The British Amateur Television Club

CQ-TV

No. 262 – Winter 2018

Es'hail-2 launches!

... and much more inside!

Cover photograph: DH2VA

ATV DX Records

We have recently generated a UK ATV records page on the BATC wiki at

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

The tables list the date, distance achieved, call signs and locator of both stations plus a link to any report which has been published on the member's forum.

The page has been created from trawling through the activity pages on the forum, Ken W6HHC's world record list, contest results and Noel's memory and so is not complete and may be inaccurate.

As well as the current record is also lists some previous records, so we have a list of previous activities and can see the progression over the last few years.

Please feel free to add or let us know (wiki tables can be a bit challenging) any updates / amendments you wish to claim.

146MHz

UK only band released for amateur use on October 10th 2014

Date	Distance	Station 1	Location	Station 2	Location	Mode
30-12-2014	3.6 kms	G4CPE	IO91SW	G0WFT		333Ks
11-01-2015	28 kms	G0LPS	IO94EQ	M0DTS		333Ks
21-02-2015	50 kms	G0LPS	IO94EQ	M0DTS/P		333Ks
13-06-2015	95 kms	G8GTZ/P	IO91GI - Walbury Hill	G4CPE	IO91SW	333Ks
13-06-2015	115 kms	G0LPS	IO94EQ	M0DTS/P		333Ks
11-06-2016	121 kms	G8VPG/P	IO81LS - Blorenge	G8GKQ/P	Walbury - IO91GI	333Ks
03-09-2016	169 kms	G8VPG/P	IO80WX - Win Green	G8GTZ/P	IO82FE - Brown Clee	333Ks
03-09-2016	182 kms	G8GTZ/P	IO82QL - Brown Clee	G8GKQ/P	IO80UU - Bulbarrow	333Ks
11-12-2016	185 kms	G8GTZ/P	IO90JO - Ventnor	G8VPG/P	IO81LS - Boringe	333Ks
29-12-2016	277 kms	G8GTZ	IO91KF	G0MJW	IO83RO	333Ks
30-12-2016	294 kms	G8LES	IO91LC	G0MJW	IO83RO	333Ks
24-10-2018	407 kms	M0DTS/P	IO94MJ	G4UVZ	IO80KX	333Ks

CQ-TV 262

Contents:

BATC Online

Website: http://www.batc.org.uk
BATC Wiki: https://wiki.batc.org.uk/BATC_Wiki
Forum: https://forum.batc.org.uk/
Stream: https://batc.org.uk/live/
Dxspot: https://www.dxspot.tv/

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Contributions

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

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

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

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

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

From the Chairman...

Dave Crump G8GKQ

The Autumn is generally a quiet time in the ATV world, but the last 3 months seem to have been really eventful.

It was good to see so many stations taking advantage of the enhanced tropospheric conditions in October. Congratulations to Rob M0DTS and Adrian G3UVZ for making 407 km 2-way DATV contacts on both 146 MHz and 10 GHz. Malcolm G0UHY went one better (well, maybe half better) by managing to get his 146 MHz signals to Rob at 477 km; unfortunately not a 2-way.

Heather M0HMO and John G7ACD organised another ATV Workshop at Eaton Manor in Shropshire with around 20 attendees. Lots of progress made during the day with Portsdowns, MiniTiouners and 5.6 GHz kit debugged and made to work. Special thanks to Heather and John for all their effort and support to the ATV Community.

The Es'hail-2 satellite was launched and is currently undergoing in-orbit testing. When the Wideband transponder becomes available early next year it should offer us the ability to exchange fast-scan DATV pictures with other amateurs in our hemisphere. Just as exciting is the opportunity that it will offer us to showcase our hobby to a much wider audience, so please start thinking about events local to you that might benefit from a demonstration of amateur satellite TV.

Looking towards next year, the Portsdown team have been busy developing support for the LimeSDR Mini as an alternative to the bespoke Portsdown filter-modulator board. While the filter-modulator board might be the best solution for high symbol rate DVB-S QPSK, the LimeSDR Mini offers the potential to transmit more bandwidth-efficient modes such as DVB-S2 32APSK at 1 MS and below – ideal for Es'hail-2. Unfortunately, the Raspberry Pi tends to run out of processing power for the higher symbol rates with the LimeSDR. To support the use of the LimeSDR, the BATC shop will obtaining a stock of LimeSDR Minis for sale to members in the UK and EU. Pricing will be reasonable compared to ordering from the USA and then paying carriage, VAT and fees. Please keep an eye on the Forum for the launch date and exact price.

To promote the proposed regional Mini-CATs (Mini Conventions for Amateur Television) in 2019 the BATC will contribute up to £200 towards pre-approved expenses for each event. I'm really pleased that Shaun G8VPG has offered to run one in Bristol on Sunday 31 March, and that the Wirral Amateur Radio Society will be hosting another on Saturday 11 May. Please give them your support by attending, or if it is too far to travel, think about organising one in your area.

At the end of this busy year, I must thank the other Committee members for all their hard work. There is so much that goes on behind the scenes to keep the BATC running smoothly, and most of their effort is unseen. Thanks team!

I hope to see many of you on the air during the Christmas Repeater Contest, or using Es'hail-2, before the next CQ-TV is published.

73, Dave G8GKQ

Regional CAT meetings

- **Sunday 31st March @ Bristol**
  - **At North Bristol ARC BS7 0TD**
  - **Contact G8VPG g8vpg@aol.com**
- **Saturday 11th May @ Wirral**
  - **"Kittens 19" run by Wirral Amateur Radio Society**
  - **In the club house CH46 1DW**
  - **secretary.g3nwr@virginmedia.com**

The Listing

new and renewing members

Rob Burn G8NXG

In this edition of The Listing we feature members who have joined the BATC or have renewed memberships during September, October and November. One thing that always stands out is the growing number of members who continue to support the BATC from outside the UK; always encouraging to note. Anyway, the list follows the usual format, with the post-town in alphabetical order by country.

We are always on the lookout for interesting material for CQ-TV and I suspect that some overseas members will have a story to tell about their particular ATV circumstances. I would encourage anyone who would like to share experiences to get in touch with a view to writing an article for CQ-TV. Have no worries about English or grammar; it is the content that is important and we would be happy to re-structure any article to enable publication in CQ-TV. Get writing – but do send pictures separately! I would be happy to answer queries or you can submit stuff direct to our editor – ***editor@batc.tv***

I am pleased to report that our membership appears to be settled at about the 1100 level. Given the opportunities to be had with DATV, now available for use on a number of bands, plus the cost-effective opportunities to get onto 5.6GHz presented by FPV modules, we as ATVers have much to be thankful for the ideas and skills of fellow enthusiasts who are prepared to share their endeavours for the benefit of all. Of course, this is not confined to ATV or amateur radio in general however it is worth keeping in mind that there are many unsung heroes that we rely upon to enjoy our hobby; sometimes without realising!

As you will read elsewhere, 2019 is a special year for the BATC as the club will have reached the ripe old age of 70! It is amazing to consider some of the technical changes that have occurred in the intervening years; changes which feel that they are accelerating as time goes on.

That's it for now; best wishes for your seasonal celebrations – whenever they occur!

Australia		
Luke Groeneveld	VK2LGW	Punchbowl
John O'Shea	VK2ATU	Revesby
Mark Harris	VK3EME	White Hills
New Zealand		
Mark Atherton	ZL3JVX	Christchurch
Israel		
Chris Gomoiu	4X1RF	Haifa
Japan		
Katsumi Morita	JA3RVS	Wakayama
South Africa		
Leon Korkie	ZS1MM	Bredasdorp
Thailand		
Sontaya Kumsan	HS2KSP	Rayong
Austria		
Thomas Völker	OE6EMF	Bad Waltersdorf
Manfred Scholl	OE1MSA	Wien
Belgium		
Arthur Lambriex	ON4FIN	Dilbeek
Joël Lebon	ON4LJ	Gosselies
Freddy Vanoppen	ON1AVO	Heusden-zolder
France		
Bringer Jean-Louis	F1AIW	Beaumont St Cyr
Malcolm Beeson		Beziers
Claude Sarroi	F1DIW	Gagnac / Garonne
Guy Gounel	F1BFZ	Grambois
Gilbert Feraud	F5CAU	La Gaude
Franck Dubuis	F1SSF	La Tuiliére
Denis Jeanningros	F6ITK	Le Fenouiller
Patrice Cand	F8BUU	Maisons Alfort
Evariste Courjaud	F5OEO	Migne-auxances
Morata Gilbert	F1FWX	Nimes
Jean Lemercier	F1YI	Pelissanne
Camille Farrougia	F4IBA	Villeneuve Loubet
Germany		
Helmut Schröder	DG3KHS	Bornheim
Wolfgang Buchner	DF3RO	Offenstetten
Juergen Pott	DF1EO	Solingen
Rainer Schmitz	DG8KD	Willich
Ireland		
Jim Smith	EI4CP	Greystones
Latvia		
Janis Dimpers	YL3AKC	Lielvarde
Malta		
Mario Cordina	9H5MR	Mosta

Netherlands		
Anne Westra	PE1GTA	Alkmaar
Peter Meijboom	PA3PM	Amsterdam
Wilko Bulte	PA1WBU	Arnhem
Pascal Witjes	PA1PAS	Arnhem
Carlo C.Bodde	PE1MWL	Bennebroek
Oebele Lijzenga	PA3BJC	Damwald
Herman Blom	PB0AHX	Delft
Henri Van der heijden	PE1PYC	Den Bosch
Herman Ten grotenhuis	PA0TEN	Eefde
Boele Ytsma	PE2BY	Nieuwehorne
Martin Groos	PD0RJI	Numansdorp
Rob Krijgsman	PE1CHY	Terborg
Frank Marx	PA2MRX	Uden
Norway		
Peter Ebsworth	LB0K	Steinsland
Portugal		
Pedro Meneses	CU2FH	Azores Isl.
Slovenia		
Matjaz Zibert	S59MZ	Kranj
Spain		
Joaquim Fabregas Rius	EA3ANS	Barcelona
Benjamin Piñol	EA3XU	Barcelona
Albert Ramos	EA3IBE	Caldes de Montbui
Juan Garcia Dolz	EA3EDK	Sant Fost de Campsentelles
Aitor Echeandia	EB2AT	Vitoria
Sweden		
Jan Andersson	SM0OFV	Solna
Switzerland		
Daniel Harzenmoser	HB9GVD	Dietikon
Martin Klaper	HB9ARK	Kappel
Achim Vollhardt	DH2VA	Zurich
United Kingdom		
Ron Mount	G7DOE	Abingdon
Peter Harston	GW4JQP	Ammanford
Seamus Import	G7ITT	Appleby-in-Westmorland
Robert Brown	GI6IVJ	Bangor
Dave Quigley	G3PRI	Bishops Stortford
Gerald Ashcroft	G8AKL	Bluntisham
Derek Lewis	G1AEQ	Bolton
Tony Swan	M0EUY	Bordon

Alan Mcdowell	G0KOO	Boston
Tony Bonds	G8VTN	Bridgnorth
John Saunders	M0JES	Bridgwater
Ivor Green	G1IXF	Bristol
Chris Watts	G7PVL	Bristol
Ian Parker	G8XZD	Bristol
Shaun O'Sullivan	G8VPG	Bristol
Paul Stallibrass	M0PDA	Bury St Edmunds
David Cattermole	M0DMC	Cambridge
Gary Franklin	G4GHD	Canvey Island
Keith Winnard	GW3TKH	Cardiff
Nick Gilbey		Charmouth
Alvey Street	G4KSY	Chesterfield
Alan Taylor	G1MSA	Coventry
Dave Cawley	G4IUG	Dartmouth
David JOHN	G3WCB	Dartmouth
Terry Jeacock	G0EZY	Doncaster
Peter Biggadike	G8JAN	Downham Market
Anthony Price	G8KBG	Dudley
Don Saunders	G0WFT	Dunstable
Steve Marshall	M0SKM	Dunstable
Malcolm Bay	M0MBO	Dunstable. Beds
Peter Lewis		East Cowes
Chris Donne	G3YKK	East Halton
Peter Green	G0ABI	Eggesford
Mark Farnworth	G4WVU	Fakenham
Malcolm Gregory	G0JYQ	Fareham
Stewart Hunt	G4DWM	Frosterely
A Koeller	M5AGB	Gosport
Leonard Stockwell	M1DPE	Grays
Steve Barrett	G4HTZ	Great Wakering
Kevin Smith	G7UXW	Guildford
Don Roomes	G0RQL	Holsworthy
Frank Heritage	M0AEU	Hook
Peter Stonebridge	G8ZQA	Ipswich
Fred Young	G7NBV	Kettering
John Franks	G3SQQ	Kirkby In Ashfield
Steve Greaves	2E0XAY	Leicester
Phil Taylor	M0VSE	Leicester
Jim Stevenson	G0EJQ	Lincoln
Stephen McBain	2E0SSM	Lincoln
James Alexander	MW1BAJ	Llanelli
Nick Moldon	G1BVI	Maidenbower
David Richards		Maltby
Andy Rutter	G8HCK	Malton
Paul Newman	G8UDI	Market Rasen

Kay Pullan	G8NZR	Mirfield
Roger Farmer		Monmouth
Adrian Leggett	M0NWK	Newark
Anthony Horsfall	G4CBW	Newcastle-under-Lyme
Dale Robins	2W0ODS	Newport
Ian Macdonald	GM8AVM	Newton Stewart
John Grant	GI7UGV	Newtownards
Ian Brothwell	G4EAN	Nottingham
Alan Bolton	G1EAB	Nottingham
Jonathan Bain		Peterhead
Nik Roe	G4ACW	Petersfield
Richard Horton	G4AOJ	Purley
Geoff Cowling	G0FRX	Reedness, Goole
Roger Hopkins	GW4NOS	Rhondda
Mike Richards	G4WNC	Ringwood
Phil Hayes	M0PIT	Roade
Damian McSorley	G4LHT	Ruislip
Vincent Lynch	M0LCR	Salford
Clive Sanders	G4KCM	Salisbury
Angus Young	M0IKB	Scarborough
Barry Chambers	G8AGN	Sheffield
Derek Latham	G6HXL	Skelmersdale
Ashraf Khan		Southampton
Julian Speakman	M0UGA	St Albans
David Leary	G8JKV	St. Ives
Tony Hill	G8GFQ	Stoke-on-Trent
Stephen Yates	G4NZV	Tewkesbury

Ray Benitez	M0DHP	Thames Ditton
Philip Gabel	G1TAI	Towcester
Arthur Turner	G4CPE	Upper Sundon
Simon Tribe	G0IEY	Waterlooville
Julia Tribe	G0IUY	Waterlooville
Brian Bailey	G1UFA	Waterlooville
Dave Remnant	M0SAT	Watford
Stephen Pettitt	M0MOI	Wellingborough
Andy Mace	M0MUX	West Drayton
Edward Harland	G3VPF	Weymouth
Lee Molyneux	G0DBH	Wigan
Richard Giles	G4LBH	Wimborne
Robert Hammond	G4FKR	Winchester
Graham Le Good	G4GUN	Witney
Brian Duffell	G3VGZ	Yarm
Canada		
Rolland Jubinville	VE3RJ	Sault Ste Marie
USA		
Mel Whitten	K0PFX	Bridgeton
Gary Oaks	KB9VGD	Burlington
Gary Sutton	WB5PJB	Castle Rock
Clifton Peoples	KE8QR	Clayton
Mark Culross	KD5RXT	Fort Worth
Keith Pugh	W5IU	Fort Worth
Rodney S Fritz	WB9KMO	Mesa
Don Hill	KE6BXT	Mission Viejo
Richard Hoover	AB0CV	Saint Louis

ATV activity weekends and contests

Christmas repeater contest

- 22nd December through to New Years Day
- Points per Km from Tx to repeater
- £100 to the repeater group with most contacts logged

2019 Activity days:

- 12/13th January
- 9/10th February
- 9/10th March – high band activity weekend & awards for leading stations on 5.6GHz

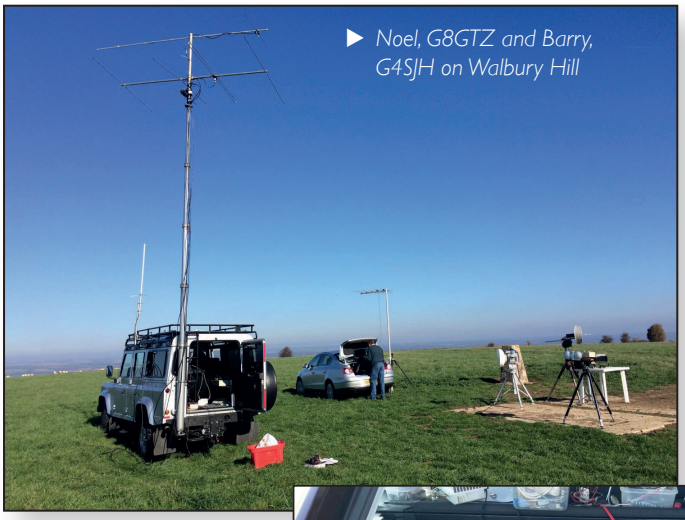
See https://batc.org.uk/contests/

Contest and Activity Day News

Clive Reynolds G3GJA

Activity News

Late October saw a stable high-pressure system over the southern half of the country that produced some really good ducts. Shaun G8VPG kicked off on the 21st before the main event during the low band activity weekend with a 71MHz one way from the Blorenge Mountain near Abergavenny to Luton. Receiver problems prevented making it a two-way but his pictures were seen at a distance of 180km. He had some microwave ops for company that were taking part in the 4th UKuG's 24, 47 & 76GHz Microwave Contest.



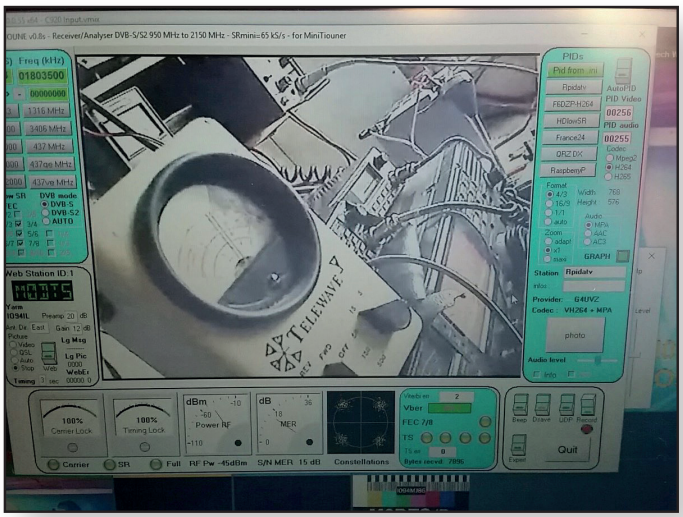
▶ *Noel, G8GTZ and Barry, G4SJH on Walbury Hill*

Walbury was visited by Noel G8GTZ on the 21st for the activity weekend and bagged G8VPG one-way, G7JTT (right) and G4FRE/P two way on 71MHz at 134km.

Predictions for some good ducting on the 24th looked promising on both the F5LEN site and Hepburn.

▶ *Shaun, G8VPG received by Rob, M0DTS*

The predictions were accurate and Shaun G8VPG struck gold in the afternoon with a 2-way on 5.6GHz over a 369.5km path between the Mendips and the North York Moors to Rob M0DTS.



On the Moors Rob was doing well on 146.5MHz too, with a 407km contact with G4UVZ in Taunton followed by a 477km contact with Malcolm G0UHY in Torquay.

Meanwhile Noel was getting some good contacts up to Lancashire and seeing proof of the inversion that created the duct.

Contest News

To generate some ATV activity over the Christmas holidays, the Club is organising a contest running from the 22nd December to the New Year. This should be a relaxed affair that you can fit in between family duties at home or if you fancy some fresh air then you can add your / portable score in as well.

A certificate will be awarded for the station with most points and the runner up plus we will be awarding a £100 prize to the repeater group has the most claimed points through their repeater. With all repeater groups struggling for funds, this is a chance for you to help your group cover costs such as insurance, electricity and rent.

Christmas 2018 BATC Repeater Activity Contest Rules

1. **Introduction**. The main object of an Amateur Television Contest is to promote ATV activity. Anyone interested in ATV, whether they are members of the British Amateur Television Club or not, are welcome to take part.
2. **Eligibility**. BATC Contests are open to all licensed radio amateurs who are equipped to transmit pictures by analogue or digital Fast Scan
3. **Dates and Times**. The contest will run from 0000hrs GMT on 22nd December 2018 to 2359hrs GMT on the 1st January 2019.
4. **Location**. The operating location must be within the terms of your licence. If operating away from your main station, please get the permission of the landowner.
5. **Frequencies**. Within the allocated segments of the 70cm, 23cm, 13cm, 9cm, 6cm, 3cm and 1.5cm bands for FSTV. The NoV bands of 71MHz and 146.5MHz are also eligible. Operation must be via repeaters.
6. **Power**. Output power must not exceed that set out in the terms of your licence.
7. **Exchange**. Both a CALL SIGN and a FOUR-FIGURE code number must be conveyed via video. Confirmation of reception is by transmitting back the sum of the code numbers on the talk-back channel, not the actual transmitted number. Please note that all four digits in the contest number should be different and not consecutive. The numbers must be different for each band, e.g. these numbers are OK: 2741, 4820, etc, these are not:- 1111, 1138, 1381, 1234 etc. Reports should be exchanged by talkback, using a 1-5 video quality report and a serial number, starting at 001 for each band.
8. **Scoring.** Points are claimed for the RF path from the transmitting station to the repeater. The following multipliers should be used: 71MHz & 146MHz @ 5 points per km, 70cm @ 3 points per km, 23cm @ 2 points per km and for contacts on higher bands @ 5 points per km.

RF or Internet links between two repeaters do not count for additional points.

You may claim points for contacts with the same station on the same day provided you use a different band. The following day you can claim points for the same contacts.

Contacts from multiple locations are permitted on the same day, band and with the same callsigns, i.e., you can go out portable to two locations and all of the points earned /p can be added to those claimed for working the same stations on the same bands later in the day from the home station.

Use the standard rounding for decimals when converting distance to points. 0.5 and above add one point, anything less than 0.5 use the integer only.

Examples:

a. Two stations are located in the same locator square, but make a 2-way contact on 23 cm through a repeater 50 km away. Each one-way contact earns 100 points (50km x 2 points per km) from each end of the RF path, so the total score for each station is 100 points.

b. If one station transmits to the repeater on 13 cm, he uses the distance to the repeater and the 13 cm multiplier. If the other transmitting station is using a 70cm or 2m input the points are calculated using the appropriate band multiplier.

c. A station operates /p from IO93PV and uses a repeater at IO93RS37 (distance 17.5km) to contact G9XYZ. He uses both the 23cm and 70cm inputs and claims 35 points for the 23cm contact and 53 points for the 70cm contact. He then moves to IO93OU91 (distance 14.7km from the repeater) and makes the same contacts on the same bands. He claims 29 and 44 points respectively. His total for the day if he makes no further contacts is the sum of all contacts, 161 points.

9. **Distance Calculations**. Your computer program should give 6371.290982 km as the earth's radius and 111.2036 km for each degree change in latitude before rounding off to the nearest km. For scoring purposes, all valid contacts shall be deemed to have taken place over a distance of at least 5 Km, even if the two stations or the repeater in the contact have the same or adjacent locators. Scoring should

be based on the distance between the centres of location squares, not map distance. Full 6-character length QTH locators must be used.

10. Logs. A separate summary log sheet should be submitted for each band, with a single cover sheet for all bands. The cover sheet should indicate for each band: Call sign of station entering contest, Contest name, Band, TX Power, Aerial etc., Code number used, QTH locators used, Total number of QSOs and best DX etc., Name and address of 1st operator, names and call signs of operators and the signed declaration. The log sheets should list for each contact, the date/time, Station Worked, Report/Serial number received, Repeater Callsign, Repeater Locator, Locator of other station, km from your station to repeater and points claimed. Each band should begin with the serial number 001. No station to be worked more than once on a specific day through the same repeater unless a different band or location is used. Please mark duplicates. You could lose points for gross errors, however the contest manager will correct minor errors of scoring and distance calculation. Logs must be posted or e-mailed by the third Monday after the contest.

11. Receive only section. Send or e-mail a log sheet giving your Call sign / BRS No. and name and address, Band, Date/Time, Call sign of station seen, Repeater Callsign, Repeater Locator, Locator of other station, Code number received, km from your station to repeater, km from repeater to distant station and points claimed. Scoring is the same as for a one-way contact defined above.

12. Disputes. The decision of the contest manager and/or the BATC Committee is final.

13. Spirit of the Contest. Don't leave your video transmission on any longer than necessary. Let other stations use the repeater as well. Contests mean activity and good fun, join in and, even if you only work one or two stations, please send a log in.

14. Declaration of Interest. Although acting as contest manager, I reserve the right to take part.

15. Electronic Logs. Both paper and electronic Logs are acceptable. Electronic logs should be submitted using the Excel-format Repeater Contest Logsheet which can be downloaded from the BATC Web Site.

16. Contact Address. Entries and logs should also be submitted to:
C. Reynolds,
49 Westborough Way,
Anlaby Common,
East Riding of Yorkshire
HU4 7SW.

Computer logs should be submitted by e-mail to ***contests@batc.org.uk***. Please make sure that you get an acknowledgement from the Contest Manager - e-mails do go astray!

Activity calendar

0001 UTC 22 Dec '18 – 2359 UTC 1 Jan '19	BATC Winter Repeater Contest
1200 UTC 12 Jan – 1800 UTC 13 Jan '19	ATV Activity Weekend
1200 UTC 9 Feb – 1800 UTC 10 Feb '19	ATV Activity Weekend
1200 UTC 9 March – 1800 UTC 10 March '19	High band Activity weekend - ATV 5.6 GHz and Above
1200 UTC 6 April - 1800 UTC 7 April '19	ATV Activity Weekend
1200 UTC 4 May - 1800 UTC 5 May '19	ATV Activity Weekend
1200 UTC 8 June - 1800 UTC 9 June '19	IARU International ATV Contest
1200 UTC 13 July – 1800 UTC 14 July '19	ATV Activity Weekend
1200 UTC 10 Aug - 1800 UTC 11 Aug '19	ATV Activity Weekend
1200 UTC 14 Sept – 1200 UTC 15 Sept '19	ATV Activity Weekend

BATC report to the RSGB Spectrum Forum – October 2018

Noel Matthews, G8GTZ

Reduced Bandwidth (RB-TV) digital television transmissions continue to evolve with stations active on all bands from 50MHz to 76GHz. Digital modulation tests continue to indicate that DVB-S2 provides about a 2dB improvement over DVB-S for the same bandwidth. Stations are now experimenting with the new H265 codec and have successfully transmitted full 1920 by 1080 HD pictures in 500KHz bandwidth on the 146MHz band. Reports of these initiatives have been fed back to Ofcom as important examples of continued innovation in Amateur Radio.

Activity levels

ATV activity on all bands is increasing, particularly on the 5.6GHz band where the use of cheap drone FPV equipment has enabled a very easy and low cost route to get on air.

This increase in activity was reflected in the recent IARU Region 1 contest results where UK had the most entries of any country and UK stations won the 9cms, 24GHz and 76GHz sections.

The Bands

50 MHz

There has been a limited amount of RB-TV testing at the top end of the existing band. The BATC has supported the IARU region 1 team initiative to gain an additional 2 MHz at WRC 2019 and provided input to the Ofcom consultation. If this initiative is successful it is envisaged that there will be more RB-TV activity on the band.

71 MHz

The recent ability to apply online for an NoV has sparked interest in this band and ATVers are having to learn new skills to operate on the band including higher noise floors and huge antennas! Even with the 100 watt ERP restriction, QSOs in excess of 150Km have already been achieved.

146-147 MHz

The recently released top end of the 2mtr band is regularly used for RB-TV. Even though the maximum transmit power is limited to 50 watts ERP, ATV QSOs using 500KHz bandwidth over 200Km are now happening regularly with the current record standing at 280Km.

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 over 200 Km made around the UK and into Europe.

1.3 GHz

Significant progress has been made in clearing the outstanding repeater applications for 23cms and currently 27 repeaters are licensed for this band, which continues to be very popular for analogue and digital transmission. Simplex, non repeater, operation is also popular in the band.

2.3 GHz

There are still 2 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 number of operators are known to building 2.4GHz DATV equipment ready to take advantage of the Es'hail-2 geostationary satellite which is due for launch in late 2018.

3.4 GHz

7 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 were active during the IARU contest using Reduced Bandwidth DATV..

5.6GHz

With the availability of the low cost (<£20) FPV equipment we are seeing a significant increase in the number of ATV and WBFM stations using the 5.6 GHz band. There are 2 repeaters with inputs on 5665MHz and we believe this will become an important band to attract newcomers to ATV and microwaves.

10 GHz

6 repeaters are licensed for this band and it is also quite active with simplex operation.

There is still FM activity on the band and the low cost HB100 Doppler module is being tested with a view to providing a low cost alternative to the now obsolete Solfan heads.

A number of stations are active with DATV on the band using standard narrow band transverters from144 / 432 MHz to generate DATV signals on the band. Distances over 100Km have been worked easily.

24GHz

A number of stations are active on 24GHz ATV undertaking mainly portable work with the current best DX standing at 80Kms.

Higher bands

2 stations are active on 76GHz and have achieved 30+kms one way and M0DTS has successfully transmitted video on 134 GHz.

TV Repeaters

Overall we currently have 42 TV repeaters licensed and 1 new repeater NoV has been requested. The repeaters are using 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 a 25% increase during the past 4 years with the Portsdown DATV system proving to be a popular route back in to the hobby for many.

BATC believes that building a community of ATV builders and operators through online communities on the member's forum, providing a reliable source of relevant information on wikis and in the 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 recognize achievements in the community and the use of the BATC shop stocks otherwise difficult to source components for BATC sponsored projects.

In order to further increase operator numbers, BATC has awarded a number of prizes for contest winners and organizes a monthly activity weekend timed to coincide with activity weekends in neighbouring IARU countries.

BATC response to WRC Agenda Item 1.1

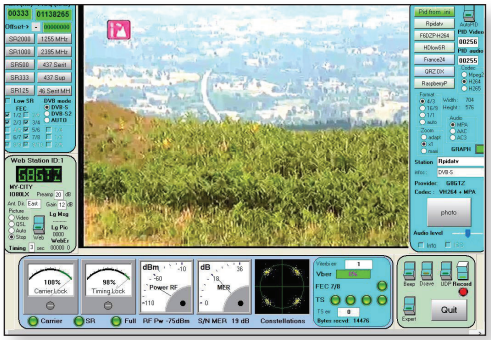
British Amateur Television Club (BATC) response to WRC Agenda Item 1.1 Possible allocation to the Amateur service in 50 - 54MHz in Region 1.

Over the past 4 years members of the BATC has conducted experiments and tests to show the viability of sending real time true High Definition video in bandwidths of less than 1 MHz on the recently allocated Amateur Radio spectrum at 146MHz and 71 MHz. Ofcom have fully supported these tests and John Regnault, the RSGB VHF manager, has on 2 occasions presented the results to Kevin Delaney in Ofcom Spectrum Policy and Planning and the Business Radio Interest Group.

Following on from this success, where video was transmitted over distances up to 150Km using single carrier DVB-S modes, we are now keen to try similar experiments on 50 MHz where we think that by using certain advanced types of OFDM modulation, it may be possible to achieve distances of 100s if not 1,000s of Kms.

In order to minimise interference to other already established amateur services and give the potential to conduct experiments with operators in region 2 and 3, we would ideally conduct these experiments in the 52 – 54 MHz segment. We believe harmonising 52 – 54 MHz in IARU region 1 would help us to achieve maximum benefit from these experiments which have already shown UK amateur radio operators to be innovation leaders in this field. We therefore ask that Ofcom actively support agenda item 1.1 rather than adopt a monitoring position.

▶ *Screen shot of real time video on 71MHz over an 87Km path*



The story behind Es'hail-2

Peter Guelzow – DB2OS

With Es'hail-2, the first geostationary amateur radio satellite in orbit, a long-cherished wish of the radio amateurs has become reality - almost half a century after the SYNCART proposal which had a similar ambition. AMSAT-DL President and P4-A Project Manager Peter Gülzow, DB2OS, explains how this came about.

Es'hail-2 is a television and amateur radio satellite of the Es'hailSat Qatar Satellite Company from Qatar. How did the contact to the Qatari people come about?

The stone started rolling with a personal invitation to Qatar's National Day celebration in December 2012. The Qatar Amateur Radio Society (QARS) organized the first international amateur radio festival in the Middle East.

The conference was chaired by A71AU, H.E. Abdullah bin Hamad Al Attiyah, Chairman of the Qatar Amateur Radio Society (QARS), former deputy Prime Minister of The State of Qatar, Minister of Energy Industry, Chairman of the Administrative Control and Transparency Authority. In his opening address, HE Abdullah bin Hamad Al Attiyah stressed the significant role amateur radio plays in the society during the opening of the Qatar international amateur radio festival at the Al Rayyan Theatre in Souq Waqif.

In the presence of the former Deputy Prime Minister of Qatar and other high-ranking personalities I was able to present and promote the ambitious amateur radio projects of AMSAT-DL. From the beginning of the OSCAR's, through the P3-Satellites (OSCAR-10 to OSCAR-40) in the high elliptical orbits, up to the planned P5 missions to Mars (or moon). I was struck by a very large wave of sympathy, enthusiasm and long-standing applause, which I have rarely experienced that strong before. Also, the follow-on discussions with high-ranking representatives of the government and QARS were very positive. Qatar wants to play a positive role in the world and supports the idea of international friendship, education, research and emergency radio in humanitarian disasters.

After about two weeks of silence I was surprised by a phone call from the Qatar Satellite Company, Es'hailSat in Doha. I was informed that Es'hailSat was asked from the highest authority to build an amateur radio satellite project for Qatar and wanted to discuss with me which possibilities exist in general. When I first asked what they have in mind, I was quickly told that I'm the one to suggest what they should do. So, we started with a CubeSat. But that was not really what I and they wanted. On the other hand, something like P3-E seemed also no real option, although I would have loved the idea. The propulsion with hazardous fuel makes things more complicated nowadays.

I knew Es'hail-2 was already in the planning stage, so finally I suggested to put an amateur radio payload on this geostationary satellite as a kind of "hosted payload", i.e. to be built by AMSAT-DL. I also argued that this could be the first geostationary satellite carrying amateur radio, which we call "Phase-4". It turned out that this became a really strong selling point for this project, alongside with the Digital Amateur TV transponder which I already had in mind. Indeed, a unique project with which Qatar would make history in amateur radio achievements.

Thus, AMSAT-DL, together with Es'hailSat and QARS developed a concept for two amateur radio transponders on the commercial communication and television satellite Es'hail-2, as a, so-called, "Hosted Payload".

I myself was involved from the beginning of the satellite definition. First discussions with several potential satellite manufacturers from Europe and US took place only a few months later at the aerospace exhibition in Le Bourges/ Paris, as well as in many other teleconferences and "home phone calls". The corresponding confidentiality agreements had to be signed by me personally on behalf of AMSAT-DL. That also meant that for a long time one could never talk openly about the project, including the exact start date later.

After all, the main purpose of the satellite is to provide commercial radio services in direct competition with other established satellite operators. That is why we must show great restraint in everything we report until the end, even if this does not always meet with understanding among radio amateurs!

With the support of Michael Fletcher, OH2AUE and later Achim Vollhardt DH2VA, who then took over the role of project manager, all specifications and requirements were defined in detail together with the experts from Es'hailSat and Mitsubishi (MELCO) which got the contract to build the satellite. We also visited Es'hailSat in Doha and Melco in Japan several times to discuss all details of the project. In a workshop we explained the technical features and differences of our linear transponder to the MELCO engineers, in particular the functionality of the AGC/ALC which is a key for the linear transponder. Typically, pure linear transponders and uncoordinated multiple access are not known there. Commercial TV transponders work fundamentally differently, e.g. the transmission power of the uplink stations is regularly adjusted under the direction of on observation station in order to guarantee a constant picture quality. Since this does not work in this way in amateur radio, appropriate technical measures and safety devices are necessary to ensure that the final stages are not overridden. In contrast to the usual practice with AMSAT-DL, MELCO has built the transponders according to our requirements and specifications and thus also assumes responsibility for Es'hailSat, which, is of course, also an advantage for us for insurance reasons.

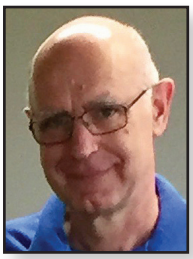
Originally AMSAT-DL hoped to build the hardware, but Es'hailSat convinced us that this a better idea to start with and "be more experimental" next time. This has been mainly because of insurance and legal reasons with the contracted manufacturer.

After appropriate review meetings and verification of the design, AMSAT-DL then concentrated on the ground segment. In the Satellite Control Center (SCC) of Es'hailSat. An uplink and downlink device will be installed, which serves for monitoring as well as providing the telemetry beacons and a ground-based LEILA for the narrow band transponder. All of this equipment has been designed and built by the AMSAT-DL team.

A DATV beacon in DVB-S2 format will be provided for the broadband transponder, on which a video loop will run. In addition, the ground station also contains a regular radio station for SSB and DATV operation, which will then be set up there as a club station under A71A for special occasions. An almost identical backup station will be set up in Bochum at the AMSAT-DL headquarters at the IUZ and, of course, at the QARS in Doha. A "mobile station" will also be set up to transmit e.g. "live" amateur radio television from events such as Ham Radio.

After the launch of Es'hail-2, which happened on November 15th, we now still must wait another few months before the AMSAT P4-A transponders can be opened for general usage by the amateur radio community. The spacecraft is already undergoing extensive In-Orbit testing and verification. It has been "parked" in a temporary position and before being moved to its final destination at 26°E.

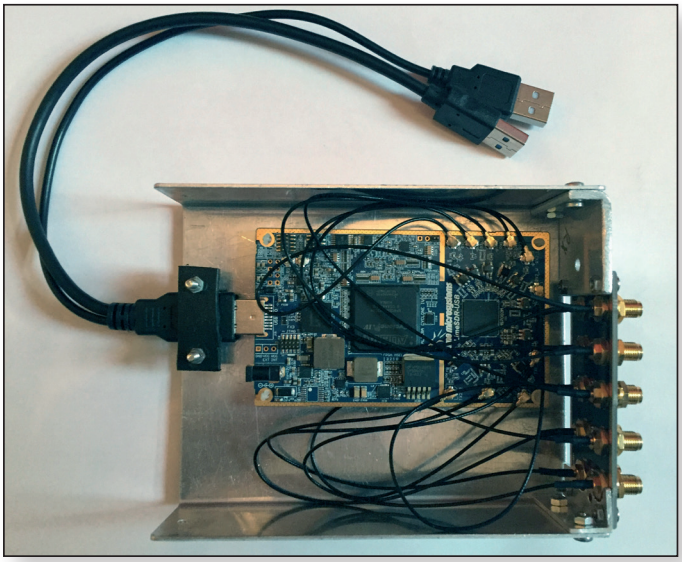
Photograph: DB2OS



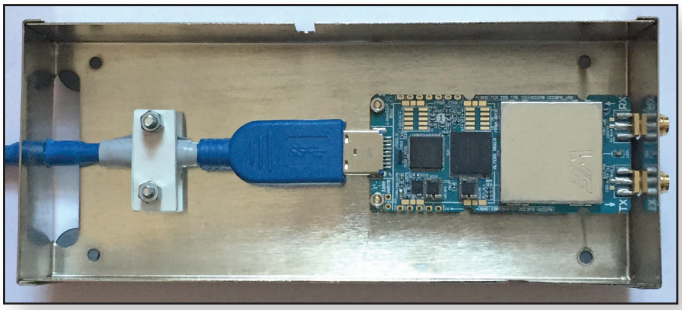
Portsdown Support for the LimeSDR

Dave Crump G8GKQ

The LimeSDR family of software defined radios (SDRs) are based on the Lime Microsystems LMS7002M "Field Programmable Radio Frequency" integrated circuit. The datasheet can be found here: ***https://github.com/myriadrf/LMS7002M-docs/blob/master/LMS7002M_Data_Sheet_v3.1r00.pdf.*** There are 2 basic versions of the LimeSDR currently on sale, the dual input/output LimeSDR USB, which retails at about £325, and the single input/output LimeSDR Mini which costs about £175 in the UK. The units are very capable SDRs which can transmit and receive from HF to over 3 GHz.



▶ *The LimeSDR USB with SMA Connection Panel*



▶ *The LimeSDR Mini Mounted in a Protective Case*

Although designed in the UK, the LimeSDRs are manufactured for Crowd Supply ***https://www.crowdsupply.com/lime-micro/*** in the USA and sold from there.

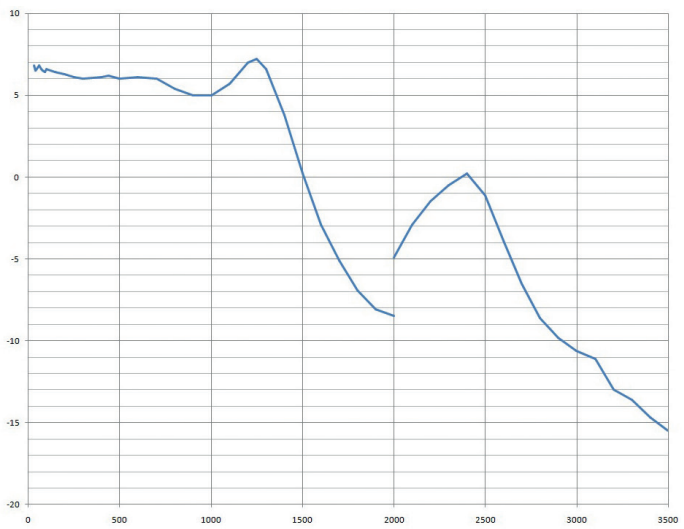
Evariste F5OEO has for some time been able to demonstrate Digital TV transmissions from the LimeSDR Mini and I was able to take his code and modify it for use within the Portsdown system. Thanks to Malcolm G0UHY, who loaned me his LimeSDR USB, I was able to make sure that the code supported both versions.

LimeSDR Mini within Portsdown

The LimeSDR can replace the Portsdown filter-modulator board together with the ADF4351 and the LO filter in the Portsdown system. It connects to the Raspberry Pi by USB2, but does need a powered USB hub to provide sufficient supply current (or an external power supply can be used with the LimeSDR USB). The output of the LimeSDR is routed to the 4-way or 8-way RF switch in the same way as the output from the Portsdown filter-modulator board would have been.

LimeSDR support is built in to the latest Portsdown release (20181130), but you might need to check that the firmware on your LimeSDR is up to date. You can check this from the "Lime Config" Menu accessed through Menu 3. You can also update the firmware from the same menu. Note that the firmware loaded by the Portsdown is a more recent version than that used by DATV Express v1.25LP11. The Portsdown-compatible firmware does not work well with this version of DATV Express. DATV Express Version 1.25pl12 works with the same firmware as the latest Portsdown software, so please upgrade to retain compatibility.

To use the LimeSDR, simply connect the SDR (through a powered USB Hub) to the RPi and then select "Lime Mini" or "Lime USB" from the "Output to" menu.



▶ *Typical LimeSDR Mini Output in dBm vs frequency in MHz*

If your desired option is greyed-out it means that the RPi cannot detect that the device is connected. You should set a Lime Gain of 88 to start with; this will give you about +5 dBm (3 mW) output. The output does reduce significantly with frequency above 1300 MHz and is plotted below. There is a step change at 2000 MHz because that is where the output circuitry is switched.

The Lime Gain setting can be used to control the output power in steps of 2 – 6 dB; however it does not control the output smoothly, and gives different steps for Carrier, low symbol rates and high symbol rates. If you need fine control of the output level, I would suggest using the software controlled attenuator described on the BATC Wiki.

DVB-S2 Modulation

Once the LimeSDR is selected, the DVB-S2 modulation modes become available on the "Modulation" menu. Note that these are currently "pilots off", but I hope to enable the selection of "pilots on" in future.

I would like to make the DVB-S2 modes available with the DATV Express modulator board in future, but there is no prospect of them being available with the Portsdown Filter-modulator board; the I and Q signals on that board are limited to 2 states each (+1 and -1) so it can only do QPSK.

Limitations

Driving the LimeSDR needs a lot of processing power from the RPi, so some of the more processor-intensive video modes do not work – the RPi just has not got enough processing power:

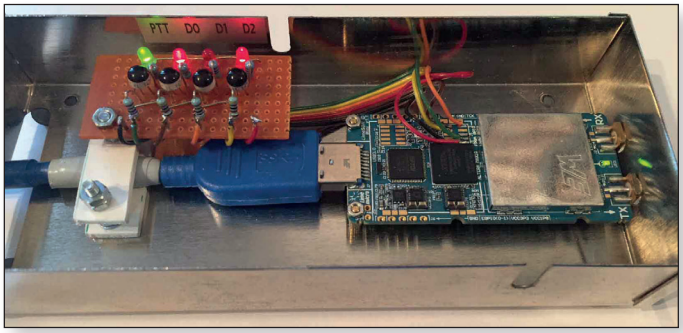
- H264 modes generally work at up to SR2000 and occasionally SR4000.
- MPEG-2 modes are generally limited to about SR1000.

I have not had time to test how much improvement is gained from using an RPi 3B+, but I would certainly recommend this faster model for new builds.

PTT and Output Switching

Every time that the Lime is set to transmit, it self-calibrates. This involves it generating signals out of band at potentially 10 times the power level set. This process only takes a few seconds, but could potentially cause harmful interference or destroy your PA Devices. To mitigate this, I have set a delay in the Portsdown PTT when a LimeSDR is selected so that it does not switch to transmit until 7 seconds after the start of calibration.

I have also managed to control the FPGA GPIO lines on the LimeSDR Mini and LimeSDR USB to drive the PTT and band select lines. GPIOs 0, 1 and 2 give the same signals as the RPi Band LSB, NSB and MSB. GPIO 7 gives the PTT signal which goes high the moment the calibration is finished. These signals can be taken from J5 on the LimeSDR Mini (see ***https://wiki.myriadrf.org/LimeSDR-Mini_v1.1_hardware_description***) or J18 on the LimeSDR USB (see ***http://wiki.myriadrf.org/LimeSDR-USB_hardware_description***). The pin connections on the LimeSDR USB are different from those on the LimeSDR Mini. You can see the LimeSDR Mini connections being used on my test rig.



▶ *Direct connection to the LimeSDR Mini GPIO Pads*

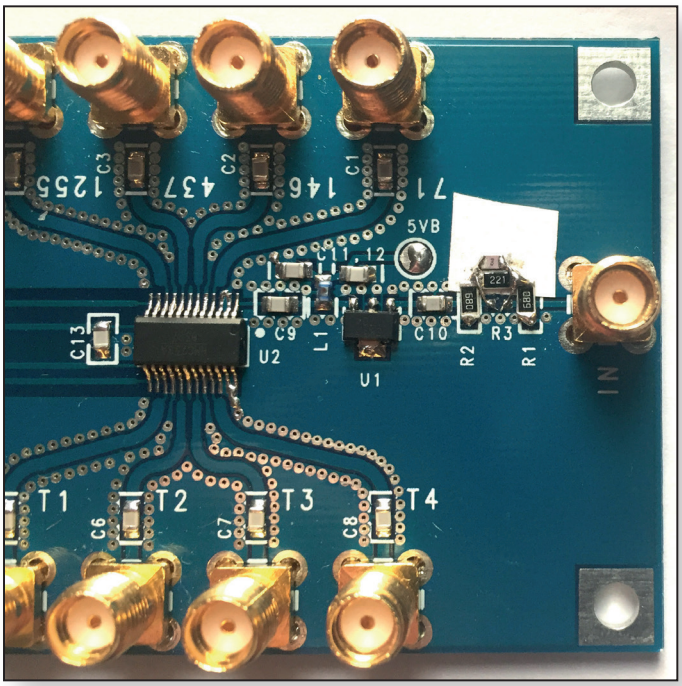
Use of the Portsdown 8-way Switch and RF Switch

The Portsdown 8-band decode and 8-way RF Output switch boards are well suited to be used with the LimeSDR boards. As mentioned earlier, they can either be controlled from the Raspberry Pi GPIO pins or from the GPIO outputs of the LimeSDR.

These boards provide 2 very useful functions. Firstly they provide (optical) isolation between the transmitter switching circuitry and the sensitive FPGA on the LimeSDR. Secondly, they provide amplification of the signal level from the LimeSDR. This particularly useful at 2405 MHz, where the 0 dBm typical output of the can be boosted to between +5 dBm and + 10 dBm.

One modification is required to the 8-way RF Output switch board to provide higher gain at 2405 MHz relative to other frequencies. C16 (2p7) needs reducing to 1pf, and R5 (68 ohms) needs replacing with a wire link. Alternatively (although I haven't tested it) R5 could be simply be replaced with a 2p2 or 1p8 capacitor and C16 left as 2p7. The modification on my prototype board is shown here with the 1pf capacitor on the white square.

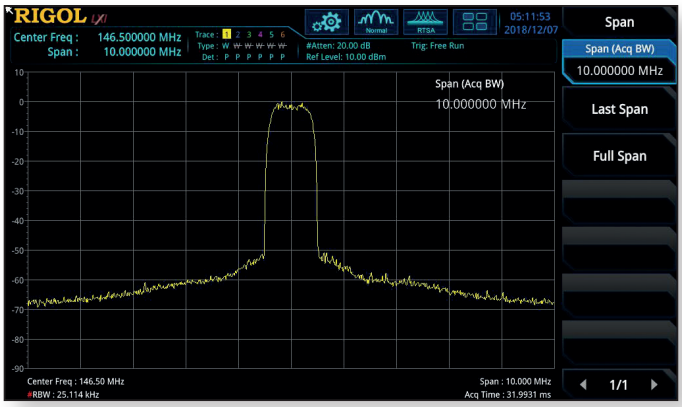
... STOP PRESS ...
LimeSDR Minis are soon to be available from the BATC Shop



▶ *Modified 8-way RF Switch*

Results with the LimeSDR

The LimeSDR can produce a really clean signal at low symbol rates where it uses 2x up-sampling to get the best results. The plot below was an experiment to see how much data could be fitted into 1 MHz of RF bandwidth, and you can see that at an SR of 720KS, there is nothing above -50dB within 5 MHz either side of this 32APSK transmission. At SRs above 1MS, the transmission is not quite so clean as up-sampling is not used, but it is still much better than the filter-modulator board.



As we learn more about these SDRs and how to drive them, the results should get even better. All the code is open source and is on the BATC GitHub site ***https://github.com/BritishAmateurTelevisionClub/portsdown*** . If you are interested, please take a look; I would welcome suggestions for improvement.

LimeSDRs are currently available from Crowd Supply in the USA, and are then subject to UK VAT on import. The BATC Shop team is investigating whether it is practical for us to stock LimeSDRs for purchase by our members. Please keep an eye on the BATC Forum for updates.

GB2RS RSGB News

Just a quick reminder that GB2RS news is streamed live by G8ROG on Sunday morning at 9:00am on ***https://batc.org.uk/live/g8rog***

Sydney Amateur Television goes 5.6 GHz

John O'Shea, VK2ATU

With the popularity of drones has come the availability of low cost 6cm video receivers and transmitters. This has been exploited by UK amateurs with distance records of over 150km being achieved with only 600mW power levels.

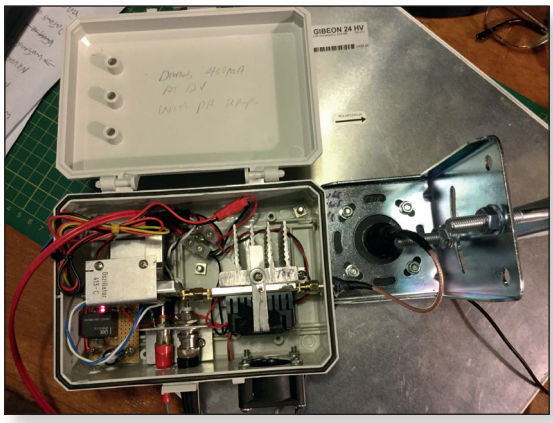
I had thought for some time about adding a 5.6GHz input to our Lawson ATV repeater, VK2RTS located in the Blue Mountains west of Sydney. Lawson is 728m above sea level and according to the web site "heywhatsthat" is line of site to my QTH at Revesby 60km away but would such low cost equipment do the job?

I purchased a matching transmitter and receiver from a Chinese model shop. They are labelled TS832 and are made by a number of manufacturers. The drone FM transmitters and receivers have 40 fixed frequency channels with a small display showing the channel number selected by two buttons. Most of the channels are in the Wi-Fi band but the "Race Band" is below that and there are three frequencies, 5.695, 5.752 and 5.820GHz that are close to the Australian ATV 6cm band centre frequency allocations. Check before ordering as there are other channel combinations that don't include the Australian frequencies.

I mounted the transmitter and receiver each in portable cabinets with small 6x6cm patch antennas with a claimed 14dBI gain and headed off to a local park to see what range could be achieved.

Setting up on one side of the park with the 600mw transmitter on 5.695GHz and the receiver on the other side, some 700m away.

Video received was P5 excellent. But turning the receive antenna showed only minor variation in the received signal strength even at right angles. This made me doubt the claimed gain figures of these small patch antennas.



The next range test was to be a hill top at Liverpool, some 11km from my QTH.

Arriving at the site I set up the tripod, mounted the receiver with the small TFT screen and audio amp. Telephoned my helper back home to turn on the transmitter now mounted on an 8 metre mast at my QTH with a confirmed line of sight to the hill top. No picture at all, both locations where using the small patch antennas.

Reading the British Amateur Television Club magazine, CQTV an article caught my eye regarding the Polish made Gibeon patch antennas, 33cm by 33cm square and have 24dBI gain with female N connector. I ordered two of them from a UK eBay seller. The manufacturers SWR graph shows the best match is closest to our 5.695GHz frequency. Now with the much larger patch antenna in place at the QTH and fitted to the portable receiver I was off to the hill again. Success! a beautiful P5 picture with good sound.

Having confirmed line of sight to Lawson some 60km away it was time to see if video could be received there. I purchased a 3W power amp from the same Chinese model shop and added a substantial heatsink to improve cooling and mounted it up on the mast with the transmitter. I included a 5 second timer to power up the transmitter before the P.A. There have been reports of PA's failing when powered up before RF drive. I also tapped threads into the heat sink with screws to hold tight copper wire to keep the heat sink firmly in place. First remove the yellow sticker and apply thermal grease. Always have an antenna or dummy load connected when powering up drone transmitters and power amps, they fail very quickly otherwise!

Arriving at Lawson I set up just down the road from the repeater site with an unobstructed view to the distant CBD. With the receiver and large patch antenna on a solid tripod it was time to phone my helper to power up the transmitter. It was a calm warm day and all my fingers where crossed. The screen sprang to life with a good picture, not P5 but close. The audio tone was audible but in and out of the noise. I swapped over to the small 6cm patch antenna, not expecting to see anything - but to my

surprise there was a weak but viewable picture. So now I tried a small omnidirectional three loop cloverleaf antenna, I couldn't believe it, a reasonable picture! - This was showing real promise.

I packed up, drove up the road and knocked on Paul VK2JPL's door, the home of the ATV repeater. We set up the receiver on Paul's backyard shack roof.

We were looking right at the neighbours tile roof but still received a passable black and white picture. This was looking promising.

After showing the other ATV's in the group the video of the field tests it was decided to set a Saturday to install the 5.6GHz receiver on the tower at Lawson.

Saturday dawned fine and sunny and we had agreed to meet at the repeater site at 10am and all were on time. Garry VK2CRJ, young Paul VK2KZO, Paul VK2JPL and myself with the receiver and DTMF controller. Young Paul volunteered to go up the tower on the extension ladder with tool belt and patch antenna with receiver attached. Garry delved into the ATV workings and connected the new controller in front of the original. We then fed the three cables up the tower, one to feed the 12 VDC up to the receiver and two to feed the audio and video down.

The distant transmitter was activated and a perfect full colour picture was received with clear audio - success. Further testing of the DTMF tones confirmed on and off operation and the original analogue and digital inputs were working as normal, all in all a very successful result. A few weeks later with heavy rain we observed that over the 60km path no observable attenuation occurred. My previous testing through heavy tree foliage showed that 6cm video RF can penetrate more than theory would suggest.

Lawson ATV is active on Monday nights from 7pm on digital 446.500MHz and streamed on the British Amateur Television Club website by Garry VK2CRJ. Voice liaison is on FM, 147.325MHz + offset. Interested Amateur operators are always welcome to call in.

Many thanks to the Sydney ATV Group for their help and cooperation.

John VK2ATU

Email: ***stargate101@optusnet.com.au***

▶ **John, VK2ATU in his shack**

References

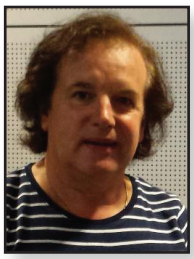
British Amateur TV Club:
https://batc.org.uk/live/

UK Ebay seller:
http://www.ebay.co.uk/usr/3gwifi_warehouse?_trksid=p2047675.l2559

Antenna Manufacturer:
https://yagi.pl/antena-gibeon-24hv-z-obudowa-zlacze-ufl

Heywhatsthat, line of sight check:
https://www.heywhatsthat.com/

Drone video, Banggood:
https://www.banggood.com/



We were there at the launch of the Es'Hail-2 satellite!

Jen Easdown G4HIZ

As I am sure many of you will know by now, the long-awaited launch of the Es'Hail-2 satellite took place on Thursday 15th November 2108. The satellite was built for Es'HailSat of Qatar and had been slated for launch for the last year or so, but had now finally made it to the launch pad. This commercial Geostationary satellite is unique in being the Worlds' first to host an Amateur Radio payload, potentially providing amateur global coverage from Brazil to Thailand using 2.4/10GHz transponders.

Like many radio amateurs interested in this satellite, I had kept a close eye on launch schedules and when it was listed for November, decided that I wouldn't mind watching the launch. This was made into a firm plan when both Noel G8GTZ and a group from AMSAT-DL also expressed an interest and so a bunch of us planned to travel to Cape Canaveral to view the launch. The group coordinated on arrival and as well as viewing the launch visited the Kennedy Space Centre (several times !). In our group were Noel Matthews G8GTZ, Achim Vollhardt DH2VA, Per Malbak DC3ZB and Peter Guelzow DB2OS, President of AMSAT-DL and Project Leader for the Phase 4-A amateur payload and myself, Jen Easdown G4HIZ.

To make travel plans for a satellite launch is always tricky, the later you leave it then flights can become full/expensive, hotels unavailable etc, but a point is reached when the commitment has to be made and for me this was about one month in advance, knowing from experience that the launch team will be working flat-out to reach the launch date and only unforeseen circumstances would delay that. It was sobering to realise that even with all the technicalities in place, things can happen to scrub the launch, like weather, people entering the exclusion zones, etc, such that the official probability of launch on a certain day was only 50%. To cater for this, a launch window 24 hours later was pencilled in. The group, as well as many radio amateurs world-wide, had been waiting years for this launch (planning began in 2012) and now it seemed nothing could stop it.

The Florida weather in November is surprisingly warm, with daily temperatures reaching up to 29C. But with the approaching change of season came changeable weather. The weather at the beginning of week had included lightning but as the week progressed, the weather improved and Thursday 15th November was confirmed as the launch date.

Photo by Achim DH2VA

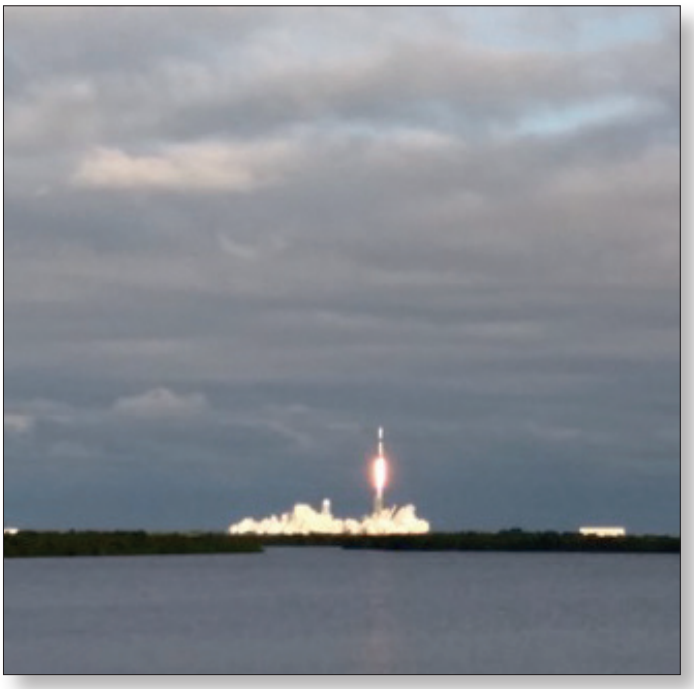
► *The group on the day before the launch, Noel, Peter, Per and myself on a recce to check out the launch viewing area. Achim is behind the camera!*

When the launch day arrived, the group arrived early at KSC in order to win a place at the viewing stand located at the Saturn V centre. We were told that a few thousand people may be heading there and places were limited. The day started very sunny but then began to cloud over, causing not a little consternation that the launch may be scrubbed. Time passed relatively quickly and about one hour before the start of the launch window, sun-beams magically shone down and illuminated the pad, as if there were search-lights from above! The launch pad itself was the historic Pad 39A, from which all the manned lunar missions had launched and many Space Shuttle missions and had now been leased by Space-X for their launches including this Falcon 9 rocket carrying the satellite we had all been waiting for.

The last hour before launch passed very quickly, with 'Go for Fuelling', 'Go for Launch', the final countdown arriving and the launch heralded by a huge mass of vapour around the base of the pad, which was a few miles distant. The sound takes a few seconds to reach the viewers, but when it does, whoa you can feel it! There is a deep thundering roar interspersed with a crackling noise. The rocket rose majestically and was visible for some time, even through the cloud cover. At another viewing area nearby, a large screen showed live video coverage of the rocket engines and satellite during launch and it was possible to view the actual satellite separation thirty-two minutes later.

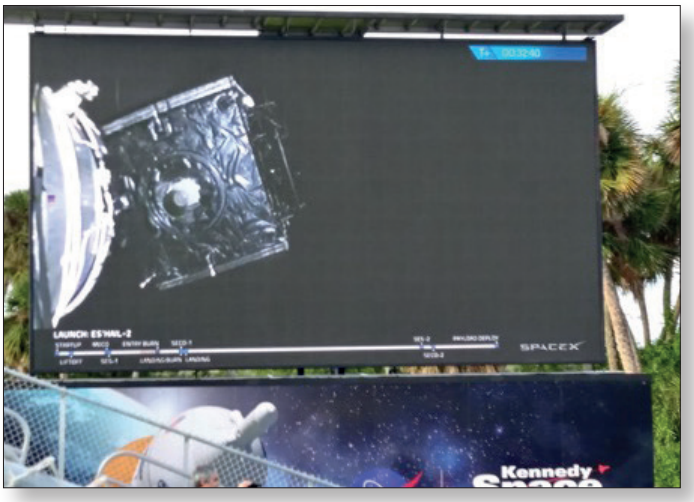
For those interested in the launch video, this was upload to web and can be seen at:
https://www.youtube.com/watch?v=PhTbzc-BqKs

Photo Jen G4HIZ



▶ *Launch of the Es'Hail-2 satellite aboard a Falcon 9 rocket from Pad 39A, Cape Canaveral, 15.46 EST, 15th November 2018, carrying the Worlds' first Geostationary satellite Amateur Radio payload.*

Photo Jen G4HIZ



▶ *Es'Hail-2 separation 32 minutes after the rocket launch.*

An unexpected bonus came after the launch. Peter DB2OS had word that we were invited to the post-launch celebration meal hosted by EshailSat, which we duly attended and each received a coveted Es'Hail-2/ Space-X Mission Patch. Our thanks for the kind hospitality extended. We were a pretty incongruous bunch in short-sleeves and mixing with the well-suited dignitaries, but we were welcomed all the same.

What next ?

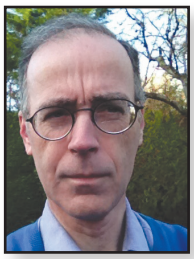
The satellite separated from the launcher at an altitude of about 540km and was travelling at roughly 34000 km per hour (21000mph). The job over the next few days was to raise the altitude of the satellite by mean of a series of burns of the large engine at the base of the satellite (which can be seen in the photo showing satellite separation). The orbit is then circularised and altitude adjusted to insert the satellite into a geostationary orbital position to begin its In-Orbit-Testing. The IOT as its known, performs a number of important functions and it is remembering at this stage that this satellite was launched primarily as a commercial venture and the Amateur Radio part of it was included as a passenger only. On the ground, the satellite will have been tested thoroughly in a Thermal Vacuum chamber to check-out the payload in simulated space conditions, an RF anechoic chamber to characterise the antennas and on a vibration table and acoustic chamber to simulate launch. At every stage the satellite's continuing health would have been verified. But the greatest test of all is the launch itself and the IOT is carried out to basically check that nothing has broken and all is performing roughly as it was on the ground. At the time of writing, the satellite IOT location had been determined and listed on the web as 24 degrees East. This is a couple of degrees West of the eventual location which is believed to be 26 degrees East. Why test at a different location to the final one? Well, there are a number of reasons. First of all, the satellite platform itself needs to be characterised, to establish that all is stable and the satellite is pointing in the right direction and has the required power from the Sun. Following this, the actual payload testing can commence and checking the antennas is the first step. One method employed is to radiate a carrier whilst rocking the satellite pointing from side to side, this will provide a 'cut' of the antenna pattern that can be compared with the on-ground measurements. By tilting the satellite up and down a series of cuts provide confidence that the antennas have survived launch. After this payload testing can commence in earnest, which will include all the equipment on-board. The satellite has 24 Ku-band and 11 Ka-band transponders at least and each one will be checked out. At some point, the Amateur Radio part will be tested, but this will not be the first priority. With all this testing going on, the risk of interfering with any operational satellites must be minimised and the IOT location is chosen to best satisfy this.

The whole IOT process can take several weeks and it is important to be patient whilst this is happening, we have waited a long time for this satellite, a few weeks more won't hurt!

It is anticipated that AMSAT-DL will work with the Qatari Amateur Radio society to check out the Amateur payloads, once the satellite has been made available to them first (possibly in January 2019). After this, access will require careful coordination in order to reap the benefits of this unique resource and the BATC and AMSAT-UK will be providing their support to AMSAT-DL in this important role.

A 23cm Power Amplifier For Digital ATV

Shaun O'Sullivan, G8VPG



Introduction

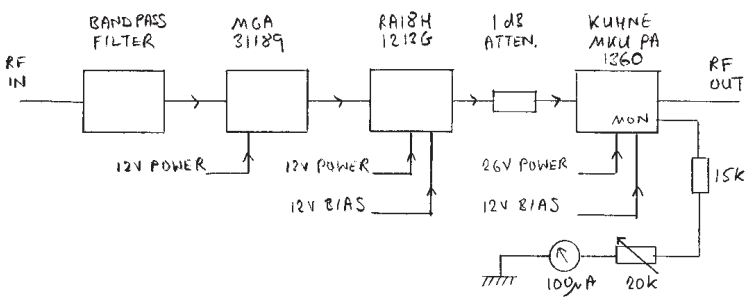
Nearly five years ago, when I first started to experiment with digital ATV, I built a 23cm power amplifier to go with my newly acquired DTX1 transmitter. This was based around the Mitsubishi RA18H1213G power amplifier module. This has a manufacturers rating of 18W, although it needs to be de-rated when in class A mode with digital modulation. Some driver stages were needed to boost the output of the DTX1 to a level sufficient for the Mitsubishi. For these I used a 2W kit amplifier from G4BAO and a couple of MMIC stages based on the PGA103 and a kit from G4DDK.

After a while, I felt the need for more power and so I bought an MKU PA 1360 kit from Kuhne Electronics in Germany[1]. This is a single stage device built around an MRF9060LR1 MOSFET. This has a rating of 60W in narrowband use, but must be de-rated to about half this level with digital ATV modulation. It needs a maximum drive level of 3W and so I used my Mitsubishi based amplifier to drive it, with the output of the DTX1 suitably scaled back to avoid over-driving. A similar amplifier is available ready built from Kuhne.

This arrangement was never entirely satisfactory. It was contained in two enclosures. The PGA103 driver stages were not very reliable in service and I had several failures. Perhaps because of a lack of attention to screening and construction details, the power output was prone to fluctuations that I was never able to eliminate entirely. When another driver stage failed, I decided the time had come for a complete re-build.

Design

The objective was to build an amplifier with sufficient gain to drive the Kuhne output stage to its maximum usable level. It was to be compact and built into one enclosure. After playing around with various options as lash-ups on the bench, I arrived at the block diagram below.



The input from the DTX1 is passed through a bandpass filter which was supplied by the DTX1 manufacturer, Antennair. These were actually made by the late DG0VE in Germany and so are no longer available.

The first gain stage is an MGA31189 MMIC, which is based on a kit supplied by Minikits Australia[2]. For those who do not want to do surface mount component soldering, it is also available fully built. However, everything is well laid out with lots of space and the components are not the smallest type, so this would be a good first surface mount project. The output from this is applied to the Mitsubishi module. There is insufficient gain to fully drive the Mitsubishi, but more than enough to exceed the maximum input level of the Kuhne, so care is needed in commissioning and testing.

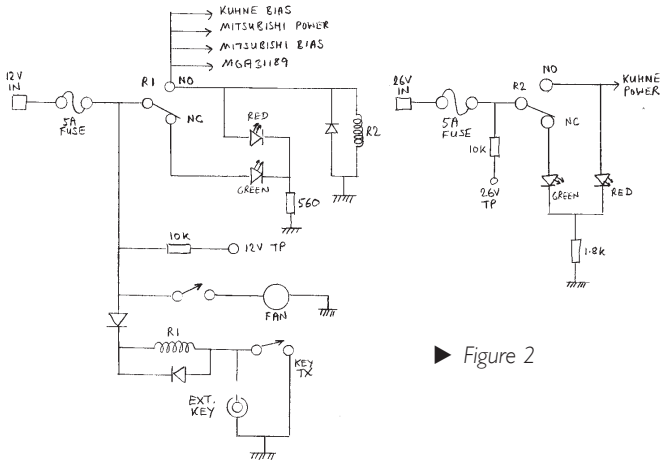
I have based the Mitsubishi stage around a board available from Bert Modderman PE1RKI in the Netherlands[3]. A similar kit is also available from Minikits Australia[4]. Both suppliers will also provide fully assembled versions if you do not want to construct your own.

I have installed a small 1dB attenuator between the Mitsubishi and Kuhne stages because when I coupled them directly, there was a tendency for the Kuhne to become unstable and take off. The attenuator eliminates this problem. The same basic design has been used in the GB3ZZ Bristol repeater and has years of continuous service history, so it is known to be reliable.

As a final touch, the Kuhne output stage has a monitor output. This is a simple forward coupler and rectifier that provides a dc voltage proportional to rf output. I used a 100uA meter and a couple of resistors to provide a power output meter on the front panel of the amplifier.

Control & Power

The control & power circuitry is very simple and is shown in figure 2. The Kuhne needs a 26V power supply, but everything else runs off a standard 12V supply. For the 26V supply, I bought a Meanwell SP-150-27 switch mode power supply via Kuhne. This has an adjustable output voltage of up to 27V at 5.6A, is in a screened ventilated metal enclosure and seems to operate quite cleanly. Each supply rail enters via a 5A fuse and is applied to a relay with contacts rated at 10A. Reverse biased diodes are connected across each relay coil to suppress any back emf when they are turned off.



▶ *Figure 2*

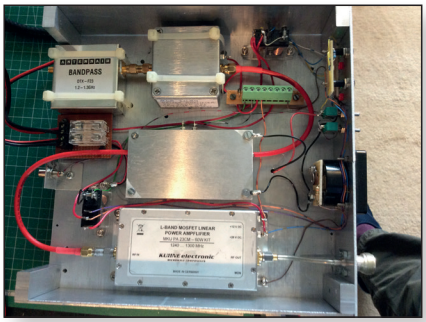
The 12V relay is turned on by either a front panel switch or an external signal that grounds the centre pin of the external key socket. This is driven by an aerial change over relay for the main 23cm aerial feed to my shack. The arrangement is designed to suit longish ATV overs rather than quick fire voice contacts. A diode in the supply to the keying switch prevents the amplifier from operating if the 12V supply is connected reverse polarity, but no such protection is provided on the 26V supply, so beware!

In standby mode, both relays drive a pair of front panel green LEDs, which indicate that the 12 & 26V supplies are connected. When the 12V relay changes over, it sends 12V to the MGA31189, Mitsubishi and Kuhne bias input. It also operates the 26V relay which applies the 26V power feed to the Kuhne. A pair of red front panel LEDs indicates that the amplifier has switched over to transmit mode.

I also fitted a couple of voltage test points to check the supply rails from the front panel when in transmit mode. The 10k resistors will have negligible affect on the reading, but prevent an inadvertent short from blowing the supply fuses.

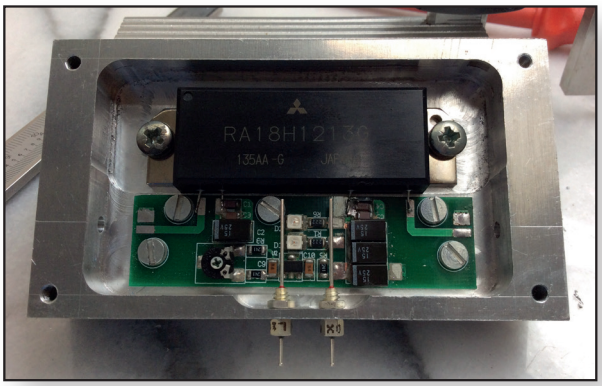
Construction

These amplifiers operate in class A mode and are not very power efficient, producing about four times as much heat as rf output. Therefore they need to be placed on a good heatsink. I also fitted a 100mm fan above the Mitsubishi and Kuhne stages. I bought a large heatsink at a rally and cut off a section roughly 23cm square. This was sufficient to lay out all of the components with good access, but also pleasingly compact. It would also ensure that everything was rigidly held in place.



I was determined that this amplifier would be stable and so each gain stage is contained in its own screened enclosure. The MGA31189 kit is designed to fit a Hammond diecast box type 1550Q, size approx. 54x58x32mm, and a complete hardware kit is available from Minikits[5].

Bert Modderman produces beautifully machined hardware and will supply an enclosure milled from a solid billet of aluminium for the Mitsubishi. He will also supply a dual cavity enclosure with space for a MMIC driver stage to replace the MGA31189 and we have used these in GB3ZZ for many years. However, I bought my own milling machine a couple of years ago and produced my own enclosure size 100x55x20mm. For the majority of people without a mechanical workshop, a standard diecast aluminium box of about the same size will do just as well!



GM3SEK has written an excellent paper full of practical advice about using these Mitsubishi modules and I would strongly recommend that any one using them reads it. It may be downloaded from G4DDKs website[6]. The key issues are careful earth bonding of the module fixing screws to the pcb and not overtightening these fixing screws, which can stress the internal ceramic pcb and cause it to crack – this is terminal and a new module is required.

Kuhne supply a milled aluminium enclosure for their amplifier. Power to each enclosure is via bolt-in feed through capacitors. Inter-stage rf connections are made with sma connectors and either semi-rigid 3.6mm diameter cable or a more flexible version (the red cable I used is Huber & Suhner Sucoform, which is rated to 33GHz, but of course I picked up a cheap length at a rally!)

At each corner of the heatsink, I have made a small aluminium pillar size 19x9x50mm. These are fixed to the heatsink with drilled and tapped screws. A front panel and sides were formed from small pieces of aluminium sheet and screwed to the pillars. It suited my shack layout to have the rf input at the rear and output on the front panel, but this can be varied to suit individual requirements.

Commissioning & Testing

First of all, I completed the power and switching circuitry and tested that all the right voltages were in the right place, the relays switched and the LEDs came on. I then installed the Mitsubishi stage.

Bolt it down to the heatsink with some heat conductive compound underneath. Terminate input and output with 50 ohm loads. Check that the bias trimmer pot is set to minimum. You can check this by applying bias voltage only and measuring the voltage at the bias pin of the module. The maximum bias voltage is 5V, but at this level the module will be tuned on fully and drawing lots of current, enough to blow the 5A input fuse. Connect an ammeter able to read up to 6A in the 12V power supply to the Mitsubishi and turn it on. There should be little or no current. I use a Uni-T model UT210E clamp on ammeter, which is unusual in that it also measures dc current and convenient because it avoids having to break the power rail to insert a conventional ammeter. Carefully advance the bias trimmer pot to achieve a standing current of about 3.5A. Let the module warm up for a while and screw on the enclosure cover to check that this is stable.

The next stage is to install the bandpass filter and MGA31189. Connect your chosen transmitter to the input and set it to minimum rf output. Connect the output of the Mitsubishi through an rf power meter to a 50 ohm dummy load. Be sure to have the 1dB attenuator on the output of the Mitsubishi. It is necessary to carefully calibrate the output of the Mitsubishi with the drive level from your transmitter. This arrangement could over-drive the Kuhne, whose maximum input level is 3W. This is not idle talk; in the previous arrangement I did overdrive it and the replacement transistor cost £50 – ouch!

Using a DTX1 transmitter, I noted the Mitsubishi output at 5% intervals and the maximum achieved after the attenuator was 2.6W, which is a safe level. However, the DATV Express or Portsdown have a higher output and may drive the Mitsubishi to in excess of 3W, which is dangerous. You could adjust the size of the interstage attenuator to counteract this.

The final stage is to install the Kuhne. The bias current must be set up in a similar manner to the Mitsubishi above; in this case the set point is 0.4A. Once this is done, you can test the whole assembly to see what it will produce! I set the transmitter back to minimum output level and gradually increased drive level in 5% stages. Besides the power meter and dummy load, I also used a coupler to drive a spectrum analyser to monitor the output waveform. As output level increases, shoulders will appear either side of the main output waveform, which have the effect of widening the signal and wasting power. As an absolute maximum, these should not be higher than 30dB below the main waveform peak.

My tests have shown that up to 14W output with a 4ms/s signal, the shoulders are 50dB down. At 26W, they were 38dB down and at 30W they are 30dB down. The maximum I drove it to was 32W, where the shoulders were still 30dB down, the input to the Kuhne was 2W, the Mitsubishi current at 12V was 3.6A and the Kuhne current at 26V was 3.2A. I would suggest a maximum usable power output of 30W and at this level, adjust the trimmer pot on the monitor output for the meter to read full scale. It is finished!

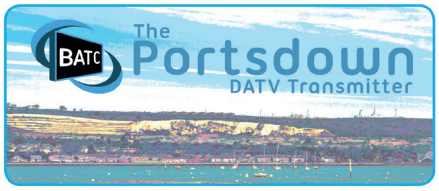
Conclusion

There is nothing especially original about this amplifier, but it does show how a very useful power output level may be achieved with readily available components. No doubt many variations could be made to suit what you may have available or can obtain cheaply! All of the gain stages are available ready built for those who do not want to assemble them, leaving just the mechanical assembly to be done.

I am very pleased with the result. By ensuring that each stage is in a screened enclosure and the mechanical construction is rigid, the power output level is completely stable, with just a small drop off of 1-2W as it warms up from cold.

Web References

1. Kuhne MKU PA 1360 amplifier kit;
   https://shop.kuhne-electronic.de/kuhne/en/shop/accessoires/other-components/Case+for+MKU+PA+23CM60W+KIT/?card=1019
2. [2] Minikits Australia MGA31189 kit;
   https://www.minikits.com.au/electronic-kits/rf-amplifiers/rf-wideband/MGA31189-Amplifier
3. Bert Modderman PE1RKI RA18H1213G kit;
   http://www.pe1rki.com/amplifiers.html
4. Minikits Australia RA18H1213G kit;
   https://www.minikits.com.au/electronic-kits/rf-amplifiers/rf-high-power/RA-SHF-Amplifier
5. Minikits Australia MGA31189 hardware kit;
   https://www.minikits.com.au/EME162-HW-KIT
6. GM3SEK paper on using Mitsubishi power amplifier modules;
   http://www.g4ddk.com/



Portsdown Newsletter

Dave Crump, G8GKQ

I continue to be overwhelmed by the support for the Portsdown project. At the last count there were 315 unique buyers of parts for it from the BATC Shop. The applications now include repeater stream "receivers" in addition to the normal transmit functionality.

New Features

Since the last Portsdown Newsletter I seem to have spent a lot of my time chasing and trying to cure obscure faults in the software. However, I have managed to implement the following new features with a lot of help from Evariste F5OEO:

- Updated to the latest version of Raspbian Stretch
- Added an audio capability to H264 transmissions and improved the picture quality.
- A second, improved, composite video monitor function.
- Support for the LimeSDR with DVB-S and DVB-S2 modes.

Improved H264 encoding with Audio

The feature that caused me the most angst was the update to the latest version of Stretch. A routine update to the operating system about 4 months ago meant that H264 encoding from the RPi camera would no longer work. To preserve the capability, I froze the in-use version of Stretch at a previous working version. Evariste wrote a new version of the H264 encoding software within a few days, but I knew that he was also working on incorporating an audio capability and only wanted to change the software once.

After many tests and attempts at different configurations, I was finally able to implement Evariste's new H264 encoding software and so update the Stretch operating system to the latest version. There are still a few bugs in the H264 encoding, but it is generally a great improvement in terms of picture quality – and of course it now includes sound. The bugs include:

- When transmitting a static test card or Contest numbers at high symbol rates, or at lower symbol rates (333) with DATV Express, only the top part of the picture is transmitted. The higher the symbol rate, the less picture is displayed.
- There is a 5 second burst of white noise on the sound channel every now and then.
- When the animated test card (TCANIM) is being transmitted, neither the animation nor the test card is shown on the 3.5 inch touchscreen. The TX button goes red to show that transmission is in progress. This is because of a conflict between the program that updates the touchscreen and the H264 encoder. The transmitted animation is far smoother than previously transmitted – it is just not displayed locally. The animation is displayed on the 7 inch touchscreen (although that is not perfectly positioned yet).

The H264 audio is AAC encoded at 24000 bps. This data rate is subtracted from the data rate available for video, so if you are running very low SRs, try turning the audio off for better pictures. I have noticed that MiniTioune does not always change the audio decoder when the transmitted signal switches from AAC to MPA (as produced by the C920 webcam) and it needs to be manually selected on MiniTioune.

Composite Video Monitor Function

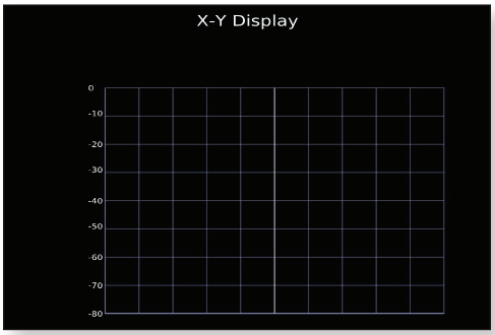
I had implemented a basic video monitor function over a year ago. All that function did was to take 3 snapshots of the video input each second and display them. With the increased use of the 7 inch screen with its fast update rate, something better was required. The new function is also selected from Menu 2 and is labeled "Video Monitor". It will display the video from the EasyCap video input at a better (5 fps?) frame rate on the 3.5 inch touchscreen and at 25 fps on the 7 inch touchscreen. It does have the capability to display noisy pictures, and so is suitable for use with 5.6 GHz FM receivers. However, I have noticed that it tends to suffer from an increasing delay while viewing a noisy input. More tests (and hopefully improvements) to follow.

Note that the video monitor function is stand-alone; it is not possible to display the video from the EasyCap at the same time as it being transmitted.

Minor Improvements

I have just reminded myself of what I had written that I hoped to achieve in my last Portsdown Newsletter. The list included "Moving more set-up functions from the Console to the touchscreen". I have made a start on that as there is now a "System Config" menu accessible from Menu 3, with a "Factory Reset" button. This restores all the settings (except the display type) back to the new build condition.

The list also included "Trying to make an X-Y display using the MCP3002 A-D converter". Yes, I have tried, and briefly managed to plot the output of my spectrum analyser, but it is not yet reliable enough for normal use. More work required!



▶ *Prototype X-Y Display*

There are numerous other minor tweaks that I have made to the software with many more to come.

Support for LimeSDR Mini and LimeSDR USB with DVB-S2

Evariste has been experimenting with the LimeSDR for some time, and after a few setbacks he has put together some code that supports both DVB-S and DVB-S2 from either the LimeSDR Mini or the LimeSDR USB.

This provides much better waveforms than the Portsdown filter-modulator board – not quite up to the standard of DATV Express, but very close. For example here is the output spectrum at 333 KS in the 146 MHz band:

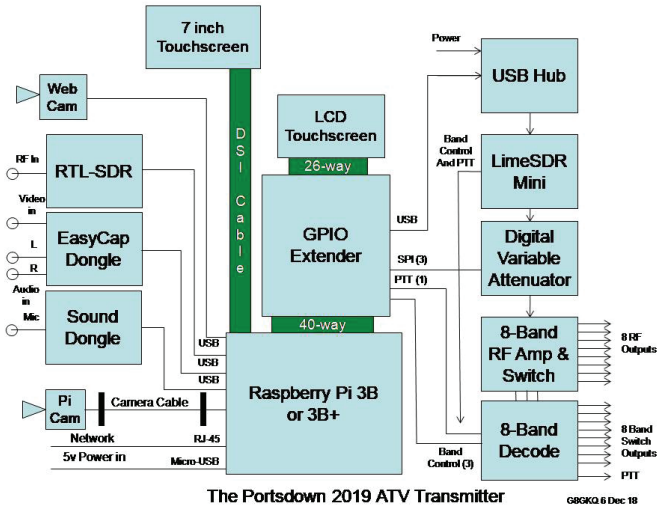
I have written a separate article in this issue about using the LimeSDR, but the key points are:

- The LimeSDR must be powered from an external USB (USB 2) Hub.
- H264 modes generally work at up to SR2000 and occasionally SR4000.
- MPEG-2 modes are limited to SR1000 due to lack of processing power.
- The LimeSDR Mini will output about 5 dBm on any frequency from 30 to 1300 MHz, and 0 dBm on 2400 MHz. The LimeSDR USB has a lower output at 2400 MHz (about -7 dBm).
- The LimeSDR can control, and benefits from being used with, the BATC 8-way RF switch which boosts the output on 2405 MHz to 5 dBm.

Hardware for 2019

As sales of assembled Portsdown filter-modulator boards have really slowed down, the BATC will not be getting any more assembled boards made up, although blank PCBs will continue to be available for some time.

The recommended hardware for Portsdown in 2019 will be to use a LimeSDR Mini. So the new system diagram is as shown here.



Future Work

I am often asked whether I am going to support the ADALM Pluto SDR with the Portsdown. The answer is yes, but only IF someone can help me by producing some code for the Raspberry Pi that enables the Pluto to generate a DATV signal from the I and Q values available in the Portsdown. At present I just do not have the knowledge or the time to produce this software on my own.

I am working on getting the LimeSDR to receive DATV using LeanDVB and, thanks to Tim G4WIM, I have some proof of concept code working. When this is more reliable, I will incorporate it into the production build. I also hope to introduce other functions that make use of the LimeSDR.

The DATV Express has the potential to produce DVB-S2 when driven by the Portsdown; I will certainly try to get this working.

However, my main objective is to support Portsdown users who want to use the equipment on the air; that's what it is all about!

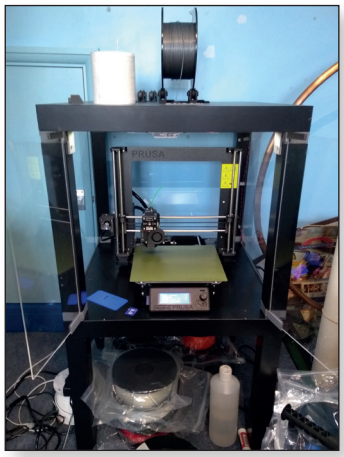
I bought a 3-D printer

Gareth, G4XAT

Many members will have seen the array of 3-D printed 'things' that I put on display at CAT18. Several of you asked me about my printer and mentioned their own experiences so I thought I'd share my story with you all.

For the last 30+ years I've been involved in teaching Design & Technology and Electronics and met 3-D printing in various forms even way back in 2002. More recently my school acquired one and it produced reasonable results most of the time. It used ABS as a printing medium, which is not as it turns out, a very forgiving material. It's prone to warping and not staying stuck to the print bed, so effectively junking the print, sometimes after a lot of hours.

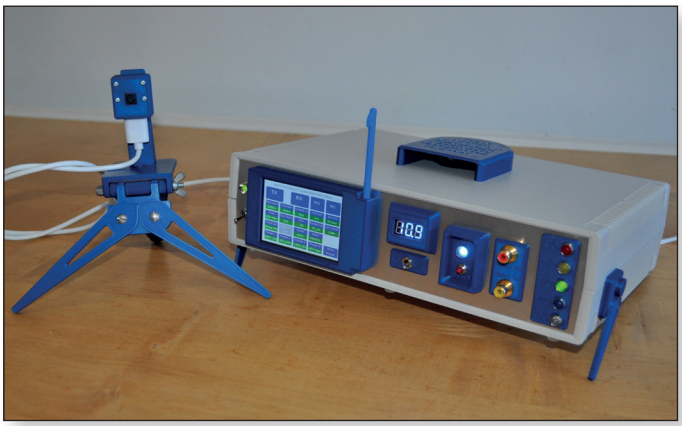
My eldest son Josh (now a fully-fledged Mechanical Engineer) used the printer (via dad's staff privileges!) for a variety of bits and pieces for his final year university project and also some key parts for the human powered submarine project he was involved in. He was awarded funding for his work and bought his own 3-D printer which he has made good use of. Being a bit of a wiz with CAD he designed all sorts for mounts and trim pieces for his home-built Caterham style kit car, contributing to it passing its IVA test (a sort of 'super' MOT for new-build amateur cars) first time round. With Josh living in Warwick (handy lodgings for CAT18!) and me retired from my school in SE London last year I lost access to the school workshops and all the nice machines they contained. So, I put 'get a 3-D printer' on my list of desirable things. A quick trawl of eBay will reveal a lot of 'cheap' 3-D printers and even Aldi sold one recently. I bought one at school for a 6th form summer project and it certainly worked after a style. A Facebook group popped up and the many users started to work out how to get the things to deliver decent printed results. It was a long road plagued with hassle and grief. Via my membership of a model engineering club (SMEE) and in particular the digital control off-shoot group, one of their members mentioned that he had bought a PRUSA I3 V3 (released earlier this year) and that he built it from a kit, saving a bit in the process. He also said that it had 'printed straight off the bat and hadn't stopped'. Recommendation indeed. Josef Prusa is arguably the recent 'father' of 3-D printing and his products are well documented and often copied (China). Not wishing to spend endless hours with extensive 'tuning' of a cheap clone printer and as I've had my fill of fiddling about with worn or cheap kit (at work) I embarked on flogging off surplus 'car' parts that I had acquired over the years – one of my other interests. Some of my fortuitous purchases made a significant profit too, so it wasn't long before I had the funds to order the printer -£700. Six weeks later the kit arrived (lead time now down to days), but I was busy with all sorts of stuff so it sat in its box for a few weeks. Then we had some bad weather, so I spent about 14 hours - over two days - building it. There is a very good manual, with a big-screen version available online too but it went together without any problems. Some mechanical aptitude helps, along with RTFM!! It was then calibrated and it passed every test. It has since printed for over 20 days' worth of jobs and hasn't needed anything. It just works…



Ideally I need to learn some suitable CAD myself, but that's for a 'rainy day'. Websites like 'thingiverse' (***https://www.thingiverse.com/***)have most of what you might need, plus a whole load of things that you didn't know you needed.

If you want one for yourself, ***https://tinyurl.com/yazm8zc9*** - just add £700. If you want it ready built and tested, add another £200. It comes with a roll of filament, but you might like to add some to the order. It's good stuff and you will soon need more. This printer is capable of printing a wide range of materials, not just the popular PLA filament.

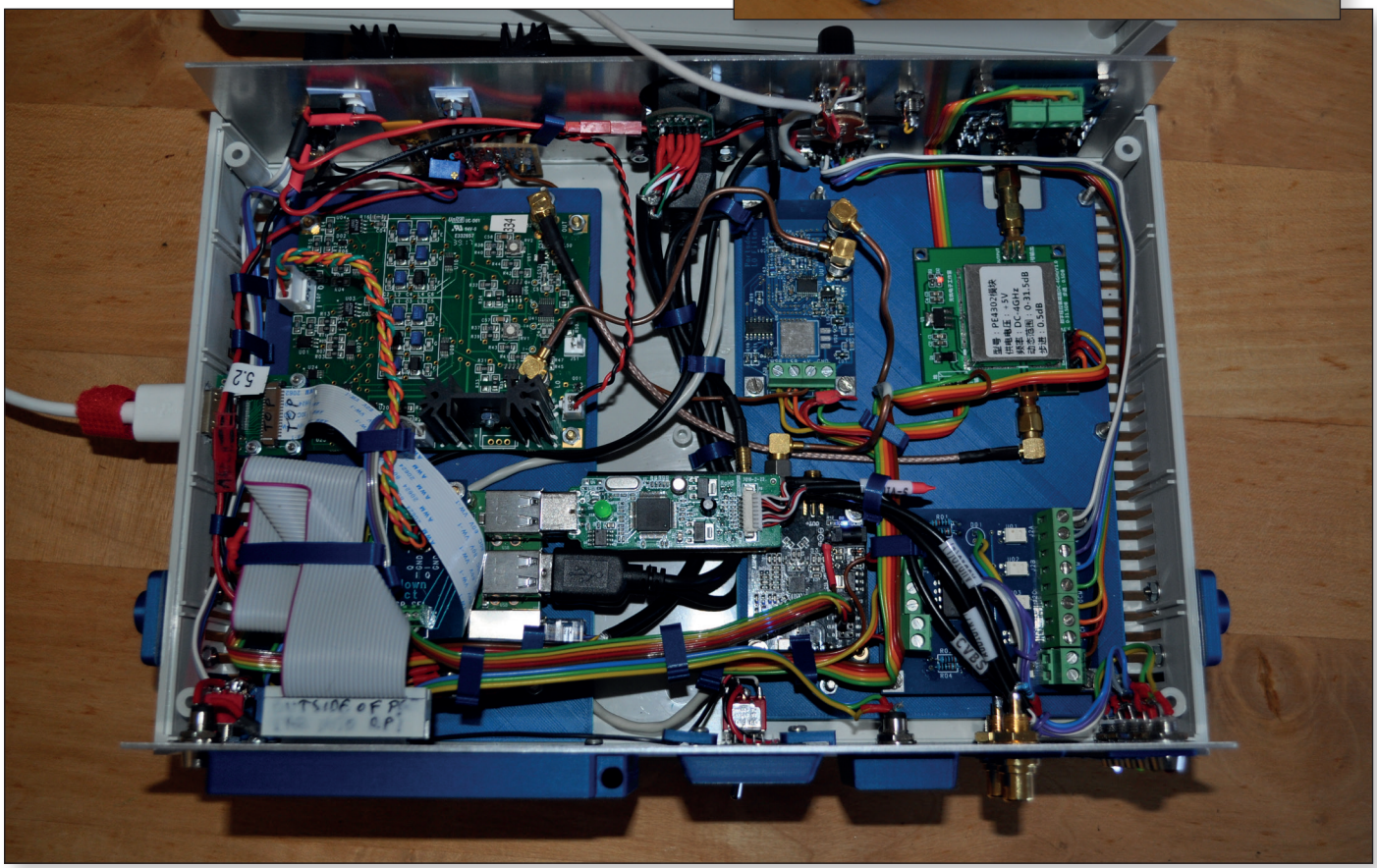
After 20+ days' work (that's a lot of printing!) the printer threw a 'fan error' message, so I contacted the on-line help - who are really great. We jointly narrowed it down



to a fan fault and a credit to cover the cost of a new fan was issued on the spot. It still prints fine, but the fan speed can't be changed to suit various aspects of printing. Not really an issue and I will fit the replacement fan as soon as I have a gap in the production schedule! This is the only fault I have had and compared to my previous experiences with 3 other brands of printer this is really trivial. Pretty much the only printed parts I have junked are down to my own design errors rather than a printer fault. However, bed cleanliness is essential – buy a litre of IPA, eBay supplier tradechemicals ***https://tinyurl.com/ybuz5bh5*** supplied mine after I trawled round 6 local chemists who all told me how hard it was to get these days. I use a fresh sheet of toilet paper moistened with IPA from a pump dispenser used for nail polish remover. (***https://tinyurl.com/ydbkmd5d***)

There is an abundance of CAD suitable for designing your own parts, but like most software, there is a learning curve (and it's long). I'm using Autodesk Inventor (what my son uses, so he can help me out!) but the brand doesn't really matter. About the only tip I have is to think differently when designing for 3-D printing. Remember you ADD material in layers rather than the traditional REMOVE material until you end up with a 1" square cube, a filing task beloved of engineering apprentices from years long gone by!

► *Some of Gareth's 3-D Printing - for the Portsdown TX*



DVB-S DATV signal power measurement

Mark, GM4ISM

Mark GM4ISM gave this excellent reply to a question on the UK Microwave group email reflector and we thought it was worth publishing in CQ-TV - Editor

Hi all

A few points about measurement of DVB-S (or other OFDM multi-carrier modulated signals)

The most accurate way to measure, as has been pointed out, is with a good thermal power meter. Unfortunately those have become a bit old hat and more modern HP (Agilent) and other professional grade power meters use power heads based on diode detectors. These are generally as good or better than the old thermal heads for CW measurements but beware, a number of them become inaccurate on multi carrier systems because they detect the peak RF voltage. It is a characteristic of these modulation schemes that the peak voltage for a given mean power is much higher that that produced by a single carrier of the same mean power.

Typically 10dB crest factor is used in the industry. This means that the peak voltage that will be present on a 10W DVB-S transmission will be the same as a 100W Cw transmission

This value is a statistical based 'rule of thumb' but nevertheless, any detector that effectively sees peak RF voltages and relates them to power can indicate an incorrect value. This applies to spectrum analysers (irrespective of their RBW setting) and diode power meter heads etc. Analysers with multiple detector settings will give different readings according to the setting. If all your analyser settings are kept constant then the error on a measured DVB power level will be reproducible, so it is possible to 'correct' the reading once you have a reference from a more accurate measurement technique.

The most modern power meters have all this sorted out and many modern spectrum analysers have occupied channel power measurement capability which correct for these errors.

Another comment is that a number of modulators in the professional world can be made to output a CW carrier but there can be some uncertainty in using it as a reference for power level, as the OFDM mean power will be significantly lower than the CW OP power capability of the system. This is because to prevent IPs being generated, the amplifier must have a degree of headroom to ensure linearity.

I don't know about amateur DVB systems but the laws of physics hold for all. The headroom needed for an uncorrected DVB signal is in the order of 4dB minimum, depending on how much degradation of MER you are willing to accept.

So unless you have access to a thermal power meter or one with a head you know is designed for DVB, or a nice spec analyser with occupied channel power, measurements of power of a DVB-S signal will likely be several dB off.

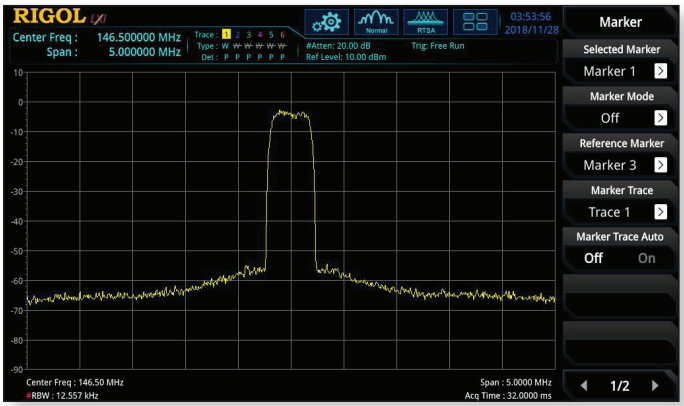
If you don't have this capability, measure the saturated power of your system on a single carrier and assume that the max signal you will achieve with a usable DVB-S signal is at least 4dB below this.

Birds and other simple power meters all use diode detectors and are typically 1.5 - 2dB out (reading high) but I can't say I have studied this in depth.

Amateurs rarely have access to calibrated professional equipment capable of determining the ERP to say 1dB and I would suggest that OFCOM know this. They can't do this accurately either; there are too many variables (feeder filter losses cable losses antenna gain etc all add up). You must make an effort to measure and calculate the ERP and keep within the licence. Understanding the limitations of your test equipment is part of this.

The same goes for keeping the emissions within the amateur allocation which is more important. Good filtering and system design is arguably more important for beacons and repeaters.

As has been mentioned before, ask if you need assistance. Use the facilities of the microwave round tables [and CAT meetings] where test gear is often available.

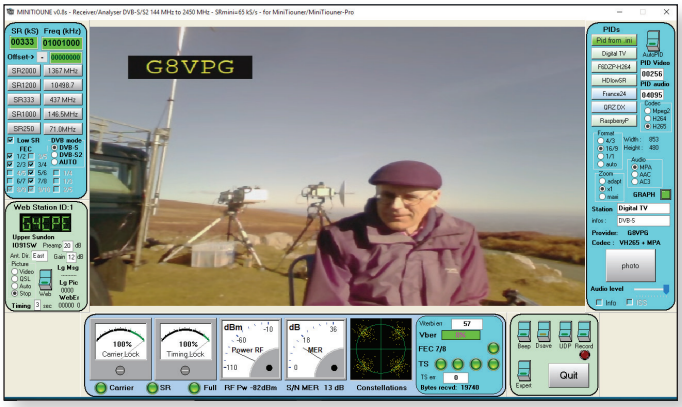


Low band DATV – progress on 71MHz and tests on 50MHz!

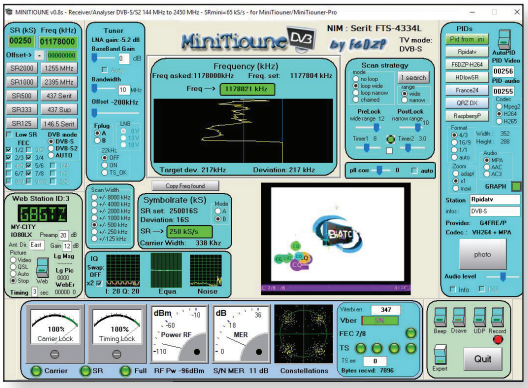
Noel Matthews, G8GTZ

Experimentation is continuing on the "new" lower DATV bands but they are proving a challenge! Not only are we having to handle huge antennas which need to be much higher above the ground to avoid the ground effect but also getting used to high noise levels on receive, sometimes caused by the receive station's own equipment such as PC and monitors! Once it does work, reasonable distances are being worked and stations running H265 are achieving some really high quality images.

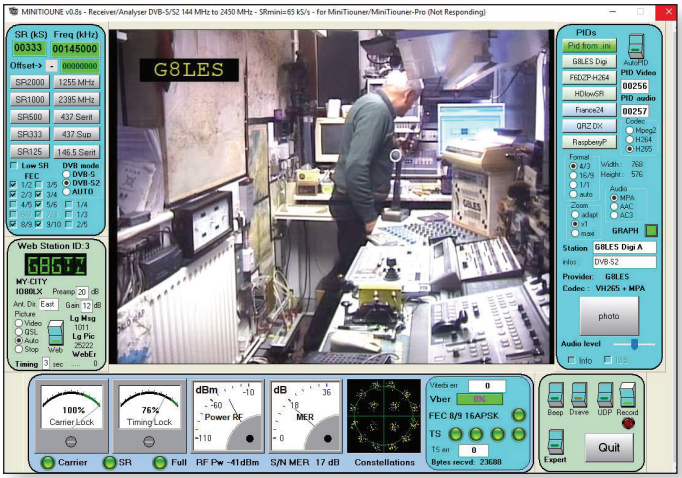
71MHz - The October activity day had a focus on the lower bands (71MHz and 146MHz) and several stations were active on 71MHz. - G4FRE/P (IO82LB) and G8GTZ/P (IO91GI) at 134Kms were 2 Kms short of taking the 2 way record! GW8VPG who was also active during the weekend from Blorenge mountain (IO81LS), and his 71MHz signals were received by Arthur G4CPE in Luton (IO91SW) at a distance of 180Km. G4CPE went on to work Mike G0MJW on 66Ks! For more details see ***https://forum.batc.org.uk/viewtopic.php?f=75&t=5662***



During the recent December activity weekend G4FRE/P on Clee Hill (IO82QJ) worked G8GTZ/P at Win Green (IO80WX) to extend the 71MHz record to 160Kms – it can only be a matter of time before that record get broken!



50 MHz - At the request of the RSGB VHF manager to support the WRC19 push for 4MHz at 50MHz, G8GTZ and G8LES conducted some RBTV tests in early November. Although this was not the first 2 way DATV QSO on 6mts, which was achieved by G4CPE and M0SKM in 2014, it was the best DX at 7.5Kms!



Both stations used retuned narrow band transverters for both transmit and receive and used 51.75MHz a frequency agreed with the 6 metre Group chairman G4IFX. The MER was in excess of 20dB and G8LES transmitted H265 pictures over DVB-S2 16APSK giving some high quality images at 1.1 mbit/sec.

Dave G4FRE has also been experimenting on the 50MHz band and achieved a one way at 60KMs. More tests to follow with hopefully greater distances!

DATV on 24cms

Tim Forrester, G4WIM

Introduction

I've had an interest in Amateur TV since the early 1970's when I was first licensed as G8GIW, since then this interest has led to some interesting career choices and the development various types of digital communications equipment.

Recently it has become possible to assemble a relatively sophisticated DATV system by combining various building blocks from a number of sources.

In this case the key components being a Raspberry Pi3 B+ running Portsdown code combined with a Lime Mini SDR and Minitiouner receiver.

The following gives an outline of the above system which was built for use when out portable or as a 'loaner system' to anyone who wanted to dip their toes into DATV.

Loaning the equipment out has resulted in a small flurry of activity locally through the newly licensed GB3FT repeater located in Blackpool IO83LU and kindly hosted by G3WGU.

Many thanks to the BATC and Noel G8GTZ for getting GB3FT licensed – despite the general consensus that it was impossible !

Current stations active locally are G4EWJ, G3ZGZ, G4MXR, G3WGU, G4WIM, G1EPL, G3YTI, G8WZW, G4YLB, G3RFL, G0LZX, G4CBW – some more active than others. There's also several others locally who are getting ready.

So if you'd like to join us and think you might be within range, get in touch with me.

System Description

Photo 1 shows the general set up including a lap top to run the Minitiouner application for the receive side – although there are plans to have the receiver running on the Lime SDR / RPI at some point.

Besides the lap top there is a Raspberry Pi3 B+ mounted on the rear of a 7" touch screen to control the tx / rx. Just above the touch screen is a Pi camera, but the Portsdown code running on the RPI also supports composite video input with a suitable dongle.

The diecast box contains all the RF stuff plus an Atmel Atmega328p controller which monitors the PA to keep it within it's safe operating conditions and to sequence the tx drive, bias and relay control when changing over from tx to rx etc.

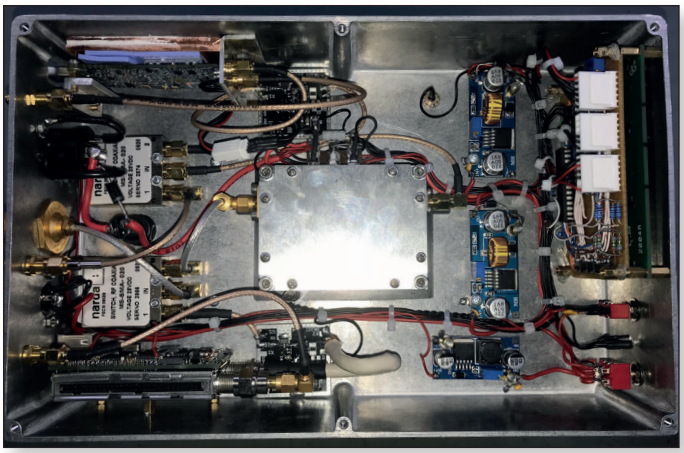
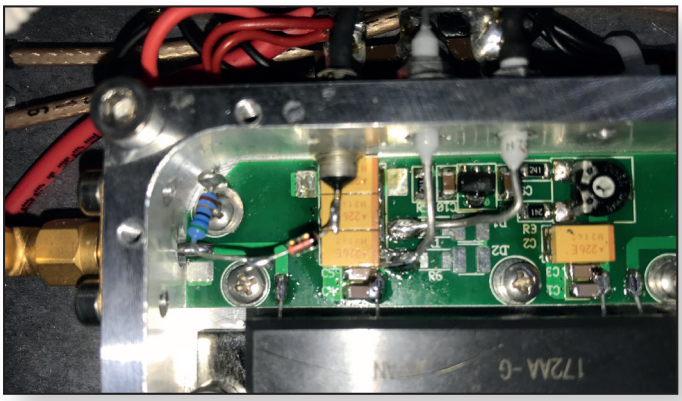


Photo 2 shows the general layout of all key components within the diecast box.

The transceiver has been designed to be as versatile as possible, thus when not being used on 24cm DATV all tx / rx inputs and outputs are available on the rear panel.

A minor modification has been made to the Bert PE1RKI 24cm PA to sample forward tx power, see photo 4 – rather crude but seems to work ok.

Internal to the diecast box upper left is the Lime Mini attached to the side along with heat spreaders to help keep it cool – it can draw up to 4.5 watts from a USB3 capable port, but in this case is directly powered from the RPI USB2 port.



The RPI itself is powered from a dedicated 3.5A 5.1V buck SMPS regulator, middle right. There is another identical regulator (upper right) for the Minitiouner rx (modified to accept 5V) and Atmel controller.

The final SMPS (lower right) is a boost regulator to 28V to run the two coaxial relays. One relay is the main 24cm Tx/Rx relay (lower left) and the other coax relay (upper left) is to direct the Lime Mini tx signal to either the Bert PE1RKI PA driver (a PGA103 centre top) or to the outside world.

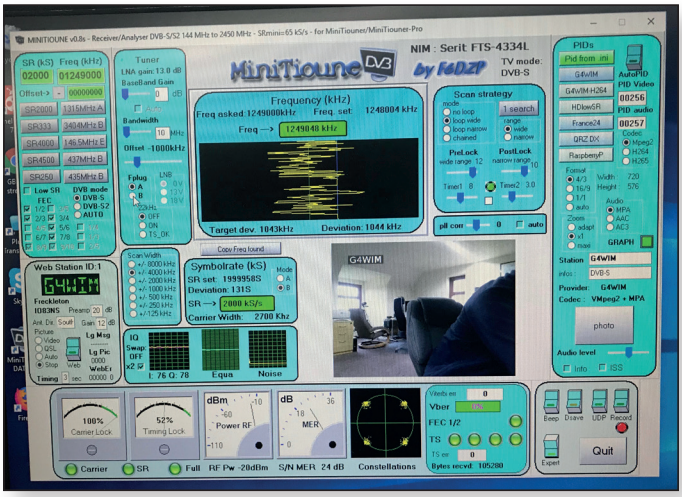
The 24cm LNA is another PGA103 MMIC (centre bottom), but note there are no filters on either the tx or rx signal paths – thus allowing operation on other bands / modes. Other modes being supported by SDR Angel – best run under Linux Ubuntu imho.

I use external bandpass filters for the band in use to prevent outband rx blocking.

Lime Drive	1249MHz Pout	1275MHz Pout	1315MHz Pout
40	54mW	136mW	4mW
45	140mW	350mW	10mW
50	350mW	900mW	27mW
55	900mW	2.2W	70mW
60	2.25W	5.2W	180mW
65	5.2W	11.5W	430mW
70	11.6W	19W	1W
72	13W	O/D	1.3W
74	16W	O/D	1.6W
75	O/D	O/D	2W
80	O/D	O/D	4.2W
85	O/D	O/D	6W
90	O/D	O/D	8W

Picture 5 shows the tx output power for various Lime Mini tx gain settings on the RPI, a handy cheat sheet. The Atmel controller prevents overdrive / over temp conditions.

Picture 6 shows the unit on tx and the operating conditions at just under 10 watts output.



Picture 8 shows the Minitiouner application running on a lap top, note the MER of 24dB is about as good as it currently gets with the Lime Mini.

Conclusion

The above gives a very brief outline of a compact 24cm DATV station, however it can even be simpler as a Comag SL30/12 (or similar Sat rx) can often be had for £10 from eBay and GB3FT can be accessed with a simple FM transmitter and viewed on the BATC web streaming site.

The Lime Mini is a great asset as it can do much more than DATV – being a fully fledged SDR and widely supported means it opens up opportunities for many interesting experiments and modes which are beyond the scope of this article. Currently the Lime Mini costs $139 from the USA plus import duties and shipping etc.

I hope the above has at least shown how it's possible to assemble a compact 24cm DATV station, and if you want to 'have a go' then feel free to contact me – my details are good on qrz.com

Measuring Power on 5.6GHz & a New Receiver

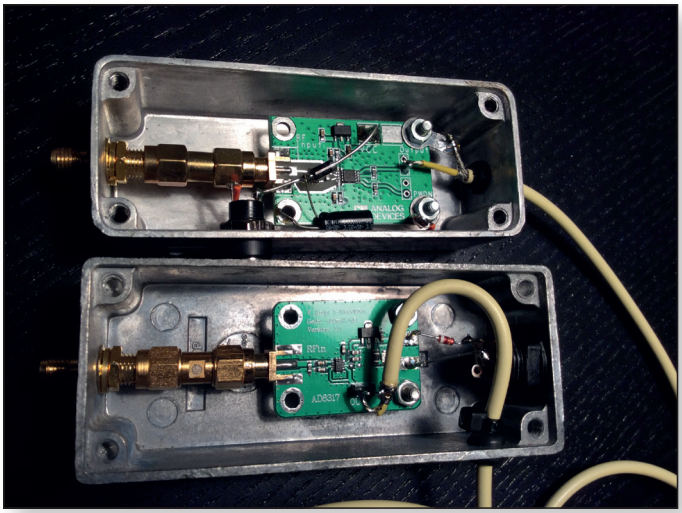
Shaun O'Sullivan, G8VPG

Measuring Power on 5.6GHz

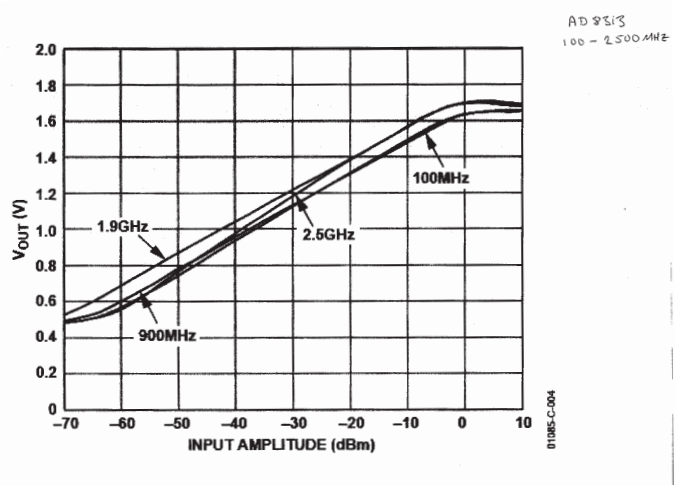
Over the past year, I have become enthused with using the cheap Chinese modules for 5.6GHz ATV. These are intended for use by drone pilots to send video signals back to the radio control position. It was discovered that most of these may be configured to operate at 5665MHz within the amateur radio band. They transmit wideband fm video modulation, often with sound sub-carriers. This is now the least expensive and simplest way to become active on ATV.

My equipment has undergone a gradual evolution during the year. The modules first available tended to have a fixed rf output power level in the range 300-600mW. The transmitter modules are very small with minimal heat sinking and become very hot at this power level and as a consequence, tend not to last very long! The modules presently available have switchable output levels in the range 5-600mW. At low power levels up to 50mW, they run nice and coolly, but of course range will be reduced. I have managed to obtain some used commercial microwave amplifiers for the 5-6GHz range and these produce a comfortable output level of 1W when driven with 50mW.

In order to set this up, some means of measuring power at 5.6GHz is needed. This is much harder and more expensive to do than measuring power at, say, 23cm. The professional approach would be to use an rf power meter, such as the devices produced by HP or Marconi. These use a separate measuring head to sense the power level. Even second-hand, a meter and power head is likely to cost quite a few hundred pounds from a reputable dealer.



A much less expensive approach is to use a logarithmic amplifier chip. These are devices that produce a dc output voltage in proportion to the rf input level. The resulting rf power level may be read off a graph provided by the device manufacturer. They typically have a linear dynamic range of 50-60dB and a maximum input level of about 0dBm (1mW). Hence to measure larger power levels, it is necessary to apply attenuation to the input. Fig.1 shows the calibration graph for the Analog Devices AD8313, which has a working range of 100-2500MHz.



These logarithmic amplifiers are available built onto a small pcb from numerous Chinese suppliers on Ebay, typically for about £10-12. One device that caught my eye is the AD8317. This will work up to 8GHz and with reduced dynamic range up to 10GHz. I bought one and the photograph shows it fitted into a small aluminium box. There is a problem though; it is built on standard glass fibre pcb material and above about 4GHz, this becomes increasingly lossy and hence the results become increasingly inaccurate. I estimate that at 5.6GHz, it is about 6dB adrift from the manufacturers graph. Unless you had a means to calibrate it, it not going to be useful at the higher end of its range.

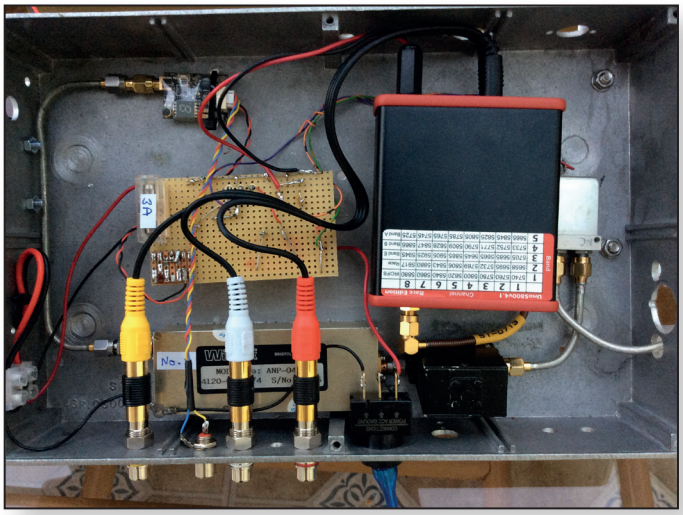
Whilst trawling the internet for a solution to this problem, I came across a Chinese supplier of drone equipment called ImmersionRC [1]. Their products seem to be aimed at the more serious drone pilot who is concerned with drone racing. One of their products is the RF Power Meter v2[2]. These are available from a number of UK radio control model specialists for about £65. I decided to buy one.

It is really tiny, just 62mm long and triangular in cross-section like a bar of Toblerone chocolate. There is an SMA input socket at one end and a small, backlit lcd display with two control buttons on one face. It contains a lithium ion battery which may be recharged from a usb supply. It is supplied with an SMA male to male coupler and a small 5.6GHz rubber duck aerial. I'm pretty certain it is based on a logarithmic amplifier chip; the specification seems very similar to the AD8317. A 30dB attenuator is built into the device, which limits its sensitivity to about –25dBm, but it is claimed to take up to 30dBm (1W) for short periods not exceeding 30 seconds. It has a number of selectable calibrated bands; 35, 72, 433, 1200, 2400 & 5600-6000MHz in 50MHz segments. Accuracy is claimed to be +/-0.5dB and the readout is in dBm & W to two decimal places. It also has a power graph mode for pulsed transmissions, with adjustable timebase. A users technical manual may be downloaded[3].

Comparing its readings with my Bird model 43 power meter on the bands I have the correct elements for suggest that its accuracy is pretty consistent with the Bird. Until an opportunity to buy a good professional power meter and measurement head at the right price comes along, I think this will fulfill a very useful function.

A New 5.6GHz Receiver

Whilst browsing the ImmersionRC website, I noticed the range of 5.6GHz video receivers that they produce. These are much more substantial than the typical drone receiver modules and are housed in a small extruded aluminium case. They claim a sensitivity of better than –90dBm and to incorporate some bandpass filtering. I bought the basic single channel version, the Uno 5800, which is available from UK suppliers for about £50[4]. It has an SMA rf input and two composite video/audio outputs. There is also a mini-DIN socket which is configured for the data links that drone racers use, but which need not concern us. Channel selection is by the usual sequence of pushing two buttons at the right time. This is a little fiddly, but once set to 5665MHz, it remembers this and powers up on this channel each time. There is also a complicated battery low voltage alarm, but it may be powered by a standard 12V external supply and again, this need not concern us. The users technical manual may be downloaded from the receiver webpage[4].



I haven't been able to do back to back comparisons with a conventional drone module receiver. The first time I took it out portable was on 24th October 2018 when there was a huge lift on. I worked M0DTS/P at 370km, a new world record for fm tv on the band, so I think it is safe to assume that it does its job very well!

Web References

1. ImmersionRC website; ***https://www.immersionrc.com/***
2. ImmersionRC Power Meter v2; ***https://www.immersionrc.com/fpv-products/rfpwrv2/***
3. ImmersionRC Power Meter v2 manual; ***https://docs.google.com/document/d/1MHtkZg81mqF2xibuO7tHb-OH-I9ib3NImpGnRQWFtBo/edit***
4. ImmersionRc Uno 5800 receiver; ***https://www.immersionrc.com/fpv-products/uno5800-av-rx/***

Baliu RB-TV in Catalonia

Jaume, EA3FRB

On Tuesday, October 23, the first (and only) television channel for amateur bandwidth, RB-TV, was activated, in the 70 cm band in Catalonia. This is a new project from EA3CNO, Antoni, and EA3ANS, Joaquim, who have already displayed amateur television at the stand of the URCAT at MercaHam 2018 with a mention included in the journal of the British Amateur Televison Club.

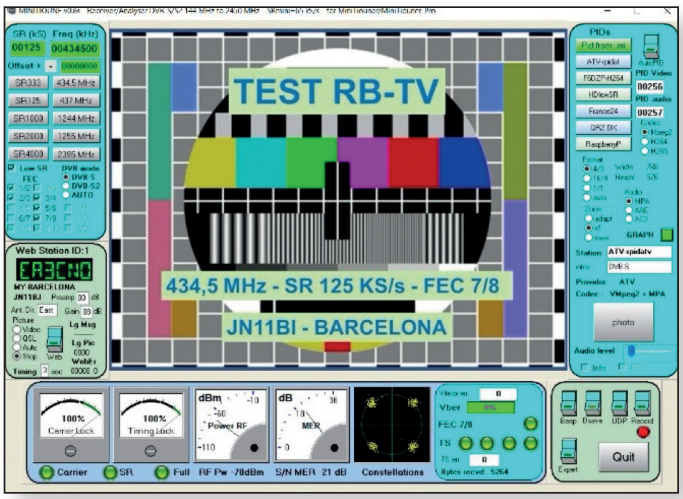
These are the details:

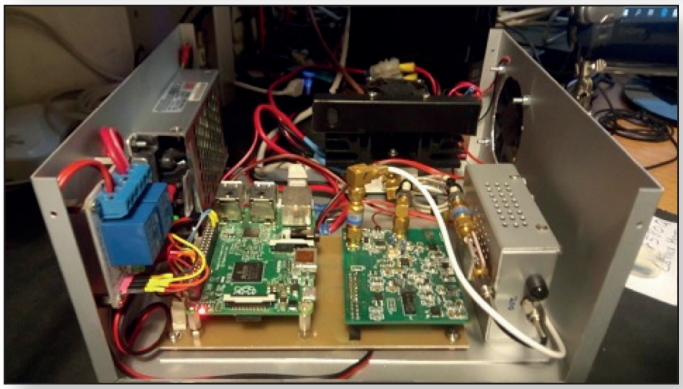
- Location: Montjuïc, Barcelona
- Locator: JN11BI
- Power: 1W
- Antenna: 2 element Yagi
- Frequency: 434.5 MHz
- Video standard: DVB-S MPEG2
- Symbol rate: 125 KS / s
- FEC: 7/8

The software allows you to change the symbol rate (125, 250, 333, 500, 1000 KS / s), FEC (1/2, 2/3, 3/4, 5/6, 7/8), video standard (MPEG2, H246), format (4/3, 16/9) depending on the needs or tests that you want to carry out.

To receive it you only need a yagi antenna for 434 MHz; a preamp; SDR; Raspberry PI and LCD screen.

More details on RB-TV can be found on the EA3CNO website.





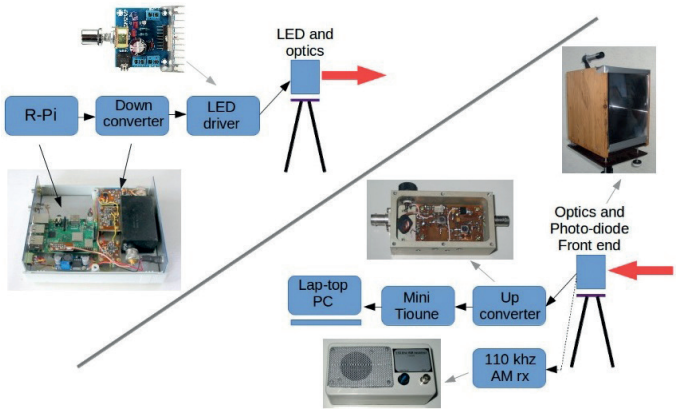
DATV over optical - Part 2: interfacing the two

Bernie Wright G4HJW

Portsdown transmitter and MiniTioune receiver units were already available and seemed the ideal starting point for the DATV part of this project – the issue being how best to use them, with this write-up concentrating on the initial thinking and first-off implementation. Where later work provided useful additional information, notes have been added in italics.

Also, in order to keep the article to a reasonable length, a fair amount of background work has been left out, hence the occasional web link to cover some of the more interesting details.

For maximum optical head sensitivity, it was assumed that the working frequency needed to be kept as low as possible, implying that we should use or regenerate the basic Transport Stream.



Tx Exciter

A baseband output that also has error correction coding applied direct from the Raspberry Pi is not currently available. Instead, translation to final radio frequency via I/Q outputs suitable for Weaver method phasing is provided, not forgetting the 'ugly' mode output, programmable directly to final frequency.

Three methods of obtaining a baseband or quasi-baseband signal initially came to mind:

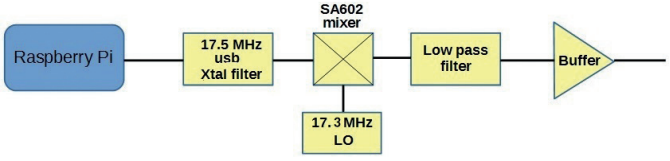
1. Write a version of Raspberry-Pi software that outputs in the form required.
2. Use the existing I/Q outputs and a quadrature modulator to regenerate a baseband signal.
3. Use the 'ugly' output in some way.

The first of these is clearly the most elegant solution, but is beyond my abilities, so not an option without enlisting the help of others, and at such an early stage this did not seem a reasonable thing to do. However, Heather M0HMO has been contemplating the requirement and may well be able to provide modified code as part of other ongoing work at some point in the future.

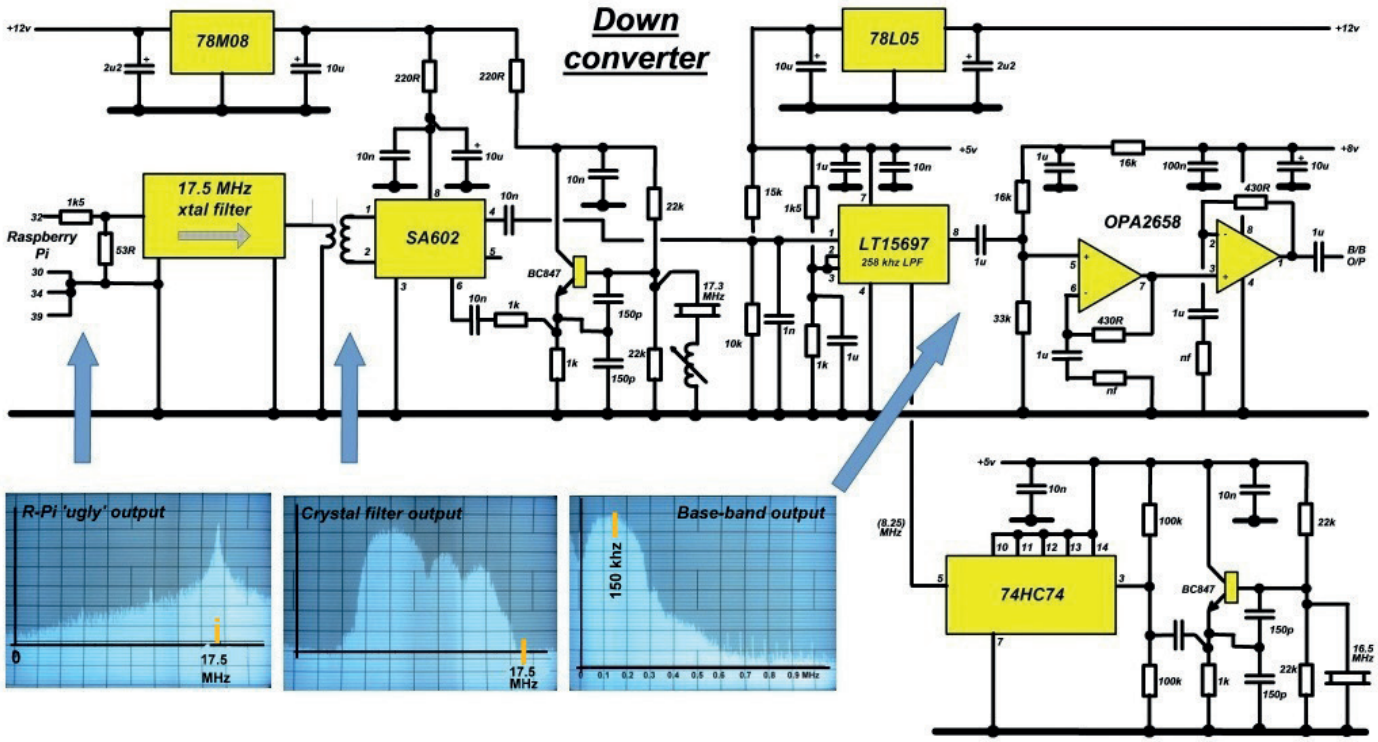
As a hardware-only solution, the use of the I/Q signals and a balanced modulator would seem the next best way forward, but using the 'ugly' output simply appealed more, and a quick check was made of how low the output frequency could be programmed. All seemed well down to about 1 MHz, and as a suitably wide bandwidth crystal filter at 17.5 MHz was sitting in the junk box just waiting to be used, this was added to the output and found to be quite effective at cleaning up the 'ugly' mode signal when using a symbol rate of 333 ks/s. A check was made of the MER when the combination was up-converted to 146.5 MHz and applied as a reasonably strong signal to the MiniTioune receiver to see if variation of Group delay through the crystal filter, or whatever, was going to be a problem. The result was 18 dB, which was considered good enough to continue with this approach. (*In fact, group delay is not the main cause of this relatively low MER ceiling, but rather the combination of SR and output frequency programmed into the R-Pi – see later*).

Although the 333 ks/s SR signal looks quite suitable for up-conversion to 146.5 MHz (***http://www.earf.co.uk/333khz.jpg***), for optical work, I wanted to at least start with a lower symbol rate in an attempt to maximise range and 150 ks/s seemed to be lowest that still resulted in a reasonable picture quality. With this narrower bandwidth, it made sense to offset the signal to one edge of the crystal filter to make full use of one filter edge stop-band slope. Doing this for the lower side obviously results in plenty of unwanted sidebands at the upper end, but once down converted to base-band, a switched capacitor LPF was able to remove these components easily enough.

To avoid loading problems at the LPF chip output, a high output current op-amp was used as a buffer. Up-converting to 146.5 MHz again to measure the large signal MER resulted in the same 18 dB figure being obtained.

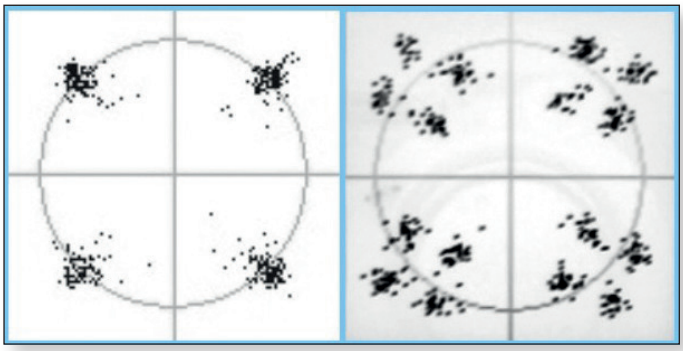


The output of the exciter is a signal centered at 150 khz, with nulls at 0 and 300 khz (though intermod distortion



has obscured these somewhat in the thumbnail spectrum image shown).

(*The constellation diagram reveals extra information regarding the low ultimate MER figure, in that dependent on circuit arrangement, sometimes the four quadrant groupings can appear as random deviations, and sometimes as an additional four groupings within each quadrant. In the former case, the errors are not synchronised with the symbol rate and therefor appear totally random. They are the result of timing approximations in the R-Pi software. In the latter case, the errors are synchronised to the SR, because changes in group delay in both the crystal filter and the LPF [where the turnover point is set to too low a frequency] correspond to signal frequencies directly related to the symbol rate modulation*).



Non signal level related distortion:

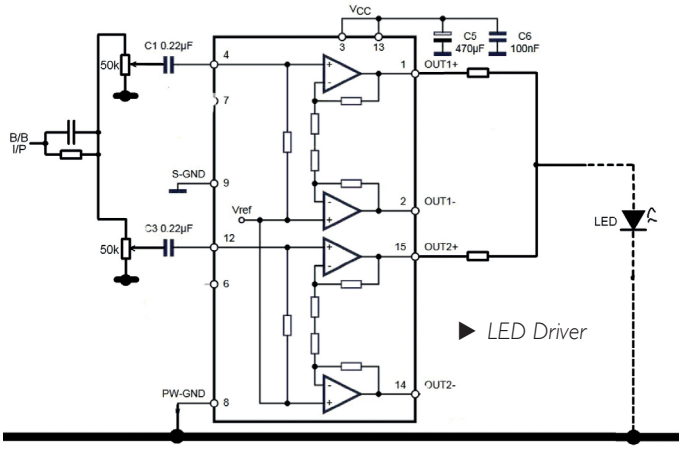
Left: Non-synchronous (R-Pi 'ugly' mode s/w)

Right: Combination of both synchronous (Group delay) and non-synchronous (R-Pi 'ugly' mode s/w)

Transmit LED and LED drive amplifier

As mentioned in Part 1, two popular LED types used for audio optical work are the Osram 'Golden Dragon' series (1.5W) and the red Luminus Devices 'Phlatlight' (24W). Early measurements erroneously indicated that the Phlatlight would be too sluggish to operate at 150 khz carrier frequency, so a red Golden Dragon was used for all first-off testing.

Light output is pretty much proportional to LED current, with the terminal voltage remaining fairly constant, and a power FET would normally be used as a current source driver, but for a second time, an alternative appealed more, assuming it would work at these higher frequencies - thus one of the low cost stereo amplifier boards available from China on eBay was tried. One that was already on hand used a TDA7297, and on measurement was found to have a frequency response that had only dropped 3dB at 300 khz, ie, adequate for the task in hand.

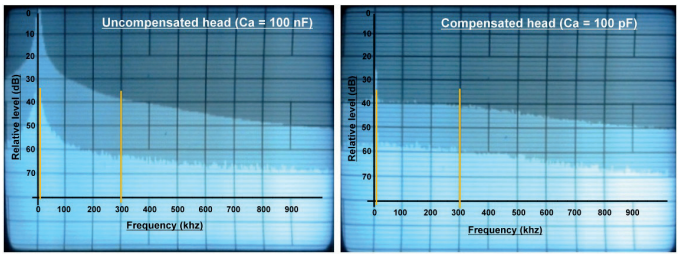


A small amount of frequency compensation was added to the amplifier input to redress the high end 3dB droop. All testing was done with the LED operating linearly in Class A, simply by dc coupling it to one half of the bridge output, and setting the quiescent current by appropriate choice of series resistor. It seemed sensible to use both of the stereo amplifiers in the IC package to spread the load, though one alone is adequate to drive a 1.5W Golden Dragon LED to full output. The arrangement is obviously not very power efficient, but for such a low power LED, this didn't seem important and it has resulted in a simple and reliable modulator.

Receiver optical head

Although optical detectors based on current mode photo-diode operation have bandwidths well in excess of what is needed here, they are far less sensitive than their voltage mode counterpart (***http://www.earf.co.uk/IVphotodiode.htm***), even at bandwidths well beyond the -3dB figure of the voltage mode detector used here. The input FET buffer is fairly standard and one interesting feature is that despite the gain starting to fall above 1 khz due to the input shunt capacitance, the noise output falls almost in step, right up to 0.5 Mhz or so, loosing only about 5 dB S/N in the process.
High frequency video-amp type op-amps have been used following the FET to add extra gain. These also provide a low resistance output drive capability suitable for 50 ohm loads, which has been useful during testing. Frequency compensation is via a suitable choice of value for capacitor Ca, and this alone is adequate for use up to 300 khz.

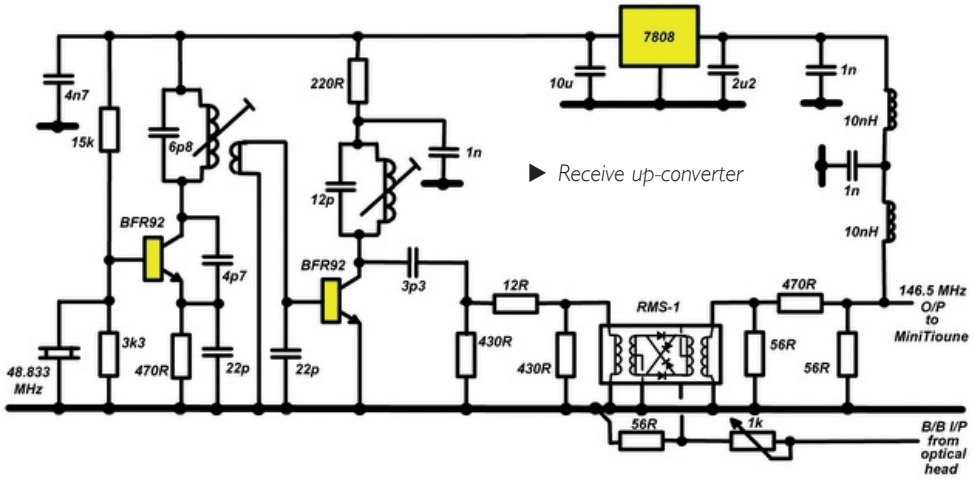
The OPA2658U op-amp maintains its gain well into the VHF spectrum, so to avoid any issues of amplified 2m noise making its way into the MiniTioune receiver, shunt capacitor Cb was added to the input of the 2nd op-amp stage.



▶ *Frequency response of optical head before and after frequency compensation (in each case, the lower trace shows the no-signal noise floor)*

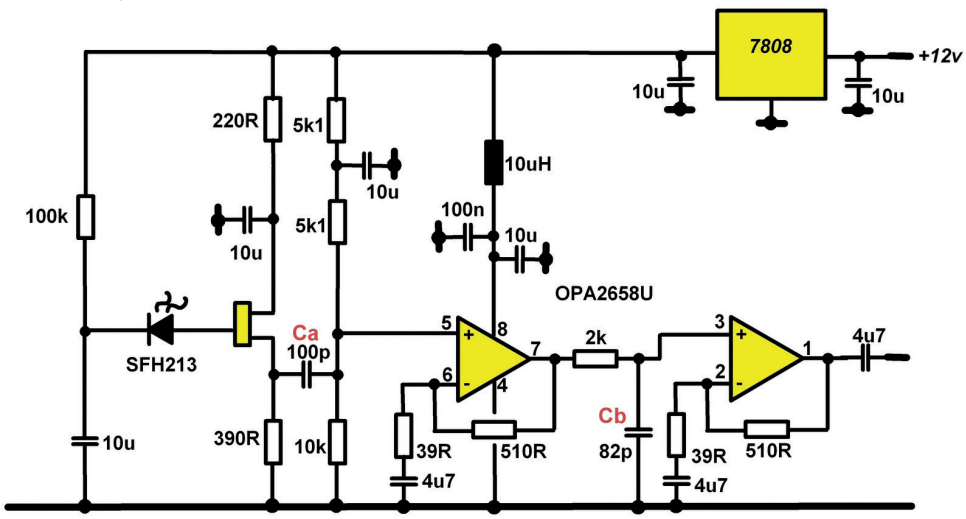
Receive up-converter:

Since a second wide-band crystal filter was available, initial up-conversion to 146.5 MHz was done in two stages, with the first producing a usb signal at 17.5 MHz.. Thus, after final conversion to 146.5 MHz, an identical, but frequency translated base-band signal, was available to feed the MiniTioune receiver (***http://www.earf.co.uk/upconv.JPG***).



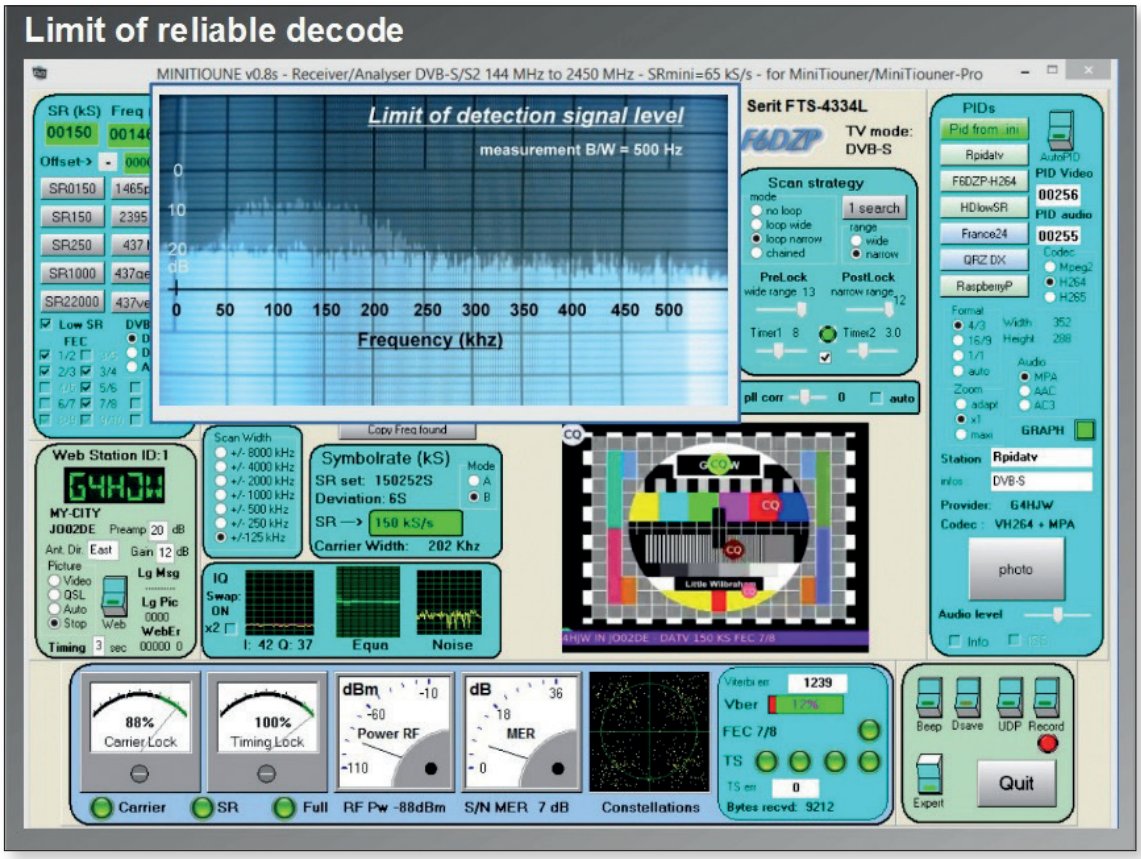
▶ *Receive up-converter*

▶ *Receive Optical Head*



Later work, however, showed that a dsb signal could just as easily be decoded by the MiniTioune software, so a single mixer with a 146.5 MHz LO was found to be all that was actually needed, and it is this circuit that is shown in the accompanying diagram. With this simpler arrangement, LO leakage is within the Minitioune IF bandwidth, so an input level pot has been included to ensure that the DATV signal can be kept at a maximum level, consistent

▶ *Test range reception equating to 30 km range*



with non-overloading of the mixer. The dc supply for the up-converter is conveniently taken from the MiniTioune receiver.

Results and conclusions:

It is difficult to arrange full-blown tests here in Cambridge, so a 30m long test range was put together in the back garden. For this, the transmit LED was run at 0.75 mA, with no Fresnel lens ahead of it, representing in both cases a 30 dB reduction in signal (ie, 60 dB total). The receive optical head was fitted into a light box using an A4 size Fresnel lens. Although the received signal was on the limit of reliable detection (7 dB MER), this still equates to a potential range of 30 km at the full 1.5W drive level into the Golden Dragon LED/Fresnel lens combination, which is really quite encouraging when you contemplate what the 24W Phlatlight LED should be capable of achieving on a clear dark night, though the effect of light scintilation could be a issue, as others have pointed out, so it does really need trying.

Lining up the optics is made much easier by adding a simple AM receiver to the optical head output and listening to the rise in noise as the lightbox is swung across the incoming light beam, the MiniTioune display having way too much delay to use that. Likewise, a portable LW radio placed near the feed to the transmit LED is a useful way of confirming that the LED is actually being modulated.

As mentioned, quite a lot of work has been done since this first off testing, from which interesting snippets of information have emerged. For instance, the discovery that in 'ugly' mode, when the output frequency was set to eight times the SR setting, the ultimate MER achieved rose to 31 dB. Likewise, the ability of the receive head to operate effectively at a much higher frequency than expected, simply because the noise floor was decreasing at a similar rate to the gain fall-off – something I had never really looked at closely when using voice-only modulation, allowing higher symbol rates be contemplated. It may also be useful to raise the carrier frequency further away from its current minimal frequency.

Indeed this is so – but too late to include details here. Suffice to say, at 2 MHz carrier output and SR of 250 khz, down-converted to a final carrier frequency of 455 khz has resulted in a much simpler tx down-converter, and one that gives an excellent MER figure. Additional optical head frequency compensation has resulted in a head respond that is flat to a couple of dB or so up to 1 MHz.

If only for the sake of completeness, a tx I/Q modulator approach to signal generation is probably the next thing to try, but there are clearly plenty of alternative ideas and improvements, particularly on the receive head design, to try for anyone who wants to have a go, and who knows, I might even manage an optical DATV QSO with someone one day!

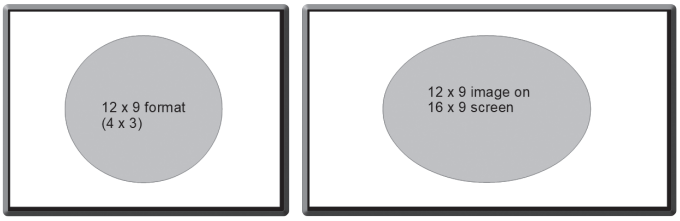
Video Fundamentals 16

Aspect Ratio re-visited

Brian Summers G8GQS

I was recently asked about "aspect ratio" so I thought it worthwhile to revisit that subject which was previously covered in Video Fundamentals number 6.

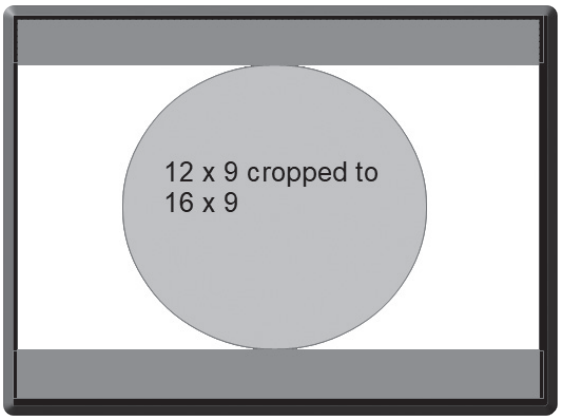
The heart of the problem is ensuring that your display device, monitor or whatever is the same shape as the camera sensor. Easy! So...



The camera output is 12:9* and the stretched view on a widescreen monitor, or "short fat people" as it is sometimes described. There are a number of solutions to this, some easier than others!

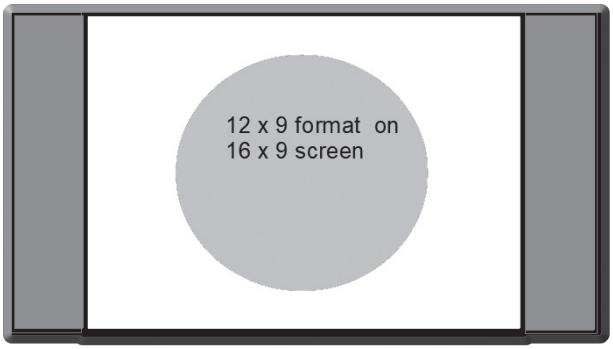
*I have called 4:3, 12:9 for ease of comparison here.

- If you have an old camera it may be possible to reduce the scan height so the scanned patch is 16:9.
- Use an anamorphic lens, to pre distort the image, difficult to find the right lens and probably cheaper to buy a new camera.
- Correct it electronically by discarding or not using parts of the picture/screen.



Here the top and bottom of the picture has been discarded, leaving a 16:9 patch. To achieve this the signal goes through an "aspect ratio converter".

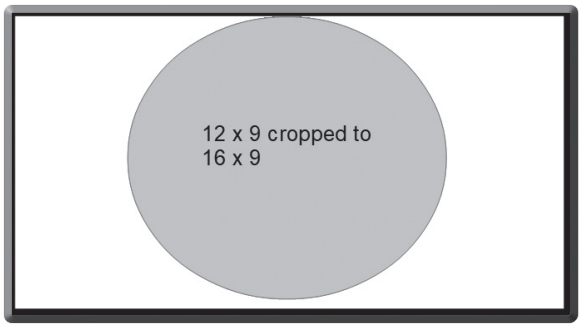
The top and bottom (shown to the right) are really gone and the new picture fills the full screen of the widescreen monitor/TV. The drawback of this solution is you lose the heads/feet of the subject and there is a loss of vertical resolution.



In this solution the 12:9 picture is inserted whole into the 16:9 screen. You do not lose any picture information but the side bars are annoying and there is some loss of horizontal resolution. There are intermediate versions of these two methods, partial crop/partial side bars. You often see an extreme version of this technique with cellphone footage on news reports.

During the transition period from 12:9 to 16:9 there were any number of options but the key item was the aspect ratio converter box. As the world have moved on there is little call for these now, apart from the need to replay old 12:9 footage. The result of this is these complex boxes are redundant and can be bought cheaply, hours of fun but hard to mend! It's quite likely that you can do this sort of conversion in a suitable computer.

Most recent TVs are capable of switching display sizes, analog TVs had a 14 bit data word in line 23 and digital TVs have an "Active Format Description" (AFD) in the MPEG data stream. Typically, they can change the size and shape of the displayed picture, so that the image shown has the correct ratio, 12:9, 14:9, 16:9, overscan, and a couple of "shoot and protect modes". If you can get an AFD into your 12:9 cameras output a receiving TV should switch to Pillar Box display and circles will still be round. Search Wikipedia for more information.

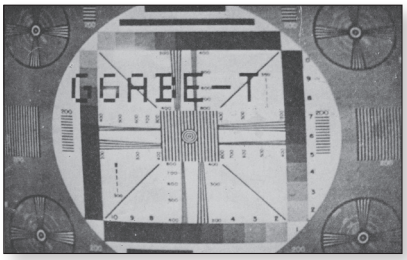


Turning Back the Pages

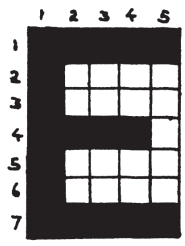
A dip into the archives of CQ-TV, looking at the issue of 47 years ago *Peter Delaney - G8KZG*

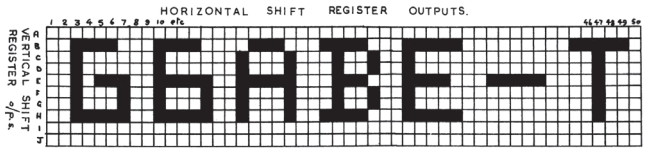
CQ-TV 74

CQTV 74 was dated May 1971, and began with an apology to members as the post office workers' strike had delayed delivery of the previous issue - the Editor wrote that "Had it started one day later, … !"



The front cover showed a picture of a test card with an electronically generated amateur television callsign overlaid on it, and inside the design was described by Dave Lawton. As the method of generating characters was quite novel at the time, Dave explained that the letters were formed by selecting elements within a 5 unit wide and 7 unit high rectangle. - as shown here, and that with each character matrix placed side by side they could be scanned by horizontal and vertical





shift registers. The block diagram showed how the gating waveforms were generated - it was "left to the individual to use what integrated circuits are available to them, so actual wiring details" were not shown. As the registers scanned across each line of the screen the shift register output could

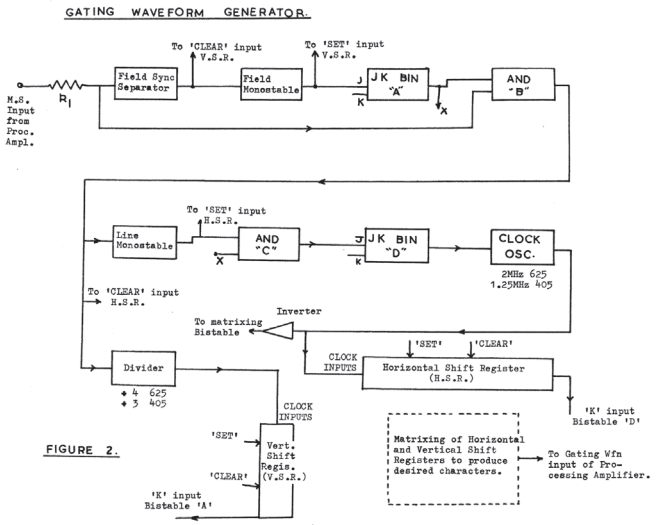


FIGURE 2.

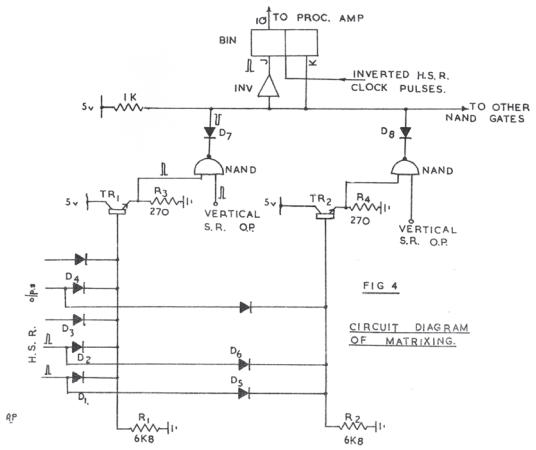
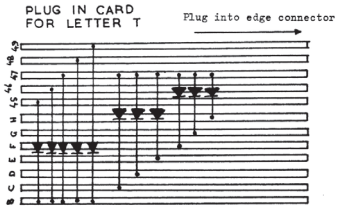
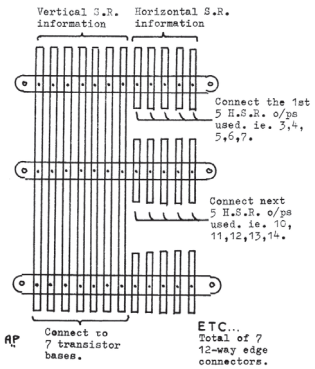


FIG 4

be selected where required to represent part of a letter or number by a matrix of diodes. The diode matrix for each character was assembled on a small piece of Veroboard, arranged to plug into one of a series of edge connectors. The output from these matrices was then fed to a processing amplifier. A sync separator at Tr2 and Tr3 fed a clamp pulse generator Tr4, Tr5 and Tr6 that set the black level of the video signal





at Tr8. The output from the diode matrices was applied to Tr10 - the level of the character signal could be set, by RV25, to anywhere between black level and peak white, and the combined signal is inverted by Tr11, which drives the output stage of Tr12, Tr13 and Tr14.

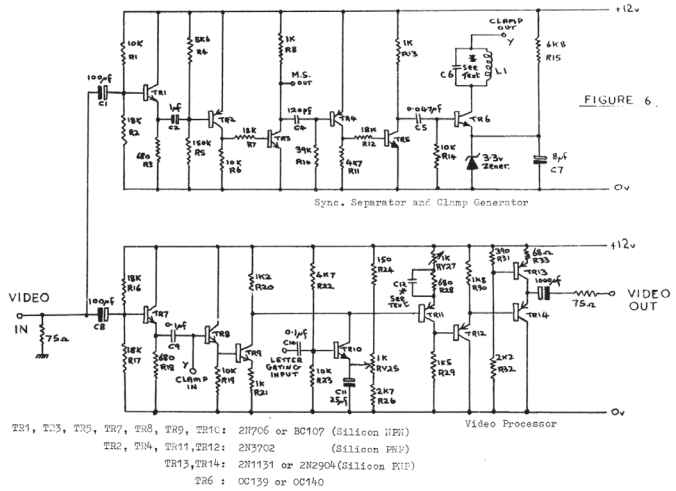


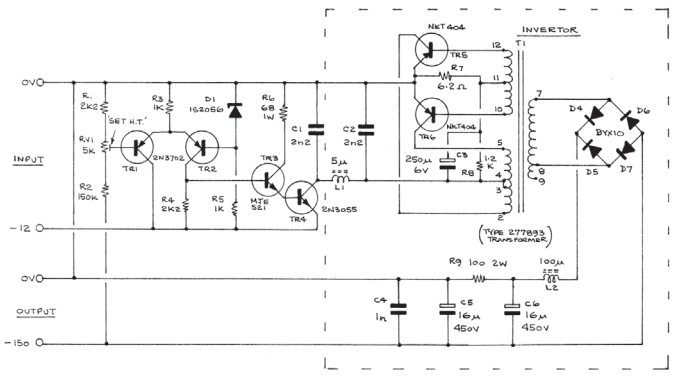
FIGURE 6.

Sync. Separator and Clamp Generator

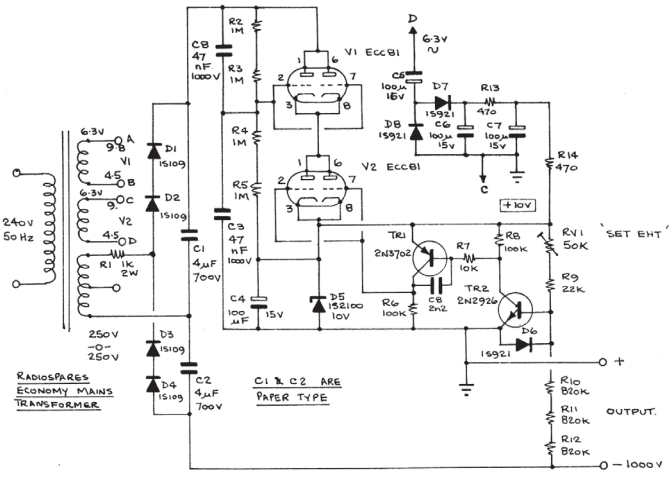
TR1, TR3, TR5, TR7, TR8, TR9, TR10: 2N706 or BC107 (Silicon NPN)
TR2, TR4, TR11, TR12: 2N3702 (Silicon PNP)
TR13, TR14: 2N1131 or 2N2904 (Silicon PNP)
TR6 : OC139 or OC140

(This design pre-dated, of course, by several years the use of 'home computers' for text generation - before this a callsign would be a slide in a flying spot scanner or a card (often hand-written) placed in front of the camera lens.)

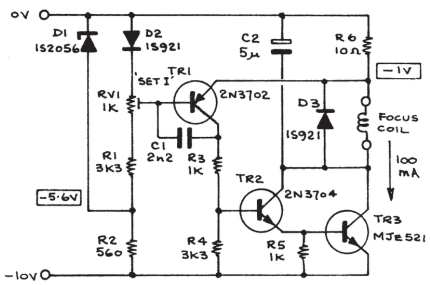
John Lawrence's "Circuit Notebook" series continued with some further uses for zener diodes, including an inverter



that could produce a high voltage output for the grid modulator in a transmitter - useful when working portable. It was stabilised by comparing a fraction of the output, set by RV1, with the voltage across the zener diode D1 in the long tailed pair Tr1 and Tr2, which controlled the pass transistor, Tr4, in the normal inverter primary circuit. An EHT supply for a photomultiplier tube was shown in Fig 13, in which the transformer drives a voltage doubler, and the regulator circuit - using two valves in series, so that each

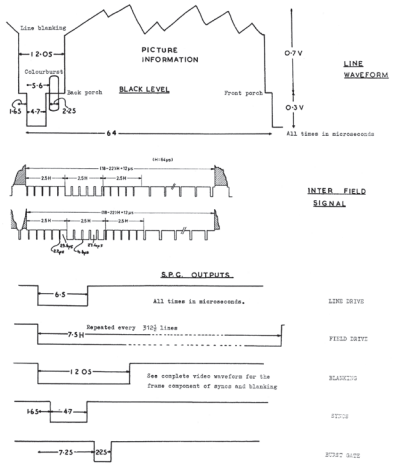


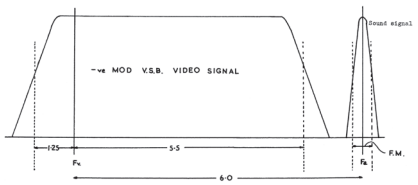
operated within its maximum ratings, compared a fraction of the output with the voltage across the zener diode, D5. John showed that zener diode circuits could be used not only to controlling voltages in supplies, but also the current. This was particularly useful for regulating the current through the focus coil that surrounded a vidicon (or similar) camera tube. The current through the coil also passed through the resistor R6, and by comparing that voltage with the voltage across the zener diode D1. The resultant signal would vary the current passing through Tr3 - and hence the focus coil.



Arthur Critchley's "tutorial series" on Integrated Circuits explored more examples from the 74xx series of TTL logic circuits, this time looking at decade counters, monostables and Schmitt triggers. The applications included creating a 'window' in the picture, generating the front porch of sync pulses and oscillators. The articles were already becoming the 'handy reference point' on digital logic circuits.

In the early 1970s, many British television amateurs were still using the 405 line, 50 field system, but as equipment became more widely available there was a move to adopt the 625 line, 50 field system. A series of diagrams were published in CQ-TV, showing the line waveform, with the timings and relative voltages of the various parts of the waveform; the more complex waveform for the sync pulses between fields (two different drawings, one with a 'half line' at the end of the pattern, and one with the half line at the start, as happens with interlaced scanning), and then the timings for the 5 standard sync pulse generator outputs used to drive the video sources and other equipment in a studio. Because the 625 line video signal inherently occupied a wider bandwidth than the older version, ways had to be used to keep limit the rf spectrum of the transmitted signal. To keep the full resolution that 625 lines was capable of, instead of using double sideband amplitude modulation, a process was used to create a vestigial sideband modulation - where one sideband was kept complete, but the other was reduced, so keeping the overall bandwidth within the allowable limits. The diagram also showed the frequency modulated audio signal, spaced at 6MHz from the main vision carrier frequency. The 'Letters to the Editor' included one from the Club Chairman, Malcolm Sparrow, suggesting that "any amateur setting up a station from scratch would be foolish to ignore the fact that eventually the majority of UK amateurs will operate on 625 lines, whether monochrome or colour".

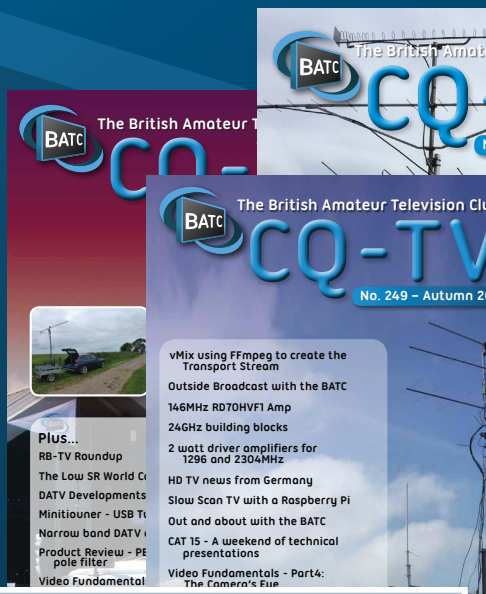


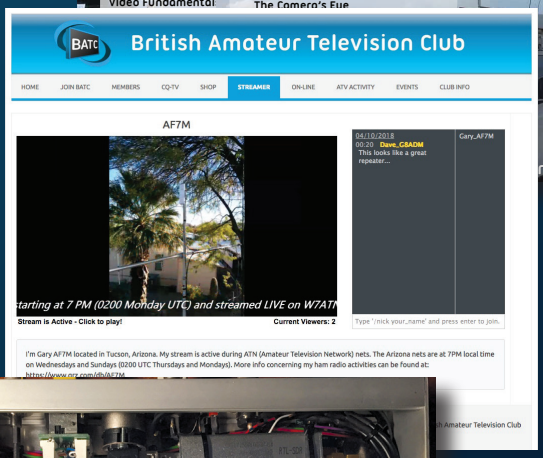


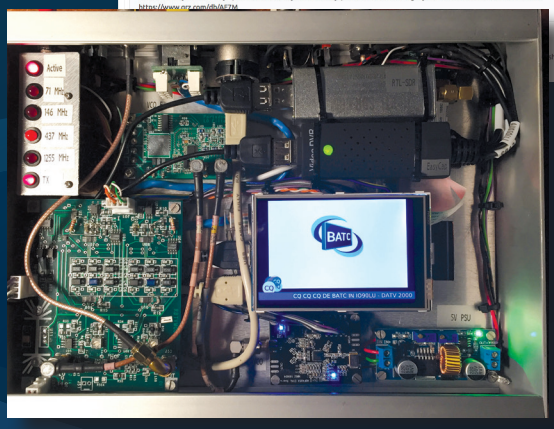
The British Amateur Television Club

The club provides the following for its members:

- A **colour magazine**, CQ-TV, produced for members in paper or .pdf (cyber membership) formats.
- **Web site** – where you can find our online shop stocking hard to get components, software downloads for published projects and much more.
- A **members forum** at https://forum.batc.org.uk/ for help, information and the interchange of ideas.
- A **video streaming** facility at https://batc.org.uk/live/ which enables repeaters and individual members to be seen worldwide.
- An **annual Convention** held in the UK where you can meet other members, visit demonstrations and listen to lectures.
- **Meet other club members** at the BATC stand at local rallies across the country.
- The **BATC Wiki** for all the details of systems and projects for all things ATV. https://wiki.batc.org.uk







www.batc.org.uk

BATC
Out and About

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

2019

10 Feb	Harwell	www.g3pia.net/radio-electronics-rally
31 March	Bristol Mini-CAT	forum.batc.org.uk/viewtopic.php?f=119&t=5773
14 April	West London.	www.radiofairs.co.uk
28 April	NARS, Blackpool	www.narsa.org.uk
28 April	Norden, Rochdale.	www.g0roc.co.uk
11 May	Wirral Mini-CAT	forum.batc.org.uk/viewforum.php?f=119
?? May	Dunstable Downs RC	www.ddrcbootsale.org
23 June.	Newbury	www.nadars.org.uk
16 June	West of England.	www.westrally.org.uk
21 - 23 June	Friedrichshafen.	www.hamradio-friedrichshafen.de
14 July.	McMichael Radio Rally	www.mcmichaelrally.org.uk
11 August	Flight Refuelling	www.frars.org.uk
27 - 28th Sept	National Hamfest.	www.nationalhamfest.org.uk

For a list of all rallies see: http://rsgb.org/main/news/rallies/

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