



The British Amateur Television Club

CQ-TV

No. 251 – Spring 2016

**The Principia Mission -
BATC involvement**

A BATC Wiki

**Peter Blakeborough, G3PYB -
Silent Key**

**CAT 16 and BATC AGM
announced**

**Simple Antenna Tracker
for the ISS**

Animated Test Cards

Activity at GB3ET

**DATV-Express power
amplifiers**

**Reduced Bandwidth TV
Modulator**

**New Application for
DATV-Express**

**leandvb: A lightweight
software DVB-S
demodulator**



**First HamTV video
with a schools'
ARISS contact!**

... and all the regular features

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



Available from BATC shop

- ▶ DTX1 DATV transmitter PCB complete with case and front panel **£459** including postage

Specification subject to change without notice

International ATV Contest 11/12th June 2016

- All bands up to 24 GHz
- Digital and analogue modes
- BATC certificates for best Dx contact using RB-TV
 - 800kHz bandwidth or less on any band
 - Including the new UK 70 MHz DATV band!
- See CQ-TV and the BATC forum for rules

Get out portable in the great British Summer and have some fun!





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Printed in Great Britain. ISSN 1466-6790

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Contributions

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

Alternatively you can write to us at:
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We aim to publish CQ-TV quarterly in
March, June, September and December.

The deadlines for each issue are:

Spring - Please submit by February 28th

Summer - Please submit by May 31st

Autumn - Please submit by August 31st

Winter - Please submit November 30th

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



It was with great sadness that we heard our president Peter Blakeborough G3PYB passed away suddenly in January. As well as his interest in microwaves, Peter was an active ATV operator and the great thing about Peter was that he was always experimenting with new technologies – indeed it was only just before last Christmas that I had the pleasure to work him during the December BATC activity day on 146 MHz RB-TV.

He accomplished many firsts in the world of amateur radio and television and in 2006 as recognition of these achievements, he was asked to become president of the British Amateur Television Club. Peter undertook this role with great relish and the ATV community benefitted hugely from both his wisdom and leadership. But apart from his vast technical knowledge, perhaps the greatest thing about Peter was his willingness to help and give advice to others – whether beginners or friends he had known for years. Peter had a very generous spirit and was an inspiration to us all - he will be sadly missed.

The BATC activity days are continuing to provide a focus for those brave enough to venture out to their local hill top and operate ATV and it's great to see several stations active on 146 MHz in March. But the activity days are not just about RB-TV and portable operation and are an opportunity for everyone to "get on air" – they are not a contest but an excuse to fire up the ATV transmitter and have a QSO with a few of the locals. We've deliberately timed the summer days to coincide with the major VHF / UHF contests so, if your Radio Club is planning to participate in those contests, why not suggest putting on an ATV station at the same time. In particular we'd like to see as many as possible of you on air for the Summer Fun contest in June – this is an International Contest and it would be good to see the UK with as much activity as some of the other countries in region 1.

And if you are active on air why not tell us and CQ-TV readers about your station. "My station", which starts in this CQ-TV, will feature a different ATV operator in each edition – just send your details and a couple of pictures to your editor Frank, M0AEU.

The ATV technology developments continue with Charles G4GUO releasing Windows software for the DATVExpress project – this has breathed new life in to the project and made it accessible to those not familiar with Linux (I include myself in that!). The DATVExpress

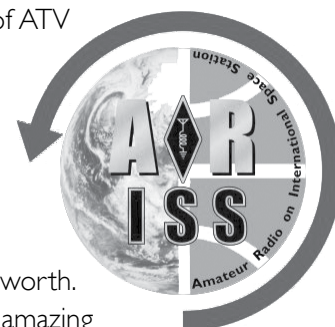
is a really flexible DATV and RB-TV system covering 70 MHz to 2450 MHz at all symbol rates from 125 Ks to 15+ Ms and in this edition of CQ-TV, Art WA8RMC describes various driver amplifiers suitable for DATVExpress (and other systems such as DTX1). Colin G4KLB and others have also been busy developing a variable rate RB-TV modulator card for the RPi. The BATC shop has a limited number of PCBs available and all the details are being made available on the brand new BATC Wiki.

What's a Wiki – well, take a look at the article in this edition but think of it as your local reference library where we can all put documents and information we think others may be interested in. The success of the wiki is very dependent on you – as it relies on everyone contributing material and using it as a valuable reference library.

The other big news in the world of ATV is that Tim Peake finally connected the camera to the HamTV transmitter and for the first time in 18 months we had live video from the ISS on February 11th for the schools contact with the Royal Masonic School in Rickmansworth.

The impact of seeing Tim live was amazing and Amateur Radio has never had so much publicity on national and local TV & Radio – There are 5 more contacts scheduled during April and May and if you missed the contacts see <https://principia.ariss.org/> for details on the project.

Finally, you may have noticed this edition of CQ-TV was slightly later than planned. Well, as you know BATC is run by a few members for the members and sometimes people have to prioritise other things first. This is actually a sign that we are still very short of volunteers to help run your club and I was personally very disappointed with the response from you all to our appeal for a new membership secretary and for help with the website. YOUR club still has these vacancies which need filling as a matter of URGENCY, plus we are now looking for a new president. If you feel it's time you put something back in to this great hobby of ours, please contact me asap and we will work out how you can help contribute to the ongoing success of the British Amateur Television Club. 🗨️





Members News

Dave Mann – G8ADM

International Space Station

Following the first successful reception of the HamTV system from the ISS to a schools' ARISS contact on the 11th February 2016 at the Royal Masonic School for Girls in Rickmansworth, there are still five more scheduled contacts that should all be running the HamTV system.

The next of these contacts is due to take place in the week starting 18th April from St Richards College, Bexhill-on-sea, followed later in the same week with a contact with Wellesley House School, Broadstairs, Kent. Exact dates and times aren't known until about a week before the contact. At the start of May the ISS contact will be with Ashfield Primary School pupils in Yorkshire. They will be put in direct contact with Tim Peake between May 3 and 6. This will be organised by staff member Michael Ross M6FFK, through his links with Otley Amateur Radio Society (OARS) and supported by BBC One Show scientist - and Otley resident - Dr Marty Jopson. All of the contacts are streamed live by the BATC and can be seen on the ARISS Principia website <http://principia.ariss.org/live/>. The website will also contain full details of the date and times of the contacts as soon as they are known, and it contains a dashboard showing the current position of the space station. Even with relatively simple equipment, reception of the video direct from the ISS is possible - see the articles by Dave G8GKQ in this and the previous issue of CQ-TV.



Colin, G3KLB, has also been receiving the ISS directly using a computer controlled auto tracking dish. The pictures show Colin's dish and the computer receiver screen. More details: www.batc.org.uk/forum/



Geo-Synchronous ATV Satellite

Further to our report last year, the Es'hailSat-2 satellite, 26E, from The Qatar Satellite Company that will have an ATV repeater on board is still on schedule for launch in the autumn. This will be 13cm input and 3cm out. Because it will be geo-synchronous, dish pointing will be much easier. Watch this space for more information later in the year.



TV Repeaters

GB3GG, near Grimsby in N.E. England will be losing its site in September. It is on top of a school that is being demolished. Unfortunately they have not been able to find a new site for the repeater.

GB3IV in RNAS Collingwood near Portsmouth is off the air. It may be re-built on this site or may move to a better location in a higher site. Details, when known, will be on its streaming web site, <http://www.batc.tv>, or on the BATC forum, <http://www.batc.org.uk/forum/>. The repeater keeper is Howard, G3NZL.

Several repeaters now also have narrow band digital inputs with transport streams as low as 300KS/Sec on various bands including the new upper 2m band. This can be very useful when testing reduced bandwidth transmissions when no one is about. See repeaters streaming sites, <http://www.batc.tv>, or the individual repeater web sites for further details. I have also heard rumours that the 6m and 4m bands may be extended in frequency to allow specialist transmissions such as DATV to be transmitted in narrow band just like the extended 2m band. Time will tell.

Most clubs and repeaters have an activity night. Please make sure your activity night is shown on your repeater streaming page, this will encourage activity on the evening.

RSGB News

Roy, G8CKN transmits the GB2RS news from the RSGB at 9.30 am every Sunday morning in television and on several FM amateur radio channels. The TV transmission is via the GB3HV repeater near Farnham in Surrey. This video is also streamed on the internet via the BATC, www.batc.tv, click on News Desk on the left and then select GB2RS News. Television recordings of previous weeks are also available here. Roy started broadcasting the



news on 2M FM 37 years ago and on 70 cm and 23 cm TV 21 years ago. The streaming service started 15 years ago, well done Roy, quite an achievement! Mike, G8LES has acted as a backup provider when Roy is not available. So after all this time Roy is looking for one or more amateurs to take over these transmissions. If you are interested in helping out then please contact me. Assistance can be given by Roy to set up the transmissions and some equipment may also be available.

Broadcast Equipment Exhibitions

There are several exhibitions each year showing the latest very expensive professional broadcast television cameras and equipment. The main two are: NAB in Las Vegas in the spring and IBC in Amsterdam in the autumn. More recently there have been two smaller exhibitions in the UK, BVE, in London Dockland in the early spring and Manchester in the autumn, www.bveexpo.com. If you are interested in the latest broadcast products then they are well worth a visit especially as admission is free for those that pre-register on-line. 🗨️

Please send any news for CQ-TV 252 to me by the end of May secretary@batc.org.uk



Dave Crump, G8GKQ over looking the sea at Lulworth, Dorset to work some RBTv on 146Mhz to Noel, G8GTZ and Shaun, G8VPG.



Contest and Activity Day News

Dave Crump – G8GKQ

ATV Activity Weekend 12/13 March

Another successful activity weekend. I heard that the following stations were active:

Call	Location	Locator
G8GTZ/P	Walbury Hill, Berks	IO91GI
G8GTZ/P	Hannington, Hants	IO91JH
G8ADM	Pinner, Middx	IO91TO
G8GKQ/P	Wareham, Dorset	IO80WP
M0DTS/P	North York Moors	IO94MJ
M0DTS	Yarm, Cleveland	IO94IL
G1LPS	Spennymoor, Co Dur	IO94EQ
G3NWR/P	Holme Moss	IO93AN
G4ZCN	Hartlepool	IO94JP
G4CPE	Upper Sundon, Beds	IO91SW
G0MJW	Harwell, Oxon	
M0SKM	Dunstable, Beds	IO91RV
G3KKD	Cambridge	JO02CF
G4KLB	Bournemouth, Dorset	IO90BR
G4GUO	Worthing, Sussex	
M0IKB	Scarborough	
G4YWD	The Wirral	
G3UVR	The Wirral	
G6WRC	Warrington	

If you're not on the list, please let me know. The more activity that we can publicise, the more stations will be tempted to get on the air!

Tropospheric conditions seemed to be above average, with some good contacts and some that "just got away", including an attempted 146.5 MHz RB-TV contact between G8GTZ/P on Walbury Hill and M0DTS/P on the North York Moors.

Rob, M0DTS reports: "I managed to see G3NWR/P from Holme Moss on 23cm with great ease, it is a good path! We tried on 3cm both ways without success but there was a obstruction probably causing that.

I was accessing and watching GB3KM at times 23cm/3.4G, GB3YT was a good signal in between radar but i still could not access for some reason.



Terry G1LPS appeared a bit later and he was receiving my 23cm Digital, we also had a qso on 146.5MHz DATV using the new Express software, this makes doing RBTv so easy and allowed a nice qso with the very low latency of the Audio+Video in the new software.

I did do some mobile 2m DATV when I was travelling home from the IP site and Terry was receiving this OK until the power lead escaped from the DATV Express... More mobile tests soon.

I managed one contact with Barry G4ZCN on 23cm DATV on Sunday.

Contest and Activity Weekend Calendar

1200 UTC 7 May 2016 - 1800 UTC 8 May 2016:	ATV Activity Weekend
1200 UTC 11 June 2016 - 1800 UTC 12 June 2016:	IARU International ATV Contest
1200 UTC 9 July 2016 - 1800 UTC 10 July 2016:	ATV Activity Weekend
1200 UTC 13 August 2016 - 1800 UTC 14 August 2016:	ATV Activity Weekend
1200 UTC 10 September 2016 - 1800 UTC 11 September 2016:	ATV Activity Weekend
1200 UTC 10 December 2015 - 1800 UTC 11 December 2016:	ATV Activity Weekend
1200 UTC 11 March 2017 - 1800 UTC 12 March 2017	ATV Activity Weekend

I spent most of Sunday re-fitting the gear back in the shack and watching a weak signal just below decode threshold from GB3YT using my 3m dish; on the 2x44el yagi's which are 25ft above the dish there was no sign of YT, height does not always win when you have 30dB+ antenna gain."

Brian, G4EWJ, reports: "G6NOI and I arrived at the 1675ft ASL Holme Moss viewing car park at 1230 on Saturday. There was plenty of snow around, but fortunately the roads were clear. We didn't get to try half the things we wanted to do. Too much equipment and too little time. We must get better organised. The June outing should give us a few more hours.



MODTS/P on the North York Moors received us off the back of our beam on 23cm digital. We got into GB3YT near Huddersfield very easily and received GB3VL in Lincoln on 23cm digital without a preamp. We failed to receive MODTS/P and GB3LX in Lincoln on 10GHz. MODTS/P was slightly obstructed, but the lack of GB3LX was a surprise. We ran out of time to try 2m with MODTS/P and GILPS.

We were expecting reception problems on 2m, with having a megawatt of Band 2 and DAB on the other side of the road. It started out well, but we found that when we rotated the mast with the 2m Slim Jim on top, we completely lost all reception on 2m in certain positions. Curious. We changed to a mag mount and that worked fine.

We moved on to a second site a few miles away on the A635 west of Holmfirth, of 'Last of the Summer Wine' fame. We had a 2 way

23cm digital contact with G4YWD on the Wirral, a one way analogue to G3UVR on the Wirral and a 2 way analogue with Warrington Radio Club at their QTH."

In the South, Noel, G8GTZ/P, Colin, G4KLB and myself tested RB-TV on 146 and 437, switching to normal DATV on 437 once the beams had been aligned.



Next Event

The next event is the activity weekend on 7/8 May. The aim is simple – to generate as much ATV simplex and repeater activity as possible. Please try to get on the air and let me know how you get on. It will be good preparation for the IARU Contest in June.

Latest News

Remember that you can always find the latest Contest and Activity Weekend News on the BATC Forum. There are links to the rules and the entry spreadsheets there and on the BATC website. 🗨️



CAT 16 and BATC AGM 24/25 September 2016 at Cosford

The Convention for Amateur Television 2016 (CAT 16) and the club's Biennial General Meeting will be held in the Conference Room of the Royal Air Force Museum at Cosford, near Telford, Shropshire on 24 and 25 September.

In addition to a very interesting BATC lecture programme, visitors to CAT 16 will have the free access to the RAF Museum. Parking for CAT 16 visitors will also be free of charge. We also hope to be able to offer members a free guided tour.



The RAF Museum is located near Junction 3 of the M54, halfway between Wolverhampton and Telford. Members are advised to book hotels in Telford; we will arrange a suitable meeting place to get together for Dinner on the Saturday evening.



Outline agenda

Confirmed presenters include Charles G4GUO (DATV Express), Phil M0DNY (new BATC Streamer developments) and Noel G8GTZ (receiving and presenting HamTV from the ISS). *More to follow...*

Saturday

- 1000 Museum and Conference Room open to CAT 16 Attendees
- 1300 CAT 16 Talks begin
- 1700 End of Talks; Museum closes.
- 1930 Meet for Dinner in Telford

Sunday

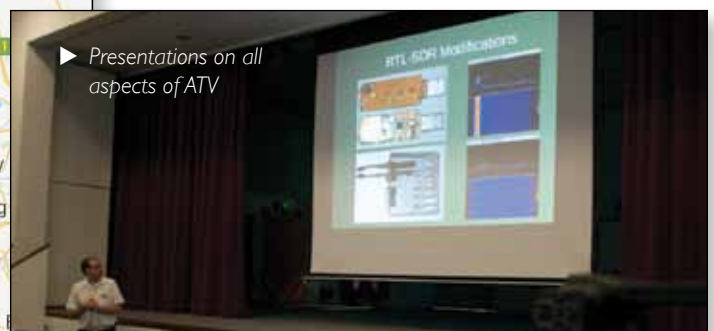
- 1000 Museum and Conference Room open to CAT 16 Attendees
- 1015 CAT 16 Talks begin
- 1230 Break for Lunch
- 1330 BATC BGM
- 1430 Museum Guided Tour
- 1600 CAT 16 closes

Catering

There will be a small charge for CAT 16 visitors to cover Tea and coffee which will be available throughout Saturday afternoon and Sunday morning.

There will be no charge for those members just attending the BGM on Sunday afternoon.

Snacks and lunch will be available for purchase at the "Refuel" Restaurant, in the same building as the conference room. 🗺️





Peter Blakeborough, G3PYB - Silent Key

Peter, who has had a lifelong interest in Amateur Television, passed away in hospital on the 8th of January 2016 after a serious heart attack over the Christmas holiday. Peter was President of the BATC for many years. He was full of energy and has been highly involved in the hobby. More recently he has constructed equipment for narrow band TV that can be used on the 146–147.5 MHz section of the 2m band.

Peter was born in Scarborough in 1945 and joined the BBC as a trainee in the late 1960's. I first met him on the air when he lived near the Crystal Palace BBC Transmitter and we regularly exchanged pictures on 70cm AM ATV. Later I worked with Peter in the early 1970's in Andover. Later that decade he moved back to YTV in Leeds where he ran the installation and maintenance department. Peter made good use of the Emly Moor 1000 feet tower where

he installed an ATV repeater and various microwave beacons. In the 1980's Peter and family moved down to Portsmouth when he was a director of Wood and Douglas.

Peter was very interested in microwaves and built CW/SSB equipment for bands up to 76 GHz. I worked him on 437 MHz, 3.4 GHz and 10 GHz all digital ATV in 2004/5 when he went portable on the Surrey hills. This was fairly revolutionary in those days. Peter also ran the new GB31V ATV repeater at Collingwood, Portsmouth.

I have known Peter for over 50 years. He will be sadly missed by the amateur community. We wish his wife, Sandy and their children, Russell and Lucy all the very best for their future.

Dave Mann – G8ADM





1945 - 2016



BATC Wiki

As part of the redevelopment of BATC web services we are launching the BATC Wiki.

The screenshot shows the BATC Wiki homepage. At the top, there is a navigation bar with 'Main page' and 'Discussion' tabs, and a search box. The main content area includes a welcome message: 'Welcome to the British Amateur Television Club Wiki - the place to find information on ATV related equipment and projects. Please treat this as a reference library - please use the BATC forum for discussion on these or any other items.' Below this is a list of contents with 10 items, including 'New to Amateur TV?', 'BATC services', and 'ATV repeaters'. To the right of the contents is a test card image for GB3KM, Kirk Merrington, featuring a church and a landscape. Below the test card is the caption: '• Example Test Card from a UK Repeater - GB3KM'. The left sidebar contains links for 'Main page', 'Recent changes', 'Random page', 'Help', and 'Tools'.

What is a wiki?

Think of it as our reference library where we can all put documents and information we think others may be interested in – so if someone asks you by email or on the BATC forum “have you got a circuit for xyz” then, as long as there is no copyright issue, you put it in to the reference library or wiki. The advantage is that the wiki, unlike your email or forum messages, is designed to hold information

and make it accessible – and every time someone puts something new up there, the knowledge base just grows.

What’s on the Wiki

Well that is up to you! It is primarily designed to store pictures and documents (pdfs) of interest to the ATV community but we will also be using as the place to find software from CQ-TV projects and also back issues of CQ-TV.

Got a scan of a rare equipment manual that others may be interested in, want to start a reference library for all articles on RB-TV or found a load of interesting web links for ATVers – just start a new topic and put it on the wiki...

As well as information of interest to the whole ATV community, we will use the wiki to put BATC specific information such as instructions on how to reset your password, how to stream to batc.tv, how to renew your membership etc and how to use the shop.

So when you email us for information on 'how to...', we will send you the appropriate wiki link and if you find the information is not correct, you can change it so it works correctly for the next person!

We are also looking to use it to generate and publish an interactive index for articles in all back issues of CQ-TV. You'll see we've made a start, but if you have a spare ten minutes and an old paper or soft copy of an edition which is not already in there, you can just log in and start adding it.

Content categories we have thought about already include the following but feel free to add more as you use them:

- ▶ 1.1 New to Amateur TV?
- ▶ 1.2 BATC services
- ▶ 1.3 CQ-TV Magazine
- ▶ 1.4 BATC and ATV projects
- ▶ 1.5 ATV Equipment manuals and schematics
- ▶ 1.6 Ex commercial broadcast equipment manuals
- ▶ 1.7 Test equipment manuals
- ▶ 1.8 Other equipment information related to ATV

Who can access it?

Anyone can use the wiki, you don't have to be a BATC member to read the articles and download the information but we are limiting the ability to edit the content and upload new information to BATC members.

This is your site – any information which you feel is of use to others can be put on the Wiki but please observe any copyright restrictions on your material you use.

Does it replace the forum/website?

No, the forum is the place to discuss things and the website is the first landing place for new comers and is used for official information such as the constitution. If the Wiki is the library, then the forum is the coffee shop and the website is the shop window!

The forum / wiki and web site will all work together - it is fine to load content on the Wiki and then post a link and discuss it on the forum – and maybe it will save hours of

trawling posts to see which is the latest version of that circuit you're trying to build!

So what now?

The BATC wiki is live at https://wiki.batc.tv/Main_Page – go and have a look around and you'll see there's already some information in there which you can read and download. Next, create yourself an account and start adding content but please take care!

Choosing a user name

The wiki is on the new BATC server system and in the future we will be looking to implement an LDAP authentication server to give you a common log in across all the BATC platforms.

However, we did not want to delay releasing the wiki until that was ready and so to make the future change-over as painless as possible, you will need to have a common user name for every platform on the new server as we release them.

We suggest you create a user name using your call sign in UPPER CASE and your first name and call sign in the real name field. (If you are not licensed then use your first name as user and first and second name in the real name field)

Editing and adding content

Once you have logged in you can still view as normal but you will see the pages look slightly different in that there is an edit button against everything. Either click on edit to change something already there or if there is no content in a category when you click on the link, you will see the 'create' screen and you can start to add content.

The BATC wiki is based on the Mediawiki application and many of you may have already used it on other sites – if not, there is full documentation at

<https://www.mediawiki.org/wiki/Help:Contents>

Don't worry if you mess something up – it's not permanently broken and you'll be able to go back in to the item and change it or as this is an ATV community resource someone else can come along and correct your mistakes!

It's your wiki

The way the wiki works and how successful it will be is entirely dependent on YOU! Everything on it is user generated so if you see something is missing, you take the initiative and add it! Hopefully between us we can grow it in to an invaluable resource for the whole ATV community and we'll wonder whatever we did without it! 🗨️

The Principia Mission Give us a wave Tim!

Working with the UK Space Agency, ARISS (Amateur Radio on the International Space Station) developed a programme enabling a number of schools to speak directly to Tim Peake, the first British ESA astronaut to visit the station, during the duration of his stay.

This enables live interaction between pupils and Tim and has already turned out to be one of the highlights of the Principia STEM outreach programme. The prearranged schools contacts are taking place between January and May 2016 and students are able to put a number of questions directly to the astronaut using amateur radio VHF and UHF radio equipment specially installed at the school for the occasion.

For Tim Peake's mission, the ARISS team of licensed UK Radio Amateurs, led by Ciaran Morgan M0XTD, also planned a world first by receiving live video from the ISS during the contact. Using the HamTV transmitter, which has recently been commissioned on board the ISS, Tim will be the first astronaut to use this equipment during a two way schools contact.

As well as building a vehicle based receive system, which is installed at the school on the day of the contact, the team are utilising Goonhilly Earth Station in Cornwall to receive the 2.4 GHz HamTV transmissions from the ISS with a 3.8 metre dish loaned to the project by Satellite Catapult. The dish is almost in the shadow of the 29 metre dish "Arthur" built in 1962 to receive the first transatlantic television signals from the Telstar-1 spacecraft. See CQ-TV250 for more details of the Goonhilly site.

The VHF and UHF amateur Radio station

The team provide a direct voice contact for up to ten pupils at each of the selected schools with Tim Peake on the ISS. We are using a VHF / UHF amateur radio station specially established for the event at each school, consisting of a Kenwood TS2000, preamps, power amplifiers to get to 160 watts and vhf & uhf x-beam yagis on a computer controlled elevation/azimuth rotator - mounted on a sixty foot mobile tower. An external microphone and push-to-talk switch are rigged at the front of the stage for the students to operate. All the students controlling the ptt take the foundation exam or already hold licences.

- ▶ *The VHF/UHF beams atop of the 60' mast with John, G7ACD providing the muscle power*

Frank Heritage - MOAEU



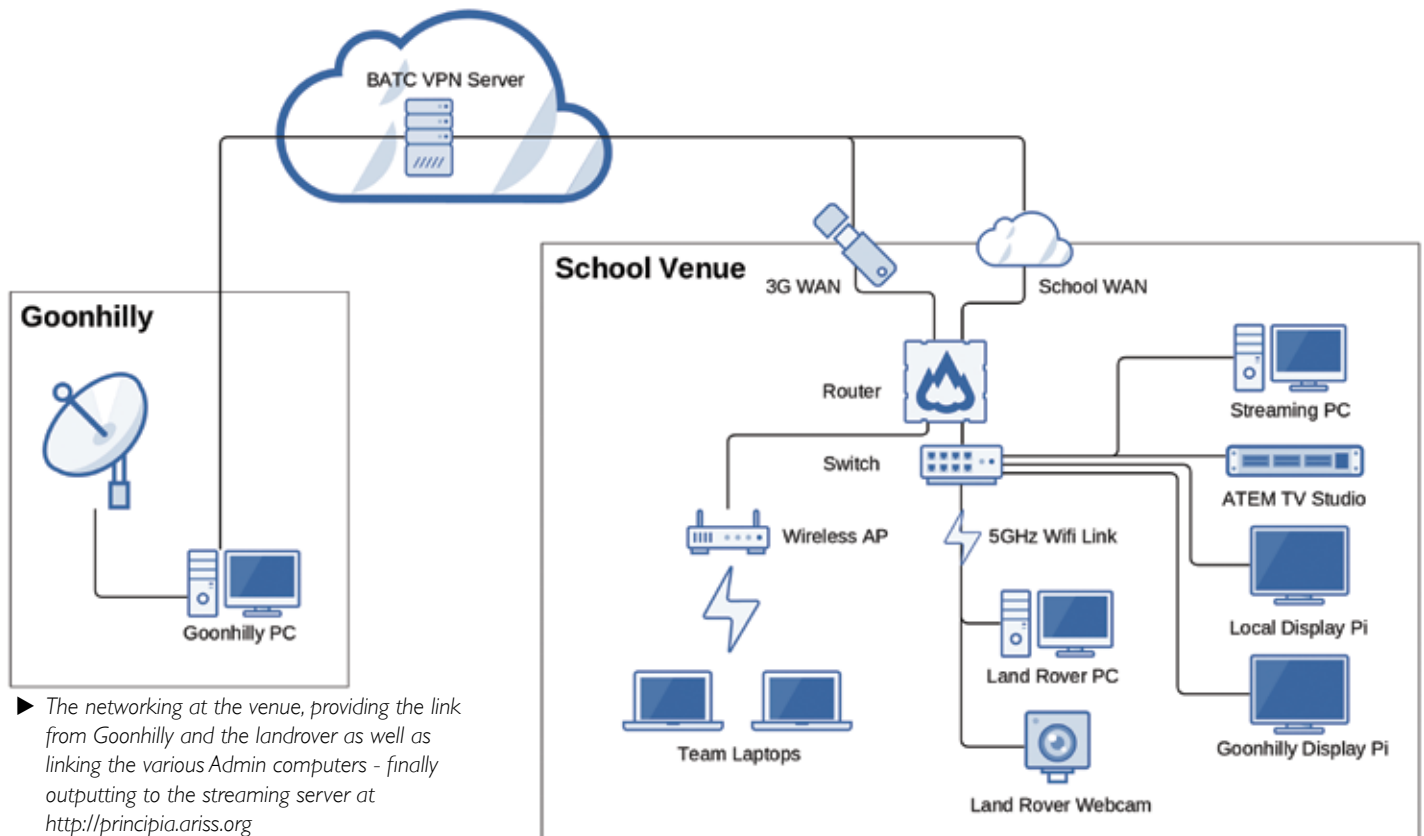
Live video reception at the school and at Goonhilly Earth station:

Our secondary aim is the reception of real time video of Tim inside the ISS using the S band HamTV transmissions. These are received directly at the school and also by using a system at Goonhilly. The local receive system uses a 1.2 metre vehicle mounted dish and Tutoune software developed by F6DZP to receive the DVB-S signal and the output from the system is fed across an internal IP network to the main video production desktop.



The Goonhilly signal is back hauled to the school over a dedicated VPN network and displayed when the local signal is not available. The signal from the DATV receivers at both locations is received by a pair of Raspberry Pi computers in the AV rack and their HDMI output is fed into the ATEM Television Studio. There are webcams on all the aerials that can be monitored live in the hall to provide that confidence that they are pointing in the right direction!





The digital receiver output from both the Goonhilly and the local receivers, along with dish cams and an ISS tracking map is available at <http://principia.ariss.org/Dashboard/>

We have a redundancy system in place in case of reception failure of the audio for the contact with SDR receivers located at the station of Graham G3VZV and from PA3WEG in the Netherlands at Delft. This station has proved useful as it loses the signal from the ISS later due to being further east than the UK.



Video presentation and live webcast

The schools produce a presentation leading up to the contact, showcasing the work done in the school and occasionally featuring a guest presenter or speaker.

The City of Norwich School had a presentation with live experiments from Mark Thompson - of Sky at Night fame, and a presentation by weatherman and radio amateur Jim Bacon, G3YLA. These presentations, along with the video from the ISS are displayed on a large screen for all to see. This is also controlled from the AV production desk.

We are additionally providing a live webcast of the event with two cameras in the room and the presentations mixed to a streaming server. This includes live audio and video of the contact, a real time tracking map and other data and is available at <https://principia.ariss.org/Live/>





▶ Noel, G8GTZ, mixing the audio from the contact for the webstream

The audio in the room is either mixed and controlled by the school if they have the facility in house, or by the BATC team to ensure a balance between the audio from the room mics, and the audio from the radio for the contact. All of the audio feeds are then

fed into the ATEM Television Studio, through one of the cameras down the HDMI cable.

The contacts so far...

After a dry run in Basingstoke in December, the team assembled at the Sandringham School in St Albans for the first contact on 8th January. Unfortunately for technical reasons, the HamTV system was not available on the ISS for this contact.



▶ The production desk at St Albans - with Graham and Noel discussing details

The second contact took place from the Royal Masonic School for Girls, Rickmansworth on the 11th February. Even on the preceding orbit there was no sign of the camera on the HamTV transmitter - just the familiar 'blue line' on the blank carrier screen - we had no idea if we were going to 'see' Tim or not. As the moment of acquisition approached, all the computer systems took over and the various aerials swung down to the horizon to track the approaching spacecraft. After just a couple of calls on VHF, Tim came back loud and clear, to much cheering and applause from the assembled audience. With contact established, the questions from the students began... then after a couple of questions, as the ISS rose high enough above the horizon for the signal from the HamTV to lock up the receiver, and Tim appeared on the main screen. Success! I think Ciaran was elated! With students primed to continue regardless with the contact, Ciaran

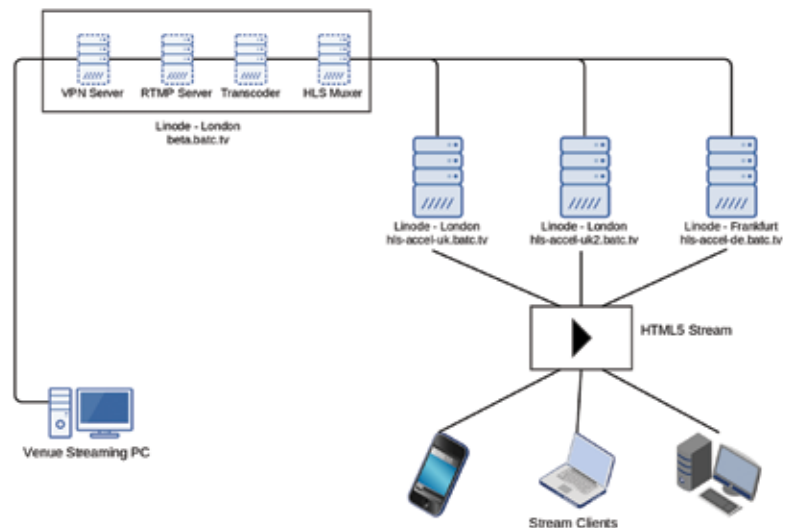


jumped on the mic in between overs to let Tim know we had a picture – 'Give us a wave Tim!' And he did! The video typically drops out about 30 seconds ahead of the audio, but it's certainly added a new dimension to the schools' contact! On occasion the HamTV transmitter is not available during the contact - this is due to the transmitter sharing the rack and power supply with a number of other experiments.

What's next?

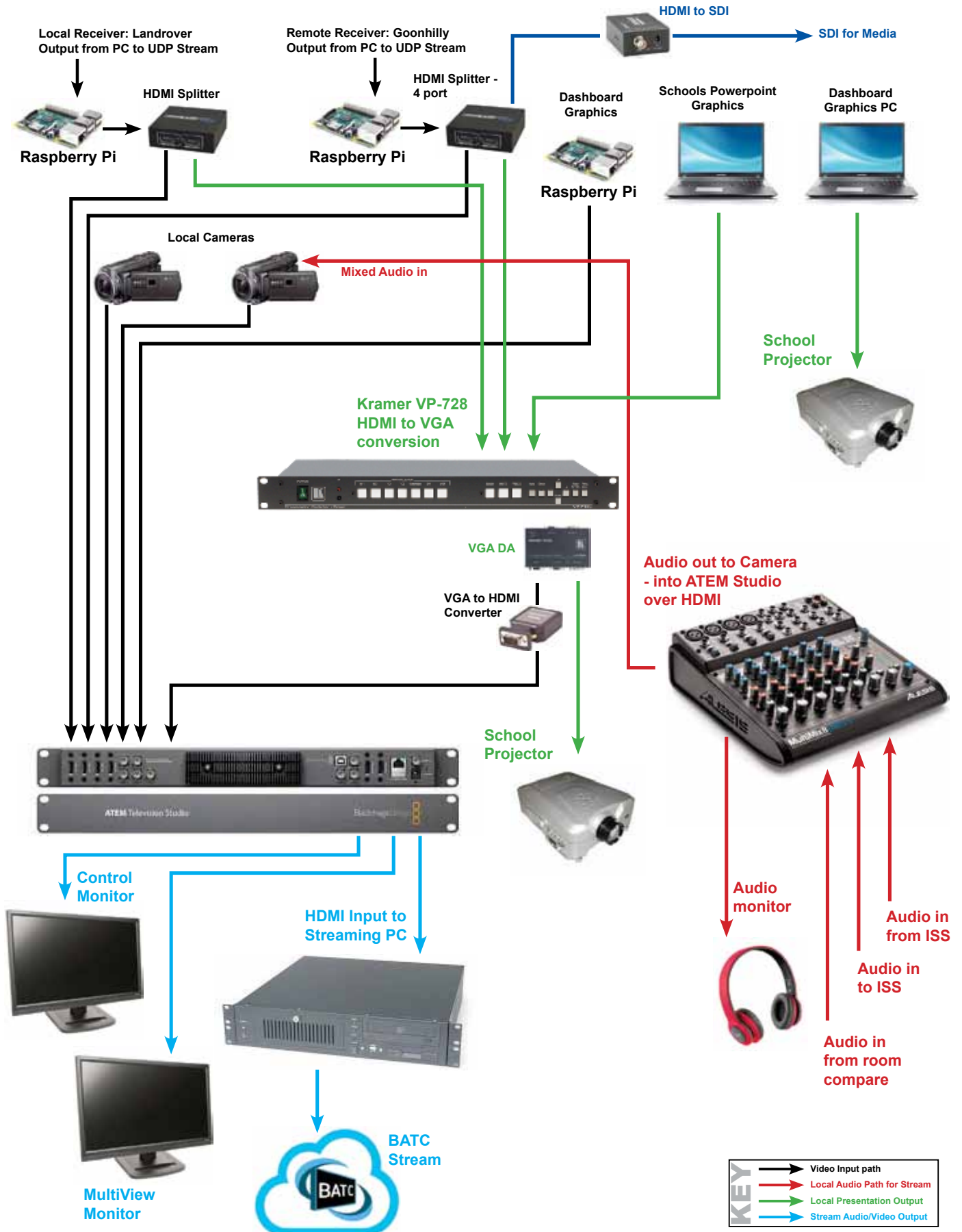
There are five more schools scheduled to have a contact with Tim over the next few weeks - The exact date and time will not be known until a few days before the contact. These contacts are not guaranteed and are subject to the other work taking place on the ISS and the work schedules of the astronauts. For all the details on dates and times be sure to check the Principia ARISS website: <http://principia.ariss.org> and watch the event live on the video streaming page.

If you manage to receive the HamTV directly, please do send us details of how you achieved it and the set-up you've used. Latest news is that the HamTV will be off for at least six months from June 2016 - so grab it now while you can!



▶ Details of the streaming servers used to deliver the ISS contacts to the web. On some of the events over 1,500 viewers watched the contact.

Schools Presentation Set-up



Social Media



Ian Parker - G8XZD

I caught sight of a tweet the other day that made me think.



It was from the IARU commenting that the first ARISS schools video contact in February represented the culmination of 16 years' work behind the scenes.

You can imagine how many people have been involved in that time and how many meetings they've all had to attend to make it all possible.

And as the ARISS roadshow travelled across the country staffed by volunteer radio hams each location brought its own challenges – and rewards.

As part of the "day job" I went to visit one of the schools chosen - Oasis Academy Brightstowe in Bristol - as they prepared for their big day.

Parked up outside was Noel's now infamous Land Rover (no the mast still wasn't up) and people were busy on the school roof rigging aerials.



► *Ciaran, M0XTD checks the connections on the VHF and UHF beams on the roof of the school*

Once inside the school (did you know it's easier to get into a prison...) there was radio equipment, computers and wires everywhere - it looked like someone's shack had exploded to fill as much of the school's stage as possible.

There I was greeted by the ARISS crew including many leading lights from the BATC – Ciaran, M0XTD; Noel, G8GTZ; Graham, G3VZV; Frank, M0AEU; Carlos, G3VHF and John, G7ACD. (Also on the team, but missing from Bristol: Phil, M0DNY and Howard, G6LVB)

And in the corner a group of people were crowded round a couple of laptops looking rather serious while jabbering away on their mobiles and feverishly tapping away on the keyboard trying to connect to their remote receiver at Goonhilly.



As the day went on the fevered brows turned to smiles and laughter once all the problems were sorted out.

On the big day itself the build up to the ISS contact was perfectly stage managed by Ciaran Morgan, M0XTD. One of the stories he could dine on for years to come is that he is the man with the ISS' phone number in his mobile.

His warm up act included a game where a ball is thrown from one person to another and a third has to shine a torch on the moving ball – showing how difficult it is for the Goonhilly dish to track the ISS.

Then even closer to the contact he changes gear and with a serious face on announces 'this is only an experiment'.

"And what happens with experiments?," he asks the pupils.

"Things can go wrong," one replies.

He pauses and looks at his screen then calls the space station.

“GBISS this is GBIOAB over”

Nothing but static on the speakers – such was the tension in the hall you could hear a pin drop.

Moments later the cheer from the hall nearly lifted the school hall roof as Tim Peake’s voice cracked through the radio.

The questions started and moments later there was an even bigger cheer as he appeared on a giant video screen waving to the crowd.



I’ve been involved with the mainstream media for more years that I care to remember and this was one of those ‘lump in the throat’ moments when you thought you’d seen everything when clearly you hadn’t.

Even in this always-connected internet age where you could do the same thing on Skype it was still one of those magic moments.

The students who had been chosen were nervously lined up on stage as the television cameras rolled

Among the questions from pupils was one from 15-year-old Seema who wants to be the first female Afghan astronaut.

Major Peake told her it was a “wonderful idea and ambition” and that she should “follow her dreams”

There was even a cheeky appearance by a grown-up” Frank Bell G7CND from the One Show asking a question.


The retired science teacher, had been part of the amateur radio linkup in 1991 between students at the Royal Grammar School, Guildford, and the UK’s first astronaut Helen Sharman GB1MIR onboard the Mir Space Station.

As the signal faded away another big cheer for Tim to say goodbye before all the pupils involved were hastily shuffled off to do TV interviews.

A final speech in the hall then came with the immortal words...

“If this can be done by amateurs just imagine what you as professionals could do in the future.”

The link-up was part of the Amateur Radio on the International Space Station project which aims to inspire students, to pursue interests and careers in science, technology, engineering and maths through an interest in amateur radio.

Sixteen years of work? Time well spent! 



► Brightstowe student Seema poses her question to Tim Peake. Note the BBC logo - Screenshot from the BBC broadcast, fed from the BATC cameras and web stream!



Simple Antenna Tracker for the ISS

Dave Crump – G8GKQ

This article describes how an inexpensive rotator can be used to track high elevation ISS passes allowing the reception of up to 4 minutes of video from the ARISS HamTV transmitter.

Introduction

Having built a simple antenna and receiver for ARISS HamTV (described in CQ-TV 250 page 33), I wanted to be able to steer the antenna to follow the ISS across the sky, but was not prepared to purchase a 2-axis rotator specifically for the project. I did have an ancient (35 years old) single axis rotator and some bits of mast lying around in my small garden, and thought that I might be able to use them to steer the dish if the ISS followed a linear arc across the sky. After some research, I found that by setting the orientation of the mast correctly, and then tilting it to point at the ISS on the highest part of its arc, I would be able to track the ISS with less than 2 degrees of error. This is well within the 12 degree beamwidth of my small dish.

Mechanical Arrangement

The first thing to do is to fix the dish to the rotator (possibly using a short stub mast or a flat plate) so that it points exactly 90 degrees to the axis of rotation. You may already have used a similar setup for normal microwave operations. Then you need to align the mast so that, when tilted, the dish can rotate from the rising azimuth through to the setting azimuth. This alignment is typically within 20 degrees of true North or South. Lastly the mast needs to be tilted so that at the highest point of the pass, the dish points directly at the ISS. This is typically between 60 and 90 degrees elevation. The exact alignments need to be calculated and reset for each pass – this is not an install and forget solution!



I clamped the mast to one piece of tubing (weighted down) at its base, and used an inverted T to hold the end of mast up.

Alignment and Pointing Calculations

The first thing to do is to choose which pass you wish to receive. Up till now I have usually only tracked the passes where Tim Peake is involved in UK schools contacts, and has the HamTV camera in use. Then you need to generate a file containing the ISS bearing and elevation from your location for each second of the pass. By visual examination of this data you can work out whether the pass is to the North or South of you, the rising azimuth (I use the 15 degree azimuth), and the setting azimuth; you can then take the mid-point of these 2 to work out the azimuth orientation of your mast. Then check the highest elevation – your mast will need to be tilted so that the dish can point at this highest elevation. Here is a sample from my elevation and azimuth file showing the ISS rising through 30 degrees elevation on a bearing of 273 degrees:

```
2016-02-11T18:12:46.000Z,28.7,273.4
2016-02-11T18:12:47.000Z,29,273.5
2016-02-11T18:12:48.000Z,29.4,273.6
2016-02-11T18:12:49.000Z,29.7,273.7
2016-02-11T18:12:50.000Z,30,273.8
2016-02-11T18:12:51.000Z,30.3,273.9
2016-02-11T18:12:52.000Z,30.6,274
2016-02-11T18:12:53.000Z,31,274.1
```

I wrote an MS Excel program to calculate the desired rotator angle for each second during the pass. It really does need to be calculated that often – the ISS moves at 1 degree per second at the top of its pass. The program first converts the azimuth and elevation into x, y and z lengths for the unit vector based on local vertical and true North. The next step is to perform a rotational coordinate transformation (around the local vertical) to get the 3 vector lengths using a horizontal axis system aligned with the mast. A second coordinate transformation rotates about a horizontal line perpendicular to the mast to shift the “vertical” axis to align with the rotator arc. It is then easy to convert the vectors back to a desired rotator angle (+ or – from the “vertical”) and error angle. The error angle is typically less than 2 degrees – I use this as a cross-check. The final output of the program is a second text file with a line for each second, showing the time and the desired rotator angle for that time.

Here is an extract:

```
2016-02-11 18:12:46.000000, 60.4
2016-02-11 18:12:47.000000, 60.1
2016-02-11 18:12:48.000000, 59.7
2016-02-11 18:12:49.000000, 59.4
2016-02-11 18:12:50.000000, 59.1
2016-02-11 18:12:51.000000, 58.7
2016-02-11 18:12:52.000000, 58.4
2016-02-11 18:12:53.000000, 58.0
```

Controlling the Rotator

The rotator can be manually controlled by reference to a clock and the text file, but I wanted an automatic solution. Careful examination of my rotator control unit showed that it used 3 switches, all controlled by the “desired bearing” dial. The first switch turned the 240 volt AC mains on at the primary of the transformer. The second 2 switches selected clockwise or anti-clockwise motion (at a rate of 6 degrees per second) by switching 24 volts or so of AC at the secondary of the transformer. I put a suitably rated relay inside the rotator controller to switch the mains, and bought its solenoid connection and the 2 other switch terminals out to a socket on the side of the rotator controller.

I needed to have accurate feedback on the dish position, so I mounted an old wire-wound potentiometer at the back of the dish with a wooden reference arm mounted below the rotator. This wooden structure can be seen in the photo.



I wrote a program in Python on a Raspberry Pi to read the tracking file, check the rotator position and then energise the appropriate relays to move the dish. My first hardware version used a GertBoard for the analogue to digital converter and the relay drivers, but later I simply put the analogue to digital conversion IC (MCP3002) and

discrete darlington relay drivers on a piece of veroboard in a box with the relays. This box was connected to the Raspberry Pi through a ribbon cable. The Raspberry Pi connects to my home internet network so that it can get the correct (exact) time, and I then start the program using remote log-in over ssh from a PC.

Results

During the second UK schools contact on 11 February, I received 3 minutes 47 seconds of video. I acquired the video at about 27 degrees elevation as the ISS rose, and lost it at about 19 degrees as it set. Given the buildings that surround my back garden, this is about the best that I can hope to achieve.




Talkback

I have subsequently attached an additional stub mast to the rotator and put a 5 element 2 metre beam on that mast. This enables me to receive Tim's replies to the school on 145.8 MHz directly.

Data Sources and Software

For initial set-up, I use the GoISSWatch iPhone/iPad app. It is easy to extract the rising azimuth, setting azimuth and highest elevation from the app. This enables accurate position of the mast and dish prior to the pass, and reasonable results can be achieved with manual control of the rotator during an ISS Pass. During early testing, I achieved 2 minutes of continuous manual tracking on my first attempt.

For accurate automatic tracking, I used a custom-built JavaScript website to provide me with the list of azimuths and elevations for the ISS. You can see this site at <https://www.philcrump.co.uk/gkqsats>. I then wrote the Excel and Python programs myself. If you have built the mechanical arrangement, I would be quite happy to share these prototype programs with you – just e-mail me at dave.g8gkq@gmail.com. 



Animated Test Cards

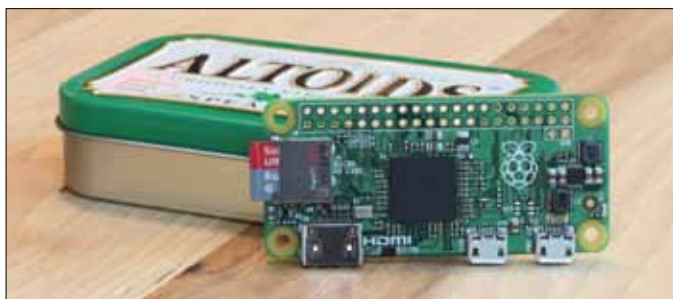
Brian Jordan – G4EWJ

Background

When receiving a test card transmission with digital ATV, it is not always obvious if the picture has frozen due to lack of signal, or how frequently dropouts or glitches are occurring.

The frames of video in a digital transmission are sent as a Group Of Pictures (GOP), with the first frame of a GOP containing a complete picture and the subsequent frames containing only changes from the previous frame. GOP length can vary, but 15 frames is typical.

A digital transmission will send the complete test card as the first frame of a GOP and the other frames will be padded out. If a glitch in reception occurs in the padding data, then it is quite likely that no disturbance will be seen on screen. By putting some movement into a test card, it is more likely that a reception glitch will be noticed.



With its composite video output, the Raspberry Pi is an ideal test card generator, particularly if you can obtain a RPi Zero. The TCANIM program uses a JPEG image of your choice and floats balloons over it and also has an optional sliding text banner at the bottom of the screen.

The RPi should be set for standard PAL output on the composite port (720x576i). The HDMI output could also be used at this resolution for the highest quality, if you have an HDMI video capture device. The program only works at 720x576 resolution.

The configuration instructions below relate to composite output. Some knowledge of the NANO editor is required.

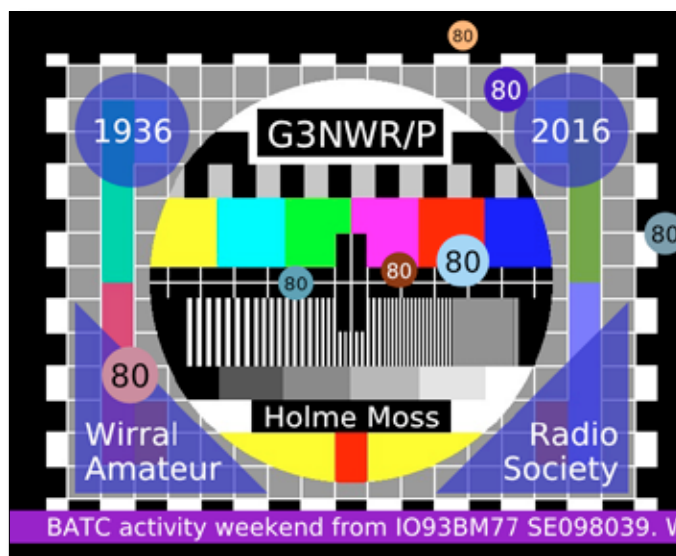
A JPEG file of 720x576 is slightly too big and 640x480 seems the best size. The program has parameters to adjust the position of the JPEG file on screen.

TCANIM was adapted from demo programs in a graphics package called openVG. It is not necessary to install the package to run TCANIM.

There is a sample video at: <http://tinyurl.com/tcanim-mpg>

It runs smoothly when viewed on a 50Hz TV system. Viewing on a PC, or in Dropbox, can sometimes make it slightly jerky.

Thanks to G4KLB and G8GKQ for helping with the testing.



Configuring the RPi

Edit the RPi configuration file:

```
sudo nano /boot/config.txt
```

Locate the line: **sdtv_mode=2**

Remove any # character at the front (# disables a line).

Locate the line: **#hdmi_force_hotplug=1**

Make sure that it has a # at the front, otherwise composite output will be disabled.

Save the file and reboot.

Installing the Program

The files required on the RPi are:

tcanim1v04 the executable program

tcademo1v04.sh a shell (.BAT) file to run the demo

testcard640.jpg a sample test card

Make the files executable:

```
sudo chmod +x tcanim1v04 tcademo1v04.sh
```

Copy and modify the .sh file when using your own test card.

Starting the Demo

Type: `./tcademo1v04.sh`

The `.sh` file contains:

```
./tcanim1v04 testcard640.jpg 40 52 "CQ"
"This text will appear on the sliding
banner."
```

testcard640.jpg is the test card image.

40 and 52 are the X and Y offsets from the bottom left of the screen, that are applied to the position of the JPEG file.

"CQ" is the text that will appear on the balloons. The limit is 4 characters. Use "" if no balloon text is required.

"This text will appear on the sliding banner:" is the banner text. The limit is 1000 characters. Use "" for the banner text if a banner is not required.

When started, the program shows the test card alone for a few seconds, then fires a salvo of large balloons and then settles down to firing smaller balloons and showing the text banner.

This sequence repeats after 5 minutes.
Hit **CTRL-C** to stop the program.

*The files and a sample video for this project can be found on the BATC Wiki pages here:
https://wiki.batc.tv/RPi_Test_Card*

Producing Your Own Test Card

The Windows program PAINT is very useful for putting call signs onto a test card image.

Save the image as a `.BMP` file while working on it, as this will avoid any loss in quality by repeated compression. Save the image as a `.JPG` file when it is ready to be used.

Auto Starting the Test Card

Edit the file that runs commands at start up:

```
sudo nano /etc/rc.local
```

At the bottom of the file, there will be a line: `exit 0`

Just before this line, insert the lines:


```
cd /home/pi
./tcademo1v04.sh &
```

The `&` at the end is very important. It allows the RPi to carry on past the line. Adjust the `cd` command for wherever the files have been installed.

Stopping the Auto-started Test Card

Once the test card is running, it takes over the screen.

To stop it, there are two options:

1. Log in via ssh and type: `sudo killall tcanim*`
2. Log in blind using a keyboard and then type the line above. 

CAT16 and BATC GM 24/25 September

- 2 day program including talks and demos
- Members bring and buy
- Test equipment area
- Free access to museum
- Saturday evening dinner
- Museum guided tour



RAF Cosford Museum - TF11 8UP
Just off M54 Junction 3

My Station



Shaun O'Sullivan – G8VPG

Another new series of articles in CQ-TV in which we invite readers to send in details about their station - a few words and some photographs showing their set-up. In this edition we visit the station of Shaun, G8VPG. If you would like to be featured, please send your text and images to the editor: editor@batc.org.uk

My name is Shaun O'Sullivan and I was licensed in 1980 as G8VPG. I was a keen listener as a schoolboy, so my active interest in radio goes back nearly 50 years. My station is located at Salford, a village on the A4 midway between Bristol and Bath. I am lucky enough to be in range of two ATV repeaters, GB3ZZ & GB3UT.

When first licensed, I was very active on 2m sideband. I became interested in ATV after a club demonstration and started with a 70cm AM station; Microwave Modules upconverter; Wood & Douglas kit based Transmitter and ex-shop vidicon CCTV camera. During the 1980's, there was upwards of 20 active stations in the Bristol area and on activity evenings, you had to wait quite a while for your turn to transmit.



► A view of the main operating position in the shack. The two small monitors on the right hand side monitor GB3ZZ channel 1 & 2.

After a few years on 70cm, G4ZQF and myself moved up to 23cm, using Wood & Douglas kit; free running 416MHz oscillator and varactor tripler. In 1985, G4ZQF and myself formed the Severnside TV Group and after 18 months or so, put the first incarnation of GB3ZZ on air. The repeater has been on air continuously for 30 years, largely thanks to G1IXF. I am Secretary & Treasurer of the Group and also organise our main fund raising event, the West of England Radio Rally.

Although I earned my living as a Consulting Engineer, it was not in the electronics or radio area, so I consider myself to be an "amateur" amateur. Like most people,

there have been periods when I was less active due to business and family commitments. Two years ago, G1IXF encouraged me to operate digital ATV and lent me some of his kit. I was amazed at how well it worked and this has been my main activity since.



I use a DTX1 for 23cm & 70cm and a chain of homebrew & kit amplifiers. I like to make my own equipment where possible, often from suppliers such as Minikits. During the past year, I have constructed the Minitioune and Dighthin projects and got these on air on 146.5MHz. I have just acquired a DATV Express board and hope to take this out portable in the Spring.

Besides ATV, I can also run voice & data modes on most bands 80m to 23cm, and have a long standing interest in Band I DX-TV, although there are few stations left to receive now. The past few weeks I have been experimenting with digital voice modes such as DMR & DSTAR; there is always something new in Amateur Radio. These modes could be useful for ATV if we could establish national and worldwide reflectors dedicated to ATV. 🗣️





Activity at GB3ET

Peter Yarde – G8DKC



The wait for a frequency allocation for GB3ET at Edgehill (the famous battle), continues... John M1CNJ Proposed Keeper and myself filled out the application in July 2015.

We did look at a 3.4Ghz application but decided to stick with the more conventional 23cms, so we are digging in for the wait.

At the same time we have a great site and have all the usual permissions to erect a mast – power is already on site (also an old phone line that only needs repairing). We are good for various tests and activities.

No point sitting at home and muttering about government departments when you have such a good /P - /A location at 708ft, 216m.

The predicted edges of coverage are beyond Worcester to the west; North of Birmingham and Leicester and beyond Northampton to the East, Luton, Princes Risborough, and Wantage. Back to the Cotswolds, Northleach in the south west, and Evesham in the west. Luckily we are all well known for pushing the boundaries of “predicted edges”.



We are hoping to have kit and a 40ft plus mast (the final height of ET mast probably 60ft) set up in May to do some serious testing and we will let you know exactly when on the BATC Forum.



73

The GB3ET Team – John M1CNJ, Peter G8DKC, Christine M6CDM, and Hekla the dog. 🐕



Video Fundamentals 6

What shape and how many Lines? *Brian Summers – G8GQS*

What shape?

In 1936 the UK's high definition all electronic television service started with 405 lines. In 1936 this was at the cutting edge of technology and the aspect ratio was 5:4, that is the picture was 5 units wide by 4 units high. Today we would call this standard 405/50i. The March 1950 edition of *Wireless World* announced the first change to the wider aspect ratio of 4:3. In practice as everybody had the similar round tubes it was effectively a reduction in the picture height.

Things have moved on a bit since then and now we have a plethora of line and aspect ratio standards. First I would like to talk about the aspect ratio. Looking at the film world – which has it's own set of different formats, cinemascope, etc – there are problems showing films on television as to how they are presented. The simple choice is to show all of the film with black areas top & bottom (letterbox)¹. This looks bad on a 4:3 TV screen and it wastes the vertical resolution as many lines have no picture information. The next option is to just show the middle of the film, but here the action in the picture wings is lost. A more costly option, is to do "pan & scan" and pre-record it before transmission, perhaps the least worst option.

In the late 1990s we started to see the arrival of TV widescreen with camera and display devices of 16:9 aspect ratio, this was artistically an improvement, but many compromises had to be taken during the period when the viewers had both aspect ratios in use.

The principle to keep in mind is a circle viewed by the camera should still be a circle when seen by the viewer.

There are many variants on the above; for a while the BBC shot and recorded programs in 16:9 and transmitted them domestically in 14:9, a halfway house, and sent them

to Europe in 4:3. This all made framing the shot and the positioning of graphics interesting with shoot and protect safe areas. The electronic changing of the aspect ratio mentioned above was done, predictably, in an Aspect Ratio Converter (ARCing). The same result could be achieved in a conventional DVE (Digital Effects Unit), now often combined with the vision mixer. What was once hard and needed lots of silicon has now become commonplace. There is a very good website² by Alan Pemberton that goes into this in much greater detail.

* An "Active Format Descriptor" or AFD is transmitted so the TV can auto switch to the correct display shape. The analogue version of this was called WSS, (Wide Screen Signalling) transmitted on the first half of line 23.

How many Lines?

So having looked at the shape of the picture, how many lines should there be? And what of interlace?

Originally in the 1930s interlacing solved two problems. They are related to each other and the problems still apply today.

The first was flicker; the film industry solved this by showing each image twice from a base image rate of 24 pictures per second. Film pull-down, flash image, flash same image again, pull-down next image and so on. This fooled the eye into thinking the display rate was 48 pictures per-second.

The second problem was bandwidth, still with us today. Not much of a problem for film, just use 35mm instead of 8mm. Looking here at the resolution of film as spatial bandwidth.

Television copied this basic idea of showing the picture twice, field 1, then field 2 that is half of the then 405 lines in each frame. So 25 complete pictures per second at

Camera format	4:3 screen option 1	4:3 screen option 2	4:3 screen option 3
16:9 Widescreen aspect ratio	Reduce monitor/TV scan height to match 16:9 with un-scanned area top & bottom	Electronically reduce the height of the picture with black top & bottom (letterbox)	Electronically crop the sides to provide 4:3 ratio (pillarbox)

Camera format	16:9 screen (CRT)	16:9 screen	16:9 active screen
4:3 Aspect ratio	Reduce scan width,	Electronically reduce the width of the picture with black at the sides (pillarbox)	Modern display screens can switch aspect ratios* if this function can be accessed.

a rate of 50 half pictures³ per-second solves the flicker problem and reduces the bandwidth by half. It does also reduce the temporal resolution by half, as movement in the picture causes each frame to be different.

The same idea applies to most current line standards 525/60, 625/50, 1080/50i notice here that the HD 1080 has an i to indicate interlace. Even today bandwidth is a problem, but a different problem from 1936 when it was technically hard to achieve the required analogue bandwidth. Today you can in principle have as much digital bandwidth as you like, it just costs money.

The intermediate HD standard of 720 lines could be transmitted as i or p. You could have 1080p but it doubled the bandwidth and therefore the transmission costs. Once you are in the digital domain there are any number of options, 1080p at 25 pictures was one that springs to mind. (film effect).

TV's can now have the ability to up-convert the frame rate, 100 or 200Hz rates are promoted as a way of reducing flicker. Some TVs make a better job of this than others. Often an attempt is made at interpolating the movement between the transmitted frames with varying degrees of success. It is worth mentioning that the human eye when viewing larger, brighter screens is more likely to perceive flicker and increasing the display rate reduces this problem⁴. We in the 50Hz countries are used to our field repetition rate, but visitors from the 60Hz areas can often see flicker on 50Hz displays until they become used to it.

Bandwidth

Perhaps we ought to look at some numbers – they can be staggeringly large. For an SD (Standard Definition) picture, that is for 625 lines, the broadcast studio uses the REC601 SDI⁵ = 270Mb/s. 1080/50i HD is much more at 1.485Gb/s and 1080/50p at 2.97Gb/s. It is patently obvious that there is a huge amount of compression applied to these signals for distribution and transmission. Bits or Bytes? Note the small b, so it's bits.

Where bandwidth is not limited, as for instance, in your computer/monitor cable, the line rate (vertical pixels) can be high as can the refresh rate (frames per-second no interlace). This can be 60 - 80Hz. to eradicate flicker.

When you enter the computer world of video editing there are still bandwidth limitations. Storage, processing, distribution are still problems even with the high compression rates with the resultant artefacts. It's worth mentioning here that video with MPEG compression can be tricky to edit as you get I & P frames which means you can't always cut where you wish.

As explained Progressive is a higher bandwidth solution with a refresh rate high enough to avoid flicker, at least 50hz. Stepping down from this is full Interlaced with 2 half pictures, this reduces the bandwidth by half. Next is a fudge of progressive at 25hz and show it twice, the artistic film effect. If you are viewing on a LCD or projector this may not be too much of a problem as the pixels are turned on for longer, but you do get movement judder. Next is 'either field' – this is effectively a picture with half the vertical resolution as you have thrown away a field of information and this leads to jagged edges on diagonal lines.

The whole area of resolution, display rates, compression, recording formats, LCDs & projectors, video cable formats, SDI, HDMI, Firewire... have become increasing complex. For example 1080-line standards are defined for 23.98p, 24p, 25p, 29.97p, 30p, 50i, 50p, 59.96i, 59.96p and 60i and 60p according to what mains power frequency and country you are in.

With today's technology, and if you were starting with a clean sheet of paper to write your design on, it is unlikely that you would choose to employ interlace, but then there is already a lot written on our sheet of paper...

It's worth mentioning that with the proposed new 4K system, 3840 pixels by 2160 lines, there is a strong argument for increasing the picture rate to 100 or 120hz to give improved temporal resolution to match the spatial resolution of the picture.

My personal view is that there are enough pixels in HD for viewing a normal, say 45 inch screen at a normal distance, something to do with the resolution of the human eye versus the pixel size. As a BBC vision engineer trained to spot defects in the picture I do find I am annoyed by the artefacts introduced by the high compression used. It would be better to improve the fidelity of the picture, up the frame rate and have a few less shopping channels. There... rant over! 🗨️

1 Letterbox and Pillarbox are the slang terms used.

2 <http://www.pembers.freereserve.co.uk/Test-Cards/Test-Card-Technical.html#Aspect-Ratio>

3 The lines are interleaved to give what we call interlace.

4 https://en.wikipedia.org/wiki/Flicker_fusion_threshold

5 http://www.itu.int/dms_pubrec/itu-r/rec/bt/R-REC-BT.656-5-200712-I#PDF-E.pdf

6 The Quantel digital fact book is a mine of information a free download. [http://quantel.info/resource.nsf/Files/DigitalFactBook_20th/\\$FILE/DigitalFactBook_20th.pdf](http://quantel.info/resource.nsf/Files/DigitalFactBook_20th/$FILE/DigitalFactBook_20th.pdf)



DATV-Express power amplifiers

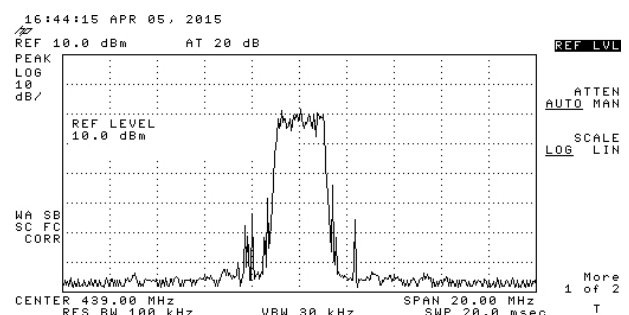
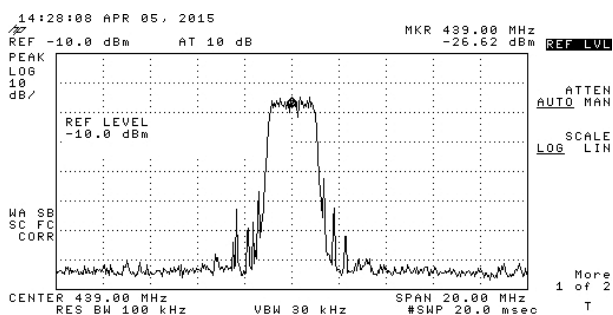
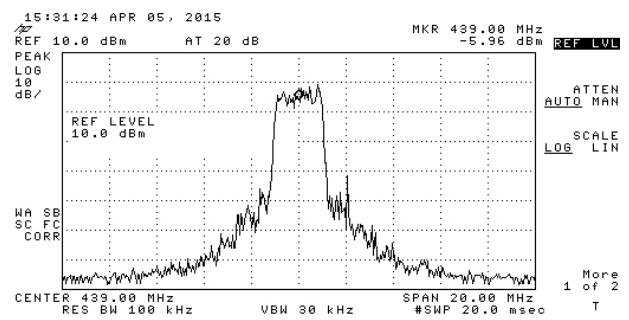
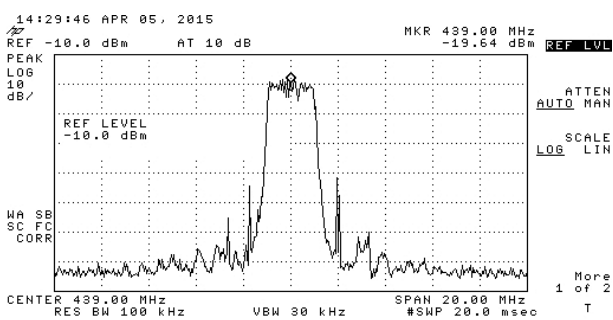
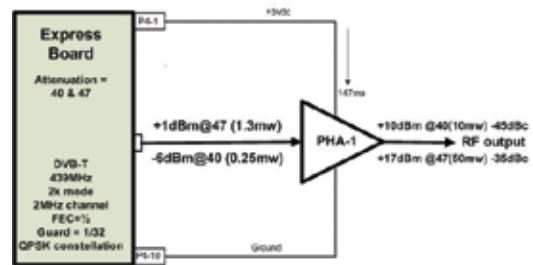
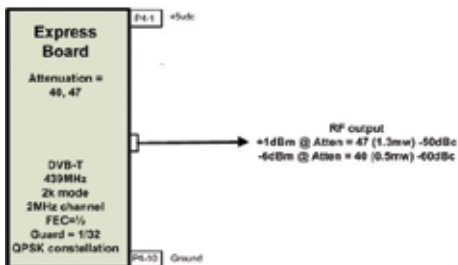
Art Towslee – WA8RMC

The DATV-Express board is capable of generating a +10dBm DVB-S +1dBm DVB-T signal. (See www.DATV-Express.com for details). Either of these signals is not much good without amplification. So, what follows are details for a few post amplifiers to boost it to a more manageable level. This goes for all other DATV transmitters on the market also, not just DATV-Express. However, the Express board has a cleaner signal, the output is higher and covers a 70 to 2450MHz frequency range. The cleaner signal is the most important parameter because as you add amplifiers, the signal gets degraded thereby limiting the number and types of post amplifiers. In general, signal distortion (spectral re-growth) can be tolerated until it rises to about 20dB below the top of the haystack. For comparison, broadcast industry limits re-growth to greater than 40 dB below top of the haystack (-40dBc) prior to the final amplifier.

First, let's start by looking at the Express board output at minimum attenuation (setting 47 top graph) and then again with 7dB of electronic attenuation inserted (setting 40 in bottom graph). Note a slight amount of distortion

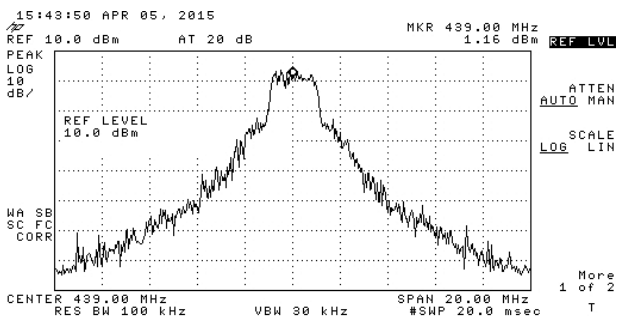
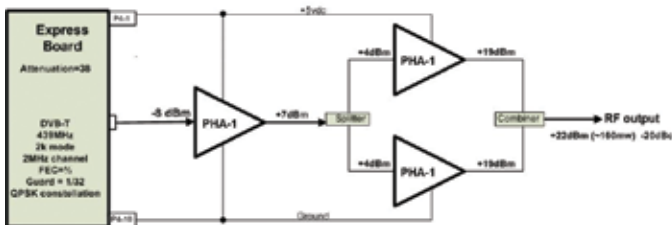
re-growth on either side of the main carrier on the bottom. This is due to a slight amount of non-linearity introduced in the Express internal MMIC amplifier at that signal level. It's down about 50 dB from peak carrier which is good but later we'll see what that does to the signal as amplifier stages are added. (The signal peaks to the left and right of the signal are a result of limited software oversampling in the program and can't be avoided here).

Now, let's look at a 439MHz application using a simple amplifier addition to see how much output power can be achieved. A good selection is a Minicircuits type PHA-1 wide band MMIC. It operates from 50MHz to 6GHz on +5VDC, has about 15dB of gain (I measured 16) and is relatively cheap at around \$3.00 in small quantities. It's powered directly from Express with only a small modification.* Express is first set for its maximum DVB-T attenuator setting 47 for +1dBm (1.3mw). The single PHA-1 amplifier output in the left graph is about +17dBm (~50mw). That's good for a simple addition to Express but generally not high enough for most practical applications. Also the re-growth increased noticeably. If this is the final



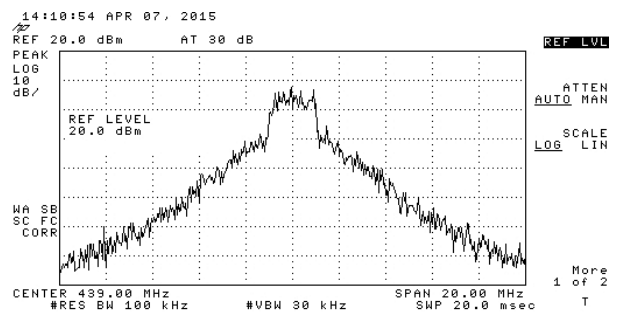
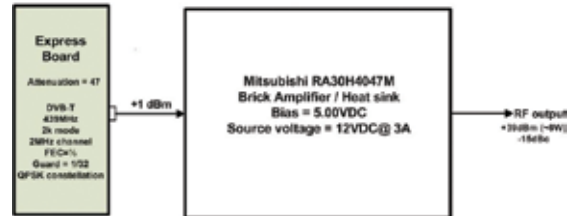
output, it's OK (re-growth at -35dBc) but in order to add another amplifier stage, the output must be reduced to minimize re-growth here and prevent the next amplifier input stage overload.

To increase the output it gets a bit more complicated but not that difficult, so stay with me! Since the single PHA-1 can only tolerate a +6dBm maximum input signal without distortion, an added single amplifier after the first one at Express full output is not practical. Instead, parallel two PHA-1's with a signal splitter on the input and a combiner on the output. That way the pair can be fed with twice the signal a single device could accept and maintain the same gain. (The signal is reduced by 3dB at each input but increased by 3dB at the combined output). The Express output must then be reduced to about -8dBm so the first amp outputs +7dBm (15dB gain) and then split into two +4dBm signals to feed the parallel combination. Then the two +19dBm outputs (4dBm+ 15dB) re-combine to produce one +22dBm (~160mw) signal. This output signal has enough re-growth distortion to put it about 20dB down from the top of the haystack signal. 160mw is now high enough for short range over-the-air communications. If a cleaner signal with lower re-growth distortion is desired, it will be necessary to lower the Express signal feeding the amplifiers for a corresponding reduction in signal output. There is NO FREE LUNCH HERE! The single and parallel combination can still operate from the Express board internal +5VDC source.*

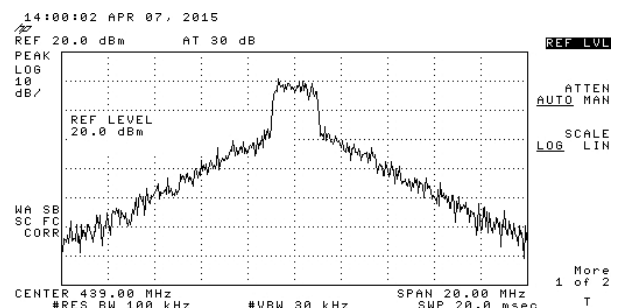
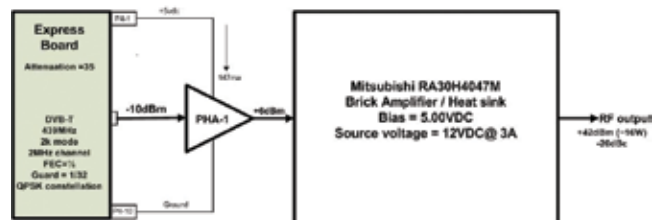


OK, so much for the simple PHA-1 amplifiers. To output still more power I'll first try to discard both PHA-1 amplifiers and use a high power "brick" amplifier instead. The Mitsubishi RA30H4047M amplifier will accept the signal from Express and output about 8 watts without any

intermediate amplifier. However, it costs about \$40, it must be sourced from a separate +12VDC 3 amp supply, it must be installed on an appropriate heat sink / cooling fan and the best output signal obtained is inferior to the PHA-1 amplifier arrangements. However it could be adequate for DATV applications if a band pass filter is used to eliminate the distortion spectral re-growth sidebands. The best compromise I got with the below arrangement was 8 watts out with re-growth down only 15 dB.



A reason the above combination does not look good is because the Express output is set at maximum to get enough signal through the brick amp. At that level, as I said before, there is a slight amount of re-growth in the Express output at the 47 attenuation level. It is not noticeable there but when it's passed through a ~50db brick amplifier and added to some inherent brick amp non-linearity, it becomes almost unmanageable as seen in the graph. A solution is to lower the Express output and add a single PHA-1 intermediate amplifier between it and the brick amp. As a result, re-growth is lowered and maximum output is raised, a worthwhile achievement.



So, after all the effort, what is learned here? DATV DVB-T amplifiers are possible but it's not easy to obtain "broadcast quality" signals. Small distortion signal components can make a huge difference in the end result. Remember also, the re-growth sidebands in the power output envelope do not contribute toward a better signal. Just because the 'Bird' wattmeter shows an increase in output may not mean the signal is stronger or better! About 16 watts true power is achievable with sidebands 20dB below haystack top.

OK, how about DVB-S applications. DVB-S operation is mostly, if not all, on the 23cm 1240-1300MHz band due to the availability of inexpensive DVB-S satellite receivers designed for 940-2150 MHz without modification. Since the maximum Express DVB-S output is about +10dBm (10mw), a single PHA-1 amplifier can't be used because it's limited to about +6dBm at its input. So, if more output from a DVB-S signal is needed, start with the dual PHA-1 amplifier that will handle +10dBm at the input. However, that's subject matter for another article tailored just to DVB-S so stay tuned.

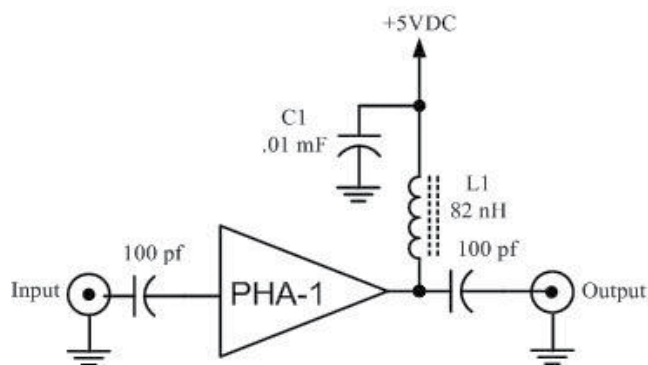
Single PHA-1 amplifier construction details:

This amp is good for 439-1280 without change. It'll handle up to about +6dBm at the input and will give about 15-16dB gain @ 439 and about 11-12dB @ 1280. I assembled it on a piece of G10 circuit board 1" square. Connectors are SMA.

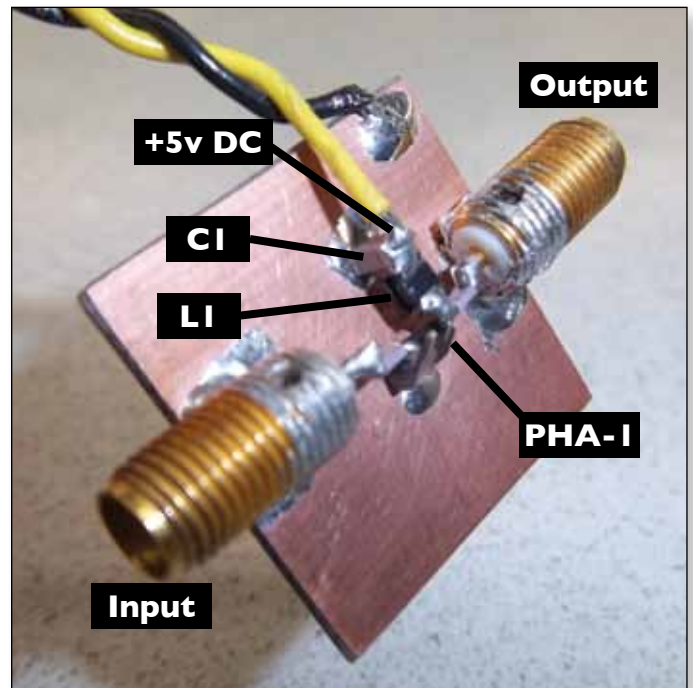
5V supply draws about 150mA.

Caps = 50pf or greater:

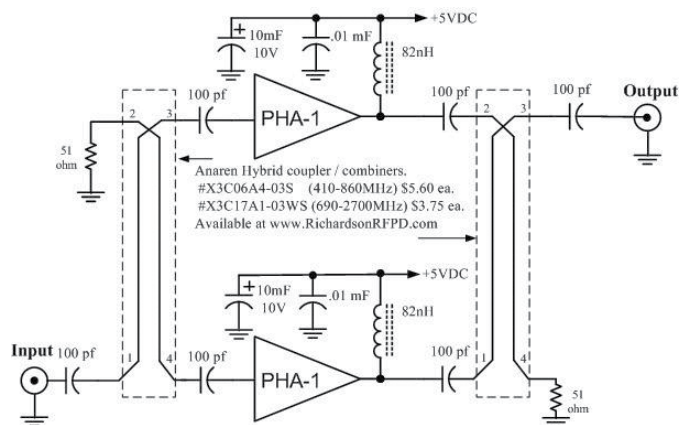
L1 = 50nH or greater but less than 1uH.



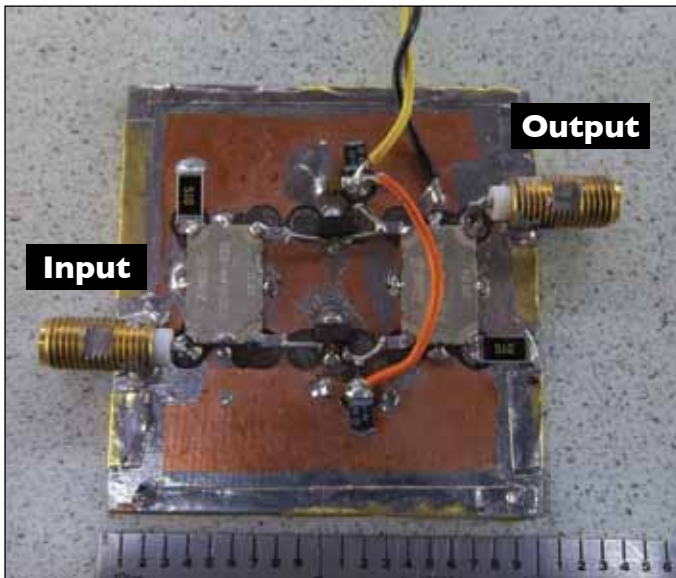
* The Express board was designed to supply power for an external low current SWR amplifier to feed forward and reverse DC signals back to the Express board for processing. Therefore the +5VDC output at P4-I won't source enough current for the PHA-1 amplifier power needs. R31 (49.9Ω) in series with the DC supply must be removed or shorted out to provide enough power to drive the PHA-1 amps. (DO NOT SHORT CIRCUIT THIS LINE WITH R31 BYPASSED) No other modification is required.



Dual PHA-1 amplifier details:



This amp is good for 439 and 900MHz operation using the Anaren X3C06A4-03S splitter/combiner (\$5.60) and 1200- 2400MHz with the Anaren X3C17A1-03WS (\$3.75) available in the USA at Richardson Electronics (RichardsonRFPD.com). The dual arrangement allows twice as much input signal with the same gain as a single unit. It draws about 290ma. I used a piece of 2" x 2" blank G10 circuit board and used a 'pad cutter' to create small isolated circuit pads. I then laid the surface mount parts on the pads as shown in the pictures above. (See how to make a pad cutter at <https://www.youtube.com/watch?v=uFLdDTT5-wk>. The video shows how to create your own tool for it. (I apologize for the crude look of my prototype. I didn't clean it up for the picture). Some pads were removed to clear space for components.



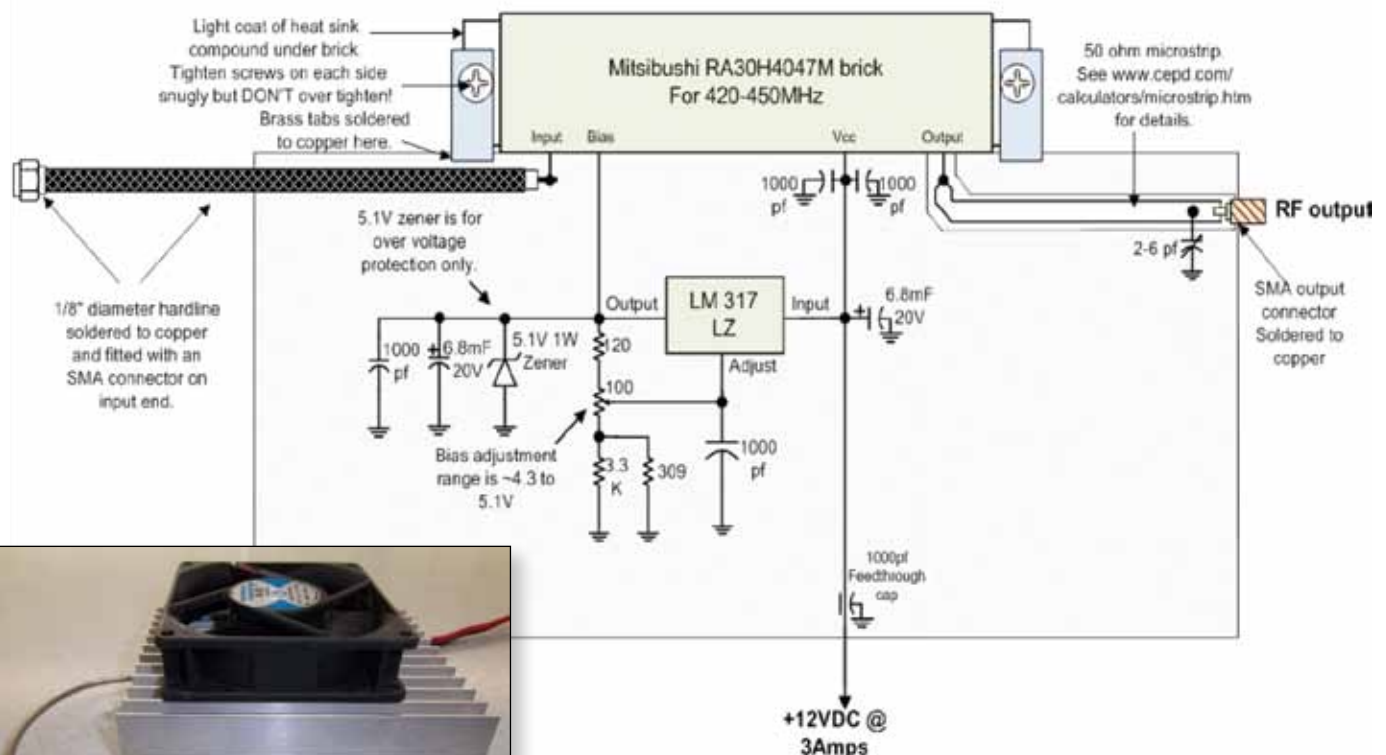
Just be careful to test the line for correct voltage BEFORE connecting it to the brick. The 5.1V zener is there just in case... Maximum brick voltage is 5.25V and is NOT forgiving of mistakes. I used 6.8mF 20V tantalum filter caps but good electrolytics over 1mF are ok too. Final points: I used brass tabs soldered to the board and placed over the brick mounting screws as shown. These are very important to prevent oscillation. Also, use a THIN coat of heat sink compound and brick mounting screws with lock washers. Tighten snugly but DO NOT over tighten. If too snug, the brick will warp and crack the internal ceramic substrate. That would NOT be good!

BRICK Amplifier details

This amp works as shown for 420-450MHz operation. I assembled the circuitry on a piece of 1.5" x 5.5" blank G10 double sided circuit board. Note that I folded pieces of thin brass shim stock around all edges so the bottom copper totally connects with top copper breaking it only at the brick output wire. Here again, I used a pad cutter to fabricate isolated pads to connect SM components. The output trace is a strip line 0.120" wide. (See www.cepd.com/calculators/microstrip.htm for calculation details). Note the 2-6pf cap on the output line. It may not be needed but improved the match enough to make it worthwhile. Placement is not critical. I made the bias voltage adjustable but it may as well be fixed at 5.00v.



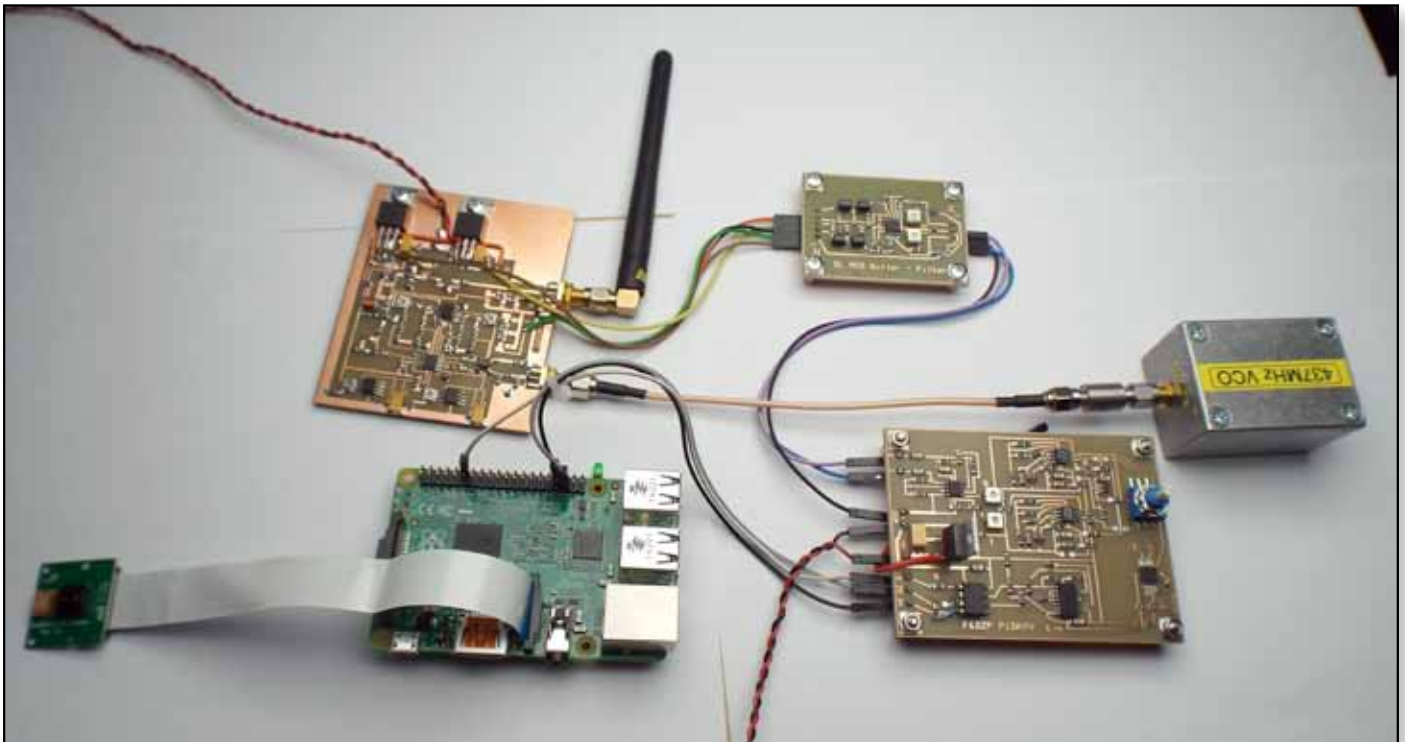
OK, that's just about it guys. I will treat the DVB-S subject in more depth in another article. 📺





Reduced Bandwidth TV Modulator

Colin Watts – G4KLB



In CQ-TV 250 I showed the prototype of Jean Pierre's PIDATV filter and modulator solution for SR100 to SR650. This prototype could be used with a DigiThin modulator or as shown in the picture a DigiLite MK6 modulator.

The U2970B modulator as used in the DigiThin is easier to solder and has a good specification, but is not available from any of the big suppliers, so it was decided to use the AD8345 or AD8346 (depending on the desired output frequency) as used by DigiLite.

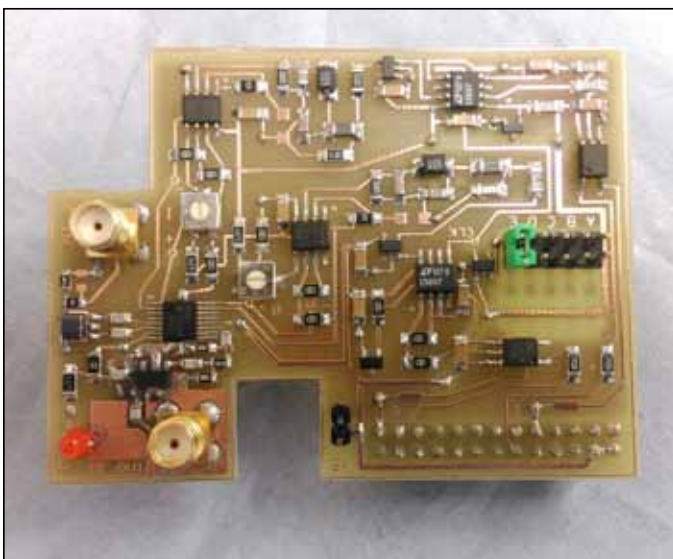
The above prototype was redesigned to fit on one PCB and plug into a Raspberry Pi.

John O'Loughlin who has done all the PCB layouts and mods for me to build has christened this version RBTVMOD which is short for Reduced Bandwidth TV Modulator.

The key component in Jean Pierre's design that makes this possible are the two LTG 1569-7 filters described by the manufacturer as Linear Phase, DC Accurate, Tunable, 10th Order Lowpass Filter.

To control the filter response, a resistance between two pins is all that is required, as we have two of them, (one for I and one for Q signals) a dual pot was used. The potentiometers I was using didn't track very well, giving different resistances on the two tracks. John noted that the filters could also be controlled by varying an external clock. A LTC6900 oscillator was added which allowed the same control signal to be supplied to both filters with only a single pot.

I found it a bit fiddly to adjust the pot each time I changed symbol rate and concluded I would most likely only be selecting SR125, SR250, SR333 and SR500 anyway. So fixed resistors selectable by jumper replaced the single pot.

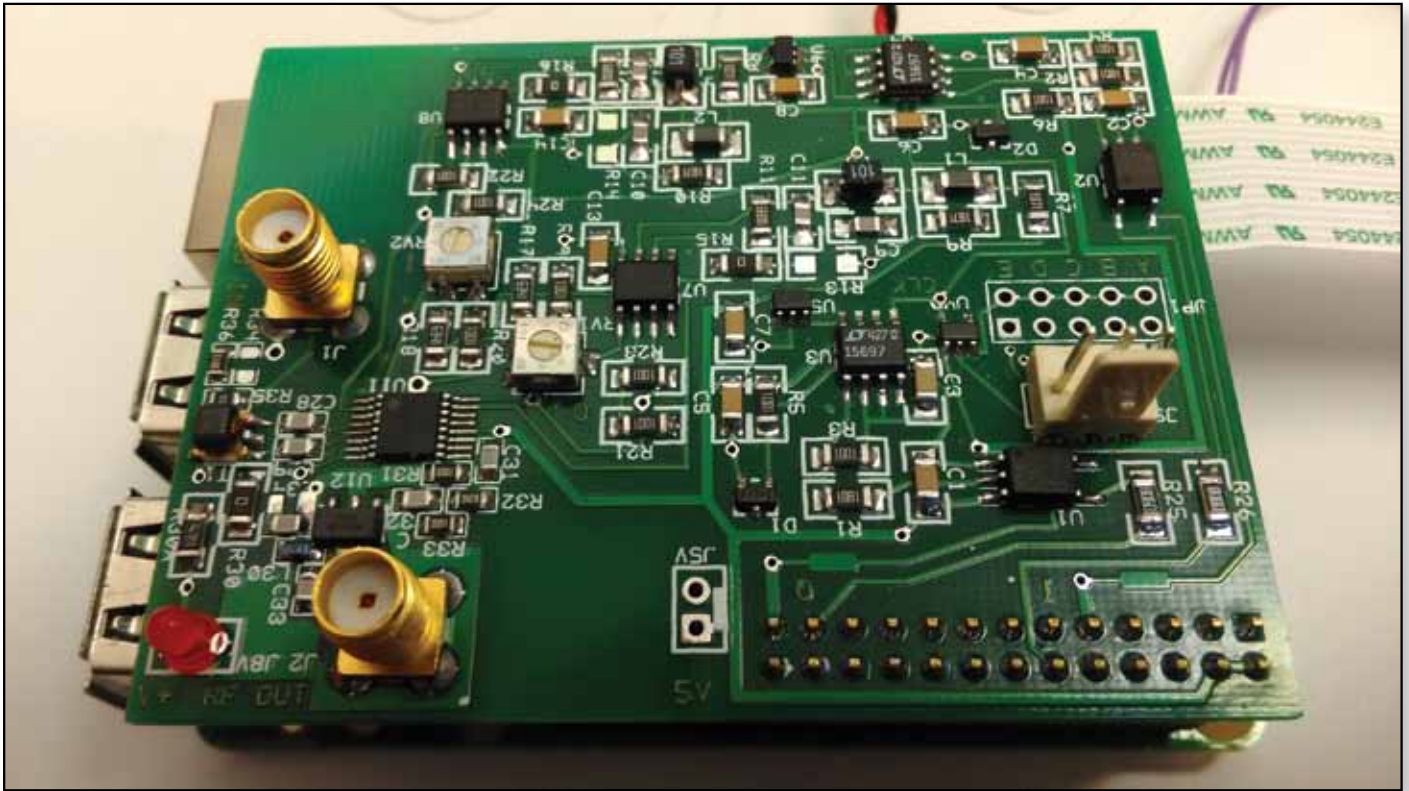


Never satisfied, I said I wanted to be able to switch SR without having to change the jumper position as if I was /P it would be inside a box, so an optional ADG704 4 Channel multiplexer was added to the layout to enable remote selection by a rotary switch.

The latest iteration incorporating these mods is below, shown fitted to a Raspberry PI 2.

I have been using Evariste's F5OEO gbmenu via putty or Alain's F1CJN Arduino and 2 line LCD display to set the other parameters. Very interested in Jean Pierre's F6DZP touch screen and Arduino that looks as it will be the easiest to use. (and looks cool)

Development continues... 🎧



A limited number of PCBs are available for this project through the BATC shop. Details are also available on the new BATC Wiki... www.batc.org.uk & wiki.batc.tv for full details - Ed.

Amendment

Re GB3TM activity night – This is **TUESDAY at 7pm** and not as quoted in the last issue. Apologies for any inconvenience caused with the wrong details! - Editor

CameraTalkback

As a way of improving communication between vintage camera collectors and OB enthusiasts I have set up a mail reflector service. See opening page of :- www.tvcameramuseum.org to join, I hope that if enough people join this group it can become self sustaining in its own right. If you are into vintage "give it a go".

Regards Brian Summers.





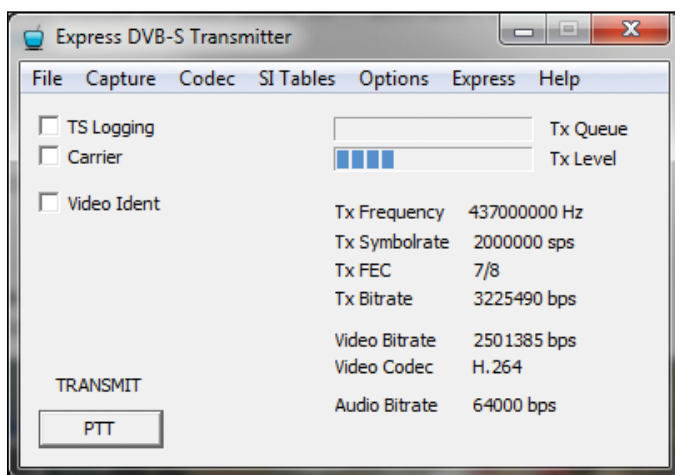
New Application for DATV-Express

Charles Brain – G4GUO

For those of you that follow the BATC forums you will probably have seen that a new software application is being written for the DATV-Express board.

It had become obvious from member's feedback that the original Linux software was difficult to use and that the hardware devices it supported were becoming both hard to obtain and some were also no longer being supported.

It was therefore decided to produce something that was much easier to use, would not require a knowledge of Linux and could use cheap web cameras. Hence this new project was born.



Initially I designed it to work with the free version of the vMix software suite. This is still the best way to use it. After I released my initial version of the software it became obvious that people also wanted it to work with just a web camera.

At the moment it is necessary to use Zadig to install the driver for the DATV-Express board however an automated install program has been produced to install the software application itself.

The program can accept input from vMix, a webcam or a capture device. I have only tested it using a Logitech C920 HD web camera but I have been told it works with other webcams. As well as webcams it also works with some of the cheap Chinese Easycaps. When using the Easycaps directly with the program there is an issue with interlacing, the software cannot de-interlace the signal so you will see some lines on movement.

For HD experiments I have also added direct support for the Blackmagic Decklink Minirecorder - this device costs about £100 and supports both HDMI and SDI input. If

you have a USB3 interface on your computer there is also support for the Magewell USB3 HDMI capture device. The Magewell is expensive at £240 but has on board RAM and can do hardware format conversion.

The program supports MPEG2, H.264 (also known as MPEG4-AVC) and H.265 (HEVC) video encoding. The HEVC support is very experimental, it requires a fast computer and has other issues which are down to the immaturity of some HEVC codecs.

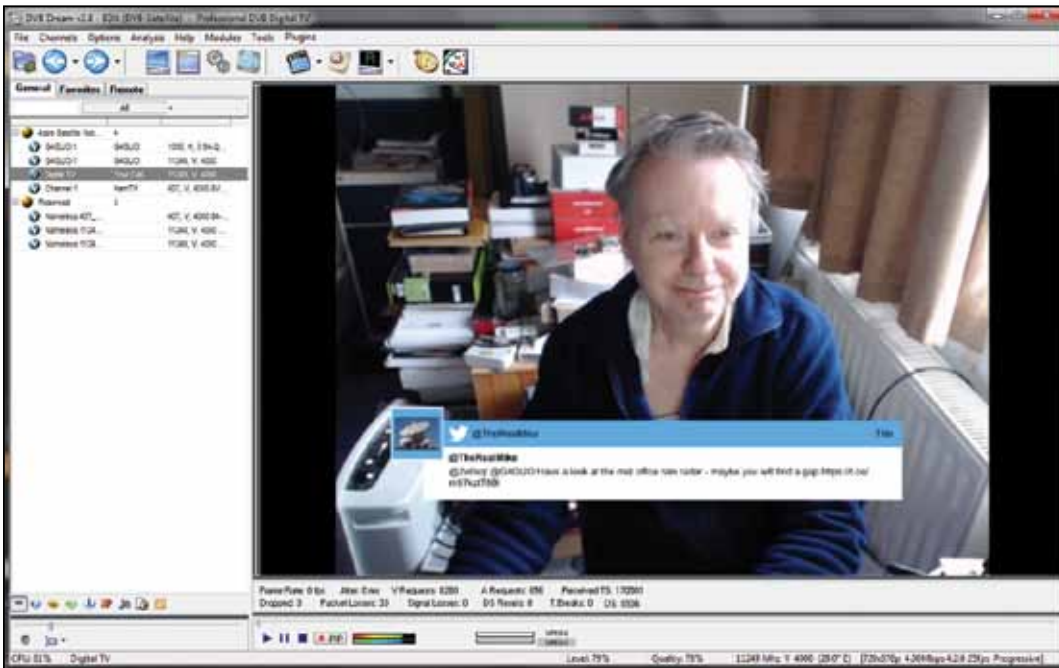
Audio encoding only supports MPEG I Layer II at present although this will hopefully change soon.

A new version of the DATV-Express FPGA firmware has also been created which now supports symbol rates from as low as 100 KS/s to around 10MS/s. The frequency range remains the same 65 MHz to around 2.48 Ghz.

The codecs are based on the Zerano Windows distribution of FFmpeg. I will occasionally update the software to support newer releases of Zerano. I will also update the software to support other capture devices but I can only support those devices I have access to.

I have purposely not added a load of video effect features because those can be done more professionally with the free version of vMix. When vMix 17 is released I may buy a licence so I can test HD support with the program. I have done some HD testing with the C920 HD camera. The C920 HD in 1920x1080 mode outputs its data in MJPEG (Motion JPEG) format which then has to be decoded by the program into YUV420P then re-encoded into the format you wish to transmit, this means some extra CPU overhead.

Both audio and video capture use Microsoft Direct Show, the bit stream is then extracted using the Sample Grabber filter. These samples are then sent to the codecs. The resulting Elementary Stream is converted into a Packetised Elementary Stream (PES) and the PES is converted into an MPEG-2 Transport Stream. PSI (Program Specific Information) and DVB SI (Service Information) are also added. The Transport Stream is then sent to the DATV-Express hardware where it is converted into a DVB-S signal by the FPGA; IQ modulation takes place and the signal is amplified and presented to the SMA connector on the board.



The image above is an example of the signal being received using DVB Dream. vMix is adding a live Twitter stream to the transmission.

Please share your experiences of the program good or bad. 🗨️

The program has not been officially released yet but beta versions of it can be obtained by looking on the BATC forum. In time I plan to release the full source code so that those of you that want to can modify it or simply just look at it. As yet there is no official manual as the software is still being developed but I have added some notes on how to use it, these are located in a file called notes.txt in the downloaded .zip file.

More Modifications to the SUP-2400

Dave Crump – G8GKQ

As mentioned in the last CQ-TV (CQ-TV 250 pp 17-19), it is difficult to move the SUP-2400 downconverter local oscillator much below 2300 MHz. I have devised a modification that enables reliable operation at 2281 MHz, enabling the use of a readily-available 8.912 MHz crystal to lock the PLL.

What is required is to increase the value of one of the printed inductors in the VCO. This is done by cutting the 3 parallel tracks at one end of the long printed inductor, and adding an 18 mm loop of very thin (0.2 mm) wire, in free space above the PCB. Here is a photo of my modified unit:



The loop of wire can be seen overlaid on some PVC insulating tape keeping it clear of the components beneath.

One side-effect of increasing the inductance is reduced drive to the prescaler used in the PLL. To cure this, I replaced the 1K5 chip resistor connected to pin 1 of the 8-pin prescaler chip with a 220 ohm resistor. You can see this resistor just to the left of the new wire loop. The prescaler is marked 1507, and is a UBPI507GV 3.0 GHz divide by 256 chip that needs -15dBm of drive.

You can monitor the control voltage going to the VCO at the 0 ohm link positioned adjacent to pin 8 of the 74HC4046A PLL chip next to the casing. I achieved best results when this voltage stabilised between 0.5 and 1.0 volts.

One last comment – in my previous article, I recommended the use of a 26.8 MHz crystal running at its fundamental, just below 9 MHz. Whilst this works in some situations, I did find that my oscillator would cease to run when the unit got very hot inside a case with my MiniTiouner and mains power supply. I had no such problems with fundamental crystals. 🗨️

leandvb: A lightweight software DVB-S demodulator

Pascal Brisset, F4DAV



leandvb is a lightweight implementation of portions of the DVB-S standard in plain C++. It is developed primarily for receiving Digital Amateur TV, including HamTV from the International Space Station.

Motivations

DVB-S was developed in the 1990s for digital satellite TV broadcasts. In recent years it has been adopted by the amateur radio community for Digital Amateur TV (DATV). Inexpensive hardware-accelerated DVB-S receivers are available in the form of set-top-boxes, PCI cards and USB dongles. Unfortunately not all receivers are suitable for DATV for the following reasons:

- ▶ Their RF stage is typically optimized for an input signal in the 950 – 2150 MHz range (downconverted from 10.700 – 12.750 GHz by a satellite LNB), whereas DATV experiments are also conducted in the 70cm and 13cm bands (possibly even 2m and 6m). Frequency converters add unnecessary cost, complexity and noise.
- ▶ They are designed to provide a plug-and-play experience for non-technical users, whereas radio amateurs may prefer to have control over as many settings as possible in order to make the most of propagation conditions.
- ▶ Some receivers do not support the very low symbol rates that amateurs are required to use due to bandwidth constraints.
- ▶ Some prominent DATV transmitters, such as the ISS HamVideo system, generate a slightly non-compliant MPEG stream which some receivers fail to decode.

With custom drivers it is apparently possible to tune out-of-spec, support non standard symbol rates, control internal settings and retrieve raw MPEG packets: see <http://www.vivadatv.org>. But this approach only works with specific chipsets

Software-defined receivers avoid these problems entirely. SDR front-ends are now available for many frequency bands with various trade-offs between price, bandwidth and dynamic range. The popular RTL-SDR dongles cover 10m, 6m, 2m, 70cm and 23cm.

A software DVB-S receiver also brings all the benefits of software-defined radio:

- ▶ One can capture raw I/Q samples from the air and demodulate them later. There are fewer opportunities for non-recoverable operator error during the recording phase. This is especially useful for transient signals such as those from the ISS.
- ▶ Demodulation can be attempted as many times as necessary with various combinations of parameters until the final error rate is minimized.
- ▶ Waveforms can be examined and pre-processed prior to demodulation, e.g. to eliminate spurious signals or correct unexpected frequency offsets. Computationally intensive algorithms can be used in an attempt to remove non-random noise.
- ▶ Coherent I/Q captures from multiple receivers could be combined to achieve array gain, diversity gain or better directivity.
- ▶ Perfectly identical signals can be injected into multiple software demodulators for benchmarking purposes.
- ▶ A SDR receiver doubles as a crude spectrum analyzer. This is useful for troubleshooting many problems, e.g. detecting in-band interference.
- ▶ Software demodulators are future-proof because all SDR front-ends have essentially the same interface: configure center frequency, sample rate and gain; receive raw I/Q data. Actually, as computer performance increases, a given software demodulator will become capable of supporting faster modulation rates or processing larger numbers of channels simultaneously.

Related work

gr-dvb (<http://www.edmundtse.com/wp-content/uploads/2009/04/treatise.pdf>) is a complete implementation of DVB-S for gnuradio. I used it extensively during earlier DATV experiments (see <http://www.pabr.org/radio/softdatv/softdatv.en.html>).

gr-dvb has great value as a reference implementation and as an educational tool, but it is too slow to demodulate typical DATV signals in real-time, even on a fast desktop PC. Besides, it requires the whole gnuradio infrastructure including Boost, SWIG and Python; this is impractical on embedded platforms.

By contrast, leandvb is written in plain C++ with barely any dependency, and is 10 times faster on a single core than gr-dvb running on two cores. The speed-up comes at the cost of receiver sensitivity; for some applications this is an acceptable trade-off. More specifically, leandvb does not currently implement the Viterbi algorithm for deconvolution.

Current features and limitations

- ▶ DVB-S, QPSK, FEC 1/2 only.
- ▶ Automatic filtering of “birdies” (useful with low-cost SDR hardware).
- ▶ Detection of conjugated I/Q signals (for downconverters with L.O. above the signal).
- ▶ Tested at low sampling rate (2 Msymbols/s at 2.4 Msamples/s).
- ▶ Default input format is unsigned 8-bit I/Q (compatible with the rtl_sdr command-line utility).
- ▶ Also supports 32-bit float I/Q format (compatible with gqrx).
- ▶ No band-pass filtering. In crowded bands, consider reducing the sampling rate so that only the signal of interest is captured.
- ▶ Demodulation only.

Installation

leandvb requires only a C++ compiler and standard libraries. It is developed for Linux and may compile on other UNIX-like and embedded platforms as well.

```
$ wget http://www.pabr.org/radio/leandvb/leandvb.cc
$ g++ -O3 leandvb.cc -o leandvb
```

The optional crude GUI requires libX11.

```
$ g++ -O3 -DGUI leandvb.cc -lX11 -o leandvb
```

Future versions will be released on github.

Usage

Usage: leandvb [options] < IQ > TS

Input options:

```
--u8      Input format is 8-bit unsigned
          (rtl_sdr, default)
--f32     Input format is 32-bit float (gqrx)
-f HZ     Input sample rate (default: 2.4e6)
--loop    Repeat (stdin must be a file)
```

Preprocessing options:

```
--anf N      Number of birdies to remove
             (default: 1)
--agc       Enable AGC. Required unless
             input amplitude is 64 (e.g.
             rtl-sdr with hardware AGC)
--derotate HZ For use with --ppout,
             otherwise use --tune
--ppout FILE Dump preprocessed IQ data
```

DVB-S options:

```
--sr HZ      Symbol rate (default: 2e6)
--tune HZ     Bias frequency for demodulation
```

GUI options:

```
--gui        Show constellation and
             spectrum
--duration S Width of timeline plot
             (default: 60)
--linger     Keep GUI running after EOF
```

For HamTV signals at 2395 MHz downconverted to 397 MHz by a MMDS LNB with 1998 MHz LO:

```
$ rtl_sdr -f 397000000 -s 2400000 capture.iq
$ ./leandvb --gui < capture.iq > capture.ts
$ ffplay capture.ts
```

Conceptually, a live receiver and decoder would be started as follows:

```
$ rtl_sdr -f 397000000 -s 2400000 - |
./leandvb --gui | vlc -
```

However, this ignores known problems with real-time multimedia streaming:

- ▶ Some MPEG players insist on scanning their input stream prior to decoding. The resulting latency can sometimes be reduced by specifying formats and codecs manually on the command-line.
- ▶ Most MPEG players will synchronize playback with the clock of the sound card, regardless of the actual input data rate. This will unavoidably cause buffer underruns (leading to audio artifacts) or overruns (causing leandvb to stall and lose synchronization). This can sometimes be mitigated by manually specifying a frame rate slightly higher than the real value.

Performance

CPU usage

leandvb can demodulate 2 Msymbols/s digitized at 2.4 Msamples/s in real-time on a 1.33 GHz Intel Z3745 tablet. This makes it possible to receive HamTV from the ISS with a low-cost portable setup, which was the original goal of the project.

leandvb is also known to work on Raspberry Pi platforms, but at slower symbol rates.

Table 1: Benchmark between platforms

leandvb on various platforms.

Dataset	gqrx_20151211_204746
samprate/symbrate/dur	2.4M / 2M / 23
Intel Core i7	2588 KiB in 4s
Intel Atom Z3745	2588 KiB in 13s
Raspberry Pi 2 Model B	2639 KiB in 50s

Sensitivity

leandvb successfully demodulates a HamTV signal captured during an overhead pass of the ISS with a

linearly-polarized 24 dBi dish, MMDS downconverter and RTL-SDR R820T2 dongle. By contrast, demodulation was extremely poor during another pass at 47° elevation with wet weather. A larger and properly polarized dish would have helped.

Table 2. Benchmark between demodulators

On Intel Core i7.

Dataset	gqrx_20151211_204746
samprate/symbrate/dur	2.4M / 2M / 23
leandvb	2588 KiB in 4s
gr-dvb without Viterbi	2579 KiB in 8s (17s total)
gr-dvb	2648 KiB in 37s (58s total)

Troubleshooting

This section lists symptoms, diagnostics and workarounds for common problems.

1. Wrong data format

Samples are not decoded correctly. Specify --u8 or --f32.



2. Insufficient amplitude

- ▶ HW AGC is off and gain is too low.
- ▶ or RF signal is too weak.



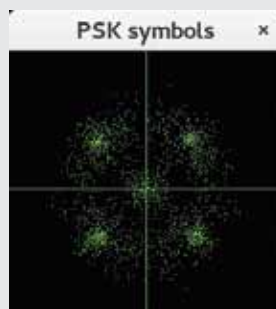
3. Excessive amplitude

- ▶ HW AGC is off and gain is too high.
- ▶ or RF signal is too strong.



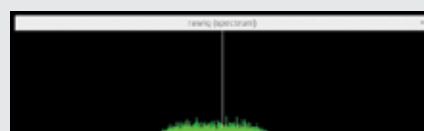
4. Wrong symbol/sample rate

Timing recovery is erratic. Check -f and --sr.



5. Excessive oversampling

The SDR front-end is capturing a larger bandwidth than is necessary. This would cause problems if there was another transmission nearby. Decrease the sampling rate.



6. In-band interference

Here a birdie (top right) is automatically filtered (bottom).

This restores the ring-shaped I/Q pattern (bottom left).

Increase --anf if needed.

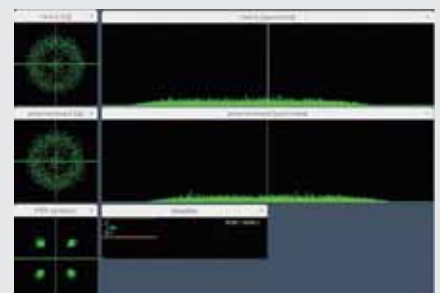


7. Frequency offset

SNR is good but tuning is slightly wrong (top right).

The spectrum is re-centered with --derotate -50000 (middle right).

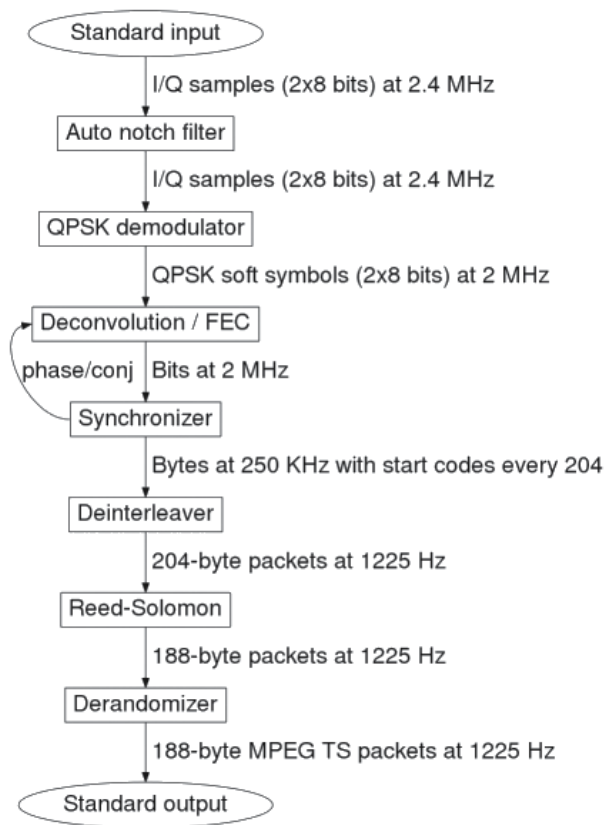
Note: The demodulator would have tolerated this offset anyway.



Implementation details

Figure 8. DVB-S demodulation flowgraph

(For typical HamTV signals at 2 Msymbols/s and FEC=1/2)



The auto notch filter block performs a Fourier transform about once per second to identify spurious signals. Then it tracks their phase and amplitude in order to filter them.

Subsequent blocks follow the DVB-S standard closely. See https://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=5316 for details.

The QPSK demodulator performs timing recovery and interpolation. It outputs soft symbols because DVB-S encourages Viterbi decoding, but the current implementation thresholds them immediately into 2-bit QPSK symbols.

The deconvolution block reverses the inner (convolutional) coding, but the current implementation does not correct errors.

The synchronizer searches for MPEG start codes in the bitstream. One in eight start codes is inverted. The synchronizer determines byte boundaries and decides whether the constellation is rotated by 0, 90, 180 or 270°. It also detects whether samples are conjugated.

The deinterleaver reverses the byte shuffling that is performed during modulation. (This is done to spread burst noise over a large number of packets so that Reed-Solomon can be more effective.) By design, start codes are not shuffled.

The Reed-Solomon block uses the last 16 bytes of each 204-byte packet to detect and correct errors.

The derandomizer reverses the bitwise obfuscation that is performed during modulation. (This is done for “energy dispersal”, i.e. to flatten the RF spectrum.) It also de-inverts the inverted start codes.

Note: Since leandvb currently supports only FEC=1/2, code puncturing is not implemented.

Future work

- ▶ Better interpolation
- ▶ Better deconvolution, maybe partial Viterbi
- ▶ MER/EVM/SNR display.
- ▶ Sensitivity benchmarks with simulated noise.
- ▶ Multi-threading
- ▶ SIMD optimizations on x86 and ARM
- ▶ Dynamic demodulation trade-offs for optimal performance on all platforms
- ▶ Other modulations and FEC settings; DVB-S2
- ▶ Modulator (for testing purposes; there are already several software-defined DATV modulators)
- ▶ GQRX plugin
- ▶ Android app.

Intellectual property issues

leandvb is developed primarily for non-commercial research and experimentation in the context of amateur radio. Irrespective of opinions about the legitimacy of software patents, anyone contemplating other uses should probably seek legal advice about the following issues.

The DVB-S standard was originally published in 1994 as ETS 300 421. There is hope that any applicable patents have expired or will expire shortly. However, even after a standard has become patent-free, some implementation details could still be subject to IP rights.

A complete software DVB-S receiver would typically include a MPEG-2 decoder. The MPEG-2 standard was finalized around 1995 and published in 1996. This article (http://www.osnews.com/story/24954/US_Patent_Expiration_for_MP3_MPEG-2_H_264/) estimates that it will become patent-free in 2018.

Related standards such as DVB-T (1997), H.264 (2003), DVB-S2 (2005), DVB-T2 (2008) and HEVC (2013) are probably covered by patents. 🗨️



Open Broadcaster Software with DATV Express

Chris Tanner – MWOLLK

Much has changed since I wrote about using FFmpeg to generate a DVB-S transport stream for DATV Express. Most notably Charles G4GUO, the DATV Express software author, has now incorporated the FFmpeg encoding process into DATV Express program. This now takes as its input the vMix (or other) DirectShow virtual video and audio devices.

For myself I have been researching and using alternatives to vMix, in part because I was frustrated by the limits of the basic version of the program and couldn't afford a full license, but mostly because I have found that one program in particular is much better at colour keying than vMix. That program is Open Broadcaster Software or 'OBS'.

OBS is described on their web site at obsproject.com as "Free and open source software for video recording and live streaming." I have long subscribed to the open source model for software. In general, although there is a lot of unfinished software out there, there are numerous open source applications which offer comparable (or better) functionality to commercial software and are continually refined and updated by an enthusiastic community - for the benefit of the community.

FFmpeg is a good example of a very powerful piece of open source software albeit with a steep learning curve. OBS, in my view, is rapidly becoming another essential piece of open source software in the field of live video production and streaming.

What does OBS offer?

Borne out of the desire to stream gameplay for viewing online using services like YouTube, Twitch and others; at its core OBS offers a simple way to capture live windows or desktops and generate a suitable stream for sending to a Flash Media Server (or more recently Adobe Media Server) video streaming service. A variety of input devices are supported, filters including chroma and colour keying are provided, "unlimited" scenes and sources (limited only by your computer capacity) and a flexible plugin architecture which adds things like video playback and onscreen text from a variety of sources. The GPU is used to do the hard work leaving plenty of resource for running games or in our case DATV Express software!

OBS comes in two versions at present: OBS 1 (or Classic) was developed for Windows with a separate development "OBS Multiplatform" (recently renamed OBS Studio) being developed for Windows, Mac and Linux platforms.

The classic version offers a basic capture and stream tool which is optimised to be lightweight and very efficient at what it does. OBS Studio is developing into a much more comprehensive tool and is starting to offer features more like vMix such as transitions, a preview window and multiple outputs.

Why did I start using OBS?

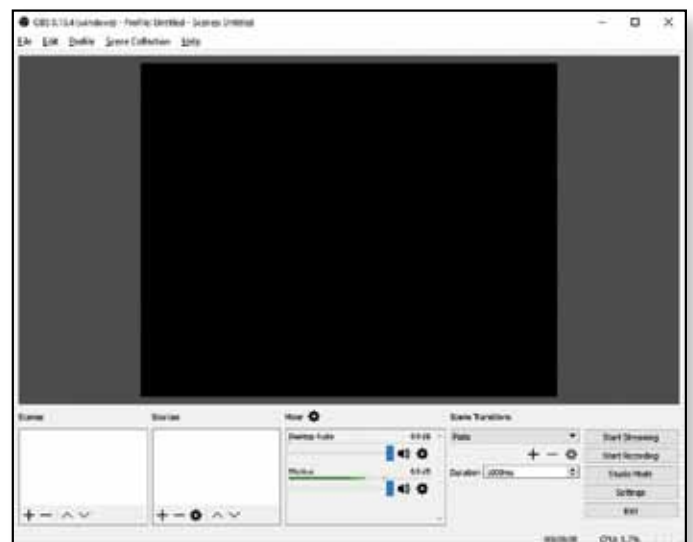
I first came across OBS when I was trying to achieve a good colour key using vMix and suffering all sorts of fringing and fluttering around the edge of my keyed image. OBS offered better control over the keying, particularly the availability of edge filtering and blending to reduce fringing effects. Newer versions of vMix have improved the colour keying and now offer similar performance with careful setup.

Installing and getting started with OBS

Download OBS from <https://obsproject.com/>

I recommend the Studio version as this is the newer codebase and will offer more features in future. Run the installer accepting defaults (unless you have strong reasons not to) and finally elect to run the program.

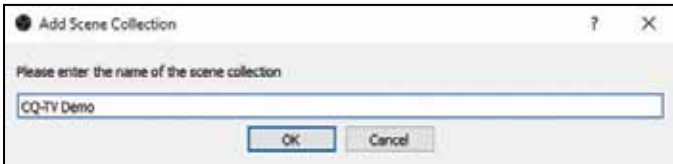
OBS will launch a new, empty window.



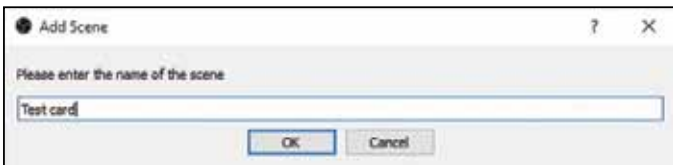
Most of the window displays the current (blank) output video, across the bottom is the current list of scenes and sources, the audio mixing panel and the transitions panel. Finally there are the master recording and streaming controls.

OBS Organises itself as a collection of scenes, each of which may contain one or more sources, which in turn may include filters and other plug-ins. You can either just start creating scenes and sources in which case they'll be stored in the default scene collection or organise your collections as follows:

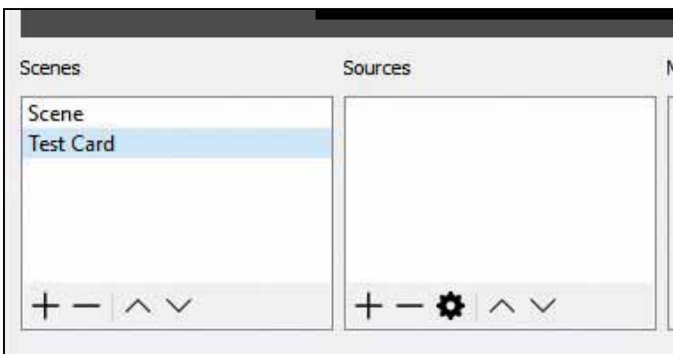
Go to the Scene Collection menu and choose New to create a new collection:



I'll create a demo for CQ-TV. OK this and notice that a default scene called 'Scene' has now appeared in the Scenes panel. Click the + button at the bottom of the Scenes panel and create a scene called 'Test Card':



With the 'Test Card' scene selected:



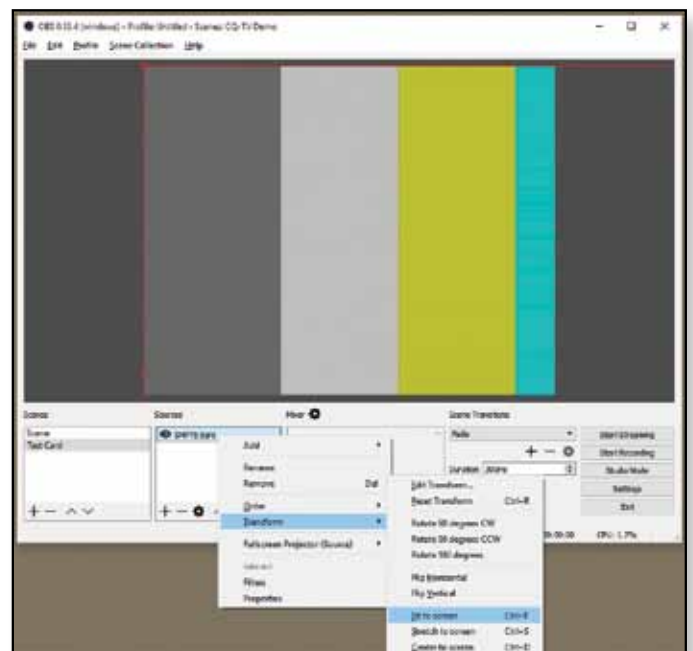
Click on the + button at the bottom of the Sources panel and select 'Image'. In the 'Create/Select source' dialog keep it on Create New and add a suitable source name:



OK this and finally in the Image dialog browse for a suitable test card Image - I assume you have one on your system already:



OK this and we have our first input and scene - our test card! It probably won't look quite right unless you happen to have chosen an image that is the same resolution as OBS default. Either press Ctrl-F or Right click on the 'SMPTE Bars' source and choose 'Transform' - 'Fit to Screen':

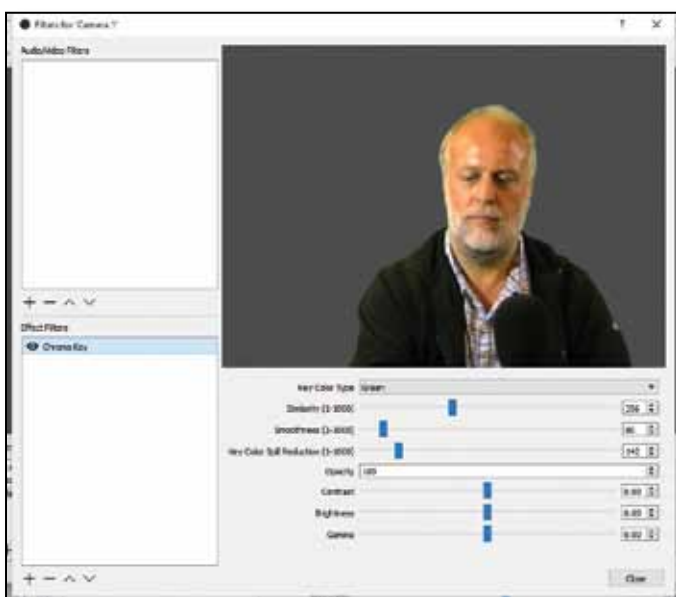


You may need to 'Stretch to screen' if your image aspect ratio is different or you can choose to drag the red grab handles on the image to adjust it manually.

Now repeat the process but this time create a new scene for your main camera and add a suitably named video capture source to it:



Now to use that green screen right click on the camera source and choose Filters. You can add filters to adjust the image properties but we're going to click the + button on the Effect Filters panel and select Chroma (NOT Color) Key, name it and then either select Green or Custom Color. Adjust the Similarity, Smoothness and Key Color Spill Reduction to get the best result:



Finally add another image source to your camera scene to give yourself a nice background image:



Streaming from OBS

Now we have OBS ready to go how do we get OBS output into DATV Express?

Unfortunately OBS does not currently offer a virtual DirectShow device on Windows so it cannot be used with the latest version of DATV Express ServerApp. Instead we have to send a stream from OBS to a suitable Adobe Media Server or compatible and then grab the stream from there into Express Server using - you guessed it - Ffmpeg!

It will come as no surprise to hear that the Ffmpeg script will be based upon my previous scripts so I will concentrate first upon setting up our media server.

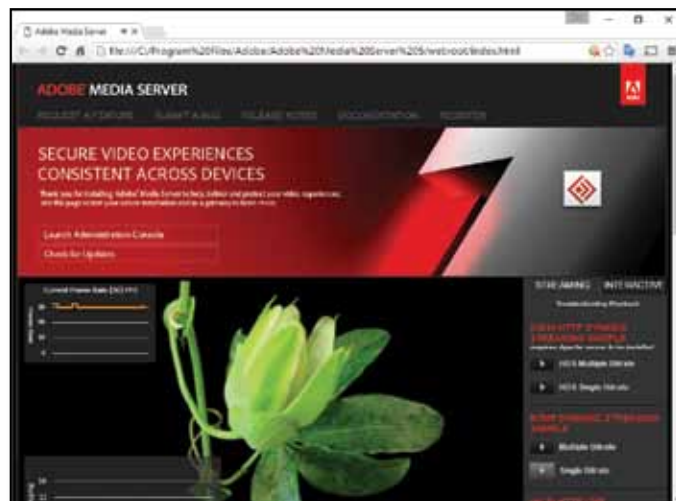
Adobe Media Server

Note that other AMS compatible servers are available. If you prefer another solution then see my notes on Red5 media server below! YOU DON'T NEED TO INSTALL BOTH AMS AND RED5!

I chose to use AMS simply because it is most likely to work (being the original target for OBS) and a free version is available. I originally installed it on Windows 7 and it has survived the upgrade to Windows 10 with only minor issues around the shortcuts for starting the server which had to be set to run as administrator.

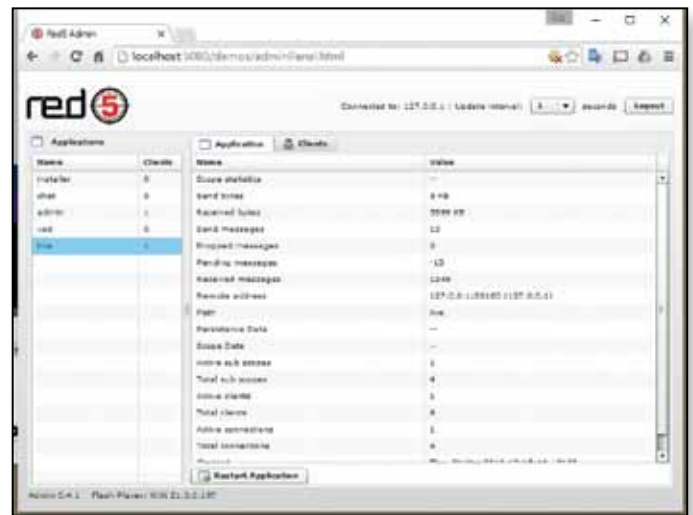
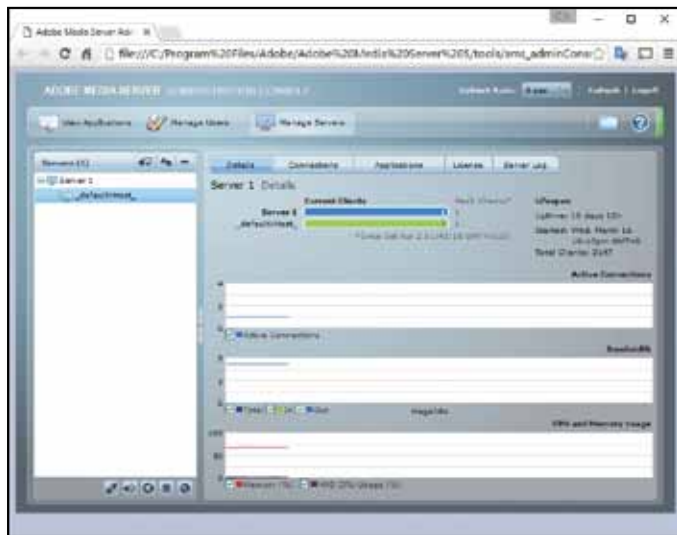
The first thing you'll need is the correct version of AMS. The one I used is the Starter version which is free for non commercial use and more than adequate for our needs.

Download it from <http://www.adobe.com/products/adobe-media-server-family/buying-guide-comparison.html> - you'll need to register for an Adobe ID if you don't already have one. Run the installer. Once completed it will automatically launch the server in the background and will also launch a web browser to the server demo page.



You should see a default video running which is included with the server - this shows it's all working. Don't proceed unless this is working as you'll probably be wasting your time.

You'll find a shortcut to the server admin tool on your start menu:



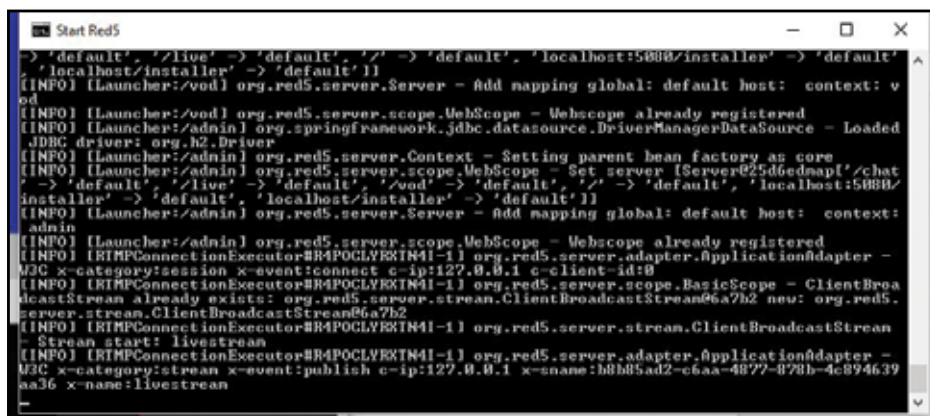
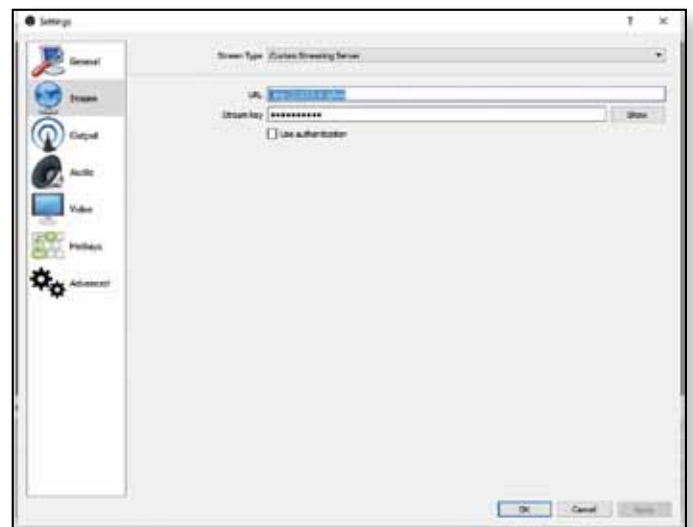
Check Red5 is working by pointing a browser at <http://localhost:5080>. You can also access the Red5 admin console at <http://localhost:5080/demos/adminPanel.html>

Configure OBS output

We now have a working media server so we need to configure OBS to send it's output to our new server. The configuration is the same for AMS and Red5!

Red5 Media Server

I also tested the Red5 media server. Like AMS this is a one click install but this program is Open Source as in free. You may need to install a Java Runtime Environment, if you don't have it already, available from <http://www.oracle.com/technetwork/java/javase/downloads/jre8-downloads-2133155.html> Once that's installed download Red5 from <http://red5.org> I used the file **red5-server-1.0.7-M10.zip** Unzip it then run the **red5.bat** file to install. You have to launch the server yourself: You'll find a "Start Red5" shortcut on your start menu - the server then runs in a command line. If you see lots of java errors (lines starting "at...") you'll probably need to upgrade your Java Runtime Environment (I did) to the latest version - see above.



Launch OBS and go into settings. Down the left site of the settings dialog you'll see a series of tabs; choose Stream.

Select Stream Type: Custom Streaming Server then enter the URL as **rtmp://127.0.0.1/live** and Stream Key: **livestream**

Now close the dialog by clicking OK and then start OBS streaming by clicking the Start Streaming button. If there is any problem after a few

seconds OBS will present a message dialog to the effect that the stream server couldn't be found or similar. Check the Red5 console or look for errors in the AMS log if you have problems.

Finally we need to grab the stream from our media server and send it to Express.

Take the batch file used to send vMix to Express, make a copy of it (suitably renamed) then change the first part of the FFmpeg command as follows:

```
start "Video feed to DATV Express" /b /
high c:\ffmpeg\bin\ffmpeg ^
-f dshow -i video="vMix Video" -f dshow
-i audio="vMix Audio" ^
```

Becomes:

```
start "Video feed to DATV Express" /b /
high c:\ffmpeg\bin\ffmpeg ^
-f flv -rtmp_live 1 -rtmp_app live
-rtmp_playpath livestream -i rtmp://
localhost:1935/live/livestream/ ^
```

(note that the last line from `-f flv` to `/livestream/` is all on the same line)

All this does is to tell FFmpeg to get its input from the media server instead of the DirectShow virtual devices. Nothing else has been changed!

Launch the batch file and then launch Express Server in the normal way.

Debugging

Remember that you can use VLC to view the streams at both stages:

OBS Output: `rtmp://127.0.0.1/live/livestream`

FFmpeg output:

`udp://@:1958`

(or whatever port number you're using)

Conclusion

This approach works well enough although it is clearly less than desirable to transcode in this way (mpeg4 to mpeg2). If your receiver supports DVB-S with an mpeg4 stream (modern receivers do but the one at GB3TM does not unfortunately) you could alter the FFmpeg batch file to simply copy

the mpeg4 stream to its output. I will leave that as an exercise for you to play with! (hint: look for Copy codecs in the FFmpeg documentation).

The other thing that can be done is to redirect the output to another device e.g. RPiDATV instead of using DATV Express. This will work well across the network to a suitable device and was demonstrated by Alain FICJN in early March. Thank you Alain!

I should mention that there appears to have been a DirectShow output plugin for OBS Classic in the past, indeed there are DirectShow virtual devices that will accept an RTMP stream available, so it may well be that a DirectShow solution can be found in the near future obviating the need to run an AMS or compatible server at all.

Finally to demonstrate some of the enhancements that OBS can benefit from using plugins this screenshot of my GB3TM activity night OBS console shows OBS in studio mode. The output on the right includes a graphic overlay with dynamic text included using a text plugin and an external program "Snaz" to generate the system stats at bottom left and a scrolling QSO sequence reminder at bottom right. The preview screen includes a scrolling text overlay. Fun stuff! 🗨️

Links:

Open Broadcaster: <https://obsproject.com/>

vMix: <http://www.vmix.com/>

FFmpeg: <https://www.ffmpeg.org/>

Adobe Media Server: <http://www.adobe.com>

Red5: <http://red5.org>

VLC: <http://www.videolan.org/>

Snaz: <http://jimmyappelt.be/snaz/>



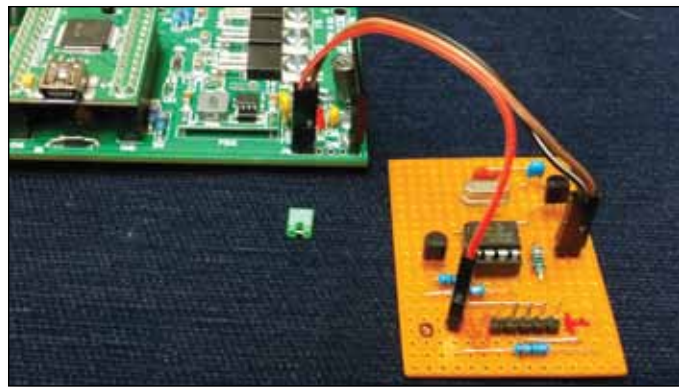


SUP2400 DiSEqC update

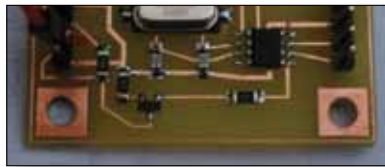
Colin Watts – G4KLB

After reading the excellent article in CQ-TV 250 by Ron G7DOE, regarding his method of switching the SUP 2400 into upconverting mode, I was excited to try this out as had trawled the internet unsuccessfully for some time looking for the DiSEqC codes when we first started to use the converters for 70cm DATV.

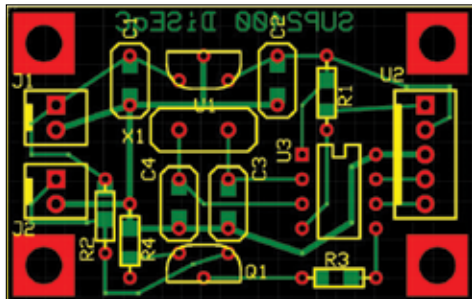
Interfacing to a MiniTiouner, is very easy, just removed the link that sends 12v to the LNB, used the supply side to feed the circuit and fed the output back to the LNB feed, there is also a ground connection on the same header.



I showed it off on the GB3SQ net and my friend John O'Loughlin drew out a surface mount version knowing I would be unable to resist making it!

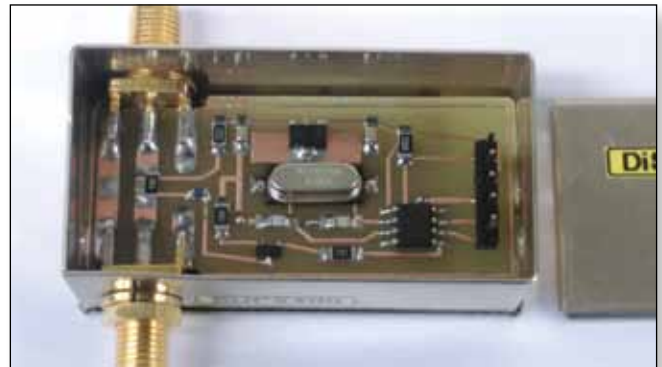


He has also produced a through hole version PCB for those who would like to go that way



All three of these versions function exactly the same of course, but I like the sm version best.

The three versions above are easily interfaced to MiniTiouner, but I often use a standard RX for 70cm DATV, so we looked at how this could be achieved



without modifying the receiver, the co-ax powered version was born. The main consideration was not to introduce too much loss in the RF path. The one below has SMA sockets, so to eliminate the inevitable adaptors another version using 'F' sockets was constructed.



We now had 5 different versions which we decided was too many, the answer was obvious, make a Sixth! A universal board that could be used in both situations, the part with the F sockets could be cut off if not required.

Conclusion

All the versions have worked well; I did have one SUP2400 that was slow to start, so the controller had sent to code before it was ready, maybe a one off, not heard anyone else experiencing this issue. After a steep learning curve with MPLAB X IDE I have changed the delay from 100mS to 250mS and now that one is always OK, many thanks to Ron for this suggestion and for putting all the comments in the source file that enabled me to work out what to do!



I have been asked the \$64000 question of whether it works better or worse than the M0DTS mod, I have not been able to do a proper test on that one yet, I always get a MER of 31 in the shack. 🗨️



Getting started in ATV - DATV reception

More and more amateurs are starting to transmit digital ATV signals on 23cms and 70cms for simplex/DX operation and most repeaters also have a digital output capability. This article gives a quick introduction to the various technologies and modes in use and looks at some practical ways to receive these digital ATV signals.

MPEG-2 video encoding and DVB-S QPSK modulation has been adopted as the current standard in the UK for DATV on 23cms and 70cms. This means we are using the same technology as standard definition satellite TV services such as the FreeSat service in the UK and the signals can be received on a standard consumer Free To Air Set Top Box (FTA STB).

DVB-S uses a variable bandwidth modulation scheme, depending on the video and audio bit rates transmitted and the amount of Forward Error Correction (FEC) applied. As a variable bandwidth system, it is ideally suited to 70cms where we are now able to run full colour video and 2 audio channels in 2 MHz. On 23cms, where bandwidth is not at such a premium, we can run 4 Msymbols, thereby achieving better picture quality within a slightly increased bandwidth of 4 MHz.

Note that the DVB-T (OFDM) modulation scheme as used by FreeView has not been adopted by amateurs in the UK and a FreeView box will not receive UK DATV signals. This is primarily due to the fixed 6/7/8 MHz bandwidth of the system, which gives a lower power / bandwidth ratio than 2 or 4 MHz QPSK and requires highly linear PAs and group delay correction over the full 8 MHz spectrum.

DATV activity in the UK

70cms – ATV activity on this band, which has the potential for real DX working, has been revitalised by the use of DVB-S QPSK modulation. With a bandwidth of only 2MHz centred on 437 MHz (the DATV operating frequency), we can achieve reasonable power levels and linearity from amplifiers designed for narrow band operation.

23 cms – Once again DVB-S is being adopted, using a slightly higher symbol rate of 4 Msymbols, which typically occupies 4 MHz and good results are being achieved by stations using DATV for simplex contacts. A noise free digital picture with 2 audio channels can normally be locked when a P2 noisy analogue ATV signal is received.

Most repeaters are now equipped with either DATV receive or transmit capability or both and noise free pictures can be achieved when a digital input signal is relayed via a digital output.

Higher bands – Tests have been carried out on 2.3 and 3.4GHz with good results and there are a couple of repeaters running digital 10GHz outputs.

Receiving DATV - Mast head pre-amplifiers

In order to achieve reasonable results on any band above 50 MHz it is essential to use a mast head pre-amplifier. The latest generation of MMICs mean that a sub 1dB noise figure and very good cross modulation performance can be achieved from very simple designs which are easy to build and at very low cost. Sam Jewell, G4DDK, does a kit of parts for a pre-amplifier based on the SPF5043 which, despite its small size, has extremely good performance at 70cms, 23cms and even 2.3 GHz at a cost of only £12. See <http://www.g4ddk.com/SPFAMP.pdf>



► G4DDK SPF5043 pre-amp

The pre-amp should be mounted in a waterproof box as close as possible to the antennae feed point, along with a change over relay if transmit operation is envisaged. As the system noise figure is already determined by the pre-amp, and as long as the cable run is not longer than 20 metres, good quality satellite TV co-ax can be used to connect the pre-amp to the receiver in the shack and also feed DC power up to the pre-amp and antennae change over relay.

Receiving DATV – 23cms

Receiving 23cms DATV is easy! A basic Free to Air (FTA) Digital STB from ebay or Maplin (a lot of people use the Comag range of receivers from Maplin) will tune 23cms without any modification, although most require additional gain in the shack for optimum performance. A satellite L

band line amplifier (also available from many suppliers on eBay) will work in most circumstances and if you live in a noisy RF environment, you may need to provide some band pass filtering.

Even the cheapest satellite receivers seem to have a “pass through” L Band output and your existing 23cms FM ATV receiver can be fed directly from this output without the need for a separate splitter.

If you are very close to your local repeater you may be able to use a flat plate or Alford slot antenna to receive it – where more gain is required a 23cms narrow band yagi with mast head preamp will give good results in most other situations .

To be able to receive a DVB-S signal you will need to know the symbol rate (effectively the bit rate) and possibly the FEC to set your receiver up with the correct parameters along with the frequency of the transmission. Typical parameters for 23cms are 4.000 Msymbols at 1/2 or 3/4 FEC - exactly how these parameters are entered and the receivers is tuned depends on the make and model of STB.

Note, the box MUST be able to receive FTA broadcasts and a SKY or similar dedicated satellite service box will NOT tune to the DATV parameters.

► [G8GTZ Tutioune monitor page](#)

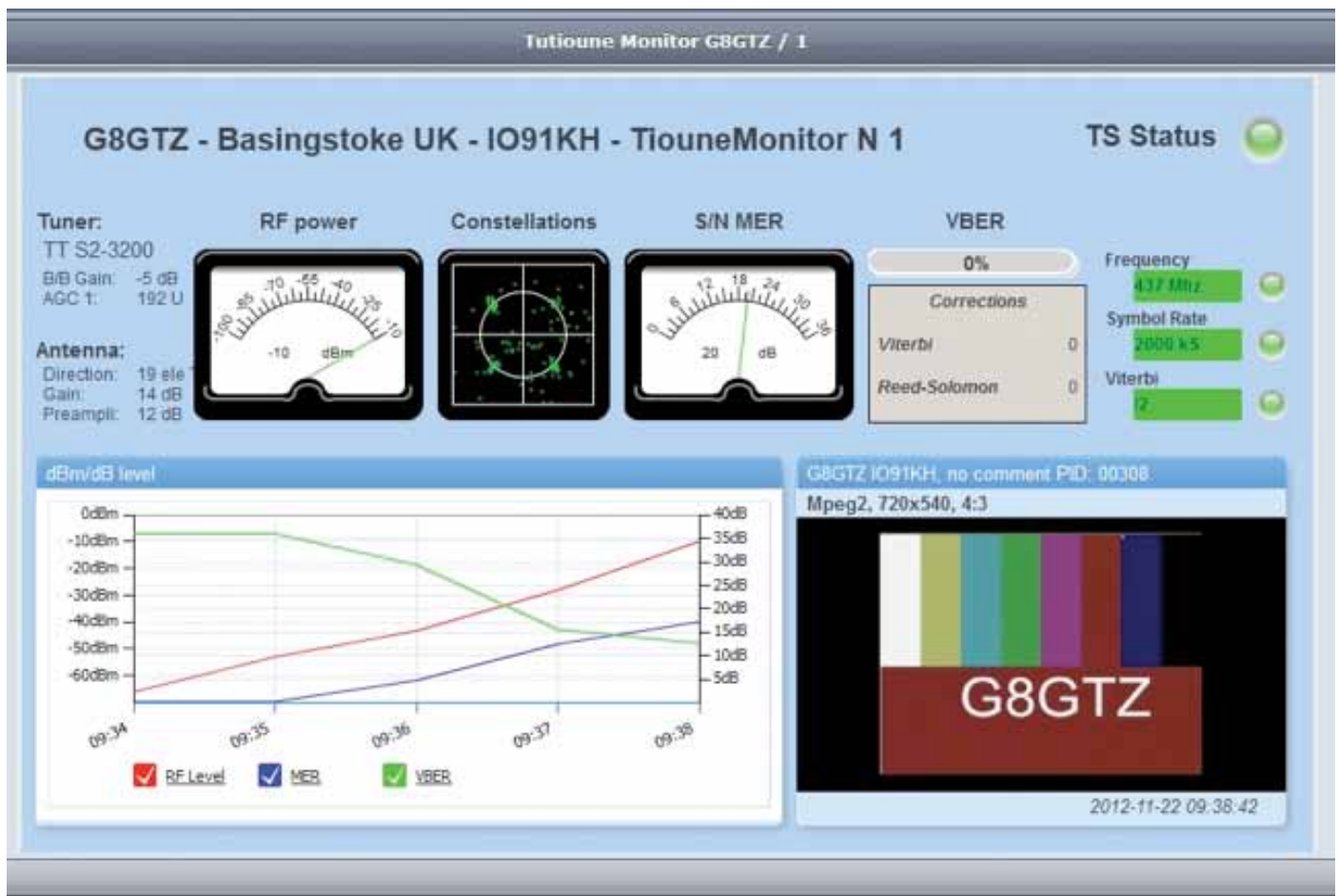
F6DZP has developed the Tutioune PC software specifically for DATV and as well as being a high performance receiver gives very detailed analysis of the signal and also enables web based monitoring of the received signal – see the link below for an example from my DATV station: http://www.vivadatv.org/tutioune.php?om_id=G8GTZ&station_id=1

The software runs on a Windows PC and used the USB minituner hardware featured in CQ-TV. The major components for this project are available from the BATC shop.

Receiving DATV – 70cms

The reason why it is easy to receive 23cms DATV is that the satellite boxes tune L Band (950 – 2150 MHz) which of course includes 23cms. However, in order to receive 437 MHz (70cms) DATV on a standard satellite STB, you need to up convert the signal to L band.

Luckily there is a consumer device available in the USA which is used on cable networks to up convert UHF signals to L Band where they are then received on a standard satellite box. These units are made by a company called Zinwell and known as SUP-2400. They are available on ebay, but only in the US and they do require modification, which involves SMD components, to work on DATV.





► SUP-2400

In order to help promote the use of 70cms DATV and to compliment the Digilite 70cms project, the BATC shop now has stock of these units in un modified form and can be modified as described in the article in CQTV 250, page 29. Alternatively a small Disecq controller to enable their use on 70cms without hardware modifications by Ron G7DOE was published in CQ-TV 250

Most ATV operators on 70cms use a long yagi or similar high gain aerial designed for narrow band use. To receive 70cms DATV, the SUP2400 is put in line between your 70cms mast head pre-amp and the digital STB. As the upconverters are very wide band it is possible a band pass filter will be required between the mast head pre-amp output and SUP-2400 input.



► The popular BigSat set-top-box, used for receiving DATV

The digital Set-Top-Box is tuned to the up converted 70cms frequency – the SUP-2400 has a high side 2400 MHz LO and so 437 MHz is tuned at 1963 MHz. The DVB-S parameters are entered as normal which for 70cms operation are 2 Msymbols with 1/2 or 3/4 FEC.

Receiving DATV – the higher bands

Narrow band QPSK operation is possible on the higher bands and reception is relatively easy on 3.4 GHz and 10 GHz.

2.3 GHz - As well as the problems caused the pollution from wi fi and other ISM services, there are no consumer devices to enable easy reception of 2.3GHz DATV signals although home brew converters down to L band are relative easy to make.

3.4 GHz – There are now several ATV repeaters in the UK transmitting DATV signals on 3.4 GHz - it is easy to receive DATV signals at 3.4 GHz as C band LNBS cover the band and down convert signals to L band, thereby enabling the use of a standard receiver. Several ATV operators have found they can use just the LNB to receive their local repeater but the LNB can be used with a Sky mini dish simply by replacing the standard Sky LNB with the C band unit and makes a 20+ dB gain antenna!

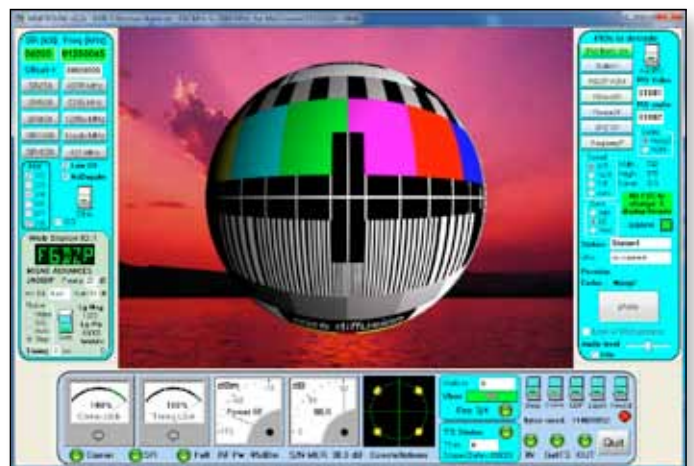
10 GHz - Similarly, the use of modified standard satellite LNBS to cover the 10 GHz amateur band which are readily available on ebay, make for easy reception of DATV signals on that band.

Summary

Receiving DATV signals is not hard, particularly if you have a reasonable narrow band station on 70cms or 23cms – you simply need a simple STB or PC running Minitune software. For more details visit the BATC wiki pages https://wiki.batc.tv/BATC_Wiki or join in the discussions on the BATC forum <http://www.batc.org.uk/forum/>



► A MiniTuner - see the BATC shop for details of the parts available to purchase.



► The MiniTune software for running the MiniTuner - full details from <http://www.vivadatv.org/>

Turning Back the Pages

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

Peter Delaney - G8KZG

CQ-TV 63

The opening editorial drew attention to the different way in which resistors were going to be labelled in diagrams. To avoid the possibility of the decimal point being lost by the printing process, the Club was changing from the old convention of 2.2k to say 2k2, and similarly 3M3 instead of 3.3M, or 4Ω7 instead of 4.7 Ω. "It's a method which is becoming quite common these days, but we'd like your comments on it before we decide whether to keep it or not".

From time to time, the magazine included a 'Helpful Hint', and in this issue there were three of them. Copper wire, readers learnt, could be used as fuse wire if you know the right size to use - a 'few useful ones' were given:-

- 1 amp – 47swg 2 amp – 43swg 3 amp – 41swg
- 4 amp – 39swg 5 amp – 38swg 10 amp – 33swg
- 15 amp – 30swg 20 amp – 20swg

The next 'Helpful Hint' was the transistor coding system then being used by Mullard (and other firms):-

First letter

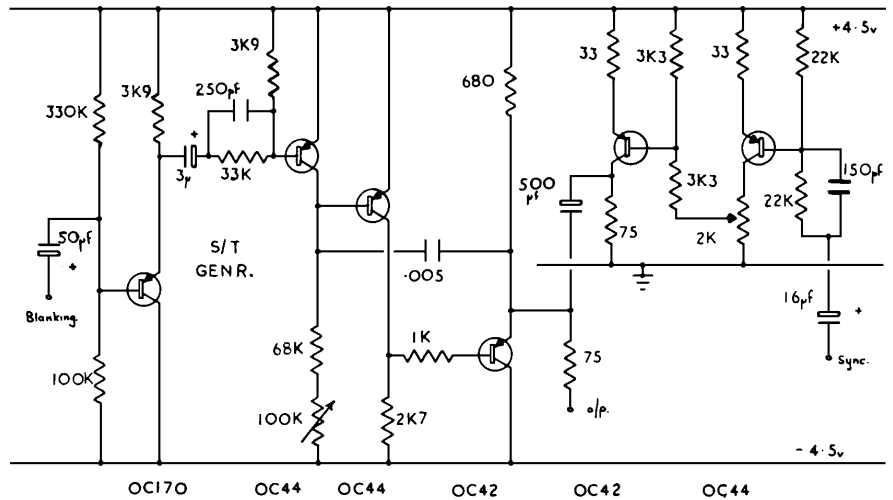
- A – Germanium B – Silicon

Second letter

- A – Diode
- C – Low power audio frequency transistor
- D – Audio frequency power transistor
- E – Tunnel diode
- F – Low power high frequency transistor
- L – High frequency power transistor
- S – Low power switching transistor
- U – Switching power transistor

Any other letter or number was an individual type serial number

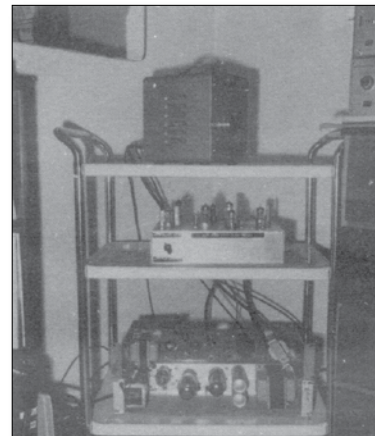
(So the AF117 was a germanium low power high frequency transistor, and a BC183L was a silicon low power audio frequency transistor. The OC42, OC44 and OC170 that are in the spg circuit were devices using the earlier system, based on valve nomenclature, where the first character was the heater voltage and the second letter denoted the number of electrodes, with a serial



number after that - an OC device being a 'triode valve' (C) with a zero voltage heater (O) - ie a transistor!

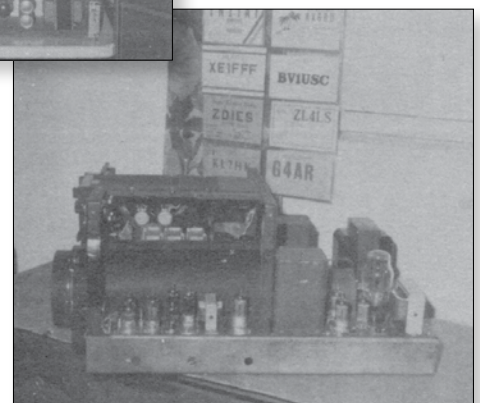
The third 'Helpful Hint' gave the correct size of drill to use for BA bolts (then 'standard' for electronic equipment).

BA size	Clear	Tapping	BA size	Clear	Tapping
1	3	17	6	31	43
2	10	24	7	36	46
3	18	30	8	42	50
4	25	32	9	46	53
5	29	37	10	49	54



Three American enthusiasts for the slow scan mode, T J Cohen, T Polluck and D Veazey, had produced a comprehensive report, in order to gain use of additional short wave bands for transmitting

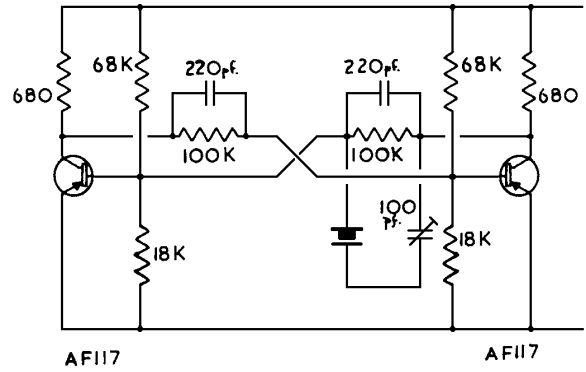
their picture signals. Their report included mention of work being done on SSTV world-wide, including in



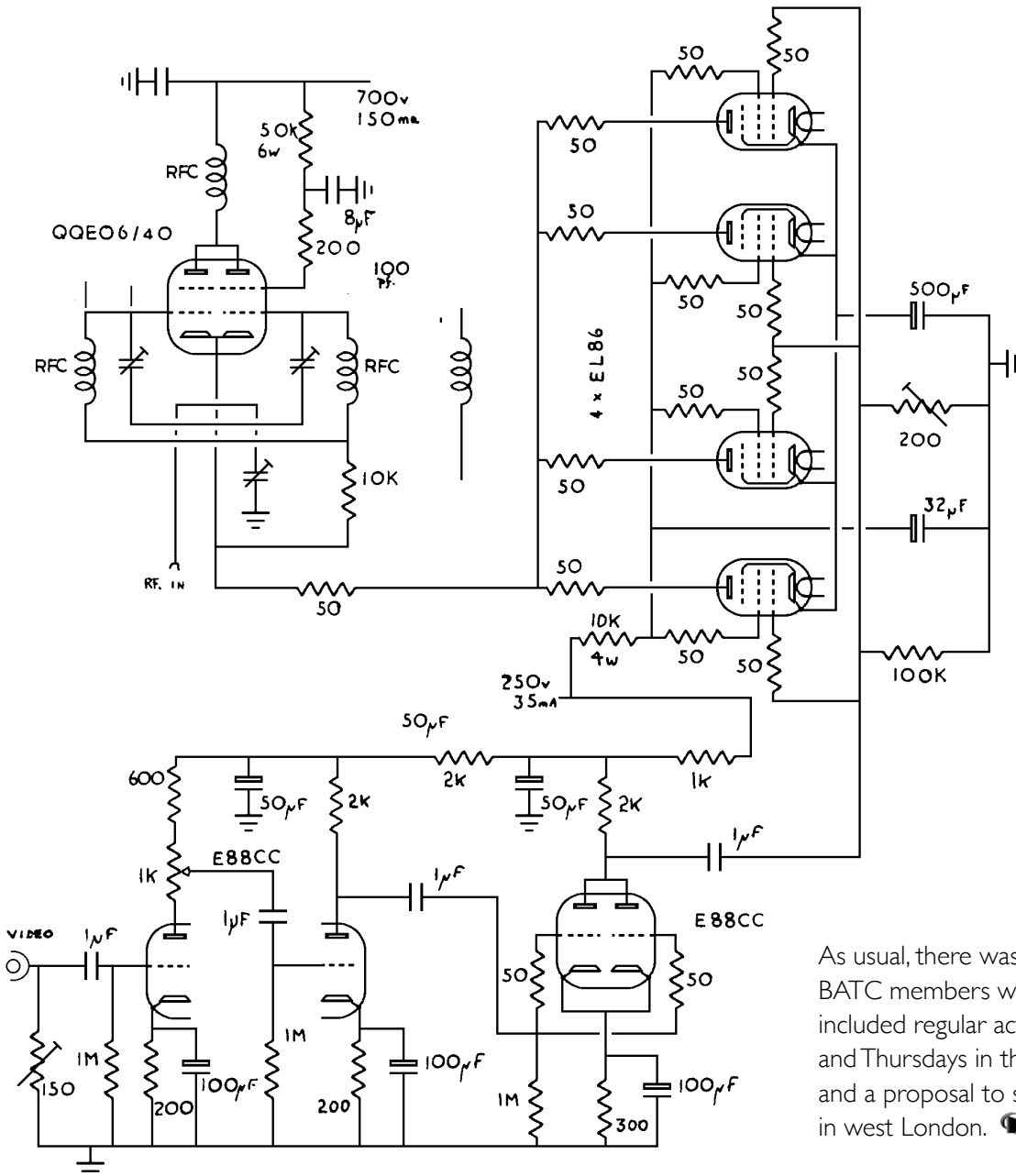
Britain, Belgium, India, as well as other Americans (notably Cop Macdonald and Don Miller. The report suggested that everyone should use a compatible system -- although it did "assume that everyone is going to choose the American standard". The pictures show the SSTV camera and monitor used by Theodore Cohen in his experiments.

"In these days of transistor supremacy, it may seem strange to publish any design using valves", but there is "a sneaking feeling that unless there is a glow somewhere, it can't really be working" said the introduction to a video modulator design by DJ1GQ that was described as being a 'little unusual', as it used four EL86 valves in parallel.

Experimentation with sync pulse generating circuits continued, with developments suggested to a design by Mike Cox that had been published some 4 years earlier. One member had designed a circuit to produce a



composite sawtooth waveform, which added a sync mixer to the original - by setting the 'sync amp' control to zero, the non-composite signal as produced in the original version was available. Another circuit was for a new crystal master oscillator, which had the advantage of being able to tweak the frequency slightly if the available crystal was not exactly right.



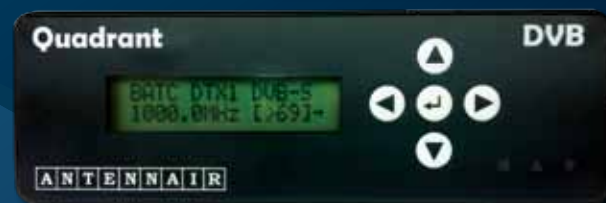
As usual, there was also news of what BATC members were doing, and this included regular activity nights on Mondays and Thursdays in the Stoke-on-Trent area, and a proposal to set up an ATV group in west London.

The British Amateur Television Club

The logo for the British Amateur Television Club (BATC) features the letters 'BATC' in a white, sans-serif font inside a dark blue trapezoidal shape. This shape is set against a background of three concentric, light blue curved lines that suggest motion or a signal path.

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.
- ▶ The new **BATC Wiki** for all the details of systems and projects for all things ATV. <https://wiki.batc.tv/>



www.batc.org.uk



BATC

Out and About

RadioFairs



You will be able to see the BATC stand at the following forthcoming rallies and events in 2016. Come and say hello!

10 April – NORBRECK, Blackpool.

www.narsa.org.uk

17 April – West London Radio & Electronics Show, Kempton Park, Surrey

www.radiofairs.co.uk

21 May – Norden, Rochdale

www.radars.me.uk

22 May – Dunstable Downs Radio Club Bootsale.

www.ddrcbootsale.org

4, 5 June – SERF - Eastbourne, Sussex

<http://serf.org.uk>

19 June – 29th Newbury Radio Rally

www.nadars.org.uk

26 June – West of England Radio Rally

www.westrally.org.uk

17 July – McMichael Rally, Near Reading.

www.McMichaelRally.org.uk

24-25 September – BATC Convention.

www.batc.org.uk

30 Sept. & 1 Oct – National Hamfest, Lincoln.

www.nationalhamfest.org.uk

6 November – West London Radio & Electronics Show, Kempton Park, Surrey.

www.radiofairs.co.uk

More volunteers are needed to run the BATC stand at rallies, especially in the North and West. If you are able to help, please contact the membership secretary.

batc.org.uk