The British Amateur Television Club

CQ-TV

No. 270 – Winter 2020

A quick word about "SATSAGEN"

Composite Video Source

CAT20 – a review

BATC project status – December 2020

Modifying the Nooelec Ham it up Up-converter for 71 MHz DATV

How to use a Pluto for DATV

Modifications to a board from Bison Electronics

Building the Ryde Receiver

A TXCO for QO-100

Television History – Live! Part 2

9 cm station from Wimax components

The BATC Bursary Scheme

BATC report to the RSGB Spectrum Forum

The extremes of operating in December!

VK5BI portable working VK5YYY on 1278 MHz over approx. 92 kms and the snow covered aerials of Pierre HB9IAM

... and much more inside!

CQ-TV 270

Contents:

Contributions

Contributions for publication or for constructive comment are welcome. The preferred method of communication is by email; all relevant committee email addresses are published in CQ-TV.

Alternatively you can write to us at:
BATC Secretary, 12 Petrel Croft, Kempshott, Basingstoke, Hampshire, RG22 5JY, UK

Contributing authors should note that we aim to publish CQ-TV quarterly in March, June, September and December.

The deadlines for each issue are:
Spring - Please submit by February 28th
Summer - Please submit by May 31st
Autumn - Please submit by August 31st
Winter - Please submit by November 30th

Please submit your contribution as soon as you can before the deadline date. Do not wait for the deadline if you have something to publish as it is easier to prepare page layouts where we have contributions in advance.

Contributions can be in almost any file format - except Microsoft Publisher! MS Word is preferred. Pictures should be submitted in high quality as separate files. Pictures embedded in a file are difficult to extract for publication however if you do wish to demonstrate your completed layout, a sample of your finalised work should be submitted at the same time.

Please note the implications of submitting an article detailed in the 'Legal Niceties'

BATC

President: David Mann, G8ADM

Chairman: Dave Crump G8GKQ
Club affairs and Technical queries. .
Email: chair@batc.tv

General Secretary: Noel Matthews, G8GTZ
General club correspondence and business.
ETCC Liason
Email: secretary@batc.tv

Shop/Members Services: Noel Matthews, G8GTZ
Email: shop@batc.tv

Hon. Treasurer: Brian Summers, G8GQS
Enquiries about club finances, donations, Club Constitution.
Email: treasurer@batc.tv

Contests: Clive Reynolds G3GJA
Email: contests@batc.tv

Digital Architect: Phil Crump M0DNY
Email: phil@philcrump.co.uk

CQ-TV Editor: Frank Heritage, M0AEU
Email: editor@batc.tv

Repeaters: Clive Reynolds, G3GJA

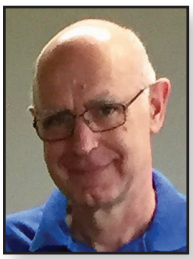
Publicity/Social media: Ian Parker, G8XZD
Email: publicity@batc.tv

Membership: Robert Burn, G8NXG
All membership inquiries including new applications, current membership, non receipt of CQ-TV, subscriptions.
Email: memsec@batc.tv

BATC Online

Website: http://www.batc.org.uk
BATC Wiki: https://wiki.batc.org.uk/
Forum: https://forum.batc.org.uk/
Stream: https://batc.org.uk/live/
Dxspot: https://dxspot.batc.org.uk/
YouTube: https://tinyurl.com/BATCYouTube/

Printed in Great Britain. ISSN 1466-6790



From the Chairman...

Dave Crump G8GKQ

Thank you to all of you who were able to join us online (and on-air) for CAT 20. It was really encouraging to be able to reach such a large audience (350+) for our Annual Convention. We are already planning for CAT 21 which, even if we are able to have some sort of physical meeting, will again be directed towards an online audience.

The event would not have run so smoothly without a vast amount of effort from Noel G8GTZ and many other contributors. My thanks to them all. If you missed any of the talks, they are available on the BATC YouTube channel, and the presentation slides are available on the BATC Wiki.

There is a lot of innovation going on behind the scenes by BATC members at the moment; we have a single-board DATV receiver under development and many of you will have seen the prototypes being demonstrated on the QO-100 net. Please be patient with us to get the hardware and software right before we release it; the project is complex and we need to make it as easy as possible to build and use.

We are also supporting some experimentation with reduced-bandwidth DVB-T tuners. The idea is to use software similar to LongMynd but with a DVB-T capable tuner. Some proof of concept work has been successful, but there is a long way to go. Part of the motivation for this work is the recently-announced 500 kHz shared data modes allocation in the 50 MHz band. Whilst the Portsdown 4 with a Pluto can transmit DVB-S2 on this frequency, greater DX will need a mode such as DVB-T that is less vulnerable to multipath effects. Complementary work is also underway to investigate reduced-bandwidth DVB-T transmission systems.

I'm pleased to see articles from a wide variety of authors in this issue and also to welcome Gareth G4XAT to the BATC Shop Team. Gareth will be programming and dispatching many of the SD Cards that seem to be so popular at the moment.

Lastly, I want to thank everyone who has contributed to the success of the BATC during 2020 and wish you and your families a Happy Christmas and good health in 2021.

73
Dave, G8GKQ

From the President...

2020 a great year for ATV

ATV has been a very useful activity in these difficult times during the ongoing Coronavirus pandemic.

It's been interesting for us to see each other without any physical contact and has allowed the membership of the BATC to grow to record numbers - with more direct links around the world and many repeater contacts with no commercial gain.

The most amazing recent event is the availability to amateurs of the geosynchronous satellite Qatar-100 over the Middle East. This allows inputs on the amateur 13cm band and outputs on the amateur 3cm band.

With a one-metre dish I can watch pictures from northern Europe to the Middle East and eastern South America live in my shack 24hrs a day rather different than watching pictures locally from around London.

Thank you for joining the BATC, having been a member since 1958 it is great to see how the club has developed and I look forward to seeing us grow in the future.

David Mann, G8ADM
BATC President.

The Listing

new and renewing members

Rob Burn G8NXG

The list of members who have recently joined the BATC, or have recently renewed a BATC membership subscription appears below. As most members will be aware, you will see your name, call sign and post town only once and for this list, only if you joined or renewed your subscription within the three month period to 30th November.

This same cycle is repeated each time that CQ-TV is published, so that the information tracks the three monthly publishing cycle of the magazine.

There are a couple of reasons why this list and others before it exist. As explained above the appearance of your details is triggered as and when you join or renew membership, thus at least confirming that you are indeed a member! Secondly, other members who may be local to you can get in touch to share ATV topics or even a QSO where possible. That connection to another is managed by yours truly, in adherence to the Club constitution. All you have to do is to send me an e-mail with details of the ATVer whom you wish to contact and if acceptable to the member I can put you in touch.

Whilst I am all too skilled at making mistakes the data are extracted from Club sales of subscriptions, so initially are as accurate as can be. That said, there are quite a number of revisions and corrections which need to be made prior to publication, all of which are carried out manually. Of course, this where errors can creep in, so do let me know if you spot one.

Finally, many thanks to all those who continue to belong to and support the Club.

Australia		
Luke Groeneveld	VK2LGW	Punchbowl
John O'Shea	VK2ATU	Revesby
Mark Harris	VK3EME	White Hills
Austria		
Thomas Völker	OE6EMF	Bad Waltersdorf
Kern Helmut	OE6KUG	Feldbach
Karl-Heinz Rudolph	OE8KHR	Sankt Johann im Rosental
Belgium		
Stefan Dombrowski	ON6TI	Brussels
Patrick Schepens	ON7ASN	Deinze
Roland De Beukelaer	ON4RDB	Diest
Joël Lebon	ON4LJ	Gosselies
Jozef Maes	ON3XX	Moerzeke
Erik Platteeuw	ON4LP	Sint-Michiels
Canada		
Boudewijn Tenty	VE3TOK	Hamilton
Denmark		
John Lund	OZ2JY	Aalborg
Peter Bystrup Jensen	OZ1PBJ	Aalestrup
France		
Malcolm Beeson		Beziers
Gilles Delpech	F1BFU	Champdeniers Saint Denis
Graham Murly	F4WDB	Champniers et Reilhac
Gerard Bouvier	F5ELY	Fontenay-sous-Bois
Masset Michel	F1VNI	Haulchin
Crouzy Bernard	F1CYK	L'Union
Gilbert Feraud	F5CAU	La Gaude
Roland Lavigne	F6GDL	La Genette
Franck Dubuis	F1SSF	La Tuiliére
Guy Gounel	F1BFZ	Magnet
Patrick Giraudeau	F6HMP	Paris
Jean Lemercier	F1YI	Pelissanne
Camille Farrougia	F4IBA	Villeneuve Loubet
Stewart Hunt	F5VJJ	Vouleme
Germany		
Hans-J. Zibull	DJ2LY	Altenholz
Rolf Singer	DK6IT	Berlin
Andre Polle	DG2OAJ	Hohnhorst
Hans-Joachim Mueller	DL3RY	Kumhausen
Lutz Acker	DL1LOD	Leipzig
Hans-Jochen Fries	DK1MG	Merzig
Wolfgang Buchner	DF3RO	Offenstetten
Bernd Lange	DL4EQ	Ratingen
Hans Schubert	DL9YCC	Rheine
Robert Schneider	DB1JJ	Solingen
Matthias Rauhut	DF2OF	Sonsbeck
Hungary		
Béla Mucs	HA4BM	Szekesfehervar

Ireland		
Craig Robinson	EI3FW	Boyle
Jim Smith	EI4CP	Greystones
Roddy Walsh	EI7DF	Rathcoffey
Israel		
Yoram Rotbach	4Z5YR	Modiin
Italy		
Piergiorgio Aimale	IW1DBF	Borgo san Dalmazzo
Alberto Ciampa		Torrita
Renzo Sartori	I3SWR	Treviso
Japan		
Katsumi Morita	JA3RVS	Wakayama
Latvia		
Janis Dimpers	YL3AKC	Riga
Malta		
Noel Scerri	9H1FX	Kirkop
Netherlands		
Wilko Bulte	PA1WBU	Arnhem
Carlo Bodde	PE1MWL	Bennebroek
Oebele Lijzenga	PA3BJC	Damwald
Henk van den Bor	PE1NCH	Den Helder
John Bosch	PD2PRT	Hilversum
F.A. Breeman		Koog aan de Zaan
Gerard Snippert	PE5GSL	Losser
Peter de Heer	PE1PYT	Maassluis
Boele Ytsma	PE2BY	Nieuwehorne
Martin Groos	PD0RJI	Numansdorp
Rob Krijgsman	PE1CHY	Terborg
Frank Marx	PA2MRX	Uden
Jan van Muijlwijk	PA3FXB	Veendam
Bastiaan Mooijman	PA3BAS	Velp
Michael Tel	PD4MT	Vlaardingen
Wouter Weggelaar	PA3WAG	Voorburg
Otto Aden	PA2OTT	Wiuwert
Rene Tuijtel	PH3V	Zundert
Portugal		
Pedro Meneses	CU2FH	Azores Isl.
Slovenia		
Matjaz Zibert	S59MZ	Kranj
South Africa		
Leon Korkie	ZS1MM	Bredasdorp
Spain		
Albert Ramos	EA3IBE	Caldes de Montbui
Jesus Roman Rodriguez Hernandez	EA8RH	Piedra Hincada
Juan Pedro Martinez Balboa	EB3FYO	Riudarenes
Manuel Martinez Reyes	EA7CTL	San Fernando
Joaquim Fabregas Rius	EA3ANS	Olesa de Montserrat
Sweden		
Hakan Johansson	SM6TLX	Uddevalla
Switzerland		
Daniel Harzenmoser	HB9GVD	Dietikon
Martin Klaper	HB9ARK	Kappel
Peter Studer	HB9DUT	Riggisberg
United Kingdom		
Seamus Import	G7ITT	Appleby-in-Westmorland
Robert Brown	GI6IVJ	Bangor
Brent Watson	G5TV	Barnsley
Julian Grammer	G1EKW	Bedford
Graham Cheater	G4FUA	Bradley Stoke
Roger Ray	G8CUB	Brentwood
Tony Bonds	G8VTN	Bridgnorth
John Saunders	M0JES	Bridgwater
Ivor Green	G1IXF	Bristol
Julian Baldwin	G3UHK	Bristol
Shaun O'Sullivan	G8VPG	Bristol
Stephen Michie		Bristol
Ian Parker	G8XZD	Bristol
Malcolm Bay	M0MBO	Buckingham
Anthony Haley	G4MMT	Bude
Paul Stallibrass	M0PDA	Bury St Edmunds
David Cattermole	M0DMC	Cambridge
Keith Winnard	GW3TKH	Cardiff
Tim Wills	G8PZD	Cheltenham
Nigel Jones	2E0NJT	Chingford
Darren Smith	M7IWF	Corby
Alan Taylor	G1MSA	Coventry
Dave Cawley	G4IUG	Dartmouth
Anthony Price	G8KBG	Dudley
Steve Marshall	M0SKM	Dunstable
David Taylor	GM8ARV	Edinburgh
Malcolm Gregory	G0JYQ	Fareham
Alan Course	G4HND	Geddington
Geoff Cowling	G0FRX	Goole
Louis Thompson	M7LAT	Grays
Owen Williams	M7OMW	Heswall

Don Roomes	G0RQL	Holsworthy
Frank Heritage	M0AEU	Hook
Lyndon Reynolds	M0LDR	Hull
John Franks	G3SQQ	Kirkby-in-Ashfield
Michael Still		Lancing
Phil Taylor	M0VSE	Leicester
Justin Fanning		London
Tarsam Singh Bimbra	G8WKU	London
Nick Moldon	G1BVI	Maidenbower
Timothy Simmons	G8JFX	Maidwell
Andy Rutter	G8HCK	Malton
Geoff Bingham	G4TQM	Manchester
Paul Newman	G8UDI	Market Rasen
Peter Harston	GW4JQP	Milford Haven
David Pearson	G4UFS	Milton Keynes
Kay Pullan	G8NZR	Mirfield
Roger Farmer		Monmouth
Anthony Horsfall	G4CBW	Newcastle-under-Lyme
Nicholas Camp	G7KFQ	Newquay
John Grant	GI7UGV	Newtownards
Stuart Tyler	G1ZAR	Nottingham
Alan Bolton	G1EAB	Nottingham
Michael Purnell	G4XIX	Okehampton
Ian Harbert	2E0MWU	Orpington
Richard Horton	G4AOJ	Purley
Roger Hopkins	GW4NOS	Rhondda
Ian Bailey	M0HVO	Ringwood
Mike Richards	G4WNC	Ringwood
Ian Saturley	M0IJS	Rugby
Brian Hardy	G4BIP	Scaldwell
Angus Young	M0IKB	Scarborough
Mark Horn	M0WGF	Sheerness
Barry Chambers	G8AGN	Sheffield
Derek Latham	G6HXL	Skelmersdale
David Leary	G8JKV	St. Ives
Mike Binks	G0LJF	Stockport
Malcolm Chrzanowski	G7IAM	Stoke on Trent
Neil Austin	G6DSG	Stoke-on-Trent
Vincent Lynch	M0LCR	Stretton
Stephen Yates	G4NZV	Tewkesbury
Philip Gabel	G1TAI	Towcester
Arthur Turner	G4CPE	Upper Sundon
Andrew Amos	M0VVA	Waltham Cross
Simon Tribe	G0IEY	Waterlooville
Julia Tribe	G0IUY	Waterlooville
Brian Bailey	G1UFA	Waterlooville
Stephen Pettitt	M0MOI	Wellingborough
Lee Molyneux	G0DBH	Wigan
Antony Mark Tilt	G1JMX	Willenhall
Richard Giles	G4LBH	Wimborne
Ron Berkeley	G0WUO	Wirral
Brian Duffell	G3VGZ	Yarm
Nigel Knapton	G1JKE	York
United States		
Robert Derderian	N2IPH	Bridgeton
Gary Sutton	WB5PJB	Castle Rock
Mark Culross	KD5RXT	Fort Worth
Rodney S Fritz	WB9KMO	Mesa
Don Hill	KE6BXT	Mission Viejo
Dale Elshoff	WB8CJW	Powell
Neil Gustafson	W3ZQI	Timonium
Bruce Kobie	K8FIX	Tipp City

The BATC Bursary Scheme

Noel Matthews G8GTZ

The BATC bursary fund enables grants of money to be given to individuals and groups who are initiating projects to benefit the ATV community in their local area, nationally or internationally.

In the past year we have received the following applications for funding, note the figures are the maximum approved amount and not necessarily what has been donated to the group.

- BATC repeater transmit system demo - £100
- GB3CT Portsdown transmitter system - £200
- Basingstoke Makerspace MiniTiouner receiver - £60
- GB3GG Portsdown transmitter system - £228
- GB3KM transmission system for the 2020s - £250
- MiniTiouner to Dwingelo 25m dish project - £60
- GB3NQ digital upgrade – £602

- Ryde set top box development team support - £200
- GB3FT transmit system upgrade - £300
- GB3HV Ryde receiver - £140
- GB3EY Ryde receiver - £132

In order to give full transparency of the funding granted by the BATC we will in future be publishing details of grants as they are awarded on the BATC forum *https://forum.batc.org.uk/viewforum.php?f=132*

If you have a project which you believe could qualify for a BATC bursary, please fill in the form on the BATC website describing the project, the amount required, the reasons why it should attract BATC funding and how it will benefit the ATV community.

The applicants should be prepared to have a telephone call with committee members to provide more details and answer any questions before the application is considered.

A condition of the award will be to submit an article to CQ-TV detailing the project and its success or failure.

The ideas below give some guidance on the types of projects that might attract funding:

- Pump-priming for development projects to fund things such as development tools / hardware, prototype PCBs manufacturer and software licence costs
- One-off funding for repeater groups - this can be used for whatever the group needs but should be towards one-off costs such as rebuilds or legal fees. We will not accept applications to fund ongoing annual fees such as site rent and electricity costs
- ATV infrastructure – a typical example could be the Oscar 100 web SDR and monitoring which BATC has built at Goonhilly
- Funding for Dxpeditions with an ATV interest
- Outreach support for ATV groups and funding for demo kit and sponsoring radio clubs to buy ATV equipment for use by their members

BATC report to the RSGB Spectrum Forum – November 2020

While day-to-day activity continues on 70cms and 23cms, experimentation on the low bands (50 and 71MHz) plus the microwave bands above 2.3GHz continues, especially during BATC activity weekends. It is interesting to note that Dutch ATV operators have now adopted the narrow band techniques pioneered by the UK ATV community and RB-TV QSOs between the countries have taken place on 146 and 437 MHz.

The ATV community continues to innovate with very low bandwidth transmissions using H265 video encoding and DVB-S2 modulation and transmissions using 33ks (50KHz bandwidth) are regularly seen on QO-100.

IARU region 1 contest

The Annual IARU contest is perhaps the best indicator of ATV activity and trends across the UK and Europe. In 2020, despite limitations on activity in some countries, there were 92 entries from eight countries on all bands from 432MHz to 76GHz. This is an increase from 55 in 2019 and UK stations were band winners on four of the six bands above 2.3GHz.

The Bands

50 MHz

Tests have continued on 51 MHz to support the IARU Region One team initiative at WRC 2019. The current distance record using low power stations stands at 140 km. Note, DVB-S2 is currently used which will limit the use of any enhanced propagation modes due to its vulnerability to multi-path and other phase distortion effects.

71 MHz

ATVers have had to learn new skills to operate on the band including coping with higher noise floors and huge antennas.

Even with the 100 Watt ERP restriction, the current DX record is 160 km and again phase distortion will prevent the use of any enhanced propagation modes 71MHz offers.

146-147 MHz

Many ATVers have applied for a special NoV to operate in this band and even though the maximum transmit power is limited to 50 watts ERP, ATV QSOs using 500KHz or less bandwidth more than 200km are now happening regularly with the current record standing at 407km.

430-440 MHz

This band is much more active due to the narrower bandwidth of digital TV transmissions that can now fit into this crowded allocation. Regularly there are long distance transmission of more than 200km made around the UK and into Europe.

1.3 GHz

In light of the potential changes to 23cms, the BATC has published a proposed new standard migrating TV repeater outputs to DVB-S2 1Ms (1.2MHz occupied bandwidth) operation. Tests indicate a gain of 13 dB over a 16MHz FM signal with no loss in video quality.

A standard design for a repeater transmission system has been published and the BATC is actively encouraging groups to adopt the new standard by providing funds to help repeater groups migrate to the new standard.

2.3 – 2.4 GHz

There are still two repeaters licensed for this band and, even though we lost 40MHz of the band in the PSSR process, there continues to be a small amount of simplex operation.

A large number of operators have built 2.4GHz DATV and NB equipment to operate on Oscar100 – we need a plan to encourage these stations to use the equipment for terrestrial contacts.

3.4 GHz

Seven repeaters are now licenced for this band and due to a lower noise floor and easy receive systems using C band LNBs, the performance is equal to or better than 13cms. With the band having been reduced to 10MHz, there is only sufficient bandwidth to allow the digital repeater output to be on this band with inputs on other bands.

Due to bandwidth limitations there is little simplex operation on this band although stations are active during BATC and IARU contests using Reduced Bandwidth DATV.

5.6GHz

With the availability of the low cost (<£20) FPV FM ATV transmit and receive equipment we are seeing a significant increase in the number of ATV and WBFM stations using the 5.6 GHz band. There are two repeaters with inputs on 5665MHz and we believe this will become an important band to attract newcomers to ATV and microwaves.

10 GHz

Six repeaters are licenced for this band and it is also quite active with simplex operation. Several stations are active with DATV on the band using standard narrow band transverters from 144 / 432 MHz to generate DATV signals on the band. The current best DX stands at 407km between M0DTS and G4UVZ worked during a tropo opening in October 2018.

24GHz

A number of stations are active on 24GHz ATV undertaking mainly portable work with the current best DX standing at 136km.

Higher bands

The first UK 47GHz DATV QSOs have recently taken place, at least three stations are active on 76GHz and M0DTS has successfully transmitted video on 134 GHz. A number of ATVers have purchased 122 GHz equipment and we expect to see some FM ATV activity on that band in 2021.

Oscar 100

The launch of the geostationary Oscar100 satellite has seen a large increase in activity and interest in ATV – more than 150 UK stations are known to be operational on DATV https://wiki.batc.org.uk/QO100_DATV_Users

The BATC wideband spectrum monitor and narrowband WebSDR have enabled everyone to get a glimpse of the activity and innovation on the satellite which provides coverage of 60% of the world's population.

https://eshail.batc.org.uk/wb/
https://eshail.batc.org.uk/nb/

TV Repeaters

Overall we currently have 42 TV repeaters licenced on the 1.3 GHz, 2.4GHz, 3.4GHz and 10GHz bands with a mixture of analogue and digital transmission outputs.

The BATC

BATC membership continue to grow with Oscar 100 encouraging more stations to be active on DATV - the Portsdown DATV system proving to be a popular route back into the hobby for many.

The BATC believes that building a community of ATV builders and operators through online communities on the members' forum, providing a reliable source of relevant information on wiki sites, in CQ-TV magazine, and reporting activity on social media is fundamental to the growth we have seen both in ATV activity and BATC membership.

The BATC continues to support and drive initiatives with a program of awards and grants to recognise achievements in the community and the use of the BATC shop to stock otherwise difficult-to-source components for BATC-sponsored projects.

The BATC has actively supported the development of the Raspberry Pi4 / Pluto-based Langstone narrowband transceiver project and the Ryde DATV set top box project.

In order to further increase operator numbers, the BATC has awarded a number of prizes for contest winners and organizes a monthly activity weekend timed to coincide with activity weekends in neighboring IARU countries, thereby helping to promote the use of all our bands from 50 MHz upwards.

Activity and Contests

Clive Reynolds G3GJA

Sept 19th - 50 and 71MHz contest

Four entries were received for the 50/70MHz Low Band Contest in September. All were Section 2 for portable/roving stations. Conditions were mediocre and equipment problems plagued many stations that took part.

Congratulations to Dave G4FRE/P who won by a substantial margin. Dave was presented with his trophy during the virtual CAT20.

Pos	Call	Section	6m pts	4m pts	Total
1	G4FRE/P	2 Roving	4009	1088	1497
2	G8GTZ/P	2 Roving	312	651	963
3	G8VPG/P	2 Roving	0	418	418
4	M0DTS/P	2 Roving	0	78	78

25th October – 70cm and 23cm Activity Day

Having an Activity Day immediately after CAT20 was not a good idea, so unsurprisingly there is nothing to report. Everyone was probably recovering from CAT20 or having to make amends for spending most of the previous day away from their families. Lesson learnt; I won't do it again!

19th & 20th December –13cm and up Activity Weekend

This is the last Activity Weekend of the year. Although nominally focussed on the microwave bands, please feel free to activate any bands of your choice. There's not much chance of tropo for the lower bands but there could be some rain scatter on the higher bands that needs experimenting with to find out what the possibilities are.

Christmas 2020 Repeater Activity Contest and Activity Challenge

The competition will run from 24th December 2020 through to Sunday 3rd January 2021 inclusive with the aim of increasing repeater use. The repeater used to get the winning score will be awarded £100 that will help the supporting repeater group through what has been a difficult year.

This year, your QSOs via the repeaters can be entered onto the BATC Ladder web site. The web site will be modified so that you can enter the repeater's callsign and the points claimed. It's suggested that you use the contest Excel spreadsheet (see the download link in the Activity & Contests section in the Forum) to calculate your score and then enter that into the Ladder.

Alongside the Repeater Contest, an Activity Challenge will run using the Ladder in the same way as the Lockdown event. Any confirmed ATV QSOs can be entered, not just repeater contacts. If not using a repeater just leave the repeater callsign field and points field blank.

The full rules for the Christmas 2020 events can be found here:

https://wiki.batc.org.uk/Christmas_2020_BATC_Repeater_Activity_Contest_and_Activity_Challenge

Repeater Update

East Yorkshire's ATV repeater GB3EY finally became fully operational from its new site at Cave Wold Radio Station near Hull on the 22nd November. This is the culmination of a process that was started in 1998.

▶ *GB3EY's 'retro' teletext look comes from the BATC I2C project used as its logic*

EY was established, initially as a beacon, within a hundred yards of the North Sea to the east of Hull in 1990. The 16MHz wide FM transmissions and even wider set top box receivers in use needed strong signals that were difficult to achieve from the intended service area due to the site's low height above sea level. The bandwidths used were prone to interference from the CAA's radar at Claxby, some 25 miles away and running 400MW EIRP. An attempt to move EY in 1998 to a better location failed to get past the vetting process because it was deemed that any change to the repeater would result in the loss of the NoV at a time when the CAA did not look favourably on ATV repeaters in the 23cm band.

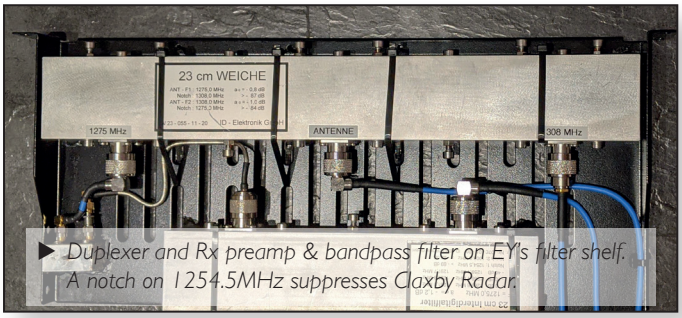
The repeater carried on with dwindling activity until Claxby moved its lower channel closer to EY's input as part of the changes to accommodate the Galileo geo-location system. It then became unusable and effectively became an ATV beacon as it was impossible to get a clean signal in. Another issue with the original site is its proximity to the North Sea which rots antennas; a Tonna ATV Yagi lasted just six months before the boom turned into powder.

In April 2014, a new application to move EY was submitted to the RSGB's ETCC, based on converting it from analogue to digital operation. This stagnated after being forwarded on to the primary users and to cut long story short, eventually Ofcom took the lack of response as an 'OK' and the NoV was issued in August 2018. Not surprisingly, after waiting 20 years and getting nowhere, the repeater group were not prepared!

A year after the NoV appeared a DATV beacon was run from the new site, initially on a temporary antenna and, later on, the Alford Slot currently in use. Reception reports were very encouraging using half of the approved ERP. The site, a former Pye PMR location is exclusively used by the East Yorkshire Repeater Group. It is 155m ASL with the ATV 23cm Alford Slot at 180m ASL. It houses GB3EY, GB3HS on 2m, GB7HU on 70cm and Raynet relays.

▶ *The East Yorkshire Repeater Group's 20m tower being prepared for a 5m extension to support EY's Alford Slot. The 5GHz grid reflector is used for an Internet feed from G3GJA's QTH.*

An attempt in September 2020 to complete the repeater's move and conversion to digital was aborted when it was found that the receiver was prone to locking up when changing modes on weak signals. Despite notches at the radar frequency, there was some odd behaviour that could have been attributed to the radar getting into the receiver because of its wide bandwidth.

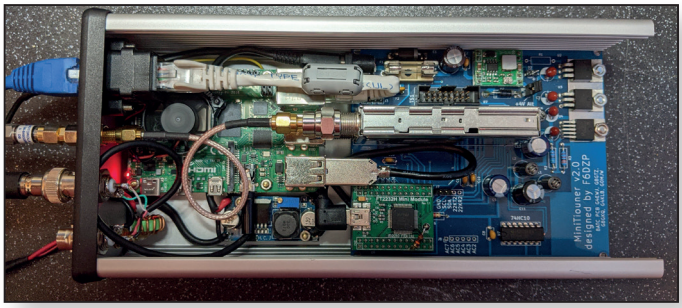


▶ *Duplexer and Rx preamp & bandpass filter on EY's filter shelf. A notch on 1254.5MHz suppresses Claxby Radar.*

To the rescue comes the BATC, just when needed. Through the BATC's Bursary Scheme, the repeater group was able to purchase the parts needed to make a 'headless' version the BATC Ryde receiver. The software had recently been released in a version that supported a locked signal output matching the signalling requirement of the analogue GB3EY logic that had been adapted for digital use.

▶ *First pictures relayed by GB3EY as seen by Richard G4YTV*

A Minitioune v2 board and a Raspberry Pi 4 were squeezed into a 220mm long version of the Hammond box recommended for the Minitioune. Tests showed the Ryde to be superior to any previously tried set-top box receiver as well as accepting multiple symbol rates. Coupled with an improved duplexer from ID-Elecktronik, the receive channel has proved to be quite sensitive. From home I have been able to get a D1 report from the repeater at a distance of 9.9km using DVB-S2, H264, 333kS/s and FEC ½ with a measured output of only 0.3mW (-5dBm) from a barefoot Lime Mini.



▶ *GB3EY's Ryde DATV receiver built into a 220 x 163 x 53mm Hammond box*

To date, pictures have been relayed by M0MLJ, G8VDP, G0AZQ, M1ASR and G3GJA. The repeater has been seen by G7AVU, G0EYZ, G5TV, G4YTV, G4TMZ and M0DTS has seen it a couple of dB above noise on his 3m dish over an extremely difficult 92km path traversing the North York Moors.

Streaming to the BATC website has been tested and a permanent service using a direct connection to the transmitter video and audio feeds is planned.

The East Yorkshire Repeater Group would like to thank everyone involved with the Ryde receiver project and for financial support, the BATC's Bursary Scheme, Hull & District ARC and Hornsea ARC.

A quick word about "SATSAGEN"

Paul M0EYT

What is it?

It is a piece of Windows software designed to be used with the ADALM-Pluto SDR that many of us are using to generate quality DATV xPSK with the F5OEO firmware.

The software converts the Pluto into three pieces of test equipment which cover 40MHz to 6015MHz and consists of: 1) a **S**pectrum **A**nalyser, 2) a **T**racking generator / **S**pectrum **A**nalyser and 3) a signal **GEN**erator, hence the catchy name "SATSAGEN".

Usually one and two might be incorporated into a standard desktop unit such as one of the Siglent SSA30xx units covering up to 3.2GHz, and three would typically be a stand-alone signal generator. The PC used to run SATSAGEN doesn't need to be of a super spec, I'm using an old shack PC that just about runs Windows 10, i3 CPU etc, 8 GB RAM.

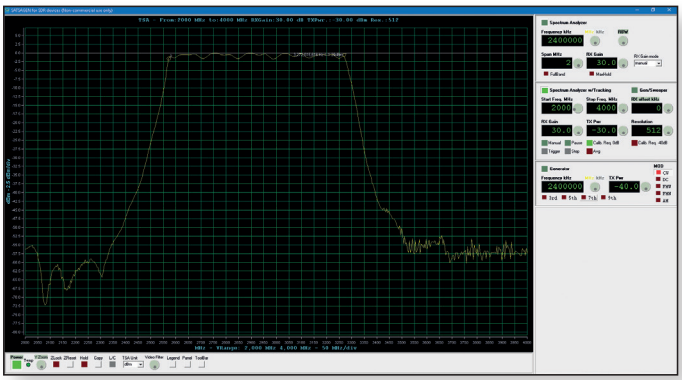
Tracking generator /Spectrum Analyser

As a quick example, the software is set to cover 2000-4000MHz in "spectrum analyser w/ tracking" mode.

As with any analyser and tracking generator you first must calibrate out the cables, etc, this is done by connecting your cables and then a SMA worm or back to back in place of the DUT.

The "Calib Reg 0dB" option is selected followed by selecting spectrum analyser w/ tracking. The calibration process runs turning the "Calib Reg 0dB" from red to green. Next replace the SMA worm or back to back with the thing you want to test, in my case a surplus BPF covering S-Band from an sig-int receiver array.

I put a pair of pads (attenuators) either side of the BPF to help with matching, if you do the same then don't forget to calibrate with them connected.

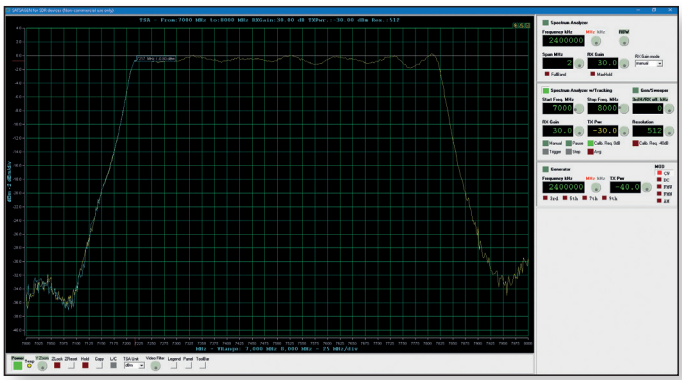


▶ *Figure 1: Standard SA + TG mode 2-4GHz span*

You can clearly see from the plot that the filter covers 2570 to 3270MHz. Hovering the mouse over the plot allows you to read off frequency + level referenced to 0dBm.

The "spectrum analyser w/ tracking" can also be operated in harmonic mode and a multiplier can be set to cover non-native frequencies (i.e. those above 6GHz.) The next example shows a sweep of an X-Band military satellite receive filter, nominally covering 7250-7750MHz. The response is as expected.

▶ *Figure 2: PLUTO with X-Band Band Pass Filter connected.*

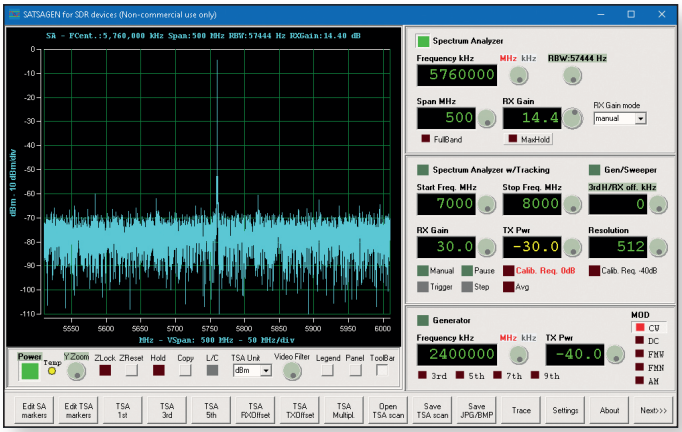


▶ *Figure 3: Harmonic SA + TG mode 7-8GHz span*

Spectrum Analyser

To use the spectrum analyser mode, the settings are very simple. Select the centre frequency in kHz and the span in MHz. Adjust the RX gain to suit.

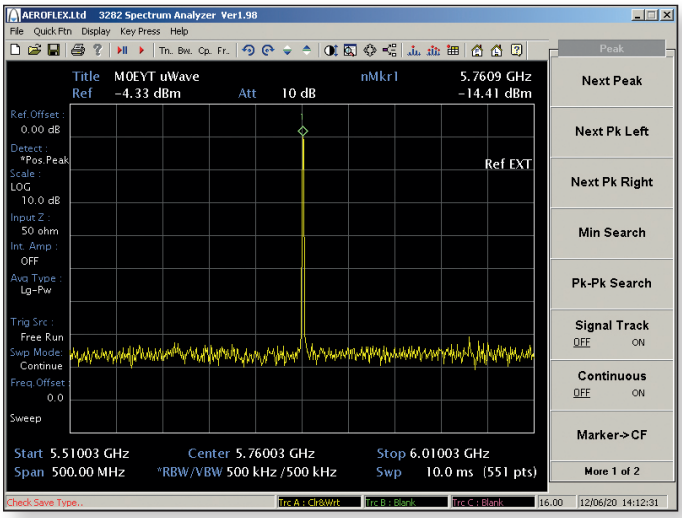
As an example, a signal generator was set to generate 0dBm at 5760MHz, with about six-foot of coax to the instruments.



▶ *Figure 4: Spectrum Analyser Function - 5760MHz Centre*

My spectrum analyser has a 10dB pad on the input at all times, and reads -14dBm, so in reality -4dBm which is about what we see on the SATSAGEN software.

The spectrum analyser function is pretty handy, but you have to carefully set the gain to avoid overloading the ADC or you get strange artefacts on the display.



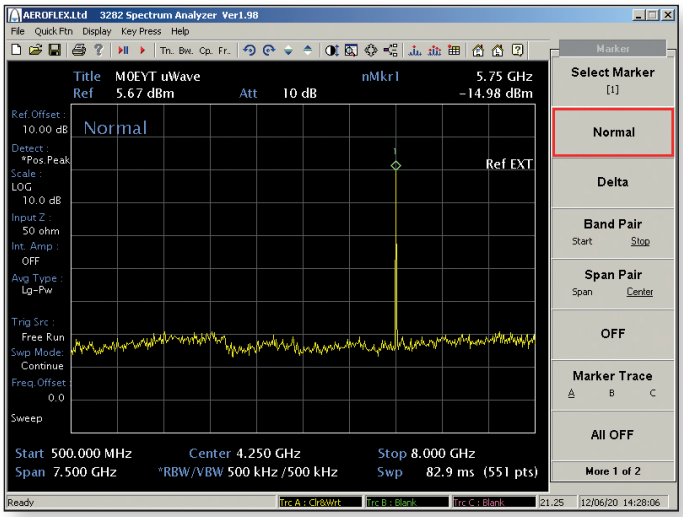
▶ *Figure 5: "Proper" Spectrum Analyser 5760MHz Centre*

Signal Generator

A quick test was made of the signal generator function. Here the centre frequency of 5760MHz was selected with 0dBm output. About six-foot of coax was used to connect the Pluto RF output to my spectrum analyser.

The output looks fairly clean however with lower frequencies such as those in the 13cm band; it was possible to see second harmonics.

A BPF is recommended where you are using the Pluto as a flexible LO, at lower frequencies at least.



▶ *Figure 6: "Proper" Spectrum Analyser 0.5-8GHz Coverage*

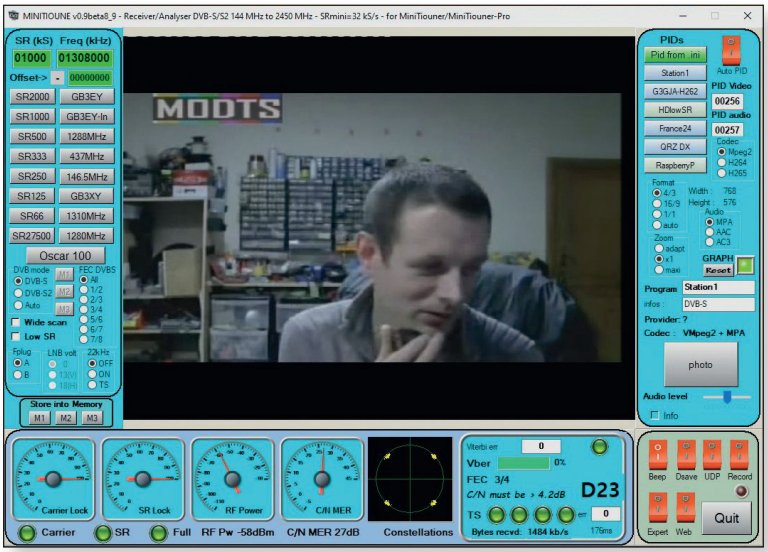
You can get a Pluto from *www.mouser.co.uk* - search for part number 584-ADALM-PLUTO, they are currently £118.92 + VAT - an ideal Christmas present for your shack.

This excellent software can be downloaded from *http://www.albfer.com/satsagen-download-page/* and the author also has an "appreciation box" at *https://paypal.me/FERRARIS944*

Here and there...

Here is a screenshot of Rob, M0DTS using 333kS/s H265 getting into GB3EY at the beginning of December. The distance from Rob to EY is 93km over the top of the North York Moors under flat conditions, no AS.

From Rob's QTH the signal has to climb over a 1300 feet hill that's only 6.5 miles away. Rob's estimated EIRP for his signal was 150kW (150w to the antenna which is a 3m dish giving about 30dBi gain). His signal was peaking around D2 for most of the time.



Composite Video Source

Dave Crump G8GKQ

This article describes a composite video source which is an excellent beginner's project but would be useful in any TV amateur's shack.

One of the shortcomings of the Portsdown 4 is that it is not currently capable of providing a composite video output, which is typically used as a drive signal for 5.6 GHz FM ATV equipment.

During CAT 20, I mentioned that this was a capability gap and, within hours, Brian G4EWJ e-mailed me to say that he had some software that would run on a stand-alone Raspberry Pi that would satisfy the requirement.

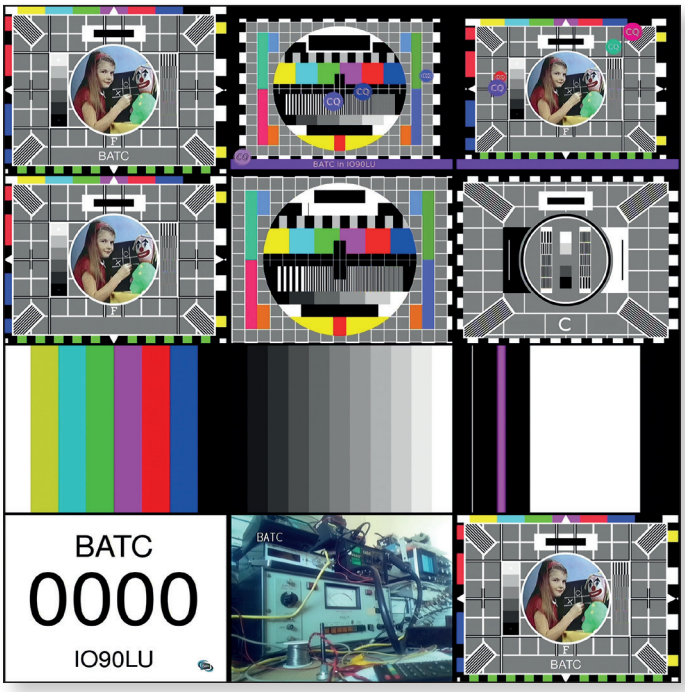
I tested Brian's software and it seemed to be almost exactly what I had in mind. I now have developed it and written an installer so that it is simple to build your own SD card.

Finally, I have created an SD Card image for download, so that the card can be created in a single operation.

Capabilities

Using a Raspberry Pi 1, 2 or 3, or a Pi Zero or a Pi Zero W, this video source will output a PAL static test card, or a test card with a moving banner and bouncing balls, from the composite video output.

Test card F can be overlayed with a programmable callsign. Additionally, a contest card is available.



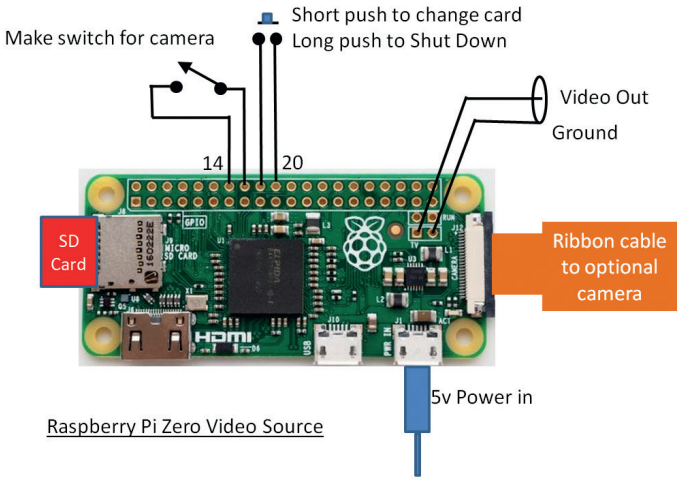
If a Raspberry Pi Camera is connected, it can output a picture from the camera with a callsign overlay. It is not designed (yet) to output an HDMI signal and will not work on a Raspberry Pi 4.

The test cards shown are selected sequentially on each press of the push button. Closing the switch selects the camera. A long press (> 2 seconds) of the push button shuts the Raspberry Pi down safely.

On shutdown, the last selection is saved and used at the next power-up.

Hardware Design

The design is really simple. All that is required is a Power Supply, a push-button and a video output socket. If you want the camera capability, then you need a camera and a single pole toggle switch as well. You can conduct initial testing without the push-button and switch.



The wiring is shown above. Some points to note for the Raspberry Pi Zero:

- Unusually, the ground of the video output is a circular PCB connection (actually Pin 2 of the connector) while the square land (pin 1) is the video output.
- The Raspberry Pi Zero, as supplied, has no pins on the headers, so you can either solder directly to the PCB, or fit header pins.
- If using a camera, you will need a special camera ribbon cable for the Raspberry Pi Zero, as the camera connector is smaller than the standard Raspberry Pi camera connectors.

- The same wiring arrangement works equally well for Raspberry Pi Zero W, or the full size Raspberry Pi 1, 2 or 3. The video output connector on a Raspberry Pi 1 is a phono socket, whereas it is a 4-terminal 3.5mm jack on the more recent Raspberry Pis.

Software

The software needs to be written to the SD Card using a PC. You can then customise it with your own callsign on the PC before fitting the card to the Raspberry Pi Zero. A full system image is available on GitHub here:
https://github.com/BritishAmateurTelevisionClub/vidsource/releases

Download and unzip vidsource.zip; the unzipped file is vidsource.img. Write this image to an SD Card (size 4GB or greater) using Win32DiskImager.

Once the image is on the card, open Windows Explorer and find the SD card volume which will be called boot. There should be a folder in that volume called testcard. There are 3 files to edit in that folder: callsign.txt, where you should replace "BATC" with your callsign; locator.txt, where you should replace "IO90LU" with your locator, and numbers.txt, where you should enter contest numbers that you might like to use. In each case save the changes once made.

You can change these files (for example to put in a portable callsign or locator) between uses as many times as you like and the static test cards and camera overlay will be amended the next time you start the card up. The banner text is more complex, and you will need to directly edit the last line of tcdata1.txt and tcdata2.txt with any revised banner text.

If you want to edit the files on a network-connected Raspberry Pi, you will find them in the folder /boot/testcard/. You should use commands of the form "sudo nano /boot/testcard/callsign.txt" to edit them as they are owned by the root user.

It is possible to build your own card using the instructions on the GitHub site; the procedure is similar to building a Portsdown or a Ryde SD Card. However, there is no update process. Future updates will simply require a new card to be built.

Output Level

Some early constructors have reported that the composite video output level is more than 1.0v peak-peak. I measured my prototype at 1.02v p-p, but I am not sure of the accuracy of my measurement. If you do see the whites crushing when displaying/transmitting the greyscale, consider adding some attenuation (a 75 ohm "pi" attenuator) on the output. Don't forget that the output needs to be correctly terminated in 75 ohms to be anywhere near the correct output level.

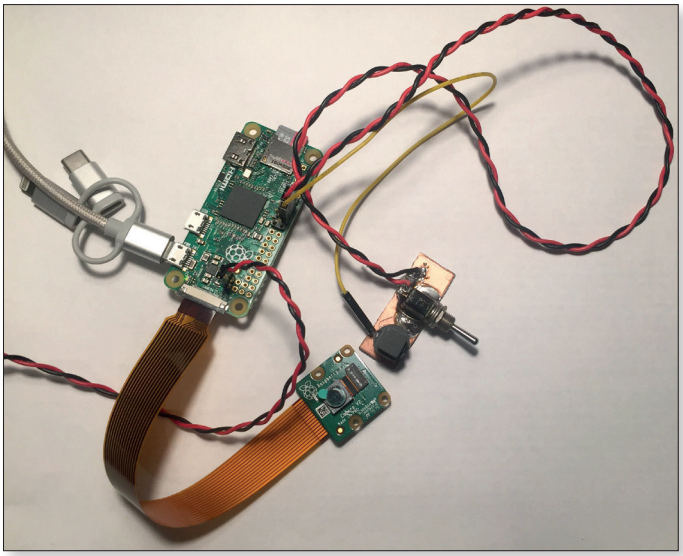
The BATC EasyCap in current Portsdown versions seems to work better with a video input of about 0.75v p-p, but is happy with 1.0v p-p on Windows systems. A software fix for the Portsdown is being developed to make it accept 1.0v p-p without white crushing. The fault had not been noticed before this video source was developed!

HDMI

This version of the video source is not designed as a source for HDMI images. A future version will have a 16:9 HDMI capability. If an HDMI monitor is connected to this version, no composite video output will be obtained, and the HDMI display will show smaller versions of the testcards, or a 4:3 sized camera image.

Finishing Off

It is well worth putting a unit like this in a rugged box, perhaps with a 12v to 5v power supply, so that the Raspberry Pi (and camera) does not get damaged on the bench or during portable operation. Simply cut up a Mini USB lead and connect the 5v supply to the red and black wires. Sadly, at the time of writing, my unit was still a bundle of wires!



VideoSource SD Cards

Pre-built SD Cards for this project will be available from the BATC Shop, for the standard price of £10 (including UK Postage). They can be found in the "Project Hardware" section.
https://batc.org.uk/category/projecthw/

CAT20 – a review

Rob G8NXG

One of the earliest casualties of the Coronavirus pandemic was the restriction of meeting people in close proximity. This meant most club meetings and radio rallies were cancelled as the year progressed. As it became obvious that the pandemic was a long-term affair, larger rallies and conventions met the same fate, including CAT20.

Originally intended as a traditional convention to be held in Coventry, this year CAT20 was held as a 'webinar', one of those useful activities invented for an internet age. Perhaps one of the major saviours of internet meetings, Zoom, was little known to domestic audiences until the start of the pandemic, when TV stations in the UK commenced using the technology for off-site interviews.

Until then, Zoom Video Communications Inc., to give the company its full title had been largely aimed at the corporate market, with pricing to match. However, what excited domestic users and more than a few radio amateurs is the existence of a no-charge, limited function version of its software, which anyone can use - Zoom Basic.

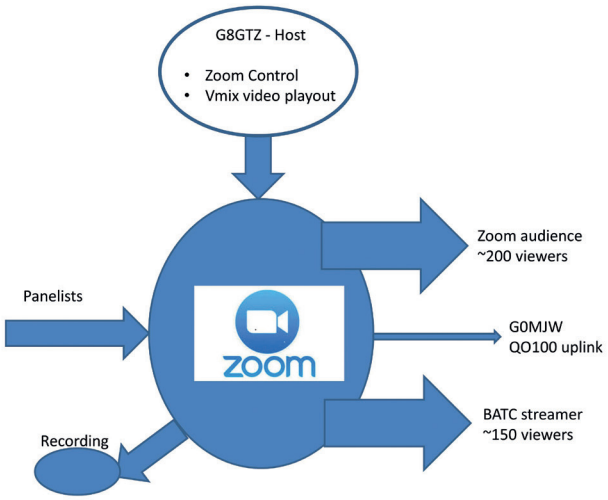
Fortunately, in what is possibly a sensible pricing structure designed for broad appeal, the paid version of the Zoom ecosystem can be tailored to fit the needs of many kinds of organisation, so steps were taken to investigate and learn how best the BATC could make use of this medium.

Step forward Noel G8GTZ, who 'volunteered' to investigate Zoom, its terminology and its foibles. After a few practice sessions conducted with committee members we were able to publish the webinar programme. Meanwhile, Dave G8GKQ put together a workable agenda for CAT20 presentations, having gained support from various authors. So the best-laid plans were set out and all that remained was to tie it all together …

For some time, CAT presentations have been streamed live via the BATC streamer and recorded for later inclusion on the BATC YouTube channel. In addition to ensuring that we could offer the same service, this time arrangements had also been made to relay the output via QO-100. Never let it be said that the BATC does not take advantage of most means of communication!

On the day Noel became the CAT controller – running the Zoom software with feeds from vMix. This enabled him to play the opening and interstitial videos and control interaction between speakers.

Recordings were generated by Zoom; Mike G0MJW provided an engineering back-channel by up-linking the Zoom output on to QO-100; this was used by Dave, G8GKQ to feed the BATC Streamer. A text-only coordination channel was created via WhatsApp.



The presentations

After introductions, Dave G8GKQ presented an up-to-date picture of the Portsdown DATV system, now in its fourth iteration. After a project overview Dave went on to explain the new features which now include the LongMynd receiver, the use of Pluto SDR, and the LKV373 HDMI input not to mention its integration with the Langstone microwave transceiver project.

Up next was Tim MW0RUD who described the concepts and development of the Ryde set top box receiver. The level of interest in the project, originally conceived by Noel G8GTZ, sometimes results in shortages of parts in the BATC Shop. Tim took us through the trials and tribulations of Ryde workings and presented his thoughts about more features to be introduced over the medium and longer term.

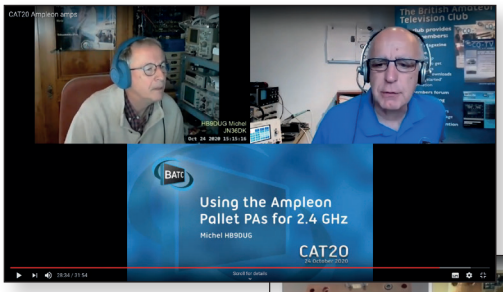
Colin G4KLB took over the reins next, with a practical demonstration of working QO100 from his shack. This included use of the wideband monitor to give some idea of the traffic through the satellite, and a QSO with John G7JTT in duplex mode. Both were able to provide shack pictures despite earlier concerns of high winds which swept much of the UK on the day.

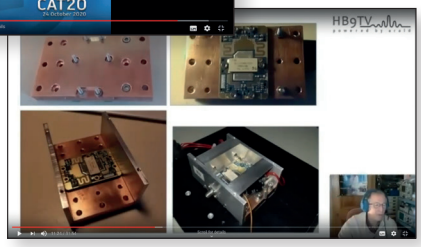
GB3KM ATV repeater has been on the air since 2004 – originally very much an analogue repeater. Rob M0DTS presented the journey of GB3KM from a wholly analogue repeater to one which will make use of digital techniques for control and monitoring. In addition to offering a DATV input, up to four analogue inputs on different frequencies will be available. Although there are a couple of legacy analogue outputs, the primary output is DATV.

The BATC has been offering bursaries since 2018, with the objective being to provide financial grants to individuals or groups who are involved in the practical aspects of ATV, primarily where new initiatives are involved. This is intended to be a way of enabling development and progress within ATV communities world-wide and Noel G8GTZ presented the workings of the scheme since inception and brought us up to date with details of all the current applications.

The final presentation before lunch concerned contests and awards and was presented by Clive G3GJA and Dave G8GKQ. The winners of the Activity Contest were announced, and a 'virtual' presentation of the Contest Award was made to Dave G4FRE. The Grant Dixon Award was presented to Heather M0HMO for her creation of the LongMynd receiver.

Lunch and 'breakouts' followed where viewers were invited to ask questions about the Portsdown and Ryde projects, plus QO-100.

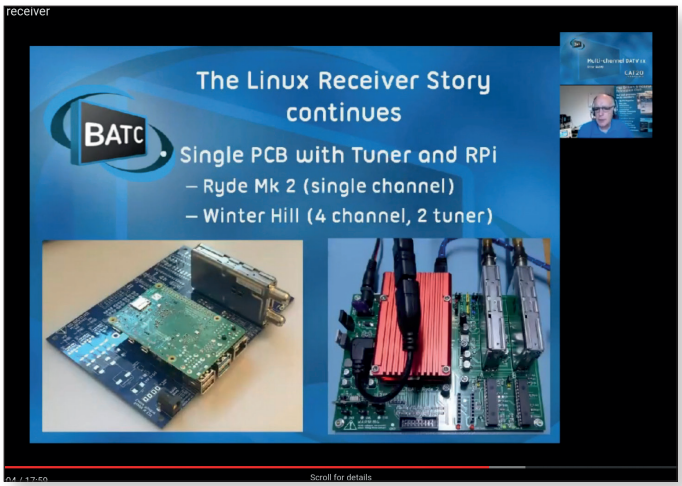




The afternoon session began with a talk from Michel, HB9DUG about the implementation of the Ampleon BPC2425M9X250 PA module for use in ATV systems. This is a 'work in progress' and Michel described the early development of a proposed two-stage PA system making use of this module plus another from Skyworks. We hope to see the results published in CQ-TV soon.

This was followed by the experiences of David G4NRT in creating business-level webinar presentations where the demands of appropriate lighting and audio are much higher than those found in ATV or domestic situations. That said, it is surprising to see just what commercial broadcasters are happy to transmit in these difficult times.

The third presentation of the afternoon was taken up by Phil, M0DNY who guided us through the impending demise of support of the Adobe Flash Player and what this means to users of the BATC Streamer. He described his intentions to introduce an open-source replacement, WebRTC, which is now currently under assessment.



The new 'Winter Hill' project was the next item on the agenda, the workings of which was described by one of its architects, Brian G4EWJ. This new project will be a single board solution and makes use of two Serit tuners including a board mounted Raspberry Pi 4. Another version is also in the offing, this time using a single Serit tuner and, if all works out, this will form the Ryde mark two.

The final presentation of the day was given over to Brian G8GQS who described the evolution of OB (outside broadcast) vehicles from the 1930s, where the Baird mechanical TV system was in use, to electronic versions up to and beyond the BBC type eight truck. Later iterations featured slide-out expanding vehicles with multiple cameras, sound etc. MCR21, a 1960s monochrome OB vehicle, is currently undergoing bodywork renovations; the hope is that it will be restored into something close to its original condition in 1963 to include the vision and audio mixers of the time.

This has been a 'taster' in terms of the presentations themselves and this just underlines the broad range of interests that the ATV hobby features. The talks can be viewed in their entirety on the BATC YouTube Channel and the slides used by the presenters are also available to view on the BATC Wiki. For those who were not able to view the presentations on the day please do take advantage of them.

One of the great things about adopting the Zoom technology for CAT20 was that members world-wide were able participate and some 350 members did, either via the streamer or Zoom. There has been enough interest in the webinar format that it is the intention include the facility in the next CAT, if all possible.

Many thanks to all the presenters and participants who made it all happen.

References

https://www.youtube.com/channel/UCUWLnUZllytlcCFd93tnBzw

https://wiki.batc.org.uk/CAT_20

https://forum.batc.org.uk/viewtopic.php?f=128&t=7003

CQ-TV cover photographs required!

A big thank you to all our authors for the articles you see in CQ-TV. We hope you enjoy reading the technical and experience related articles. If you have anything you think the rest of the ATV community would like to see, please email *editor@batc.tv*

We are also always on the lookout for striking photographs to feature on the cover of CQ-TV, so if you have something suitable, please email the Editor.

BATC project status – December 2020

Noel Matthews G8GTZ

There are now many BATC-supported projects – this article lists them, their status and where you can get more information.

All the projects described are ATV community projects made possible by volunteers giving their time and effort freely. If you feel you would like to join any of the project teams just put a message up on the BATC forum and you'll get a very warm welcome.

Portsdown DATV system

The aim of the Portsdown project is to enable an amateur radio operator with little or no knowledge of digital ATV to construct the hardware elements, load and configure the software and get on the air with DATV. There are now four distinct Portsdown versions:

Portsdown 2018 Classic

The original version launched in 2017 and is based on the Raspbian Jessie operating system running on a Raspberry Pi 3 with a 3.5 inch touchscreen. It used the BATC-supplied filter-modulator board and could take video from the Raspberry Pi camera or the EasyCap. It can transmit DVB-S MPEG-2 with audio, or H264 without audio.

This version is no longer supported, although it will continue to work as built.

Portsdown 2019 Stretch

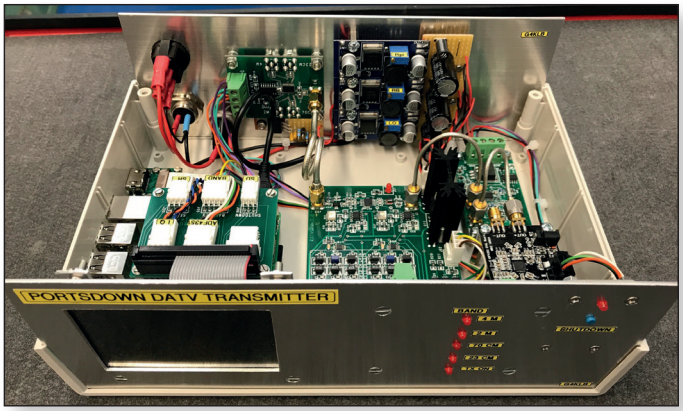
This was the second version, using the Raspbian Stretch Operating System. Support for the seven-inch touchscreen was added and some webcams could also be used as a video source. Audio capability was added for H264 encoding, and early support was provided for the LimeSDR Mini.

Later versions also supported the LongMynd receive software enabling good DATV reception using the MiniTiouner hardware

Again, this version is no longer supported, although it will continue to work as built.

Portsdown 2020 Buster

The current in-use version of the Portsdown is Buster 2020. This introduces support for the LimeDVB firmware on the LimeSDR Mini and also supports the use of standard firmware on the LimeSDR USB and the LimeNET Micro.



The LongMynd receive capability has been improved with the addition of a player that will display some H265 signals. It will also control an external Jetson Nano with an HDMI capture device to allow the transmission of high definition H265 signals.

This version will continue to be actively supported while the Buster operating system is current for the Raspberry Pi.

Portsdown 4

The latest version of the Portsdown is the Portsdown 4. This uses the Raspios Buster operating system on a Raspberry Pi 4 with a seven-inch screen and a LimeSDR. Unlike the previous version changes it does not maintain hardware compatibility with the classic (filter-modulator) Portsdown.

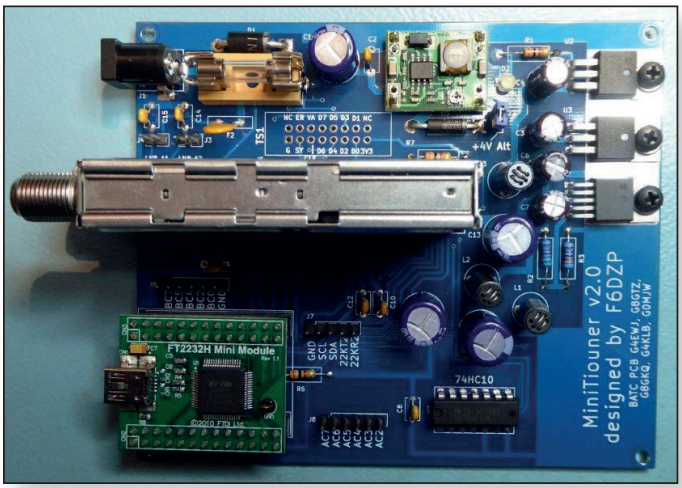
New builders are recommended to build the Portsdown 4 which, when used with a Adalm Pluto, is integrated with the Langstone microwave transceiver software enabling an advanced multimode narrowband and DATV transceiver covering 70MHz to 6GHz for under £300.

The first release of the Portsdown 4 was in late July 2020. Constructors can build their own SD cards using the install file on Github or pre-programmed SD Cards are also available from the BATC Shop.

https://wiki.batc.org.uk/The_Portsdown_Transmitter

Langstone narrowband transceiver

While not a BATC-sponsored project, the Langstone microwave narrowband transceiver, with coverage from 70MHz to 6GHz, runs alongside the Portsdown 4. See *https://wiki.microwavers.org.uk/Langstone_Project* for more details.



MiniTiouner V2 USB receiver hardware

Designed with the assistance of F6DZP, the MiniTiouner USB receiver V2 PCB has been available for three years and is used with the MiniTiouner PC software and the Ryde mark one receiver. Over 800 PCBs have been sold!

https://wiki.batc.org.uk/MiniTiouner_hardware_Version_2

LongMynd Linux receiver core

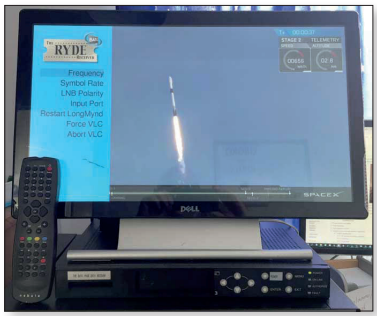
Developed by Heather, M0HMO, the LongMynd receiver is the core software which works with the MiniTiouner hardware and is used as the basis for the Portsdown DATV receiver and the Ryde set top box receiver. It has also been used been used by some amateurs as a basis for a Linux desktop receiver.

The source code is available on the BATC Github - *https://github.com/BritishAmateurTelevisionClub/longmynd*

Ryde DVB-S and S2 set top box

The BATC Ryde receiver is a stand-alone receiver or set top box (STB) designed specifically for DATV with similar functionality to a consumer STB.

It is controlled by an IR remote and has a "point and shoot" interface - simply enter frequency and SR, and the Ryde will look for DATV signals without the need to enter bouquets, transponders or scan across a range of frequencies.

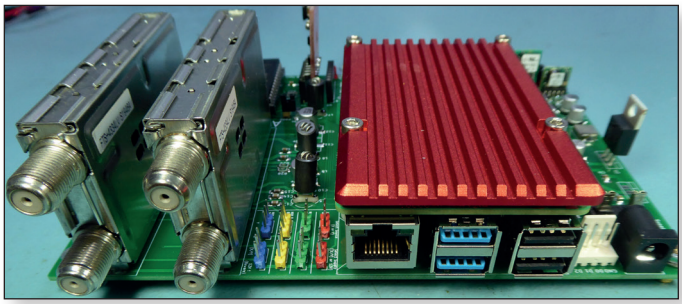


The Ryde mark one receiver uses a Raspberry Pi4 and separate MiniTiouner V2 PCB. The Ryde mark two, currently in development, will use the BATC advanced receiver PCB described below.

https://wiki.batc.org.uk/Ryde_Receiver

BATC advanced receiver PCB

Designed by Mike G0MJW, this development will enable the Raspberry Pi 4 and Serit tuner to be mounted on a single PCB and removes the need for an expensive USB interface. It is envisaged the PCB will be available in late Spring 2021.



Winterhill muli-channel receiver

Using the same advanced receiver PCB, this development by Brian G4EWJ will run on the Raspberry Pi4 desktop environment providing a multi-channel receiver capable of receiving up to four channels simultaneously.

Knucker OFDM project

Currently in the design phase (and a long way from release) the Knucker receiver project is a variable bandwidth DVB-T USB receiver based around the Serit FTM-4762 NIM.

It is envisaged a narrowband OFDM capability may be integrated in to the Portsdown system. This potential project is only at feasibility stage and no commitment to it becoming a reality is possible at this stage.

BATC video source

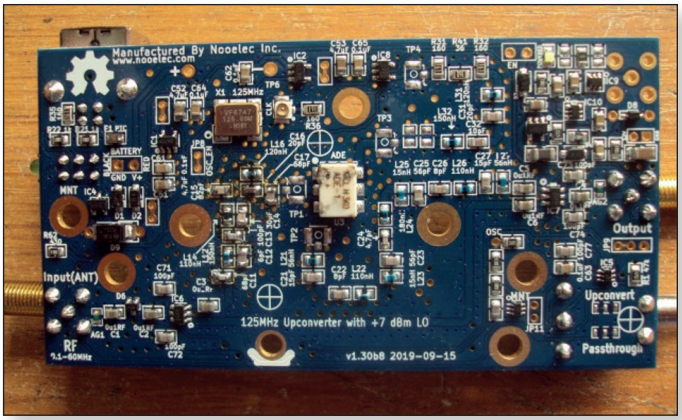
The BATC Video Source uses a Raspberry Pi 1, 2 or 3, a Pi Zero or a Pi Zero W as a composite video (PAL) signal source. It will output a static test card, or a test card with a moving banner and bouncing balls, from the composite video output. Test card F can be overlaid with a programmable callsign. Additionally, a contest testcard is available, and a Pi camera can be connected and used.

(See full article on page 13 - Ed)

▶ *The Langstone Narrowband Transceiver*

Modifying the Nooelec Ham it up Up-converter for 71 MHz DATV

Jim Smith G7NTG



I read the description of this up-converter and thought it would be useful to use with a MiniTiouner to extend the receive range downwards to cover the 71 MHz band for DATV. The range it covers is listed as 100 kHz to 65 MHz.

I bought one and tested it and the coverage is as stated, with a very sharp roll off at 65 MHz, so, as bought, it is no use for 71 MHz.

I decided to remove and replace the input filter components to change the top end roll-off to about 80 MHz so I downloaded a piece of filter design software from Coilcraft for elliptical filters and worked out the values of components required.

The size needed is SMD 0402 which are very small so some level of skill with SMD components is needed. Removal of the old components is easy because both ends of the components can be heated together.

The components are numbered with values on the PCB so the process is vastly simplified.

The following components are replaced with these new values:

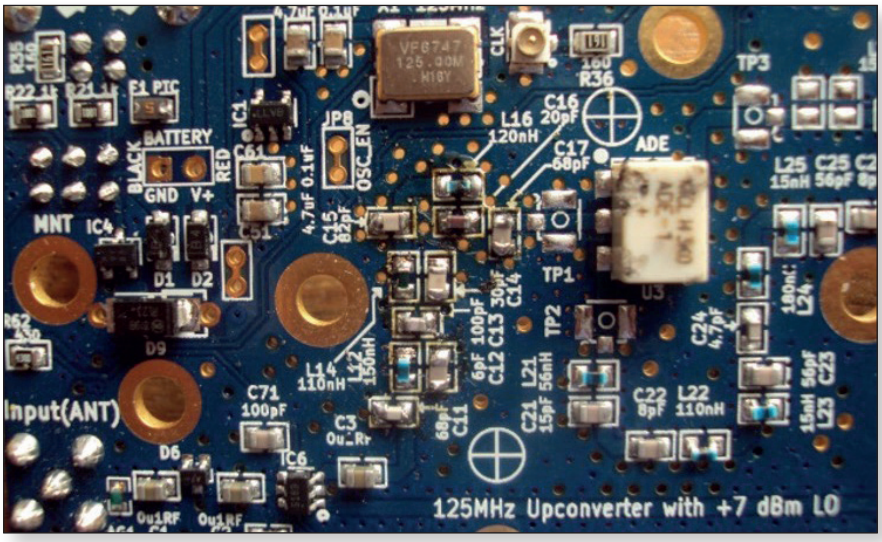
C11	18pF
L12	72nH
C12	33pF
C13	39pF
L14	68nH
C14	47pF
C15	47pF
L16	120nH
C16	8.2pF
C17	33pF

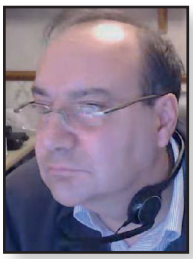
Having done the modifications, the up-converter was tested again and found to work very nicely when fitted between the 4m preamplifier and the MiniTouner (which was tuned to 196 MHz, ie 125 MHz up from 71 MHz). The filter roll-off frequency was around 85 MHz.

Using this up-converter with its various types of power feed and built in, reasonably accurate, local oscillator, makes setting up for 4m ATV receive very simple.

I use a standard MiniTiouner and an RP4s preamp from Spectrum Communications.

For details of the up-converter, just search for Nooelec Ham it up, and for the Coilcraft software search "Coilcraft elliptic filter designer" or go to *https://www.coilcraft.com/apps/lc_filter_designer/lc_filter_designer.cfm*.





How to use a Pluto for DATV

Mike Willis G0MJW

Let's start from the beginning, and apologies to those who have read much of this before.

In Analog Devices' own words, the *"ADALM-Pluto Active Learning Module (PlutoSDR) is an easy to use tool available from Analog Devices Inc. (ADI) that can be used to introduce fundamentals of Software Defined Radio (SDR) or Radio Frequency (RF) or Communications as advanced topics in electrical engineering in a self or instructor lead setting".*
https://wiki.analog.com/university/tools/pluto

In practice it is a highly advanced RF device with capabilities to transmit and receive across all amateur VHF/UHF bands from 6m to 6cm at a very attractive price.

It can do this with RF bandwidths of up to 20 MHz and can transmit and receive simultaneously. It may look like a toy, and it is in the sense all amateur gear is something we like to play with, but it's much more capable than its looks imply.

There are limitations. While the Pluto contains the highly capable AD9363 RF chip, it does not contain any significant RF filters or high-power amplifiers.

The wide-open front end needs external filtering for use on the air, both to avoid overload on receive and unwanted emissions on transmit. Additionally, the AD9363 is a cut down chip that officially "only" covers 325MHz to 3.8 GHz.

With a software hack it appears to tune over the full 70MHz – 6 GHz range, but this is not guaranteed.

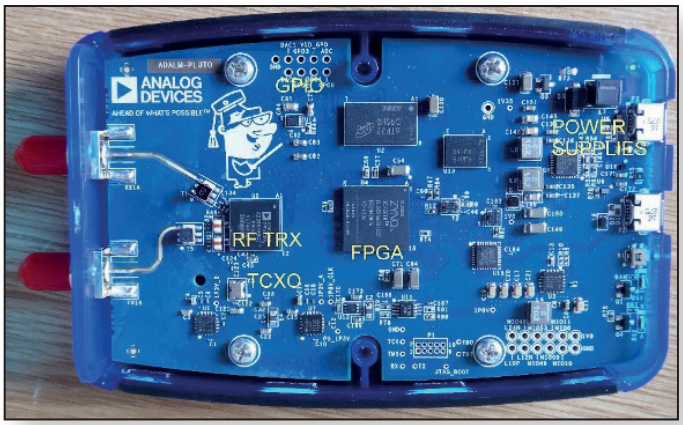
It also contains an FPGA that implements two ARM cores, with one disabled. Another software hack enables both. It's almost as if the hardware engineers pulled a blinder by developing a device that should sell for much more but can be sold cheaply to universities and amateurs without undermining their professional products which must meet guaranteed specifications.

Not only this but Analog Devices open-sourced the project, which means we get the chance to tweak and that is what the rest of this article is about.

Initial Steps

The Pluto uses a USB-2 interface. There are two USB ports, one for power and another for data/power. Normally you can just use the single data port, however there are reasons to use the power port which we will deal with later. I will only cover Windows use here. If you use Linux, you probably know what to do anyway, if you use a Mac you are probably used to being on your own but it's pretty similar.

The first thing to do is to take a screwdriver and take it apart. This is what it looks like inside.



Have a good look, figure out what parts do what, find the frequency reference chip (TCXO), find the general purpose input/output (GPIO), note the complete absence of RF filtering (an opportunity as well as a curse).

After this, before doing any modifications, it's probably best to download the drivers and test it works. The drivers can be found, along with comprehensive instructions on how to install them at *https://wiki.analog.com/university/tools/pluto/drivers/windows*

Once installed, the Pluto will appear as a USB device. It will open a virtual USB drive and appear as a network adapter with the address 192.168.2.1. It also contains a webserver that you can access through a web browser.

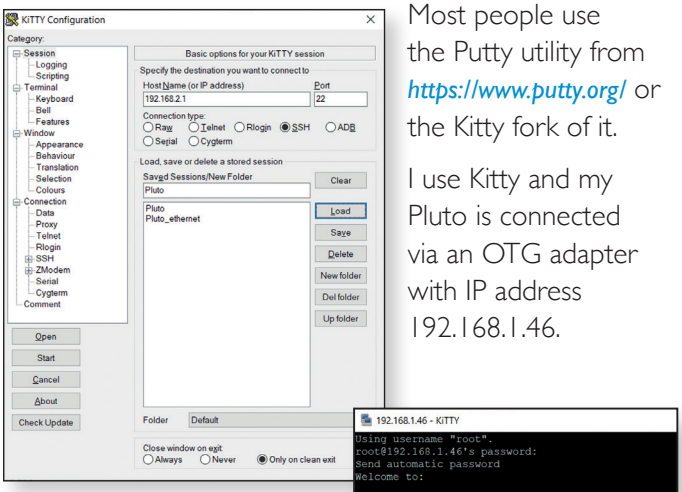
Check all that works as expected.

The Pluto's USB port can also act as an on-the-go (OTG) port. This means you can attach a OTG Ethernet adapter and put it on your home network. There are many advantages to this, but make sure you use a wired adapter and not a WiFi one.

Power can be an issue, the Pluto can only supply limited current to the attached device and a powered USB OTG hub or a Y cable is usually the best option. DD1US has written a nice guide *https://tinyurl.com/y6ljpb6x*

Expanding the frequency range and enabling the second CPU

The Pluto behaves as a headless computer (no screen or keyboard) and you can log into it in the same way as a raspberry PI using secure shell.



Most people use the Putty utility from *https://www.putty.org/* or the Kitty fork of it.

I use Kitty and my Pluto is connected via an OTG adapter with IP address 192.168.1.46.

I have updated the firmware as in the next section

SSH into the Pluto.
Enter the commands:

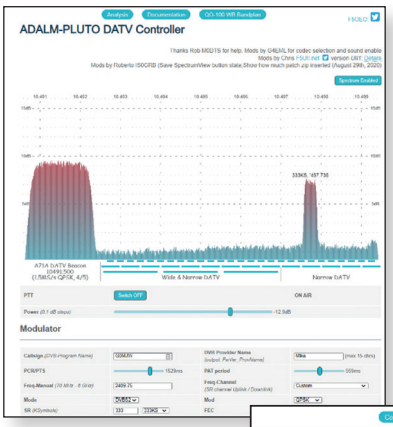
```
# fw_setenv attr_name compatible
# fw_setenv attr_val ad9364
# fw_setenv maxcpus
# reboot
```

Loading the alternative firmware

Evariste, F5OEO has developed alternative software aimed at DATV use. This is available at *http://firmware.hackhamradio.com/*

Download and update to this firmware. It is a simple process, involving copying the file to the Pluto flash drive and ejecting the drive. Instructions on how to do this are at *https://wiki.analog.com/university/tools/pluto/users/firmware* but do not update to the official firmware, instead update to the version from F5OEO. At time of writing the version dated 29 August 2020 appears best. This allows patches to be added if needed to enable new features or fix bugs. Later versions of this firmware exist and probably work well but I have not tested them yet.

Entering the Pluto IP into a web browser should now produce a web page showing the controller where you can enter your callsign, name, parameters etc. There is also a useful documentation tab and a transport stream analysis tab that we will cover later.

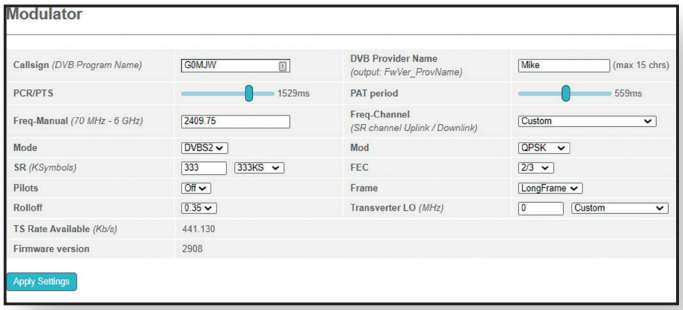


In order to transmit a DATV signal with the Pluto it needs to be sent a DVB-compliant transport stream at the correct bit rate.

The controller helpfully calculates this rate for you.

For example, the BATC net specifies DVB-S2, 333ks QPSK 2/3 FEC where the maximum rate is 441 kilobits per second. Hopefully most modulation settings will not require explanation.

The only one that does is PCR/PTS. In simplistic terms, this relates to the presentation time stamp compared to the programme clock reference and is to do with AV timing buffers. The higher the value the better, but that increases latency. If you are getting audio breakup try increasing the value.



Encoding and generating the transport stream

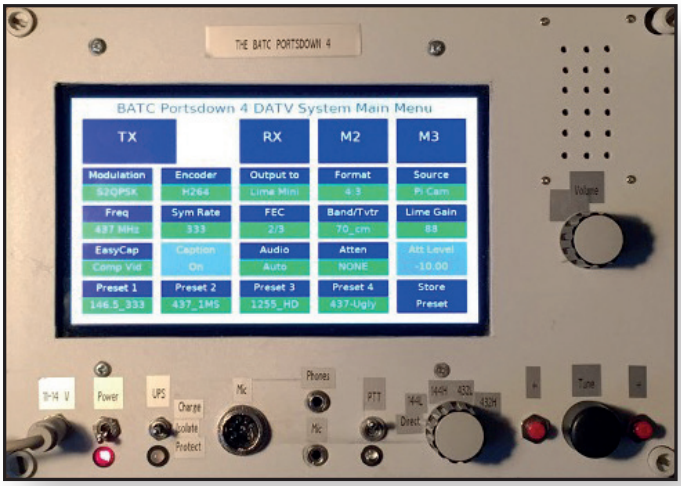
There are several ways of generating a transport stream to send to the Pluto:

- **Portsdown 4**
  This is the latest iteration of the Portsdown project and uses the Raspberry Pi4. It is probably the simplest way to drive the Pluto. There are some limitations, for example it cannot yet encode H265 video, which is gaining in popularity.
- **RTMP streaming protocol**
  This can be from a streaming package like Open Broadcaster Studio (OBS) or vMix, ffmpeg or from a PI with NGINX or ffmpeg or from a mobile phone with an application such as Larix Broadcaster.
- **UDP protocol**
  The transport stream is generated on a local computer (e.g. PC, PI, Jetson-Nano) and streamed as UDP packets to the Pluto. Or the transport stream is generated by an external encoder box and streamed as UDP packets to the Pluto.

I will now cover each of these in a little more detail.

Portsdown 4

This is well documented on the BATC Wiki at *https://wiki.batc.org.uk/Portsdown_4*



▶ *G8GKQ's Portsdown 4*

Like earlier versions of the Portsdown system, the Pi4-based Portsdown 4 can generate MPEG2 and H264-encoded video from several sources and is controlled with the now familiar touchscreen interface. It can also provide control signals for relays, calculate beam headings and be used with a Minitiouner to receive RB-DATV, making it an excellent portable choice.

Integrated with the Langstone project from G4EML, the same hardware becomes an all-mode microwave transceiver covering all bands from 70MHz to 5.7GHz and with a bit of coaching, can also cover 50MHz and 10GHz.

RTMP Streaming

The RTMP method is described under the documentation tab of the Pluto web server. For example one might enter in vMix or OBS streaming windows:

```
URL:rtmp://192.168.2.1:7272/,437,DVBS2,QPSK,333,23,
Stream key: ,G0MJW, [Hint – use your own
callsign, not mine]
```

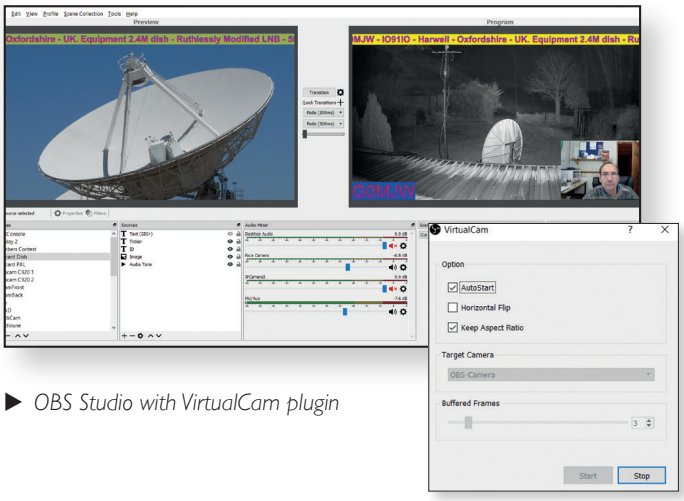
The stream rate needs to be set to an appropriate value, in this case 440kb/s in the vMix or OBS streaming settings. The rate can be calculated from *http://www.satbroadcasts.com/DVB-S_Bitrate_and_Bandwidth_Calculator.html* but note the Pluto will now do it for you.

UDP Streaming – PC or Jetson-Nano generated Transport Stream

The most flexible way of generating a transport stream is to do it yourself. This gives the widest range of parameters to tweak in order to get the best outcome, particularly for very low bit rates. This flexibility means it is also the most challenging, but most of the work has been done already.

The requirements are a copy of ffmpeg *https://ffmpeg.org/* and a video and audio source, which could be a webcam and microphone, OBS, vMix, or a stream from another device.

We will use OBS *https://obsproject.com/download* as an example as the software is free and easy to use, once you get used to it. Using OBS for DATV is another article but there are plenty of tutorials on the web.

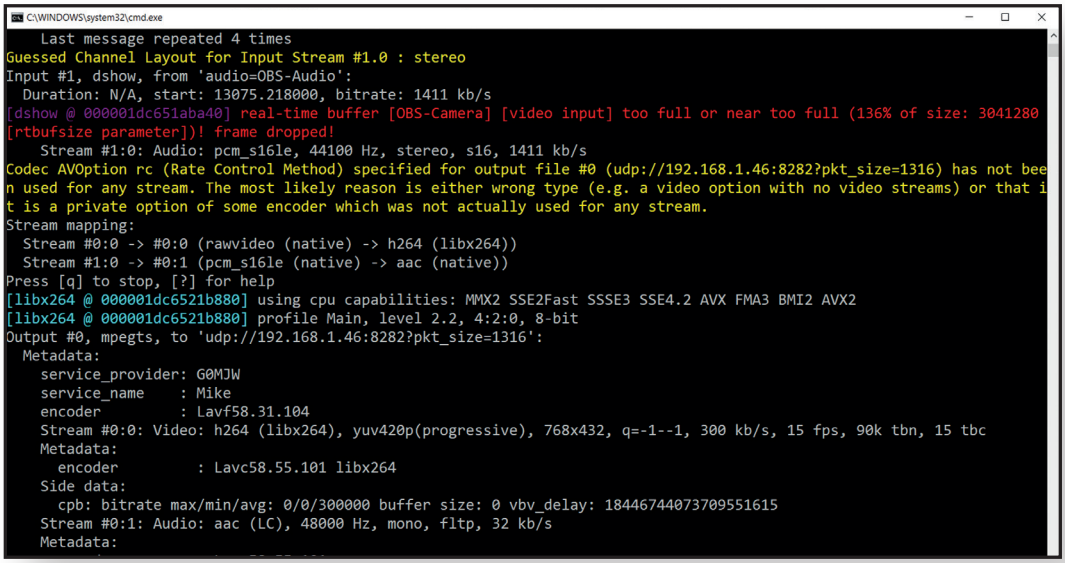


▶ *OBS Studio with VirtualCam plugin*

OBS needs the Virtual Camera plugin *https://obsproject.com/forum/resources/obs-virtualcam.949/*

I do not recommend using the built-in virtual camera in later versions as it does not yet have a sound capability which makes getting lip-sync correct very challenging.

This virtual camera makes the OBS output appear to the system as a webcam, (handy also for Zoom calls). The virtual camera needs to be enabled. Only one is required and it should be called OBS-Camera. The devices created are "OBS-Camera" and "OBS-Audio". vMix has a similar capability called External Output. In this case it's "vMix Video" and "vMix Audio".



What we need to do is capture these virtual sources with ffmpeg, transcode them to digital video, assemble into a mpeg transport stream and send that by UDP to the Pluto.

Sounds complicated and it is, but it's just a single, very long command line:

Here is what I use to generate the 440kb/s transport stream for the BATC net as described earlier. Rather than type it every time I saved it as a batch file called BATCNET.BAT on the desktop and simply double click it once OBS is running, setting appropriate parameters on the Pluto web interface.

```
c:\ffmpeg\bin\ffmpeg -f dshow -i
video="OBS-Camera" -thread_queue_size 512
-f dshow -i audio="OBS-Audio" -vcodec h264
-s 768x432 -r 15 -bf 0 -pix_fmt yuv420p
-b:v 300k -preset slow -profile:v main
-rc cbr_hq -rc-lookahead 5 -acodec aac
-aac_coder twoloop -ar 48000 -ac 1 -b:a
32k -f mpegts -muxrate 440k -streamid
0:256 -streamid 1:257 -max_delay 1500000
-metadata service_provider="G0MJW"
-metadata service_name="Mike" -y
"udp://192.168.1.46:8282?pkt_size=1316"
```

With H264 encoding at the relatively low symbol rates we use for the BATC net, it is important not to try and send too high resolution or the results will be disappointing. Try 768x432 instead of 1920x1080 for example.

A little can also be gained from reducing the frame rate, which is fine for QSOs. Increasing the buffer size (max delay) improves the stability and helps prevent audio dropouts.

To send H265 video, which is about twice as efficient, with much better picture quality, it is possible to encode in software on a fast PC but it is best to use hardware acceleration which is included in recent graphics cards designed for streaming video.

This example is for an Nvidia card with the video encoder highlighted.

```
c:\ffmpeg\bin\ffmpeg -f dshow -i
video="OBS-Camera" -thread_queue_size 512
-f dshow -i audio="OBS-Audio" -vcodec
hevc_nvenc -s 1920x1080 -bf 0 -pix_fmt
yuv420p -b:v 300k -r 15 -preset slow
-profile:v main -rc cbr_hq -rc-lookahead
5 -acodec aac -aac_coder twoloop -ar
48000 -ac 1 -b:a 64k -f mpegts -muxrate
440k -streamid 0:256 -streamid 1:257
-max_delay 2500000 -pcr_period 40 -pat_
period 0.4 "udp://192.168.2.1:8282?pkt_
size=1316&bitrate=440000"
```

Other makes of card will have a slightly different codec name, e.g. AMD Radeon cards with hardware encoding (hevc_amf) are supported in recent ffmpeg versions. See *https://trac.ffmpeg.org/wiki/Encode/H.265*

Understanding these commands requires knowledge of ffmpeg but I will break down an example, with a twist.

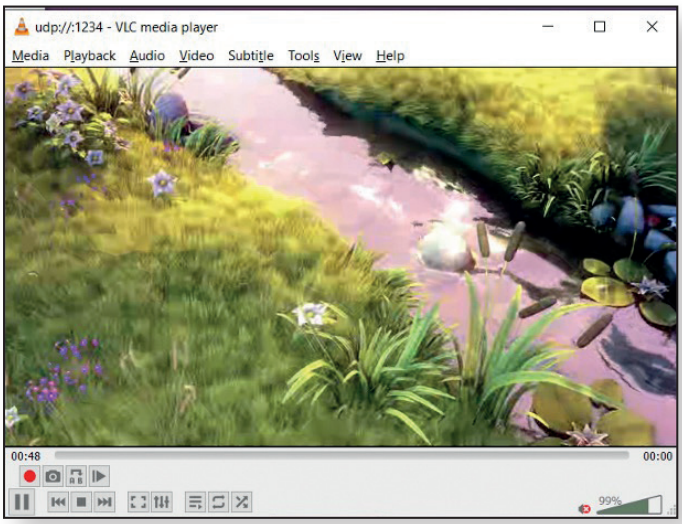
This command generates a 200kb/s (e.g. 125ks QPSK 5/6) transport stream but instead of sending it to the Pluto, sends it to the local machine where it can be displayed in VideoLanClient (VLC).

```
c:\ffmpeg\bin\ffmpeg -f dshow -i
video="OBS-Camera" -thread_queue_size 512
-f dshow -i audio="OBS-Audio" -vcodec
hevc_nvenc -s 1280x720 -bf 0 -pix_fmt
yuv420p -b:v 130k -r 15 -preset slow
-profile:v main -rc cbr_hq -rc-lookahead
5 -acodec aac -aac_coder twoloop -ar
48000 -ac 1 -b:a 24k -f mpegts -muxrate
200k -streamid 0:256 -streamid 1:257
-max_delay 2500000 -pcr_period 40 -pat_
period 0.4 "udp://127.0.0.1:1234?pkt_
size=1316&bitrate=200000"
```

The quality as demonstrated above, is fairly good for 125ks. Breaking it down:

`c:\ffmpeg\bin\ffmpeg`	The program name
`-f dshow -i video="OBS-Camera" -thread_queue_size 512`	Video input parameters
`-f dshow -i audio="OBS-Audio"`	Audio input parameters
`-vcodec hevc_nvenc -s 1280x720 -bf 0 -pix_fmt yuv420p -b:v 130k -r 15 -preset slow -profile:v main -rc cbr_hq -rc-lookahead 5`	Video encoding settings – Nvidia HEVC (H265), format yuv420p, resolution 1280x720, bitrate 130kb/s, framerate 15fps, encoding pre-sets and profile, high quality constant bit rate
`-acodec aac -aac_coder twoloop -ar 48000 -ac 1 -b:a 24k`	Audio encoding settings – AAC transcoded from 48kb/s to 24 kb/s
`-f mpegts -muxrate 200k -streamid 0:256 -streamid 1:257 -max_delay 2500000 -pcr_period 40 -pat_period 0.4`	MPEG transport stream settings, bit rate 200kb/s, stream IDs, maximum delay between audio and video, how often metadata is sent.
`"udp://127.0.0.1:1234?pkt_size =1316&bitrate=200000"`	Destination IP address, port and bitrate.

A similar approach is possible with the Jetson Nano using Gstreamer or FFMPEG. See John, G7JTT's set of articles in CQTV for more details.



Most of the above parameters are obscure, but the good news is they have been tested and developed largely by Evariste, F5OEO and Yves, F4HSL - so we only need to follow their lead.

This approach, with realistic expectations for frame rate and resolution, works down to 35ks/s. This does come at the expense of increasing encoding delays and that is not great for QSOs, but is fine for sending contest exchanges, where drastically lowering the symbol rate can make the difference between a contact or not.

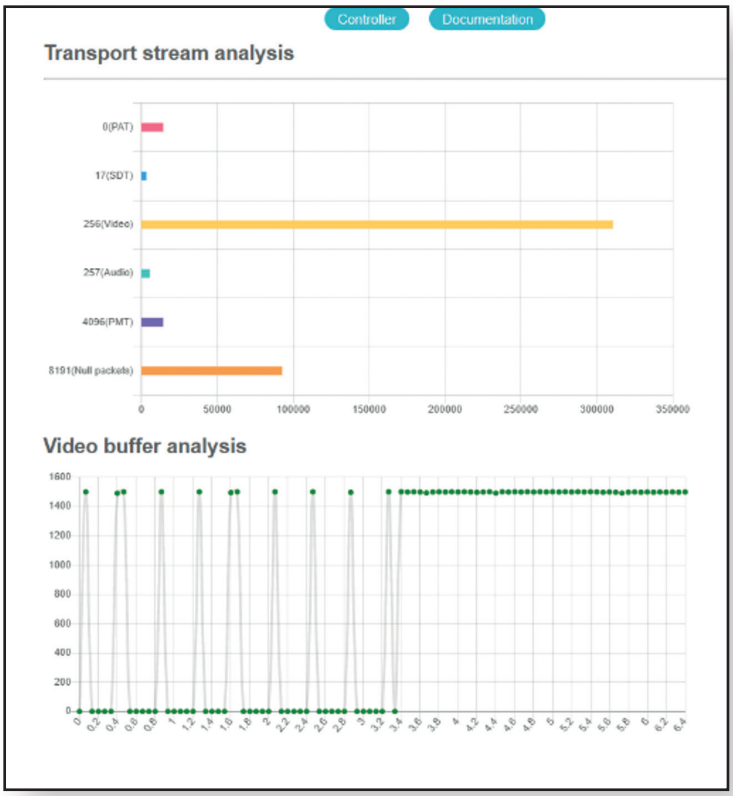
UDP Streaming – Using the H264/H265 encoder

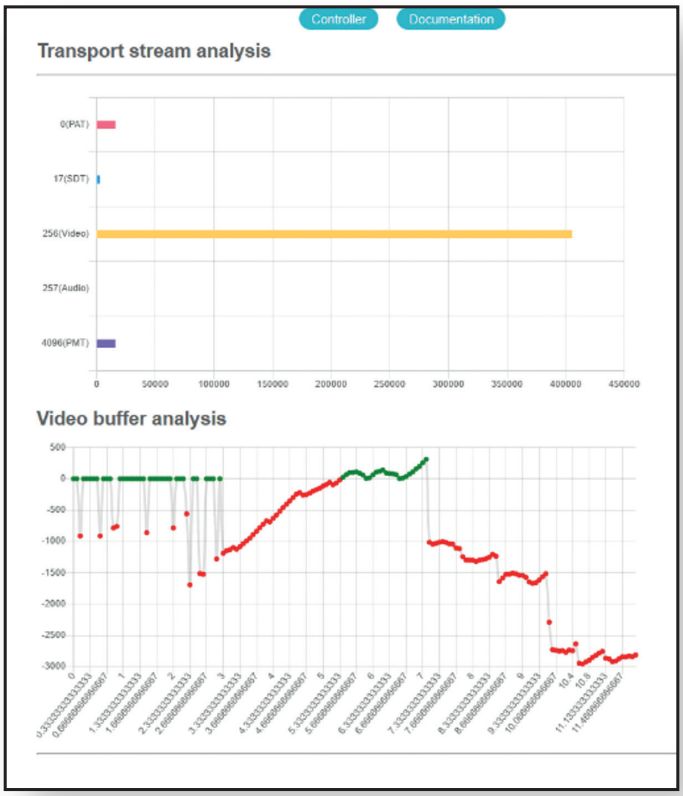
Recently HDMI capture/streaming encoders have appeared for around £70 which can encode HDMI audio and video into various streaming formats. The F5OEO firmware supports the specific encoder in the picture and controls it, using fairly conservative settings that work OK for most content.

If all the batch files seem like too much, use is as simple as plugging it in, selecting the "Force Compliant" option and providing an HDMI input. Rob, M0DTS has developed a patch to fix a bug in the selection logic in the 290820 firmware *https://github.com/m0dts/HDMI-Encoder-Tools*

The encoding quality is not as good as the graphics card method, but it's still pretty good and with the benefit of low latency.

Note – don't try to use the other methods or your Pluto for anything else if you have one of these on the network as they will clash. Either turn it off or hide it from the Pluto by fudging the IP address. If your Pluto is plugged in via a USB port rather than on an ethernet cable, you need to bridge the networks.





Note on reliability

Encoding for reduced bandwidth is somewhat pushing the envelope in terms of encode performance. H265 in particular is not as constant rate as we would like, while the transmission rate is fixed. Consequently, an encoding bitrate margin is required with results depending strongly on the picture content and movement.

A rule of thumb is to set the video bitrate to 60% of the available capacity. If that doesn't work out, e.g. there are stream errors due to the data rate being exceeded, try lower, if it works too well, try higher etc.

The F5OEO Pluto firmware includes a simple but effective transport stream analysis tab that will show you if things are working or not. There should be a few, but not too many null packets and the buffer should not overrun.

In this example, on the left things look good. On the right, not good. The video bit rate has been set a little too high. There is a lot more information to be had by looking at the codecs and statistics under the tool tab of VLC or using a transport stream analysis program.

PTT Output

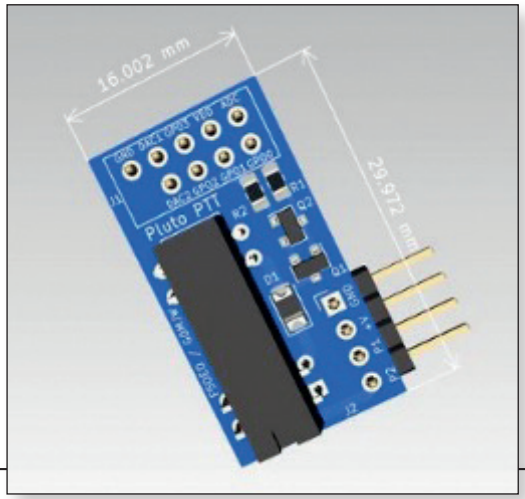
Many people will want to control the transmitter from the Pluto. This can be done via the GPIO port. A simple two transistor circuit with a relay can achieve this.

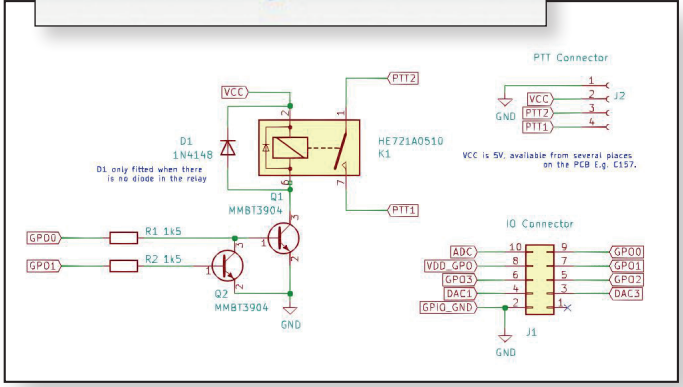
A PCB and details are in the BATC shop - *https://batc.org.uk/shop/pluto-ptt-output-driver-pcb-2/*

Conclusion

Hopefully this brief guide has provided some actual guidance, but if more is needed please remember the BATC Wiki.

https://wiki.batc.org.uk/Custom_DATV_Firmware_for_the_Pluto

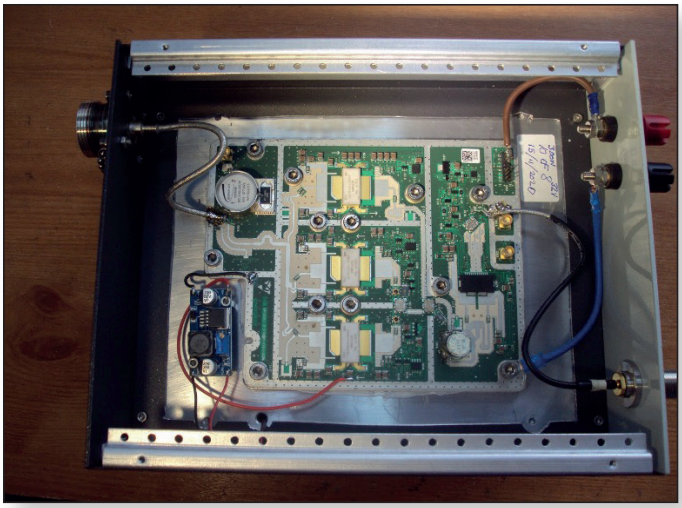




Modifications to a board from Bison Electronics

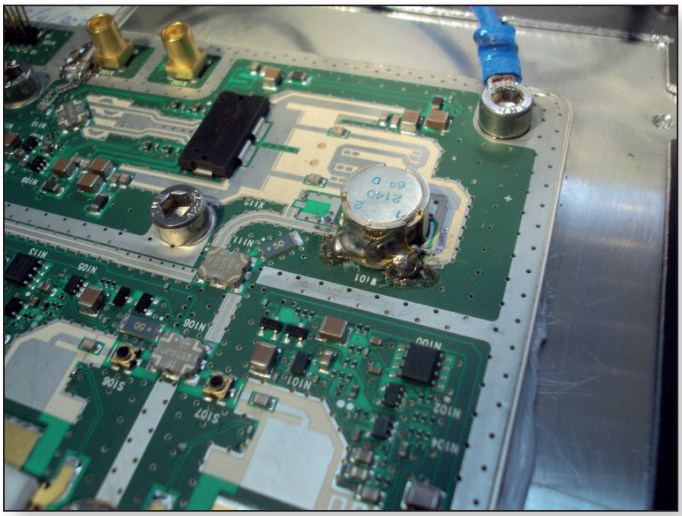
Jim Smith G7NTG

Modifications to a board from Bison Electronics with three BLF8G22LS-160BV Transistors



Bolt the pallet down to a BIG heatsink with 12 x M5 screws.

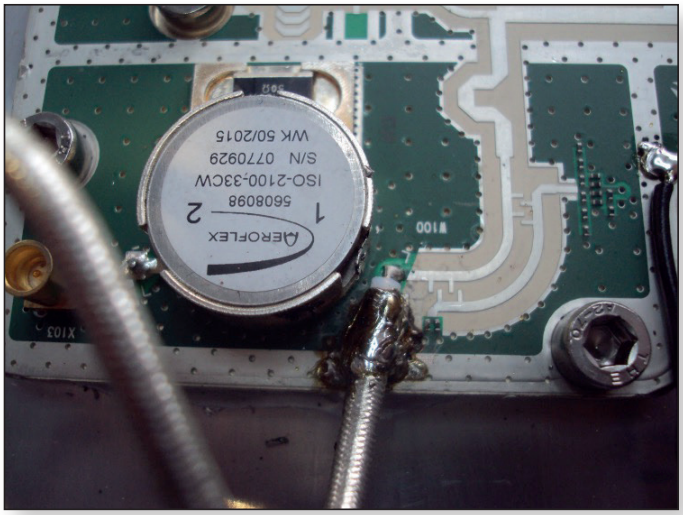
First, bypass the small circulator by cutting off the original connectors and then fitting some small semi-rigid cable soldering it to the body of the circulator as the ground plane.



You will need a good hot soldering iron – I use a Weller 75-watt temperature-controlled iron with a 5mm screwdriver bit at 400C.

Disconnect the input to the large circulator and connect the output semi rigid RG-405 as shown.

I recommend a 7/16 output connector but N should be OK.



Connect the input as shown by cutting the track from the input connector.

Connect +32VDC to the outer 6 pins of X105 as shown using 4mm-square cable.

Drive power max is 180mW for 300W out at 2400MHz and 25mW for 250W P1dB out.

Max power at 2300MHz is around 500W with P1dB around 400W.

Power supply needs to be capable of up to 35 amps at 32 volts.

If you have any questions or would like me to build you one for £400 + postage (subject to availability of PCB's) please contact me at *thebigclunk@virginmedia.com*.

PLEASE NOTE THAT TESTING THIS AMPLIFIER WITHOUT THE SCREENING COVER IS VERY DANGEROUS FOR YOUR EYES. FIT THE SCREEN EVERY TIME WHEN TUNING AND TESTING!

The Portsdown Newsletter

Dave Crump, G8GKQ

Things have been a little quieter on the Portsdown front of late (mainly due to the need to support the Ryde receiver), but there have been a number of minor updates.

Portsdown 4 GPIO Connections

The Portsdown 4 is compatible with all the RF switching boards that were designed for earlier Portsdown versions, but two GPIO pin connection changes have had to be made due to differences in the Raspberry Pi 4 design.

The first change affects the Band LSB (or D0) signal which has been moved from GPIO pin 28 to pin 32. Pin 32 is available on the GPIO interface board as the (now unused) "I" output, pin 2 on J03.

Note that the signal that used to be called the Band MSB is now referred to as Band D1, and the old transverter switch signal is now referred to as Band D2 (same pins, just a more logical name).

The second pin that has changed was used to drive the SPI LE line for the ADF4351 synthesizer. This signal, which has moved from GPIO pin 27 to pin 33, is only used on the Portsdown 4 if you are using an ADF4351 with the Portsdown 4 signal generator (see below).

Portsdown Updates

Two recent updates have been made to both the Portsdown 2020 and the Portsdown 4. The first simply improved the reliability of the LongMynd receiver through an update to the LongMynd code.

The second update reduced the contrast setting on the EasyCap input (for transmission, streaming and display) so that white crushing did not occur on a true 1v p-p grey scale input. The need for this update only became apparent during initial use of the Raspberry Pi video source described elsewhere in this issue of CQ-TV.

Other minor updates (slightly) improved the phase noise of filter-modulator board transmissions on 23 cm for the Portsdown 2020, and added a "blink" on the Portsdown 4's 7 inch display to indicate a successful snap (screen capture) of a received signal or stream.

Portsdown 4 Signal Generator

Many of you will have used the old Portsdown signal generator, which used the ADF4351 or a DATV Express card as the signal source.

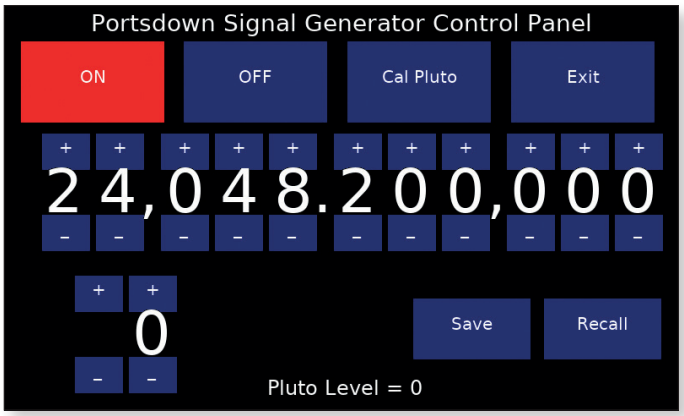
This capability was not initially included in the Portsdown 4 because it needed hundreds of lines of code to be re-written. This work has now been completed, and a new improved signal generator has now been added to the Portsdown 4, which uses the Pluto as the primary output device, covering 50 MHz to 6 GHz.

The capability to use an ADF4351 or the DATV Express as an output source has been retained and supplemented with the ability to drive an ADF5355 (covering up to 13.6 GHz) or an Elcom microwave source.

The Elcom sources only work over an 800 MHz or so frequency range in the 12 GHz region (depending on the model). Their advantage is superior stability and low phase noise, but they are only programmable in 3.33 MHz steps.

The most recent new feature is the "fifth harmonic" mode for the Pluto signal generator, which enables it to generate low level marker signals at frequencies up to 30GHz.

Thanks to Colin G4EML for doing the original research on this capability.



▶ *Portsdown Signal Generator on 24048.2 MHz*

HDMI Input to the Portsdown 4

The LKV373A unit (described in CQ-TV 269 pp 22-23) can now be used as an HDMI input device for the Portsdown 4 in Pluto transmit, streaming or local display modes. It does not work with Lime or DATV Express.

To use it, make sure that you have the LKV373A's IP address and port set on the Jetson/LKV Config Menu (accessed from Menu 3) and you can then select HDMI as a video source for streaming or for transmissions using the Pluto. You can also view the HDMI video using the HDMI Monitor on Menu 2.

Sadly, it seems that the LKV373A V3.0 is no longer manufactured and is becoming difficult to purchase. I would be interested to hear of any other HDMI capture devices that have a reasonably stable manufacturing source and supply chain (not just eBay) that could be candidates for inclusion in future Portsdown updates.

SD Cards

I recently had the opportunity to test three different types of SD Cards. The Raspberry Pi is quite fussy about SD Cards, but until this test I had not realised quite how fussy.

I tested three types of card:

- **The Samsung Pro UHS-I** - Amazon: Samsung Memory 16 GB Pro MicroSDHC UHS-I Grade 1 Class 10 Memory Card without Adapter
- **The Kingston Class 4 card** - Amazon: Class 4 Kingston Micro SDHC memory card With Sd Adapter HC MicroSD (16GB)
- **The SanDisk Ultra** as sold by the BATC Shop - Amazon: SanDisk Ultra 16 GB microSDHC Memory Card + SD Adapter with A1 App Performance Up to 98 MB/s, Class 10, U1.

For the test, after writing a Raspios Buster image to each card, I measured how long they took to complete a build of the Portsdown 2020 software on a Raspberry Pi 3.

Samsung Pro UHS1: 2 hours 33 minutes (average of 3 cards) Kingston Class 4: 1 hour 21 minutes (average of 2 cards) SanDisk Ultra: 35 minutes (average of many cards)

These results speak for themselves, but I did also check for usability, and the Samsung and Kingston cards were noticeably slower to boot up and shutdown.

In the early days of the Portsdown I spent many hours troubleshooting problems that turned out to be caused by sub-standard SD Cards. The SanDisk Ultra 16 GB cards are currently less than £5 each from Amazon, so I very strongly recommend the purchase of these, not only for the Portsdown, but also for the Ryde and the Raspberry Pi Zero video source.

Future Capabilities

Please let me know if there is something that you feel that you can add to the Portsdown capability. If you have an idea that might work, and just need to know a bit more before you write some code to try it, please contact me by e-mail and we'll try to make it work.

Building the Ryde Receiver

Shaun O'Sullivan G8VPG

Over the past two months, Ivor G1IXF and myself have built three BATC Ryde receivers. Two of these are destined for GB3ZZ and the other is for personal use. Ivor assembled all the parts, fitted them into a case and completed the power wiring. I fitted the wiring to the Pi GPIO, various accessories such as lock relay, delay timers, infra-red sensor, software installation and off-air testing.

Two of these receivers used the BATC Minitioune board. This is now a mature project and assembly is straightforward, made easy by the superb quality of the PCB. There is lots of information on the BATC Wiki about building a Minitiouner and no changes are required to use it with the Ryde receiver.

The third receiver used the French, REF supplied Minitiouner S board. This is a single channel Minitiouner which is supplied as a fully assembled PCB. It is necessary to fit the Serit tuner and some LED indicator lamps. The tuner used is the horizontal version and it fits under the board, thus making the PCB smaller than the BATC version.

The components are all surface mounted and the board includes provision for 14/18V LNB supplies. One of the LED lamps is for signal lock, but this only works with Mintioune software. There is some indication that the board uses a little less power than the BATC version, but otherwise performance is very similar.

The Pi requires a 5V power supply, capable of supplying 2A, although the running current usually averages about 0.8A for the receiver. We have used a Meanwell-branded 12 to 5V downconverter, which is built into a perforated metal case rather like their mains power supplies. I think this is a better-quality power supply than the various eBay supplied bare PCBs that are available, albeit more expensive. I have set the output to 5.2V and applied power direct to GPIO pins two and six. This prevents the Pi low voltage warning from appearing on the screen.

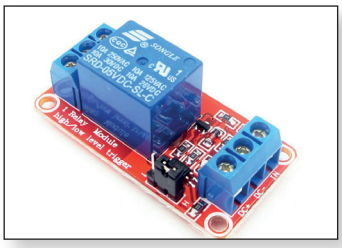
The Pi has been assembled into a two-piece die-cast aluminium case that also acts as a heatsink. This has kept it running at a comfortably cool temperature.

We have not fitted the keyboard to these receivers. Control is via the infra-red handset. We have used a TSOP2438 sensor. This requires a 3.3V supply that I have taken from GPIO pin one. The sensor is quite sensitive and works well behind the typical smoked screen that is found on a set top box.

The receivers have been built into a variety of cases that were available, mostly stripped out old analogue satellite receivers. One problem of having no radio rallies for the past year is that we are running very low on project boxes.

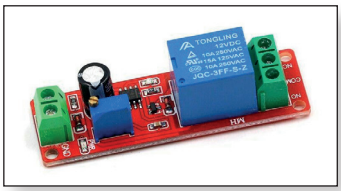
The GB3ZZ logic control requires all inputs to be brought out to baseband video and audio. Hence, we have used the analogue output from the Pi, which is provided by a 3.5mm four-pole jack. There is no standard for how these jacks are wired between the various manufacturers of video equipment, hence you need to check that any pre-assembled cable is correctly terminated.

Because these receivers are to be used in a repeater, we need a lock output to indicate when a valid signal is present. This is taken from GPIO pin seven. I have connected this to an opto-isolated relay board from eBay. These boards are very inexpensive and are sold for use with Arduinos etc.



▶ *A opto-isolated relay board from Ebay can be used to safely drive a lock lamp or repeater logic system.*

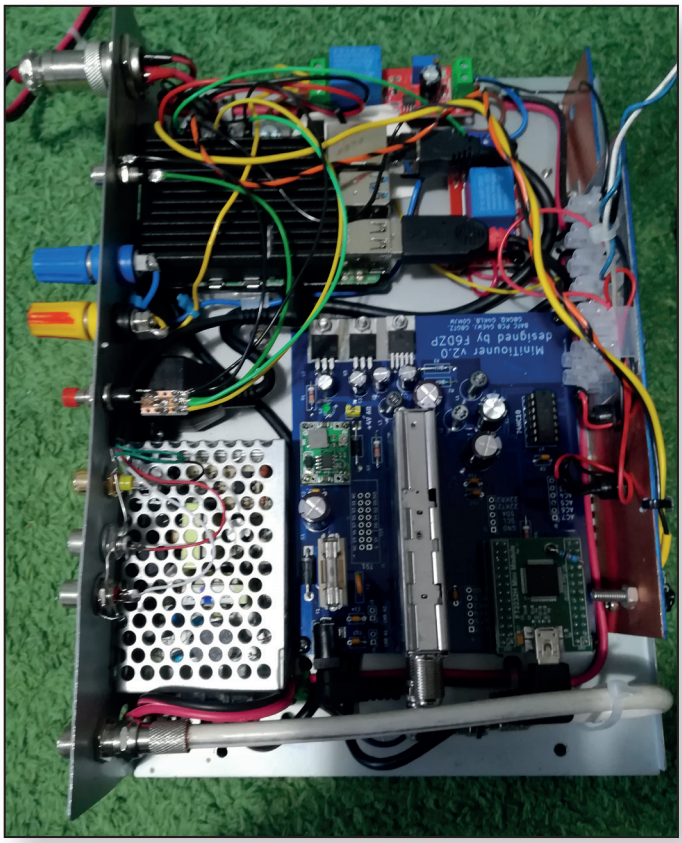
We found that on certain frequencies, mostly in the 70cm region, the Ryde was prone to generating brief false lock signals, which causes the lock relay to chatter. To prevent this from switching the repeater output, I have put a two-second time delay on the lock relay output. This is once again a very inexpensive eBay 0.5-10 second timer delay board, using an NE555 timer chip. This also has the beneficial effect that when the repeater switches over, the red "locked – no video" screen will have gone.



▶ *An Ebay sourced time delay board has been used to delay repeater access by two seconds to avoid any spurious access signals.*

I have also fitted the hardware shutdown button to each receiver. This must be enabled in the console menu screen and is connected to GPIO pin 26. GB3ZZ is full of infra-red controlled devices and we try to avoid using handsets on site because we have had so many incorrect interactions.

The latest Ryde software seems very stable and crashes have been few. However, leaving any computer running for weeks on end will eventually result in a crash. In a remote repeater, this means a visit to site to reset it. We have adopted the same system that has been running very well for 18 months with the Portsdown-based streamer. A timer-controlled relay operates the hardware shut down button to safely shut down the Pi. This is followed two minutes later by another timer-controlled relay that cycles the power to the Pi, thus rebooting it. If it crashes, the next reboot cycle will correct it automatically.



▶ *The inside of the second Ryde receiver, which is destined for the GB3ZZ 437MHz input. This was squeezed into an old analogue satellite receiver case. Photo credit G1IXE*

I have written the MicroSD cards for the Pi using the instructions on the BATC Ryde Github page and this has always worked flawlessly. These receivers have been set up to start on a fixed frequency, either 1249 or 437MHz, which are the repeater input channels.

Symbol rate scanning has been enabled, 1249MHz using 2Ms, 1Ms and 333ks, and on 437MHz using 1Ms and 333ks. This works well and the receivers lock up once they cycle round to the correct symbol rate. There is a delay of about five to six seconds per symbol rate scanned.

The receivers have been tested with off-air signals and their sensitivity and lock stability seems to be good. The increase in sensitivity as the symbol rate is reduced seems broadly in line with theoretical expectations.

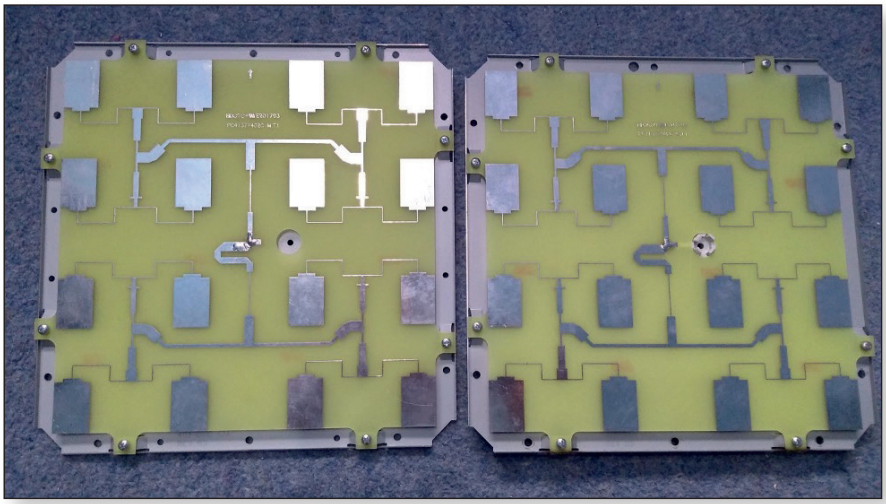
By the time you read this, we hope that these receivers will be fitted to GB3ZZ. Compared to the primary input on 1249MHz, 4Ms, DVB-S, using DVB-S2 and 333ks should result in a 10dB improvement in sensitivity. It is hoped that this will allow more DX stations to get in, particularly during lifts.

Four stations in Bristol (G4BVK, G1IXF, G8XZD and myself) have now built and used the Ryde receiver and all of us have been very impressed. It is at least as good as any other low symbol rate DATV receiver and the BATC team is to be congratulated in taking a concept to a reliable product in such a short space of time.

A TXCO for QO-100

Gareth Evans G4XAT

OK, so it's not Lisle Street, but we are living in times of outstanding surplus availability that can feed many aspects of our hobby.



Over the years I'm sure we have found suppliers of good stuff at sensible prices – places like J Birkett of Lincoln. One of the modern-day sources is Mainline Electronics which if I recall were one of the early sources for PA 'bricks' and specialist components.

Latterly they have diversified into 'surplus' and I have bought 3.4GHz Ionica stuff from them. Always worth a look at their eBay shop but start with the amateur section. *http://www.ebaystores.co.uk/Mainline-Electronics-LTD/Amateur-TV-/_i.html?_fsub=20696990&_sid=97717606&_trksid=p4634.c0.m322* or you will browse for ages…

I spotted their 'WIMAX 3.5GHz TX/RX' with a pair being offered for £28 delivered. Having set up my 5.6GHz station by using a pair of flat-plate aerials fixed to a common bar, I thought I'd chance doing the same thing on 3.4GHz.

Maybe not a perfect match, but hopefully usable or tweakable (once I find out how to change the required shape/size of either the feedline or patches).

A pair were duly ordered and arrived. The whole assembly is contained in a sealed (welded shut) ABS enclosure.

To liberate the contents needs the whole flange cutting away all the way round. No going back but it's not an ideal mount anyway and for /P use plenty of simple weather proofing would work. A carrier bag over the pair for instance.

Inside there is a very nice 16 element PCB antenna mounted over a steel back plate. This was easily removed from its RF section by unsoldering the centre feed and removing the screws.

Fitting a SMA to the rear of the metal panel involved drilling two two-mm holes, bolting up and re-soldering. I then calibrated my Satsagen (Pluto) with a directional coupler and dummy load, then ran a scan.

While not lab grade, and with me not being an expert in interpreting these things, I'm sure I was looking at a reasonable match at around 3.4GHz. The steel back-plates already have suitable fixing holes in them, and I have some spare one-inch square alloy tube to bolt them to, side by side, the same solution I used for my 5.6GHz.

With my Langstone (& Portsdown) having separate RX and TX ports, it's a high gain portable solution for roughly half the cost of similar commercial products from e.g. *https://yagi.pl/antena-panelowa-bat-16-hv-wimax*. And still doesn't need a change-over relay. Interesting that their VSWR graph looks like my return loss plot.

Inevitably I wondered if there were any useful parts to be had on the control board. Two fairly low power TX strips were easy to spot, but too tiny for me to consider re-using (I have a Stealth amp for 3.4GHz anyway). But I spied a 10MHz TXCO and looked it up on the www.

Quite a good spec and frequency adjustable via a control voltage. Duly unsoldered and connected to a DC source, the tone sounded good with no 'audible' jumps as it was warmed up.

At this point I remembered a conversation I had with Martin, G4FKK. He had built a GPS locked 10MHz source using an old-style ovened crystal. He then used the accurate 10MHz to clock a SI5351 to produce other handy frequencies, for example, 25MHz for injection locking a LNB for NB use on QO-100.

He kindly wrote the few lines of code needed to get an Arduino Nano to control an eBay SI5351 breakout board and it was all lashed up on the bench. Success, no jitter (not even on 30th harmonic of 144.2MHz), just a bit of drift. This was addressed by wrapping it up in sponge and once thermal equilibrium was reached, it was nice and stable.

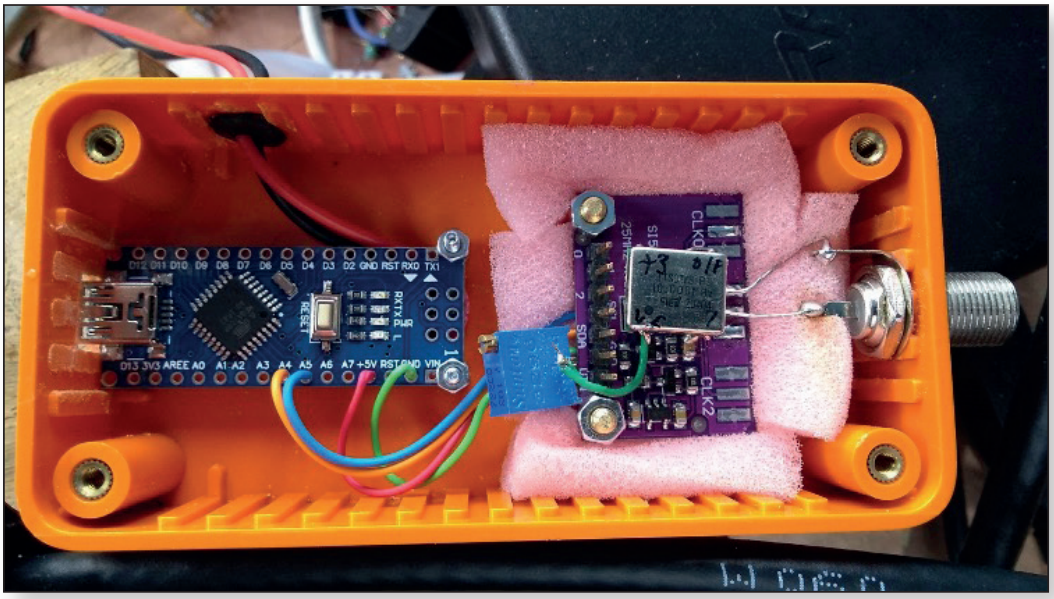
At this stage the project was built 'properly' to use with NB QO-100. A small plastic box was chosen from stock and a bit of drilling and filing ensued. A 10k multi-tune pot was added and found to adjust the 10MHz over a 21kHz span. Sponge was added inside the box and the lid screwed on.

Feeding the 25MHz up to a hacked four-port Octagon LNB was next (as per *https://wiki.batc.org.uk/Es%27hail-2_LNBs_and_Antennaes*) and then time was spent trying to find the right beacon and get the Langstone offsets sorted out (thanks for your mathematical patience Martin).

Once I'd found the beacon, I was able to tweak the control pot and offset numbers until everything lined up. From cold, the QO-100 beacon appears to drift about 5kHz.

Overnight, if it's left on, the cooling shack gives a drift of 2.5-3kHz. Additional external sponge (salvaged from a some very handy ferrite packaging supplied when I bought some Fair-rite ferrites from Farnell) makes the drift very slow. This morning it's taken three hours to climb back up the dial to 10489.500.

Very adequate for SSB and CW/SSTV reception. And it was essentially… 'free'. Various other SM components like capacitors, inductors and even a 75MHz SAW filter are on the boards. Remember, you get two units, the next step is to (with lots of Martin's help) enact a similar GPS lock on this little TXCO.



A bit tricky to unsolder (pads under the board), it's easier to hacksaw the board free and connect to that. Brutal but it works. As-is, with the SI5351 drive at the 2mA level, it works really well with the NB transponder. I'm not so sure about the WB section though, I have a feeling it should really be filtered and level optimised for best performance. Something about phase noise I think I read.

Television History – Live! Part 2

The Broadcast Engineering Conservation Group - *Jeffrey Borinsky*

In Part 1 (CQ-TV 268) we started live on air from Birmingham in 2019. Now we go back another 66 years to 1953. The BATC was just four years old and the greatest outside broadcast (OB) in the history of the British TV service was about to start.

In the sight of all the people

Then the Queen arising out of her Chair, supported as before, the Sword of State being carried before her, shall go to the Altar, and make her solemn Oath in the sight of all the people to observe the premisses.

On 2 June 1953 Queen Elizabeth II was crowned. Thanks to the largest ever OB in the UK, 75% of people in the UK saw her coronation live on TV; more than had ever seen a British monarch being crowned before.

The Queen's coronation marked British television's coming of age. Against the wishes of her advisers, the young monarch herself insisted on having cameras in Westminster Abbey. What's less well known is that the very first British OB had been at the coronation of her father, George VI. This was in 1937, not long after the start of the world's first regular high definition TV service, at a time when high definition meant 405 lines. Just three cameras and a single OB truck near Hyde Park Corner allowed viewers a glimpse of the royal procession.

▶ *Marconi 1950s publicity images*

▶ *Vivat in BBC service as MCR23*

▶ *Vivat restored interior*

Vivat Regina!

▶ *Vivat in London*

▶ *Vivat as found*

▶ *Vivat on set for "The Crown" with Paul Marshall playing a cameraman*

At the 1953 coronation, Hubert Parry's 1902 setting of the coronation anthem I was glad was sung by the Westminster School choristers, complete with the cry: Vivat Regina! It was therefore only fitting that the project to re-create a coronation-era OB truck should be called Vivat.

There are no surviving examples of 1950s BBC television outside broadcast units, despite the '50s being such an important decade for the new medium of TV. Project Vivat has remedied that by re-creating a representative operational unit. It is based on a very similar early 1960s vehicle, fitted out with original early 1950s equipment. The vehicle is 390 EXH, originally the BBC's MCR23 (Mobile Control Room).

Before it reached us, Vivat was languishing as a redundant and derelict mobile classroom. After much work by BECG members, paid for by them personally, it now looks splendid in the original dark-green BBC livery. Most of the monitors and other equipment have now been installed. The cameras and associated equipment are Marconi Mk II and Mk III series, the models used at the coronation. Final wiring remains to be done. The BECG would like to thank Bryant Unlimited which has sponsored the project with donations of cable and connectors.

Vivat has been used as a prop in several productions, most notably for a scene at Churchill's funeral in The Crown. Paul Marshall is a very good vintage cameraman!

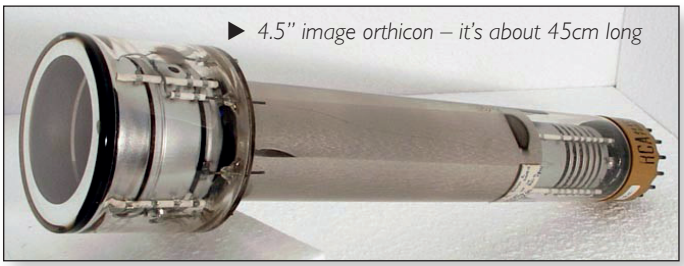
Inside and out – the ob story

While many early TV performances came from the studios at Alexandra Palace, there were also exciting events elsewhere. After that first OB in 1937, the BBC covered numerous events outside the studio. The football authorities worried that TV would reduce their crowds at matches, but tennis and boxing had no such qualms; Wimbledon was a regular OB fixture. The BBC used all its limited OB resources for the 1948 "austerity" Olympics. And some OBs literally worked "in the field" as this photo from 1954 shows. The camera is a Marconi Mk II image orthicon; a Pye D16T receiver is being used as a monitor.

Cameras again – in colour

In part one I looked at monochrome cameras. Now it's time for colour.

Although colour TV started in Europe more than a decade after the USA we were fortunate that Philips had developed the Plumbicon tube. Before that, you either had image orthicons which were far too bulky, or vidicons. The latter were just about acceptable in monochrome with plenty of light but it was all but impossible to match a set for colour. The Plumbicon was essentially a vidicon with much better performance due to a lead oxide target.



▶ *4.5" image orthicon – it's about 45cm long*

▶ *30cm Plumbicon*

The big debate was between 3 and 4 tube cameras. Philips made the first Plumbicon colour camera, the PC60, with 3 tubes: one each for red, green and blue. Marconi and EMI decided they could get better results by using an extra tube for luminance. This would directly provide a high resolution monochrome picture while the other tubes provided lower resolution, and hence lower noise, colour imaging. While the Marconi Mk VII and EMI 2001 worked well, in retrospect this wasn't the right way to do it. All later cameras used 3 tubes with the high resolution luminance taken from the green channel.

▶ *Marconi Mk VII colour camera (above)*

▶ *EMI 2001 colour camera on Vinten pedestal*

The Marconi Mk VII and Mk VIII cameras had good sales, both in the UK and abroad. The Mk VIII was the world's first colour camera with automated alignment. Before then you pointed the camera at a crosshatch chart and tediously adjusted many controls to accurately overlay the images from the 4 tubes.

The Mk IX was compact but less successful and the Mk X existed only as a prototype. And that was the end of Marconi as a maker of TV cameras.

Camera mounts

Cameras have to be mounted on something. The most famous name in the field in the UK is Vinten, from the early days until now. A complete Marconi Mk VII colour camera from 1967 weighs about 100kg yet with a good pan-tilt head and gas pedestal it can be moved accurately with a light touch.

Gas pedestals use high pressure nitrogen to counterbalance the weight of the camera, allowing the camera operator to raise and lower it with a light touch. If you're foolish enough to remove the camera without inserting the locking pin, the rapidly rising column may well put you in hospital. Like a hand grenade, don't pull the pin unless you know what you're doing.

Monitors

Perhaps not as exciting as cameras but always needed. Professional monitors were big, expensive and power hungry. So even the BBC used domestic TV sets, modified to have a video input. The Pye D16T, an early post WW2 TV, was very useful as it had an earthed chassis. It cost only £45 in 1946 (about £1800 in today's money) and could be readily modified to have a video input. The Ekco TMB272 portable was also used and could be run from a 12V car battery. In the early days of amateur TV, a monitor nearly always meant a modified TV. This required an isolating transformer since most TVs had a live chassis.

▶ *Ekco TMB272 mains/battery portable*

Come colour in 1967 and colour monitors were too big, heavy and expensive to be used throughout a control room or OB truck. Typically the main monitor stack would have two; for transmission and preview. All the others would be monochrome.

The BECG has a wide selection of monitors, from 1950s to modern. Some are too unreliable to use in a working truck so we have slightly compromised authenticity to keep the show on the road. We are fortunate to have been given a large number of 12" Melford monochrome monitors to use in ABC-Thames. They are slightly later than is strictly correct, but they should be reliable.
A big thank you to Harefield Hospital TV.

Yorkshire / Tyne Tees NUB 327F

▶ *Yorkshire/Tyne Tees in original Yorkshire livery*

▶ *Yorkshire/Tyne Tees as found at Harefield*

▶ *Yorkshire/Tyne Tees in fake snow for "The Royal"*

▶ *Yorkshire/Tyne Tees on the terrace at Alexandra Palace*

ITV used to be a collection of regional companies that were friendly rivals, each with its own identity and traditions. So why the curious split personality? This truck was built for the newly formed Yorkshire TV in 1968. After various adventures it is now in the BECG, but with Tyne Tees colours. How did that happen?

Built by Marconi on a Bedford chassis, it was one of the "Yorkshire Twins" that opened the service in 1968 (literally, as the studios were not finished!). Later it was sold to the Central Electricity Generating Board (CEGB) as a production vehicle for training videos, and then acquired by Harefield Hospital Television, where we first set eyes on it. Fast forward twenty years to 2001 and it was decaying so we agreed to purchase it and preserve it.

We collected it in January 2001. It still had lots of equipment fitted, both original and additional. It was covered in moss and hadn't been started for ten years, but a pressure washer, some new hoses, fluids, diesel, batteries and a large "battery boiler" coaxed it back to life and we drove away. A split coolant hose was the only incident on the way back to base.

After a good clean out we started to refit and repair. We fitted a mixture of cameras and control gear to make a sort of chameleon rather than a strict preservation like the Southern truck (in Part 1).

Things were pushed along by a request for the truck to appear in the 2003 Christmas special of The Royal filmed in Scarborough, which was Tyne Tees country. A quick paint job and some decals supplied by the production company transformed the old Yorkshire truck into Tyne Tees TV OB unit 3 and that is how it has stayed ever since.
It has subsequently had a new high-quality respray.

Out and about

As with Southern, many BATC members will be familiar with this truck. Amongst many outings it has been to a Marconi reunion in Chelmsford where it received a very warm welcome. Pictures from the truck went out live on Anglia TV news.

In 2006, there was a special event at Alexandra Palace in north London to celebrate the 70th anniversary of the start of the BBC television service. We used the truck to make a programme using vintage technology – two Marconi Mk IV cameras and one Marconi Mk V camera cabled back to the truck, which was parked on the terrace outside the studios. We had several working 405-line sets supplied by enthusiasts to display the programme live in the old transmitter hall and it was also carried by a local amateur television repeater.

Equipment

Besides having a dual personality, several types of equipment are fitted so it can be used as a technology exhibition. Monochrome cameras are Marconi Mk IV and Mk V using 4.5" image orthicon tubes.
Colour cameras are Marconi Mk VIII Plumbicon.

... And more

The BECG has a huge variety of TV equipment.
As well as from cameras and monitors, we have many video tape recorders from 2" Quadruplex to cassette formats. Telecine, microphones, mixers both vision and sound plus much more that's hard to list and classify.
Much of this equipment is in working order or can readily be made to work.

BECG members have also preserved and restored several later outside broadcast vehicles, mostly ex-BBC. We hope to feature these in a future article.

Broadcast Engineering Conservation Group

We are a small group of qualified and experienced professionals dedicated to the survival and interpretation of television history. Our main purpose is to promote and demonstrate vintage TV. We have achieved many successes in this field.

The BECG brings together much equipment, currently owned by the founders. We have many cameras, monitors, video tape recorders and all the less visible paraphernalia that are needed to make TV programmes. The biggest parts of our equipment comprises the four outside broadcast trucks that are the main feature of these articles

The BECG is a registered charity, 1189469. The founders are also the trustees. The BECG is financed entirely by the founders and by private donations.

Founders

Dr Paul Marshall G8MJW (Chairman)
Dave Hill G8MGP (Secretary & Webmaster)
Jeffrey Borinsky (Treasurer)
Richard Harris M0TUW
Martin Pritchard
Phil Nott

Acknowledgements

The author thanks fellow founders for their contributions.

Kaleidoscope: *www.tvbrain.info*

Photos: BECG members, Ruth Slavid, Dicky Howett, Science Museum (Plumbicon tube)

Contact

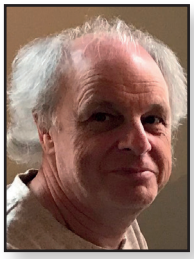
To learn more about us, or help us in any way please email at: *contactus@becg.org.uk*

More information on the trucks, cameras, monitors etc and other BECG activities can be found at: *www.becg.org.uk*

Much of the equipment shown in this article is available to hire for film and TV production.

9 cm station from Wimax components

Chris van den Berg PA3CRX



Some years ago, Pollin in Germany sold surplus Wimax units that contained two complete transmitters and receivers for frequencies just above the 9 cm band.

It included power supplies, amplifiers, bandpass filters, RF boards (everything x2) and hardware like the housing, ventilators etc.

The amplifiers and filters are often seen at rallies; the amplifier I bought was offered in the Netherlands by someone from the UK.

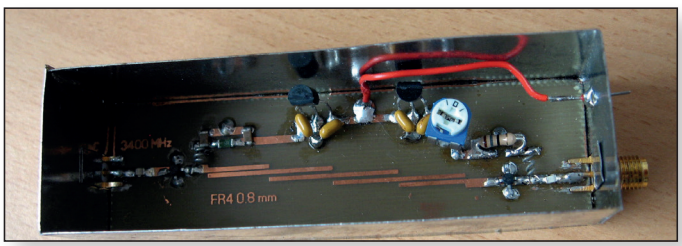
My 9 cm transmitter

With one of the purple power amplifiers of the Wimax unit, a lot of gain is present, and is specified at 50 dB with a P1 of +54 dBm. With a -6dBm input the output will be 20 Watt.

It can be switched on/off by adding 5 Volt to a connection point. I soldered a 78L05 voltage regulator to this pin to do the job.

As a driver for this power amplifier, I thought about a FM signal, reduced to the bandwidth of 10 MHz (see CQ-TV 269). So I needed a classic FM circuit to start with. After some calculation, I found out that if I used a frequency tripler, I could use a present old circuit with a PLL (SP5060) and a PAL colour burst crystal of 4,433 MHz. This makes 1134,9 MHz but it could be adjusted a bit.

Frans, PE1FOT, had developed a frequency multiplier containing two MMICs (SNA486) and a stripline filter on 0.8 mm Fr4 material.



▶ *Picture two: Amplifier/doubler/tripler/filter for 9 cm designed by PE1FOT, using two SNA486*

Fr4 has a wide specification of dielectric coefficient but the filter is wide enough to have the multiplied frequency always passed in the 9 cm band and other harmonics suppressed. Loss in Fr4 is high with this kind of filters but with the gain of MMICs this doesn't matter.

As a tripler, output is about 3dB more then the input power. The output was still too high so I made the bias voltage of the second MMIC adjustable with a potentiometer.

The output level could now be adjusted and reduced this way. The output signal of 3405 MHz is forwarded to the power amplifier resulting in a total output of about 25 Watts.

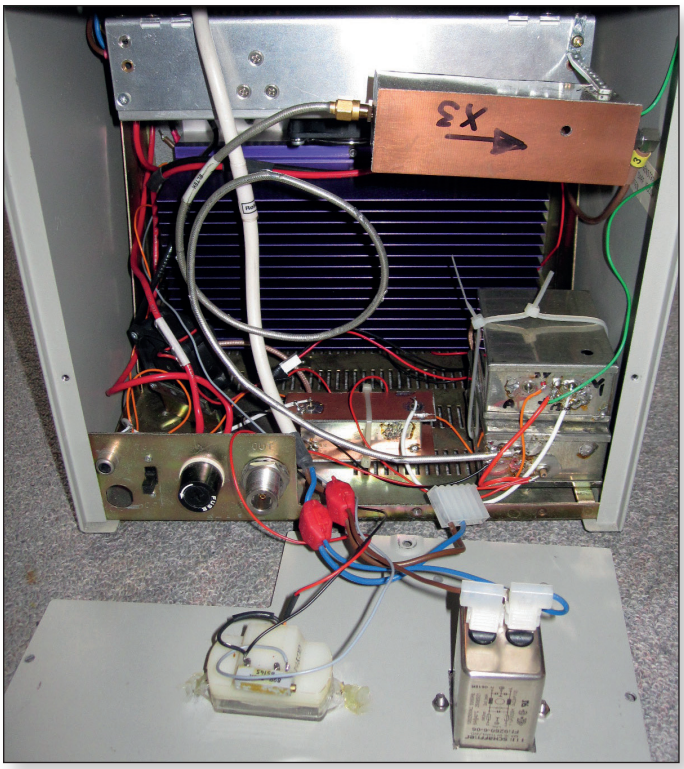
I could not find a housing for these components so I decided to dismantle a black and white monitor that I could not get rid of (no one wanted to have it, despite no 'blue screen'). With a metal plate (cover of a scrapped audio amplifier) at the place of the CRT it became a closed box. To have an idea if output power is present, an analogue meter is placed at the front. Voltage for this meter is present on the power amplifier. I did not calibrate it, it is just an indicator.

▶ *Old monitor with a metal plate instead of the CRT*

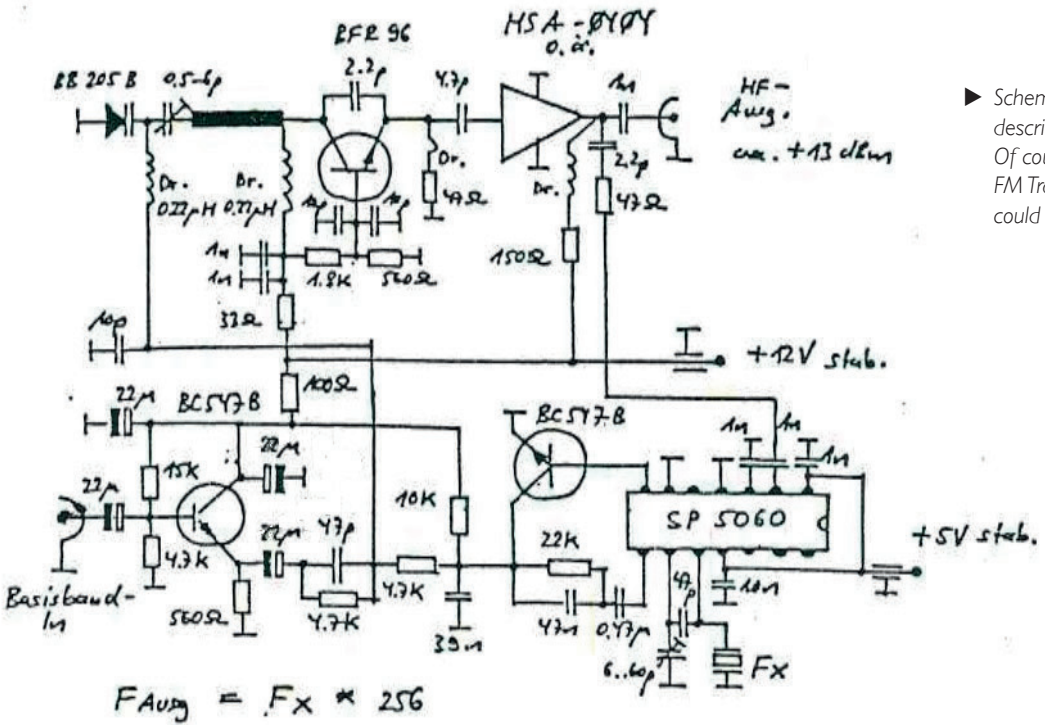
▶ *The back of the monitor is now the front of the transmitter*

Inside, a small fan is pointed to the heat sink of the PA to give it some extra cooling.

When the mains is connected, everything is supplied with power, but the PA is switched off. With a switch on the front, the 5 VDC is applied to the amplifier and the output is present.



▶ *View inside of the 9 cm transmitter. On the bottom, from left to right, the following modules: video filter, baseband and PLL, following the semi-rigid to the multiplier 'X3' and the purple power amplifier. The switched power supply is mounted above.*



▶ *Schematic of the used transmitter once described in TV-Amateur 67/1 987. Of course, the schematic of the 24 cm FM Transmitter in the ATV Compendium could also be used instead.*

My 9 cm converter

The RF boards in the Wimax unit are multi-layer and all individual circuits are separated with metal screens with lids. So it could easily be determined what the function of the individual circuits are, reading the component identification (glasses needed).

VCOs, synthesizer ICs, mixers, wideband amplifiers, low noise amplifiers, 10 MHz oscillator. I did not see these RF boards at rallies, so they are likely still in many shacks.

With a metal saw I divided the circuits and de-burred the sides with sandpaper. (When you have the circuit the way you want, prevent short circuits by tape on the bottom and sides).

With a bandpass filter, preamp, mixer and VCO I wanted to make a converter to be used with a RTL stick.

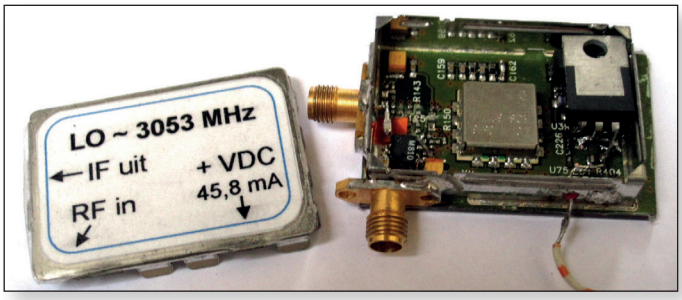
The filter needed to be adjusted to the 9 cm band. From the pre-amp the filter needed to be removed. As a mixer I wanted to use an IAM81008, with the LO signal coming from a VCO.

Depending on the available measurement equipment, it is either a piece of cake or a bit harder. In my case I first made two VCOs to work, one as a sweeper and one with the IAM81008 as a converter for my spectrum analyzer.

In this way, I extended the range of the spectrum analyzer. (I now have a NWT6000, filters could be wobbled more easily).

In the metal compartments of the VCOs, also a kind of voltage regulators are present, to let the VCO function on 5 Volt.

I blew this regulator, so I added a 7805 instead. Because I had no idea how to use the synthesiser IC I cut the connections to it and mounted the IAM81008 above it. I went to a radio amateur friend who could define the frequency of my LO, it is 3053 MHz.

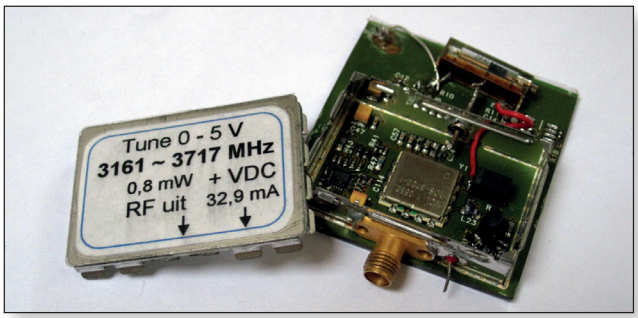


▶ *The converter with free-running VCO*

After connecting the converter to the spectrum analyzer I could see the noise level increased. (I later realised I could also have switched on the PLL and multiplier of the transmitter to find out what the LO frequency is when the signal on the spectrum analyser appears). With my HP spectrum analyser, it is possible to enter the off-set frequency so the screen reflects the actual frequency.

For the sweeping oscillator I took another compartment of the RF board and removed the connection of the VCO to the synthesizer. A small circuit with an uA741 made automatic sweep of the voltage (so the frequency) possible.

For real time adjustment just find a sweep frequency that will show a lot of signals on the screen. While using the 'max hold' function of the spectrum analyser, the final curve could be seen.



▶ *The VCO unit with manual frequency adjustment but at this point also a wave generator could be connected for frequency sweeps*

After connecting the black WIMAX filter between the sweeper and the converter it shows a very nice bandpass shape.

The filter

The filter has three SMA connectors. In fact there are two filters, shifted in frequency. with one common connector.

These filters could be separated mechanically (with a saw) but I did not do that. I just used one of them. With a small socket wrench and an Allen key it is possible to do small adjustments without detuning too much at the moment the locking nut is a bit loose. The passband curve could be shifted this way, some screws do have more effect then the other. (And when you do the screw too deep, you have to open the filter to get it out) The filter contains also some lid screws. If they are removed, some coupling vanes could be seen. I bent these a bit to find out the effect but it is difficult to influence the curve this way.

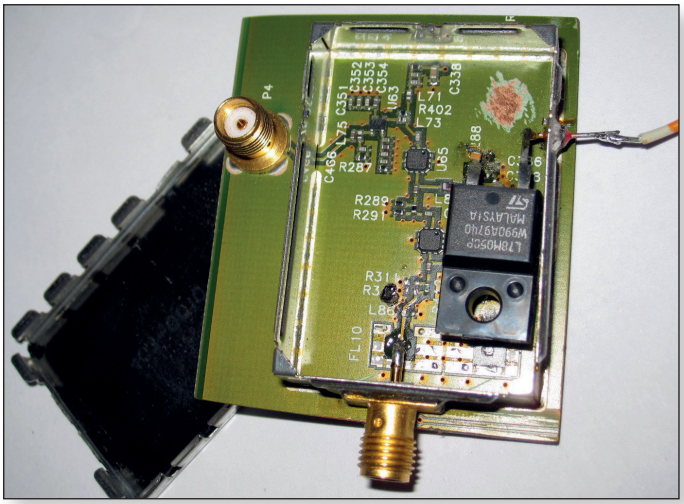
These filters do have a very low loss but unfortunately not when the shape is excellent (much wider then the 9 cm band). The function of this filter is in my case prevent overloading of the preamp so it is directly connected to the antenna. Therefore I decided to chose for minimum loss instead of (too wide) excellent shape. In fact, it is flat enough over the whole band.

Later, I checked the filter with more serious equipment (with attenuators connected to it to ensure 50 Ohm

impedance) and found out the way I had done was not too bad at all.

The pre-amp

The RF board contains low noise pre-amps with a lot of gain. The SMA (input) connectors are already connected. However, in the compartment also a small fixed bandpass filter is present. This one is difficult to remove but with a hot soldering iron and some tools I managed without destroying the board. A voltage regulator, SMA connector (output) and a feedtrough capacitor was added.

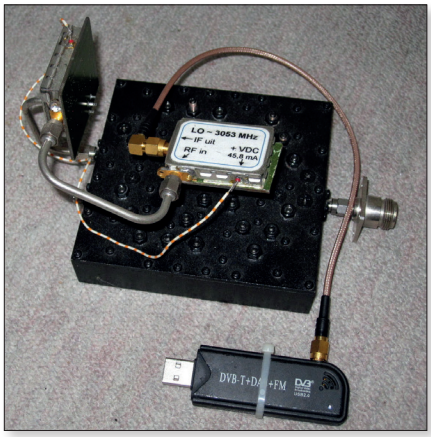


▶ *Pre-amp with removed bandpass filter, made ready for use.*

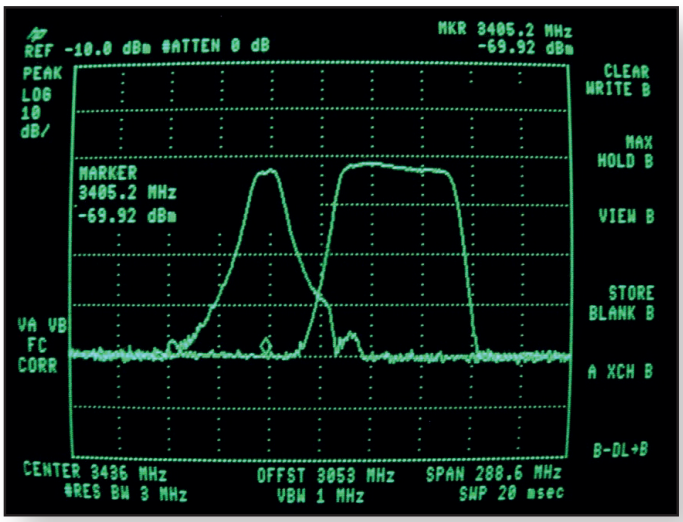
The noise figure is tested at 3405 MHz with HP equipment resulting in the following data: 1,8 dB noise figure with a gain of 38,3 dB. Not bad at all!
Because it is (now) a broadband amplifier, for curiosity also checked at 5780 MHz: noise figure 3,2 dB with a gain of 27,2 dB.

When these modules are connected to each other the IF will be about 352 MHz. The VCO drifts a bit, a pity I had not used the synthesiser…

As described in CQ-TV 269, the signal goes to the RTL stick and with TVsharp or SDRsharp (with TV plugin) signals could be received.

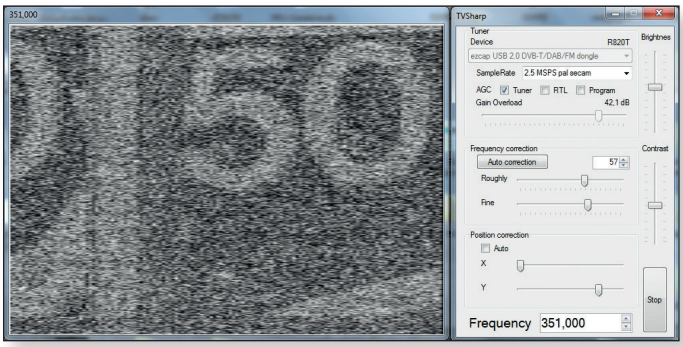


▶ *The completed 9 cm converter ready to be connected to the laptop.*



▶ *The screen of the spectrum analyser with the offset frequency of 3053 MHz. The right curve is the original WIMAX filter curve, the left one during adjustment of the screws. With further adjustment I reduced the passband loss to 0.8 dB but then the shape is wider and not flat.*

The antenna is connected directly to the filter to prevent overloading of the pre-amp by all present strong signals. This influences the noise figure in a negative way but at least I know that what I receive is really in the 9 cm band. This converter is still not mounted in some housing, it is still like this used on the table.



▶ *Result: station received with TVsharp*

The intention of this article is not to show how you should do it but as an inspiration to look around to see what you could use to experiment with.

Links:

Overview for what interesting components are on the WIMAX PCB and more pictures:

http://www.pamicrowaves.nl/website/forum/index.php?topic=537.0

Multiplier with filter including Sprint layout file.

http://www.pamicrowaves.nl/website/forum/index.php?topic=221.0

Turning Back the Pages

A dip into the archives of CQ-TV, looking at the issue of 47½ years ago

Peter Delaney - G8KZG

CQ-TV 81

John Lawrence, GW6JGA/T, has been one of the regular contributors to CQTV over many years, in particular with his 'Circuit Notebook' series. John's articles explained the principles involved in a topic, as well as giving a practical solution, and in this edition of the magazine he considered the workings of the line scan circuit in a vidicon camera. For most television amateurs, the only way to have a camera as a picture source was to build it themselves, and these articles helped many members embark on such a project.

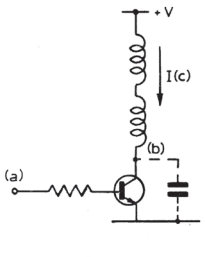


Fig. 1a

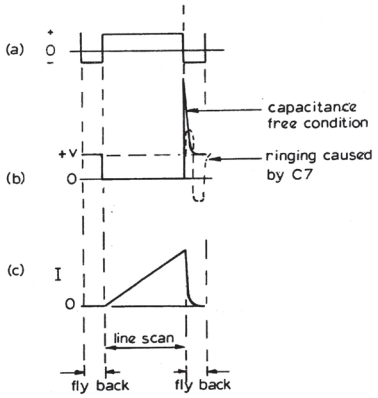


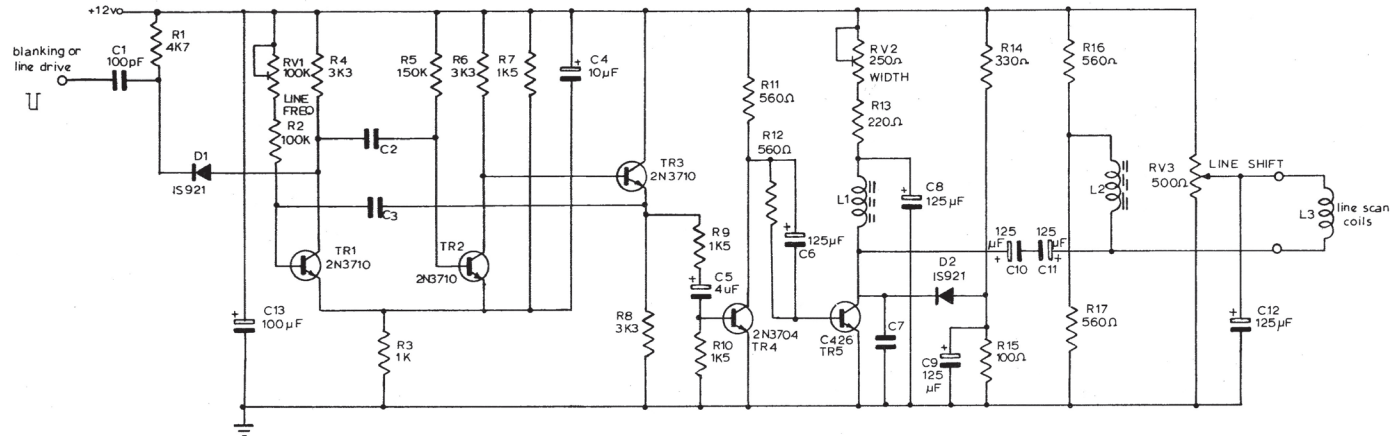
Fig. 1b

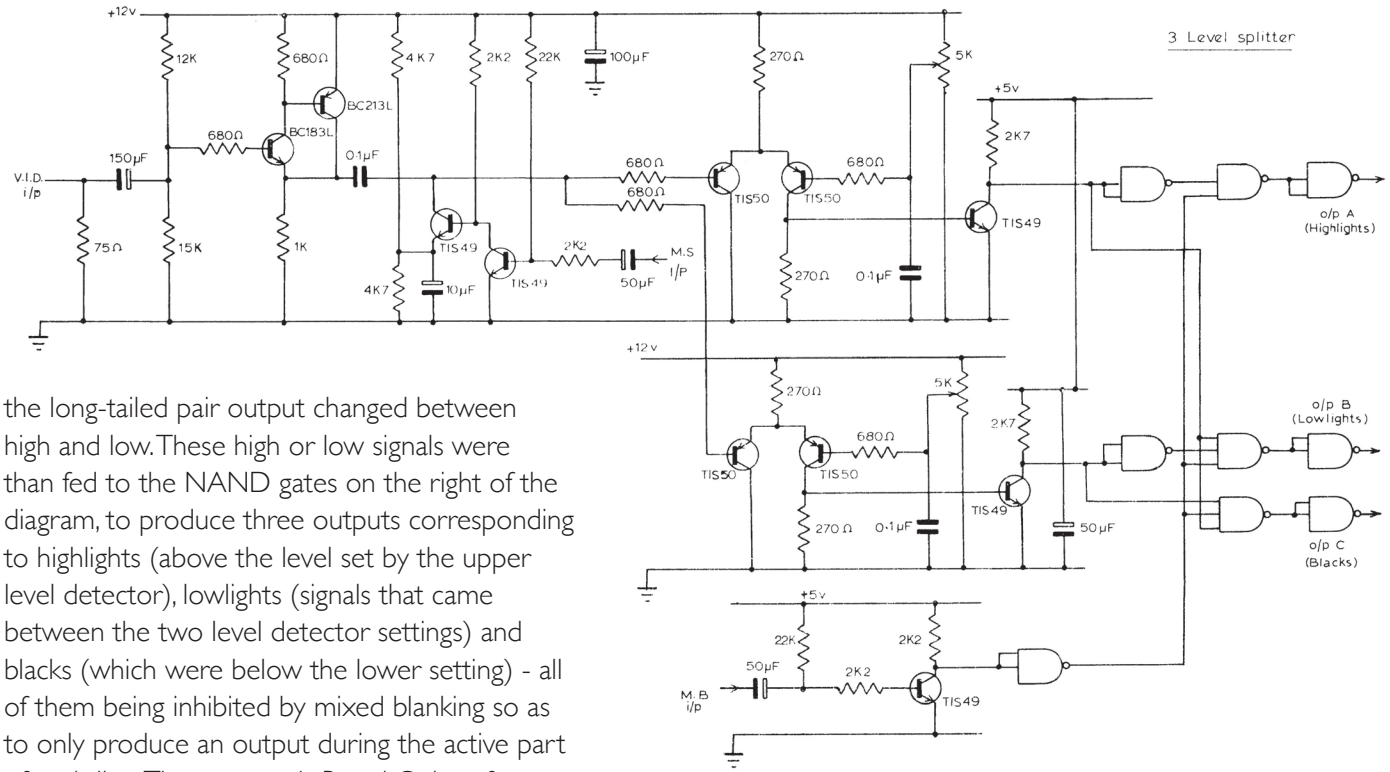
A vidicon was scanned by passing a sawtooth current through the sets of coils wound round the camera tube. In the case of the line scan coils, as in Fig 1a, this could be achieved by using a pulse ((a) in Fig 1b) to cause a transistor to switch the supply through the line coils on or off. The current through the inductance of the coil built up linearly (c) until the transistor switched off again, causing a voltage spike as at (b), which generated a rapid flyback of the beam ready for the next line.

The complete practical circuit used a line rate signal (either line drive or the blanking pulses) to trigger the multivibrator circuit based on Tr1 and Tr2, and buffered by the emitter follower stage Tr3. Tr4 was a driver stage that ensured the output device, Tr5, was switched hard on during the active part of the line, and hard off during the flyback period. The additional coils L1 and L2 enabled a dc to be added - in the case of L1 to produce symmetrical deflection, and L2 allowed for the control by a shift control.

Nigel Walker's "Ideas for Amateur Colour" was another series of articles aimed at helping members to experiment with what then a new mode. In the early 1970s, colour cameras were beyond the price reach of most amateurs *(on asking the price of an early Marconi colour camera, the answer was "this is not for sale sir, but Philips will sell you one of theirs - not including a lens - for 28,000 guineas" - in current values that is around £500,000)*. Amateurs could produce television pictures including colour by feeding, for example, the monochrome output of a caption or pattern generator into the red, green or blue inputs of a colour coder. However, Nigel had developed a colouriser which could apply an infinite variety of colours to a black and white signal from a source such as a camera. There were two basic elements to the design.

The level splitter was fed with the video input, which was then clamped to a reference black level by the pair of TIS49 transistors driven by mixed sync pulses. The input was then sent to two level detecting circuits, each formed of a long-tailed pair of TIS50 devices. A 5k Ω potentiometer provided a dc level to the other input of the 'pair', thus setting the level on the video signal at which





the long-tailed pair output changed between high and low. These high or low signals were than fed to the NAND gates on the right of the diagram, to produce three outputs corresponding to highlights (above the level set by the upper level detector), lowlights (signals that came between the two level detector settings) and blacks (which were below the lower setting) - all of them being inhibited by mixed blanking so as to only produce an output during the active part of each line. The outputs A, B and C therefore corresponded to three, adjustable, levels of grey in the monochrome image.

These were sent to the output stages, in which an infinite variety of colours could be assigned to the highlights, lowlights and 'black' levels. For each of these, three potentiometers set the proportion of red, green and blue that would correspond to the relevant grey level of the input video - R1, B1 and G1 for the highlights, etc, and then the respective red, green and blue signals were combined into an output stage of a BC183 and BC213 to match a 75 Ω line - with a π filter to keep the signals within the limits for a 625 line system - to drive a colour coder. *(The effects produced from a live black and white camera were similar to some seen on programmes like Top of the Pops).*

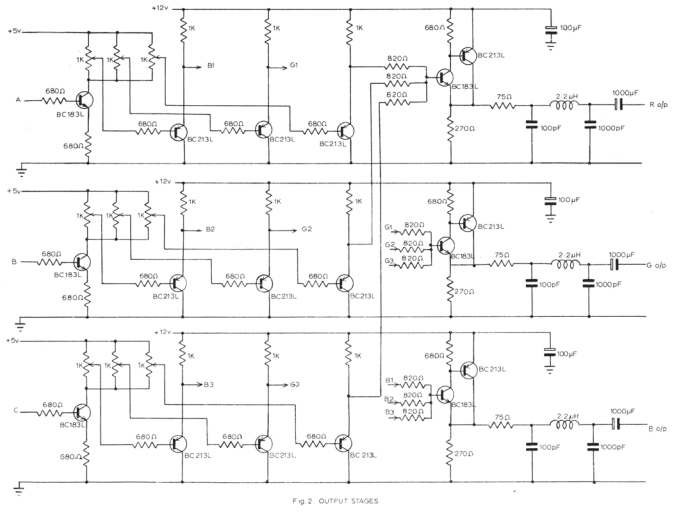
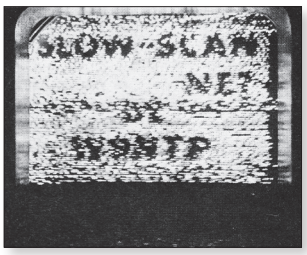
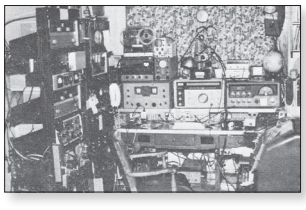
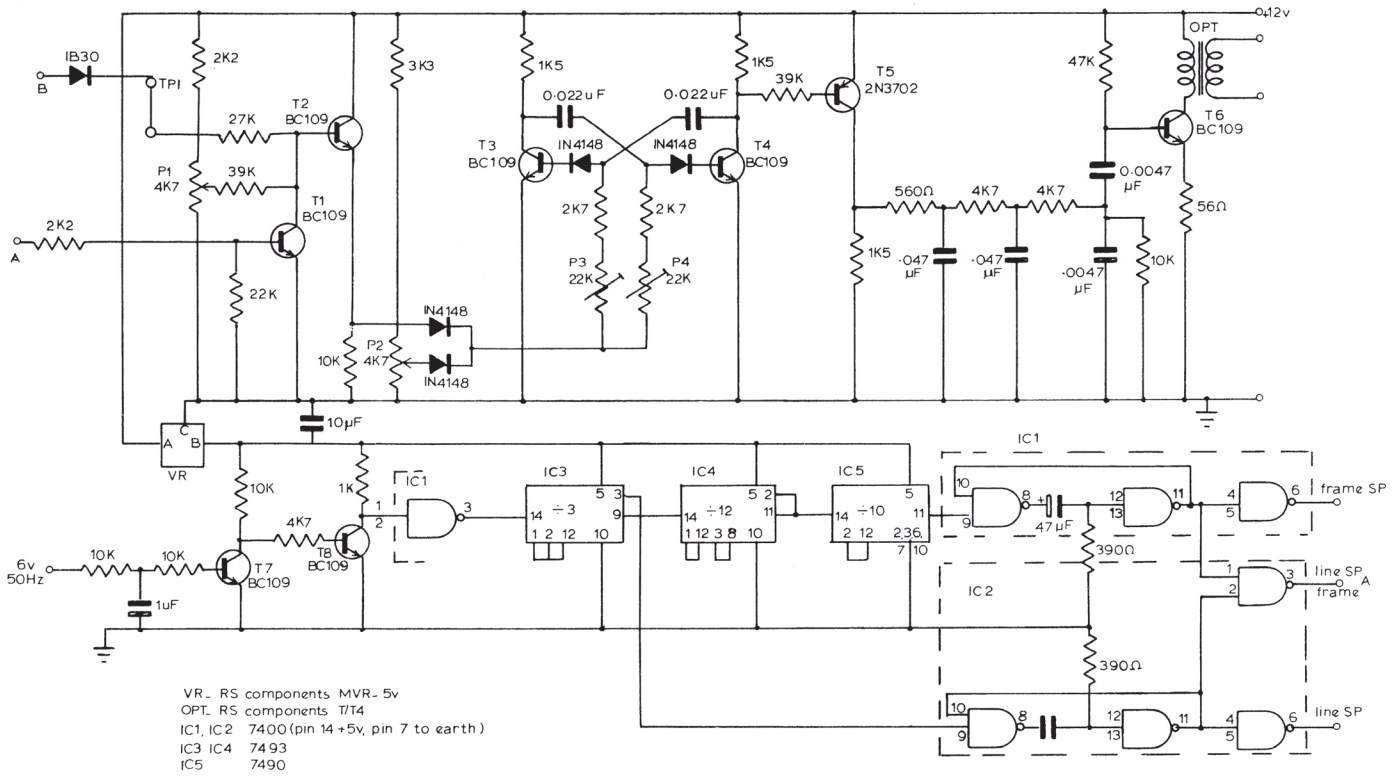


Fig. 2. OUTPUT STAGES

In much the same way as reduced bandwidth television has been developed in recent years, a method of transmitting pictures that used a narrow part of the spectrum was - and is - slow scan television. The signals fell within the audio frequency range, and so could be recorded onto cassette tape, or transmitted on the shortwave bands - and therefore enabled amateurs to communicate at far greater distances than was possible on 70 cm or higher bands (especially as the use amateur television repeaters was not yet a possibility). The picture on the front cover showed the reception of a testcard relayed via the new Oscar 6 satellite. The world-wide standard was for 120 line pictures and a frame took about 8 seconds. The line and frame standards were derived from the local mains frequency – 50 Hz in Europe and 60 Hz in North America - so were not identical, but sufficiently close to enable cross Atlantic exchanges. The station of Don Miller W9NTP - one of the leading proponents of the mode - was used in the first exchange of signals through the satellite.







VR – RS components MVR – 5v
OPT – RS components T/T4
IC1, IC2 7400 (pin 14 +5v, pin 7 to earth)
IC3 IC4 7493
IC5 7490

Fig. 1 SSTV Modulator and sync. pulse generator

The up link used the 2m band, Don having a 100 W output from a 4CX250 to feed to a 10 element aerial, and the down link was on the shortwave 10 metre band. Don's test card was produced by a home-made sampling camera.

Rather than use a camera to generate slow scan signals, a popular method was to use a flying spot scanner. The lines would be scanned on a crt on which a slide or stencil was placed with the image to be transmitted, and the light that passed through being detected by a photomultiplier tube. The resulting signal was converted to a series of tones ranging from 1.2 kHz for sync pulses to 2.3 kHz for the peak whites, being input at point B on the modulator circuit. The voltage level of the video would vary the frequency of the multivibrator T3 and T4, the square wave signal produced being passed through a low pass filter to the output stage. The lower part of the diagram shows the sync pulse generator stages - as can be seen, the mains frequency drove a divide by 3 counter to make the line rate, and IC4 and IC5 further divided the line rate by 120 to generate frame pulses, the mixed sync pulses also being fed to point A on the modulator.

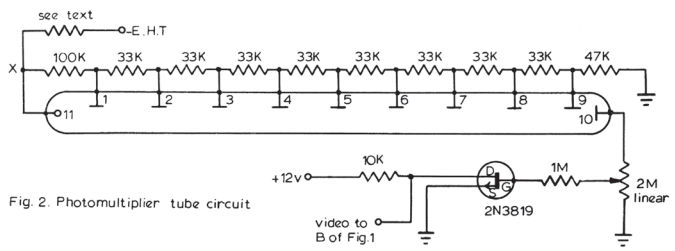
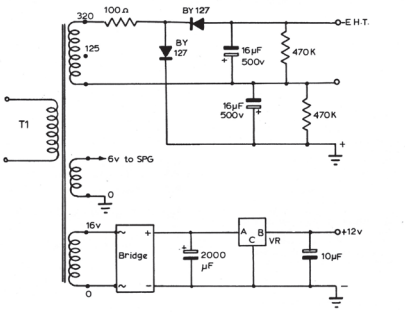


Fig. 2. Photomultiplier tube circuit

The photomultiplier tube needed a supply to each multiplier stage dynode with the EHT supply providing a 1 mA current down the resistor chain, and the power supply to produce this used a voltage doubler from the mains transformer winding. The lower winding was rectified and regulated to power the transistor circuits, and the middle winding provided the mains frequency drive for the sync pulse generator counters.



VR – RS components MVR 12
Bridge – RS components REC 60
T1 – available from Crofton Electronics – same as Camera Kit Transformer

Fig. 3. Power supply

The transformer recommended for the flying spot scanner was one commercially available in a kit to build a standard 625 line vidicon camera. The kit was made by Crofton Electronics, who's advert appeared on the back of CQTV. The design had been created by the Mullard Educational Service, using a 1" vidicon, with each section of the circuit on a separate board as an aid to teaching the principles involved. The kit cost £57, (equivalent to around £650 now) not including the vidicon, which BATC members could have obtained through the Club Sales service for £10.

The British Amateur Television Club

Out and About

Rallies and events with a BATC stand: (subject to change)

All amateur radio rallies have been cancelled.

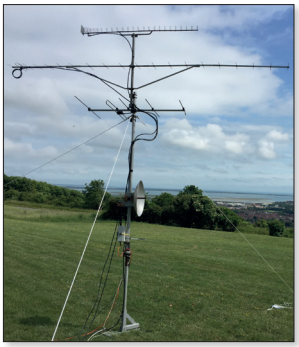
We will show any that will be running in the next issue.

The most up to date status can be found on this RSGB web page:

https://rsgb.org/main/news/rallies/

If you are able to help on the BATC Rally stands, please contact the BATC secretary.

Activity Weekends & Contests



Activity Calendar

Activity weekends and the contests will go ahead as single operator or stay-at-home events.

2020 Activity Days:

19th & 20th December – 13cm and up Activity Weekend

24th Dec to 3rd Jan 2021 – Christmas 2020 Repeater Activity Contest and Activity Challenge

2021 Activity Days:

20th and 21st February – 50 and 70 MHz

20th and 21st March – 146 and 70cms

17th and 18th April – 23cms and up

BATC Online

Website:	http://www.batc.org.uk
BATC Wiki:	https://wiki.batc.org.uk/
Forum:	https://forum.batc.org.uk/
Stream:	https://batc.org.uk/live/
Dxspot:	https://dxspot.batc.org.uk/
YouTube:	https://tinyurl.com/BATCYouTube