with a test lead across the PCB or direct connection on to the pin via a low value capacitor.

Features for future versions include improved video latency, improvement of bandwidth efficiency, internal pattern generator, automatic program start at RPi boot and hardware control of the program using switches on the GPIO port.

For further details and up to date information on the project visit the BATC forum page ***http://www.batc.org.uk/forum/viewtopic.php?f=15&t=3982***

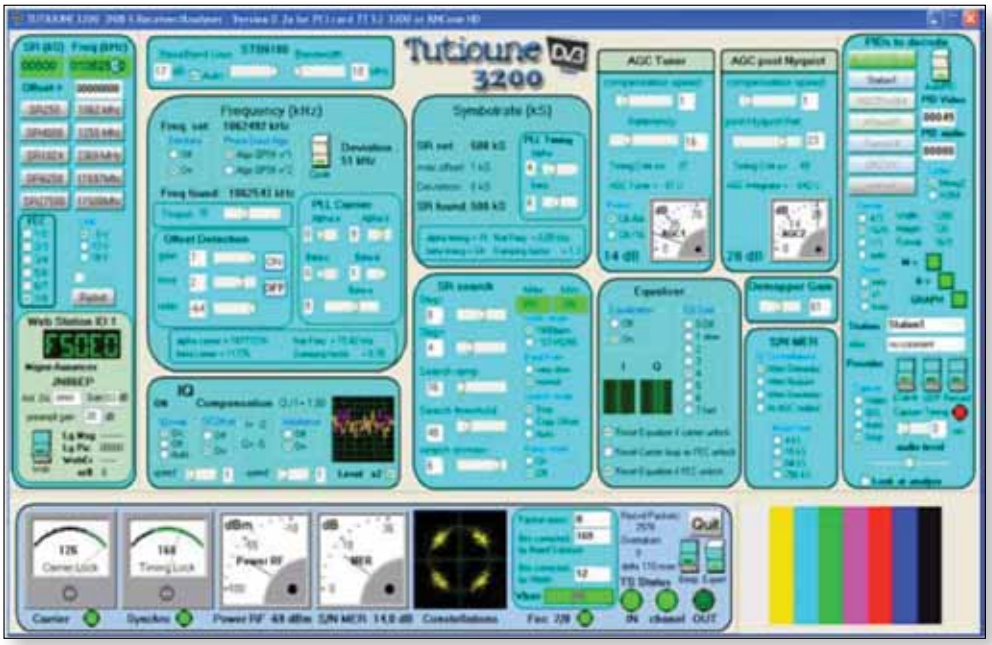
**With particular thanks to:**

Brian G4EWJ for sharing his very efficient code of channel encoding in ARM Assembler

Perceval for his Linux emergency support

F4DAY for pioneering the Poor Man DATV

PiFM for the idea of using the RPi GPIO to transmit




▶ *Tutioune display of Ugly mode at 1.0625GHz*

# New subscription rates

The BATC has incurred a small financial loss in the last two years and the current year will also see a loss, mainly due to subsidising the DTX1 sales and increases in the cost of CQ-TV postage. In particular, we have seen significant increases in the overseas postage rates and this is reflected in the sharp increase in cost for overseas paper subscriptions. In some cases it costs more to post CQ-TV than to print it!

There have also been a number of items of special expenditure but even allowing for these, our income no longer covers day to day running and we have been using our reserves to cover the losses.

Therefore at the CAT14 General Meeting it was announced that the BATC was considering increasing subscription fees and we asked for feedback from the members. The comments from the floor included that the subscriptions were too cheap when compared with other organisations, that there was a danger that perceived value of BATC would become too low and that we should temper our increases with regard to the amount of our reserves.

Your committee has taken on board these comments and agreed a small increase in subscriptions that will come into effect on 1st January 2015:-

**For the UK**

**Full Membership + cyber CQ-TV**
1 year =£6 2 years = £11 3 years = £15

**Full Membership + paper & cyber CQ-TV**
1 year = £20 2 years = £39

**For Europe (air mail service)**

**Full Membership + cyber CQ-TV**
1 year =£6 2 years = £11 3 years = £15

**Full Membership + paper & cyber CQ-TV**
1 year = £30 2 years = £59

**For Rest of World (air mail service)**

**Full Membership + cyber CQ-TV**
1 year =£6 2 years = £11 3 years = £15

**Full Membership + paper & cyber CQ-TV**
1 year = £35 2 years = £69

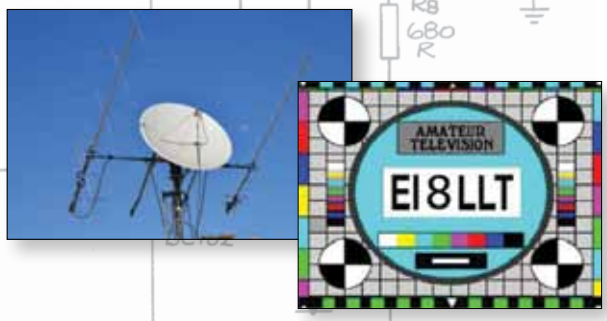
**Note:** The subscriptions to receive a cyber copy of CQ-TV are the same wherever you live and all members are able to download a cyber copy of CQ-TV, but we MUST have your email address for this.

We believe the BATC is still very good value for money offering the BATC.TV streaming service, the members shop which offers hard to get parts at near cost price, the members forum, an annual convention and CQ-TV magazine.

*Brian Summers G8GQS*
*Hon Treasurer BATC*

**Do you have any news, ideas or circuits you would like to share with your fellow BATC members in CQ-TV?**

Send any ideas, complete articles, circuits or photographs to ***editor@batc.org.uk***



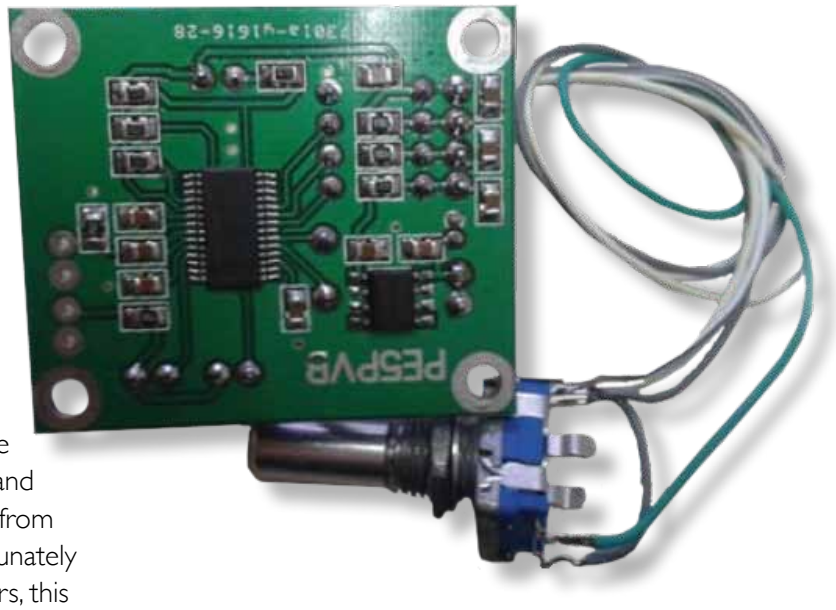

(Please contact the Editor before emailing large files!)

# MAX On-Screen-Display Generator

*Sjef Verhoeven – PE5PVB*

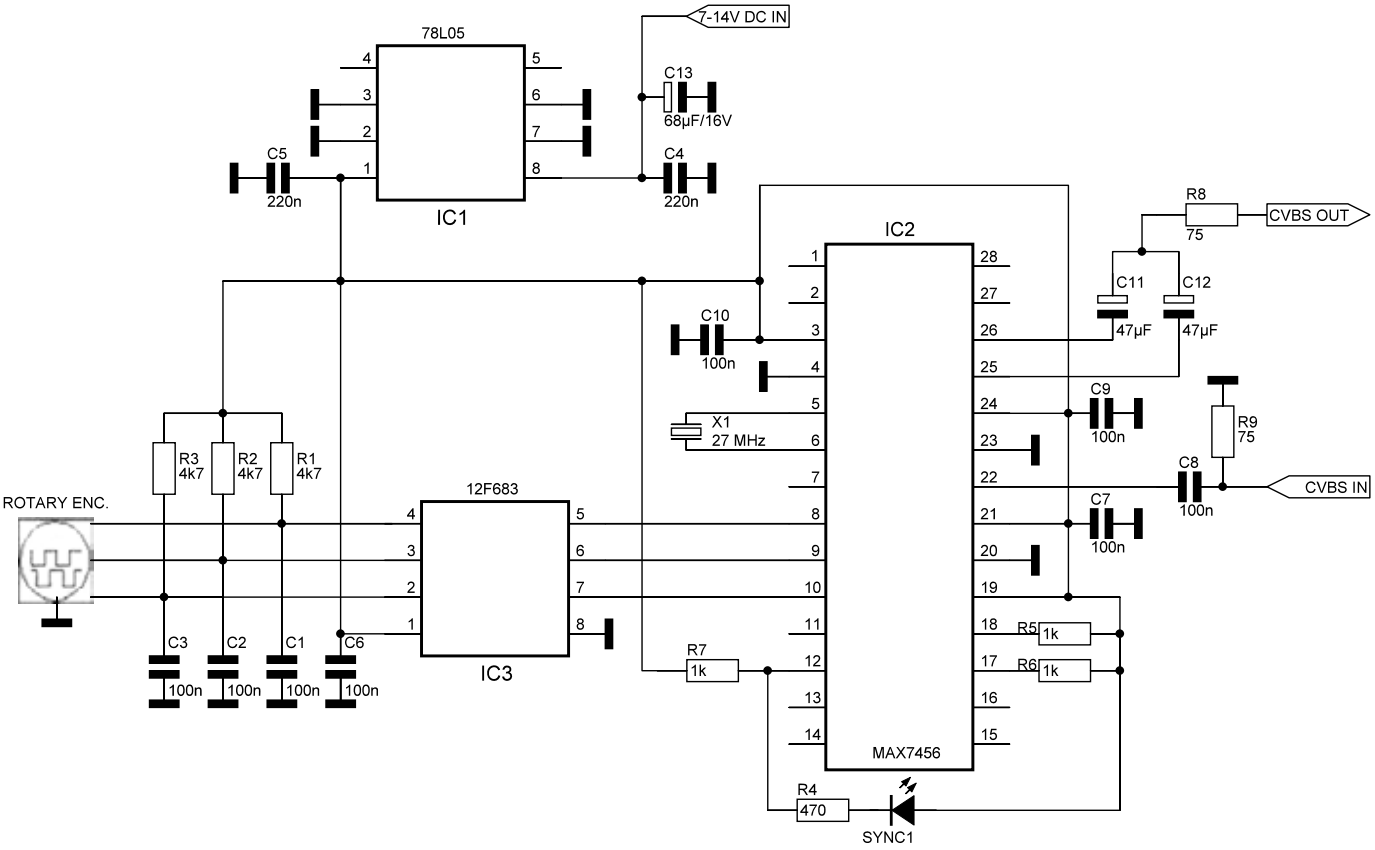
## Introduction

*During my ATV transmissions I always ran into a problem: how to add text to the screen in a simple and effective way. Before this project I used several OSD generators. Often they had a very fancy menu, but in practice it was a lot of work to change the text. They used several push buttons and you needed a manual to use it. Sometimes those buttons had double functions, so frustration all the time.*




In my search for a good OSD chip I found some famous IC's like the STV series. Unfortunately those STV's have been out of production for years now and prices are rising. Then my eye was caught by an IC from Maxim. It's a monochrome OSD generator. Unfortunately in TSSOP casing, for less experienced home brewers, this can give problems. This chip has exactly what I was looking for: easy to control by the SPI-bus, built-in sync detector and as a bonus, a small amount of free programmable memory (eeprom), where you can put your own drawn characters. Unfortunately the possibility for a larger character set is missing and when no video is applied you have a grey background instead of the nice blue one.

For some time now I have used rotary encoders in my projects. They're much easier to use than push buttons (for example, see the iPod), and you only have to drill one hole in your case. The idea was born and in a few days I ended up with this PCB and a nice result.




## Software

I wanted to create a simple project with as few components as possible. I choose not to use an external eeprom for the memory of the programmed texts. For this reason I had to limit the number of characters. With the current design you can show 8 lines of 30 characters on the screen (8x30 = 240 bytes). This is nicely in line with the internal eeprom of the 12F683 (256 bytes). Just choose the place on the screen with a turn on the rotary encoder (you'll see a flashing cursor on the point on the screen). Push the rotary encoder on the place you want to edit and turn it to choose a character. Push again to store the character. The cursor will now go automatically to the next position.

Do you want to erase the whole screen? Just push and hold the rotary encoder while applying power to the circuit. As an extra feature I added some characters so you can add a border around a text.

## Hardware

The OSD generator is built around the MAX7456 OSD generator. This is a 28-way TSSOP IC. You can easily order this part at your local hardware store or for example via eBay. Price varies a lot. If you don't have any moral objections, you can also sample the IC's for free at the Maxim Free Sample Service.

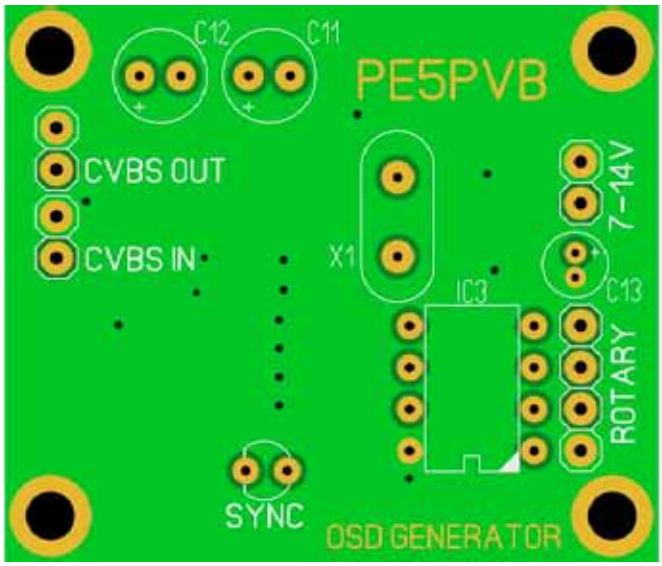
The MAX7456 is controlled by a 12F683 from Microchip. This is a small 8-way microcontroller. Of course you have to program this microcontroller with the right software. If you want to use the extra functionality of adding borders around texts you have to program this first. There are separate .hex files for this functionality, which you have to load once. The 78L05 (SOIC8) is used for the 5V power. An extra LED is added for the sync detector. Due the easy setup the PCB is small, 40x34mm.

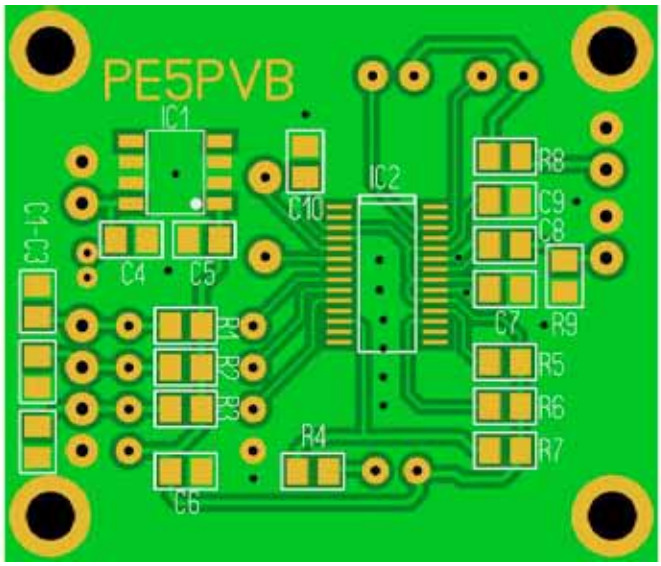
## Home brewing

Of course it's a lot of fun to build the circuit yourself. If you etch your PCB's yourself, make sure you create all the via's. I also have some factory PCB's in stock with silkscreen and via's (see photo). If you would like such a PCB with or without a presoldered MAX7456, or a complete build kit, please contact me: pe5pvb@het-bar.net

Have fun with this nice OSD generator and see you on ATV!

**All the files for this project can be downloaded from:**
***http://www.batc.org.uk/cq-tv/software/index.html***




► *Circuit Board layout - not to scale!*

# Classic circuits

Here's a circuit for a video amp that originally appeared in CQ-TV 80 (1972) but is still popular today.

If you have a circuit that you use and think other readers may benefit from building, please send it in to the Editor for publication.

This circuit was sent to C Q - T V by R.A. Rowe, who thought it might be useful to readers. He himself has used it and found it to be very good.

As can be seen from the performance table, the circuit provides a very satisfactory performance for a general purpose amplifier with a useful gain. Should be quite cheap to build too!

$Z_{in}$ = >10K max.0·4v p.p.

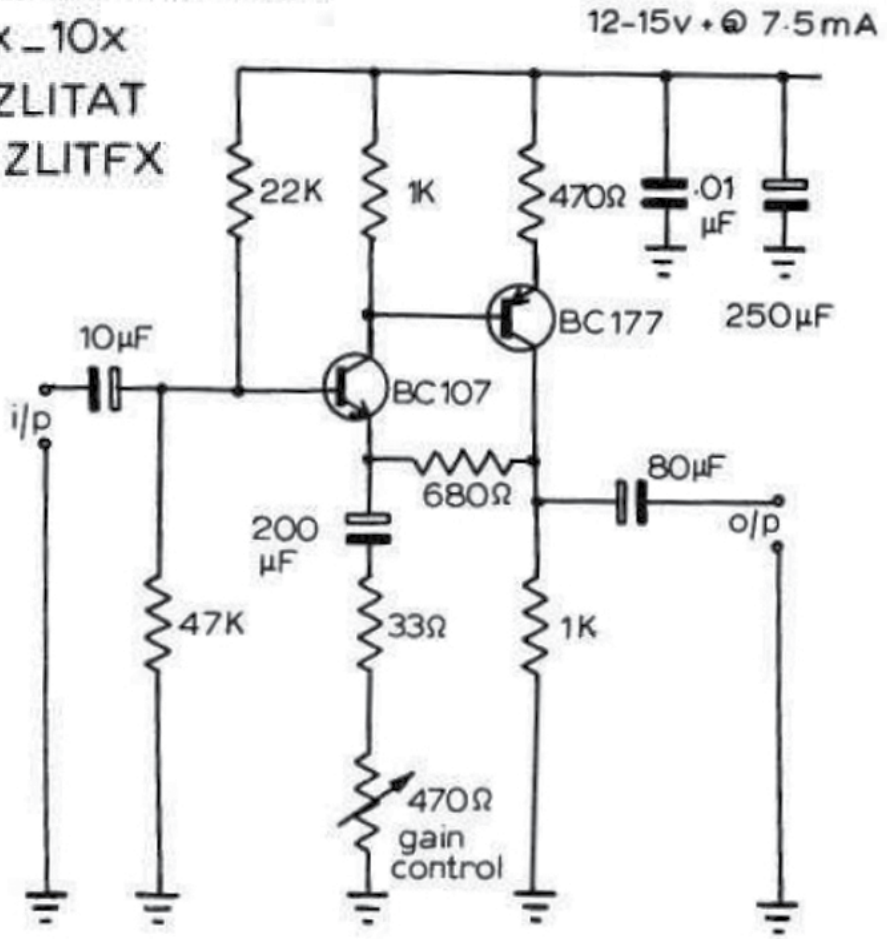
$Z_{out}$ = < 250Ω 4v p.p.

Freq. resp. 10Hz _ 5MHz ± 1db

Gain control 2x _ 10x

Circuit design ZLITAT

Circuit supplied ZLITFX



# Digital-ATV - Using ODROID with the DATV-Express board

*Ken Konechy - W6HHC*

*An earlier TechTalk I I I article explained how to use the DATV-Express exciter board for digital ATV explained with full-size Intel-based Linux PC or Linux Notebook.*

*In this follow-up article, I will discuss the next stage of the project, which is replacing the PC with a small, more portable, low powered ARM-based board. In particular, I will concentrate on the ODROID model U3 platform.*

▶ ***Figure 1*** *– Production DATV-Express hardware board for Digital-ATV*

After the main Linux DATV-Express software was released earlier this year, the project team looked at the possibility using the following "micro-PC's" to drive the DATV-Express hardware board:

- Raspberry Pi (single-core-ARM based)
- RikoMagic MK802iv (quad-core-ARM based)
- HardKernel ODROID U3 (quad-core-ARM)


▶ ***Figure 2*** *- Size of quadcore-ARM ODROID-U3 board is about the same size as Raspberry Pi*

## ODROID Model U3

The Raspberry Pi and the MK802iv units that were tested with the DATV-Express hardware board and software… each had problems when run with our project. The single-core-ARM Raspberry Pi, running at 700 MHz, was underpowered for our particular use. The MK802iv had issues with the completeness of its software repositories… that prevented easily recompiling the Linux kernel software. The small ODROID U3 (see Fig02), quad-core-ARM CPU running at 1.7 GHz, was tested and proven to be suitable for meeting our DVB-S goals.

▶ ***Figure 3*** *– Typical Block Diagram of ODROID DVB-S transmitter using DATV-Express*

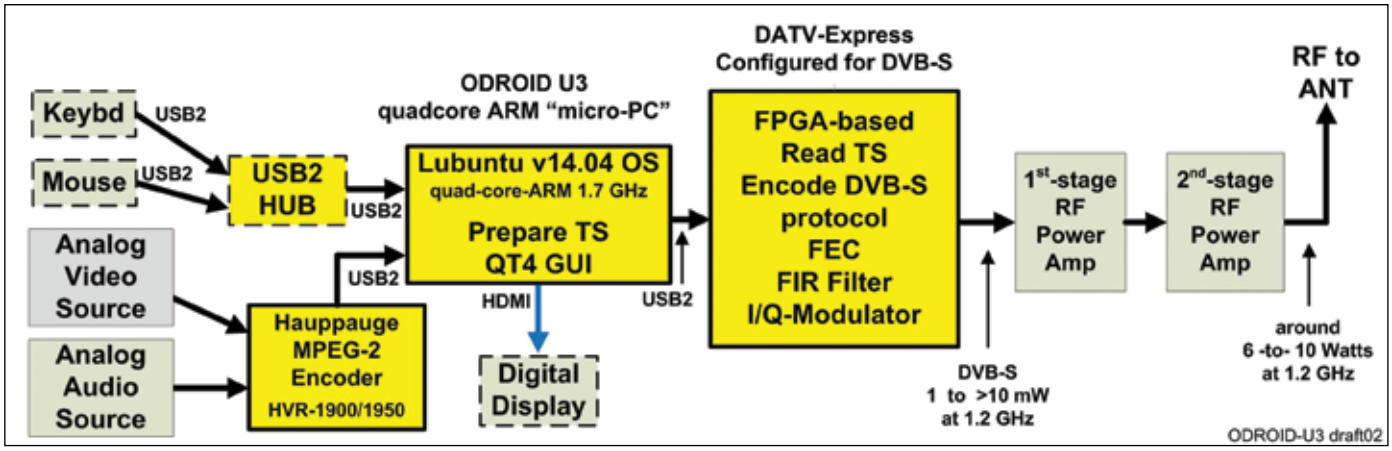
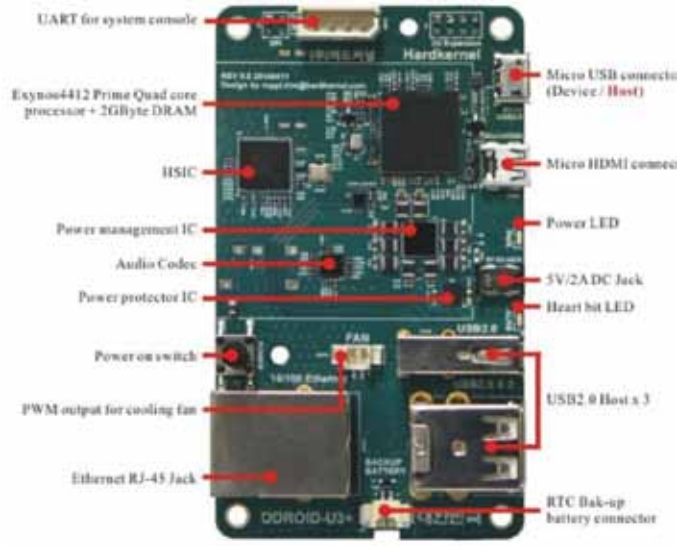


Fig03 illustrates a typical transmitter set-up for using the ODROID U3 to drive the DATV-Express board in a typical DVB-S operation. This approach uses a USB2-based Hauppauge model HVR-1900 (PAL) or the HVR-1950 (NTSC) to perform video capture and MPEG-2 encoding. The MPEG-2 video and audio elementary streams are sent by a USB2 inter-face to the ODROID for processing into a Transport Stream (TS).

The first step that project member Charles G4GUO took to get ready for allowing the software program to work with the "micro-PC" ARM computers was to move the DVB-S protocol processing into the FPGA coding, in order to offload the processing on the ODROID. The quad-core-ARM is not as powerful as an equivalent Intel quad-core i5 or i7 CPU.




▶ ***Figure 4*** *– The top side of the ODROID U3 board. The Heatsink on top of the Exynos Quad-Core CPU is not shown. Three USB2 connectors shown on right side, near bottom.*

The ODROID U3 runs with a light-weight version of Ubuntu 14.04 LTS operating system that is called Lubuntu 14.04 LTS. Lubuntu uses a small desk-top-environment called LXDE. It is recommended that the image of the Lubuntu 14.04 LTS OS be placed on a micro-SD memory chip, not the available eMMc memory module. You either need to:

a. purchase a micro-SD from HardKernel with the OS installed …or…

b. just purchase a "class 10 speed" 8 GB (or larger) micro-SD chip from your local computer store, down load the OS image from HardKernel (no cost) and burn the OS image onto the micro-SD chip. Plug the micro-SD memory chip into the slot shown in Fig05.


▶ ***Figure 5*** *– The bottom side of ODROID U3. The micro-SD memory slot is shown on right side near the top*

## Running ODROID with DATV-Express

The first steps to operate the ODROID are to attach the WiFI or Ethernet connection for the ODROID, leave off the hardware board & Hauppauge cables, connect the micro-HDMI-adapter-cable to a display, and connect the power-adapter (wall-wart) to the ODROID to power-up. You should see the ODROID boot-up on the display (with a blinking blue-LED on the ODROID board). At this point it is necessary to enable the WiFi or Ethernet connection to internet. More de-tailed instructions will be available in the DATV-Express User Guide for ODROID (coming soon to the www.DATV-Express web site).

Place the correct DATV-Express .deb file (for ARMhf) on the ODROID desktop…and double-click the file to install the DATV-Express software. You will need to modify one Lubuntu system file for access rights for USB (same as PC versions) and then you can remove the internet connection and attach the hardware board and Hauppauge video-capture unit.

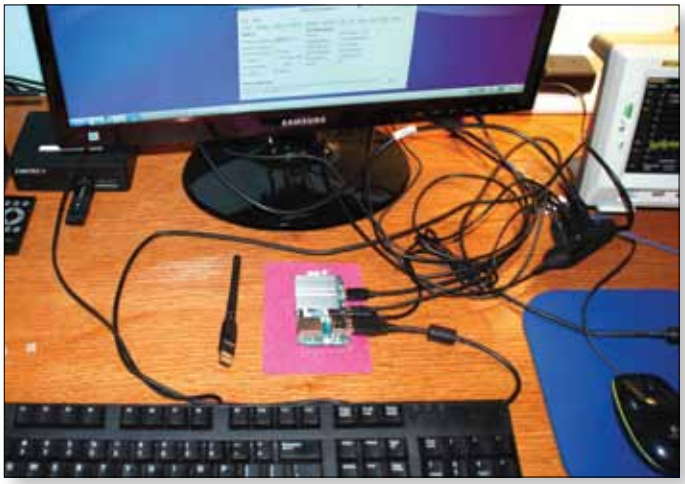

▶ ***Figure 6*** – *The DATV-Express application can be launched from the System Menu of the Lubuntu Desktop*

## Testing DATV-Express with ODROID

The DATV-Express software binary can be launched from the System Menu in the lower left-hand corner of the Lubuntu desktop. As shown in Fig06, the DATV-Express application is listed in the SOUND & VIDEO area in the system menu. Just click on it and it launches the app. The DATV-Express graphic user interface (GUI) looks essentially the same (see Fig07) as the GUI that displays on the Ubuntu PC installations. The set-up and configuration is also essentially the same except most operating will use EXPRESS-AUTO mode (in HW Tab) to offload processing from the ODROID for DVB-S operations.

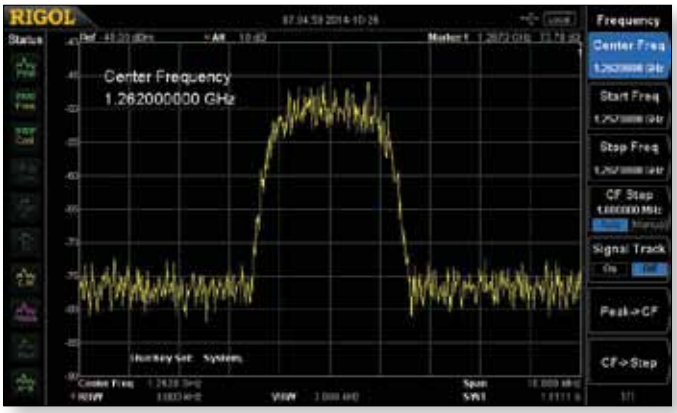

▶ ***Figure 7*** – *The DATV-Express GUI for ODROID looks essentially the same as when installed on Ubuntu on a PC*

Fig08 shows the ODROID set-up to operate and drive the DATV-Express board (not shown - off to the right). An unpowered USB-hub can be seen to the right of ODROID for connecting a mouse and keyboard. The Cisco USB WiFi unit, purchased from HardKernel, can be seen lying unconnected on the desk to the left of ODROID.



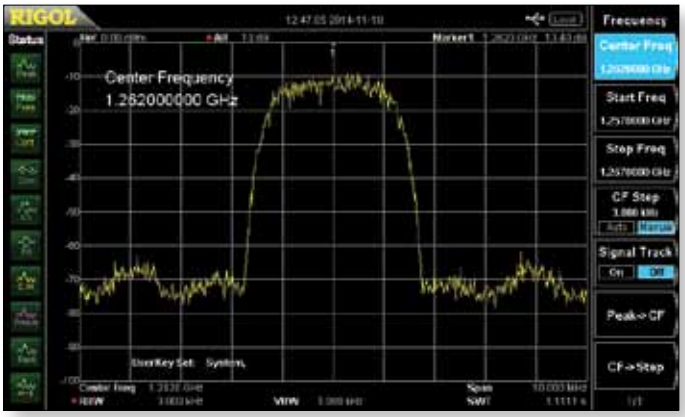
▶ ***Figure 8*** – *Set-up to use ODROID U3 to test with DATV-Express board at QTH of W6HHC*

Fig09 shows the normal DVB-S "haystack" during "barefoot" testing as displayed on a Spectrum Analyzer. This test was operated on 1262 MHz with a 3 MHz bandwidth (BWallocation) using 2.2 MSymb/sec Symbol Rate (SR).




▶ ***Figure 9*** – *Spectrum Analyzer display of "Barefoot" testing of DATV-Express exciter board using DVB-S on 1.2 GHz band.*

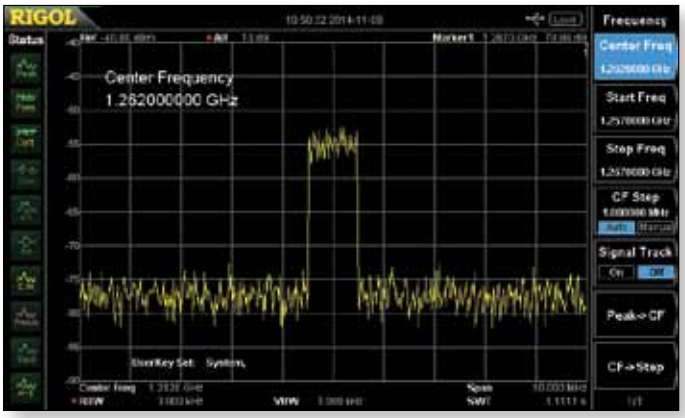
The RF coming from the DATV-Express hardware board driven by the ODROID should not be any different than when the board is being operated with a full-size PC. To confirm this, I hooked up a model MKU-P1301A first-stage RF Power Amp made by Kuhne (in Germany). This RF amp is rated at 1 watt (FM) and is the same amplifier that I used to bench test the DATV-Express board driven by a PC. As expected, Fig10 shows that same reasonably shaped DVB-S "haystack" that was also produced when testing with Ubuntu on a PC.




▶ ***Figure 10*** *– Spectrum Analyzer display of DATV-Express driving a Kuhne 1.2 GHz RF Power Amp rated at 1W (FM)*

The average output power measured in Fig10 was about 40 mW… enough to easily drive my DownEast second-stage RF PA (rated 30 watt FM) on 1.2 GHz to about 6 to 8 watt average power out.

The DATV-Express board was originally designed to just run DVB-S protocol. But, the project team is always curious if it can also run DVB-T. One of the first tests I ran on the ODROID U3 was to try the new 1 MHz bandwidth mode for DVB-T that was added in the v2.03 release of software.




▶ ***Figure 11*** *– Spectrum Analyzer of the ODROID driv-ing the Hardware Board in the 1 MHz BW mode with DVB-T protocol. The SA display span is 10 MHz.*

Fig11 was taken using QPSK modulation and FEC=1/2. I do NOT have a DVB-T receiver, so I can not view the video quality. With that modulation and FEC setting, the GUI reported the video data rate at about 0.3 Mbps, which would only support a slow video display frame rate. If I change the FEC setting to 7/8, then the GUI reports the video data-bit-rate increased to about 0.7 Mbps. Of course, the modulation for the 1 MHz bandwidth mode could be changed to use QAM-16 in order to support a higher video datarate (although with some loss of signal robustness introduced by the increased-modulation-complexity). I also tested DVB-T with QPSK in the 2 MHz BW mode. Using an alpha-test build of the software, one of the four ODROID CPUs was NOT able to keep up with the required processing load for the 2 MHz BW testing. Charles G4GUO suspects that further DVB-T load-reduction improvements could possibly be done by rewriting parts of the software in assembly language (but, will not occur soon).

## Release of ODROID software for DATV-Express

The project team plan for ODROID release is to:

3. Need to complete the test of the resulting v2.03 in-stallation on ODROID-U3 to make sure that all fea-tures work well.
4. A stand-alone ODROID-version of the USER GUIDE needs to be prepared (many Lubuntu screens look different than Ubuntu)

My current expectation is that these tasks will all be completed, released, and available on the DATV-Express web site by the end of November. [Editors note – the DATV-Express software for ODROID was released on November 28.]

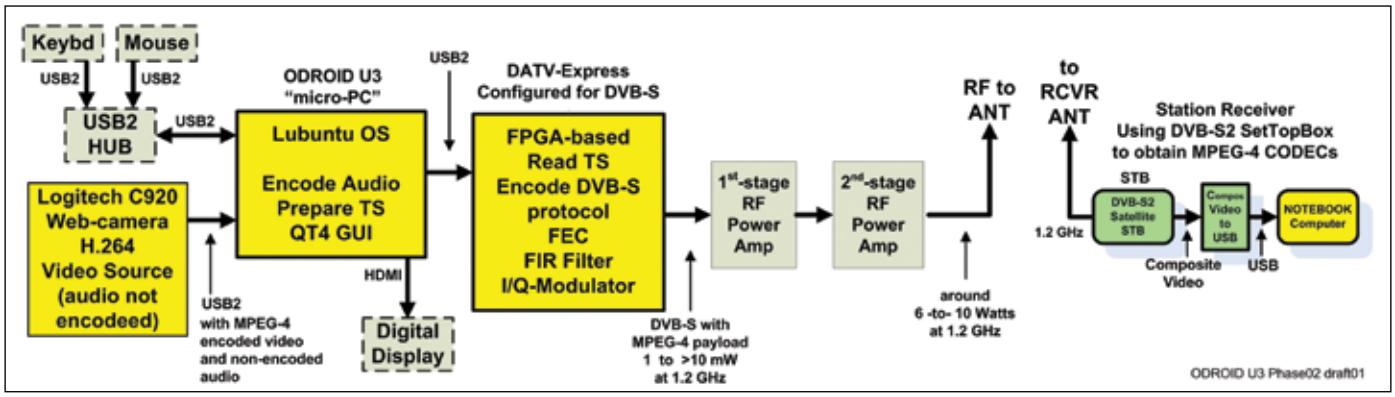
## Possible Future Roadmap with ODROID

The DATV-Express project team recognizes that currently, the Hauppauge approach for video capture creates two large problems for our project:

1. The timing on the Hauppauge PCR with a Linux driver seems to be very jittery. G4GUO has retimed the PCR and re-stamped the packets, but not perfectly.
2. Hauppauge has come out with two new HVR models; HVR-1905 (PAL) and HVR-1955 (NTSC) but have not yet come out with the Linux drivers creating a DATV-Express problem for buyers of those new models.

Alex OZ9AEC has been experimenting with a Logitech web camera, that outputs the video stream with H264 (aka MPEG-4) encoding. The Logitech model C920 web camera is small and even has mounting for a tripod.

One issue with this nice and affordable web camera is that the audio has not been encoded by MPEG-4. My personal suspicion is that Logitech may be attempting to avoid paying a license fee for AC3 (a licensed CODEC by Dolby), the normal audio for H.264? So one approach could be to encode the C920 camera audio processing a CPU CODEC for MPEG-4 or MPEG-2 on the ODROID?




▶ ***Figure 12*** *– Possible "concept" Block Diagram of ODROID DVB-S transmitter using C920 Web camera that outputs H.264 encoded video stream*

Fig 12 is a concept block diagram of ODROID U3 using the Logitech C920 web camera to transmit H.264 video with DVB-S DATV protocol. The receiver is required to be a DVB-S2 STB receiver or DVB-S2 USB dongle receiver that is also capable of receiving legacy DVB-S protocols. Note that this is not a normal commercial protocol. Also another issue is that Logitech does NOT supply Linux drivers… but do support the UVC standards supporting cameras in Linux distributions. So there may be an issue with Lubuntu? But, the project team thinks this might work for DATV?? The team plans to take some time to investigate and sort out these potential C920 issues.

## Conclusion

The ODROID U3 "micro-PC" works very well with the DATV-Express exciter board, especially for the DVB-S protocol. It makes the use of a DATV-Express transmitting station more portable by eliminating a large PC or a bulky notebook computer. The ODROID U3 is fairly affordable priced at US$65 (70 Euro) plus plastic-case, 5V/2A power adapter (wall-wart) and shipping.

## Contact Info

The author may be contacted at ***W6HHC@ARRL.net***

Reproduced from the Orange County Amateur Radio Club newsletter
***www.W6ZE.org***

# GoPro Hero 4

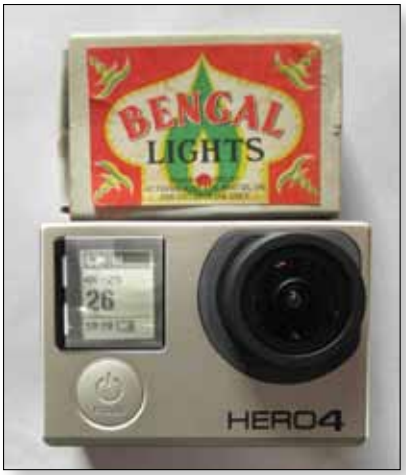
*Mike Cox - Twickenham*

## General Description


***In CQ-TV 244 I wrote a short piece about 4K television, and some kit that was on or coming to the market. Since then I decided that I had better acquire some minimal 4K kit so in future, I can talk with some experience.***

The latest in the range of GoPro cameras, the Hero 4 has only been on the market since October. It is the latest in the range of cameras, which have gained a deserved reputation for very compact video cameras, mainly for action sports.

The Hero 4 Black goes up to 4K resolution [3840 x 2160] at 30 frames per second. The camera itself, without the waterproof casing, is about the size of a matchbox.




In it, is contained the camera sensor, processing circuitry, a recorder to a micro SD card, and a battery. Connection to the outside world is via an HDMI connection and a USB link, which also charges the battery.

At the rear is a connector for a viewfinder, available as a separate item. The waterproof casing claims to be safe up to 30ft of water – useful for fishing? Currys, the main supplier, had no viewfinder [LCD Touch] when I ordered the camera, so it was difficult to frame it. However my Dell 4K computer monitor [P2815Qf] gave a clue.

Found that the GoPro UK website had stock of viewfinders and the essential remote control fob, and they are now here. The case depth has to be extended and in the viewfinder box is a selection of cases, some waterproof, some not. The viewfinder has a connector that fits into a receptacle on the camera back. When you power the camera, up comes a small but sharply focussed picture on the VF screen.

In addition to video mode, the camera can also take single shots, or multiple shots, which can be divided into BURST MODE, TIME LAPSE and NIGHT LAPSE modes. There are further sub-divisions of these modes.


Camera resolution can be set to low-res [WVGA] up to 4K/30p.

The camera lens is wide angle [approx 90 degrees], with no adjustment. What you see in the viewfinder is what you get. There is a thought that if you shoot at 4K/25 frames, then you can take a piece out of it for an HD video.

## Power

The camera has an internal re-chargeable battery, charged through the USB port. This powers the viewfinder as well, if fitted.

The remote control facility also has an internal battery, rechargeable via a USB lead.

Now that the Remote Control has arrived, It has been "paired" with the camera so that no matter where it is, up to a reasonable distance, camera can be set to record remotely.

## Using The Camera


In terms of use, video from the camera can be downloaded to a computer via the USB port. There is a specific GoPro set of software with limited editing facilities, which can be downloaded from the GoPro website. Video can also be seen on an HDMI 4K monitor [HDMI1.4 or HDMI2.0] from the micro HDMI port. At 4K/25 frames, an 8 GB memory card will give you about 15 minutes of recording, so if you want an hour, get a 32 GB card. It is early days yet, but the files on the micro |SD card are MP4. These can be taken straight into Sony Vegas Movie Studio HD Platinum 11 as 4K files and put into the timeline.


The GoPro software contains a routine to straighten out the "barrel" distortion due to the lens. Unless you are going to cut out the middle bit, this is worth doing. In terms of computer requirements, it needs Windows 7 or 8.1, a lot of memory, and a fast processor.

**Mike Sanders recommends Intel i7 for the processor and he also added:**

Resolution of 1920 by 1080 50P is preferred on a drone. However if filming at 4K 24p in celluloid film or with an electronic sensor camera set to 24p we must remember the cinematographer's handbook says that for non-juddering shots the object on the left of screen on a pan should not reach the right of screen in less than 7 seconds.

As 24p is close to 25p these rules apply. It will clearly limit action shots in this low frame rate mode if we want them to be smooth. Ok for a drone moving forwards steadily. 30p will obviously be slightly better than 25p but we must remember our destination or usage of the footage.

In post remember to keep the frame rates mathematically related. 30p (29.97)will work in a 60p (59.94) project (ideal to match the frame rate in a computer monitor), 25p will work in a 50i edit project, required for BluRay authoring. The frame blending effect or ghosting on movement will occur with say 25p in a 30p or 60p project. You can edit in 50p but when exporting a file to BluRay it must be 50i.

## Mounts For The Camera

If you go to GoPro.com, you will find a myriad mounts for the camera, even for the top of your head.

I shall be playing with the camera over the next few weeks, and space permitting, will give a report on it in the next issue.

**List of GoPro stockists:-**

- Currys
- John Lewis
- Argos
- London Camera Exchange
- Halfords
- Evans Cycles
- Amazon
- Plus others

# Turning Back the Pages

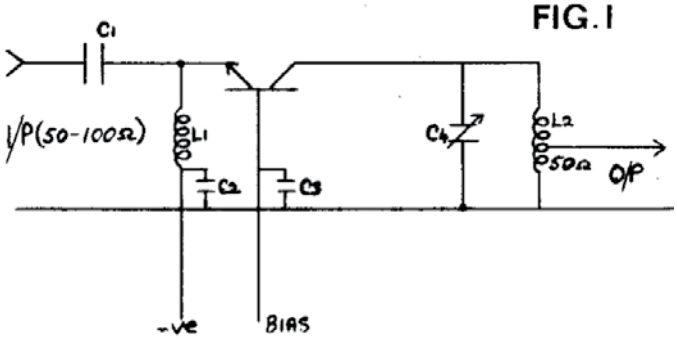
*A dip into the archives of CQ-TV, looking at the issue of 48 years ago.* *Peter Delaney - G8KZG*

## CQ-TV 59

***As often in that era, CQTV provided some good 'educational' information for its readers, and following the largely video content of CQTV58, CQTV59 was devoted more to the RF aspects of the hobby.***

Transistors had become available capable of working into the UHF range at what was termed 'reasonable' prices. For RF work, grounded base and common emitter modes were considered to be useful, and at low power,

FIG.I




the grounded base circuit was the 'most docile'. Fig I showed the arrangement - and if L2, C4 was appropriately tuned, a frequency multiplier could be made using this configuration. The author, Tony Spittle, advised that the multiplication factor should not be more than x4 per stage, on efficiency grounds. Tony added that devices like the 2N918 could produce 100mW of RF up to about 500MHz, but "If a lot more power is required my first answer is give up! However knowing how difficult it is to deter the average amateur, the following paragraph is included - but don't expect to be successful!"

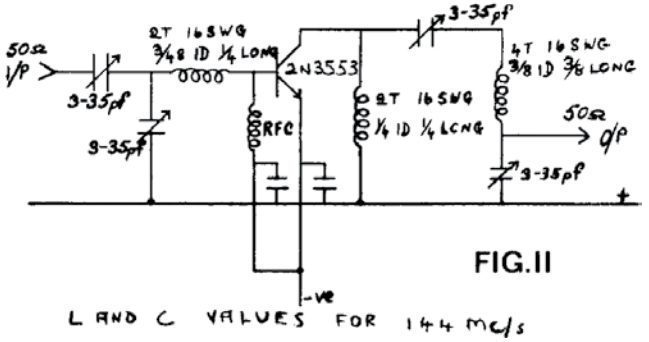



FIG.II

L AND C VALUES FOR 144 mc/s

That 'following paragraph' said that at high power VHF, the common emitter circuit seemed more stable than the grounded base. Fig II showed such a circuit, giving up to 3W on 70cm output from ½W drive on 144MHz. However, "the utmost care must be taken as there is no telling what frequencies might be generated by the device". Comments on filtering were followed by "it is most important to terminate such amplifiers properly at all times, even before you switch on otherwise the transistor will oscillate and zip goes £5" !! (£75 in today's values). The amplifier had "exhibited the ridiculously high DC - RF efficiency of 80%. A transistorised Colpitts oscillator was shown in Fig III, which could be used at the start of a multiplier chain, whilst "if one is a complete masochistic, one can attempt varactor power multiplication - Fig IV showed a tripler from 144MHz to 432MHz, and the author had one producing 2W of 70cms from 3 or 4 watts of 144MHz drive. A spectrum analyser was, however, advised to set such circuits up correctly. These ideas were demonstrated in a chain producing 100mW ouput on 360MHz (Fig V) and a circuit to generate 3 - 4 W of 144MHz in Fig VI.

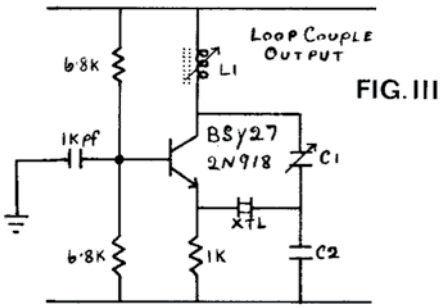



FIG. III

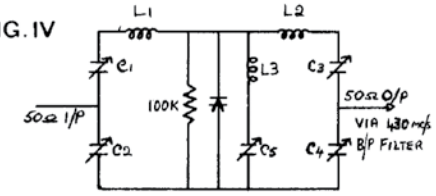
for 8 mc/s

L1 26t 26SWG ¼ inch diameter.
C1 1500 pF Fixed.
C2 150 pF Variable.

for 70 mc/s

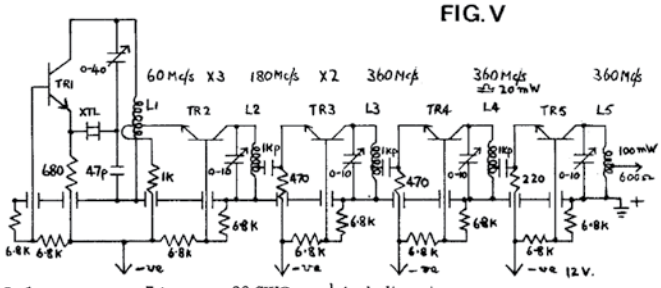
L1 6t 20SWG ¼ inch diameter.
C1 2-50 pF Variable.
C2 47 pF Fixed.

FIG. IV




C1 4-40 pF
C2 4-40 pF
C3 2-20 pF
C4 2-20 pF
C5 4-40 pF
L1 7t 18SWG ¼ inch diameter.
L2 1 in. x ¼ in. x .02 in. copper strip.
L3 2t 14SWG ¼ inch diameter.
(L2 Alternative 2t 16SWG ⅓ inch, ½ inch diameter.)

FIG. V




L.1. 7 turns 20 SWG ¼ inch diameter.
L.2. 7 turns 18 SWG ¼ inch diameter ⅜ inch long. tap 2t. up.
L.3, 4, 5. 2 turns 18 SWG ¼ inch diameter ⅜ inch long. tap ¾t. up.
Transistors: 2N914/5/6/7/8 or BFY 18, BSY 27, AF 139.

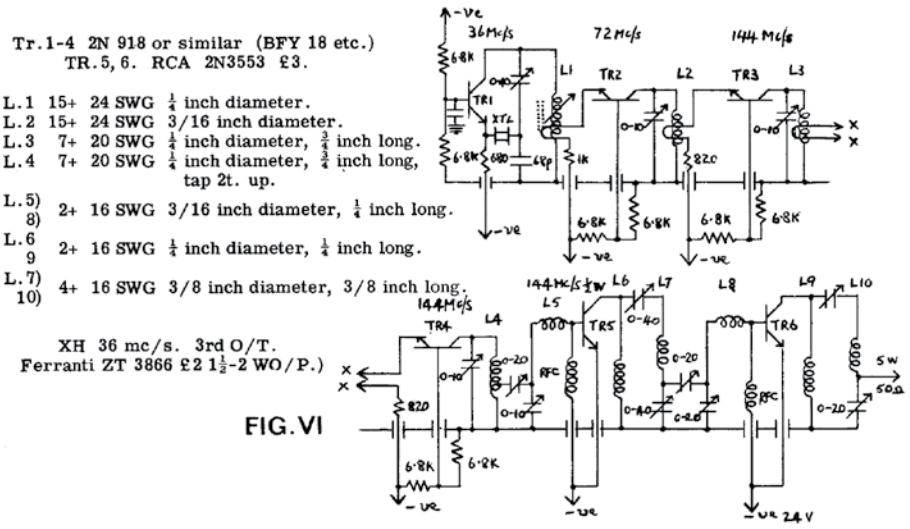
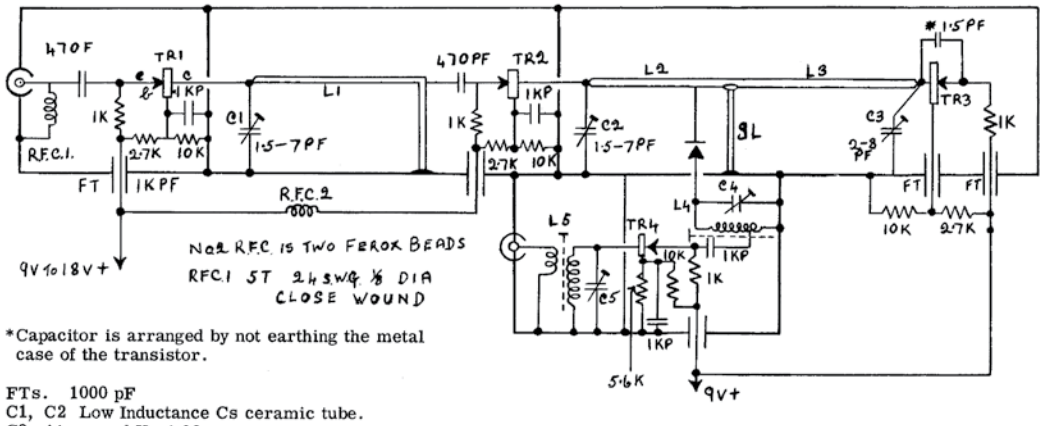



FIG.VI

A more detailed constructional article detailed the building of a transistor tuner for the 70cm band, which could produce an output within the vhf broadcast band - a 'spare' channel being used, so that a television receiver could display the signal 'down-converted' by the tuner. The circuit (Fig I) used two grounded base amplifiers, TR1 and TR2. The local oscillator, was TR3 and this fed the mixer diode - a 1N21, 1N23 or GEX66 being suggested for this.

The resultant signal was amplified by some 15dB in the IF amplifier, TR4. The details of construction were shown in Figs II and III, the basic box being made of 22swg sheet copper 'which may be cut out with a good pair of scissors'. Fig IV showed the layout of the RF output stage, whilst Fig V showed how to tune the input stage to filter out any VHF broadcast breakthrough. Fig VI detailed the shorting link, and Fig VII the bottom cover plate. (UHF tv broadcasting in Britain had begun with BBC2 in 1964, but uhf tuners were not readily available at the time).

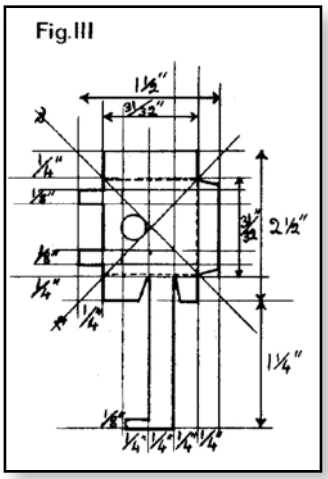
The video aspects were not ignored, however, as there was information on a variant of the vidicon tube, described in the previous issue, in which the mesh at the target end of the tube was electrically isolated from the wall anode, G3, and taken to pin 3 of the base. If the mesh was maintained at a potential about 1½ times that on the wall anode, the beam would land more accurately on the target, increasing the resolution, so that




*Capacitor is arranged by not earthing the metal case of the transistor.

FTs. 1000 pF
C1, C2 Low Inductance Cs ceramic tube.
C3 Airspaced Variable.
8pF Fixed in Series with 8pF Variable.
C4 3-30 pF Philips.
C5 3-30 pF Philips

Fig.I



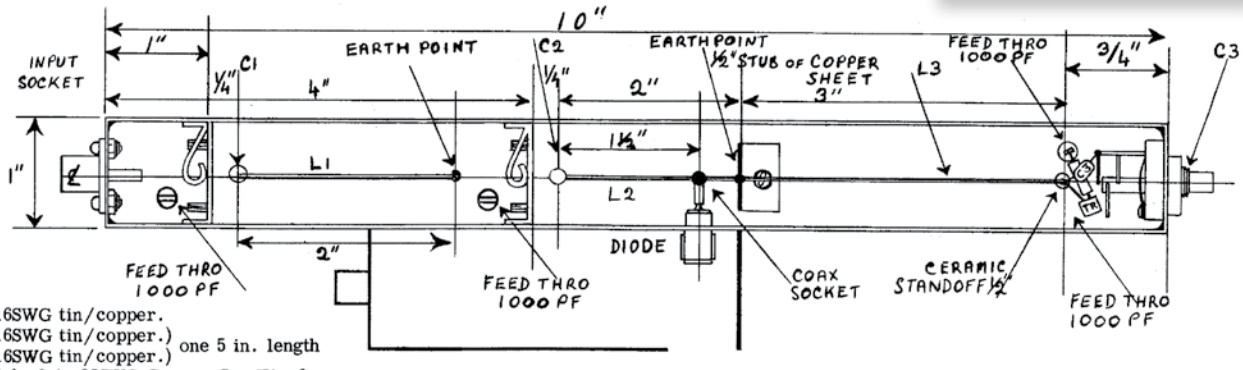
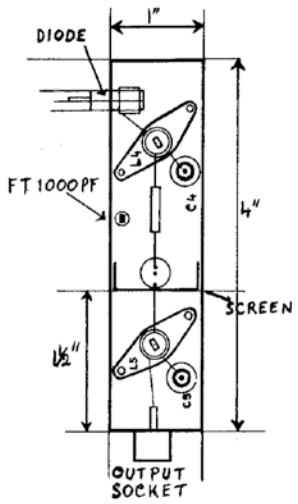




Fig.II

L1 2½ in. of 16SWG tin/copper.
L2 2 in. of 16SWG tin/copper.) one 5 in. length
L3 3 in. of 16SWG tin/copper.)
SL Shorting link plate 22SWG Copper. See Fig. 6.
L4 8t 22 SWG enam./cop. tap at 3t slug tuned (close wound ¼ inch diameter).
L5 8t 22SWG enam./cop. 3t coupling at earth's end.

Fig.IV




the high frequency response was almost double that of an integral mesh tube (although higher scanning currents were needed for this). The setting of the beam current was also less critical when using a separate mesh tube.

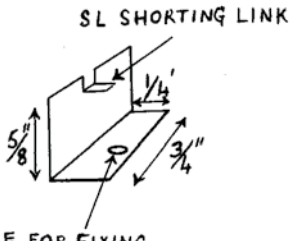



Fig.VI

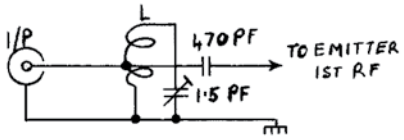



Fig.V

L = 1·5T TAP ½T FROM ⏚

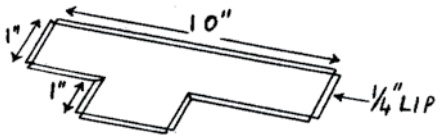



Fig.VII

Note: A Bottom cover is required for all compartments and may be made of one piece. (see Fig. 7).

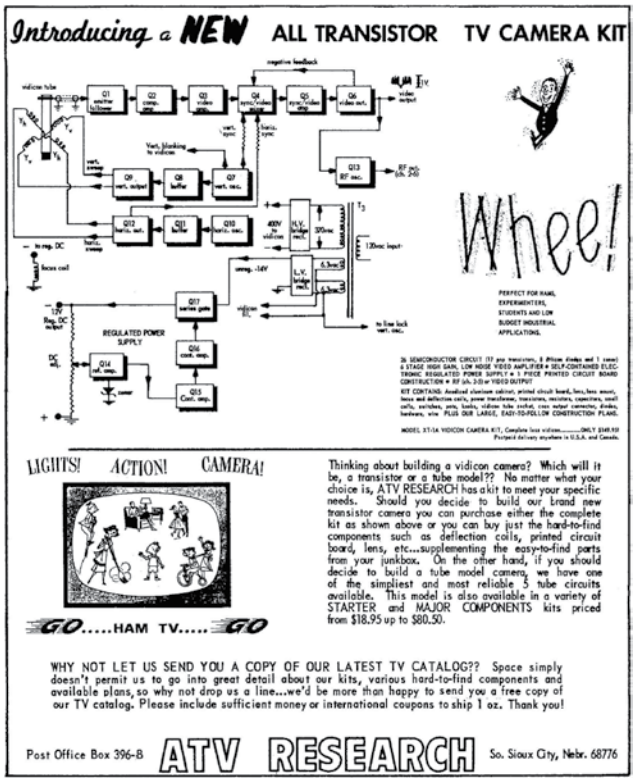
C3 may be a 2-5 PF tube trainer in position of standoff tag at end of L3 line.

The tube base connections were listed as:-

| Pin | Connection | Pin | Connection |
|---|---|---|---|
| 1 | Heater | 6 | Wall anode G3 |
| 2 | Modulator G1 | 7 | Cathode |
| 3 | Mesh G4 | 8 | Heater |
| 4 | not to be connected | Flange | Signal electrode |
| 5 | Limiter G2 | Short pin | not to be connected |

If an integral mesh tube was to be used in a circuit designed for a separate mesh vidicon, pin 3 was left unconnected; if a separate mesh tube was to be used in a circuit designed for an integral mesh variant, then pins 3 and 5 were wired together on the tube base (effectively making the connection that was inside the integral mesh device). (These pin connections applied to all makes of 1" diameter magnetically focussed and deflected vidicons, but the later, smaller, 2/3" tubes had a different set of pin connections).

For those who did not want to design their own camera, the back cover carried an advert for a kit available from ATV Research in the USA. A transistorised version, built on a single printed circuit board, cost 'just' $149.95 -- not including a vidicon. (That is around £650 in today's values).



# The British Amateur Television Club

## The club provides the following for its members:

- A **colour magazine**, CQ-TV, produced for members in paper or .pdf (cyber membership) formats.
- **Web site** – where you can find our online shop stocking hard to get components, software downloads for published projects and much more.



- A **members forum** at www.batc.org.uk/forum/ for help, information and the interchange of ideas.
- A **video streaming** facility at www.batc.tv which enables repeaters and individual members to be seen worldwide.


- An **annual Convention** held in the UK where you can meet other members, visit demonstrations and listen to lectures.
- **Meet other club members** at the BATC stand at local rallies across the country.

# www.batc.org.uk

# BATC
## Out and About


**You will be able to see the BATC stand at the following forthcoming rallies and events in 2015. Come and say hello!**

**19th April** – West London Rally – Kempton Park, Surrey (RadCom says 12th)
See: ***www.radiofairs.co.uk***

**?? May** – Dunstable Downs Radio Club Bootsale See: ***www.ddrcbootsale.org***

**6th June** – SERF – Eastbourne – Sussex (New event) See: ***http://serf.org.uk***

**21st June** - Newbury Radio Rally, Berkshire. See: ***www.nadars.org.uk***

**28th June** – West of England Radio Rally – Frome, Somerset.
See: ***www.westrally.org.uk***

**19th July** – McMichael Rally – Near Reading, Berkshire See: ***www.McMichaelRally.org.uk***

**9th August** – Flight Refuelling Hamfest – Wimbourne, Dorset
See: ***www.frars.org.uk***

**5-6th September** – BATC Convention – CAT15 - Finningley
See: ***www.batc.org.uk***

**?? September** - National Hamfest, Lincoln. See: ***www.nationalhamfest.org.uk***

**?? October** - RSGB Convention, Milton Keynes See: ***www.rsgb.org***

**8th November** – West London Rally – Kempton Park, Surrey
See: ***www.radiofairs.co.uk***

?? = Date not yet available. See website for actual date.

**If you would like BATC support at an event you are organising, please contact the membership secretary.**