Another new band for ATV enthusiasts!

Plus...

Two Way RB-DATV on 146.5Mhz

New Life for old Rotators

Setting up DATV Express for RB-DATV

The DigiThin - QPSK Modulator on the Raspberry Pi

Add-on Transport Stream Dock for the DTX1

GB3KM - the first year on 3.4GHz

Comparing DATV models

Video Fundamentals - colour bars

ATV image generator on Raspberry Pi

... and all the regular features

BATC DTX1 Digital TV Transmitter

Quadrant DVB

BATC DTX1 DVB-S
1000.0MHz [>69]↵

ANTENNAIR

MPEG-2 encoder and DVB-S modulator

▶ Self contained unit - computer not required.

▶ Composite and S-video input

▶ 2 audio channels

▶ Single PCB design

▶ Plug in option for 2nd video & audio channels

▶ Size: 165mm wide; 120mm deep; 55mm high

▶ Tunes the 70cm and 23cm bands. Tuning range from 150Mhz - 2Ghz

▶ -5 dBm output

▶ Power 500mA at 12 volts

▶ LCD front panel and keypad control

▶ RS232 control port

Specification subject to change without notice

Available from BATC shop

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

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CQ-TV 247

Contents:

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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:
March - Please submit by January 31st
June - Please submit by April 30th
September - Please submit by July 31st
December - Please submit October 31st

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

From the Chairman…

Noel Matthews - G8GTZ

The first 3 months of 2015 have already gone and the contest and rally seasons are almost upon us! The BATC will be out and about at a number of events including Kempton Park and the Rochdale Rally (see back cover for full list) where we will be selling the DTX1 at a special show price of £469 (cheques or cash only).

We will also have a BATC stand at HAMRADIO 2015 at Friedrichshafen where we will be selling items from the club shop including the DTX1. BATC is involved in organising the Friday afternoon ATV conference at HAMRADIO 2015 which will feature news of ATV activity from a number of European countries, a talk by F5OEO on RPiDATV and a session by F6DZP on using Tutioune software for weak signal DATV and RB-TV reception.

Since the launch of the RB-TV initiative in CQ-TV 246 we have seen a lot of activity, particularly on 146 MHz and the BATC award for the first 10KM+ QSO has been won by M0DTS and G1LPS – see members news and the article by Terry in this CQ-TV for more details. There are a number of developments to make RB-TV equipment available and BATC organised a meeting of the key developers to make sure we co-ordinate the efforts – see the full report later in CQ-TV.

The big ATV contest of the year is only 3 months away and it would be great to see as many stations out portable for that event which is an IARU coordinated event meaning many stations from Europe will be active. You can run FM ATV, DATV or RB-TV during the contest and BATC is funding a special prize for the longest RB-TV QSO – see Contest news and the advert for more details.

The other good news is that we have had a bumper crop of repeater NoVs come through in 2015, mainly due to the improved BATC / RSGB relationship with CAA and the activities between Ofcom and the MoD to get the PSSR clearance underway - certainly the release of the alternative inputs for GB3KM and GB3TZ were released in absolute record time! In fact there are only 3 TV NoV applications currently at Ofcom – could be an all time record and we do know that the CAA has already approved these and they are with NATS for final clearance.

The NoV's issued were GB3DK (new Kent 23cms), GB3GG (new Grimsby 23cms), GB3JT (new Hastings 23cms), GB3KM (5.6 GHz input) and GB3TZ (13cms freq change). We also had GB3NV (Norwich) and GB3HV (Farnham) licensed on 3.4 GHz in December 2014 and there will be articles on these repeaters in future editions of CQ-TV.

As you can see there's a lot going on at BATC to help support the ATV community but this does mean a lot of work for the few people on the committee and we really do need a couple more volunteers to help us. In particular we need someone to run our publicity and advertising and we are still very keen for people to help us with the development of the new BATC web presence. If you feel you can spare a couple of hours a week on either of these tasks, please get in touch and help the BATC to continue to serve the ATV community and be so much more than just a magazine. 🖢

Your BATC needs you!

As a result of BATC continuing to support and develop the ATV community worldwide and our increasing membership, we are looking for volunteers to help run the club. In particular we are looking for help with:
- Publicity – to make sure the BATC gets coverage in publications and news feeds
- Website development – we are still looking for developers to help refresh our web presence

If you feel you can help continue the success of your club, please contact any committee member

Overseas News

Dave Crump – G8GKQ

The Netherlands

The Annual VERON VHF Day will be held on Saturday 25 April at the Denksportcentrum in Apeldoorn, Dubbelbeek 24. Directions can be found at *http://www. denksportcentrumapeldoorn.nl/*. The programme covers VHF, UHF and ATV and there is a separate Amateur Satellite stream.

The Dutch Kingdom Amateur Radio Society, whose mission is to represent the interests of amateur radio operators in European and Caribbean Netherlands, publishes a monthly magazine which is available for free download from:

http://www.dkars.nl/index.php?page=magazine_uk

The magazine is not specifically about ATV, but is an interesting read. Some of the articles are in Dutch, but there are enough in English to make it worthwhile for us.

10:00 to 10:30 am Arrival of participants, coffee / tea

10:30 to 10:45 am Introduction

10:45 to 11:35 pm Lecture by Ruud PF1F: Safe distances up to SHF-antennas

12:00 to 13:00 pm Lunch

13:00 to 13:50 pm Lecture by Koert PA1KW: DATV

14:00 to 14:25 pm Contest Trophy Presentation Ceremony

14:30 to 15:20 pm Lecture by Robertino van Ginkel: DMR

15:30 to 16:20 pm Lecture by Rob PE1ITR: deep space probes

16:30 pm Closure

Ireland

The Irish Radio Transmitters Society (*http://www.irts.ie/cgi/index.cgi*) produce an excellent magazine called Echo Ireland. The cover of their December 2014 magazine showed an Experimental ATV Repeater covering Dublin - receive 1240 MHz, transmit 2390 MHz - using at least some wind power. The repeater is shown here – thanks to South Dublin Radio Club for the photo.

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

Members News

Dave Mann – G8ADM

RB-TV

Interest in Reduced Bandwidth Television continues with many amateurs using this mode on the 2m and other lower frequency bands. Those known to be active using these modes are:

Arthur G4CPE, Steve M0SKM and Don G0WFT north of Luton have had short range contacts. Arthur has also had a two way contact with the Bedford Radio Club on 2m DATV at a range of 26.5 Km when Steve and Don set up a demonstration. They hope to go out portable to try longer distances as the weather improves. They are also working with Ian G3KKD near Cambridge and hope to make contact with him using RB-TV on 2m soon.

Peter GW7BZY and Chris MW0LLK in Anglesey. They often stream their results to Peter's personal BATC streaming page.

Peter G3PYB in Portsmouth and **Colin G4KLB** in Bournemouth have been contacting Rolf F9ZG South of Cherbourg, on 70cm. Rolf indicated he regularly contacts F3YX near Paris using 251KBit RBTV (H264 encoding). In the recent opening Rolf operated mobile near Paris with Christian F6BGR, they had two way DATV contacts with G3PYB (Peter used 2Ms/sec for transmission). Look out for Christian F6BGR QTH is Dept. 80 in northern France and F6AQO in Paris both DATV active. All French ATV stations use 144.170 MHz USB for talkback.
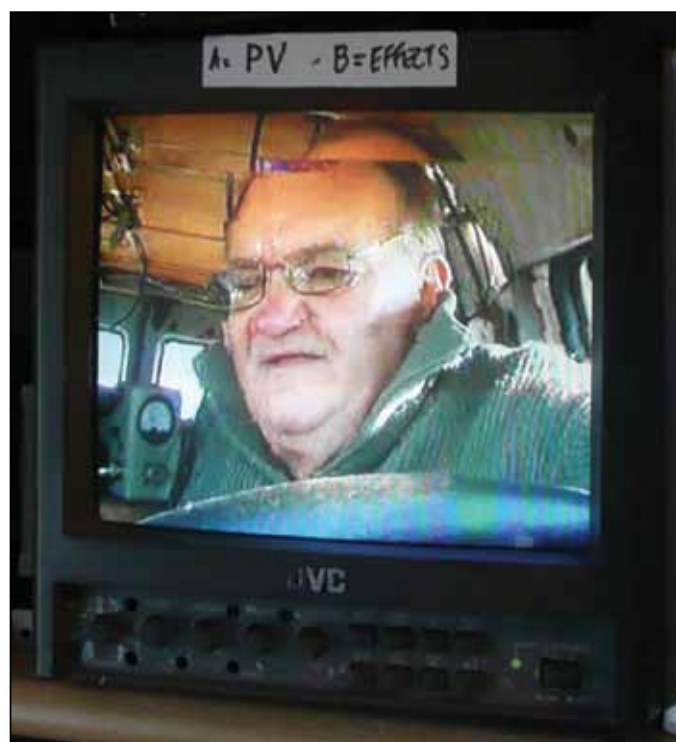
▶ *F9ZG received at G3PYB*

▶ *F6BGR received at G3PYB*

Rob M0DTS and Terry G1LPS from North Yorkshire have had a 50Km contact on 2m and this has won them the BATC award for the first contact over 10 Km. Contacts over greater distances are planned. They use DATV-Express with special firmware from G4GUO and Tutioune receivers with special software from F6DZP

Please keep us informed of any more contacts and developments using this mode.

Qatar Satellite Company's Es'hail-2 Satellite

More information has been released on this new geostationary satellite that will carry an AMSAT payload due to be launched next year. This includes a wide band transponder capable of relaying two or three television channels. Uplink: 2,405.5 MHz, S-Band, RH Circular Polarisation, 8MHz bandwidth. Downlink: 10,495 MHz, X-Band, Horizontal polarisation, 8 MHz bandwidth. Ideally this requires an LNB with a 9 GHz local oscillator to produce an IF output of 1.495 GHz to feed a regular satellite receiver. The remarkably wide coverage of the main transponder beam is shown below, centred at 26 degrees east. The wide band television transponder will fall within this area.
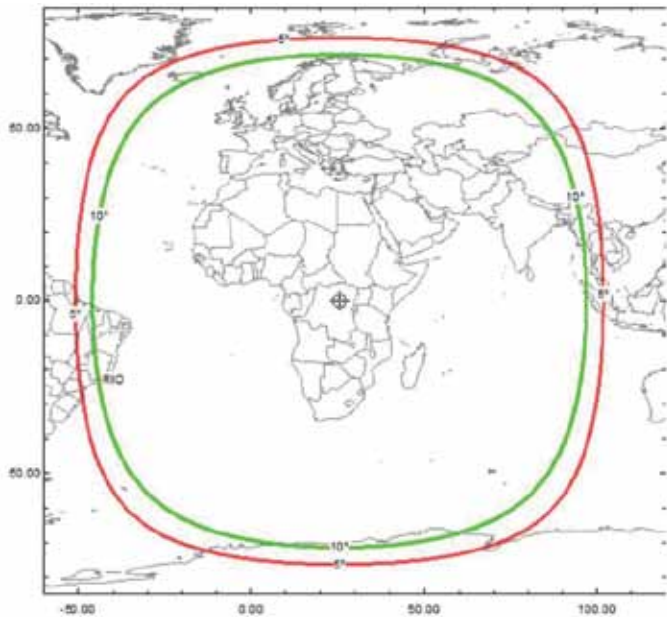
▶ *Es'hail-2 Main Transponder beam.*

This is the first amateur television relay satellite and the first amateur transponders to be in geostationary orbit.

G3XIG

Clive located in Dorchester, Dorset is developing his station to get back into ATV. Having recently retired he has more time to devote to our hobby. He is not too far from Bournemouth that's has quite an active ATV community.

G8DKC

Peter located in Colville, Leicestershire has been using 70cm DATV mobile. His antenna is a crossed dipole giving omnidirectional radiation with horizontal polarisation and running just 10W he gets into GB3GV at quite a few miles distance.

Changes to the UK Amateur licence relating to ATV

The documents relating to the revised UK Amateur licence are quite heavy going. I have summarised here the main points relating to Amateur Television. The revised licence takes effect on 7th April 2015.

13cm Band

2,310 – 2,350 MHz Restriction will apply to those near St. Kilda, Aberporth and Boscombe Down.

These mainly apply during daylight hours.
See new licence for details.

2,**350 – 2,390 MHz,** this part of the band will be removed from the amateur licence, meanwhile special restrictions apply if you are located near to Boscombe

Down, Salisbury Plain, West Wales Airport, Cardigan Bay, St. Kilda and Aberporth. See Ofcom website, *http://www.ofcom.org.uk/* for full details.

2,390-2,450 MHz. No change. Much WiFi interference in this part of the band.

9cm Band

3,410 – 3,475 MHz has been removed from this amateur band. The band is now 3,400 – 3,410 MHz and some TV repeater licences have recently been issued for outputs only in this band.

Rallies

We expect to be representing the BATC at the rallies listed on the rear cover. If you would like to help man the stands we would be pleased to see you there.

Gerry Wells, British Vintage Wireless and Television Museum.
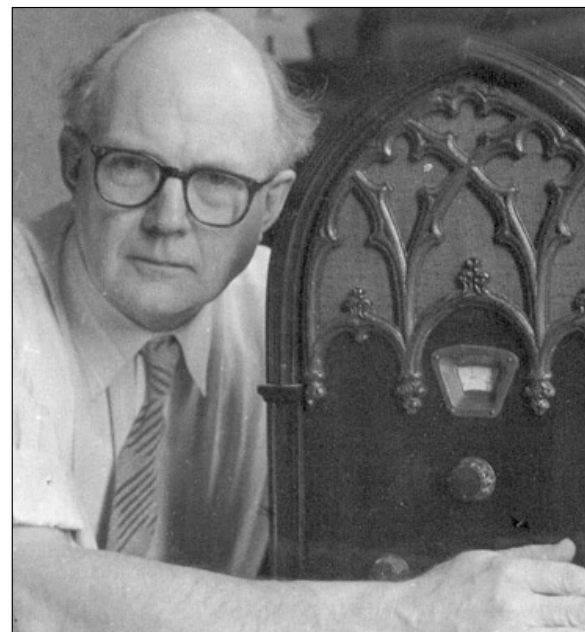
Gerry, a talented engineer, gave up his regular job due to a back injury in 1975 and converted his house into a museum. This became the British Vintage Wireless and Television Museum and is well known to many television amateurs. He eventually had 1,300 vintage radios and televisions on display, not a transistor in the house! Gerry was born in 1929 and sadly died last December 2014 at the grand age of 85. We are very grateful to Gerry for producing a remarkable museum showing the early history of television which we hope will continue to be available without him. He is survived by his daughter.
See: *http://www.bvwtm.org.uk/*

Please send any news for CQ-TV 248 to me by the end of May: secretary@batc.org.uk

Contest News

Dave Crump – G8GKQ

BATC Repeater Contest 6/7 Dec 2014

I did not receive any entries for the BATC Repeater Contest in December. I hope that I receive something from the March repeater contest which will take place just before CQ-TV goes to press. Please check the BATC Forum for the latest information.

International ATV Contest 13/14 June 2015

The highlight of the year should be the International ATV Contest on 13/14 June. The contest starts at 1pm UK time on the Saturday and runs through to 7pm on the Sunday. No-one expects you to be active for the whole contest period – the times were extended to give more stations a chance to participate. I will post more information on the BATC Forum as we approach the date. The rules for this contest are at ***http://www.batc.org.uk/ contests/IARU_ATV_contest_rules_version _2015.pdf***.

Contest Rules

There have been some minor changes to the International Contest rules, such as extending the contest duration and clarifying the situation for "Rover" stations (for example operators who move between 2 portable sites during the contest), but the basic aim remains the same – to send a 4 digit code and have it successfully received. Do remember that the numbers in the 4 digit code should not be the same or consecutive: 4752 is OK, but 2345 or 2222 are not.

The contest rules refer to times in UTC: this is Universal Coordinated Time (the abbreviation comes from the French translation which is internationally accepted). Many of us will know this as Greenwich Mean Time (GMT), which is the clock time in the UK during the winter, but one hour behind in the Summer when we use British Summer Time (BST). This is why the International Contest starts at 1pm and finishes at 7pm for us.

Contest reports use the P scale for reporting ATV signal readability:

▶ *The mobile shack of Rob, M0DTS*

Vision report: the internationally recognized codes P0 to P5

	Analogue	Digital
P0	No picture perceived	No picture perceived
P1	Synchronisation with very little picture contents	Only occasional blocks visible
P2	Only large images (callsign etc.) perceivable	Sufficient blocks to read callsigns
P3	Picture noisy but some detail resolved	Some blocking
P4	Picture slightly noisy but with good detail and resolution	Occasional blocking
P5	Noise-free picture	Solid picture

The P report is followed by a sequential 3 digit serial number for the contact. For example for your first contact on 23 cm you might send the report P4001, and for the second contact P5002. Start from one for each band; if you are unsuccessful in receiving pictures, you can send back a report such as P0003. This ensures that your attempt at a contact appears in the log.

Analogue or Digital

I am often asked whether stations should use Analogue or Digital for their contest QSOs. The answer is either – whichever one gives you the most chance of making

Contest Calendar

1200 UTC 13 Jun 2015 – 1800 UTC 14 June 2015: *IARU International ATV Contest*
1200 UTC 12 September 2015 – 1200 UTC 13 September 2015: *BATC Autumn ATV Contest*
1200 UTC 12 December 2015 – 1200 UTC 13 December 2015: *BATC Repeater Contest*
1200 UTC 26 March 2016 – 1200 UTC 27 March 2016: *BATC Repeater Contest*

a successful contact. I'm still a fan of using bandwidth-restricted AM on 70cm. My transmission is only 2 MHz wide using a 1.5 MHz video filter and a VSB transmitter. Remember that you can use the excellent TVSharp application with an RTL Dongle for receive – see *http://www.rtl-sdr.com/analogue-tv-with-rtl-sdr.*

Contest Dates

In CQ-TV 246 I wrote that the International Contest would be held in the first weekend in June. This was an error; thanks to Chris, PA3CRX, for pointing out that it is always held on the second full weekend in June. I had stated the dates correctly.

International ATV Contest 13/14 June 2014

- All bands up to 24 GHz
- Digital and analogue modes
- BATC awards for best Dx contact using RB-TV
   - 500kHz bandwidth or less on any band
      - Including the new UK 70 MHz DATV band!
   - £50 Amazon voucher each for both stations
      - One way or two way contact
- See CQ-TV and the BATC forum for rules

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

STOP PRESS – STOP PRESS – STOP PRESS – STOP PRESS

Ofcom release 70 MHz spectrum for digital experimentation

This edition of CQ-TV was delayed so that we could bring you the exciting news of more spectrum specifically released for experimentation with DATV and other digital modes. The RSGB has been encouraged by the initiatives already shown by the ATV community at 146 MHz and this announcement increases the potential bands that we have access to for DATV and RB-TV experimentation. The RSGB / Ofcom release is as follows and further information will be included in the next edition of CQ-TV.

Ofcom have agreed the use of 70.5 MHz to 71.5 MHz by radio amateurs for digital experimentation. Use will be permitted only via a Special Research Permit *http://licensing.ofcom.org.uk/binaries/spectrum/amateur-radio/apply-for-a-licence/ofw306.pdf.*

The following conditions apply:

Access to this part of the spectrum will be authorised under a Notice of Variation, time-limited to 12 months and available to Full Licence holders only.

Ofcom will retain the right to reallocate Amateur Radio spectrum at 70.5 – 71.5MHz should there be a demand for this part of the spectrum from Business Radio and/or other or new services. In the event of this happening, Ofcom will not consult on this decision. However, Ofcom will provide Amateur Radio users with 12 months' notice

before such reassignment and this notice period will be publicised on the Ofcom website.

Amateur Radio use of this spectrum will be permitted on a non-protection, non-interference basis. Please note that if use is shown to cause interference, the spectrum will be removed with immediate effect

Permission will be subject to a geographical restriction and only granted for use in England, Northern Ireland and Wales. (There is legacy use of the spectrum by the Scottish Government which precludes licensing for Amateur Radio).

► *ATV aerials are getting bigger!*

A Two way on 146.5MHz RB-DATV

Terry Roxby G1LPS

Here is how with help from Rob M0DTS and Charles G4GUO I managed to get onto this new and exciting TV band.

Charles G4GUO released a new program for sending transport streams to the DATV Express, before this it was not too easy to send a low bit rate DVB rate signal but now it is possible.

Charles has also created a modified firmware file for the DATV Express FPGA to adjust filter settings allowing clean output at low symbol rate DVB-S.

Rob M0DTS released a script that automates the encoding and passing of the transport stream to the DATV Express. With the ability to change settings.

The journey to transmitting started after receiving Rob's transmission on 146.5Mhz Symbol rate 333 on Saturday 3rd of January. I was very impressed at what could be achieved on such a low band width and had to have a go.

Below you can see a screen grab of the first pictures I got from Rob. using the Tutioune software and a Techno Trend TT budget S2 1600 version card

Over a period of a couple of hours, various Tutioune settings and receive setups were tried. The two setups I settled on as being the best with equipment at hand were:

6 element beam > Mutek preamp > Pye Europa filter > microwave modules preamp > SUP2400 > Satellite line amp > TT-1600 & Tutioune

6 element beam > Mutek preamp > Pye Europa filter > microwave modules preamp > sdrkits PA0KLT Si570 VCO kit > mixer > Satellite line amp > TT-1600 & Tutioune

Both hardware configurations gave good results once some key settings were found on the Tutioune software. The new settings stabilised and made lock much easier. Although I must admit I don't as yet fully understand all the various settings.

After these setting were made we estimated we had about 8db head room with the current set-up and lock stability even with a weak constellation and low MER.

Clive G4FVP assisted by pointing his 2 meter beam at me and transmitting on the top end of 145mhz to see if it would block Rob's incoming signal. I was happy to see that lock was maintained even with Clive's strong signal in the band.

It was also great to see that the SUP2400 we all use for 70cm reception also works well for 2 meters with the TT-budget 1600 card. This card has a wider frequency coverage compared to the TT-3200 version. The SUP2400 worked better with some help after it in the form of a satellite line amplifier.

I then set about getting the equipment together for transmit and installing the software required.

Rob kindly knocked me up a couple of amplifier stages for 1 watt (see separate article) while I was playing with the software side of things and pre tuned them for the -60db shoulder limit to give me a good starting point "Thanks Rob".

The two amplification stages comprise of an RD06HVF1 and RD15HVF1 to get from the -10dBm input signal to around 1 Watt level with -60dBc IMD products as per the recommendations.

The first two way attempt took place as soon as I was ready to transmit and could comply with the guidance. Even though the wind was howling we both crept the antennas up a little to try a contact. This was on the 11/01/15 and the exchange was made over the 28km path. Using 1 Watt.

The next 146.5Mhz session test took place on the 13th of January and we had about 20db head room on the signals with masts fully up at both ends. As a test I gradually reduced power to below 100mw and Rob was still receiving with no issues. Rob's RX chain is a similar one to mine but looked a little more sensitive. I suspect it may be down to my filter being slightly off tune.

Rob's setup:

9 element beam > preamp > Pye Europa filter > preamp > Glencom vc510 mixer > TT-1600 or TT3200 & Tutioune

▶ *G1LPS as received at M0DTS*

Comparing the Technotrend 1600 and 3200 versions of the card during the low power weak transmissions showed very little difference between them. It was very much "swings and roundabouts" which one was preferred. We have not tested lower symbol rates yet where the 1600 card may have an advantage as others suggest. The two cards do report quite different MER when the bit error rates are reporting very similar results.

▶ *The screen grab shows the comparison Top is the TT-1600 and bottom the TT-3200.*

There is however new Tutioune software being developed for the TT-1600 card that is reported as giving much better results allowing fast lock even under QSB. The two cards use different chip sets. A copy of the new software is kindly being sent to us to try.

The TX systems used at both ends were similar.

▶ PVR2 USB capture device and camera as the AV source. (Rob used two different setups here PVR350 For first tests and a Raspbery Pi also doing the encoding for the latest tests)

▶ Script for re-encoding a PVR's MPEG2 video into lower bit rate MPEG2 or MPEG4 is rb.sh

▶ ffmpeg re-encodes the video to MPEG4 video then encapsulates in a transport stream.

▶ express_server software is used to send the transport stream to the DATV Express Hardware.

The DATV Express board sends a -10dBm DVB-S signal to Amplifiers which lift the output to 1W, down 5dB cable loss to a 6 element yagi (Rob used a 9 element) giving a few Watts ERP. at each end. I was using vertical polarization Rob used slant polarization.

We have lock when 8db above the noise. The new untried software is reported to lock at a lower level still and at lower SR over a 300km link to Paris on 70cm.

Since the 6/02/15 Clive G4FVP has also been receiving my 146.5mhz TV pictures. Can't wait to try more contacts as activity increases! 🐦

146MHz RD06+RD15 Amp

Robert Swinbank M0DTS

Amplifier RD06HVF1 & RD15HVF1

I found these devices give very good results for low cost when getting started on 2m DATV, and so simple to construct!

They have about 20dB gain each stage, so -10dBm input from the DATV Express gives +30dBm of output power using both devices in series.

There is reasonably good harmonic attenuation, approx -55dBc at 1W output.

The input and output match of these devices is very similar so the layout is the same for both.

The bias is around 4V, 2k2 pot with zener ref - not original design but should be good!

All coils are 8mm inside diameter and 0.9mm wire.

Input and output series caps are 100pf.

RD06 device seems best at a bias level to get 0.4A drain current with no RF.

RD15 device seems best at a bias level to get 1.4A drain current with no RF.

These were found when the power is set to 1W.

Other caps can be variable or fixed, I got good results with the fixed values shown, 20W saturated from the RD15 device and about 7W saturated from the RD06 device.

Tuning the amp by adjusting trimmers or coils for best power at or near saturation usually gives the best linearity, tuning at low power levels for best gain will give much poorer results.

I have not tried to fit both of these devices on one board in a single box yet, it may give stability issues with the high gain but should be possible - someone else can comment there, I'm used to microwave frequencies!

There are some higher power devices in the same range so I would assume they are suitable too, still to test… 🐦

2m 1W amplifier. M0DTS. March 2015

Q1 = RD06HVF1 or RD15HVF1   Coils 8mm ID. 0.9mm wire.
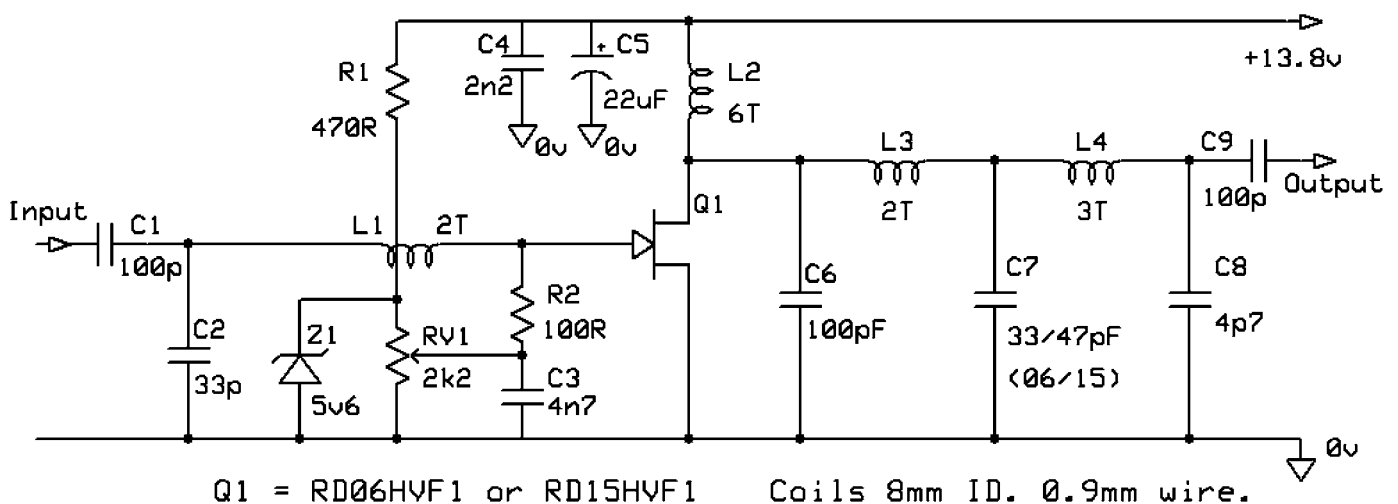
New Life for Old Rotators

Noel Matthews - G8GTZ

*Like many others I suspect, I had a couple of old TV/ cheap rotators sitting in the garage. I had also had experience of how useful a computer controlled rotator can be for remote access / tracking.*

When we decided we needed a web controlled beam on GB3HV to null out interference and give a bit more gain on 437 MHz DATV, I decided to investigate what could be done to use the perfectly good rotator motor housing by replacing the old control unit.
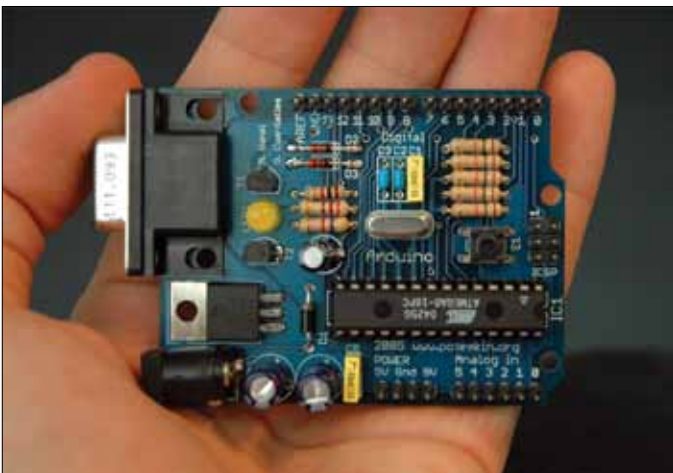

A talk at the local radio club on the Arduino led me to investigate the K3NG rotator controller - *http:// blog.radioartisan.com/yaesu-rotator-computer-serial-interface/* . This very simple (and cheap) design uses an Arduino Uno (available on ebay for under £10) to provide the logic for a rotator controller with a USB interface, manual switch inputs, relays to drive the rotator motor and the option to connect a 4 line LCD.

Sounds good but how to interface to my old AR22 rotator. First, try and find the circuit of your old controller.

The AR22 controller had 2 relays, one of which controlled the direction of rotation by reversing the motor windings and the 2nd was used to switch the mains input to the whole unit when the go button was pressed. Obviously the Arduino needed to be powered on at all times so I bypassed the mains relay and soon realised why it was there – the original (cheap?) transformer got very hot and tripped out after about 5 minutes. I replaced the transformer with one from the junk box with an 18v output. This was used to drive the motor (the original was 28v but seems to work OK on 18v) and produce the DC supply for the whole unit. The direction switch relay was replaced by 2 relays driven from the Arduino CW and CCW output and the rotator went round when the CW and CCW switch was pressed. The original (cheap) rotator did not even have end stop switches, but the K3NG system allows you to enter these in software.

However, the direction indicator proved more difficult. The wiper of the original 1k wire wound potentiometer in the bell housing is mechanically earthed as it is used as one leg of a resistive bridge. This makes it unsuitable to provide a simple 0 – 5v indication which the K3NG system requires. First thought was to use a 1K fixed resistor to provide 10 volts to one end of the potentiometer and connect the Arduino input to the mid point – this would then float between zero and 5 volts depending on the position of the earthed wiper. Unfortunately this is very non linear because as the earthed wiper approaches the midpoint the current through the 2 resistors increases causing more volt drop.
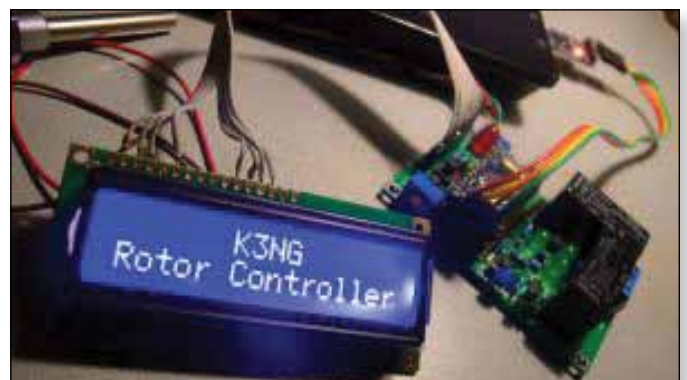
K3NG Rotator Computer Interface
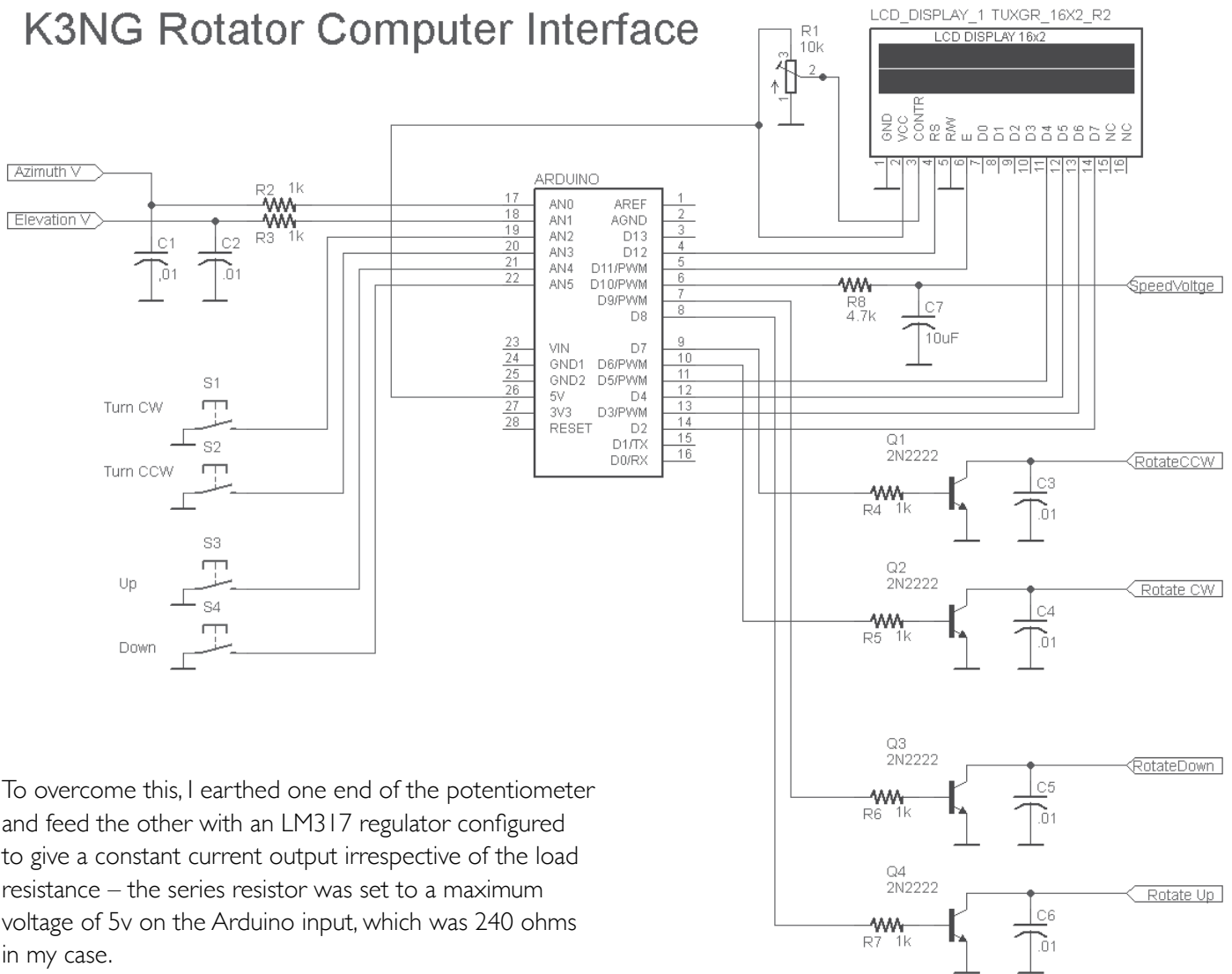
To overcome this, I earthed one end of the potentiometer and feed the other with an LM317 regulator configured to give a constant current output irrespective of the load resistance – the series resistor was set to a maximum voltage of 5v on the Arduino input, which was 240 ohms in my case.
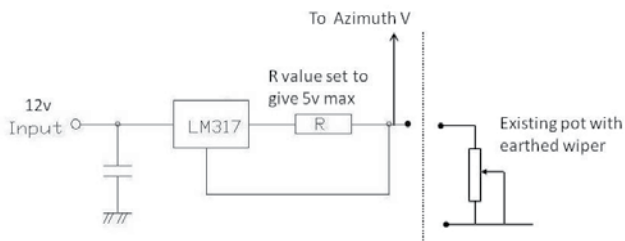
The result was a 0 – 5v indication of the rotor position and if needed an accurate calibration table for voltage vs direction can be entered in to the K3NG software.

A PC running the PSTrotator software (**http://www.qsl.net/ yo3dmu/index_Page346. htm**) was then connected to the Arduino USB port and we instantly had full computer control of the rotator.

As well as user interface with a host of features including 12 preset positions, control by satellite and APRS trackers and a "point to QRA" facility PSTrotator has a built in web server allowing remote access from any PC and DTMF control using the line input on the PC sound card. By using the K3NG software, for less than £15 an old rotator can be updated to include features normally only found on an expensive new unit and for an additional 15 euros, the PSTrotator software gives full computer control and tracking capability.

A Guide to setting up the DATV Express for RB-DATV Operation on 146.5MHz
Terry Roxby G1LPS

Installing the software required

I was a complete novice to Linux having never used the operating system before.

I must say at this point the only thing that had previously put me off getting a DATV Express was the Linux operating system. Wish I had taken the plunge earlier as installing and getting up and running really was a painless and pleasant learning curve.

Download Unbuntu 14.04.1LTS from here: **http://www.ubuntu.com** and burn the iso. image to a disk

Install Unbuntu 14.04.1LTS   and DATV express software as detailed in the DATV Express manual .

Test Express card and PVR capture card as in the manual.

The manual does say you don't have to edit the usb permissions on version 14.04.1LTS of Linux but I found it to be necessary. The process is described for the earlier version of the operating system and easy to apply.

If all functions perform correctly, proceed with the RB-DATV preparations.

Remember a NOV is required for transmission on 146.5MHz

Please read the guidelines for operating on 146-147Mhz very carefully and make sure your transmission complies.

First

Install ffmpeg

Include yasm and libx264 – these are required.

**https://trac.ffmpeg.org/wiki/CompilationGuide/Ubuntu**

It's a simple process of copy and pasting the command lines into terminal as described in the online guide.

Install DATV Express server from
https://github.com/G4GUO/express_server

by using the following command line.

```
sudo apt-get install libusb-1.0-0-dev
git clone https://github.com/G4GUO/
express_server.git
cd express_server
make
sudo make install
```
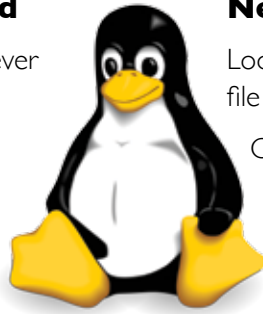
Next:

Look in the installed express_server folder and open the file called datvexpress.txt.

Change the content to the following and save

```
 #
 # Configuration file
  #
  set freq 146500000
  set srate 333000
 set tsock 1314
set fec 7/8
set level 055
set ptt tx
```

(Note: Set the output level to maintain -60 shoulders on your transmitted signal)

Next:

Download the bash script called *rb.sh* from:

http://www.m0dts.co.uk/?tag=146MHz&item=141

Put the bash script in the express_server folder.

Edit the script by changing the callsign to your own and save.

Your now ready to test the transmit (for RB-DATV do not use the standard DATV express graphical interface)

Navigate to the express_server folder using terminal by typing
```
cd express_server
```
Press **enter** and then type.
```
./rb.sh
```
Press **enter**

At this stage you may be presented with a no permission message.

If this is the case type
```
chmod +x rb.sh
```
Press **enter**

You will only have to do this once the first time running the script. It will not be necessary in future. Then repeat the step above.

You will be asked to enter various options then it should start encoding and transmitting.
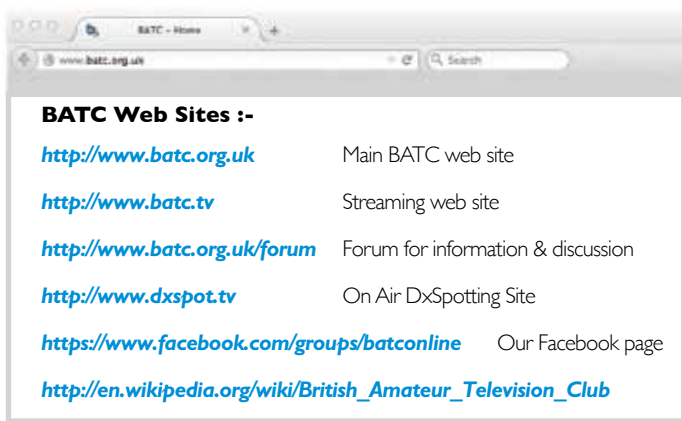
Be patient if using a slower pc – I have known it to take a minute or so to start.

You will see various information constantly updating at the bottom of the screen if all is ok – bitrate, kbits/s, fps etc. The usual led's on the express board will be lit and flickering.

The script can be stopped by pressing **Ctrl & C** together.

In the express_server folder there is a file called **commands.txt**

It is handy to print a copy of the content as this is the list of commands that can be given in a new separate second terminal window to control the express board, while running RB-DATV should you wish to. 🗨

BATC Web Sites :-

http://www.batc.org.uk	Main BATC web site
http://www.batc.tv	Streaming web site
http://www.batc.org.uk/forum	Forum for information & discussion
http://www.dxspot.tv	On Air DxSpotting Site
https://www.facebook.com/groups/batconline	Our Facebook page
http://en.wikipedia.org/wiki/British_Amateur_Television_Club	

BATC will be at the West London Radio & Electronics Show held at Kempton Park - 19 April 2015

We will have our stand in the main hall in our usual position adjacent to the Home Counties club stand.

▸ We will have the DTX1 transmitter available at a special show price of £430[1]

▸ A demonstration of video measurement, & how to get it right!

▸ Live ATV demo's by the Home Counties ATV group GB3HV

▸ There will be CQ-TVs available, badges, expert advice

▸ … and of course, BATC membership services

Do come along and have a chat, make your self known.

[1]Special low price for members only. Pay by cash - no card/PayPal facilities

DTX1 – show special price!

•Buy the DTX1 from the BATC stand at the following rallies and pay cash to get the show special price of just £430!

- •Kempton Park –19th April
- •Rochdale rally - 23rd May
- •HAMRADIO 2015 – June 26th to 28th

Price also available for cash on collection – contact us for more details.

Portsmouth RB-TV Meeting

Noel Matthews G8GTZ and Peter Blakeborough G3PYB

The opportunity to meet with Jean Pierre F9DZP on a short notice visit to the UK presented an excellent chance to compare notes on DATV and RB-TV developments in France and the UK.

A venue at Portsmouth was agreed and meeting expanded to include F5OEO Evariste and Rolf F9ZG, plus Brian G4 EWJ who made the long journey from Liverpool. We also arranged for Charles G4GUO, Rob M0DTS and Terry G1LPS to join via SKYPE. G8GTZ, G4KLB and G3PYB added to the group.

The broad objective for the meeting was to bring together leading code writers and those developing associated hardware for Reduced Bandwidth DATV transmission equipment. In the UK interest has been spurred into "over drive" with the OFCOM temporary allocation at 146 to 147MHz.

It is recognised RBDATV developments can be equally applied to existing frequency allocations, but incentive offered with VHF gives longer range opportunities.

Technical innovation in video compression algorithms coupled with development of spectrum efficient modulation hardware are at the heart of the notes reported below.

RB-TV Receive developments

Jean Pierre F9DZP (Creator of the Tutioune software for the TechnoTrend DVBS QPSK cards) opened the discussions.

It is no small task to search and lock to a narrow band transmission and then demodulate and decode stream for MPEG 2 and H264 but significant improvements have been made to the software to demodulate QPSK transmissions down to 200KBit.

The key issue is the ready access to the internal registers using code written for the STV 1600 and the STV0903+STV6110 chipsets. Improving the clock stability was discussed, but Jean Pierre indicted this was not the issue. Two PLLs are used; one for frequency and one for locking the symbol rate. The dynamics and management of the two PLLs is the dominant factor and the clocks can be modified more readily in the 1600 cards to give a better lock result. The very best results are reported to be with the 1600 PCI card as the more readily available 3200 cards have smaller frequency increments than the 1600, but the overall rapid lock and hold to demodulate has the edge in a real radio channel.

The Tutioune software and PCI cards tie the user to using a relatively powerful PC, but the package is at the leading edge for measurement and demodulation performance for judging sensitivity and linearity effects.

It functions as test equipment in addition to good performance at low symbol rates and many thanks were expressed to Jean Pierre for all his hard work to the benefit of all the amateurs users.

RPi QPSK receiver

F5OEO outlined an idea to use the Sharp NIM (Network interface modules). with integrated RF front ends and demodulation providing a transport stream for decoding on platforms such as the RPi.

The NIM modules can be specific to QPSK satellite L band or QAM cable, and are physically quite small and could be integrated on a Pi sub board. Video out would be HDMI or composite base band from the RPi.

The Sharp BF2F7VZ0164 has the same STV 0903 chip set as the Trend 1600 pci card, so the same software and register addressing can be used making a superb portable L band receiver.

RB-TV Transmit developments

F5OEO Evariste (RPi applications developer for QPSK Tx and RX) described updates to the RPi codes to launch the UglyDATV from the SD card using a graphical command line front end - this was described in a separate article in CQ-TV 246.

The system can generate the low symbol rates for RBDATV. The video picture source is the add-on Rpi camera. One idea here was to use a usb dongle to produce the audio stream - more experiments to follow. What audio bit rates to use was discussed; with a video stream of 333Kbit we ideally need a low bandwidth audio stream of say 32 or worst case 64Kbit. Adding an audio stream to an unrelated video stream has its own problem as the clocks will drift. The B+ RPI are all working at high CPU levels to achieve a good result, however the new B2 Pi gives much greater margins.

A parallel 8 bit output with service information already included is a most interesting option as this may be interfaced to external modulator such as the SR systems or DTX1 (see separate article). There are also ex-broadcaster QPSK modulators with 8 bit LVDS parallel input and an RF output from 50 to 160MHz which could be deployed using this interface.

This opens the possibility to add H264 to existing equipment currently in use for MPEG2 systems.

Brian G4EWJ (Code writer & developer of the Digi Lite modulator and DigiThin TX module) demonstrated his latest prototype processor and modulator to be used with the RPI B+with the sub board directly mounted on the RPi.

Features of his new design include a Digital I & Q filter which provided much closer control of the Nyqist filter and the improvement of the RF signal shape and adjacent products. The digital filter will track the chosen transmission bit rate. A most useful addition is a very small break off pcb section TX signal oscillator, often seen in SDR designs, using the Si570 PLL chip, controlled through I2C bus from the PIC , depending on the TX frequency range can be from 10MHz to 1.4GHz.

The physical size of the combined Rpi and sub-board will make a most useful portable transmitter.

The question of driver and PA linearity is a key issue to keep the optimum energy mask on the 146 transmissions . The M0DTS web site has more details PA devices he and G1LPS have used (see separate article in this issue).

Recommendations for RB-TV bit rates and spectrum occupancy.

The meeting consensus was for a target RB-TV bit rate of 333KBit which will be modified depending on the sound bit rate adopted. With the good I & Q filtering spectrum occupancy of 500KHz should be possible.

Field tests

Rob M0DTS and Terry G1LPS have made the first RB-TV transmissions on 146.5 over 10Km (26Km) Transmitters used were based on Express transmitters driven from a server/processor and using H264 Codecs. Receivers were Tutioune based and 333Kbit bandwidth. A great result down to the combined efforts of software writing by Rob and Charles and much testing and hours of "midnight oil".

Arthur G4CPE and colleagues have also made transmissions using just above 500KBit and ex commercial 70 MHz modulator/ MPEG2 codecs. Receivers were based on Tutioune cards. Spectrum shapes were achieved with multiple conversion and very good filtering.

Rolf F9ZG, St Gilles south of Cherbourg, has been testing with RBDATV on 70cm of several hundred km to Paris area for some time. Much of the tests were aimed at proving the revised Tutioune software. Rolf report that transmissions are viable under flat conditions with typical tropo., fading channel.

Summary

RB-TV is a very exciting new development for the ATV community. Much of the hardware and software written is being made available in the "spirit of open software" to the benefit of others. Thanks must go to all those contributors to this interesting new development. The application and ideas are those of the specific contributors, please respect their ideas and do not copy or reproduce in any form, any elements from this paper without express permission from the contributors.

DigiThin - A Narrowband QPSK Modulator for the Raspberry Pi

Brian Jordan, G4EWJ
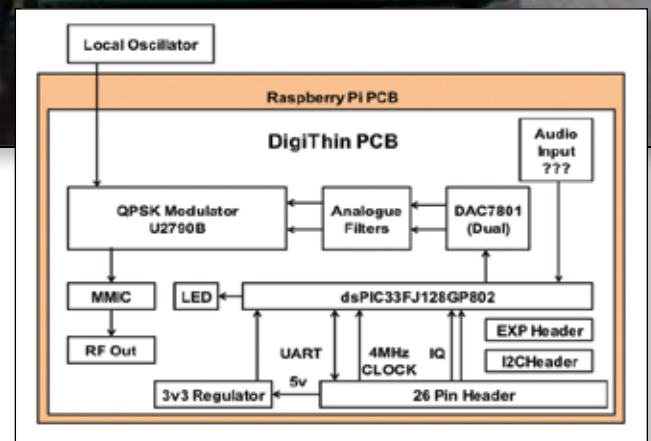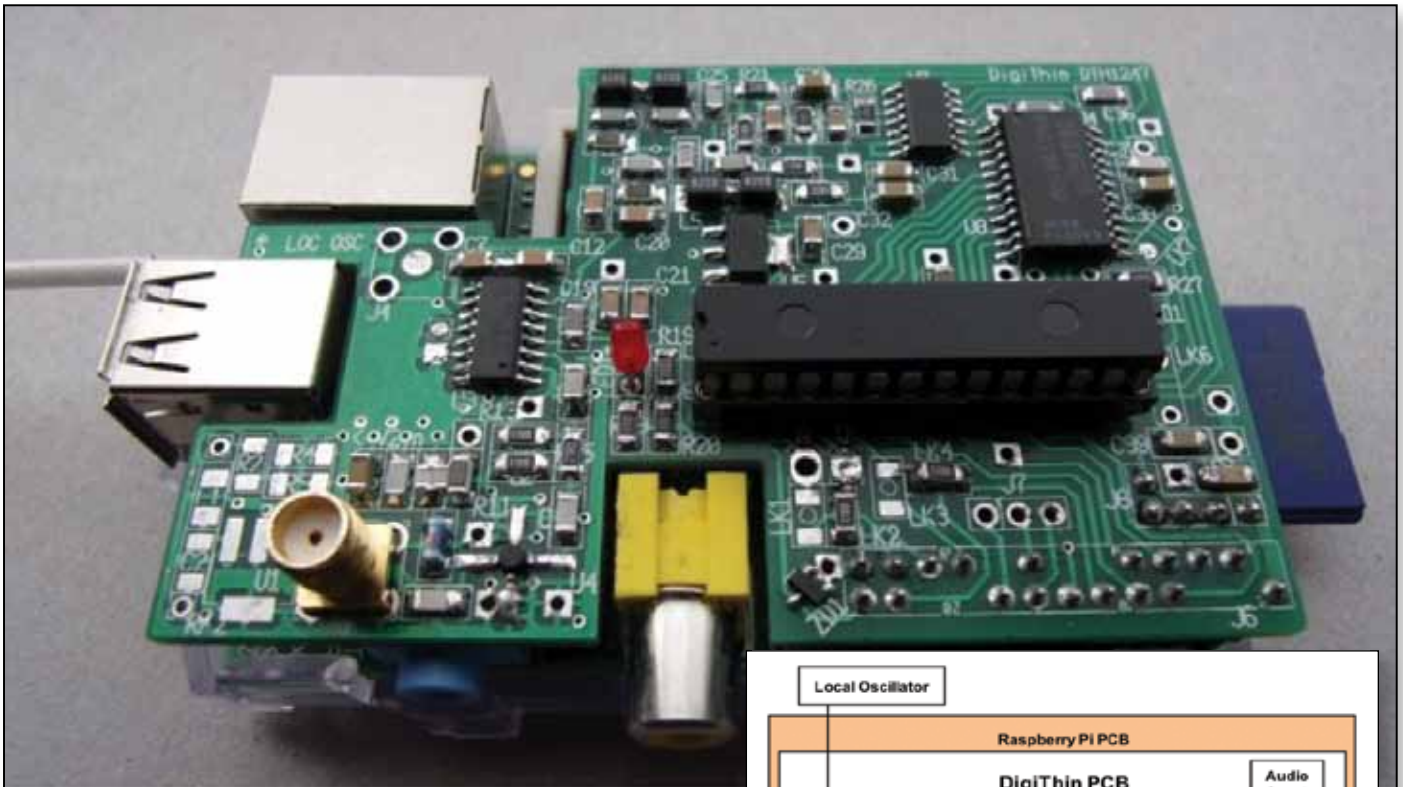
Features and Projected Spec

▶ sends QPSK / MPEG-4 video from the RPi camera

▶ fits directly on to the model B 26 pin header

▶ powered from the RPi

▶ receives IQ signals from F5OEO's RPi software

▶ applies digital filtering to the IQ signals

▶ outputs the filtered IQ signals via a digital-analogue converter (DAC)

▶ modulates directly at the tx frequency

▶ 1mW output power

▶ local oscillator (LO) option, or external

▶ several selectable symbol rates from 111k to 333k, without any hardware changes

▶ I2C and input / output expansion headers

▶ SOIC / 1206 components for easier soldering

▶ audio capture may be possible

Project Aims and Status

The main aim is to produce an RB-DATV (reduced bandwidth DATV) modulator with digital filtering, in a form that is easy to homebrew and has no adjustments. This has required some compromises. It will not have the performance of a device with more modern, but impossibly small, chips. I would have liked more time for testing and development, but the year of our 147MHz extension is ticking away. The project is not at the same level of development as DigiLite when it was launched. It is more like an advanced-stage experimental project. There will doubtless be component and maybe circuit modifications as people start to use it. It has only 333k symbols per second capability at the moment. The lower symbol rates may need slightly different filter software, but should be possible and the LO suppression needs to be improved.

Raspberry Pi

The Raspberry Pi has advantages as a cheap platform for many applications in amateur radio. The one of most interest to us is the directly connected high definition camera and H.264 (MPEG-4) video compression in hardware. MPEG-4 is twice as efficient as the MPEG-2 which we have mostly used so far and this makes low symbol rates and low bandwidth operation possible.

F5OEO has developed software for the Raspberry Pi to convert the camera video to a transport stream which can be sent to a modulator in various ways. DigiThin uses the two bit IQ option to receive the data.

The design was started before the model B+ appeared. As it gave no performance advantage, the design was not changed. If the model 2 had come out earlier, it may have been worth changing.

Video Quality

With video compression, there is always a trade-off between picture quality and movement, so narrow bandwidth require some compromises, but many of our TV transmissions are talking head and shack shots rather than fast motion.

Here is a link to some low symbol rate sample videos. The very low res one is 128 x 92 pixels. The RPi camera benefits from good lighting and the variation of the background should be reduced by this.
http://tinyurl.com/Low-SR-Samples

Connectivity

The transport stream data is received from the RPi as pairs of bits, known as the I and Q streams. Each bit stream is running at a speed identical to the symbol rate. Each IQ pair is known as a symbol and the two bits in the symbol are transmitted simultaneously.

The I and Q streams are square wave signals, so they have to be filtered before being applied to a modulator, or the transmitted bandwidth would be enormous. The DVB-S specification requires that the IQ filter is 60dB down at 1.35 times the highest square wave frequency in the IQ signals. In comparison, the 5 pole LC filter in DigiLite is only 30dB down at 2.0 times the highest square wave frequency.

DSP Filtering

It would be very difficult, probably impossible, to design an LC filter with the roll off as good as a digital filter. In addition, the filter requires a very specific roll off characteristic known as Nyquist or raised cosine. Digital filtering can require a lot of cpu power, but the low

symbol rates we are interested in make it possible with a modest cpu, such as the dsPIC used in DigiLite.

Digital signal processing is very strange stuff. It seems completely unintuitive as to how the equations work.

Raised Cosine Filter Impulse Response
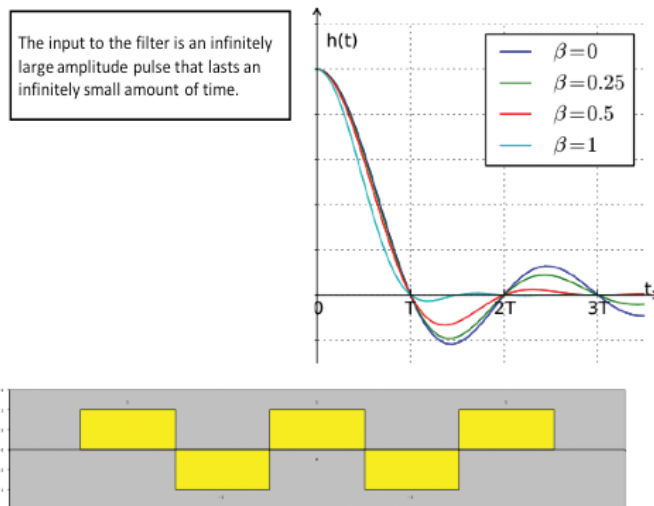
An important property of any filter is its impulse response. Basically and (I'm still trying to understand a lot of this myself) you apply an infinitely large pulse with an infinitely small width to a filter and look at what happens to the output. That tells you everything you need to know about the filter, as you can analyse its operation by splitting any input signal into a series of thin impulses and then adding the outputs generated by all the inputs. A filter can then be specified as a formula.

This leads to the surprising conclusion that any input to a filter has an effect on the output for an infinite amount of time. Any bit that is transmitted, interferes with every following bit, reducing in effect over time. This is known as ISI, inter symbol interference.

If the blocks in the diagram are the input bits (10101 in this case) and we consider that each bit consists of a single impulse at its centre, we can see that the interference caused by the middle bit is zero at the centre of all following bits. This is the useful property of the raised cosine filter. As long as we sample each bit at its centre in the receiver, there will be no interference from preceding bits.

The dsPIC on the DigiThin pcb takes the square wave IQ signals from the RPi, applies a mathematical formula to them and outputs the results to a digital to analogue converter as a shaped waveform. For 333k symbols, the DAC is updated at 4 times the symbol rate, = 1.333MHz. This is known as upsampling. Other symbol rates are upsampled by different factors so that the DAC is always updating at 1.333MHz.

Digital filter software works by generating a DAC output value arrived at by looking at as many previous input bits as possible. The higher the number of bits, the more the filter approaches the ideal width, but the higher the processing load. At 333k symbols, the initial DigiThin filter software looks back over 18 bits, upsampled by 4. This is described as a filter with 72 taps. It should be possible to increase this, perhaps to 128 taps. The more taps, the narrower the filter.

Although a digital filter does a good job, it acts in some ways like a mixer and produces spurious signals at multiples of the DAC update rate. There will be unwanted outputs around 2.666MHz, 4.000MHz etc. An analogue filter is required after the digital filter, with a roll off that starts where the digital filter finishes (at the highest symbol rate we want) and is well down by the time that the first spurious signals appear around 2.666MHz. A 5 pole LC filter achieves this.

DAC

The only DAC that was big enough for homebrew and could interface to the dsPIC was the DAC7801KU, which is difficult to find. It has only 12 bit resolution. 14 bits would be better. This makes the bandwidth a little wider than ideal.

Modulator

The U2790B QPSK modulator has self biasing inputs for LO and IQ. It can be fed with single ended signals and there are no adjustments to make. This makes it easier to interface to than the AD8345, which requires push-pull signals. It also has the advantage of having 1.27mm pin spacing rather than 0.65mm.

The output of modulator goes through a 6db attenuator and into an SGA-3586 MMIC which has a gain of 25dB, giving an output of around 1-2dBm, about 10dB below the P1 compression point for the MMIC, for good linearity.

One advantage of upsampling the digital filter input bits is that as long as the DAC update rate of 1.333MHz is kept the same, which it has to be because the analogue filter which follows it is specifically for that rate, we can use any symbol rate where the symbol rate times the upsampling factor is 1.333M. This requires different software for each symbol rate, but no hardware changes.

Symbol Rate	Upsample	DAC Update
333k	4	1.333M
266k	5	1.333M
222k	6	1.333M
190k	7	1.333M
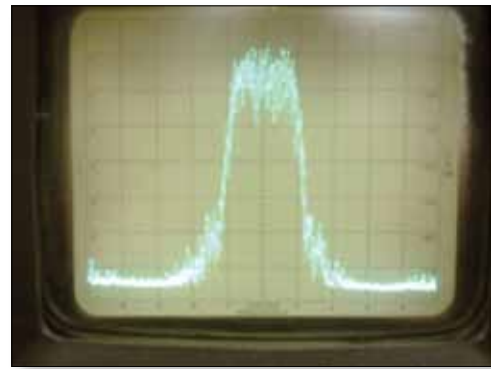
▶ *333k symbol, 10dB / 200kHz per div, ref -17dBm*

Local Oscillator

The local oscillator level should be about -10dBm at the input socket. At the top left of the DigiThin pcb is a break-off section which takes an Si570 synthesiser. These come in many versions and the cheapest costs £12 and goes to 160MHz. The Si570 pcb is designed to fit under the DigiThin pcb on the J8 I2C header and be controlled directly from the RPi. The RF output is a square wave, so it may be possible to filter the 3rd harmonic and use it on 437MHz. There is a 945MHz version that costs £40. This section is still under test and it remains to be seen how much leakage there is from an unshielded oscillator so close to the modulator section.

Reception

Broadcast receivers generally will not work at symbol rates below 1000. The TT S2-1600 PCI card with F6DZP's Tutioune software has been the mainstay of reception so far. Unfortunately, this has just become obsolete. Investigations are continuing into a replacement. Reception of RB-DATV is a greater challenge than transmission.

Components and Software

The DAC has proved difficult to find at a sensible price from normal outlets, so these are being sourced from China. When they are available, a sub-kit of the pcb and major parts will be available from the BATC shop. As the software, may be subject to frequent changes, the dsPIC will not be available from the shop, so a dsPIC programmer will be required. Investigations are continuing which may enable the RPi to program the dsPIC in circuit.

The construction and software details will be available on the web at the following links. The news will be updated if any of the others are changed.

http://tinyurl.com/DigiThin-News-Updates
http://tinyurl.com/DigiThin-Hardware
http://tinyurl.com/DigiThin-dsPIC-Software
http://tinyurl.com/DigiThin-RPi-Software

DigiThin Beta Testing

Colin Watts G4KLB

I was lucky enough to have been sent two PCBs (and a few other parts) by Brian for beta testing to see if there were any problems. This isn't a DigiThin article, just a few notes on my Beta testing experience.

Construction was very straightforward, most parts are 1206 size so not too hard to solder (I had some 0805 parts in stock, they will just fit but recommend 1206) the ICs are also fairly easy to fit, no really close spaced pins. There are some links, pads and headers for optional items such as an extra mmic on the output and for future developments. The boards have a 'snap out' part for an optional Si570 xo that is being developed. The PCB is very strong so I cut mine out instead.

If you want the assembly to fit into a standard Pi case, the dsPIC can be soldered in, but I chose to fit an IC socket for this one. (If you use a B+ or Pi2 the board will need to be fitted above the extra USB sockets anyway). I didn't have a circuit diagram so just used the PCB overlay and parts list for assembly.

All parts fitted and plugged into the Pi, it was time to switch on. Always a nervous time, looking out for smoke and bits of track disappearing. Relived that none of this happened a reassuring flash from the on-board LED was seen. A poke about with a finger confirmed nothing was getting too hot either.

The LED was flashing .-… wait or stand by in CW, nice touch I thought.

Having previously played with Evariste's UglyDATV I had an SD card with software on already - some extra files needed to be added for this version, but after several emails and Skype sessions I had completed my Big Dummy's guide to Linux!

The parts list was for 437MHz so I used a Digilite VCO (available from the BATC Shop) and although there is a 6dB attenuator on the DigiThin PCB I needed an additional 20dB attenuator on the VCO.

The digital nyquist filter on this version is for 333Ks and the test file has a FEC of ¾, so I set up Tutioune with these parameters and connected my 70cm SUP2400 upconverter, switched to H264, and although there is no sound channel at present it seemed necessary to set the audio pid to 1000 before the picture appeared (video pid was 1001 as default) IT WORKS!

The next day I dug out my Si570 VCO (that needed less attenuation) set it to 437MHz and it worked straight away, on a roll now - switched it to 146.5MHz and connected my global upconverter to the receive. Despite not making any changes to component values the video started to play. Fitted the 70cm SUP2400 back in and the video was still seen despite the constellations looking a complete mess, amazing.

I have since tried the Pickit3 in circuit programmer and can now update the DigiThin PIC software without removing the PIC and also fitted 1000pf capacitors in place of the 220pF capacitors on my second DigiThin, which works fine on 146.5MHz at 333Ks/S.

To summarize, I had no problems with the build - software and add-ons are still being developed.

Many thanks to Brian G4EWJ and Evariste F5OEO for all their hard work and assistance.

Add-On Transport Stream Dock for BATC DTX1

*Laurence Cook - M0LDZ*

Introduction

The BATC DTX1 DVB-S Encoder/Modulator has proved to be a very popular unit, and there are now many of these out in the field giving good service. It's based on Antennair's QUADRANT Modulator design, which was and still is targeted at TV distribution applications for DVB-T, such as feeding a local video signal (from a set top box or CD player) through an RF distribution system to several other DVB-T TV sets, whether in domestic or commercial applications.

As such, the main board architecture features an video encoder to convert composite, or S-Video, into uncompressed video. This then feeds an MPEG2 compression chip and the resultant transport stream fed to an FPGA which produces the complex DVB-T signal (2K carriers!!) in digital I,Q form. These are then fed to a dual DAC to generate analogue I,Q for final modulation onto an RF carrier. The MPEG chip alone is quite expensive, and so an early decision was taken to produce single channel units as standard but to allow for expansion to 2 channels by adding a daughter card with a secondary MPEG2 encoder on it, which would only be fitted if a Dual Channel unit was ordered. For amateur TV use in the DTX1 case the FPGA is loaded with DVB-S logic and the RF frequency upper limit extended, further than was envisaged initially.

Challenges

When OFCOM made the 2m Band available for Amateur DATV use we began investigating how we might make use of the DTX1 for this band as well.

The first issue to be tackled was control over the digital RF synthesiser. Work has recently been done recently to by Carl M0ICS to extend the range and it is now
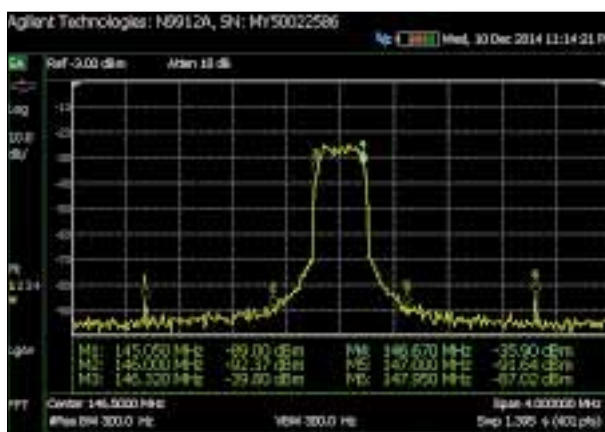
possible (via a firmware upgrade) to cover the Amateur TV 2 Metre band. So suddenly the prospect of 2m DVB-S DATV transmissions is in sight. Empirical tests later confirmed by Darren, G7LWT, have shown a nice clean signal is achievable.

The test signal was obtained from the on-board MPEG2 encoder, modified to run at low bit rate. The resulting RF spectrum plot (See Fig 1) is very encouraging but the video signal is not able to keep up with movement in the source image, so is for practical purposes really quite unusable at low bandwidths. There is little option but to compress the video using H.264 encoding which is a lot more efficient. A full explanation of why this is so is beyond the scope of this article but well described in the public domain. Unfortunately the MPEG2 chip is hard coded (well it's a software encoder with hardware assist to be precise) but the code is Fujitsu proprietary. So what can be done?

The Way Forward

It's at this point that the DTX1 architecture saves the day! The FPGA has a second transport stream input, brought out on the board to a 0.1'' pitch 34 Way Header, which is where the secondary MPEG2 board connects when used. In principle any parallel transport stream can be fed in here, although the existing firmware only 'unlocks' the port when it 'sees' an Antennair secondary encoder on the I2C bus.

This is a legacy of the original Quadrant's DVB-T offering but is restrictive for our current purposes. M0ICS has therefore produced a Beta release of code which not only covers 2 Metres but also unlocks the secondary TS Stream port and provides a flexible set of menu options to cover most likely external encoder scenarios. The on-board CPU still deals with the SI tables, keyboard scanning, LCD display etc. but does not attempt to configure and external encoder other than set the clock direction to be IN or OUT from the DTX1. So we are almost there – except the port is buried in innards of the unit, and is directly connected to the expensive Xilinx FPGA – not the sort of thing you want to connect directly to the real world. Static would see it off! So we need some sort of real world interface.

TS-Dock Board

M0LDZ (formerly 2E0DTX in case anyone is wondering) had designed a neat little PCB that plugs directly into

the main board port and mounts on the same holes as did the Secondary MPEG encoder. It derives its power throught the same connector. Electrically it's very simple – basically just some buffers to clean up signals and afford a first line of defence against static, and some explicit protection components Zeners mainly) against accidental input surges.
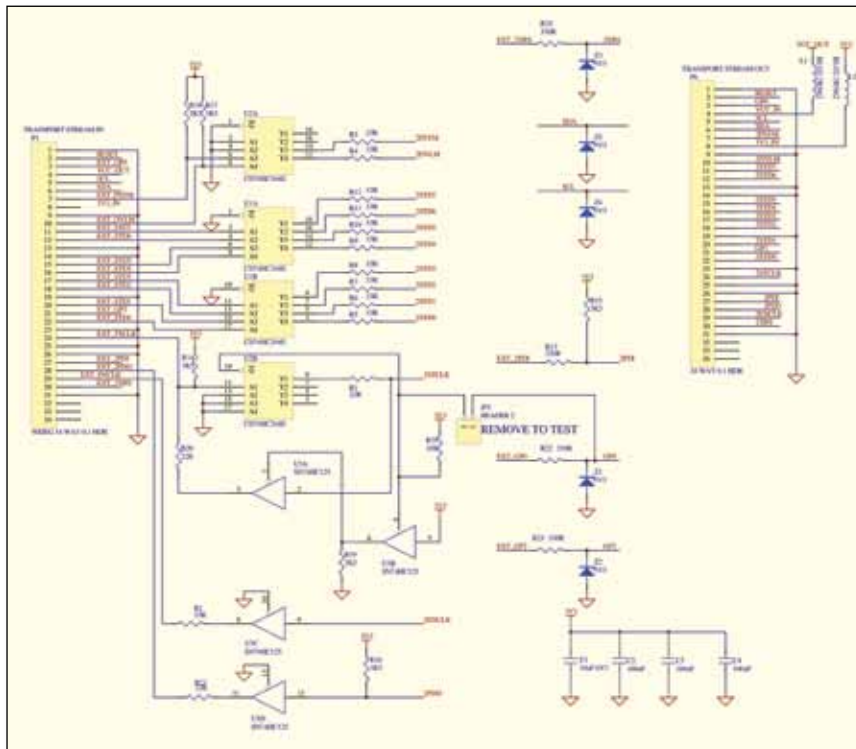
The idea is that a ribbon cable can then be routed from the board's output connector (also a 34 way header) over the top of the DTX1 rear panel, to whatever external encoder is wanted – provided it's a parallel data stream at TTL/CMOS 3V3 levels. A little judicious filing can easily take of a few mm from the top of the panel – some edging strip can be used if required to prevent cable damage.

Because the circuit is so straightforward, and there is plenty of room available, it was decided to use conventional 2 Layer laminate and through-hole components for this board and to offer the bare PCB

as the basis of a home brew project. It's not economical for Antennair to make a surface mount board in low volume, or through hole either, and so this nicely solves that problem and at the same time gets us back to the self-build project where we all started! All you need to do is get a few chips and conventional passives and start soldering.

Full documentation including parts lists will be provided with the blank PCB which will be made available through the BATC shop soon.

Producing an H.264 Transport Stream

This is the last piece of the jigsaw. For amateur use a commercial H.264 Encoder is prohibitively expensive and will probably present the stream over DVB-ASI (75 Ohm Coax) which is not compatible with the DTX1's FPGA port, and not a parallel stream.

So this final hurdle is offered back to the community. Present thinking is that a Raspberry Pi is a good candidate as it uses a chipset made by Broadcom and has hardware H.264 encoding encoding capability.

Discussions are ongoing with Evariste, F5OEO, and it is likley that his software will be modified to provide the DTX1 interface as an ouput option – watch this space!

Summary

The DTX1 has already proved itself to be a very versatile MPEG2 based DATV tx system covering 70cms and 23cms as well as other bands suchas 3.4 Ghz using external transverters. The new firmware further increases the RF coverage to include the new 146 Mhz band and the new PCB provides the capability to use H264 at normal or low symbol rates across the complete frequency range.

RPiDATV software improvements

Noel Matthews G8GTZ

Since the last issue of CQ-TV Evariste (F5OEO) has made significant improvements to the RPiDATV software. In particularly he has implemented a user interface making both the configuration and operation very easy and without requiring any Linux knowledge.

The software is supplied as an SD card image and will need installing as described in the previous article. On booting the RPi you still need to log in, type "cd RpiDATV" and then start the program by typing "./gbmenu.sh"

The top level menu will appear and from here you can configure the program or start the transmission.
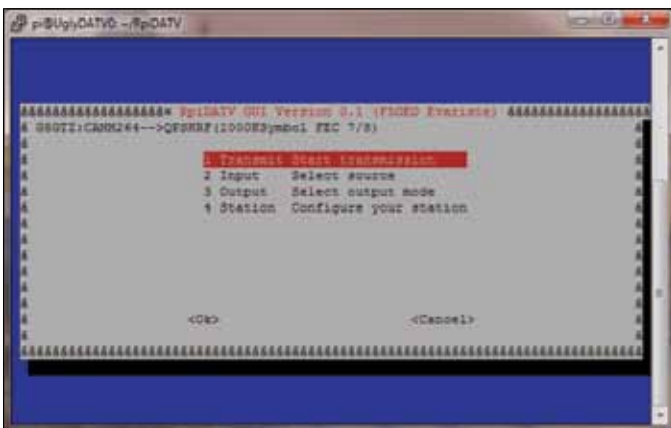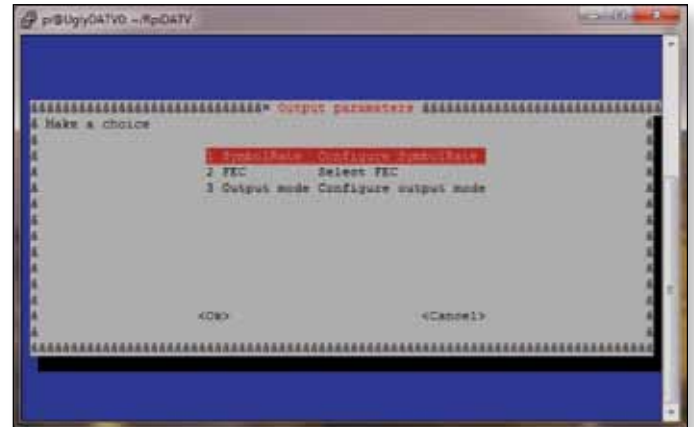

The input source menu enables selection of the on-board camera or pre-recorded transmit file which could be a test card.

The onboard RPi camera does not have an audio input but it is possible to select to use the camera with an external USB audio input.
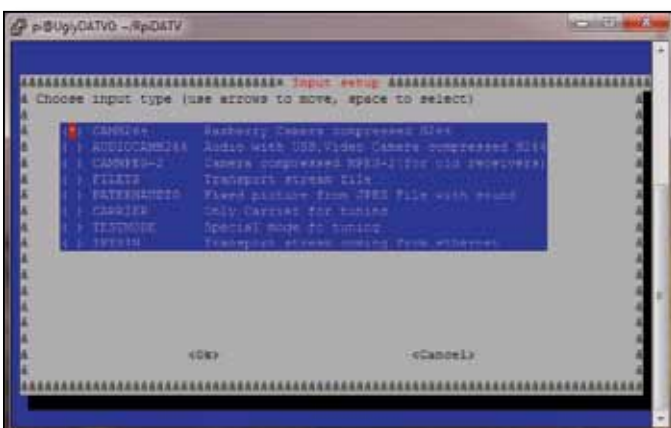

The output menu enables configuration of FEC and symbol rate but also to select the actual output mode.

Currently it allows selection of I&Q data (for connection to DigiThin or Digilite), direct QPSK modulation or UGLY mode. There is also an option to stream directly to www.batc.tv – you just need to enter your personal stream name.

In the future it is planned to offer parallel output (for connection to the DTX1 transport dock input or any external modulator with a parallel input) and a UDP output to drive DATVexpress.
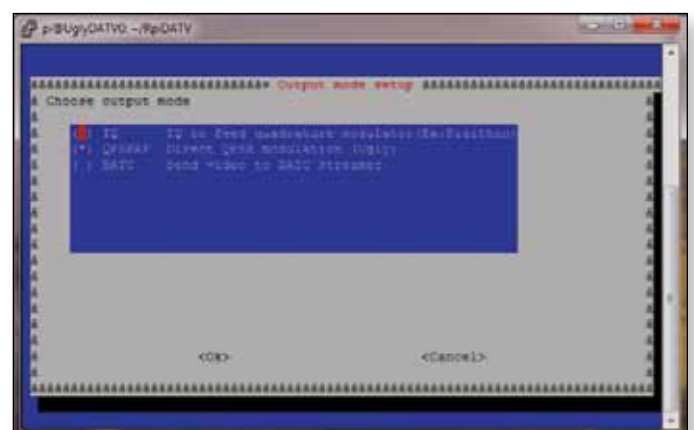
Possible future enhancements include push buttons to select SR, FEC, and input source etc and there will be no need for a display or keyboard to control the RPi, thereby making an ideal unit for portable use.

The RPiDATV software has a lot of potential to offer a low cost, versatile, easy to use and portable MPEG-4 encoder for a variety of uses and when used with the DigiThin plug in modulator card is a self contained RB-TV transmission system. 🗪

GB3KM - the first year of operating on 3.4GHz

Terry Roxby G1LPS

GB3KM recently completed two milestones. Ten years on air and its first year Transmitting on 3.4Ghz. It began its service on 3.406GHz at 16:00 on the 21st December 2013 at 16:00. This was one year and three days after the application was submitted.


▶ *The test site was at Danby Beacon IO94NL. Operated by M0DTS/P and his ATV van.*

So far the transmitter has given good coverage equal to - if not better than - that which we had previously seen on 2.44GHz before all users suffered from severe wifi interference. It's far outperforming the 10GHz output. Eddie G0EHV and Rob M0DTS are both using indoor antennae at similar distances for reception of KM's output. Clive G4FVP is using just an LNB. The BATC streamer output form the repeater is from Rob's indoor antenna at 28km. We have seen that 3.4GHz can penetrate some obstacles such as roof tiles and is not strictly line-of-sight.

When the repeater first came on air we carried out some tests to determine how well the RF would travel. Looking at the results below we can presume reflected signals must be possible but our testing has been limited as the output just worked. Leaves on trees, however, do absorb a lot of signal.

Here is an account of one of the tests.

At the transmitter end the repeater was running 10 watts into 10 meters of Pope H100 cable (a little lossy but was already installed on the mast) feeding a tiny Alford slot antenna at 200m above sea level. GB3KM is part of the shack here at G1LPS - located at Kirk Merrington IO94EQ.
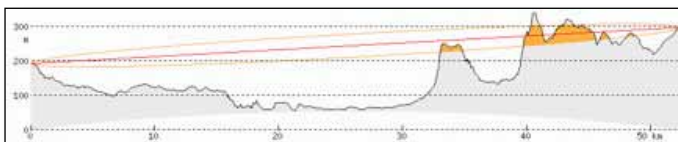
▶ *GB3KM 200m ASL*   *Site1 297m ASL 52.4km*

This site at 52.4km was chosen as it was just over the horizon. The receive antenna was a 80cm offset dish with a cheap C-Band LNB bolted on. The signal at 2.44GHz 20 watts to Alford slot was also known at the site and was compared. Being rural there was little wifi on 2.4GHz so was a good comparison. The Comag receiver reported a signal and quality of 90% on 3.4GHz

2.4GHz was P4 on the same dish with bowtie feed and Khune down converter.
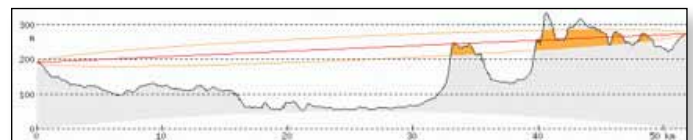
▶ *GB3KM 200m ASL*   *Site2 274m ASL 51.8km*

Rob then moved to the next test site some 30 meters lower down the hill and setup again. This time the Comag receiver reported 88% quality. We were very surprised indeed. 13cm was checked and gave a P2-3
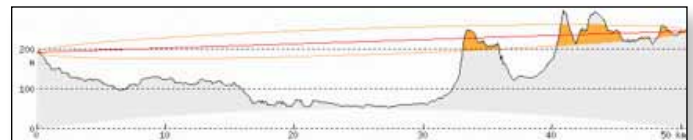
▶ *GB3KM 200m ASL*   *Site3 246m ASL 50.4km*

Spurred on Rob proceeded to an even lower site and this time the Comag reported 70% quality on 3.4Ghz. 2.4Ghz was difficult at P1 occasional P2.

In a separate test just after switch on, Brian G3KJX, went to his trusted portable site at 50km to look for the new signal and was rewarded with a P5 picture immediately with just an LNB laid on the ground. He tried a path just to the west also with good results. Unfortunately a signal from the repeater on any output is still alluding Brian at his QTH just a few miles away. He does have access on 23cm though and watches the streamer.

▶ *The stand alone Digilite TX*

Equipment installed at KM

Hauppauge usb PVR, mk808 Stick PC, Digilite and a converted Airspan AS4000 board to mix the Digilite 23cm signal to 9cm
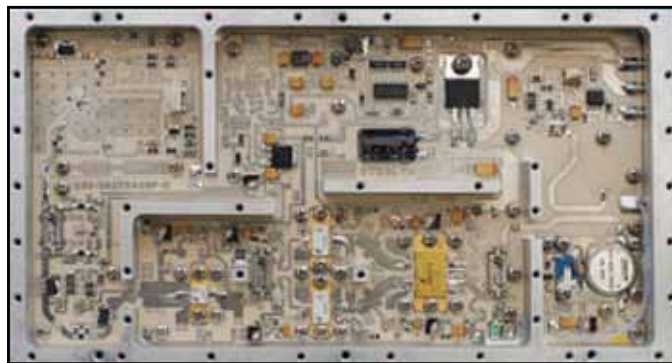
Amplifier

Recently a source of Stealth Microwave SM3437 PA modules became available. The rated power output is specified at 20W but they have been found to produce over 30W with 0dBm drive, and more importantly no modifications were needed to operate on 3406 MHz. As an added bonus it will operate safely from 13.8V as the main FETS are rated at 15V.

There is also over voltage protection contained in the PA that prevents the bias supply from activating if voltages are out of specification. In order to operate the unit the I/O pin (TTL level) needs to be pulled to a logic 1 or +5V, or simply connect via a 4.7K resistor to the +12V supply rail to activate the amplifier. The unit is biases in class A operation and consumes 8.5A with no drive. The amplifier is well protected by a circulator on the output, and has DC monitoring outputs for forward and reverse power levels.
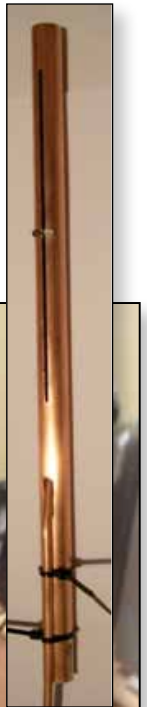

Antenna

The 3.4GHz Alford slot antenna was mounted in the same radome and on top of the 3cm transmit and receive slotted wave guide antennas. This is all mounted on top of the 3cm equipment box.

▶ *Coverage map for GB3KM*

ATV image generator using the Raspberry Pi

Ernest Neijenhuis PA3HCM

I've got a Raspberry PI for a while already, but it hasn't been very useful until today. I recently started setting up my own ATV (Amateur TeleVision) station. I needed a simple solution to generate a test pattern, something to broadcast when testing my ATV transmitter. Since the Raspberry PI has a composite video output, there must be a way to let the PI do the job.

I found several projects on the internet. However, they produce only HDMI output, no composite video. After browsing the web, I found a very easy solution using the Linux fbi command. This command allows you to load a picture in the frame buffer of the graphics adaptor.

10 Steps

Since the Raspberry PI will run Linux, some basic skills at the Linux command line will be helpful to get the thing running…

Step 1: Get yourself a Raspberry PI and a 4GB SD-card. You will also need a 5V power supply with a Micro-USB connector. Also consider buying a corresponding case (I don't know how your shack looks, but mine is always cluttered with solder drops, cut wires, metal tools, and all kind of other things that could create a short circuit on my Raspberry PI).

Step 2: While waiting for the Raspberry PI to arrive, you can create your favourite test pattern or whatever you like. Save it in JPEG format, name it test-pattern.jpg (all lowercase). Note that PAL 4:3 has a resolution of 768 x 576 pixels.

Step 3: Install RaspBian on your Raspberry PI.

Step 4: Connect display, keyboard and network. Then login at the console using the default username 'pi' and the password 'raspberry'.

Step 5: Get root:

```
pi@raspberrypi ~ $ sudo su –
root@raspberrypi:~#
```

Step 6: Install fbi:

```
root@raspberrypi:~# apt-get install
fbi
```

Step 7: Create a small script called /root/atv-generator.sh using nano:

```
# nano /root/atv-generator.sh
```

Enter this text EXACTLY, then use Ctrl-X to save and exit:

```
#!/bin/bash
/usr/bin/fbi -d /dev/fb0 -a /root/
                test-pattern.jpg
```

Step 8: Use nano to edit /etc/inittab. Find the line for tty1 and replace it as shown below. This will start the atv-generator.sh script automatically when booting the Raspberry PI.

```
…
#1:2345:respawn:/sbin/getty –noclear
38400 tty1 1:2345:respawn:/bin/bash /
root/atv-generator.sh 2:23:respawn:/
sbin/getty –noclear 38400 tty2
3:23:respawn:/sbin/getty –noclear
38400 tty3
…
```

Step 9: Put the image in the directory /root, be sure it's named test-pattern.jpg. You may use SCP or SFTP to copy it over the network, or transfer it by USB-stick.

Step 10: Reboot your Raspberry PI and enjoy your test pattern!

*More experiments in Amateur Radio including ATV can be found at Ernest's website: http://pa3hcm.nl*

Local oscillators in 1.2GHz band, for Digilite DATV System

Fabrizio Bianchi IW5BDJ

We have made seven Digilite DATV Systems and all are working well. During the testing of the prototypes we experimented with three types of local oscillators ,two with PLL system and one with xtal and we noticed that the local oscillator has a very high influence on the system stability and on MER and BER parameters. In the worse case it was impossible to decode the received signal.
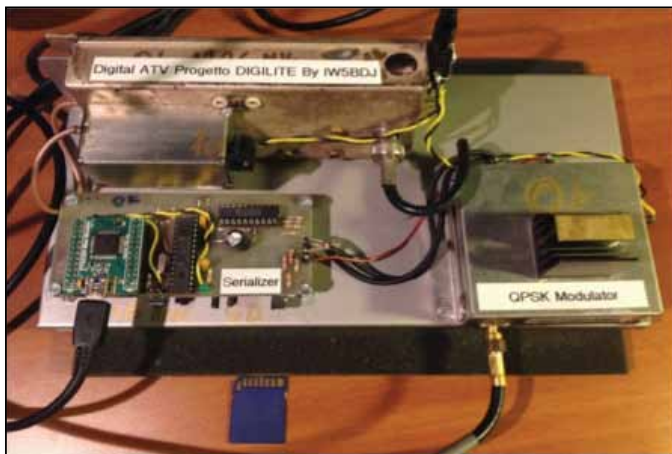
The first oscillator we looked at was the SP5055 i.c. and SP5511 controlled via I2C bus with PIC 12c508 and 24C16 used as programmed component. The circuit was the classic circuit we can find on the data sheet of SP5055, but its behaviour was not good and we had very poor decode performance. We work for a lot of time on control loop of SP 5055, without meaningful results. (*Editors note – see G8GKQ's article in CQ-TV 245, page 14, confirming these results*)

A member of our group bought a lot of tuners for analog receivers that had the oscillator controller one SP5659. Using only the local oscillator from the tuner and varying the range of oscillation by putting some capacitors around the oscillating transistor, we achieved a minimum frequency of 1100 MHz and with a very low voltage on varicap we obtained the required frequencies for our work. We put on an SMA connector to take off a little oscillator power and amplified the signal with a MMIC to a power of +2/3 dbM, enough for driving a DVB-S modulator.

With this type of oscillator ,controlled by the SP5659, we have an improvement of BER, MER, due to lower phase noise compared with the oscillator controlled by SP5055.

We repeat these experiments with the digital transponder placed on a hill about 20KM away from the transmission center – we have a great improvement thanks to SP5659 system.

The third type of local oscillator is made starting from a xtal of 12 or 24 MHz, multiplying for 108 ($12 \times 6 \times 2 \times 3 \times 3$) or 54 ($24 \times 3 \times 2 \times 3 \times 3$) to obtain 1296 MHz.

We found these oscillators in surplus market, used for professional terrestrial analog converters, and we modified the output frequencies. This type of oscillator is the best for our use – we have no errors in BER but unfortunately our testing stopped as it was not possible to easily find the required crystal for our frequencies.

It is very difficult to find the differences between these three oscillators with the aid of spectrum analyzer. If we reduce the bandwidth of this instrument we notice a large 'shimmer' with the SP5055, lower with SP5659. This 'shimmer' is the phase shift that in analog system was negligible for transmission, but in digital system became untenable..

Questo è il nostro oscillatore locale
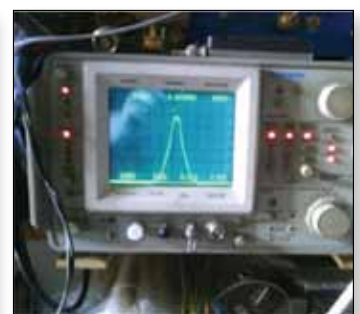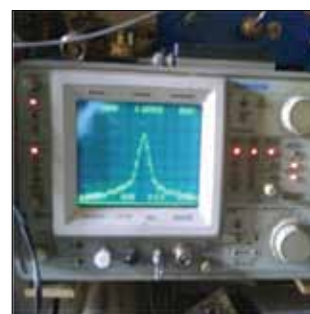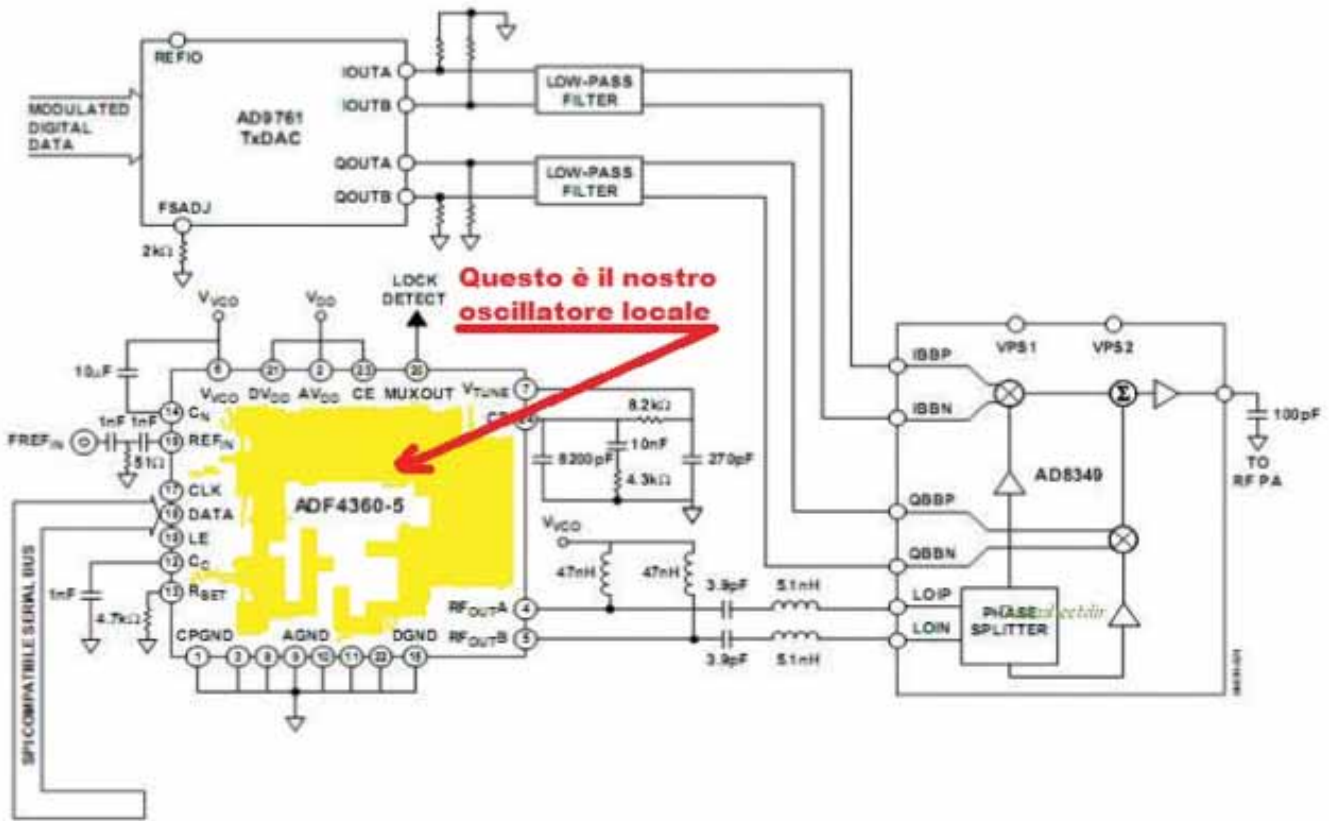
We are now studying a VCO+PLL in the same chip and following the advice of CQ-TV and the Digilite team we choose AD4360-5. This i.c. from Analog Device is able to drive directly the I and Q modulator without the use of a transformer because it conveys the right signal 90 degrees out of phase. We have already made the printed board to receive the AD4360 component, together with a new Digilite Modulator on the same board in order to obtain a compact oscillator and modulator, with very short connection. We already bought all the components and designed a prototype PCB of the oscillator with right sizes and we are happy to supply the CIRCAD file to anyone who is interested.

The hardest part of this circuit is the soldering of AD4360 due to the reduced size of the component, but we hope to realize this circuit with the aid of someone who can work with this type of components.

At the time of writing this article test are still under way, but we'll publish the results as soon as they are available.
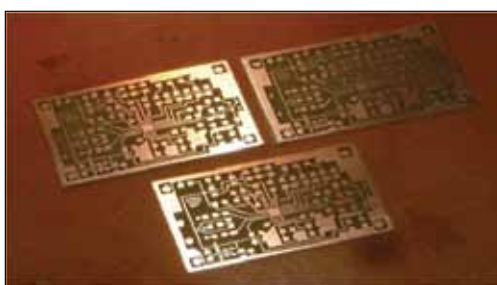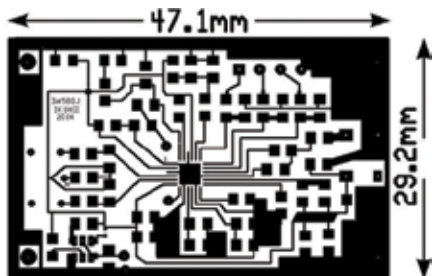
STOP PRESS - RB-TV receiver developments

As we went to press F6DZP posted news of a DIY USB tuner he is developing for use with Tutioune software – this is great news as it this means it will be possible to run Tutioune on a laptop when out portable. F5OEO is also looking at the potential to develop a self contained receiver using similar components based around the RPI.

It is very early days yet and neither project is complete but it is likely we will stock the modules and PCB in the BATC shop. This will be covered in a future edition of CQ-TV but for more details and up to date news, monitor the BATC forum. 🗨
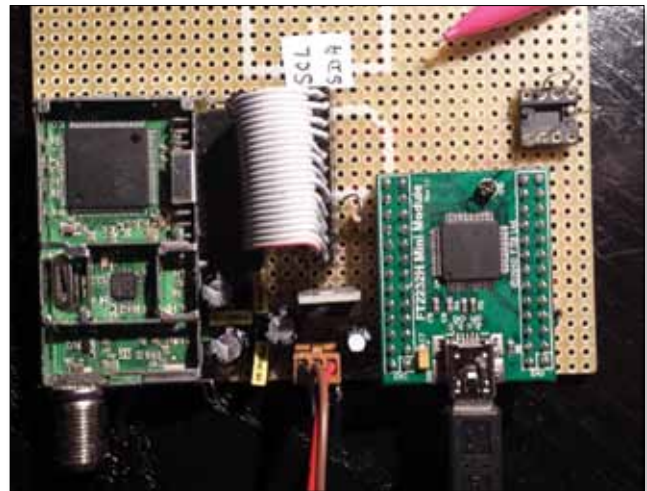
Digilite parts

With the introduction of other DATV systems, sales of Digilite parts in the BATC shop have slowed. In order to ensure the club does not end up holding stock of unwanted parts we have decided not to restock Digilite items as a matter of course when we sell out of them. If there is sufficient demand for individual parts we will buy more but members should consider the items

that are currently in stock to be last time buys and not presume that we will be restocking other items needed to complete the project.

The ATV community owes the Digilite team a big THANK YOU for this project which, over the last 3 years, has sold over 150 kits of parts and enabled many people to get on air with DATV. 🗨

Comparing DATV models

Ken Konechy W6HHC

I found myself completely overwhelmed by the sheer number of different DATV models being offered by HiDes. The following table was prepared to protect my sanity. This table compares ham DATV equipment models from BATC, DATV-Express, HiDes, and SR-Systems.

Please send any additions or corrections to me at **W6HHC@ARRL.net**

Company/MODEL	TYPE	Standalone	Price	Frequency Range	DVB-T Channel BW	Encoding	Average RF Power Output	Protocol
BATC DigiLite (kit)	TX	USB	~ £120 with soldering components	420 - 450 MHz or 1200 - 1350 MHz	N/A	MPEG-2 with Hauppauge	-10 dBm to -15 dBm	DVB-S
BATC DTX-1	TX	Y	£459 €585	70 - 1350 MHz	N/A	MPEG-2	-5 dBm	DVB-S
DATV-Express (w/ 4-core i7 PC)	TX	USB	US $300 £215	70 - 2450 MHz	1 MHz -thru- 8 MHz	MPEG-2 with Hauppauge	DVB-S 10 dBm DVB-T -5 dBm	DVB-S DVB-T
DATV-Express (w/ ODROID U3)	TX	USB	US $300 £215	70 - 2450 MHz	1 MHz	MPEG-2 with Hauppauge	DVB-S 10 dBm DVB-T -5 dBm	DVB-S DVB-T
HiDes HV-100E	TX	Y	€414 US $560	50 - 950 MHz	1 MHz -thru- 8 MHz	MPEG-2 & H.264	+3 dBm	DVB-T
HiDes HV-100EH	TX	Y	€414 US $560	1200 - 1350 MHz	1 MHz -thru- 8 MHz	MPEG-2 & H.264	-18 dBm	DVB-T
HiDes HV-110E	RX	Y	€125	170 MHz to 950 MHz	2 MHz -thru- 8 MHz	MPEG-2 & H.264	N/A	DVB-T
HiDes HV-200E	TX	Y	€492 US $660	100 MHz to 2500 MHz	1 MHz -thru- 8 MHz	MPEG-2 & H.264	between +3 and -18 dBm depending on frequency	DVB-T
HiDes HV-202E (CVBS and HDMI input)	TX	Y	US $660	100 MHz to 2500 MHz	2 MHz -thru- 8 MHz	MPEG-2 & H.264	between -3 and -18 dBm depending on frequency	DVB-T & ISDB-T
HiDes HV-310E v02	TX	Y	US $349	50 - 950 MHz & 1200 - 1350 MHz	1 MHz -thru- 8 MHz	H.264	15 dBm at 430 MHz 0.5 dBm at 1275 MHz	DVB-T
HiDes UT-100A	TX/RX	USB	US $199	RX 70 - 950 MHz TX 70 - 950 MHz & 1200 - 1350 MHz	RX 5 - 8 MHz TX 1 MHz -thru- 8 MHz	MPEG-2 & H.264	0 dBm	DVB-T
HiDes UT-100B	TX/RX	USB	125 euro	RX 70 - 950 MHz TX 70 - 950 MHz & 1200 - 1350 MHz	RX 5 - 8 MHz TX 1- 4 MHZ or 5, 6, 7, 8 MHz (by bridge switch)	MPEG-2 & H.264	0 dBm	DVB-T
HiDes UT-100C	TX only	USB	170 euro	70 - 950 MHz & 1200 - 1350 MHz	2 MHz -thru- 8 MHz	MPEG-2 & H.264	0 dBm	DVB-T
HiDes UT-100D	RX only	USB	US $80	170 - 950 MHz	2, 3, 4 MHz or 5 -thru- 8 MHz	MPEG-2 & H.264	N/A	DVB-T

Company/MODEL	TYPE	Standalone	Price	Frequency Range	DVB-T Channel BW	Encoding	Average RF Power Output	Protocol
HiDes UT-130	RX only	USB	US $199	100 - 950 MHz & 1200 - 1350 MHz & 2200 - 2600 MHz	2 MHz -thru- 8 MHz	MPEG-2 & H.264	N/A	DVB-T
HiDes UT-200AJ	TX only	USB	US $239	50 - 950 MHz & 1200 - 1350 MHz	6, 7, 8 MHz	MPEG-2 & H.264	Between -3 and -14 dBm depending on band	ISDB-T/ Tb
HiDes UT-210	TX only	USB	US $269	100 - 950 MHz & 1200 - 1350 MHz & 2350 - 2500 MHz	1 MHz -thru- 8 MHz	MPEG-2 & H.264	Between +13 dBm at 430 MHz 0 dBm other bands	DVB-T
SR-Systems e.K MiniMOD4	Transmitter Board	Y	€350 (Hams only)	70 - 2500 MHz	N/A	MPEG-2 with encoder board	0 dBm	DVB-S
SR-Systems e.K MiniMOD4	Transmitter Board	Y	€550 (Hams only)	70 - 2500 MHz	N/A	MPEG-2 with encoder board	0 dBm	DVB-S DVB-S2
SR-Systems e.K MiniMOD5	Transmitter board	Y	€500 (Hams only)	10 - 1100 MHz	1 MHz -thru- 8 MHz	MPEG-2 with encoder board	0 dBm	DVB-T
SR-Systems e.K MiniMOD5/A	Transmitter board	Y	€900 (Hams only)	10 - 1100 MHz	1 MHz -thru- 8 MHz	MPEG-2 & H.264 with encoder board	0 dBm	DVB-T DVB-T2
SR-Systems e.K HD-MOD	Transmitter board	Y	€550 (Hams only)	10 - 1100 MHz	1 MHz -thru- 8 MHz	H.264 encoder is onboard	3 dBm	DVB-T
SR-Systems e.K MPEG2 Encoder	Encoder board	Y	€175 (Hams only)	N/A	N/A	Use with exciter boards	N/A	N/A
SR-Systems e.K H.264 Encoder	Encoder board	Y	€400 (Hams only)	N/A	N/A	H.264 Use with DVB-T exciter boards	N/A	N/A
SR-Systems e.K Hamset3 (MiniMOD3 obsolete)	Transmitter	Y	€500 (Hams only)	70 - 2200 MH	2 MHz -thru- 8 MHz	MPEG-2	0 dBm	DVB-S DVB-T ATSC
SR-Systems e.K nim DVB-S (TS out)	Receiver Tuner (use with modulator)	Y	€50 (Hams only)	950 – 2150 MHz	N/A	MPEG-2	N/A	DVB-S
SR-Systems e.K nim DVB-S2 (TS out)	Receiver Tuner	Y	€100 (Hams only)	950 – 2150 MHz	N/A	MPEG-2 H.264	N/A	DVB-S DVB-S2
SR-Systems e.K nim DVB-T (TS out)	Receiver Tuner	Y	€75 (Hams only)	50.5 - 858 MHz	1 MHz -thru- 8 MHz	MPEG-2	N/A	DVB-T

► HiDes HV-310E

► DATV-Express

► HDTV Encoder

► DigiLite

► DTX 1

Video Fundamentals 2 Colour Bars

Brian Summers G8GQS

Everybody knows what colour bars look like, but what are they for?

In an analogue transmission system you can use them to measure the gain and distortions that might be present. The most demanding version are the 100% bars, but there are a wide range of different bar options for different uses:- 75%, EBU, BBC, NTSC, red patch, the list goes on…

The gains, luminance and chrominance, can be quickly set using a waveform monitor or oscilloscope. If a vectorscope is available the burst to chroma phase can be measured and some estimate of the differential gain & phase errors made.

Quickly said, but lets have a better look at what these terms mean.

Luminance Gain is simply the gain of the system, perhaps a DA[1] on the end of a long cable run, the white bar is adjusted to 0.7 volts amplitude and the sync pulse would be checked to see that it was correct at 0.3volts.

Chrominance gain is the HF gain of the system, for PAL[2], centred on 4.43Mhz. In a simple DA there would be some interaction between these two controls.

The burst to chrominance phase(s) for the 6 colours can be checked on a vectorscope as in Fig.4

Differential Gain & Phase is a more complex problem and is due to the non-linearity of amplifiers. Put simply the HF (chrominance) gain changes as the luminance signal level changes, i.e. if the chrominance gain is correct at a certain luminance level the gain might increase or decrease as the signal amplitude changes. The effect of this is to change the saturation[3] of the coloured areas of the picture.

Differential Phase is were the phase of the subcarrier changes according to the luminance amplitude, this time the hue of the colour changes according to the luminance amplitude. As the eye is quite sensitive to hue this can be a particular problem.

Whilst an incorrect signal level is easy to fix with a simple gain adjustment, Diff. Gain and Phase are very much harder to repair, so it is important that they don't occur in the first place.

1.   DA = Distribution Amplifier

2.   PAL Phase Alternate Line, an acronym referring to the colour system in use.

3.   Saturation, the amount of colour in a picture area, 0 to 100%
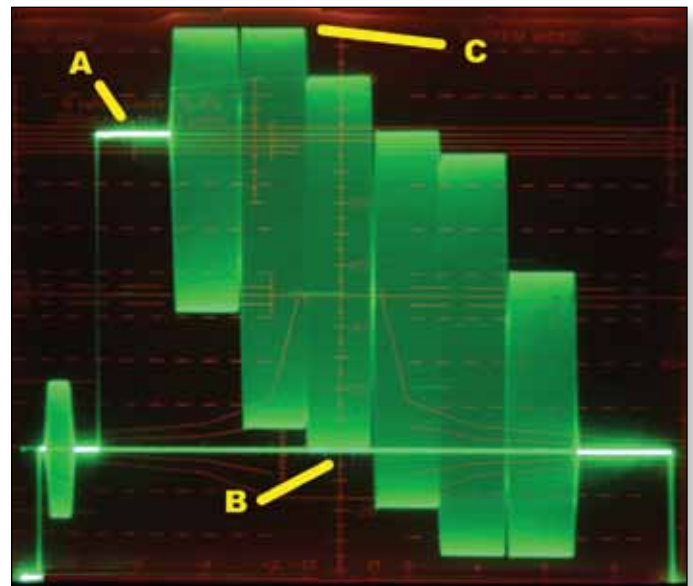
▶ *Fig. 1 100% Bars*
A = The white bar, 0.7volt no subcarrier present
B = Correct chroma amplitude when green bar just touches blacklevel
C = Flat top when U & V amplitudes correct

Now we have all seen colour bars on the monitor screen, Fig.1 is what the waveform monitor shows for a correct 100% bars signal and Fig.2 shows 75% bars. 100% bars is a demanding signal and will expose any deficiencies it the system. 75% bars are less demanding of the amplitude range of a video system and transmitters (AM broadcast) were the yellow and cyan bars of the 100% version would cause over modulation of the carrier. Less of a problem with FM and digital transmitters.
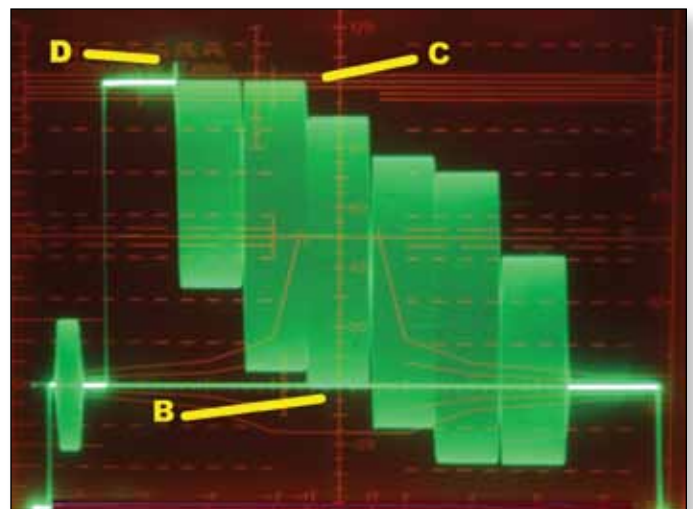
▶ *Fig. 2 75% or EBU Bars*
D = The top of these bars are flat, the little "pip" is not an error!
These Bars were made by a Tek TSG271 digital generator and are as near perfect as possible, hence the pip.
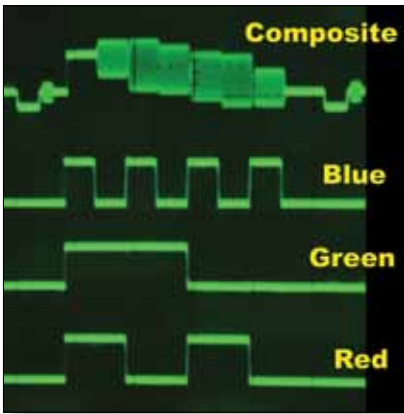
▶ *Fig. 3 Here is the RGB component signals the show the relationship between them and 100% coded signal.*

Colour bars are of course the coded version of the R G B components[4] which are simple square waves, with correctly shaped rise times. Fig.3 shows the RGB signals that are coded to produce the composite PAL signal. Added together in the ratio of R=30% G=59% B=11% to make the luminance signal to which is added the 4.43Mhz subcarrier modulated with the U and V axis signals. Depending on the abilities of the measuring vectorscope, the decoded RGB or YUV[5] waveforms can be observed.

Fig.4 is a vectorscope with 100% bars displayed. I would like to go through some of the common vertorscope features.

▶ *Fig. 4 100% bars displayed on a venerable Systems Video 1205 vectorscope.*

The graticule is marked with boxes that the dots representing the colours should be in, 12 for PAL, 6 for NTSC[6]. The small boxes are ± 3° and the larger boxes ± 10°.

Around the outside of the display is a circle, sometimes marked with degrees of rotation. This circle is used as part of the quadrature/gain calibration check that most vectorscopes have.

In the centre are the burst graticules, two lines at 90° for PAL, there is a amplitude mark for 100% and 75%, a switch adjusts the vectorscope gain so that the vector dots fall in the boxes and the burst to the appropriate mark.

A PAL vectorscope usually has a PAL/NTSC switch which overlays the PAL 180° V axis switch to show an apparent NTSC display, useful for checking that the length of the vectors are the same in both of the PAL axis. It is not a standards change switch and does not enable the display of true NTSC which has a different subcarrier frequency of 3.58Mhz.

Before you can measure the performance of a video system you have to start with a good test signal, PAL, or NTSC for that matter, colour bars are quite hard to make with any precision using analogue equipment, many "TV test" units can be quite poor. A number of manufacturers have got over this by generating the colour bars digitally via a D to A[7]. Fortunately for us amateurs these good quality digital PAL units are now redundant with the broadcasters and are cheaply available on the auction sites along with a range of waveform and vector monitors. An example would be a Tek 271 which makes a useful range of "perfect" test signals.

In closing it is worth mentioning that in a fully digital video transmission system, colour bars are not a lot of use as digital systems have a different set of errors, not much shown up by colour bars. A subject for a future topic. 🖝

This necessarily brief article only scratches the surface of the subject, for a full study please see the following for further reading:-

▶ Pal Specification IBA Technical Review 2 Technical Reference Book. [8]

▶ Principles of PAL Colour Television, H.V. Sims, ILIFFE books 1969. A full description, 154 pages.

▶ Television Measurement Techniques, L.E. Weaver, IEE monograph series 9. Very detailed, 518 pages.

▶ Television Engineering Handbook, K. Blair Benson, McGraw-Hill, 1986, covers all systems, 1478 pages.

▶ There is a Wikipedia entry:- https://en.wikipedia.org/wiki/PAL which should be read with the usual caveats.

▶ BBC DD. Technical Memorandum No. 8 242(67) Colour Bars.

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4.   Component, a colour signal is made of 3 signals RGB or the colour difference signals, Y, R-Y & B-Y.

5.   YUV, Luminance and the coded colour difference signals, see also R-Y & B-Y.

6.   NTSC National Television Standards Committee, color television standard, defined as RS-170a

7.   D to A   Digital to Analogue converter

8.   Download from the NTL pensions association http://www.ntlpa.org.uk/memorabilia

Classic circuits

First published in CQ-TV 180 but still in use today by many stations who need a very simple moving video pattern generator. Using a single 4 MHz PIC, the software and project details are still available for download from the BATC website.

http://www.batc.org.uk/cq-tv/software/index.html

PICDREAM by Alain Fort, F1CJN

Programmable Intelligent Circuit Dedicated to Radio and Electronic Amateurs, Mainly (Ouf !!)

Here is the first version of a video PIC system with:

▶ a 7 scrolling 5x7 character message at the top of the screen;

▶ gray scale bars in the middle;

▶ a real time clock at the bottom.

I wrote this program for all TV radio amateurs, looking for a low cost video generator. Thanks a lot to Peter Knight's original 4 Mhz synchronisation routines. Thanks to the British Amateur TV Club for its good pages on the PIC which decided me to use the PIC, to build my own programmer and write this little program.

I wrote all characters routines to get real 5x7 characters at 1 MHz with a 7 characters scrolling display, designed the clock routines and the gray bars and clock set-up routines. The PIC16C84 uses a 5V power supply and a 4 MHz crystal oscillator .

▶ *Picdream in use by G8GTZ on 23cms DATV in to GB3HV*
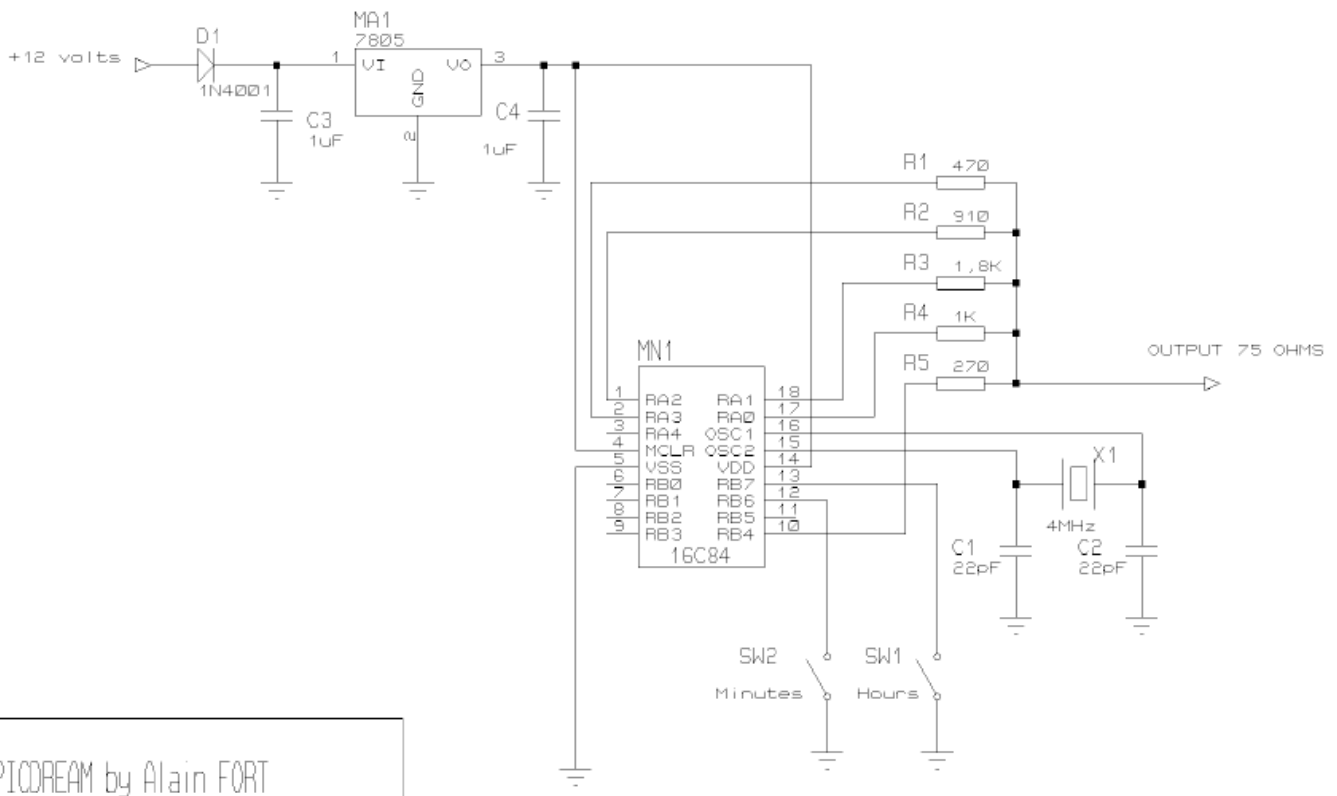
Turning Back the Pages

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

CQ-TV 60

Like several around the time, this issue of the magazine was undated, but would have been issued in 1966. Unlike the previous few issues which has a bias towards one aspect of amateur television, this one had a mix of rf, video and basic electronics articles.
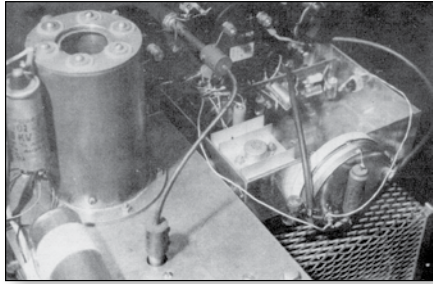
The rf related article featured a transistorised modulator for a valve 70cm transmitter. TV amateurs did not have 'ready made' transmitters available then - if you wanted to use one, you had to 'make it yourself'. Thermionic devices were still the preferred choice for high power circuits, so even the use of transistors for the modulator output stage was novel at the time. It was designed to use with positive modulation. The first 2 transistors were small npn types such as 2N3704, and the next pair were similar pnp types, 2N3702, which were followed by a TO5 style device such as a 40319, which 'must be fitted with one of the corrugated push on heat sinks'. The output device was a 2N3730, rated at 10W (or the similar 2N3731, which was rated to work at a much higher supply voltage), fitted to an aluminium heat sink spaced from the main chassis by stand-off insulated spacers, to keep the output capacitance as low as possible. The heat sink itself was not sufficient to keep the transistor cool enough, and so it was cooled by taking a 3/8'' diameter pipe from the main PA blower to direct a flow of air over it. The modulator was included in John Ware's transmitter, which was also pictured in the magazine - the notes having been prepared by a certain D Mann.

The video circuit was for a colour bar generator, designed by John Lawrence for use on 625 lines. Now-a-days, such would almost certainly be based on digital integrated circuits (or created by software within a multi purpose device), but integrated circuits were only just becoming
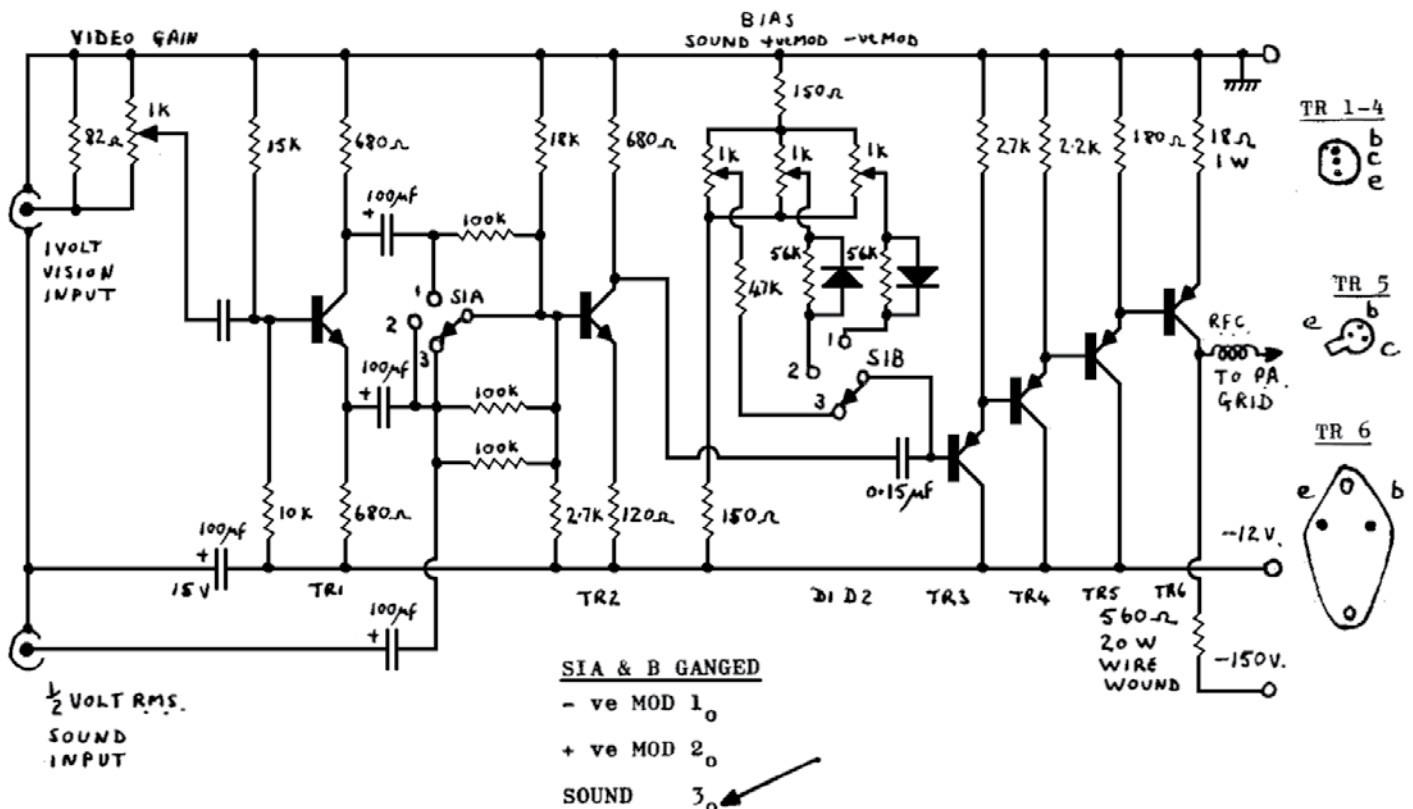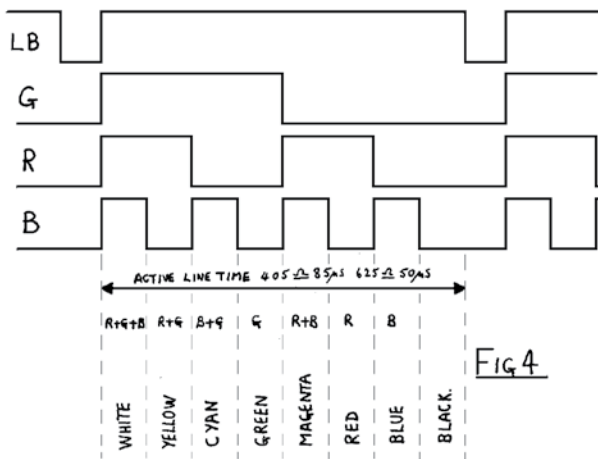
Fig.4

available to the amateur. The article set out the pulse patterns needed (Fig 4). Rather than use a counter chain from a single oscillator, the circuit (Fig 1) used 3 monostables, so arranged that they are started by the rising edge of line blanking, and then the red and blue monostables are re-triggered at the appropriate time

Fig.1

DIODES OA5   CAPACITORS in pF   RESISTORS in OHMS.

Fig.2
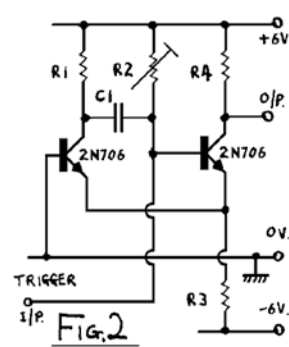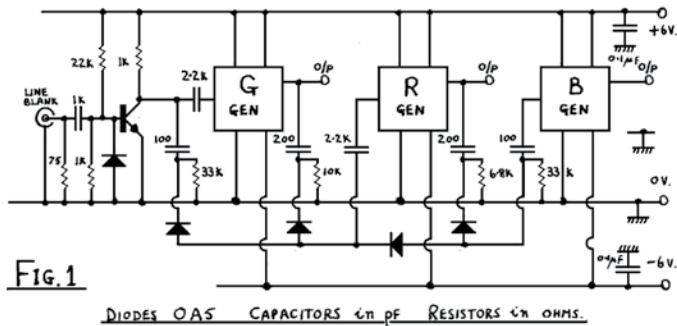
by the falling edge of green or red outputs respectively - the diodes directing the differentiated edges to the appropriate points. In the monostables, R1, R3 and R4 were 1k, except the R3 in the blue circuit which was 500R, R2 was 10k, and 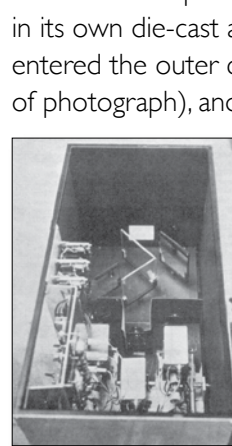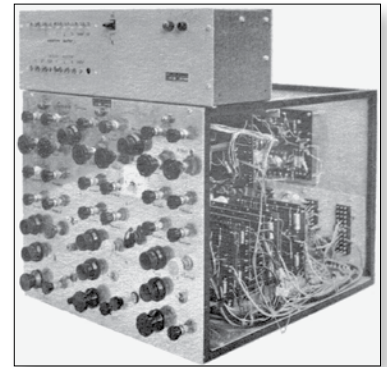the capacitors were selected to give pulse widths of 26 µS, 13 µS and 6.5 µS for the green, red and blue circuits respectively. Each output was then clipped by its own output circuit, as in Fig 3 the 27k pots setting the clipping point, and then the 1k set to give a set of 1 volt p-p outputs for feeding to a suitable coder or to an RGB monitor.

Fig.3
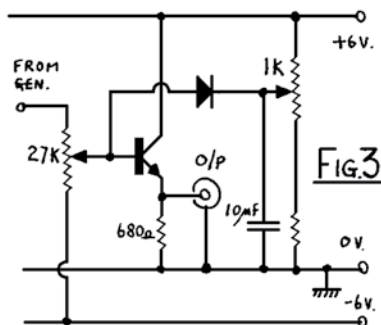
The basic electronics section introduced the unijunction transistor, which was a device having two base connections and a single emitter. Its main characteristic was to present a high resistance until the emitter voltage reached a critical value, when it would conduct, and present a very low resistance. The basic oscillator circuit used a pnp transistor to charge a capacitor C through resistor R. When the voltage across the capacitor reached the critical point of the unijunction, the latter conducted, discharging the capacitor. The effect was to produce a very linear sawtooth waveform, particularly useful in television time base circuits.

2N2160
or 2N2646
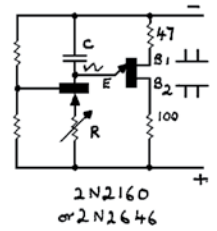
The 'postbag' included news of several members who were building vidicon cameras, flying spot scanners, monitors, transmitters and receivers for 70cm. The front cover had a photograph of the camera control unit for a colour camera, the inside of which was also shown in the magazine. The ccu circuitry was built on veroboard, and had the controls for the 3 colour channels put in a symetrical layout. The camera itself used 3 vidicon tubes, set parallel to each other (at the bottom of the photograph), each having its head amplifier in its own die-cast aluminium box. The light from the scene entered the outer case through the rectangular hole (top of photograph), and was then split into the red green and

blue channels by the mirrors and filters seen in the middle of the picture. Each channel had its own lens mounted in front of its vidicon tube - note that the middle one of these is set further back in the box than the ones to the left and right, to make the optical path of the same length for each channel.

Yes, a modern small webcam can produce a colour picture signal in an enclosure much smaller than just one of those die-cast aluminium head amplifiers, but colour cameras were rare in 1966 - even amongst broadcasters. There were no multistripe camera tubes available, nor solid state imaging devices, in those days, but Mike Cox's design showed that using components available to television amateurs, colour working was possible. ✆

The British Amateur Television Club

BATC

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 British Amateur Television Club
CQ-TV
No. 243 – March 2014

The British Amateur Television Club
CQ-TV
No. 244 – June 2014

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Rigol Spectrum Analyser discoveries
Using a small ARM based mini TV box for digital TV
The New Constitution of the British Amateur Television Club
Streaming Student Robotics 2014
4K – what is it?
... and all the regular columns

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www.batc.org.uk

BATC
Out and About

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

19th April – West London Rally – Kempton Park, Surrey
See: *www.radiofairs.co.uk*

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

23 May – Norden, Rochdale   See: *www.radars.me.uk*

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

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

26 – 28 June – Hamtronic Show, Friedrichshafen, Germany.
See: *www.hamradio-friedrichshafen.de*

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

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

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

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

25-26 September - National Hamfest, Lincoln.   See: *www.nationalhamfest.org.uk*

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

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