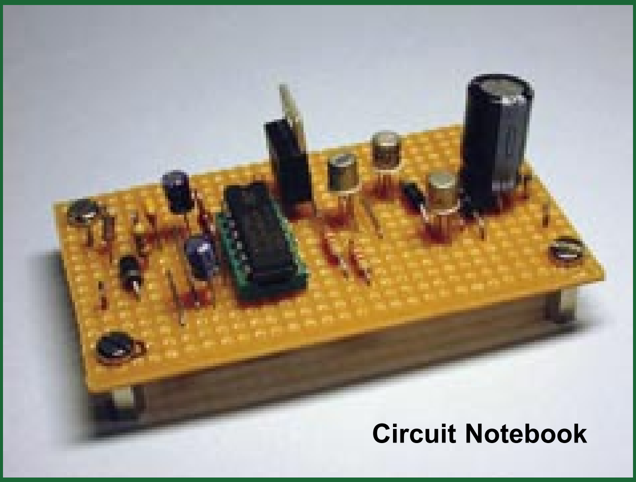
CQ-TV 202

ISSN 1466-6790



Circuit Notebook

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May 2003

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Anything to do with the CQ-TV web site Email: webmaster@cq-tv.com or for the BATCs web site. E-mail: webmaster@batc.org.uk

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Chairman's Column

By Trevor Brown

D-ATV. The AGAF and Prof. Dr. Uwe E. Kraus, DJ8DW have now finished the design for a dual mode D-ATV transmitter at Wuppertal University, which will produce GMSK and QPSK on 70 cms.

GMSK - Gaussian Minimum Shift Keying can be treated like FM. On the transmitter site highly efficient non-linear power amplifiers can be used without resulting in a broad spectrum; at the receiving end a simple FM demodulator can be used. QPSK requires a highly linear power amplifier to avoid creating a broad spectrum. QPSK is interesting as there are cheap digital satellite set-top boxes available, avoiding the need to build a receiver.

The initial production run is for 100 units and BATC has purchased 5 - three with BATC funds and two as private purchases by two of the committee members. In this way we hope that this D-ATV system can be evaluated; whether you think this is the direction for ATV or not, I hope you will agree that the best way to find out is to try it.

The units can be used in QSPK with suitable frequency conversion to 23 cms where reception can be via a commercial satellite receiver. Ian Waters will be investigating this as soon as the transmitters arrive.

The second stage of the AGAF initiative is to produce a GMSK receiver, so that this mode can also be evaluated. Graham Shirville is working hard with the authorities to get a spectral foot print agreed, so that on air tests can be carried out at selected repeater sites, in a similar way to the ATV repeater in Cologne.

CQ-TV advertising rates have been increased, but still represent value for money. They are now at a level where they contribute to the production cost of CQ-TV. Previously they raised less revenue than the print charges for producing the relevant page. BATC funds are not limitless and we need to allocate them as wisely as possible and subsidising commercial advertising is hard to justify.

You will have found a new membership application form enclosed with this CQ-TV. It is part of our efforts to keep our membership numbers up, and we would be pleased if you would give it to someone who might want to join.

I know it is a statement of the obvious, but it is through belonging and taking part in the club that all the benefits of membership can be obtained. The more members there are in the BATC, the better for all of us.

The period of membership is annual and can be for 1 or 2 years for new members (existing members have a 1 to 4 year option) and renewal is due on the appropriate anniversary of joining. The one year rate is £15 or £29 for two years.

If you need more application forms, perhaps because you are giving a talk or demo, please contact our membership secretary whose address is on page 4. Sample copies of CQ-TV are also available for lectures and demos, please contact Graham Hankins who does our exhibitions, also see page 4.

A new feature of the application form is the e-mail address box. We have started to collect these so that we would have the ability to broadcast news and urgent information to those on the list. Please note that, like all information stored by the BATC about its members, it is absolutely confidential and will not under any circumstance be divulged or "sold on".

Regarding that delicate subject of payment. Our first choice for UK members would be a cheque or postal order, second choice for UK and first choice for International would be a credit card transaction. It may be of interest to members to know that it costs us 4.18% in charges to process a credit card transaction, hence the desirability of the humble cheque. The BATC has many valued overseas members and, due to the difficulties of international money transfers, we are happy with them paying by credit card or, as second choice, a cheque in sterling drawn on a UK bank - Brian Summers, treasurer.

Editorial

You may have noticed some changes to the look of this issue of CQ-TV - let me explain.

When I took over as the editor, CQ-TV was produced in the traditional manner in that pictures and words were glued onto paper templates and taken to the printer, who then made the plates from them. My first priority was to get it to an 'electronic' system.

This was achieved by using Microsoft Word to do the layout and produce the paper 'masters' for the printer. This system required 16 pages per plate. Thus the page count had to be a multiple of 16. (This is why most of the A5 sized issues were 96 pages).

When we changed printers, they were able to accept the masters in 'electronic' format thus cutting out the requirement for me to produce paper copies. This resulted in much improved quality. Also, as they use a smaller printing press, there are only 4 pages per printing plate. At about this time, the committee made the decision to change the size of CQ-TV from A5 to A4. There were many reasons for this, but from my point of view, it made the production easier as it was difficult to persuade Word to produce a single A5 page on A4 paper.

As the layout of words and pictures became more involved the shortcomings of Word became apparent, after all, it is a word processor and not a DTP product. Thus, I decided to have a look at 'proper' DTP programs. Most of those at the cheaper end of the market weren't up to the job of handling a 52 page magazine; they seemed to be aimed more at the one or two page brochure market.

Also, the output produced had to be compatible with the printers plate making software. Taking this all into account the club has purchased a copy of Adobe InDesign 2 and this has been used to produce this issue of CQ-TV. I am now able to send a CD to the printer and a couple of week's later, CQ-TV is posted to our members. Using the right tools for the job is always to be recommended.

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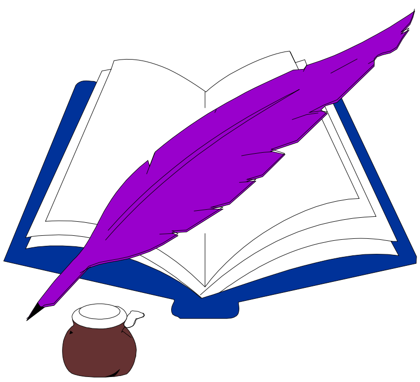
Letters and Emails

Hello Ian,

I was excited to see on the front page of the latest CQ-TV 201, that there was a low-cost test card generator article described inside. I have long mourned the passing of regular test card transmissions, but reluctantly accept that modern 4:3 televisions are much more stable than their predecessors, and anyway there are precious few tweaks! However, with the advent of widescreen (or if I may jump on my personal hobby-horse - “short-height”!) tellys, I believe there is, once more, a crying need for the test card. Modern widescreen tellys seem to have a variety of display modes to cope with 16:9, 4:3, and the various letterbox shapes that are transmitted, often doing really nasty things like stretching the sides of the 4:3 pictures so there aren’t black bands (resulting in the weather presenters becoming fat and thin as they move around the screen!). A friend has just bought an expensive Phillips telly that allows you, in these zoom modes, to select the part of the picture you actually see. But it remembers this, with no easy return to a default central setting, so you come back another day, and have no idea what part of the transmitted picture you are watching!

While I should like to start a campaign for the return of the test card to our screens, that is not what this letter is about. I was disappointed that the Test Card Generator in this quarter’s article once again produced a very poor approximation to a PAL signal. I totally accept that it was not the author’s intent to produce something of broadcast quality, and in itself, the single chip replacement for the board full of TTL is to be commended. However, I would really like to see a design for a high quality generator. One which produced the full range of analogue levels, and the correct PAL sync-pulses and shaped



edges. Perhaps such a device could use the standard REC601 sampling rates, and have a number of selectable test patterns. While EPROMs to hold several full-resolution images might be rare and expensive, there are plenty of cheap Flash-RAM or similar high capacity memories available for digital still cameras these days. They could be loaded from a computer (USB port?) and then be stand-alone with a switch to select the pattern. Oh, and ideally, both 525 and 625 capable!

I wonder if an old DTT set-top box could be modified, as that has all the PAL encoding hardware - it would just need a method of loading the test patterns into its frame-store.

I’m afraid I don’t have the design abilities to produce such a device, but I’m sure that if one COULD be produced, it would sell like the proverbial hot cakes!

Here’s hoping you have some experienced designers just looking for a project to get their teeth into!

Regards, Peter Vince G8ZZR

See my web links page at: http://www.noctua.demon.co.uk/links/links.html

Hello Ian

Graham Hankins wrote several interesting things in the latest edition. I will answer some of his questions in a minute but may I firstly say how much I agree with his view about ‘What ATV means to him’ - but please remember that a high proportion in this ‘broad church’ can neither understand nor afford to ‘go digital’, therefore an excessive amount of “get with it”/digital articles will certainly please the semi-professionals amongst us but will probably have an adverse effect on the membership-drive!

“Rallying Around” on page 14 raises several points which I will try to answer in sequence:

Keep up the good work on the rally stands Graham, I know it’s hard work but it really is appreciated.

I can understand why basic ATV construction is top of the Wish List, most of my friends spend a lot more time constructing/experimenting than

operating and (contrary to what certain BATC Committee Members say), construction is not only far from dead, it is ATV’s main strength.

Quick comments about component sources: Maplins have endured their 4th takeover and now tend to concentrate on ‘Tandy-like’ produce - they now only carry limited stocks of components in their shops. Farnell are excellent & will supply small/mixed quantities, also their web site is well worth visiting. ‘Rad Spads’ are far more sticky and their retail arm (Electromail) is very pricey. CPC carry a wide range at sensible quantities/prices but are ‘trade only’ (so you need a friend with an account). Don’t forget that many smaller suppliers carry what we need, e.g.

GH Engineering http://www.ghengineering.co.uk/ WCN Supplies info@wcnsupplies.fsnet.co.uk and Kuhnes http://www.db6nt.com/

Yes, sat Rxs are a good source of goodies and so are many VCRs; but Sunday morning boot sales are a far better source than rallies!

Now to the real point of this “E” : -

Firstly the good news: (1) The Solent 24cms Tx & Rx were ‘hatched’ about a mile from here; yes, they’ve had many mods done to them and my collection of data sheets is over an inch thick. (2) G8LES not only worked with G8CMQ on the Solent designs but was responsible for most of the later improvements. Mike has given kind permission for me to let you have whatever info you want.

Now for the bad news: (1) A quick glance in my folder revealed about 20

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relevant drawings (excluding schematics, parts lists and text). (2) Many of the sheets cover more than one subject (so at the least they need scanning, editing, creating separate files, resampling etc). (3) Some of the sheets are totally unsuitable for reproduction and need re-drawing; I can do this but it will take time. Please advise what you want and what timescales I have to work to.

Re 'Simple Antenna designs in CQ-TV: the most practical 70 & 24cms designs that I have seen are the 'Twin-quad' plate Aes (14dB measured "gain") in "The UHF Compendium" by K.Weiner, DJ9HO.

The "Testcard" programme by Barry Walker, G0LCU covers both the Amiga and the PC (if you are a masochist!), both are printable. Also, Barry Stevens (GB3VR) has got umpteen good testcards.

Why construct a TC & callsign project when the best results (sorry Black Box Co!) are available for next to nothing. You can get an Amiga 500 or 600 with genlock for next to nothing in free-ads or boot sales - the construction is then confined to a simple low-power 12v PSU (25W max, unlike PCs).

SSTV could be interesting to have another go at but it's a bit boring after FSTV.

Sorry but I'm not going to tell you how to mod the G1MFG.com Rx for continuous tuning because I assemble Giles's controllers!!!

Incidentally his new 'Microwave Video Receiver' has vastly improved push-button tuning/scanning.

Best regards, Howard Chapman.

Hi thanks for your efforts with batc mag

I have to agree with the letter in 201 re members adverts I still looked for the adverts first and then read the rest of the magazine..!!!!

I wish you would re-consider the adverts section

If its a space problem i am sure everyone will tolerate a 50% reduction in the size of all those unnecessary half page photos..!! (1page) maybe loose the satellite pages (4pages),reduce the font size and get the contest results on one page (1page), loose the 4 website advert page footers (save half a page) ....well there is 6 1/2 pages without trying :-)

While I use the internet all day I seldom go to the website and when looking thro the pile of batc mags I always look at the adverts in the magazines even from my first mag no 82...

Please can we have both magazine and web adverts...?? it has to be a easy way of filling up all the vacant pages... just copy and paste..!!! :-)

Mny thanks for the brilliant mag, 73 de **Alec G8GON**

Dear Ian,

I was just reading with interest the last letter in the article LETTERS/EMAILS to the Editor by Bob Harry G3NRT...

Alas I have an old gift 1991/1992 Callbook and like me his call is withheld and so it should in todays climate reference having your gear pinched when you advertise your RADIO or ATV address it's an open book for crime.

So basically what county does he live in would help old timers like me to help them give us a clue .....HI

Then we can give him a demo or tell him he lives in a good or crap location reference ATV most will help him so he needs to go to the ATV DOCTER in his county.....HI.....every one has one..!

**************************STOP

DONT LIKE THE 100% rise in half page increase for Colour Adverts and just 33% rise for full page.....Printing error I hope...!

I have sent my customers view to Trevor (Poor Chap left with the problem .....a very nice guy as we all are in ATV)

*************************PAUSE

TTFN G3RFL **John and Janice Hudson**

*********************** REWIND

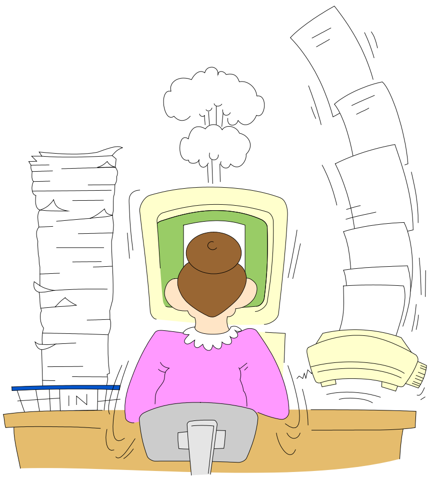
Dear Ian,

I notice that in the latest CQ-TV (201) there are two letters which comment about the availability of printed circuit boards from Members' Services. One comments 'BATC no longer supply these', and another that 'there have been numerous pcbs available.'

The purpose of Members Services has always been to try and help those who wish to construct a project that appears in one of the club books or magazines to obtain components that are otherwise difficult to obtain. This includes pcbs, crystals, semiconductors etc. As the circuit complexity increased, a move was made from single sided plain boards to double sided, through hole plated and silk screened ones, which eases the construction of something like a pulse generator or microprocessor based design. Members will appreciate that these are not made as 'one-off boards' - the cost of so doing would be prohibitive - so a judgement has to be made on an economic number for board manufacture - or a re-run when stocks become low. Designs have been kept in the 'current range' unless one of two factors applies -- either (a) a vital component (normally an integrated circuit or one of those RF 'bricks') has been discontinued by the manufacturers or (b) the demand for the board has slowed down to such a very slow trickle that it is unlikely that sales of a further batch would cover the costs of manufacture.

Boards for a number of the 'old' designs were in fact offered at a discount at the BATC rally or by mail order, but after there was no further call for them for several years, they were donated to a teaching establishment, who were able to make good use of them in helping young people develop their soldering skills.

For new circuit designs appearing in the magazine, we are always happy to consider adding a board to the range, if a pcb design is available and it looks likely that sales at a 'reasonable price' will cover the costs involved. Component supply is an increasing problem -- we have in the past created a design with 'the latest thing', and by the time the production run boards are available, the manufacturer of some (usually



the vital) part has deleted it from the catalogue. Even some of the specialist suppliers, from whom we could buy a "quantity", to make available to members, have now gone out of business (and, similarly, even the pcb makers are the fifth that we have used). The industry, it seems, is moving towards "application specific" devices, made for the equipment manufacturer, or generic programmable logic devices.

It seems to me that more atv ers are interested in 'operating' these days than 'building' or 'designing' equipment. Graham Hankins, in "What Amateur Television means to me", comments that he thinks atv is essentially about transmitting and receiving signals on the amateur bands. In the early days of BATC, members tended to specialise in either 'rf' or 'video', and if you did not 'build it yourself', it did not exist. As 'domestic' video cameras and recorders (etc) became available - and at 'less than you can build it' prices - the 'need' to build equipment has reduced, whilst the ubiquitous pc can generate callsigns, captions, test-cards etc. It is now therefore easier to 'get on air', and to have a larger proportion of 'atv-time' actually 'operating'. But there are amateurs who like the 'challenge' of developing circuits to generate or process pictures (especially to achieve close to the 'professional' effect at 'amateur' prices) - just as there are amateurs who like the 'challenge' of making a longer distance contact, or over different terrain, or by a different mode/band - or those who like the 'challenge' of resurrecting redundant broadcast equipment . Both 'branches' of the hobby involve the 'self-learning' of the 'individual' - - and many members take part in both aspects.

Neither aspect is 'better' than the other - as Graham says BATC is a "broad church", and tries to include all facets of the hobby. Long may BATC continue so to do.

Regards, Peter Delaney - Members Services

Dear Ian,

I have just received the latest copy of the club magazine for which I thank you. I have been following the correspondence with great interest during the last two or three issues and I would like to chip in my tuppence worth to the debate. I live in Dumbarton in Scotland where, understandably, the amateur population and interest in Amateur TV is rather less than some parts of England. My main ambition has been and still is to have a totally home built station with both amateur radio and amateur TV, I do realise that I am unlikely to achieve this till after I retire (in 12 months time) but I have spent the last few years acquiring equipment to make this possible and in conjunction with other local amateurs we may ultimately have a TV repeater. I would like to say that I did greatly appreciate that I could purchase PCB's from your members services and are a trifle disappointed that you are intending to phase out this facility although I do appreciate that it is rather expensive to provide this service, particularly if only a few members purchase them. It would be a great help if you could arrange for another supplier to supply the PCB's even though it may be a little more expensive. The only other magazine that I get that is similar to your own is the VHF Communications Magazine and I have bought a number of their kits direct from the German Supplier when visiting Friedeschaven for the Radio Rally. They seem to be the nearest approach to your good selves, however if you know of other suppliers that supply kits and PCB's that are unpopulated I would be interested to read about them in your magazine. Finally I would like to say that I do enjoy your magazine and would like to say thank you for all your efforts, please keep up the good work.

Regards, Barrie P Spink GM0KZX

For some reason, someone, somewhere, has got the impression that BATC is going to stop supplying pcbs !!!! News to me !

What we have done is remove from the lists

(a) those boards for which the demand had ceased, and even offering them at rallies for next to nothing did not generate any interest

(b) those boards for which a vital (usually semiconductor) part has been deleted by the manufacturers, and for which we cannot source an equivalent.

If anyone wishes to design a pcb for a new club project, or offer the design for a circuit in the magazine, would be happy to add to the range if there is likely to be enough demand to cover the basic costs. (Which we did do for the Narrow Band TV Scan Converter). As to 'price' - we have always aimed to provide boards at a price that will cover the costs, as a 'service' to members rather than as a 'profit making scheme' - and I suspect an 'alternative source' would want to generate some income from it !

Peter Delaney, Members Services

Dear Editor,

I wonder if you or any member can shed a little light on a technical problem.

In my lab, I have an elderly Mitsubishi 10" TV, modified by Snell and Wilcox to act as a receiver/monitor. This is my off-air source. Its output is used to genlock the lab SPG, and is also turned into SDI as a source for the work on the mixer. [CQ-TVs passim]

There was a certain amount of jitter on the SPG output, which I put down to the quality of the off-air video.

Thoughts turned to getting another off-air source, and a Panasonic DTT box was bought. This works fine except for one point. I would have expected the PAL output from the box to have roughly the same timing as its analogue equivalent. However when the two are displayed at H rate on a 'scope, there is a considerable and variable slip rate between them. One problem this shows up is that the lock range on the mixer clock generation system is inadequate for this difference [about 150 parts per million]. On occasions, the slip rate will change with time, on the same channel.

I know there are a number of bits of equipment in the path, but would have thought that at the end, the output would be roughly within PAL System I tolerance [2 parts in 10 million]. Any information will be greatly appreciated.

Yours sincerely, Mike Cox

The winner of this issues 'best' letter or email is Peter Vince, G8ZZR.
He will receive a TV character generator, kindly donated by The BlackBoxCamera Company. For full details visit their web site http://www.stv5730a.co.uk

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Where Are They Now?

By Peter Gibson, VK3AZL

I recently saw a picture of a vaguely familiar OB van in a recent edition of Radcom. The column finished with a query as to where similar vans are now.

The van in the accompanying pictures was supplied to Channel 7 in Melbourne by Marconi for the introduction of colour in 1974. I believe three other vans of the same type were supplied to other Australian stations at the same time.

As originally supplied, it was equipped with Marconi Mk8 cameras, a CDL1260 vision mixer and Neve audio desk. A normal complement of cameras in the early days was up to 4. In recent years, it would commonly use up to ten cameras.

This van has been in continuous use for the past 28 years and was 'put out to pasture' as of late last December, when we removed some items to re-equip another van. Even then, it was pressed into service in January as a tape van with several Digi-Beta machines.

It has been rebuilt and re-equipped several times over the years. When it did its last major job last year, it was equipped with a GVG250 mixer (ex Atlanta Olympics), Yamaha PM4000 audio desk and Hitachi or Sony cameras.

As we made the transition from film to EFP over twenty years ago, we have never really used large vans for drama productions. This van has therefore been primarily used for sport coverage, with a little outside concert work in its spare time. During our winters, we could cover up to three football (Australian Rules) games in a weekend. In summer, this truck has provided the centre court coverage at the Australian Open tennis for many years, as well as taking part in many major golf OBs. The golf coverage showed 12 cameras to be about the limit for a truck of this size.

The first picture (on the front cover) shows the van as it was delivered in 1974. The second picture (below) shows is as it was last December, with the third picture (above) showing the production area at the same time.

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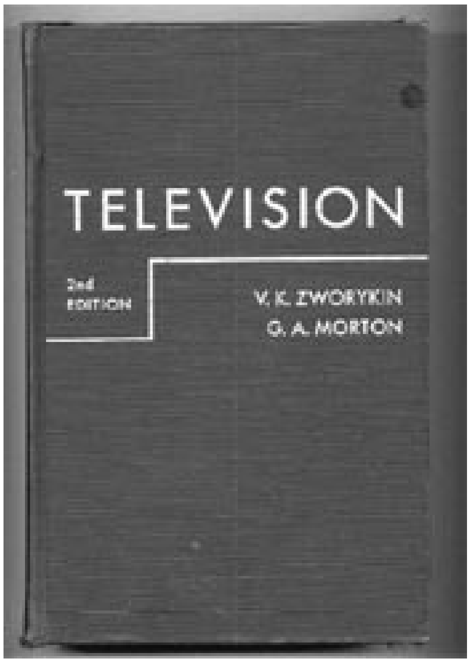
Funny how things turn up

Dicky Howett reports on a 'find'.

A friend just happened to mention that he had a 1954 copy of 'Television' by V.K.Zworykin and G.A.Morton. Nothing particularly unusual there. But this was not any old copy of 'Television'. Indeed it was nothing less than a signed copy by Mr Vladimir Iconoscope himself. Rare enough. Even more so when the dedication in the book (see picture) is to Dr S.M. Aisenstein, the then director of the English Electric Valve Company. So there we have it. A bit of history. The book itself used to be in the EEV library, but was 'cleared out' many years ago and given to my friend. Fortunately, he had preserved the book and now, to his credit, has donated it into the archives of the National Museum Of Photography Film & Television. They were grateful. They didn't even have a copy of this book, let alone a signed one!



Subscription Rates

By the Membership Secretary

Years	Surface	Airmail
One	£15.00	£21.00
Two	£29.00	£41.00
Three	£43.00	£61.00

Please note that the 'Surface' rate covers postage within the EEC, airmail rate is not required.

We have also continued to improve our web site at www.batc.org.uk and this has proved to be very popular and is now attracting many new members. Also, we have a web site devoted to the CQ-TV magazine at www.cq-tv.com

If your subscription is near its end, you will soon receive a letter inviting you to renew it.

We hope you will continue to support the Club and we look forward to receiving your renewal either by post or via our secure online web shop.

Contest News

By Richard Parkes G7MFO

Nothing much to report this quarter, except still receiving entries from the International contest last September! The 'modified' results can be found on the BATC web site. Also if you do not receive an acknowledgment from me within two weeks (normally within two days) of you sending in your results, I have not received them! This happened with the International, when the Royal Mail lost Giles G1MFG results. I would appreciate if you can send me your results via email as this saves me a lot of time entering your results onto the contest excel spread sheet. I'm writing this a few days after the Spring Vision contest and are looking forward for a few entries been sent to me.

Richard Parkes G7MFO 7 Main Street, Preston, Hull. HU12 8UB. England. Tel:- 01482 898559

E-mail: contest@batc.org.uk

Contest Calendar 2003

Summer Fun 2003 (Joint European) Saturday June 14th – Sunday June 15th
IARU International ATV Contest 2003 Saturday September 13th – Sunday September 14th
All from 1800 UTC Saturday to 1200 UTC Sunday
Fast Scan ATV all Bands.

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A Personal View of Digital Television – Part 5

By Mike Cox

In this part of the series, I am going to describe my efforts to produce a "proper" control facility for the SDI mixer [CQ-TVs passim]. You will recall that the mixer as previously described, and shown as a lash-up at Shuttleworth, used the analogue control panel dating from the days when the IBC Info Channel had analogue component switching. The switching system used two component mixers in tandem, with the second one merely used as a spilt screen inserter. This accounted for the two control cables, one 25 way D, the other a 15 way D.

Now is the time to start with a relatively clean sheet of paper, and produce a control panel that will do justice to the mixer. What does the panel have to provide? It has to have 3 or 4 banks of 8 buttons for source selection. It has to have at least 2 T-Bar faders for A/B cross fade and fade to black. It has to have a CUT button. Finally, it has to have some mode switches or buttons for selection of split screen and/or keying facilities, and preferably a third fader assembly.

Add up all these facilities, and on a wire-a-function basis, it amounts to a lot of wires. Thoughts immediately turned to something like RS422, which is a serial interface system, which can run on 2-pair cable over a considerable distance, and which is a known and reliable system. At this point, many of you will reach for the PIC Cook Book. However, some of us dinosaurs think of perhaps easier ways to tackle the problem.

In a previous existence [when I was involved with Vistek in the early 90s], I had been asked to produce a Video Proc. Amp. for use in Scandinavia. This was to be controllable over an RS422 link. Although the system worked, the project never went ahead. I still had in my garage one of the prototype units, and several issues of control panel. I also had a small stock of necessary chips. After at least 8 years since power was last applied, the system still worked.

The system is designed around a pair of 6402 UART [Universal Asynchronous Receiver Transmitter][Farnell stock no. 391-542]. I chose this particular device because it was around and was simple to use. Philips make such devices but

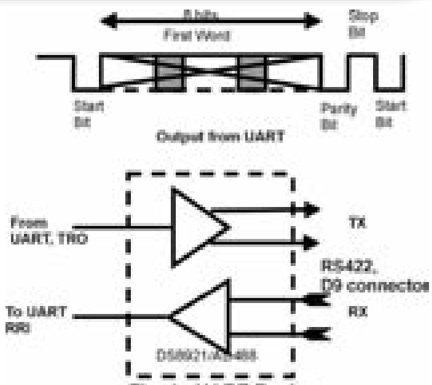

Fig. 1 UART Basics

theirs are more complicated to use. [SCN2641 – Farnell stock no. 391-414]

You do not have to use such a system for a mixer control panel – it could be used for any control purpose that needs 1 or more 8-bit words in the data stream. Fig. 1 shows the format of the serial data stream and the balanced drive to the 2-pair cable.

RS422 is a balanced interface standard, unlike RS232.

It is designed to be used at high data rates [up to 1Mbps], and up to 1000 metres of twin pair cable. There are similarities between this and the AES3

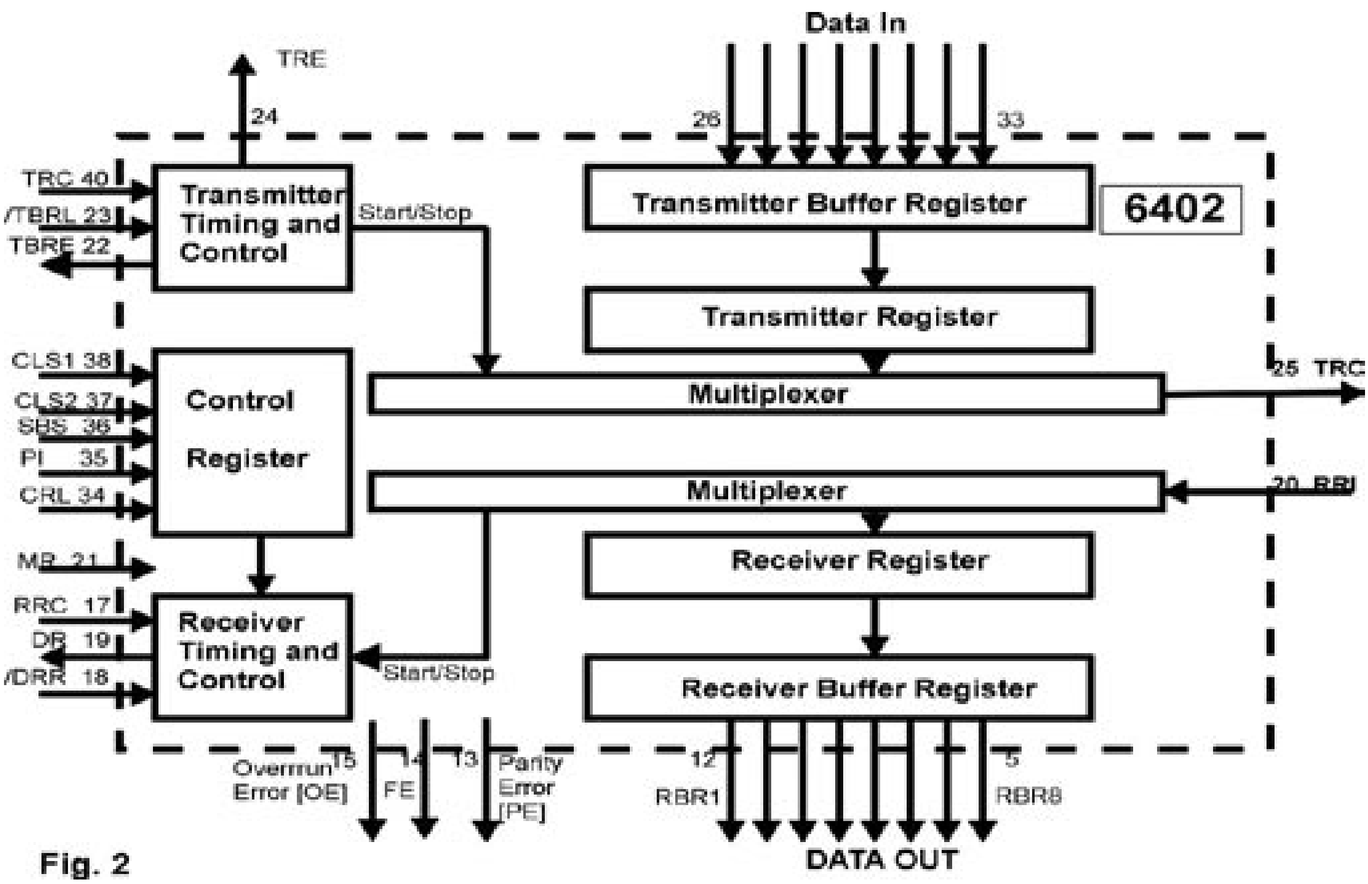

Fig. 2

digital audio interface standard in that they frequently use the same driver chips.

The levels used are between 2 to 7 volts into a 110 ohm termination resistor, recommended for long cable runs and higher speed. A D9 connector is usually used, but CAT5/6 cable and appropriate RJ45 connectors could be used.

Detailed Technical Matters

We now need to consider the block diagram [Fig. 2] and pin configuration of the 6402 UART.

Dealing with the transmit function first, data from switches, fader etc is applied to the TBR1 –TBR8 pins.

When the TBRL pin is taken momentarily high, the first word is sent out on TRO. When the word, its parity and stop bits have been transmitted, an end of character signal TRE is sent out. This is used to advance the scan counter if more than one word is to be transmitted in the time frame. It is also re-applied to TBRL so that the second word is transmitted. The process continues until all the words in the time frame have been transmitted.

The scan counter mentioned above is a 10 bit Johnson counter, whose outputs are used to drive the chip select pins of 74HC541 buffers, used as data selectors. The outputs of the 'HC541s form a bus which feeds the data inputs [TBR1-8]

At the end of the scan count cycle, the last counter output is used to suppress the signal from TRE, ending the cycle.

For use with a vision mixer, it is desirable that all information changes are implemented during the vertical interval so as to minimise picture disturbance. This means that the total cycle time must be less than 22 x 64µS, or 1.4 mS.

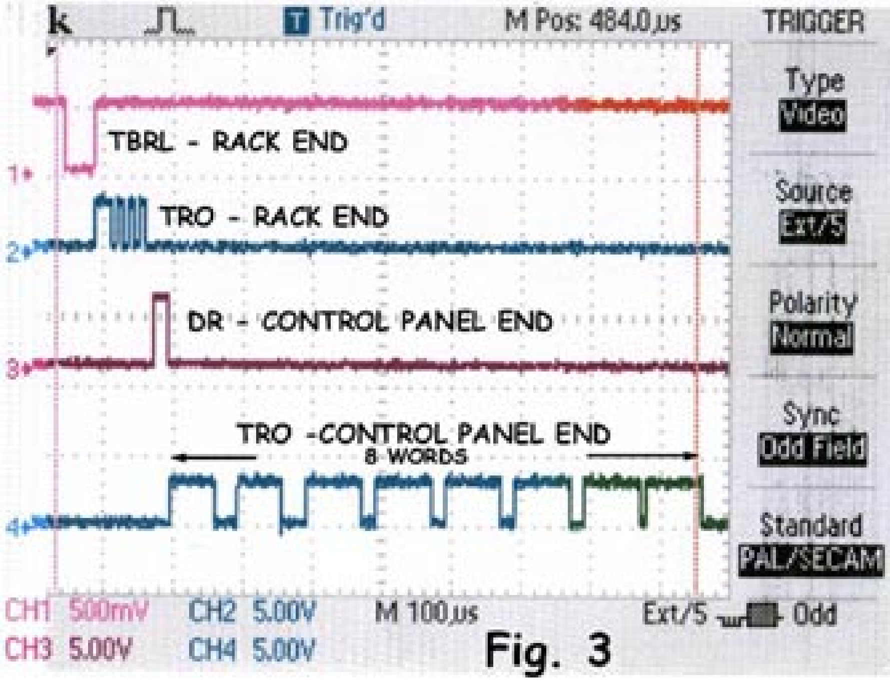

Fig. 3

This defines the clock speed for the UART. To ensure that 8 x 8 bit words can fit into the vertical interval, the clock speed is 2 MHz. The resultant bit rate is 1/16th of this speed, i.e. 125 kbps.

To ensure that the cycle starts at the beginning of the vertical interval, the UART at the electronics end (rack) transmits a single word, initiated by a field drive signal. If there is any useful information to be sent to the control panel, it can be sent in this word.

Back at the control panel, the receiver section of the UART gives a high level on the DR pin to indicate that a word has been received. This is used to reset the scan counter, and is also inverted and delayed slightly and sent back to the /DRR pin to reset the DR output. Any information sent in the word from the rack appears on the RBR output pins.

Fig. 3 shows 'scope traces from a system on the bench. The time line occupies about 2/3 of the vertical interval. The width of the TBRL pulse [top trace] is around 1 line [64uS]. Note that the transmission from the rack end is only one word long.

At the rack end, the RBR1 – 8 pins are taken to a bus feeding 8 74HC574 latches, with their clock signals taken from the DR signal and gated by the scan counter outputs. At the end of each transmitted word from the panel, DR goes high for around 30 µS.

Fig. 4 shows the same top two traces, with the lower traces showing the rack end DR signal, as described above, and the output of RBR8 [MSB] of the UART. This is high for the first two words, as these are both transmitting 80h.

Fig. 5 shows a simplified diagram of the whole system, with only four sets of 8 bit data input shown.

Fig. 6 shows a picture of the UART chip and the DS8921 RS422 interface

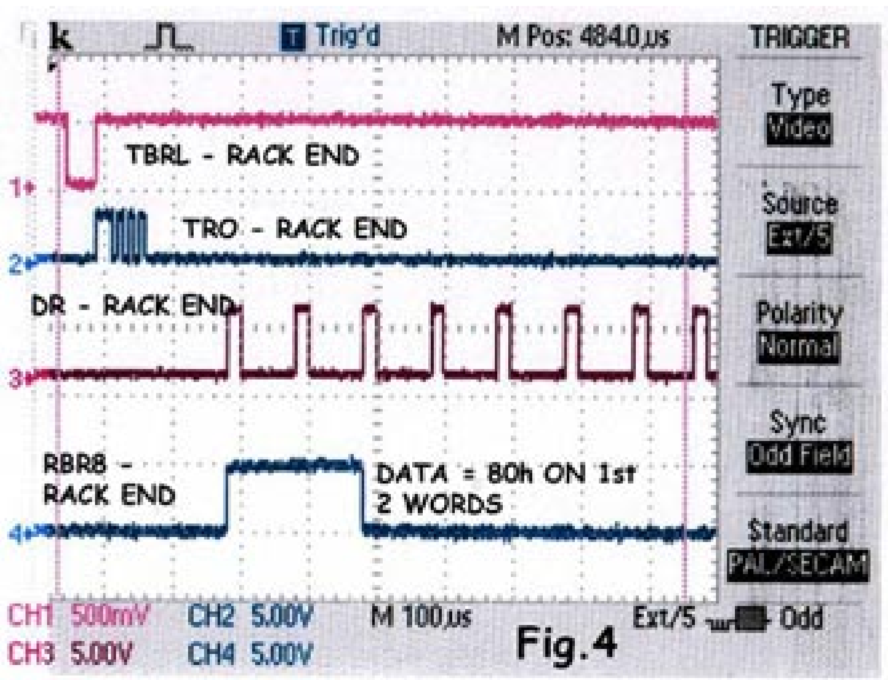

Fig.4

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chip. At the left is the 4 MHz clock crystal and the HC4024 clock divider.

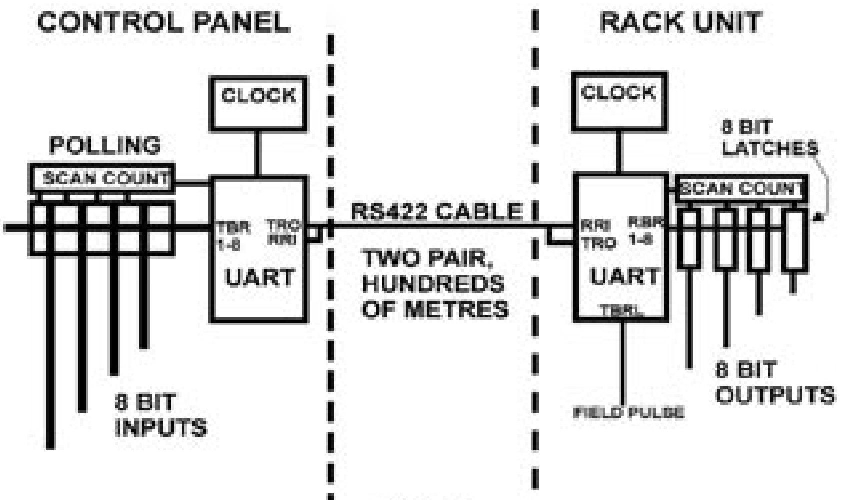

FIG. 5
SIMPLIFIED SYSTEM

We have produced a working data highway capable of transmitting 8 8-bit words during the vertical interval.

Now we have to look at the rest of the control panel.

Control Panel

In designing this, I am allowing for facilities that do not yet exist in the electronics package, but perhaps by the time this appears in print, they will have been incorporated.

The first consideration is the buttons to use. The original panel used Schadow buttons, with a single LED, and with a removable window for legending. These now seem to be difficult to get, so I have invested in some Veetronix switches, type 06. These are like the classic type of button as used by GVG and others. DT Electronics [024 7643 7437] are the UK agents. The switch carries a single LED, which can be bipolar, and - with the aid of some circuitry - light up red or green. The keycap detaches and comes apart to carry an appropriate legend, which is backlit by the LED. Fig. 7 shows a working button, and a stripped down one alongside.

The function of the mixer is arranged so that the lower [A] bank of switches selects/shows the transmitted source, while the middle [B] bank selects the NEXT source. The operator then either presses the CUT button to put the NEXT source to transmission, or move the fader over to effect a dissolve between the banks. When the fader reaches its end stop, the banks effectively swap, and the fader output is complemented [from FF to 00]. By this means, the position of the fader is not important. To effect a dissolve, the fader is moved from end to end. The A and B bank LEDs tell the operator what is on NOW and what is coming NEXT.

The upper [C] bank selects sources for the “over” facility. This is a split screen where one element is the transmission source and the other is selected by the C bank. A second fader controls a dissolve between the split and the clean transmission output. This will also be used for control of keying in future work. Further switches are included for split screen pattern selection, and a fader for split screen position. Finally two buttons control an up/down counter for Fade to Black.

Fig. 8 shows the proposed panel layout. The panel is 406mm wide, by a strange coincidence the width of two 7” LCD widescreen monitors for local monitoring. A 5mm bi-colour LED is fitted on the panel to indicate correct operation of the RS422 link.

The latching circuits for the buttons will be the same as the original panel, consisting of a pair of 4-bit counters and decoders [‘HC161/’HC4514][Fig. 9a]. The 4-bit counters are presettable, so that the bank swap can be effected. The counter outputs are stored in an 8-bit latch [‘HC574] and the outputs connected to the opposite data inputs.

At the BANK SWAP command, or the CUT button is operated, the latch stores

FIG 6 UART CHIP AND PERIPHERALS

Fig. 7 VEETRONIX 06 BUTTONS

the current state of the counters. After an interval determined by the Field Counter, a LOAD command is given which loads the data from the latch into the counters.

The BANK SWAP command comes from the output of the A/B fader ADC. This is fed to a buffer and a complementer [‘HC540/541], in parallel, with their /OE pins fed from the outputs of a D flip-flop. The buffer or complementer output goes to an 8-bit comparator [‘HC688]. The other inputs are set to FF. When the fader output reaches FF, the comparator output goes low, and via an inverter toggles the D flip-flop. The inverter output is also the BANK SWAP command to the counter/store combination [Fig. 9b].

At the rack end is another UART with a set of 8 bit latches to store the various control words and feed them to where they are needed. The technique used is the opposite of that at the control panel, with the transmit signal being the field pulse and the receive signals going to the latches.

I was greatly taken with Brian Kelly’s article in CQ-TV201 on his Test Card Generator using PLD technology [Programmable Logic Device]. I have long wanted to get into this, and have just acquired a Lattice ISP starter kit from Farnell. I look forward to putting a great deal of the discrete logic such as the bank swap, and button latch circuit into a single PLD. Progress reports will appear in future.

Further Work on Mixer

A desirable feature in any mixer is a Downstream Keyer, for inserting titles independently of the upstream mixer activity.

In the 841SDI, there is a complete Mix Effects card used just for Fade to Black. When it is not doing that, it can be used to cut holes in the video. Addition of a Full Adder in the Y channel allows the hole to be filled with the title. This is a true Linear Keyer, as the title video is not gated again, as it is in a conventional keyer, giving possible distortion to type faces.

It is necessary to interlock the switching so that the Fade to Black command cancels the Downstream Key command.

Note that this applies to monochrome titles only. Adders in the colour difference channels Cb/Cr will not do the right thing, as the Cb/Cr signals are bipolar about their black level at 80h. To achieve full colour insertion, it will be necessary to use a format converter to convert to GBR, add the title in a triple adder and convert back to YCbCr. However if Linear Keying is not required, then straightforward “keying” into the YCbCr channels will do the job.

However, it is a very simple way to add a logo or call sign without even hole

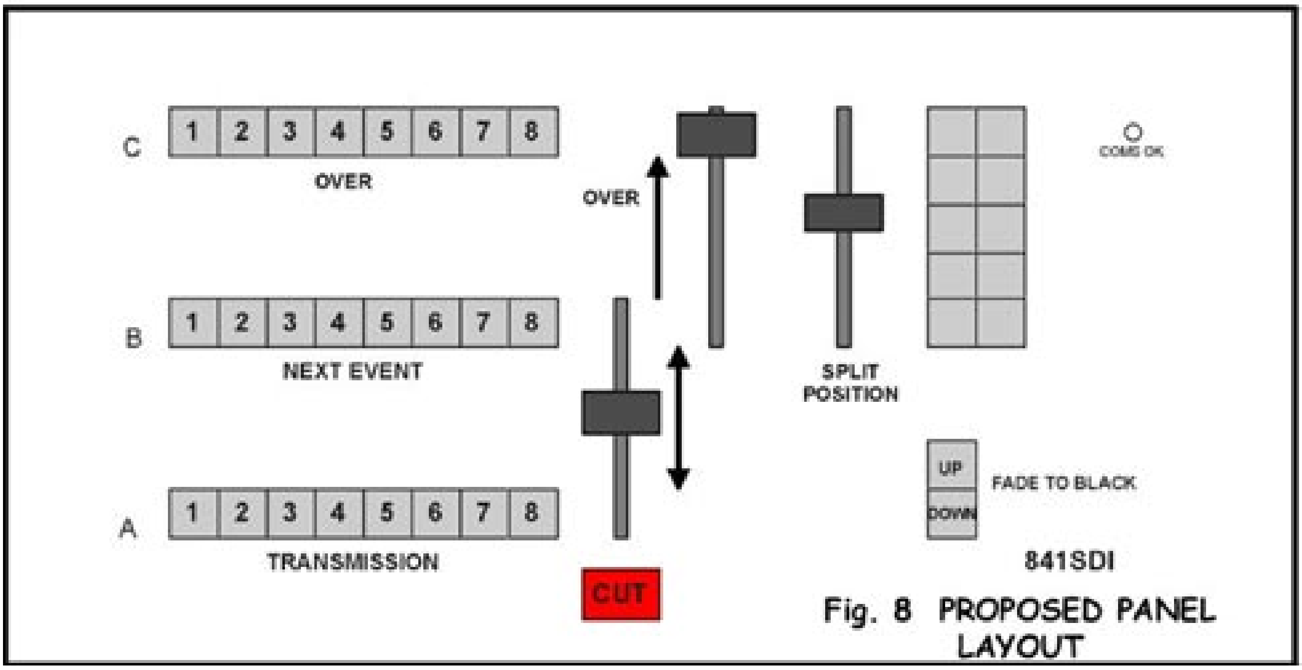

Fig. 8 PROPOSED PANEL LAYOUT

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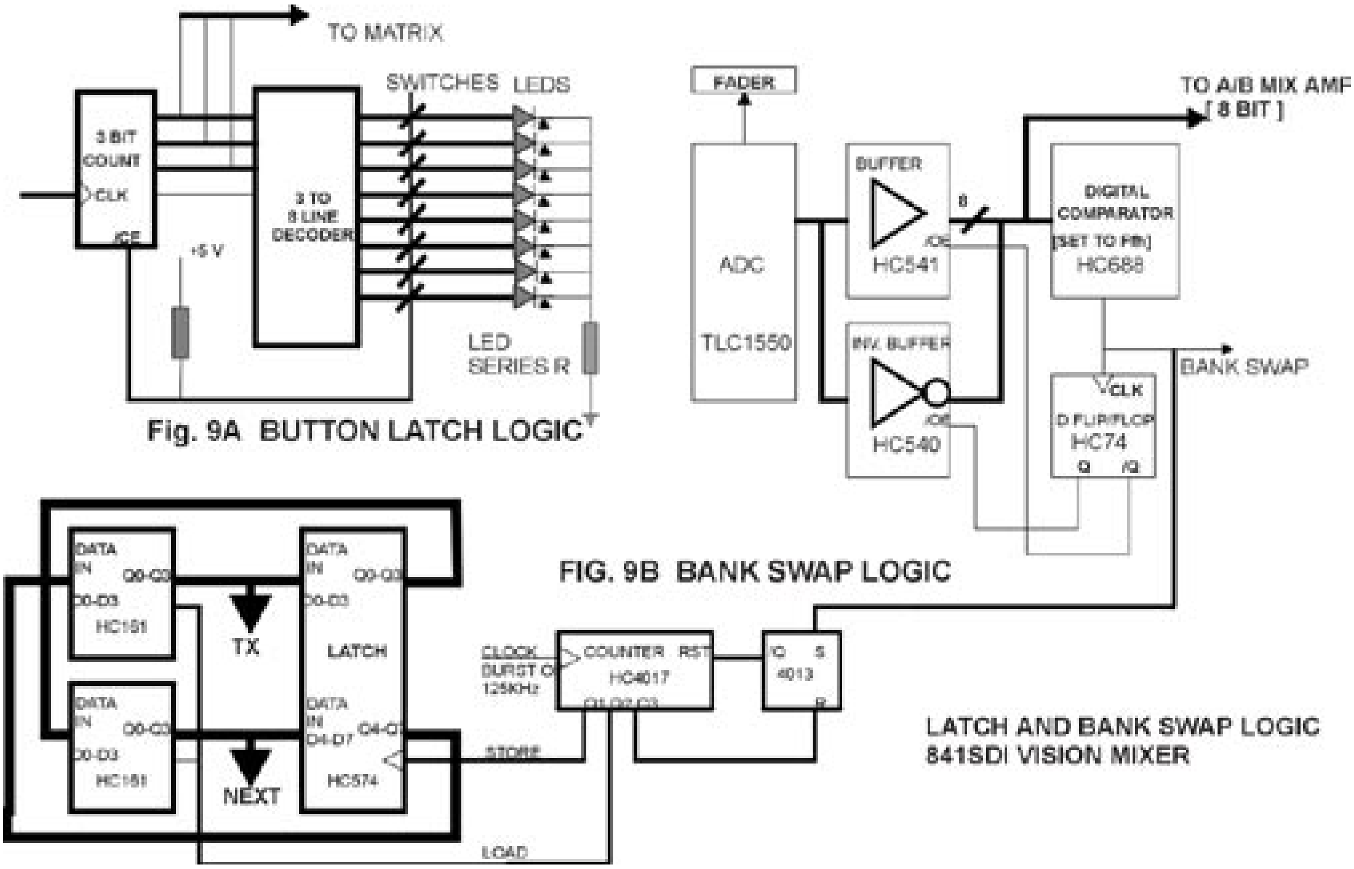
cutting. It needs to be done before the limiters to ensure that the output does not go above EBh. The version I tried uses 2 'HC283 4 bit Full Adders, and a pair of 'HC32 OR gates to ensure that should the sum come to more than FFh, the Carry Out is used to give a valid signal of FFh.

If you are using digital PAL rather than CCIR601 signals, then the adder should work ok. Fig. 10 shows a simple adder to the Y channel.



The PCB layout for the panel is almost finished; it has been tricky to get all the circuitry on, even using SM components.

By the time this appears, the board and metal work should be well ahead.

My old colleague and friend, John Holton, who in the past has done much of the graphics for the IBC Info Channel, has been appointed Chairman of the IBC Exhibition Committee. It remains to be seen how much time he will have, and it may be that the few months before IBC will see me poring over hot PhotoShop and After Effects screens to get some graphics templates ready for September 11th.

Next time I hope to show progress on the panel, together with the two 7" LCD SDI/PAL monitors that are intended to form a bridge behind the mixer panel, and will show TX and Next Event.

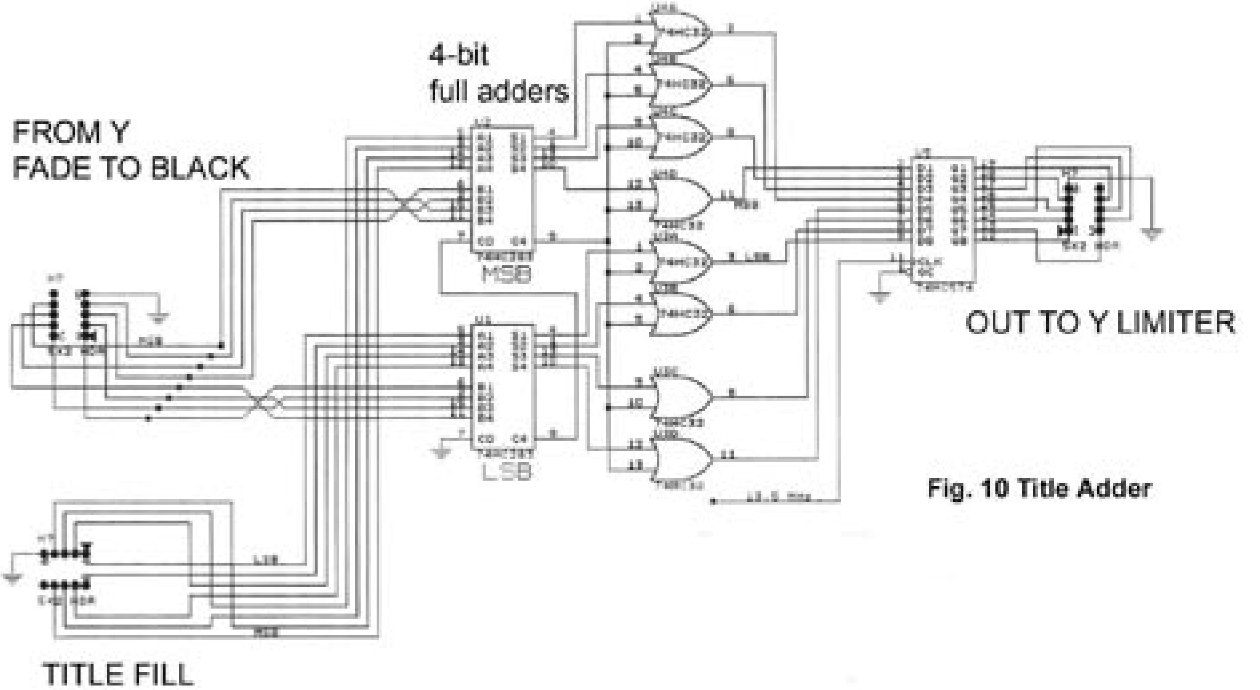


Fig. 10 Title Adder

DATV – Down Under

By Richard L. Carden VK4XRL

December the 3rd saw the first DATV transmissions from VK4XRL, the first in Brisbane and probably the first in Australia. Was it worth it and what were the results? - please read on.

Over the past couple of issues of CQTV we have seen many articles on DATV, some using DVB-T (mostly ex-commercial equipment) while others have used DVB-S. DVB-T uses the CODFM modulation system and, from an amateur point of view, the costs associated with such an undertaking would be prohibitive at this stage. The road taken after many hours of discussions was that of DVB-S, our evaluation was at the time based on costs associated with CODFM and the uncertain future of the 70cm band, at least here in Australia. Our belief was that unless you were going to use 70cm, then the slight shortcomings of DVB-S could be tolerated on the higher bands, where most of the time it was at line of sight. Also DVB-S units were available now, so tests could be carried out to ascertain if this was the way to go.

What system

Three systems using DVB-S have been developed, one by the Dutch and two in Germany. The first system to be developed was that from the Bergische University by Prof. Dr-Ing. Uwe E. Kraus DJ8DW and his team. This system produced an output in the 70cm band. The second system available was that from SR-Systems. The output from this system allowed dual operation in the 23cm and 13cm Band. Separate 23cm and 13cm units were also available. The Dutch system was not available at the time we made a decision, however their web site is worth a look, at as it has lots of valuable information on the DVB-S system. From the above, we decided to go for the system from SR-Systems. With thanks to Stefan we

managed to arrange for a set of boards to be purchased, which arrived in early December 2002.

DVB-S System

What did we receive for our outlay? Thanks to SR-Systems we were able to trace the package right throughout its travel. The box duly arrived and two boards were unwrapped; the third board, the modulator, was already mounted on the Baseband Board. No other information was included with the boards. The system as received was configured for 1291 MHz, FEC ¾ and Symbol rate of 6000. The first test was just in the shack to make sure things worked and also that the frequency was not one of our ATV allotted frequencies. The unit was duly connected to the spectrum analyser with power and video connected. The satellite receiver used for the initial tests was a Hyundai HSS-100C and the required parameters were entered as required. At switch on the satellite receiver came to life and there was a received digital picture. The unit came also with a pre-loaded test picture and this was also received. I next contacted Stefan and via e-mail a new file

was made available with somerequired changes. Also a surf of the net at this stage brought to light some extra information on the units supplied by SR-Systems. Arthur Lambriex had a very nice lot of information on setting up the software, also Rob Krijsman had an article regarding his first experiments. Both these articles were in English and I am indebted to these gentlemen as well as Stefan for the help I received. Upon loading the software, I found I had a corrupt cygwin1.dll file, Stefan then re-sent this file and all was OK. The next problem was to replace the testpic with one of my own. The program TMPGE was downloaded from the Web and, following the information from Arthur, a new testpic was up-loaded successfully. Before any tests could begin a rack system was built to house the system in, to save any wrongly placed items causing a major problem.

Test Results

Tests from the modulator output produced an output of +6dBm with shoulders sitting at –40dBc at 1250MHz. Bandwidth was at 8MHz, which is right for the parameters used. Next a

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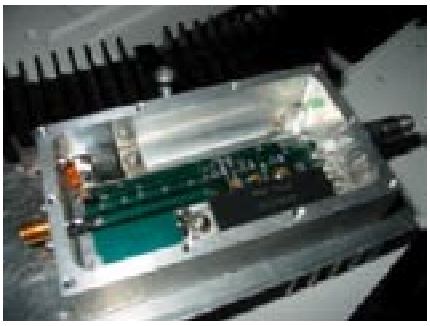
M67715 power module was used for some extra output. A pad of around 8db to 9dB was used at the input to keep the shoulders at least around –30dBc. This produced an output of around 24dBm. A second unit was built and the level was around 26dbm. Information on the net indicated that varying results would be obtained using these devices. From this humble beginning we transmitted to VK4KI about 2 to 3 km away, perfect pictures being received using a Nokia 5400 series satellite receiver. We were also able to test the Teletext system using this receiver. As yet we haven't tackled updating the Teletext software, as the Nokia is the only receiver that has Teletext. The Humax also gave great results, however both receivers switched the testpic on and off. According to the handbook for the Humax, Teletext should have worked via the Teletext decoder in the television receiver, but we couldn't seem to make that work.

Further tests were then conducted from our repeater site at Ocean View about 54km north of my QTH here in Brisbane. This produced astounding pictures especially as we were only using +26dBm from the transmitter. The transmit antenna used was a 36 element yagi while the repeater receive antenna was a quad loop. Pictures were exchanged in both directions with the repeater also retransmitting on 426.25MHz AM. It maybe possible in the future to combine two M67715 power modules to provide some extra output while still maintaining the shoulders at around –28dBc. It was decided not to use the M67762 power module due to poor intermod performance as is. Although I have seen some mention on the Web using this device with modifications to the bias circuit for an output power of around 3W, no modification details were available.



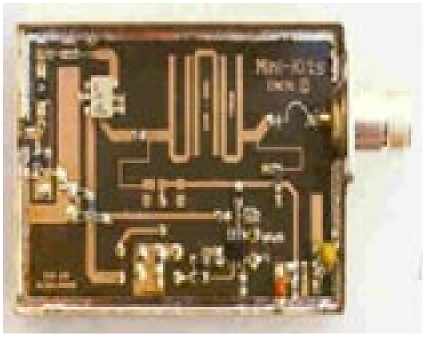
We also took the time to test a couple of class A amplifiers intended for UHF AM transmitters. These were TEKO units and the first unit consisted of a BFQ68 and a BFQ34; this had a gain of around 23db in normal operation. Checking on the data sheets revealed usable gain of 8.5dB and 8.8dB respectively, an overall gain of 17dB. Test results however showed only a gain of +11dB with an output of +17dBm for +6dBm input. The second unit was fitted with a BFW34 and a useable gain at 1200 MHz of +7dB according to the data sheets. With +6dbm input an output of only +9dBm was produced - a gain of only +3dB. Total output from both units combined was +20dBm for +6dBm input a total gain of only 14dB. Further tests maybe required to determine if better results can be obtained.

One pleasing result was that the shoulders were at –38dBcm, that being due of course to the use of Class A type transistors which run on a +28V supply. As a matter of interest the Marconi power-measuring unit showed an output power level of around +29dBm where as all other measurements were done n the Spectrum Analyser.

Further tests in the next few weeks will be carried out on 13cm using a 2W-power amplifier and down-converter from Minikits here in Australia.

Audio

The requirements as to what audio levels to use were non existent. The specification sheet for the PM1800 indicates (incorrectly stated as Analog Output) that FS (Vin=0dBV) or 2.828V p/p. From my understanding FS = Full Scale and refers to the maximum level ie. analog clip level. It is also known as FSD, Full Scale Digital. From what information that I have, the system should be operating at around –18dB, which is the EBU standard. There seems to be quite some confusion in this area. I am now in the process of making an audio interface board with +/- 3dB level control with LED readouts etc. for each transport system in use. Maybe someone could design a LCD screen with readouts using a PIC.



Sending 0vu from my audio desk was causing distortion, which was around 1.2V p/p. We set up a test using the local satellite Optus B3, which has a test channel with reference audio tones. This level was monitored on the CRO and noted. Then our transmission was monitored and the audio level adjusted for the same reading using the same receiver. The required input level was found to be 0.5V RMS that is around –16dBV. This confers with levels noted by Rob Krijsman.

Conclusions

Overall the tests have been very impressive, with most people agreeing they were the best ATV pictures ever seen, commenting on the quality and lack of noise. The power amplifiers will be the biggest challenge especially going up to the higher frequencies. Also I must admit that I would have preferred an IF of 70 MHz and then up-converted as required. The 70 MHz could then be split to all up-converters of feed via cable to the antenna combined with up-converter and amplifier.

One minor point was the use of test-cards or colour bars for testing. Since we are using digital transmission, either the picture is there or not there, therefore the receiver can lock on a still picture. I built a test generator using a PIC with scrolling ident, which uses the pro-

gram called Monoset (V1.2) to change the scrolling text and callsign. Also by use of the push buttons the callsign and clock can be alternatively switched. The encoder uses the Motorola MC1377 because I had one, however future designs would use the AD722 as this has inbuilt filters. Also it would have been nice if the line and sub-carrier relationship could have been locked. I found this more annoying than when viewing it in analogue. Likewise the Cropedy or the newer version from G3RFL can be made to switch several cards in an animation sequence.

One of the problems now encountered is the use of the computer to download required changes. Maybe a small microprocessor for control of minor functions with readout would be nice. While abdicating the use of the computer around the shack for ATV activities, we now have to control DATV transmitters, character generators, OSD units, switchers etc. How can we now control all these devices from the one computer?

I would like to take this opportunity to thank Stefan Reimann from SR-Systems, Arthur Lambriex EA5FIN and Rob Krijsman PE1CHY for their valued help and understanding during this period.

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DVB - ?, pros and cons

By Henk Medenblik, PE1JOK

When seeking for new ways to get rid of the 'old fashioned' analogue amateur television you'll first start to think about digital implementations. That is a good starting point because a digital system has some serious advantages. Unfortunately there are also some disadvantages. We will start with the advantages and work out why DVB-S is chosen so far for D-ATV One of the main advantages of a digital ATV system is the fact that picture quality is improved above that of most analogue systems. We do not encounter the negative effects of noise. We do not encounter video group delay problems, an item on which much attention has been paid by lots of amateurs. Audio quality is improved. With digital ATV we get high quality audio channels, and these high quality audio channels don't even disturb our picture quality! Also it nearly does not extend our occupied bandwidth of our signal, something which is the case with the old fashioned way where we do need some FM modulated audio carriers above our video signal. Other main advantages are the fact that analogue ATV systems occupy a lot of bandwidth. And a wide occupied bandwidth means several disadvantages:

- Less room for others to communicate
- Higher noise bandwidth

The first item is clear. We want to be as efficient as possible. If this can be done without throwing away any quality then this is nice. If we even can improve quality with less occupied bandwidth then we have even more profit! The second item is also very interesting. The higher the bandwidth of a signal the higher the received noise level will be at receiver side because noise is integrated over bandwidth. At the same time modulation schemes are characterized by their minimum threshold levels in order to be able to demodulate the modulated signal. Some digital modulation schemes are able to demodulate at lower threshold levels if we compare this situation to the 'old fashioned' FM ATV systems. One of them is for example QPSK. Now we have two main advantages over our second item. We are able to occupy less bandwidth and we can make use of lower thresholds. This means that generally spoken we could get more out of such a system with less power, better quality and less bandwidth!

Another advantage of a digital ATV system is the fact that bit errors or bursts of bit errors due to imperfections in our transmission path can be corrected. In the past decennia a lot of new coding techniques have been developed which makes digital communication a very robust system.

All these advantages have already been discovered several years ago by the commercial broadcasters. For digital television transmission systems this has leaded to the development of common standardized transmission modes. Hands and brains have been put together and that is how DVB came into life (http://www.dvb.org)

The DVB organization developed three main standards for the transmission of digital television signals. These differences where needed because the transmission media differed on some specific points:

- Transmission from satellite to earth and earth to satellite. This has been developed as the DVB-S(atellite) standard.
- Transmission on cable systems. This had been developed as the DVB-C(able) standard.
- Transmission for Terrestrial. This has been developed as the DVB-T(errestrial) standard.

All three transmission media have some different behaviour. This is the reason why these three different standards have been developed. For example, the satellite to earth transmission path will be characterized by lots of signal path attenuation and line of sight communication. Therefore such a system needs low threshold demodulation. Signal to noise ratio will be worse and therefore nothing more then QPSK can be used. QPSK is a very robust modulation scheme as seen before because it just has to make a decision in one of four quadrants. The low signal to noise ratio on the other hand will be a source for bit errors, both burst errors as single bit errors.

DVB-S

To overcome this weakness, the DVB-S standard uses different layers of Forward Error Correction (FEC) for a very robust protection against any kind of errors. The FEC consists of a Reed Solomon coding which protects against burst errors and also an additional convolutional interleaving to spread out the impact of burst errors. Beside that the system also takes any measures against bit errors by means of convolutional encoding. The convolutional encoding is better known among users of satellite television (although they might not know that....) and is recognizable in a satellite receiver setup menu under the menu item FEC rate. The fact that satellite communication will result in line of sight communication without to worry about obstacles which are placed between the transmission path tells us that less attention is paid in this system on multipath effects. Therefore, the DVB-S standard will be moderate when it comes to robustness against multipath reflections.

DVB-C

The DVB-C standard is developed for digital Television transmission on cable systems. A cable environment is a relative protected environment with respect to distortion and signal path attenuation. Higher signal to noise ratios can be achieved and the fact that there is no negative effect of multipath this standard is able to implement higher order modulation schemes. These modulation schemes are mostly restricted starting from QPSK up to 256QAM. Under very good defined environments this is extended up to 1024QAM! The FEC implementation for DVB-C is weaker than the case for DVB-S because less environmental disturbances exist. The FEC is limited to the use of a Reed Solomon encoder and convolutional interleave for protection against burst errors. DVB-C generally requires higher signal to noise ratios at receiver side due to the higher order modulation schemes and the weaker FEC implementation.

This is one reason why DVB-C is not preferred above DVB-S for Digital Amateur Television. Besides that, DVB-C is due to its higher order modulation schemes more susceptible to multipath reflections then DVB-S. When we look at comparison related to hardware issues than we see that a lot of commercial chipsets exists for DVB-C. Therefore there will be less need to build it from the ground up in some FPGA hardware. Besides that, when implemented in FPGA hardware then generally this will require more FPGA space then an DVB-S modulator implementation due to the fact that the symbol shaping filters will require bigger multipliers because of the higher order modulation scheme which requires a larger word length at the input of the filter.

DVB-T

Finally we get to the DVB-T standard. This standard was developed for terrestrial communication with the aim to overcome the destructive effects of multipath reflections. The datarates for broadcasting services are high. Therefore, the higher the bit rate the higher the negative effects of multipath reflections. The path attenuations can be frequency dependent and as a result from that this can result in a partly distorted received signal. Also the multipath reflections cause Inter Symbol Interference because reflections of the received signal interfere with the direct received path. It should be clear that the higher the bitrate or symbolrate, the higher the negative effects of these disturbances.

With terrestrial communications there will be a big chance on multipath due to the fact that mostly no line of sight communication exists due to all kind of obstacles. There is a way to overcome these disturbances. With DVB-T the effective bit rate is spread out over a large amount of digital modulated carriers. These different carriers are generally modulated with QPSK or QAM constellations. The larger the amount of carriers, the lower the effective bit rate that can be used for every single carrier. The lower the effective bit rate per carrier, the lower the negative effects of multipath reflections will be. This is the basically idea behind DVB-T. Spreading out the bit rate over a large amount of carriers. But now we come to the point, how do we create such a large amount of digital modulated carriers? For DVB-T this will be 1705 carriers for the 2K mode and 6817 carriers for the 8K mode. You can imagine that it will be impossible to make such a amount of different frequency synthesizers with VCO's and PLL chips. Furthermore, another very important issue is the fact that all these different carriers have to be spaced from each other in such a way that they do not interfere with each other and at the same time close enough so that the resultant occupied spectrum will also be as small enough. In difficult terms this is called 'orthogonality'. The carriers must be orthogonal spaced.

There exist a mathematical way to create all these carriers orthogonal spaced from each other. This is done with the Inverse Fast Fourier Transform also called IFFT. Now it works as following: The incoming bitstream is encoded with Forward Error Correction blocks like Reed Solomon and convolutional interleaving and finally convolutional encoding. After the FEC the resulting bitstream is mapped on all the constellations for the separate carriers. The resulting constellations are the input for the IFFT processor block which performs the actual transformation from frequency to time domain. After the IFFT a cyclic extension is performed on the resulting OFDM symbol which is used for the guard interval. The guard interval gives additional protection against multipath reflections. The resultant complex output of the IFFT block can then be converted to RF with a 1/Q modulator. As you can see this is a very global description of the most difficult implementation of DVB. Also with the above simple description the name of the modulation scheme is explained; Orthogonal Frequency Division Multiplexing (OFDM).

Although DVB-T is designed for best protection and robustness, it takes a lot of very fast hardware for an actual implementation. Specifically the IFFT block has a big impact on hardware implementation. Beside that, OFDM needs a high signal to noise ratio for demodulation.

Which choice for D-ATV

If we look at the possibilities for D-ATV then we come to the conclusion that DVB-T will be the ultimate if it comes to robustness. However, the high signal to noise ratio which is needed for demodulation, the big impact on hardware implementation and the fact that commercial DVB-T set-top boxes are not widely available yet, let us come to the conclusion that DVB-T is currently far away for amateur use. DVB-C has worse error protection, and the higher order modulation schemes result in higher signal to noise ratios needed at receiver side and worse protection against multipath. Also the lack of available commercial set-top boxes at this moment is a reason why this standard is not preferred for D-ATV. If we look to hardware requirements for a transmitter implementation then we have the possibility to use a wide range of commercial chipsets.

DVB-S

DVB-S finally, has a big error protection, uses very robust QPSK for modulation which requires low signal to noise ratios for proper demodulation. It isn't the best choice against multipath. However, the fact that lot of experiments in Germany and The Netherlands ended with very positive results showed out that these negative effects are less worse then expected. Beside that, a lot of cheap commercial set-top boxes exist which is a major advantage for D-ATV use. Finally, hardware implementation is a little bit more difficult then for the DVB-C case but far easier then a full DVB-T implementation.

Conclusion

DVB-S is the best choice so far for D-ATV.

Now that we have described the main differences of the various DVB standards and also named some advantages above the 'old fashioned' analogueue television broadcasting techniques we come to the discussion of a big disadvantage. As we have seen in a previous articles in Repeater about nonlinear amplification of digital modulated signals, the M-QAM techniques and also OFDM will require very linear amplifiers. With linear we don't talk about as linear as we need for SSB techniques but even more! The large amplitude swings of the carrier introduce very high intermodulation levels when the signal is non-linearly amplified. The effects are seen as spectral regrowth as described before. Although QPSK is quite robust and will still work correctly with quite high spectral regrowth levels, there is also a need to transmit a nicely shaped spectrum in order to be spectrally efficient. As stated before, D-ATV generally will need less power compared to FM TV techniques but this will not mean that the amplifiers need to be smaller! In fact, in order to keep spectral regrowth levels low enough, power amplifiers will need to be biased in class-A and the output drive levels will need to be in the order of 7-10 dB below the 1 dB compression point in order to keep spectral regrowth below -40 dBc. Therefore, a lot of commonly used handy class AB power modules can be thrown away and we have to start to build our own highly linear amplifiers again.

Another disadvantage is the delay, which occurs due to the MPEG encoding and decoding process. These delays are mainly determined by the actual MPEG encoder and also by the actual used MPEG decoder. The Philips MPEG encoder which is currently used for the Dutch DATV project seems to introduce less delay than the Fujitsu MPEG encoder which is used by both German D-ATV teams. About half a

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second of delay is a common value. Therefore, for full duplex transmissions you'll need headphones in order to converse with each other. Finally we get to the last disadvantage of D-ATV. With D-ATV there is no distinct in picture quality. This means that there are two options. We do or we do not have contact. If we see some picture then it is from utmost quality. If you are familiar with the 'old fashioned' FM TV then you'll undergo a new experience when you see D-ATV! But if the received signal is too weak then you'll see nothing. If we would have to qualify it within a scale from BO-B5 then you'll only experience values of BO or B5+++++++! So in practice you'll have to be sure that aerials are placed in position. However, if you finally experience your first live D-ATV transmission then you'll never want anything else again!

Visit the Dutch D-ATV team internet site - everything you always wanted to know about D-ATV - www.d-atv.com

Reprinted from Repeater magazine Volume 6, issue 3 - www.cchmedia.nl

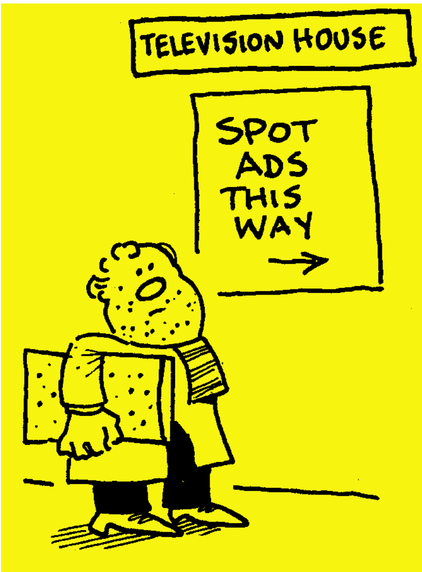
Spots for Five Seconds

Dicky Howett takes a Natural Break

From the very beginning in 1955, all the regional ITV companies had London headquarters (quite a few had London studios). But a London Office was a 'must'. After all, that was where the tempting honey-pot of television advertising was. Elsewhere was the considered the 'sticks'. In 1959 l worked in London, employed as an office boy in a Soho-based advertising studio. As an acned 15 year-old, my humble tasks included making tea and ferrying artwork between the ad studio, the printers or the clients. Occasionally, I took artwork to commercial television companies. At the time, they had premises in Hanover Square (ABC TV), Golden Square (Granada TV) and Great Cumberland Place (ATV) Sometimes I delivered material to an imposing ITV building in Kingsway (once called Adastral House, formally home to the Air Ministry) and now aptly re-christened 'Television House '. This was the home of Associated-Rediffusion Ltd (it also contained the studios of ITN plus an office for Scottish Television).

The advertising artwork that I diligently transported consisted of short messages, (perhaps illustrated), that were 10in x 8in captions used in 'spot commercials'. It was simple, direct stuff. No fancy video shoots or clever angles. Just a bit of cardboard. Cardboard or not, it certainly made money for everyone, especially the television companies. For example, back in 1961 one could purchase, courtesy of (say) ATV (in the Midlands) a five-second slide with announcer's voice-over on Lunch Box for fifteen quid. At peak times the cost of an ATV (in the Midlands) five-second slot rocketed to a staggering £70! By way of financial contrast, the all-day five-second price on Ulster Television was a mere £8. ABC TV on the other hand would charge for five seconds, a weekend top rate (Sunday evenings) of £576. But that was the cheap end of the television advertising market. The expensive stuff (at 1961 prices in the London or Midlands area) ran at an average £1,000 for an ordinary 30-second peak-time airing of a filmed commercial.

Those simple 'flash' commercials (still used - Channel (island) Television is a current example of the local school of TV advertising) represented good value and were an easy means for the small business or members of the public to advertise on the telly.



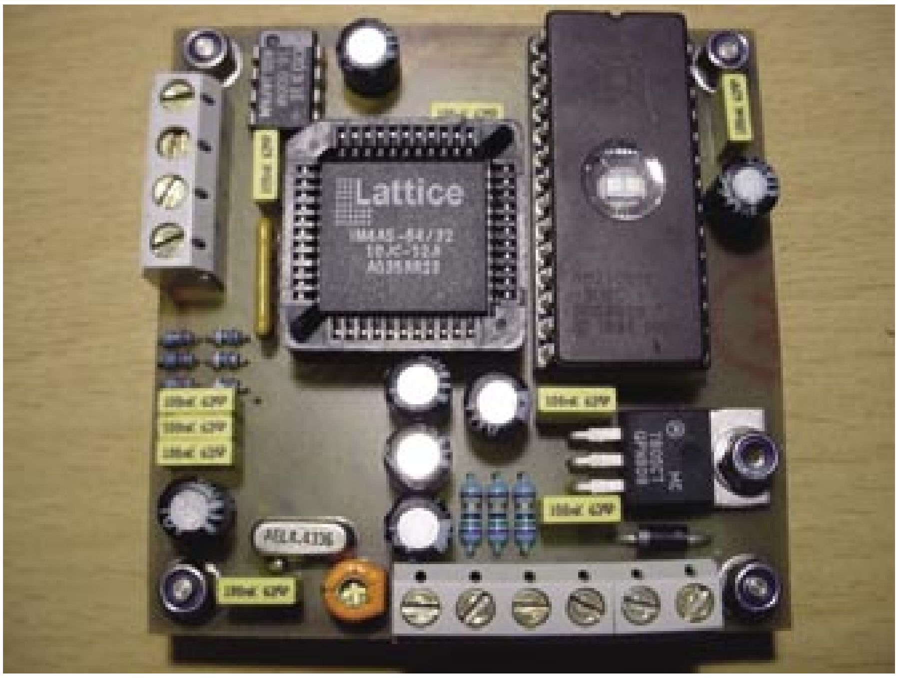
But to return to 1959, I always enjoyed visiting the ITV offices because simple soul that I was, those offices appealed to my love of telly glamour and slick production (the late nineteen-fifties was an exciting time tellywise, with new ITV companies opening every few months or so). These ITV offices had always lots of 'star' photographs on the walls and sometimes a real live star would wander in. The office decor was very 50s modern, with carpets in deep-pile pastels. There were also wire chairs to admire and an abundance of Hughie Greenery draped all around. (In fact, those ITV establishments were quite faithfully recreated in British TV 'piss-take' movies of the time. ITV establishments really were flashy and a bit vulgar with 'spivish' executives and receptionists hired more for their lipstick and vital statistics than their typing speeds (one suspects). Of course this up-beat, modern ambience was all calculated to attract advertising and be in direct contrast to the 'stuffy' old BBC, who would never cheapen themselves to anything redolent of 'commercialism'. The upshot was that was that the poor old BBC in the late 1950s by comparison to ITV always looked as if it was furnished from a Civil Service redundant furniture depot, with staff to match.

Returning to Television House, another aspect worth recalling is that in the late 1960s, the last incumbent, Thames Television, transmitted a daily magazine programme called Today. This was presented by Eamonn Andrews and was broadcast sometimes from the building's cramped glass-fronted foyer, adjacent to the Aldwych. When not on the air, the technical gear was left in situ. Amongst the kit, a Marconi Mk III monochrome camera (painted a shade of blue) and fitted with an Angenieux 10:1 servo-operated zoom, was perched on a Vinten Pathfinder dolly. The whole ensemble 'posed' in the window to publicise Thames and the programme. I passed this interesting display many times and of course, never thought to photograph it.

By 1970 Thames had vacated the building for Euston, and I forever missed my chance of an historic snap-shot. As a footnote, I purchased recently an old pedestal. This pedestal (an ancient Debrie 'Pied Chariot') was used originally way back by Associated-Rediffusion in their studios at Wembley Park and also Television House. That intriguing fact not withstanding, my dear wife has since vetoed my brilliant idea of displaying the Debrie, (purely by way of a commemoration to AR-TV/Thames Television) in our lounge window.

Colour Test Card Generator - Review

ByTrevor Brown



John Hudson G3RFL has recently designed a small stand alone colour test card generator. The unit has a power requirement of 8 to 15v at 90 mA and provides a fully interlaced PAL or Y/C output.

John was kind enough to bring one over to me for testing.

It is a single PCB about 2.5" square on which are 4 chips one of which is a lattice programmed array. The testcard data is stored in an EPROM along with 15 other useful test signals. These are selectable by steping through them with a single push-button.

It was a simple matter to wire 12v volts to the PCB and a video out connection to my scope and monitor. The unit worked first time and the testcard displayed my callsign.

The on board PAL Coder is an analogue device AD724 and is surface mounted on the underside of the PCB. It produced some very pleasant signals, which locked on my vectorscope and showed the burst to be a little low in amplitude with respect to chroma. The line timings were all within CCIR spec and the on screen testcard and details were clearly readable.

John is now marketing these PCB's ready built and programmed with the details that you supply him. These include the large callsign display up to 7 characters and two lines of smaller print for name QTH QRA or any other information you require for £70 plus 3.50 p&P.

I have to say that this small elegant PCB could have a lot of applications in ATV from repeaters to portable transmitters, and at £70 you could afford to build the PCB into your equipment.

John also is able to replace the 16 pages with a single page of animation (16 keyframes). He did not demonstrate this feature, but I am in no doubt that John knows his engineering onions and what he says is what he can do.

For more information you can visit John's website www.g3rfl.ukhome.net or give him a ring on 01253 850758.

A mighty Marconi Mk3 with zoom lens and addition rifle mic on top. The camera and attendant clambering crowd await a royal parade in 1963 - Dicky Howett

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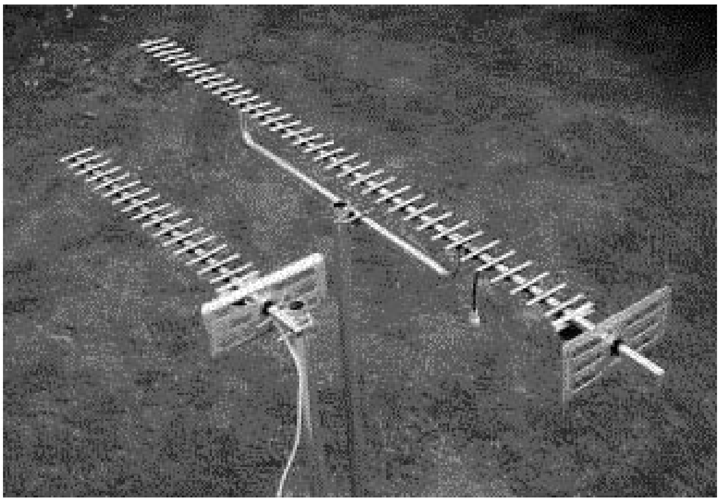

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Quarter page	£50	£75
Half page	£100	£150
Full page	£150	£200

STV 5730A - Thank You

By Richard L. Carden VK4XRL

I would like to thank all those people at BATC especially the editor Ian Pawson for selecting me and of course the people at Black Box Camera Company Ltd. for the gift.

As you can see from the photo its up and running.

As is, the unit is a pain to use without suitable software. Using the HyperTerminal program and trying to remember all the commands without deleting any information you already have was frustrating, to say the least. Please don't get me wrong, with a little foresight into how it would be operated in a real world situation this a very handy tool.

The only good thing at this stage is the first page, which comes up each time on switch on. Using a PC is OK, if only you could change the pages without a PC, especially in the field.

Two things are required to make this unit function properly, not only for ATV, but in semi-professional set-ups also. A software program could be developed to allow for easier text formatting and editing. This could be done at home and then a simple PIC or the new PICAXE micro could be used to page up or down. Maybe even a dedicated keyboard with some page memory could be developed for portable use?

Some of these ideas could be used as a basis of a club project where the prize could be one of these units - what do you think?

One always needs a dedicated computer these days in the shack which now has to be shared between the DATV transmitter, switcher, teletext, testcard generator etc. as well as being used for an ident generator. With only two comms ports available, maybe a USB interface could be used to allow for more control over the number of devices connected to the computer.

In light of the above one has to remember that the unit was only developed as a STV5730A project board. However the over all results as seen on screen are very good. Further information can be obtained from there web site www.stv5730a.co.uk. Also see the article in CQ-TV 201 by Trevor Brown.

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Satellite TV News

By Paul Holland G3TZO

Welcome to yet another edition of Satellite TV News. As usual there are details of a host of new services coming on stream and a reflection of the ever-changing nature of the technology being developed for Satellite delivered broadcast services. Events in the Middle East were building to a climax as the editorial deadline approached with Satellite delivered news feeds being activated on an increasingly frequent basis. Hopefully it will be all over by the time you read this……….

Transponder News

As usual the following snippets of new represent a tiny fraction of the changes taking place on an almost hourly basis. For up to the minute news of changes I suggest you use the Internet to visit the following two excellent sites http://www.lyngsat.com/ (for every satellite aloft) whilst Stefan Hagedorn provides daily email updates of the changes which are taking place at http://stefan.hagedorn.de/transpon2.htm. For more detailed information on active feeds try http://www.satelliweb.com/.

ORF2 Unscrambled

Austrian public broadcaster Österreichischer Rundfunk (ORF) will cease encryption of the satellite feed of its domestic TV channel ORF2 from an unspecified date in 2004. ORF2 is currently carried within ORF's digital package on Astra at 19.2° East, Tp 117 12.693 GHz (H), SR 22.000, FEC 5/6, and is encrypted for copyright reasons to restrict access to Austria. Smartcards are currently only given to domestic licence fee payers.

CCTV-9 is now on Eurobird 1 as part of the Sky Digital platform using 11662 GHz SR 27500 FEC 2/3. CCTV-9 is uplinked from Beijing to the PAS10 satellite and is downlinked at GlobeCast's Paris teleport. The signal is then uplinked back to Eurobird 1.

Arabsat 3A 26.0 Deg E - EDTV Channel, Al Mustakillah TV, Yemen TV, TV 7 (Tunisia), Sharjah TV, Al-Jazeera Satellite Channel, Jordan Satellite Channel and RTM 1 have started on 11938 GHz (V) SR 27500 FEC 3/4.

Hot Bird 6 13.0 Deg E - Middle East Broadcasting (MBC) has launched a 24-hour news channel Al-Arabiya which has replaced MBC Europe on 12597GHz (V) SR 27500 FEC 3/4.

Sirius 2/3, 5.0 Deg E - Moscow Open World TV has started on transponder 12.380 GHz (H) SR 27500, FEC 3/4.

Thor 2A/Thor 3, 0,8 Deg W - BBC Prime (Conax) and BBC World (FTA) have moved from 11.357 GHz (H) to 11.325GHz (H) using SR 24500, FEC 7/8.

Hispasat 1 A-D, 30 Deg W - Check for occasional feeds on 12.621 GHz v (SR 13600, FEC 3/4).

NSS8

New Skies Satellites (NSS) the global satellite operator based in The Hague plans to change the orbital assignment for its yet-to-be launched NSS-8 satellite. The spacecraft was originally scheduled to be launched to 105 Deg W to serve the Americas, but will now be deployed at the 57 Deg E to expand capacity in the Indian Ocean region. NSS-8 is expected to commence commercial service by January 2005.

Iraq Conflict

With the onset of hostilities in the Middle East, Associated Press Television News (APTN) launched APTN Direct in late March. The service provided two extra channels available to television news companies that subscribe to its main satellite service, known as the Global Video Wire. APTN planned to use 12 satellite earth stations to the region - including five, which were truck-mounted. The satellite trucks are specially constructed desert-friendly vehicles with the latest, lightweight uplinks mounted on the roof. APTN will use video over satellite telephones to give them maximum mobility and speed of delivery. The following picture from APTN in Baghdad was captured on Eutelsat W1 at 10.0 Deg E Frequency 10966 GHz (V) SR: 4167 - FEC: 5/6

Low Cost Satellite Return Path

SES ASTRA has announced an agreement to develop a low cost satellite-based response channel for direct-to-home set-top-boxes. The service, to be called Satmode, will provide an always-on satellite return path between a digital TV set-top-box in a user's home and content providers. The interactivity enabled by the return link will greatly enhance future applications such as video-on-demand, messaging, gaming and growing audience interaction in various types of shows. Since it is intended that Satmode will be fully integrated into the set-top box and linked to the satellite system via the return path, the use of a telephone return channel will no longer be necessary. Canal+ Technologies are to design and integrate a Satmode test system prior to the end of 2003 working with Thomson who will manufacture the modem-equipped interactive set-top box and interactive antenna components.

Ariane 5 Failure Report

The inquiry board set up to examine the cause of last years Ariane 5 launch failure which ditched Hot Bird 8 in the Atlantic has issued its report. The board concluded that the problems were caused by a piece of hardware specific to the Ariane 5 10-ton rocket and not found on the basic Ariane 5 model. This represents a major failure for Arianespace as it attempts to develop a more powerful version of the Ariane 5 launcher. The Arianespace-led inquiry board said the anomaly was caused by a leak in the Vulcain 2 engine nozzle's cooling circuit, followed by a critical overheating of the nozzle. The baseline Ariane 5 uses a Vulcain 1 engine that has so far not shown any weaknesses in the functioning and resistance of its nozzle. The next launch of using an Ariane 5 launcher was that for Eutelsat's E-Bird which was scheduled for April as we closed for press.

Space Tug

Further news has emerged on the "Space Tug" mentioned in the last issue. The geosynchronous spacecraft life extension system (SLES) otherwise known as the "space tug" will link up with orbiting spacecraft in need of a little TLC. The manufacturer, Orbital Recovery, has selected Arianespace as the preferred launch company for the SLES and intends to launch at least four space tugs beginning in 2005. The

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SLES will be carried as a secondary payload on Ariane launches, with a lift-off mass of between 500 kilograms and 800 kilograms, depending on the space tug's specific mission. As mentioned last time the SLES is designed to extend the useful lifetime of expiring telecommunications satellites by 10 years or more, and also is capable of rescuing satellites stranded in incorrect orbits.

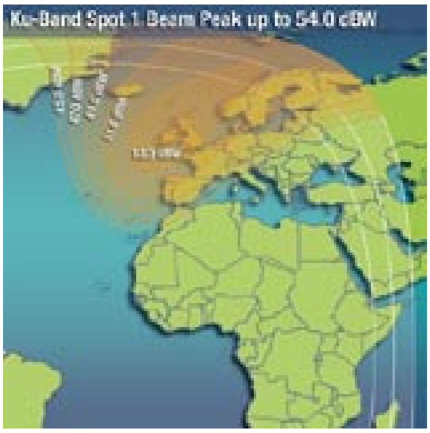
Recent Launches

Intelsat 907

Intelsat 907 satellite was successfully launched aboard an Ariane 44L vehicle on 15 February 2003 and was expected to be operational in March. Intelsat 907 will be located at 27.5º W and will provide capacity for telephony, corporate networks, Internet, video and hybrid space/terrestrial solutions on its 76 C-band and 22 Ku-band transponders (measured in 36 MHz equivalent units). The satellite will provide high power Ku-band spot beam coverage for Western Europe and West Africa and additional C-band capacity to the Americas, Europe and Africa. The high power and coverage area of the Intelsat 907 satellite will enable it to support VSATs, broadcast content distribution and broadband applications, including high-speed Internet access, multicasting and streaming. The successful launch of Intelsat 907 represents the completion of the Intelsat 9 series launches. Intelsat 907 will replace Intelsat 605, which currently holds the 27.5º W orbital slot and which will now be moved to a new location at 29.5º W to support additional customer demand in the Americas, Europe and Africa. Intelsat 907 was testing at 25.8 º W as we closed for press

Fact File

- Total Transponders: C-Band: Up to 76 (in equiv. 36 MHz units) Ku-Band: 22 (in equiv. 36 MHz units).
- Polarisation: C Band: Circular, Ku-Band: Linear
- Uplink Frequency: C-Band: 5850 to 6425 MHz Ku-Band: 14.00 to 14.50 GHz.
- Downlink Frequency: C-Band: 3625 to 4200 MHz, Ku-Band: 10.95 to 11.20 GHz and 11.45 to 11.70 GHz.
- SFD Range: (beam edge) C-Band: -89.0 to -67.0 dBW/m^2, Ku-Band: -87.0 to -69.0 dBW/m^2



New Channels

HDTV Channel to Launch

A brand new European TV channel called Euro1080 will start broadcasting exclusively in high definition throughout Europe on January 1st 2004. As mentioned in the last issue of Satellite TV News there is now an increasing pace in the development of HDTV broadcasting all over the world. There are now existing or proposed services by Japan TV, Korean Broadcasting, CCTV China, Australia (all channels from July 1st 2003 on) and in the Americas (various channels in the USA including 'HD net', 'TV Azteca-Mexico', 'TV Globo-Brasil'). For the 2004 Olympics in Athens, some 10 broadcasters have requested the acquisition and distribution of HD signals. The Euro1080 Channel will provide sports, music, events, shows, entertainment spectacles and European films focussing on content that best demonstrate the platform. The stated longer-term objective of Euro1080 is to promote an increase in consumers with HD TV sets at home. Euro1080 Channel will broadcast high production-value programmes accompanied with Dolby Digital surround-sound and will have European-wide coverage. Although at the launch there will be few domestic HDTV sets in Europe, the channel aims to get established initially by distributing content through theatres with HD projection capabilities and selected other appropriate venues (e.g. sports bars, etc.) equipped with plasma or other HD displays. The location for the station is near Antwerp in Belgium from where the contribution and actual broadcasting will be managed

More UKTV

UK broadcaster UKTV is considering the launch of a trio of new channels dedicated to nature, comedy and DIY. The stations are likely to be called UK Nature, UK Comedy and UK DIY and will begin on Sky Digital before the end of the year.

Ici Paris

In further pursuit of plans for global domination the French government has given its approval for the launch of an independent international news channel, which it hopes will one day rival CNN and the BBC. The station will be set up in association with Reseau France Outremer and Franco-German channel Arte. The proposed channel will broadcast in number of languages including French, English and Arabic. Final plans for the channel will be presented to French parliament in June.

TV.München, the commercial regional broadcaster serving Munich, aims to launch on satellite. It is likely that TV.München will join sister channel TV.Berlin that is already available on Astra. A launch date has not been finalised yet.

Off Air

Moscow Open World TV has started on Sirius 3 at 5.2 Deg E 12.380 GHz (H) SR 27500, FEC3/4.

New Arabic news channel Al Arabiya has appeared on a number of satellites. This version was received from Arabsat 3A at 26.0 Deg E.

With hours to go before the deadline for war in Iraq there was an air of surrealism on Iraqi TV with rather soporific pastoral views. Showing pictures of the various bridges in Baghdad may well have been unwise with the benefit of hindsight.

Date	Satellite	Launcher	Slot	Comments
030325	E-Bird	Ariane 5	25.5ºE	20 Ku tps
0304	Yamal 202	Proton	49.0ºE	18 C tps footprint maps
0304*06	Eutelsat W3A		7.0ºE	50 Ka & Ku tps co-located with Eutelsat W3
03	Hellas Sat 2	Atlas 5	39.0ºE	30 Ku tps
03	Zohreh 1	Proton	34.0ºE	12 Ku tps
03	Express AM 1	Proton	40.0ºE	18 Ku and 9 C and 1 L tps footprint maps
0307-09	NSS 8	Zenit 3	57.0ºE	36 Ku and 56 C tps
0307-12	Hot Bird 8		13.0ºE	4 Ka and 44 Ku tps will replace Hot Bird 1 and Hot Bird 2
0401-0409	Express AM 22	Proton	53.0ºE	24 Ku tps footprint maps
04	Europe*Star 2		45.0ºE	30 Ku tps footprint maps

Upcoming Launches

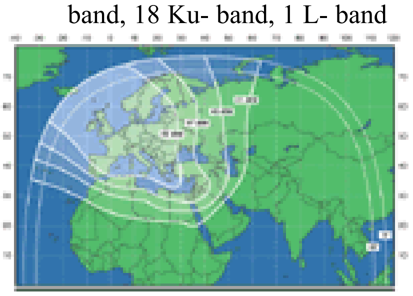
With the failures of Astra 1K and Hot Bird 7 last year now behind us we can look forward to a number of interesting launches this year. Satellite operators will no doubt be cautious in the wake of last year's disasters to be certain that problems with the Ariane 5 and Proton launchers have been resolved before committing to planned launch dates. The dates here therefore are all subject to change.

Express-AM1

The Express-AM1 satellite has been manufactured in Russia by NPO PRIKLADNOI MECHANIKI and is designed to provide a package of communications services including digital TV, telephony, video conferencing, data transmission, the Internet access and VSAT applications. The Express-AM1 spacecraft will provide coverage in both C- and Ku- bands.

Fact File

- Orbit: 40° E
- Operational lifetime: 12 years
- Stabilisation: Three axes
- Payload electric power: 4200 W
- Mass of payload: 570 kg
- Mass: 2600 kg
- Power supply: 6000 W
- Number of transponders: 9 C-band, 18 Ku- band, 1 L- band



New Products
Satellite TV on the move

Those unlucky enough not to be at the recent Consumer Electronics Show in Las Vegas with have missed seeing KVH Industries unveil their TracVision A5 in-motion satellite TV antenna. The system uses a 4-½ inch high phased-array antenna to enable satellite TV in SUVs, mini-vans and other vehicles equipped with entertainment systems. Its not clear if this equipment will make it over here in Europe or indeed if any demand exists for satellite TV on the move!

Proton Launch Failure

The quaintly named "oversight board" which was convened by International Launch Services (ILS) to investigate the Nov. 26 launch failure of a Proton/ Block DM rocket which left the SES Astra 1K satellite in a lower-than-planned orbit has completed its initial review. It identified problems with engine components of the Block DM's upper stage made by RSC Energia. The anomaly occurred at the start of the second Block DM main engine burn. Excessive fuel in the main engine ignited and caused extraordinarily high temperatures that destroyed the engine, the Russian commission found. The commission attributed the failure to contamination in engine components of the Block DM upper stage. The engine propellant was not cited as a potential root cause. ILS now intends to resume satellite launches following completion of the Oversight Board (FROB) investigation with the launch of Echostar 9 in May.

Post Bag

Ivan G3WBA emailed to say he has purchased an ATI ALL in WONDER 128 TV card for his PC at a local computer fair I. All apparently works well except the TV sound. On checking the manufacturer's web site he finds that the card is configured for PAL B/G. He is now trying to affect a change to PAL I and wonders if anyone else has attempted this and could suggest the best way to tackle it. I will pass any comments on. It was not clear from Ivan's mail if the card is equipped with the usual stereo audio output terminals.

Nick G4IMO has written to advise details of the Amateur Radio monthly transmissions from SM6CKU via Astra 1A at 5.0 Deg E. Transmissions will appear on or around the 9th of each month. As Nick says the Astra 1A is in inclined orbit so you may need to do a bit of additional tweaking of the tracking. Details of the upcoming programme each month are available on http://www.parabolic.se/index2.html. Check 11.323 GHz (H) SR 6667 FEC 1/2 Vpid 4130 Apid 4131 PCR 4130.

Peter Vince (G8ZZR) emailed with a very interesting description of his control room activities within BBC Engineering. He says the control-room use an analogue video-grabber card on a Macintosh to grab the spectrum analyser display in order to advise operators like Eutelsat where interference spikes on a leased transponder sometimes occur. The same video grabber is also used to capture the occasional interesting test card seen coming in. A recent example of this was the unusual test card from Mongolian Television (RTV) pictured below.

Peter advises of a Swedish website that has over a hundred test card images that can be found at: http://www.thbe.nu/testcards/ . Peter was involved with the creation of the widescreen test card (Test Card W) and Test Card J - the 4:3 replacement for F with the improved centre picture. More information on his activities can be found on his website at http://www.noctua.demon.co.uk/video/. Peter also refers to the satellite affliction known as "sun-outages" which occur twice a year. This happens when the sun follows the same path through the sky as the geo-stationary satellite arc, and the noise from the sun can affect reception on the ground. Peter does some calculations as part of his BBC

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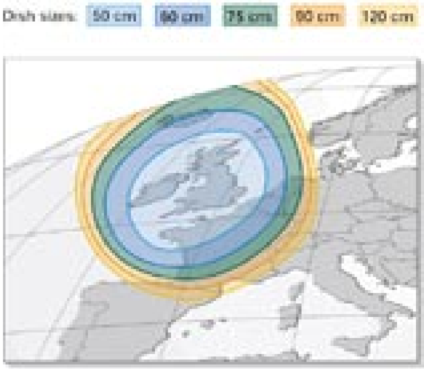
role in order that BBC link planners aren't taken by surprise when this phenomenon occurs. There are a number of pages on his website dealing with sun outages so for more information check: http://www.noctua.demon.co.uk/sun_outages/

BBC Channels to go FTA

As we closed for press there has been much discussion regarding a plan by the BBC to drop their existing Mediaguard encryption of BBC 1, 2, 3 & 4 and go FTA at 28.0 Deg E. The technical argument is by moving from Eurobird 1 to Astra 2D that the tighter footprint centred on the UK overcomes problems of programmes that are subject to various copyright restrictions. The commercial imperative seems more tied into saving £85m that the BBC pays B-Sky-B for encryption and carriage. If the BBC plans go ahead at the end of May we will see all 22 regional versions of BBC1 and BBC2 plus eight



digital channels including News 24, BBC3 and BBC4 appear somewhere within the Sky EPG. Where these services actually appear in the EPG is still subject to negotiation between the BBC and Sky.

Conclusion

That's it again for this edition. Thanks to those who have written, emailed and sent me information for use in the column. Please do write in and let me know what you are doing and let me have your news and views on the satellite TV related news matters. As usual the contact details are the same; email via paul.holland@btinternet.com or phone to 01948 770429.

East Yorkshire Repeater Group (Wanted)

By Richard Parkes G7MFO

Last year we were fortunate to acquire the local council 'emergency planning committee' tower. This is a commercial tower which you climb up the centre.

We are hoping to replace the 25m wind-up mast with this 'new' tower. We are in the process of making a new 8m section; this will make the tower a total of 26m in height.

We are after 3 x 3m lengths of Rail-Lock made out of aluminium and a Rail-Lock 'Trolley'. This is the safety system 'bar' which you will have seen on commercial towers. If you know of a mast installer or where I can get hold of the Rail-Lock please get in touch with me.

Last year we managed to purchase a Ferrograph 63 tri-colour LED display board from a rally. This is to be used on the repeater group rally stand. We are having problems communicating with it. We are after some software or help on the command codes to 'talk' to it via a PC.

A full article on the work involved on the removal, extending and planting of the tower, will hopefully be published in CQ-TV latter in the year.

Richard Parkes G7MFO 7 Main Street, Preston, Hull. HU12 8UB. England. Tel:- 01482 898559

E-mail: richard@g7mfo.karoo.co.uk

Continuous tuning for G1MFG receivers

Why not to do it, and how - by G1MFG

Over the time I've been offering my receivers a few people have asked about a continuous tuning modification. Indeed, there have been a few designs published on the Internet. The well-known LCD controller gives virtually continuous tuning whilst retaining the benefits of synthesiser operation, whereas going for true continuous (voltage) tuning is fraught with problems and significantly reduces the stability of the receiver. Further to a request published in the last CQ-TV, here's a discussion of the whys and wherefores of continuous tuning on a G1MFG.com 23/24cm receiver. Hopefully I can convince you that continuous tuning is essentially unnecessary, and a very Bad Idea. Then I'll tell you how to do it!

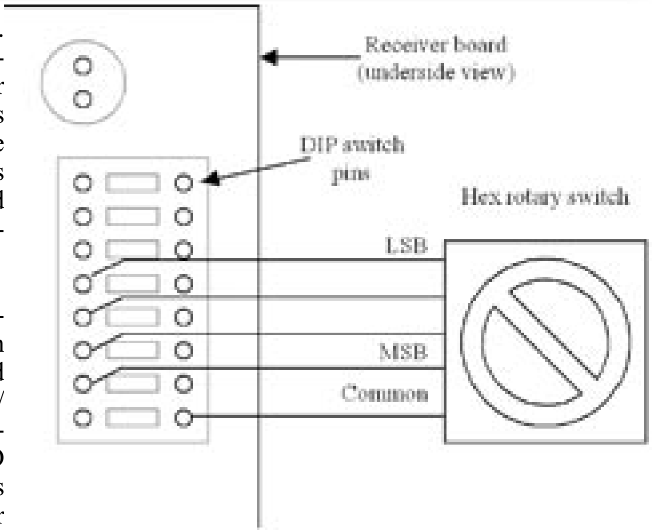
Why voltage tuning isn't such a good idea

Let's start off with a quick look at the current state of play. As supplied, the G1MFG 23/24cm receiver tunes in 500kHz steps. Practical experience shows that other than in the weakest-signal cases, this is pretty much sufficient. Why? Well, a typical modern ATV signal with 6.5 MHz highest sound subcarrier and 3 MHz deviation has a channel bandwidth of approximately 16MHz (= deviation + 2 x highest modulating frequency). A useful measure of tuning finesse is to calculate the step size as a percentage of the channel bandwidth. For a 16MHz channel and 500kHz step size, this works out at (500kHz / 16MHz)%, or about 3.1%. To put this in perspective, if we apply the same calculation to 2m voice (12.5kHz channel spacing), a tuning step size of 3.1% is around 400Hz.

Using a LCD controller with 125kHz step size the tuning step works out at 0.78% of the bandwidth, equating to a shade under 100Hz on 2m. That's SSB territory, not FM!

On the basis of these calculations, I think it's reasonable to assert that there is no case for analogue tuning to increase the finesse of frequency selection.

I said I'd show why continuously variable voltage tuning is a bad idea. The local oscillator inside the G1MFG.com 23/24cm receiver is a varicap tuned short-stripline circuit, operating at around 1.7-1.8GHz. No temperature compensation or other stabilising features are designed into the VCO, because it's intended to be used with a PLL synthesiser.



Checking out the control voltage range on a randomly selected G1MFG.com 23/24cm receiver indicates that the VCO control voltage is around 4.48V for 1240MHz and 5.22V at 1320MHz. That works out at pretty close to a tuning rate of 10mV per MHz. Or, to put it another way, you need to be able to control the tuning voltage to an accuracy of around 1mV in 5V in order to equate to the control offered by the LCD controller. Bear in mind that any hum or noise injected on the VCO control line will modulate it. The practical upshot is to increase the oscillator phase noise, and hence the noise on the received signal. You should look for a hum and noise figure of less than - say - 10% of the minimum control voltage change. So if you're aiming for the tuning to equal the LCD (1mV resolution at 5V) you need to have less than 100uV noise and ripple (a mere 0.002% of the tuning voltage).

So to re-cap, adding continuous voltage tuning requires a very high degree of stability and control in order to come anywhere near the performance given by the onboard DIP switches, let alone the LCD controller.

Digital rotary control

Let's face it: some people just like having a rotary control to play with. I've shown that there is a downside to using a pot, so are there any other alternatives? YES - provided you don't mind a compromise. A simple 16 position hexadecimal rotary switch connected in parallel with the DIP switches can easily provide tuning over the lower 2/3 of the band (1240-1300MHz) in steps of 4MHz - that's a 25%-of-a-channel increment, quite good enough for a quick look round the band.

- To use one rotary switch to cover 1240-1300MHz in 4MHz steps, make sure all the DIP switches are off, and connect the most significant bit (MSB) of the rotary switch to the innermost pin of switch 7, the next most significant to switch 6 and so on. This is shown in the following sketch. You may also like to connect a toggle switch across switch 8 so you can also cover the top end of the band.

- To use two rotary switches ('coarse' and 'fine'), make sure all the DIP switches are off. Connect the MSB pf the 'coarse' switch to SW8 down to the LSB to SW5, then the 'fine' MSB to SW4 through to the LSB to SW1. You can then use the 'coarse' rotary switch to tune in 8MHz steps and the 'fine' one for 500kHz steps.

Analogue (potentiometer) tuning

OK, here it is at last: a method of using an analogue pot to tune a G1MFG receiver. I must stress that this is not recommended by G1MFG.com, for the reasons already described.

Using a simple pot across the supply rail is fraught with problems, largely because you'd never get the necessary resolution (even with a 10-turn pot) to tune the receiver accurately. So instead, we cheat by setting the start and end voltages for the tuning pot using other pots.

Referring to the following circuit, P1 and P2 set the low frequency and high frequency limits respectively, and P3 is the tuning pot. P1 and P2 can be presets, but P3 should be a panel mount pot. Set P1 to give about 4.2V at point A, and set P2 for about 5.5V at point B. This will give a tuning range slightly wider than the amateur band.

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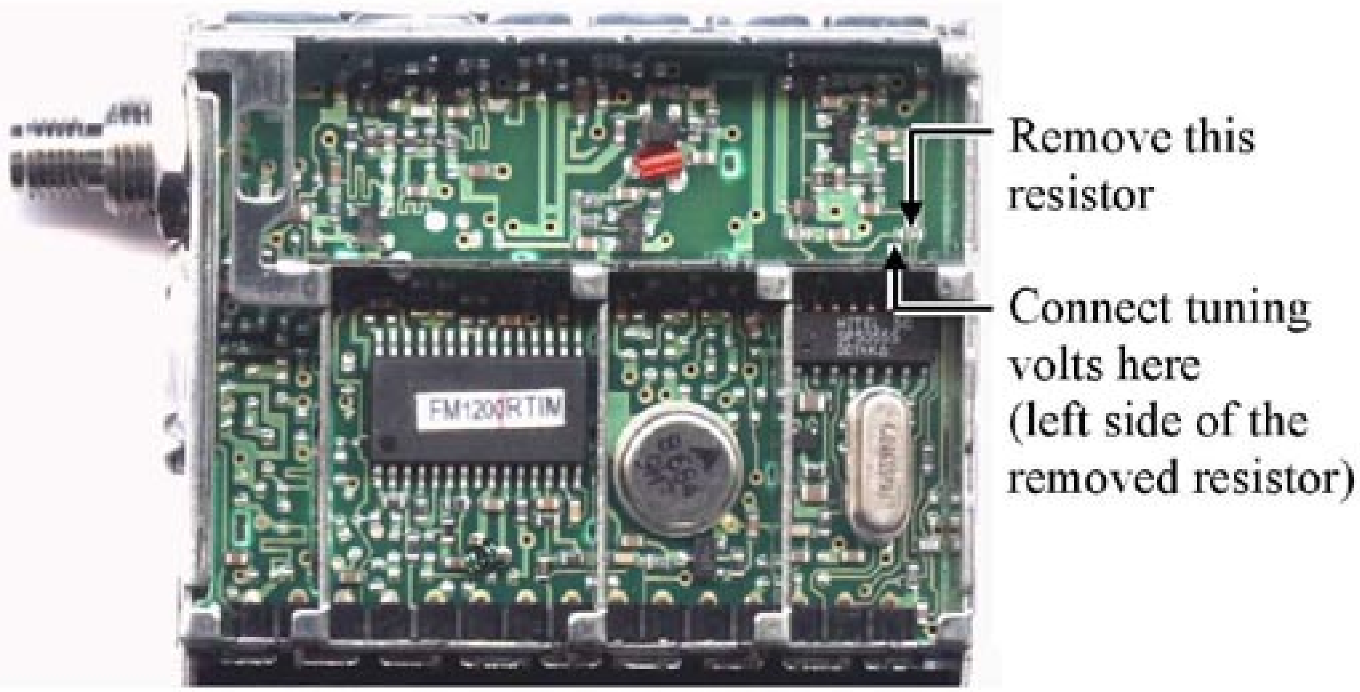
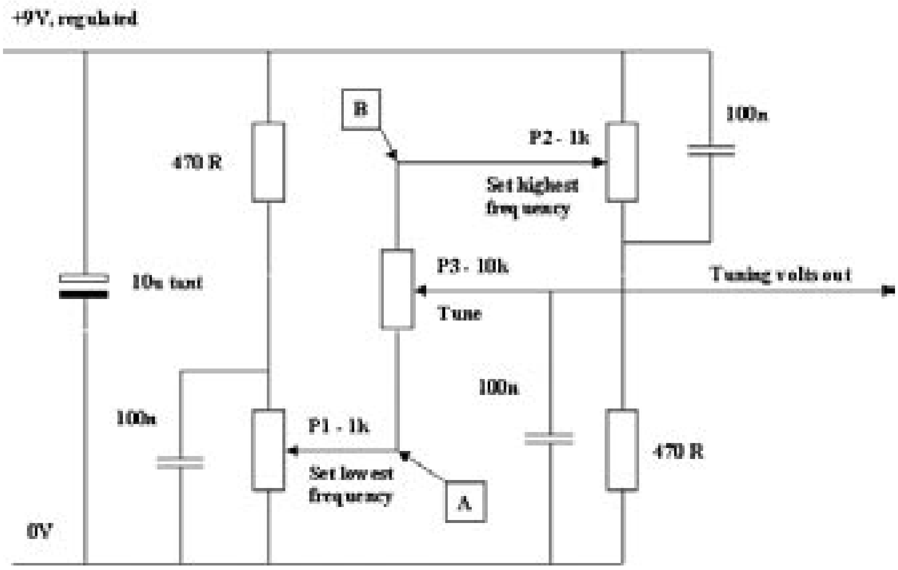
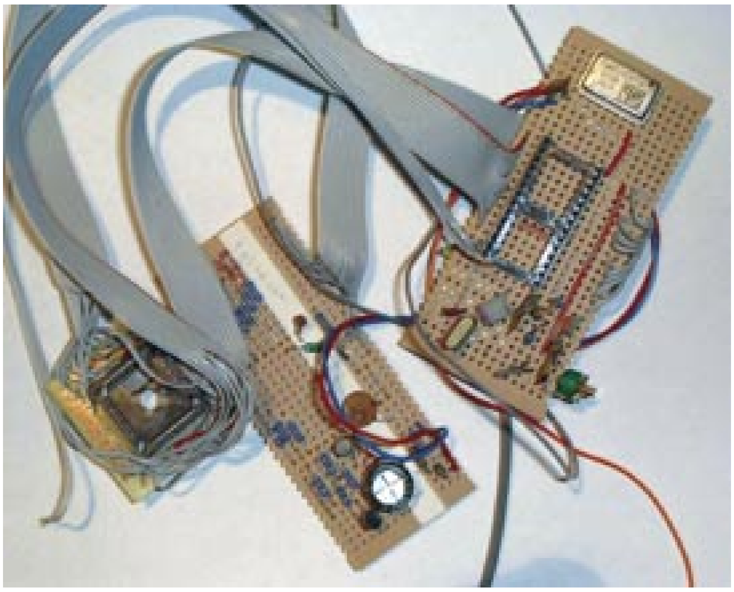


Connecting the tuning voltage calls for come surgery on the receiver. Referring to the photograph, remove the surface mount resistor indicated, then connect the tuning voltage output to the left side of where you removed the resistor. Your receiver will no longer be synthesised (or under guarantee...), and G1MFG.com can take no responsibility for any damage you do if you attempt this mod!



Conclusion

Hopefully I've managed to give an insight into the rationale behind the design decisions which went into the G1MFG.com receivers (and, by extension, the transmitters). I'm still looking in to the prospect of a new version of the LCD controller which uses a digital encoder to give rotary frequency control - any feedback would be welcome.

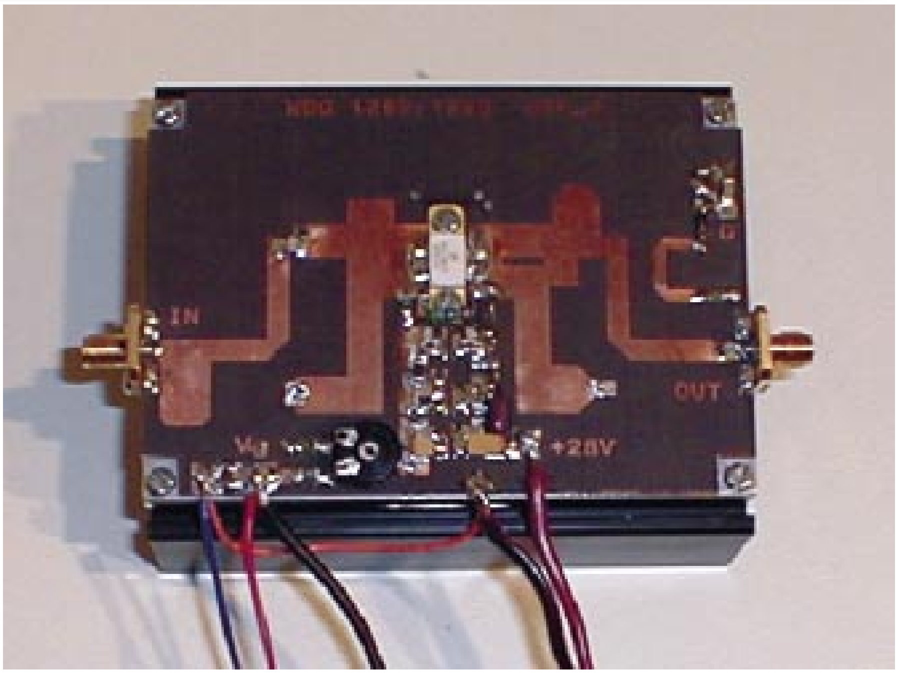


A photograph of the prototype Test Card Generator that featured in CQ-TV 201. As you can see, the final product is considerably neater than the first attempt - Brian Kelly

The G3WDG 23cms PA - a not very technical review

By Graham Shirville, G3VZV

Until recently the simplest way of generating some power in a fairly linear manner on 23cms has been to use one or more of the M57762 Mitsubishi modules. These have now been dropped from production and this new PA using a Motorola MF9045 device has been developed by G3WDG Charles Suckling as an additional product to the range sold by the RSGB Microwave Committee Components Service.



I cannot really improve on the following preliminary description provided by Charlie a couple of months back:

Available modern semiconductors are designed to run off a nominal 28V supply, and this, coupled with the higher efficiency, means that much less supply current is required, making the new amplifier more suited to mast-head mounting than the old modules.

The bandwidth of the new PA is fairly narrow. The PCB has been designed for optimum operation at 1296MHz, but small additional tuning elements are provided on the pcb as extensions to the input and output matching stubs, which allows the amplifier to be optimum at 1269MHz. Optimisation at other frequencies will also be possible (more info later).

The PA is realised using a discrete (unmatched) transistor, with matching elements provided on a low-loss ptfe based PCB. Most of the other components are SMT devices. The PCB is mounted on a 6mm thick aluminium chassis plate, with mounting holes to allow this to be bolted to an external heatsink. Indications so far are that the design should not need tuning, and further prototypes are being built to verify this.

A coupler/detector has been incorporated, to give an indication of power output.

Small signal gain [200mW input]	17-18dB
Power output at 1dB gain compression:	>30W
Power output with 1W drive:	~40W
Power output with 2W drive:	~50W
Detector output at 40W RF output:	~3mA
Drain current at 1dB gain compression	~3A
Drain current at 50W RF output	<4A

Typical performance

To date, several of the prototypes have been tested on the air, with excellent results. Applications include ssb/cw operation at 1296MHz, AO-40 uplinking at 1269MHz, and ATV in various parts of the band. We have decided to supply the units either ready built on the chassis plate, ready built on chassis plate + heatsink, or as a kit. The kit will be preassembled, leaving only the components to be fitted.

Charlie's testing shows this typical performance:

My own testing on AO40 L bank uplink started just before Christmas using a DB6NT transmit converter which has about 1 watt output and a very old and bent Sandpiper 20 turn helix antenna at about 4 foot agl.

The first thing needed was a 28 volt dc psu and this was fairly simply accomplished with a toroidal transformer, bridge rectifier, large capacitor, a 3 pin regulator and, most importantly, a fan on the heat sink.

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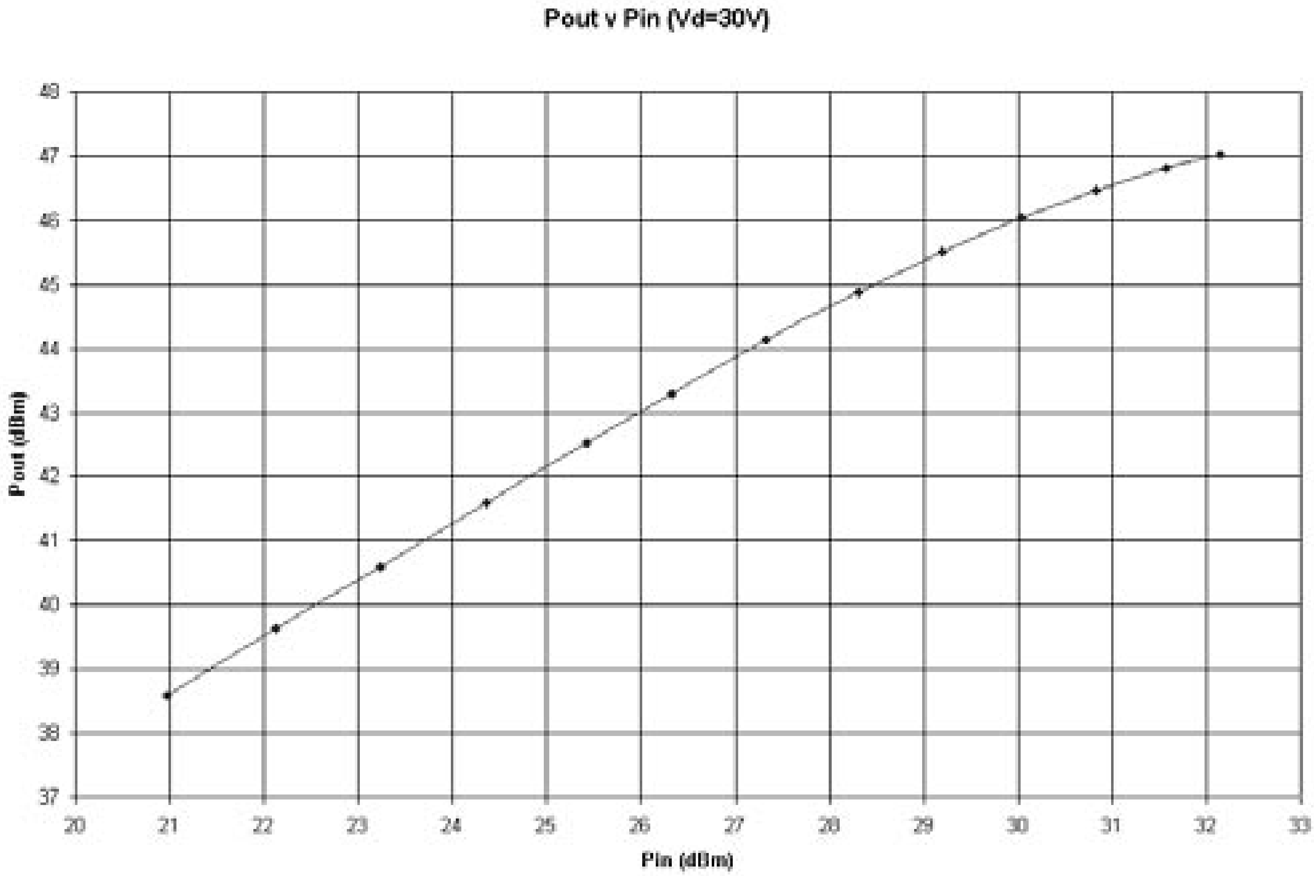

There is also a 12v regulator to supply the fans and the bias line.

The PA itself is mounted on a large heatsink which also needs needs a fan if it is going to be used continuously.

The results were impressive on Oscar 40 with my Mode L signals, even using the poor transmit antenna, being quite loud enough to need to turn down the erp to stay at <10dB on the S2 beacon on the satellite.

With my other interest in FM ATV repeater activity I am looking forward to being able to the PA in that mode. No doubt I will need a rather bigger fan though!

As this project is still in the beta test development stage, for details of current availability and prices please contact charles.suckling@ntlworld.com or Mr C Suckling G3WDG, 314A Newton Road, Rushden, Northants, NN10 0SY, UK.

Please visit our web site at -
http://www.cq-tv.com

Analogue vs. Digital ATV - What are the pros and cons?

By Brian Kelly. GW6BWX

ATV has been with us for a long time. Indeed the BATC has itself been around for 54 years, that's almost all the time recognisable television has existed.

During this period the design and manufacturing techniques used in ATV have developed more or less in parallel with those of commercial operators. The picture quality we strive to attain today is that of the broadcast companies. Go back a few years, not all that many, and the picture quality we perceived to be excellent would today be described as "adequate" at best. Take a look at some of the earlier BBC recordings, especially those in the first days of colour TV and they look decidedly "P4" by modern standards. If my ATV signal was as bad as some of the first colour broadcasts I would seriously consider there being a fault inside my transmitter. The commercial stations have always been the benchmark by which we perceive our own standards. As they have improved, so have we.

The problem with improvement is that there is a diminishing return on investment as the quality increases. To go from nothing to good is much cheaper than going from good to excellent.

Lets look at commercial stations first. The only practical solution to the problem of increasing picture quality using analogue transmissions is to widen the bandwidth they occupy. This is a scientific fact. By virtue of the band planning set out at the time the UHF broadcasts were proposed, the number of available channels was severely limited. The plan only made provision for four TV channels per region and that restriction still applies today. It is to the great credit of the ITC that not only have the four original channels been squeezed into the band but also a fifth analogue station, "5" and six digital multiplexes as well. Considering there are several hundred broadcast transmitters up and down the country that, in theory at least, don't overlap coverage areas that was no mean achievement.

So, being confined to a limited band space and at the same time needing to bow to public demand for more entertainment, what options were open? The first and most obvious step was to spread into a second band and carry on making the same type of transmission. This happened in the early 80's with the commencement of satellite relays. The broadcasters saw satellite as a huge wide-open space to sprawl into and that's just what they did. The first satellite broadcasts were analogue, I believe some of them used amplitude modulation but for technical reasons, particularly because of the limited power resources and amplifier linearity, almost all opted for frequency-modulated transmissions. With all that empty band space there was no longer such a need to keep the transmission spectrum so narrow, so typical bandwidths of satellite systems were in the order of 25 to 30MHz. For the UHF stations the limit was under 8MHz. In the early days (anyone remember when there was only one Sky channel?) things were fine, however, as the public demand still kept growing, the bands became more and more populated and we went right back to square one again. Of course, satellite has the great advantage of using highly directional receiving dishes, so the actual number of satellites could be increased, as long as they stayed more than a few degrees apart in the heavens. This allows for a very large number of channels but makes receiving them all a big problem for the consumer, who would need several fixed dishes pointing to individual satellites or a steerable dish that could be moved to select one of them at a time. Apart from a few enthusiasts who have the ability to erect and control such systems, they are not suitable for the general public.

Let's recap:

- better pictures = wider signals
- wider signals = less will fit in the band
- more bands = more equipment is needed
- satellite = more band space but still limited.
- more satellites = expensive dish or array.

So how are the needs of the public met? Compromising quality at a time when large screen TVs were starting to hit the market wasn't a sensible option. The bigger the screen is, the more obvious the limitations of quality become apparent. Opening up more bands at a time when other users were queuing for frequencies, particularly mobile and telephone services, was also not a viable option. There was an attempt to "cable" the whole country, so all the band space could be released but that has slowed to a crawl for financial and geographical reasons.

The most cost effective way forward is to utilise the same technique used by computers to compress digital images so they take less storage space. Without the quality suffering disagreeably, it is possible to shrink images, photographic or from a video source to a much smaller size, typically 20% to 30% of their original proportions. The big problem is the image is no longer in a format that can be viewed on a normal TV. As it is now a bundle of digits, it takes a computer to make sense of them again. Compressing the information does not in itself help us; we need to make use of the space left over, the remaining space from its previous dimension. As we are now in the digital domain, the space can simply be filled in with another picture. This could be more from the same picture stream or could be from a different source entirely. Just compressing and sending a single picture would waste the bandwidth just saved. It isn't possible to send the next frame of video either as it probably won't have left the camera yet!

So we now have some spare capacity in the bandwidth. Bearing in mind that the prime motive for doing this in the first place is to relieve the pressure from an overcrowded band, it makes sense to fill the freed-up space with another station. Hey presto!, two stations in the space that used to hold one. The overcrowding has suddenly halved. In practice the compressed pictures are generally quite small and the bandwidth is still quite wide so up to eight stations can be squeezed into one channel. This process is called multiplexing and the component signals can be control information as well as picture streams. For example, the Freeview transmissions on UHF and the Sky broadcasts by satellite both carry program guides and have the ability to remotely update the software running in the receiver.

As well as reducing spectrum usage, digital TV has a big financial advantage for the broadcaster: The cost of transmitting is spread across all the channels. Now, a single transmitter, with its single running cost can do what would have required up to eight transmitters before. A considerable saving is made.

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Figure 1

There's an old saying: "you don't get owt for nowt", and it is as true for digital TV as in everything else. The drawback is of course that picture quality suffers and the complexity of equipment is vastly greater than with analogue. I'm sure most professional broadcast engineers would agree that you can't beat the quality of a well set-up analogue signal. Few would also fail to recognise a digital picture. When you look closely there are several telltale 'features' of a digital picture that give the game away. The two most obvious are pixelation or 'blockiness' and compression artefacts. The pixelation can be caused by two things, a transmission error because some of the bits in the digital data stream were corrupted or lost or simply by insufficient bits being available to convey the complexity of picture. Take a close look at a digital channel showing fine background detail, a choppy sea or grass on a sports field for example, and you will see it take on a rather fuzzy appearance, often showing a rectangular pattern over the picture. The effect is more obvious on darker scenes where the numerical value of bits representing the brightness is smaller. Transmission errors are seen as misplaced blocks of picture or brief pauses in the picture being redrawn. The compression artefacts are false regions of the picture that are wrongly extracted when the compressed picture is brought back to full scale. These are clear to see if you look closely at still text, particularly against a light background. Around the edges of the characters you will see a border with a rope like pattern in it. It is always there and around any region of the picture where a step in colour or contrast occurs but text shows it up best.

Figure 1 shows the 4kW analogue transmission of Channel 5 received from transmitter at BlaenPlwyf

Figure 2 shows the digital transmission from the same mast and with the same receive antenna. This is one of 6 channels in the multiplex with 2kW total ERP.

Figure 3 shows an extreme case of a decoding error. Here the information was incorrectly decompressed and blocks are misplaced in the picture.

To minimise the effect of bit errors there are several protection mechanisms added to the video data. Digital error correction is nothing new; without realising it was there, you would have used 'Hamming bits' and 'parity bits' while watching any Teletext page. In their simplest form, these protection bits are used to periodically add confirmation that the data is intact. Parity is a single bit applied at the end of a byte to make the total number of '1' bits in the byte either odd or even. If even parity is being used and an odd number of ones are found, the byte must contain an error. Parity can't fix

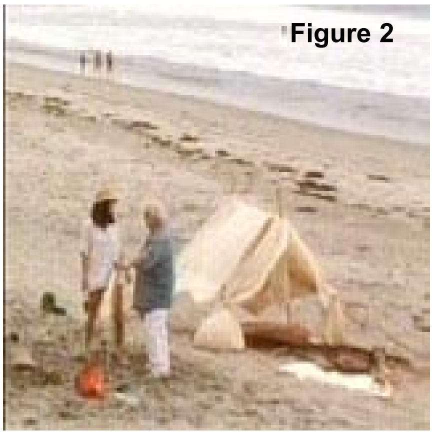

Figure 2

the error and its weakness is that it can be fooled by more than one error making the number of ones appear correctly as odd or even. Hamming bits go one stage further; a parity bit is added after each data bit, the result is a byte twice as long because it alternates between real data bits and their parity bits. Each Hamming bit represents the parity of all the bits preceding it and by the magic of mathematics (actually a few XOR gates) it is possible to see where the error has occurred in the byte. Given that each bit can only be a zero or one, it isn't difficult to work out which it should be if it's wrong!

Even these techniques are too weak for digital TV, much more powerful error trapping and correction is needed. The method actually used is very complicated and involves polynomial checksums, Reed-Solomon and Vitterbi encoding. At the end however, what counts is that even a severely tortured signal can come through unscathed. If not completely unscathed, at least the apparent damage is well hidden. There are numerous web pages that explain how TV signals are prepared for transmission and recovered at the receiving end. I wish all readers lots of luck trying to fathom such depths of mathematics though; nothing I've found so far is for beginners.

The root cause of errors is the variability of the transmission path between transmitter and receiver. It is really easy to feed a clean signal down a length of coax, try doing the same over tens or hundreds of kilometres, especially across hilly terrain and you soon witness every kind of signal distortion known to mankind. With analogue signals the degradation shows as snow or ghosting, depending on strength and multiple signal paths respectively. The eye can tolerate reasonable amounts of these effects and the brain can selectively ignore them so the viewing experience is not so seriously impaired. Digital signals do not have the luxury of gradual quality loss. Instead of the subjective picture quality falling, the integrity of the data falls and there comes a point where it can no longer be interpreted as a picture at all. Try to imagine an analogue picture with a ghost as a main signal and a delayed version of itself added together. Where there may have been a bump in the waveform at the source, it arrives with two bumps at its destination, the original and the ghost. Now visualise the same happening with a stream of binary ones and zeroes, when the delayed signal is added it can completely change the pattern of bits and turn the information it carries into nonsense.

Three main types of digital transmission are used: DVB-C, DVB-S and DVB-T. A system called ASTC is also used in the US. These are broadly similar but in view of the different signal paths they are intended for, they use different transmission modes. DVB-C is for use on cable distribution networks and it optimised for use where signal strength is likely to be high and stable but there may be some minor reflections due to

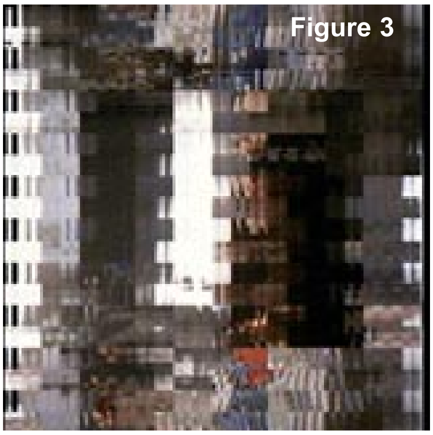

Figure 3

cable terminations being imperfect. DVB-S is for satellite broadcast, such as those from Astra. It is optimised for low signal strength where electrical noise may be present but the path is clear of reflections. DVB-T is for terrestrial transmissions where signal strength and multi-path distortion are both likely to cause problems. For the DVB-C and DVB-S systems the transmissions are modulated using QPSK, which in simple terms is a method of splitting the bytes into small groups of bits and converting these to a particular amplitude and phase. The pattern of amplitude and phase are recognised at the receiver and the data bits are reassembled into the original bytes. QPSK is short for "Quaternary Phase Shift Keying". Of course, phase shifts along the transmission path can really screw this up which is why it is used for satellite TV where the path is line-of-sight. For terrestrial TV where DVB-T is utilised, QPSK is still used but the signal is then fed through an OFDM modulator. This cleverly spreads the bits across a number of closely spaced carriers in such a way that even if a large proportion of the carriers suffer interference, the modulation can still be recovered. Again the mathematics behind this technique is very complicated. OFDM stands for "Orthogonal Frequency Division Multiplexing".

That's enough on what the commercial stations do; now let's look at how ATVers can make use of digital TV.

Firstly, and contrary to the majority of comments I get in my email every day, digital is not more complicated and not necessarily more expensive than analogue. Just as with analogue, there is no upper limit on what you can spend, but how little you spend depends on your ingenuity more than on your bank manager. Admittedly, some of the encoding circuits will have to be in complex chips but these are no more expensive than a PA transistor that can run a couple of watts on 24cm. There is the advantage that the maths has been done by someone else and all you need to do is utilise it. If that sounds like it takes the fun out of it, may I ask when was the last time you designed a transistor?

When you look closely at a digital transmitter and receiver and compare them with their analogue counterparts, they have much more in common than you might first imagine. The oscillator and RF amplifier sections are the same, the video amplifiers are the same, the PA is the same and the power supply is the same. The only difference is in the modulator and demodulator. Given that these are the bits that are 'pre-designed' for you it probably make digital easier to build than analogue.

The criticism that digital is perfect or nothing at all, referring to the critical signal level where errors can no longer be tolerated is understandable but somewhat flawed. Although it as absolutely true that a digital signal may be missed completely when it is only marginally below the threshold, that threshold is actually about the same as P2 in analogue terms. In other words, what digital can't resolve would also be stretching an analogue system to its limit. I've also seen a rather silly comment that you can't line-up a receive antenna on a weak digital signal because you can't see where the signal peaks. Well, for the past 30 years I've used an 'S' meter - I suggest you give it a try. In fact most commercial digital receivers have a built in strength meter and a signal quality meter too. The quality is assessed by monitoring the 'BER' or Bit Error Rate. This is the number of errors that have been corrected. A lower BER means a cleaner signal, it's probably as near to a 'P' grade meter as we will ever get. If you have Freeview or Sky digital, look at the installation menu and you will see the strength and BER displayed as bar graphs on the set-up screens.

Now let's turn to some of the operating advantages of digital.

For as long as I can remember, the major drawbacks to using the 70cm band for ATV have been the inability to use colour and inter-carrier sound because of insufficient band space and the problem of causing interference to other band users. Digital signals use the bandwidth more efficiently and it should be possible to transmit not only colour and sound but also data and additional sound channels without stepping out of band. In addition, the power spectrum is more evenly distributed, especially if OFDM is used. Although the potential for causing interference is still there, for a given ERP there should be on average less power per unit of bandwidth than an analogue signal would exhibit. Additionally, any interference would be heard as random noise rather than the obtrusive sync buzz that analogue ATV inflicts.

On the higher frequency bands the capacity for carrying more data, more pictures or higher quality pictures is even greater. Imagine an ATV repeater that has, for example, receivers in the 70cm, 24cm, 13cm and 3cm bands. If signals from each of these were multiplexed they could all be retransmitted over a single digital channel. As each channel would have its own ID number, a digital receiver could pick whichever input signal was desired for viewing. For example, channel 1 could be the picture from 70cms, channel 2 from 23cm and so on. Although the repeater would only broadcast on one frequency, it could cross-band repeat from several bands at once.

Some ATVers get their kicks from squeezing the most out of a limited RF carrier, some from striving to attain a 'perfect' picture. I believe digital goes some way to catering for both of these camps. Certainly, the relatively small picture degradation as signals get weaker will please the 'quality' chaser who no longer has to fight through 'snow'. The better sound and stereo capability should also please these operators and add the challenge of bettering their audio techniques to the hobby.

For the 'web-heads' out there, as all their information is already digital, it should be relatively easy to interconnect with computers, modems or whatever. It would even be feasible to run repeaters in different modes altogether. Think of a repeater carrying ATV and a high-speed packet link simultaneously or maybe acting as a proxy server to allow Internet access at high speed.

Think of the advantage of sending your regular mug shot with a test card and a page of station information at the same time.

So what equipment is available for DATV? Well, receivers are already available, both for QPSK and OFDM modes. In fact, the demand for economical domestic equipment has prompted several manufacturers to develop ICs that are virtually self-contained receivers. Zarlink, for example, produce single chip QPSK front-ends and single chip OFDM front-ends. They also make a complete receiver on a chip but this is in a 388-pin BGA package that, from an amateur point of view, is impossible to utilise. BGA, or Ball Grid Array is a chip package where instead of through pins, connections are made directly to solder pads on the underside of the chip package. Solder balls form a bridge between the PCB pads and the chip pads; there are no legs at all. With suitable tuning arrangements and digital to analogue conversion, these chips will make very high per-

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Screen capture of SM6CKU's digital test transmission via Astra 1A on February 9th, 2003

formance receivers. For the black-box people, a Freeview receiver (£99 or less) with an up or down converter in line with its antenna socket makes an excellent OFDM receiver. For QPSK there are dozens of receivers on the market. Sadly, the fixed symbol rates of the BSkyB satellite receivers make them unsuitable, but many other units are available as "DVB" set-top boxes. I recently sought advice from BATC member Tony Wise at Wyzcom about which receivers were most versatile for amateur use and he recommended the Humax CI-5100. I should point out that as well as being an active ATVer, Tony is also a Humax dealer. His advice led me to buying an excellent receiver. It arrived just in time to pick up an ATV test transmission from Sweden and it should be fully capable of receiving terrestrial QPSK ATV transmissions as well.

Transmitters are at the moment the big problem for digital ATV. Although most of the circuit blocks of a digital transmitter are the same as in an analogue transmitter, the modulator is somewhat more complicated. I am currently awaiting a DATV transmitter board from Germany and I'll review it and my test transmissions in due course. I anticipate that within a short time there will be several amateur QPSK modulator chips available and almost certainly some OFDM ones too. Those who attended recent BATC conventions will have seen commercial modulators in use as part of the satellite uplinks of the activities and lectures.

My conclusions

Analogue ATV is here to stay and although digital will probably overtake it in popularity, it will always retain a firm hold in ATV circles. I think it is too early to say which is the better system as both have their strengths and weaknesses. Analogue is simpler but has the problem of gradual quality loss as the path between stations deteriorates. Digital is more complicated but has better "P" grade per km performance. I would hate to see a split into two opposing fraternities and would much rather see a new cooperation between old and new technologists – referring to the technology, not the age of the user of course! What I would hate to see is a "it's digital so I can't do it" attitude and would remind people of that mind that CD has virtually wiped out vinyl as an audio recording medium and DVD is rapidly doing the same to VHS. If connecting up a digital ATV station is no more complicated than using either of these new digital devices, and gives us equal advantages, we shouldn't have any problems. I certainly plan to keep a foot in both camps and if I can be regarded as impartial, I'll try to make objective comparisons between them. I am not employed by any TV company or any organisation with interests in analogue or digital transmissions; in fact, I'm not employed at all at the moment so my observations are not biased by commercial interests.

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Bouncing Microwaves?

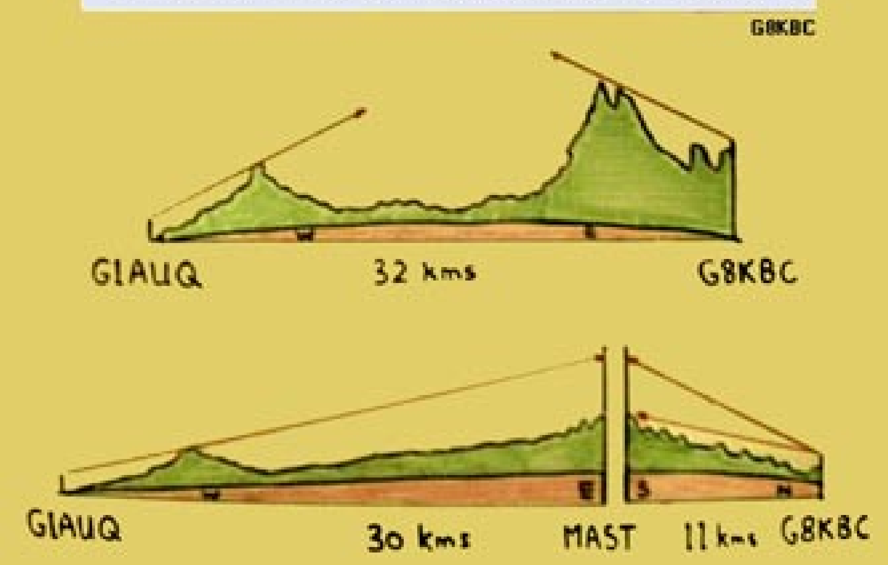
By Dave Barford G8KBC

Have you ever wondered whether it would be possible to bounce microwave signals off large objects, and if so how would it work out? Well, this is what I found out over a period of a year or so, during a series of experimental contacts with Richard G1AUQ on several bands and modes doing just that!

First of all I would like to point out that Richard and I are about 32 kms apart over a totally non line-of-sight path with two sets of intervening hills. The aim of these experiments was to see if we could improve signals between us in any way. We have already tried more conventional means, and having practically exhausted those we decided on something a bit more unusual. I had tried this bouncing technique before many years ago with some success, so I was convinced that we could use it with improved equipment to good effect. Most of the time we used 3 cms, but we have used 13 cms, 23 cms and 70 cms with various results. The test transmissions were also in different modes, for various reasons to be explained later. We also found some interesting propagation anomalies on some bands as a side effect of these studies.

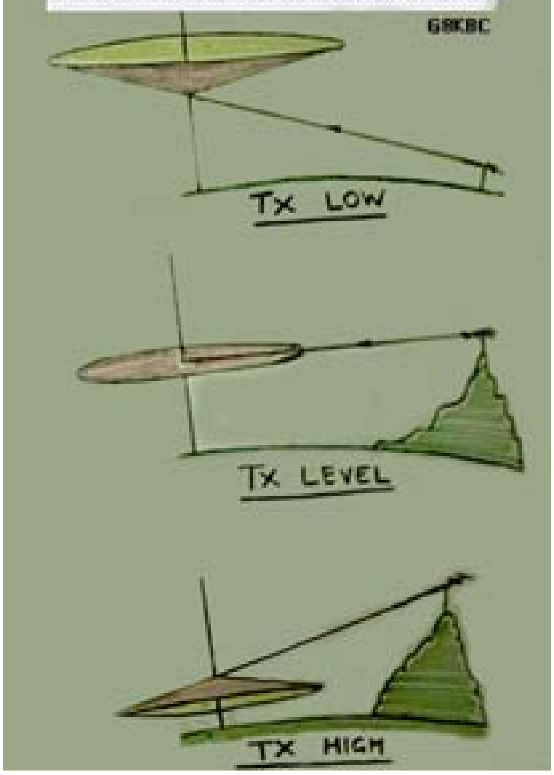
Most of the experiments involved checking the signal strengths over both the direct and indirect paths. The "direct" path of about 32 kms was over two sets of hills about 60 metres higher than the highest QTH, totally non line-of-sight and was approximately East – West. The "indirect" (or bounce) path was about 10 kms further in total, and was at approximately 90 degrees to the direct path for 11 kms to the South then bounced off the target a further 30 kms to the West at an angle of about 90 degrees. The main bounce target in these experiments was a large radio and TV mast well over 300 metres high and made in the form of a steel tube about 6metres in diameter, the top of which is just about LOS to Richard and only the lower 200ft or so obscured from my direction. The signal via bounce does have further to go. This mast is about the only large metal object visible to both of us in the area so our choice was a bit limited!

FIG1. PATHPLOTS FROM G1AUQ TO G8KBC



Richard and I have been experimenting for some time with both WBFMTV (10 MHz Bandwidth) and audio WBFM (100 kHz Bandwidth) on 3cms and have been very interested in the many different propagation effects we have noted during our endeavours. As a general guide with regard to 3cms signals the best conditions for enhanced signals would tend to be after an extended period of high pressure (fine weather), with very little or no wind (very still conditions) for several days. We believe these conditions allow the layers of air to settle and stratify, possibly allowing ducts to form. The humidity should ideally be very low (although sometimes rain, mist or fog particularly in the summer can improve signals under certain conditions). During the winter, hail or snow can often show a marked improvement in signal levels over a non line of sight path due to increased diffraction or reflection. This is particularly so if the cell is around the middle of the path (but on a line of sight path the same conditions can show a marked deteriation of the signals due to direct obstruction of the wave front). A point worth mentioning is that at times of increased diffraction or reflection due to rain or snow etc the beam-width of the received signal can increase dramatically, sometimes to almost 90 degrees, at which time some benefit may be derived by using a lower gain (wider beam-width) antenna to collect the signal.

FIG.2 - REFLECTED SIGNALS



Signal Quality

The quality of the received signal compared with the original can have a dramatic effect on the end result, which may sound obvious but in point of fact it is not. During one of our experiments Richard was using a spectrum analyser to look at the received signals on 3cms one evening and purely by chance he noticed that the signals he got from me on the reflected LOS path were very constant and covered a very small spectrum around the main

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signal, and TV pictures locked solid, but when he viewed signals from the direct non LOS path he found that they appeared to be covering a much wider spectrum with continuous variation indicating some sort of varying Doppler effect. This caused audio to have a constant warble to it, and on TV signals it caused the pictures to be difficult to lock because it made the sync pulses wider than they should be, although the picture content didn't seem to be noticeably different! I might add that the signal strengths were similar on that particular occasion so giving a very good comparison. Without the spectrum analyser we would not have found that out!

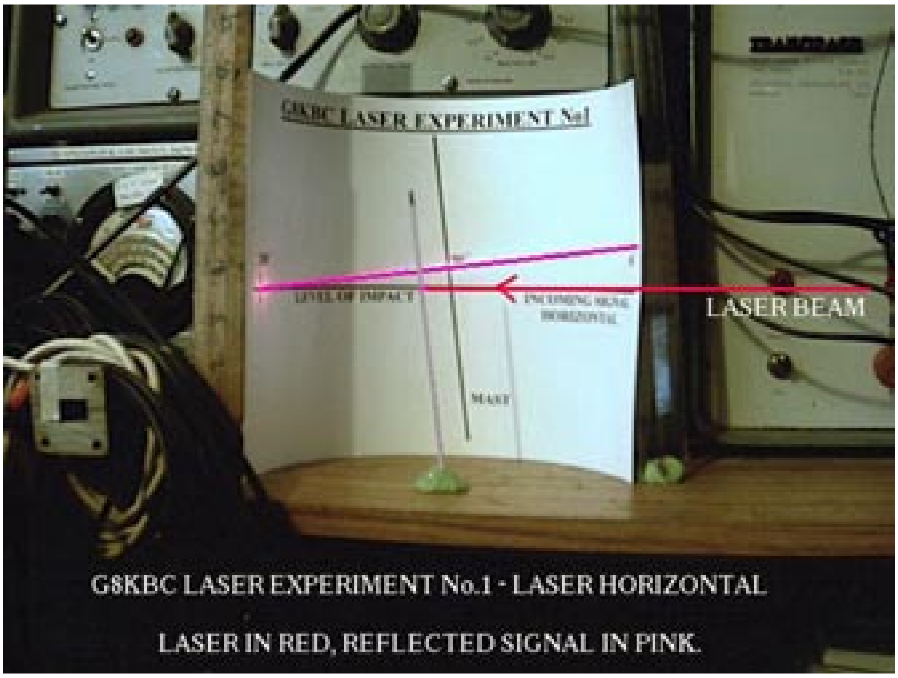
Lift Conditions

Lift conditions on 3cms are not very common in our opinion, however they do happen occasionally and when they do they can be quite amazing. I have seen several Dutch TV stations on 3cms at P5++ for several hours at a time, mainly in the summer, notably PI6ATV and Fritz PE1DWQ, both of course totally non line-of-sight, . Some have occurred around high tide, which may just be a coincidence, or possibly due to enhanced ducting over the surface of the water (this is the opposite of 70 and 23cms). I have also noticed that most of these lifts happen a day or two before, or a day or two after a new or full moon, (this affects 70, 23, 13 and 3cms to varying degrees). I can only put this down to increased high or low tide levels or possibly some magnetic or gravitational lens effect on the microwaves themselves? (Well gravity does bend light waves so why not microwaves? Perhaps the effect at full or new moon is too strong and the waves are bent downwards too much?)

Lifts I might add, do seem very few and far between on all bands, but when they due appear they can have remarkable results. For instance local signals can become much stronger or disappear altogether, whilst at the same time foreign signals will be coming in from the continent at considerable strength (probably due to some ducting) for several hours or so. Interestingly the lifts often occur on only one band, although sometimes they can happen on several at once. (I have seen GB3TN from a bounce on several occasions during lifts, from metal as well as brick objects).

General weather conditions

Obviously the overall weather conditions play a major part in the propagation of any radio/ TV signals. Dry,



bright, calm, low humidity conditions are generally better.

Dark dismal, wet, windy conditions are generally a lot worse from a propagation point of view on any microwave band (in my opinion).

Rain

Light drizzle/ mist/ foggy-rain = signals tend to be worse either direct or via bounce.

This seems to be fairly general to all bands, reflected or direct.

Heavy rain/ rain mid-point or snow cell = signals tend to be better on direct non-LOS path (probably due to refraction or reflections). Signals are worse generally on the bounce (more LOS path) probably due to attenuation of droplets/ particles etc in the path of the signal.

Flutter

This is generally more noticeable over the direct (non LOS path) particularly on 3cms. This consists mainly of multipath signals arriving at slightly different frequencies or time delays due to Doppler shifting, or possibly some variation in arrival times due to varying path lengths, (possibly caused by movements in the ether, leaves on trees, or undergrowth etc), which gives the signals a particular warbling note on audio and poor sync on TV pictures.

The flutter effect was much less noticeable on the reflected (more LOS path), which was most obvious when viewed on a spectrum analyser and showed a more or less single frequency spike on the trace. This resulted in sharper audio and much better lock on TV pictures. (Any difference of the video information as viewed on the picture itself was not so obvious).

Although this fluttering effect was most noticeable on 3cms (probably due to the small wavelength) it has also been noticed as low as 23cms on occasions, and always seems to be more prevalent under windy conditions as you would probably expect.

Reflected signals

The large, circular steel tower we used to reflect signals off seemed to work quite well on 3cms but was much less effective on 13 or 23cms and had no noticeable effect on 70cms at all. This tends to indicate that higher frequencies should prove to be excellent for this sort of work, particularly with narrower beam-widths and therefore more concentrated power levels to fully illuminate the target. As the targets would only subtend a very small beam-angle vertically and in most cases miniscule angles horizontally, this would presume very high gain antennas, which would of course in turn increase the ERP and RX capability both of which are desirable. This then indicates that the largest dish possible on the highest frequency at the most power available with a very good pointing adjustment (both vertically and horizontally) should present the best results! The reflecting object would ideally be as large as possible, probably slightly curved and visible from both stations, solid metal or metal covered, rather than brick or wood, we have also tried to get reflections from metal lattice towers but without much

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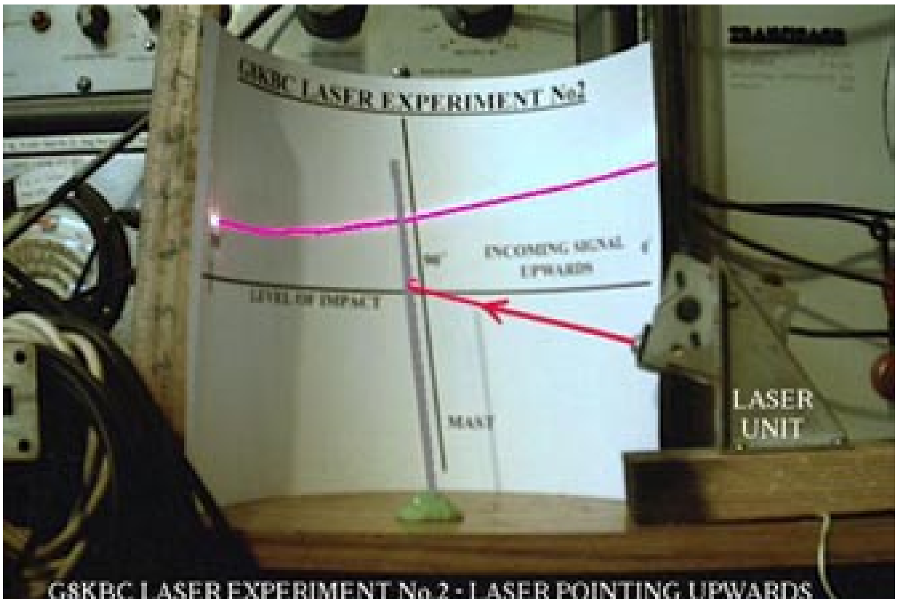
success, (probably not enough reflecting surface). Large, high buildings do work to a degree, brick does work on all bands if large enough, but again metal or metal clad is much better. If using flat surfaces, such as buildings then the angles tend to be more important between the TX and RX. The optimum reflection angle for a curved surface is usually straight back the way it came, however the shape of the reflecting object and angle can alter the optimum reflected signal. The signal strength also varies considerably due to many other factors such as curvature, surface texture, height, area, visibility (from either end of the path), reflecting material and distance from TX and RX, even the paint that is on it, etc, etc. There is therefore no definite formula other than to say any reflected signal will be weaker than a direct LOS signal over the same path length to some degree, (usually a lot), however, if there is no direct path available this mechanism may provide a signal where otherwise there would be none! Also signals reflected from round objects are generally weaker the greater the reflected angle (or further round the object).

Flat reflectors such as buildings, walls and square towers generally provide a better reflection when the perpendicular of the flat surface bisects the angle to the object from the TX and RX. Flat or rectangular objects normally produce a shadow to the rear, where little or no signal may be found.

Circular reflectors such as large round masts or towers, chimneys and gasometers etc, generally provide some degree of reflection all round, even at very shallow angles to the rear. This is generally not the case with square or flat objects that have to be much better aligned to be of use in this mode. Another point worth noting which is not immediately obvious is that due to the curvature of the Earth, a vertical object any distance away from the two stations is apparently leaning away from both stations to some degree. The effect with flat objects is that signals tend to bounce back at a slightly upward angle and the strongest part of the signal could be quite a distance above your head! However with round objects the effect is slightly different due to the continuous reflection all round (360 degrees). If the TX is directly in front of the object but slightly lower the bounce straight back travels slightly upwards, this continues all around the object in a kind of inverted cone shape. If the TX is almost horizontal to



G8KBC LASER EXPERIMENT No.2 - LASER POINTING UPWARDS

LASER IN RED, REFLECTED SIGNAL IN PINK.

the object the reflection all round will resemble a flat disk. Now the best situation for reflecting of a round object is when the TX is slightly above the target and the reflected signal resembles a downward cone which means the RX station will get a much stronger signal than any of the other cases. So if you think about it, with the signal bouncing off in a slightly downward direction to the other station on the other side of the hill this is best! Another thing to remember when bouncing signals is to keep the point of bounce as low as conveniently possible, in order to keep the reflection angles lower than they would be if you fire upwards which will make signals weaker. Due to surface texture or roughness etc there will always be a certain amount of signal at all angles, but the strongest will follow the general rules above.

By the way, I only became aware of this phenomenon when I conducted a very simple experiment, originally designed to test the reflecting ability of a round object. I arranged a thin chromium plated rod (the top section of a telescopic aerial) pressed into a piece of modelling clay to stand vertically, with a sheet of paper arranged in a semi-circle around one side of the rod, I then illuminated the centre of the rod from various angles with a laser pointer and noted the effect. The shiny rod was then moved so as to lean slightly away from the direction of the laser (to simulate the curvature of the Earth) and the effect could be clearly seen reflected onto the paper.

Experiment No.1 shows the most normal situation where a signal arriving almost horizontally from a distant TX would bounce off the mast in a slightly upward cone due to the apparent lean of the mast due to the earth's curvature.

Experiment No.2 shows a more extreme example where the TX is aiming upwards at a steeper angle at a leaning mast showing the much higher upward bounce in all directions.

Experiment No.3 shows a more ideal situation for bouncing where the TX is slightly above the level of the target so that the cone of signal is going down to the RX. This should give the stronger signals. (This does of course work the other way round with RX higher and TX lower).

From these experiments it is now obvious that to get good signals from a bounce both stations should aim at the LOWEST part of the target that is visible to both stations!

Perhaps you would like to try this experiment yourself? If you do, please be CAREFULL, and DO NOT LOOK AT THE LASER BEAM DIRECTLY!

Direct Signals

Signals over a non-LOS path seem to indicate a fairly large beam-width compared with the same strength over a LOS path, probably due to the various reflections and refractions required to get it there. I have not confirmed this yet, but it may well turn out that a lower gain antenna may give better results on non LOS paths due to its larger beam-angle allowing it to pick up more of the scattered signal than a narrower high gain one might over the same path.

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Signals over direct LOS paths should be better with high gain antennas at both ends with very good vertical and horizontal pointing ability.

Antenna Polarity

Obviously it is very important both stations use the same polarity, I have never actually proved it myself but horizontal is supposed to be better for DX and certainly most DX and TV signals are horizontally polarised so stick with that. By the way, with wave-guide, horizontal polarisation is with the two shortest sides at the top and bottom, and the two longest sides on the left and right. With round wave-guide the small monopole inside the tube should show a horizontal aspect. If you don't get this right you will probably not see any DX!

Antenna Elevation Control

From our extensive experiments Richard and myself have come to the conclusion that

Some form of elevation control would be most advantageous for propagation experiments. Elevation being particularly useful for cloud/ cell/ objects bouncing as well as getting into ducts (up or down), or even finding the optimum angle to diffract over some object or hill etc. I would think minus five to plus forty-five degrees would cover most eventualities. Some form of elevation indicator would be useful for notes and resetting to previous paths.

Modes

Remember if you can't get signals using FSTV you can always try Narrow-band TV, audio or another narrow bandwidth mode, you may get something where otherwise you would not!

Power Levels

As far back as 1990 I had done some 3cms bouncing tests with Peter G0IIT at Alford Lincs, at which time we used an old round brick-built windmill tower and that worked although signals were very weak and we were only using low power of about 50 mW with a total path length of about 9 Kms.

A few years ago I did some bounce tests on 3cms with Mick G6XDP and Brian G7AJP using about 200 mW and a total path length of about 42 Kms and 15 Kms respectively, at which time received signals varied between very weak to about P3.

Recently Richard G1AUQ and myself have been using 1.5 watts on 3cms and have had results that varied from no discernable signal (very occasionally) to P5++ depending on conditions, results on lower bands have been less promising, but still useful. For our experiments on 13cms we used about 5 watts, on 23cms about 35 watts and 70cms about 20watts up the feeder.

Again I hate to say it but there just doesn't seem to be any hard and fast rule about power levels required except MORE is BETTER!

But, having said that any amount is worth a try, what have you got to loose anyway?

Conclusions

The direct non LOS path signals were normally present most of the time at a fairly low signal strength with a great deal of flutter, but occasionally disappearing or being enhanced due to heavy rain or snow.

The bounced signals with a more LOS constituent tended to be also of low signal strength but with a much cleaner signal but easily degraded by rain or snow due to direct path attenuation effects.

The overall prevailing conditions did of course affect both paths similarly to some degree or the other, normally calm, still weather enhanced both, whilst rough, stormy, windy conditions proved to be worse, as you would expect.

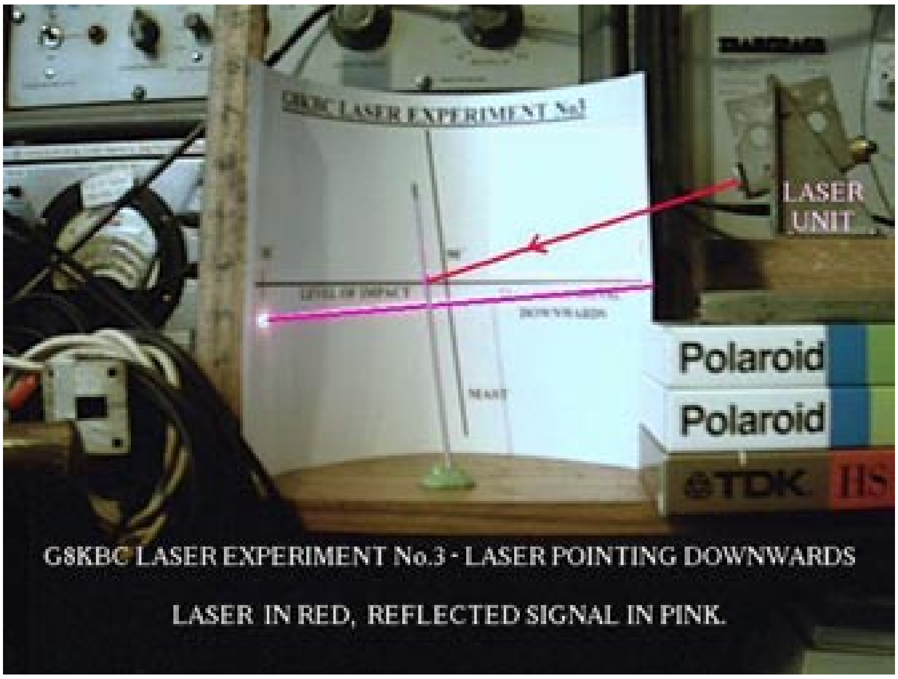
When considering using a bounce it would be well worth checking the angles and view of the target before getting started on some actual tests.

Post Script

This is not bounce related, but I have just heard from Ray 2E0AMU in Ollerton that he has noticed that some TV signals on 3cms from Bob G7AVU in Gainsborough have been stronger at various frequencies some nights and weaker on others. I have not noticed this effect myself nor do I have any explanation for it at the moment, but I will bear it in mind and see if it manifests itself in the future. If you find out why Ray, perhaps you will let me know? (Could it be the brand of Lager that night? Hi).

Also, I have recently built some Narrow Band TV equipment and intend to try some experiments with it on microwaves and light-beams and hope to write about that soon

The photographs of the laser experiments have been slightly retouched to aid understanding of the principles involved. - Ed.



G8KBC LASER EXPERIMENT No.3 - LASER POINTING DOWNWARDS

LASER IN RED, REFLECTED SIGNAL IN PINK.

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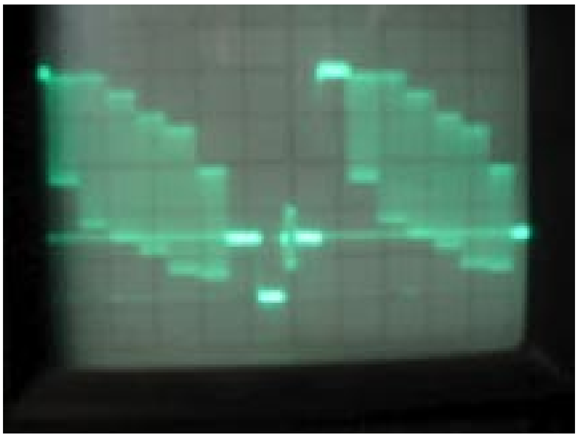
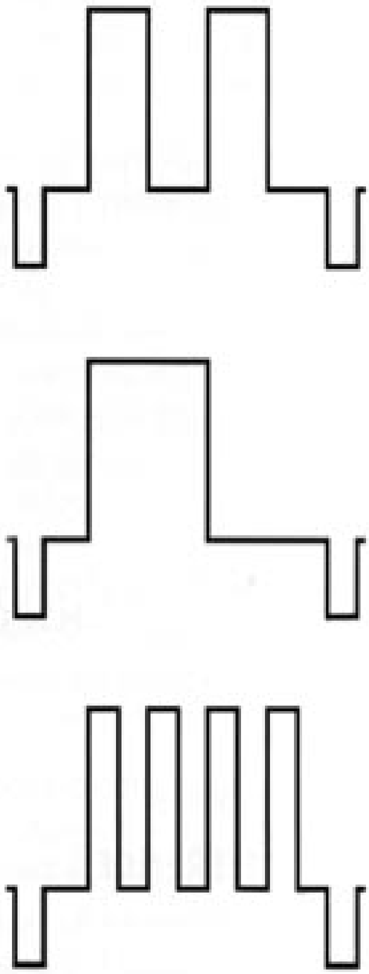
EBU Colour Bar Generation

By Richard L. Carden VK4XRL

While experimenting with digital television I required a source of EBU bars. Most



colour bar generators as presented in CQ-TV produce full bars that are 100% colour bars. These types of bars are normally used as an in house test source and give a complete check of system performance. EBU bars produce a 100% luminance white bar and 75% chrominance. A couple of circuits have appeared in past issues of CQ-TV that have produced EBU bars; some have had elaborate diode matrix's to achieve the desired effect. Let's now have a look at the required waveforms of Red, Green and Blue.

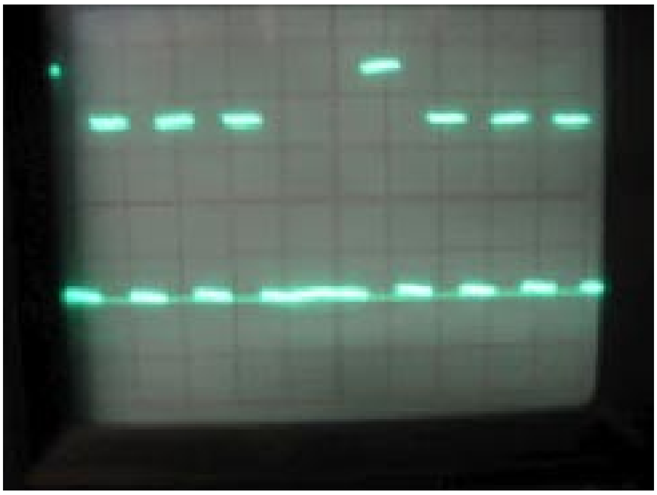


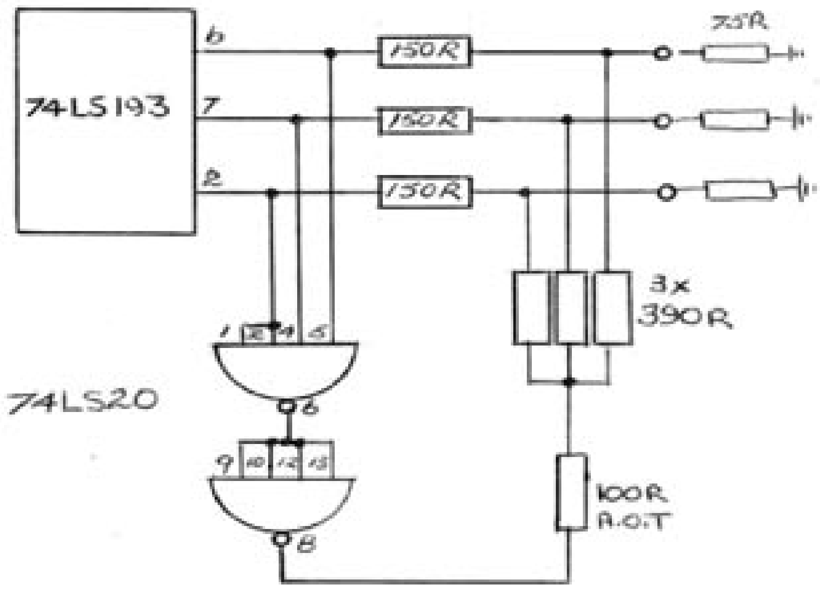
EBU bar generation.

From the following drawing you will notice that white is only produced when all three outputs are positive.

If we now feed these inputs to a NAND gate, say a 74LS20, then the resultant output is a negative pulse that represents the white flag. If we now in turn feed this signal into the spare gate, we now have a positive pulse representing the white flag. For those circuits that have gates used as outputs with resistive dividers then the adaptation is relative easy. It could be used for those using the PIC as a bar generator, such as the PIC dream etc. By adjusting the resistor matrix values, you can produce a Red, Green and Blue output waveform with 100% white pulse and 75% pulse representing chroma. For those circuits that have an internal load resistor on the colour bar generator side then the resistor matrix values will have to be re-determined.

The Photo shows the output obtained from a BATC colour coder fed with the modified colour bar generator output.





Reference:

1 Colour Bar Generator COX 222

2 CQ-TV 158 Circuit Note Book No.46 John Lawrence GW3JGA

3 Amateur Eye Dec 93 Simple colour bar generator.

4 CQ-TV 185 TELETEXT Pattern Generator Improvements. ZL1TOF

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Golden Slumbers

Dicky Howett answers a few vital TV questions

For those of us with a slight obsession with broadcast TV, the history of the medium is never very far away. Recently, via the net, a media student asked me to define 'the golden age of television'. Well, assuming that there ever was such a period (let's face it, some of us experience 'golden ages' all the time), I endeavoured to answer this recurring question. My opinionated reply was as follows: -

The 'Golden Age of Television' is a general term and it all depends from which vantage-point or country. Also, there were three distinct 'golden ages' which encompassed the themes of, Commercial, Artistic and Audience. I'll deal here only with the USA and Great Britain. In the US it was during the period of the 1950/60s that there came about the first 'golden' expansion of 'TV markets' ie commercial opportunities. American TV was never about 'public service' broadcasting inasmuch as the only 'service' uppermost was flogging the largest amount of beef jerky, or Fizzy Cola. To that end, each state or large town (or even small town) had its own TV station, with local ads and talent. Also, all the familiar TV themes and formats were devised in the USA during that time; ie the game show; the cop show: the comedy sitcom; the series or mini-series drama.

In the UK the Golden Age was located in the mid to late 1960s with a creative/artistic expansion due to improved equipment and studios. Also, UK writers were encouraged to explore new themes with regard to race, sex, social issues and class. In the late 1960s/early 1970s, colour TV had a great impact. Again, this was due mainly to improved equipment, (ie, camera pickup tubes needed much less light which meant an easier, more flexible working practice and in turn more adventurous programmes.) Also cheaper and more reliable colour TV sets appeared and the favourite plan was to rent.

Vast audiences for individual TV programmes in the 1970s can be characterised as a viewer 'Golden Age'. Favourite shows and programmes, (each with over twelve million viewers) were discussed at work the following day. (This may still hold true for some types of programmes, bad news, funerals, pop contests, but how many 'top

rated' programmes today can get even six million viewers, let alone twelve?)

In the 1970s a narrower range of programme outlets meant that most watched something each evening on just three or four channels. It was a shared experience: A 'golden age' which will probably never be repeated. These days there is an enormous availability of programme material, (off-air, cable, satellite, VCR, DVD) delivered as and when the consumer requires, although the actual choice of subject matter is quite limited and repetitive. Today, TV is strictly viewer-lead. (In the US it was and still is, advertiser-lead). Elsewhere, the difference between public and commercial broadcasters is that the public broadcaster delivers programmes to the audience and the commercial broadcaster delivers an audience to the advertiser. However, both types of broadcast delivery systems continue to produce worthwhile TV material

Pay-per-view: It's a truism that the only thing the viewer will pay for is Sport, first-run Movies and Porn. Mainstream broadcasters today endeavour to accommodate viewers tastes. Their schedules now have examples of all three of the aforementioned subjects. Plenty to choose from but not a lot of choice.

What does the future hold? More TV? Yes, unfortunately (adding up all delivery systems and anticipating some that have yet to be envisaged). Free TV? Nothing is free. Cheap TV? Not possible. All broadcast TV is very expensive. It has to make a return of some kind. Either large audiences or sales. If it doesn't pay it doesn't play, which is an axiom I've just invented. As you can appreciate, the 'Golden Age' of television ended years ago.

Lots of sweeping statements, naturally. The student then asked a supplementary about audience fragmentation and modernisation of the TV systems. My reply: -

I don't think audience fragmentation is much of a concern to the broadcaster. The big TV programmes will always get an audience. Notice also that all the major outlets are owned by relatively few operators. (If you own the ice-cream factory your customer base is always there however many flavours you sell). Modernisation: The big thing now is digitisation of the transmitted broadcast signal. In the US all receivers must eventually be equipped to get the digi-signal with all channels broadcast in a digital format. This would certainly improve the existing US NTSC analogue colour system which is prone to shifts in hue. In the UK, nation-wide digitisation must happen by 2010 (it was supposed to be 2006 but this has slipped because the take-up of digital set-top box converters (at £100 each) is quite slow. Each TV set must have its own converter of course. (In the present writers home that would mean four or five boxes). Digital TV delivers more channels or theoretically a better image (not both - the BBC actually reduced the number of channels on its digital 'Freeserve' TV service in order to improve the received signal which at

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the moment is only available in certain areas). Also high definition. As screens get larger, then a better line rate (1025?) would be advantageous. However it's up to the customer to decide what it wants. Recently, in the US, ABC TV abandoned their wide screen high definition sports coverage because there were not enough viewers willing to buy the expensive widescreen hi-def TV sets in order to receive the broadcasts! That's the trick really. No amount of second guessing will be of any use unless the viewer is able and willing to 'buy into' TV technology. One has only to look at all those technology 'predictions' made over the years. For example, by the year 1990 we should all have had videophones, personal helicopters, wall-sized TV screens, solar-heated homes. All possible and available today of course, but hardly any of us have any of the aforementioned. However, we ALL have colour TV sets, VCRs, deep freezes, microwave ovens, something we were all willing to 'buy into'. It's a safe bet that there will continue to be lots of people making lots of money posing as 'media mandarins' and good luck to them. However as the screenwriter William Goldman once remarked "nobody knows anything". All guesswork chaps.

75th Anniversary of the First Transatlantic Television Transmissions

By Ted Hardy

Narrow band television signals were transmitted in the 15 metre amateur band in January and February this year, the last transmissions being on the 8th and 9th of February, these being the days of the original transmissions by Baird in 1928.

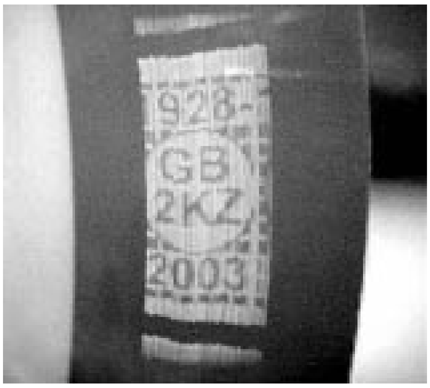
Planning for the event began in January last year, the first stage being an open discussion at the 2002 NBTVA convention. From April to September transmitting and receiving gear capable of maintaining good communications with the USA was acquired, suitable TV modulation and demodulation circuits were developed and suitable transmitting and receiving sites were being considered.

Amberley Working Museum near Arundel in Sussex has a vintage radio section, an amateur radio transmitting group, a westward facing location for aerials and warm dry accommodation for us and the equipment. A visit to the site in September started the next stage of the event. The aerials on site were not very suitable for our purpose but one of the museum radio amateurs suggested making our own aerial. The chalk cliff face to the east of the site gave us a 90ft high support for the apex of our 'V' beam aerial and trees gave us supports for the other ends of the 300ft wires. After three visits to the site we had the aerial up and an aerial tuning unit to match a 50 ohm coaxial cable to the 450 ohm aerial feeder. This completed the second stage of the event.

By now it was December and the third stage had started. From a home location, contact was established with WA2IKS in New York State on 20 metres and again a week later from Amberley. Neither location gave very good signal strengths and so we decided to change to the 15 metre band. WA2IKS was unable to provide the reception facilities we needed but put us in touch with K2MP, curator of the Antique Wireless Association museum in the New York area. The following week we made contact with both WA2IKS and K2MP at the same time. The 15 metre signals were, on average, 10dBs stronger than 20 metres.

We were now starting the fourth stage of the event. K2MP proved to be the right man in the right place at the right time; he was familiar with antique TV, he had amateur radio, test gear and computer facilities and was available for radio contact at the right times. He also had contacts through his museum for publicity and could send e-mail .wav files of pictures he had received, to us, by the following morning. A replica 30-line disc monitor, set-up instructions, receiver detector circuit modifications and a test waveform generator were sent out to him about the middle of January. We now had all our equipment up and running at Amberley. Towards the end of January we were getting promising reports of picture reception and went to Amberley on the 30th expecting to get good results, but the band was dead; no signals heard either end after more than an hour of calling and listening. An exchange of e-mail that evening confirmed that propagation was just bad that day. We decided to try again on the following Monday and found that signals were back to normal and so we tried again on Thursday. This was our last contact before the anniversary dates and resulted in the first .wav files from K2MP giving good pictures on our displays over here.

Two days later we were again at Amberley for the fifth stage, the anniversary celebrations. Both days gave reasonable results, Saturday the 8th signal strengths were good but adjacent channel interference was high, Sunday



the 9th signals were not quite as strong but interference and noise level were, less. The attached picture was transmitted during the celebration weekend and photographed then e-mailed here.

Final results which should include still photos, floppy discs, VHS video tape and CD recordings of .wav files could be some time coming in. The extent of publicity is not yet known, technical appraisals have to be made and recorded . All this information should provide much interesting work for the future.

Many people have been involved in this project but now special mention must be made of the 'Amberley' team (G4JNU, G3SDQ and G3GMZ) and K2MP who learnt how to receive NBTV in four weeks and has a groove in his thumb to prove it!

Background

The original transmissions by a small team of Baird Television engineers were from Coulsdon, near Croydon, to Hartsdale, a suburb of New York. The recent achievement, from Amberley to Hilton, was the nearest approximation to the original path that could be obtained. Conditions seem to have been even worse in 1928; sixteen weeks passed before a good 'opening' arrived (on 45 metres), the breakthrough occurring between 8th and 9th February of that year. Doug Pitt, Chairman, NBTVA

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'P' rating, Noise and Colour

By Ian Waters G3KKD.

Discussions among the Cambridge ATV group revealed that some members, not necessarily he new recruits, were not too clear about the P scale we use for picture quality reporting. Some research seemed desirable.

About 40 years ago Jeremy G3NOX published a reporting card. This had 6 off the screen pictures, black and white in those days, with varying amounts of noise. They ranged from totally noise free to one in which some picture content could just be discerned in the noise. Although the P scale was not then in use, these represented P5 to P0. This is not an easy thing to do as the integration of the photographic exposure tends to make a photo look less noisy than the picture seen by the eye. I have one of these, but I doubt many are to be found in todays ATV stations.

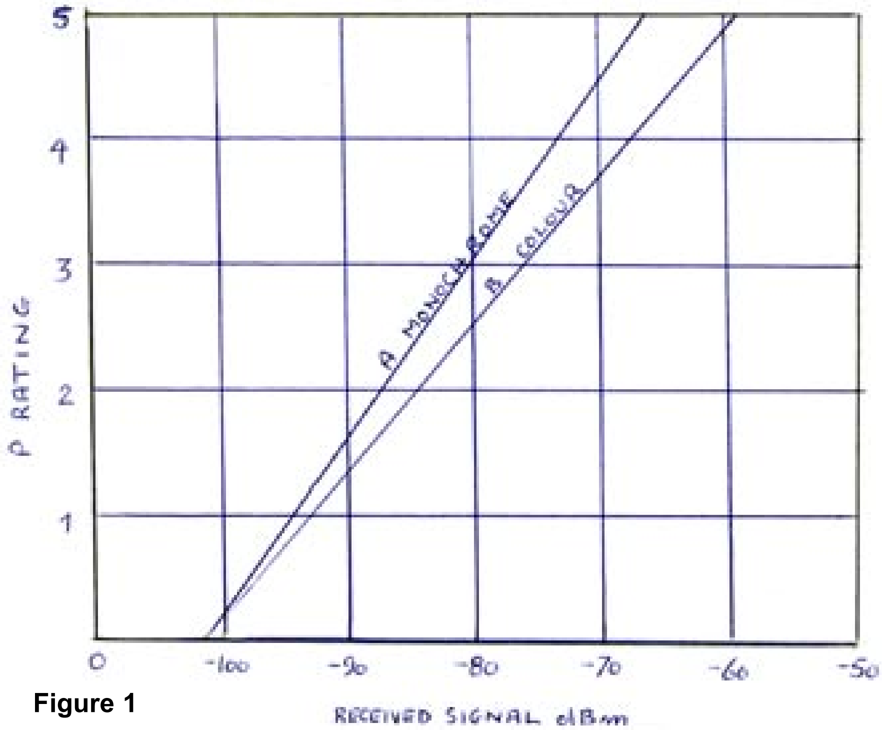


Figure 1

Rather later, in CQ-TV 177, John G8MNY published some very useful formulae. These first related TX powers, aerial gains, feeder losses and path loss to calculate a received signal level in dBm. They then calculated a receiver noise floor from its noise figure and bandwidth. An empirical formula then calculated a P rating from the margin of signal over noise floor. For convenience these formulae are repeated in Appendix 1.

I took these formulae, and wrote a simple program in basic. When used together with a path loss prediction, provided by a program such as Pathpred, it has proved very useful in estimating what results might be obtained with a particular set of equipment over a given path. Care has to be taken as path loss prediction programs are based on topographical data and know nothing about attenuators such as buildings and trees. They need to be interpreted using local knowledge.

Fig 1 curve A is a plot of P rating versus received signal in dBm of a monochrome picture, using MNY's formulae, for my receiver with an effective first stage noise figure of 0.32 dB and a bandwidth of 16 MHz. This gives a noise floor of –101.7 dBm. I used MNY's specification for P5 i.e. a 35 dB signal to noise ratio typical of VHS tape and assumed that P0 is when the signal/noise ratio is zero.

The slope is 7 dB per P point, rather more than the 6 dB per S point we use for communications.

These results were verified by feeding a signal from the local GB3PV repeater via an attenuator to my receiver and judging the P rating versus attenuation using the above mentioned reporting card. It was first necessary to attenuate the signal to a level at which the faintest trace of noise could just be seen in the grey scale and this was used as the P5 reference. Yes I am lucky to have a good signal!

At this point it became apparent that signal to noise measurements should really only be carried out on a monochrome picture, i.e. with the colour saturation control on the monitor turned to zero. The reason for this is that there are two quite different noise mechanisms involved in a colour picture. Firstly there is the luminance signal/noise ratio determined by the level of the received carrier above the noise floor of the receiver. Secondly there is the chroma signal/noise ratio determined by the level of the colour sub-carrier.

As is well known when ATV signals are received on receivers of restricted bandwidth, designed to suit the ATV specification, the chroma level is low leading to colour noise especially in saturated reds and blues. This is not so with modified satellite receivers with a wider bandwidth, but their overall signal/noise is inferior due to their bandwidth being excessive for ATV use. See my article "Bandwidth and Chroma" in CQ-TV193 page 26.

It was found experimentally, using my equipment, that a signal had to be increased by some 7dB above the level at which the luminance grey scale was free from noise before all noise disappeared from saturated colours. This fits well with the observed reduction of chroma level. Curve B in Fig 1 shows P rating versus signal in dBm for a colour picture. The slope is now 8 dB per P point.

Classic theory states that at HF receiver noise is insignificant compared with the noise picked up by the aerial, especially on the lower bands and that is before we have to suffer from PLT power line telecommunications. However at VHF/UHF the reverse is true and aerial noise is supposed to be insignificant compared with that generated by the first stages of a receiver.

Paul G8GML questioned whether, now that have low noise preamplifiers such as those using the AFT 45143 E-PHEMT FET specified as giving a noise figure of 0.3 dB at 23 cm, we should be considering aerial noise in our calculations?

As MNY's formulae do not allow for aerial noise I made a search of the literature. Some useful formulae were found in the ARRL Microwave Experimenters' Manual section 7-55. These are given in Appendix 2.

They calculate the receiver noise temperature in deg Kelvin including the aerial noise temperature. the receiver noise figure and the feeder loss. The noise temperature of a tropospheric aerial, i.e. one looking across country and not up into the sky, is said to be 290 K. This is then used, taking bandwidth into consideration, to determine the overall receive system noise floor in dBm.

I inserted my equipment parameters of NF 0.32 dB and bandwidth of 16 MHz and the result was a noise floor of –99.7 dBm, only 2 dB worse than that given by MNY's formulae. This would only be significant when looking for very weak signals, but then it could make all the difference.

I attempted to verify this by measuring the output of my 23 cm communications receiver. This receiver, which was tuned to 1296 MHz and has a bandwidth of 3 kHz, is fed from the same 20 dB panel aerial and preamplifier that I use for TV.

This proved very difficult to do mainly because a mobile phone base station mast has recently been erected about a quarter of a mile from my QTH. This is creating a dreadful racket on the 23 cm band. When beamed toward it the receiver noise increases by at least 13 dB. The noise pulsates and comes in gusts rather like listening to a gale of wind. This is presumably as the volume of traffic through the mast varies. The noise also reflects off other objects buildings etc. The noise level was independent of receiver tuning so it is probably not spurious emissions from the mast in the 23 cm band, but signals from its various transmitters intermodulating in my equipment to produce products in the band. So be warned not only do we have to contend with radar pulses but now mobile phones!

However by pointing my aerial toward a quiet part of the horizon some measurements were attempted, but I can not be sure of their accuracy. The noise level with a 50 ohm resistor connected to the receiver was compared with that with the aerial connected. It was necessary to put the resistor at the aerial end of the feeder otherwise the feeder loss would have confused things. I also used a tuner to optimise the match for both the resistor and the aerial. Although the resistor must have been generating some noise an increase of 2.7 dB was observed which fits the theory fairly well.

If/when we go digital, much of this will be academic. While we will certainly need the best signal/noise ratio to give a low BER bit error ratio, if the signal is adequate the picture will always be P5, if inadequate there will just be no picture. For this reason we will need to establish and optimise links using analog modulation before trying digital.

I hope these musings are of interest.

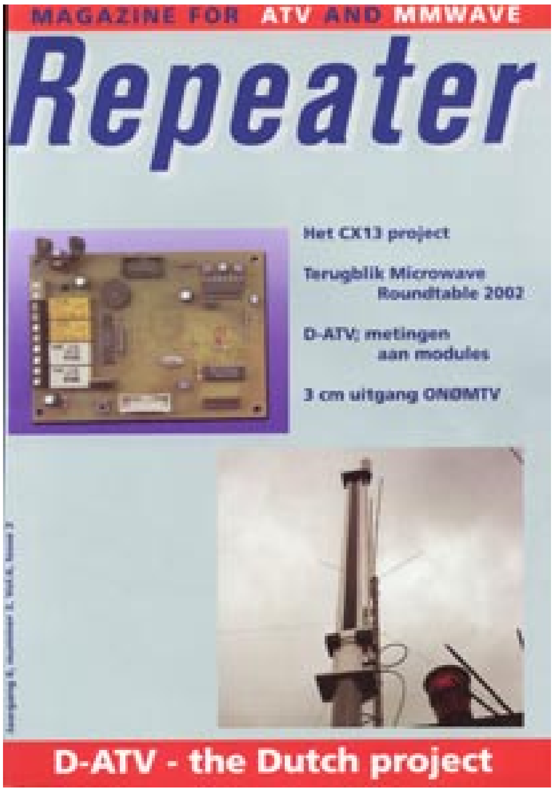
Appendix 1

1. Recd sig(dBm)= TX EIRP(W)+30 –path loss(dB) +RX ae gain(dB) –coax loss(dB).
2. RX noise floor (dB) = noise fig (dB)-174 +10 log RX bandwidth (Hz).
3. Sig/noise = recd sig – noise floor.
4. P grade = (S/N+3) x0.13.

Appendix 2.

1. RX noise temp (K) = 290(10 raised to power noise fig/10 –1).
2. Receive system noise temp (K) = Aerial noise temp (K) + 290(feed loss (ratio)-1) + feed loss (ratio) x RX noise temp (K).
3. Noise floor (dBm) = 10 log (bandwidth (Hz)) +10 log (system noise temp (K)) –198.6.

Copies of the reporting chart, mentioned in the second paragraph, are still available - item 79 - from then BATC Members Services - Ed



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Circuit Notebook 81

By John Lawrence GW3JGA

A Simple Transmit - Receive Sequencer for ATV

Where it is necessary for the transmitter and the receiver to share the same aerial then some form of coaxial changeover relay is required. The powering of different types of coax relays was discussed in Circuit Notebook 78 (CQ-TV 199).

The coax relay must only be operated and the aerial changed over when the TX is off and the TX must not be operated if the aerial is not connected to it, otherwise damage may occur.

The correct sequence is:

When going to transmit, switch the aerial to the TX, then switch the TX on.

When going to receive, switch the TX off; then switch the aerial to the RX.

The circuit of the sequencer is shown in Fig 1. It has two delay circuits. U1:B delays the turn on of the TX (RLA) until the aerial relay has had time to change over to transmit, and U1:A delays the change over of the aerial relay (RLB) to receive until the TX has turned off.

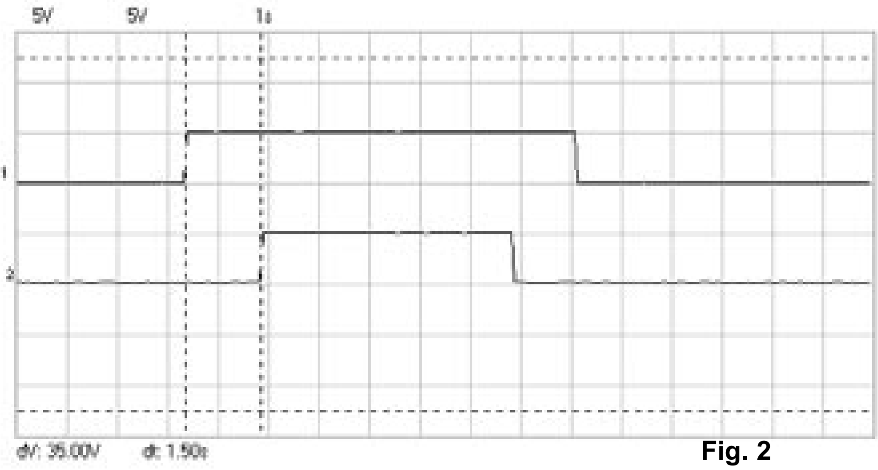


Fig. 2

The relay drive waveforms are shown in Fig.2. The upper trace is at U1 pin 3 (RLB - Aerial) and the lower trace at U1 pin 8 (RLA - TX). The oscilloscope recording shows the sequence from receive to transmit and back to receive. The delay between RLA & RLB operation is measured as 1.5 seconds, but this can be altered, by changing the values of C2 & C3.

The 74HC132 (U1) is a Quad 2-Input Nand Schmitt Trigger device. The Schmitt trigger operation provides a clean output signal from a slowly changing input signal. The 74HC (high speed CMOS) version was chosen because of its high output current capability, making it suitable for driving the following transistors. It operates from a 5 V supply provided by the 7805 regulator U2.

The circuit associated with Q2 and Q3 has been described in Circuit Notebook 78 and allows a (lower cost) 28 V relay to be used from a 12 V supply.

The Sequencer was built on Veroboard and is shown in Fig. 3.

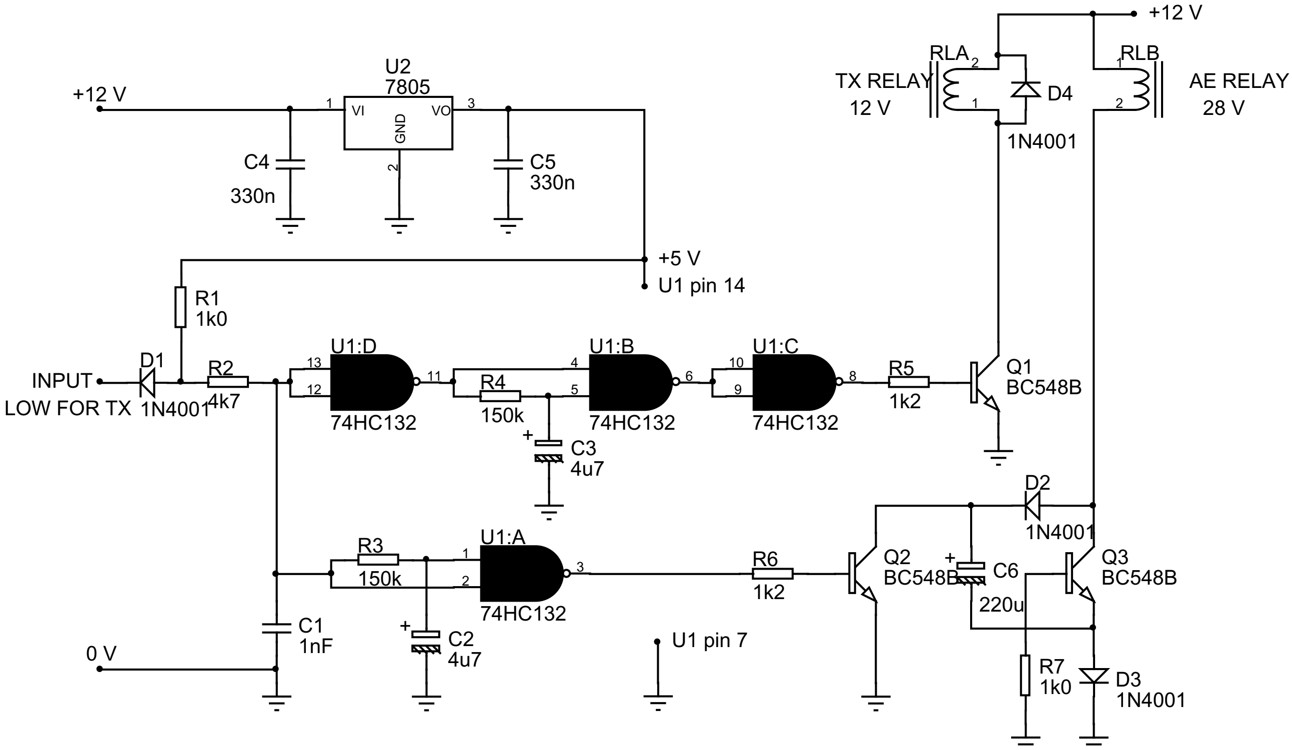


Fig. 1. RELAY DRIVER FOR TX AND AE RELAYS

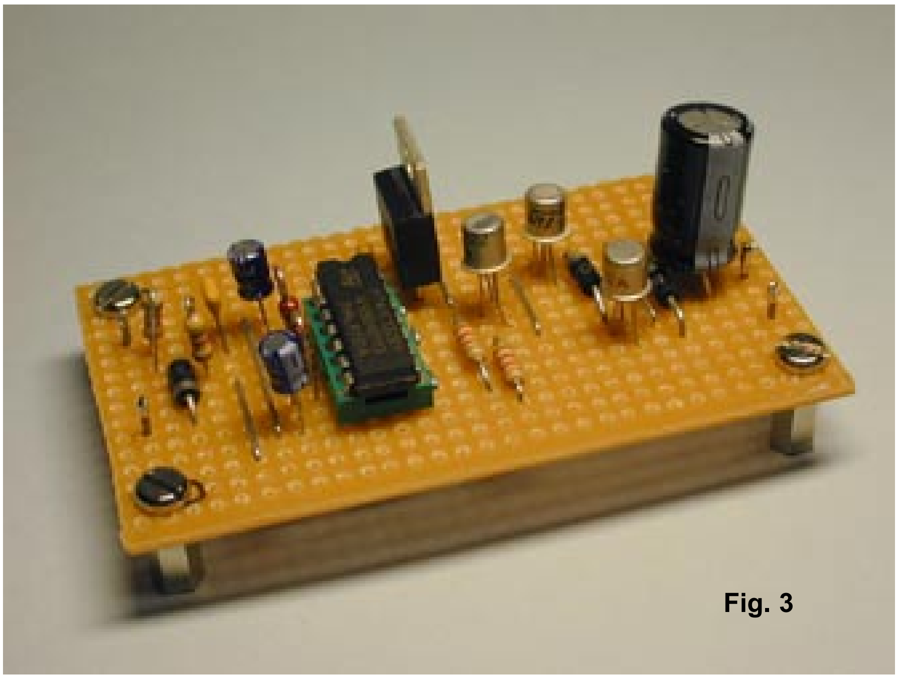
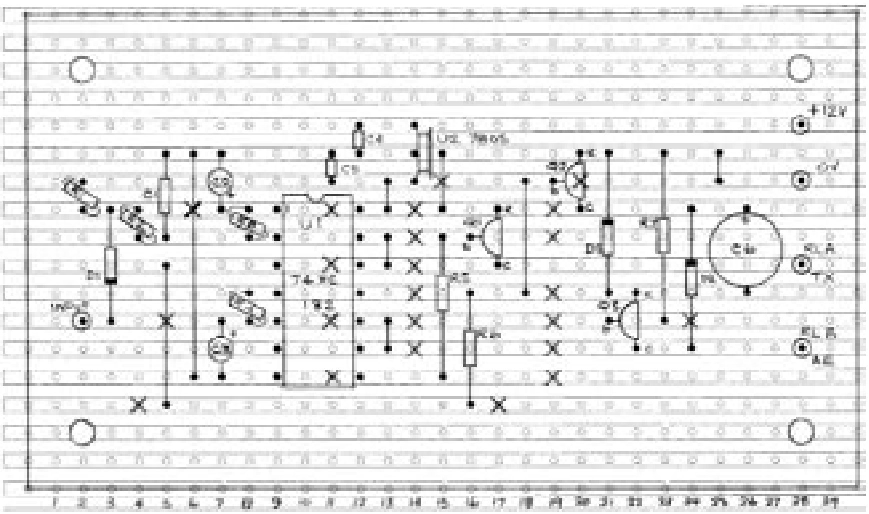


Fig. 3



Veroboard layout

Reference

Data Sheet PC74HC/HCT132
Mullard Technical Handbook 4, 1986, Part 5. - High Speed CMOC Logic HC/HCT family

Using Coax Relays with High Voltage coils John Lawrence GW3JGA - CQ-TV 199, page 43

In Retrospect

Pulse and Bar

In Fig. 8 of Part 4 of "A personal View of Digital Television" [p. 33 of CQ-TV201], the legend on the wires to pins 2 to 9 of U8 should read U5, and not U6 as printed. Mea Culpa.

Deadline

CQ-TV is published quarterly in February, May, August and November each year. The deadlines for each issue are as follows: -

February	*30th December*
May	*30th March*
August	*30th June*
November	*30th September.*

Please send your contributions in as soon as you can prior to this date.

Will all prospective contributors please be sure to read the 'Notice to Contributors' on page 3 so that you understand the implications of submitting an article for publication.

If you have pictures that you want included in your article, then please send them, in the highest possible quality, as separate files.

Commercial adverts should be sent to Trevor Brown, the advertising manager, at 14 Stairfoot Close, Adel, Leeds, LS16 8JR. Tel: 01132 670115. Email: adman@cq-tv.com. Members' sales and wants should be sent to the Editor. Email: editor@cq-tv.com

Please note that, because of the new software used for producing CQ-TV, that the required lead times have reduced and thus the 'deadline' dates have been extended to the 30th of the month.

Electronic filter for colour video signals

Peter Pohl, OE7PPJ and Darko Banko OE7DBH

A circuit similar to this was published in a magazine a couple of years ago for video playback applications. It has now been re-worked by us and adapted for amateur television purposes.

Please do not set your expectations too high though. It's not magic and the circuit will not transform a totally corrupted signal into something wonderful; even a timebase corrector (TBC) cannot achieve that kind of miracle. But the circuit will at least clean up a half-usable picture into a signal having the correct voltages and levels.

The circuit is based on a video separator for splitting the analogue signal into its components. At the core is a 44-pin FPGA (programmed IC) that repairs and filters corrupted video components, followed by a low-noise op-amp amplifier and the well-known HCF 4066 analogue switch IC. Together these work to filter and recreate the following signals at their correct levels:

1. Vertical Sync signal;
2. Colour Burst signal;
3. Composite Horizontal Sync signal;
4. Odd/Even signal (first and second half-frame).

The operational state is indicated by two LEDs. D3 shows a video signal is present, whilst D2 shows when correction is being made. The authors have tested this circuit several times over and have produced a short production run of a dozen examples in two different form factors—as a 111mm x 74mm PCB (to fit inside a tinplate case) and also uncased for rack-mount use in Eurocard format with DIN 41612 connectors.

Application reports

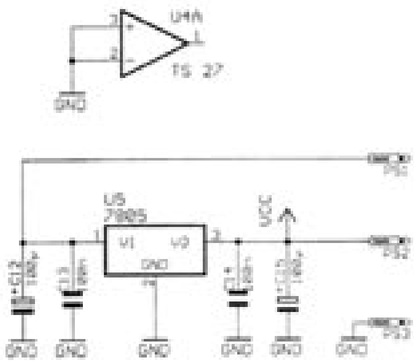
Our first application was in an ATV repeater but the circuit is equally suitable for use in receive, transmit and video playback applications. In other words, anywhere that an accurate video signal is needed.

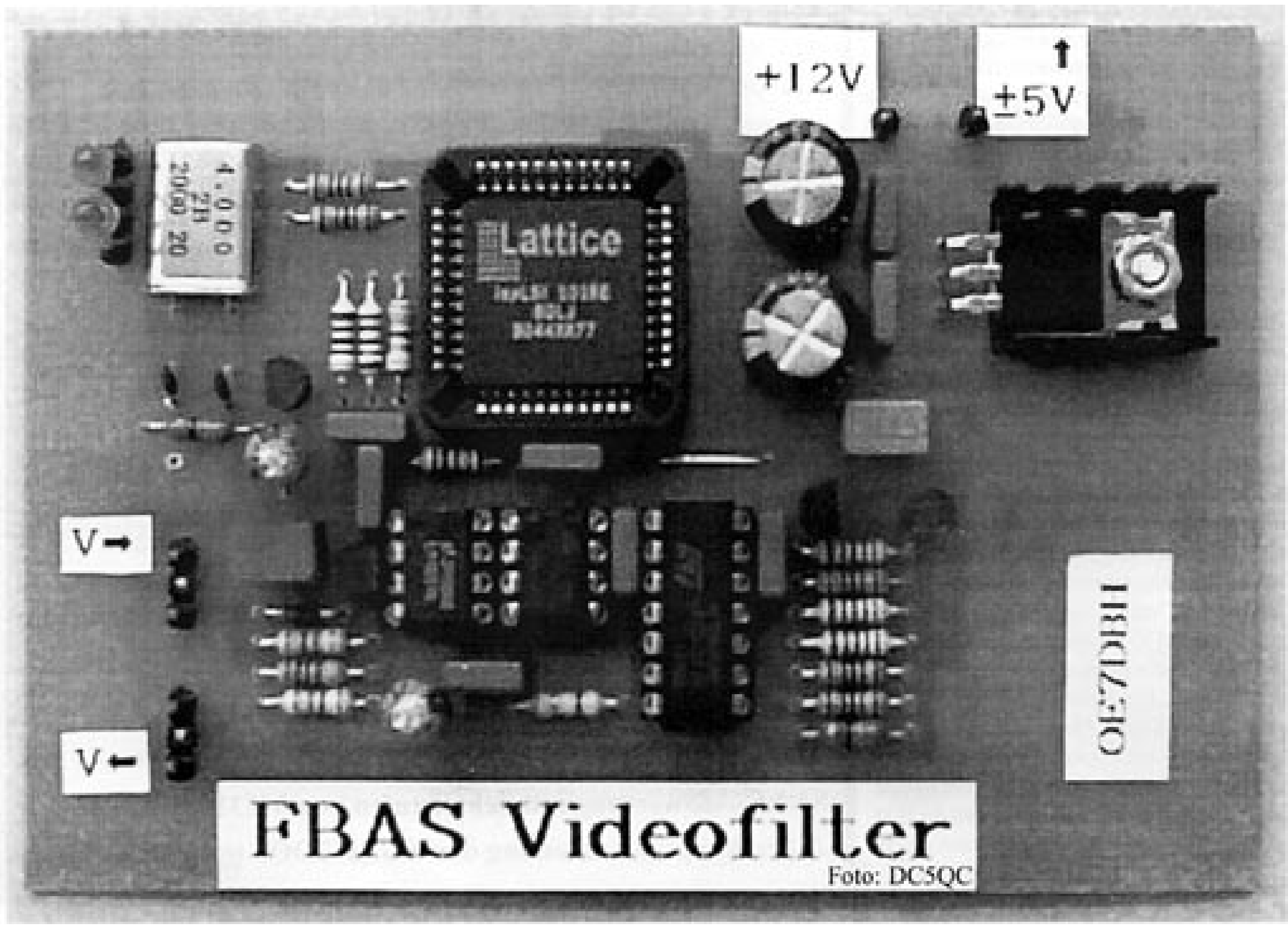
Ready-made examples in an attractive housing are also available for producing loss-free video tape copying. Website at http://members.telering.at/oe7ahj/main.htm

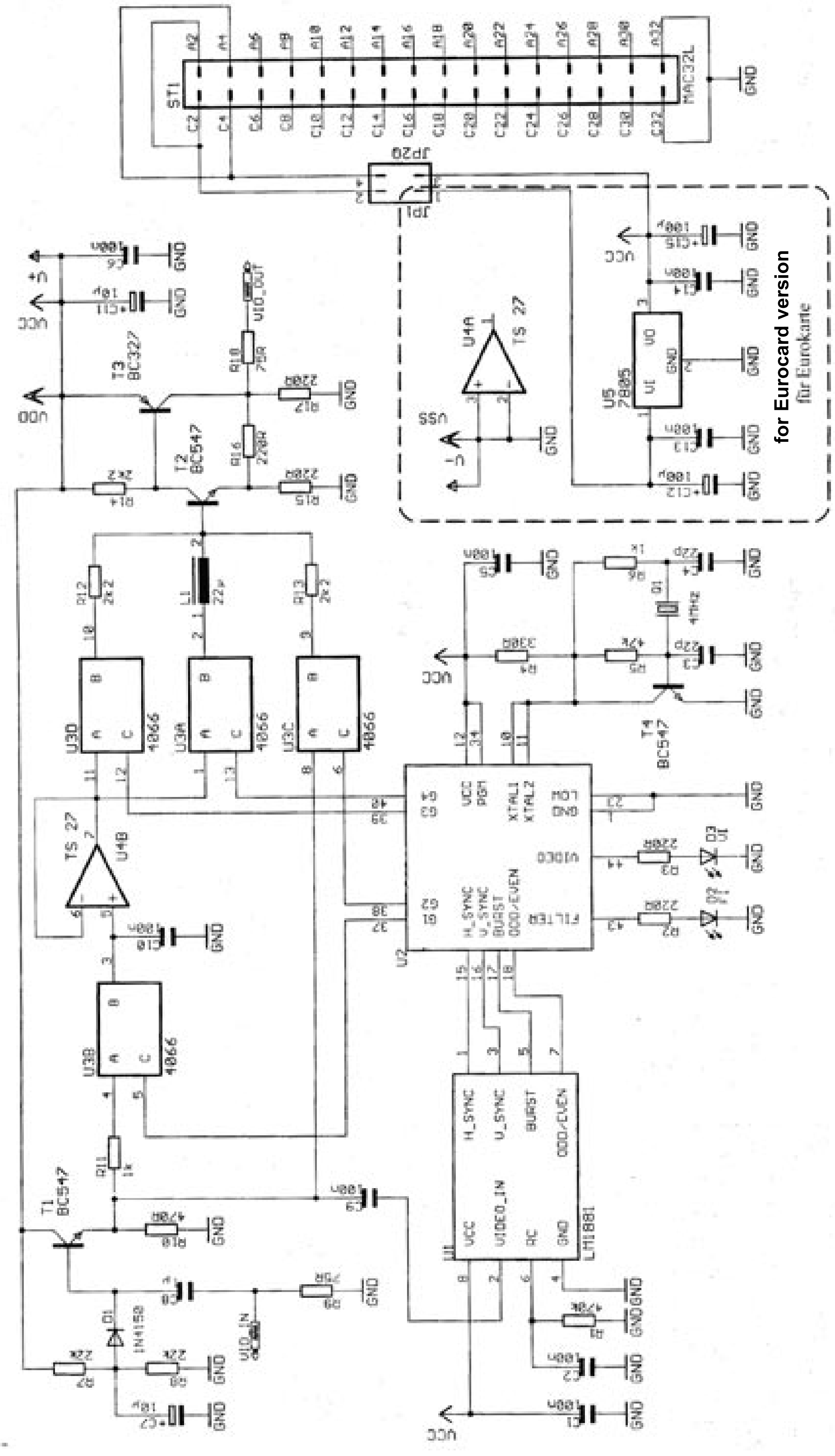
Reprinted from TV Amateur Nr. 126, http://www.agaf.de

Translated by Andrew Emmerson.

For the cased version







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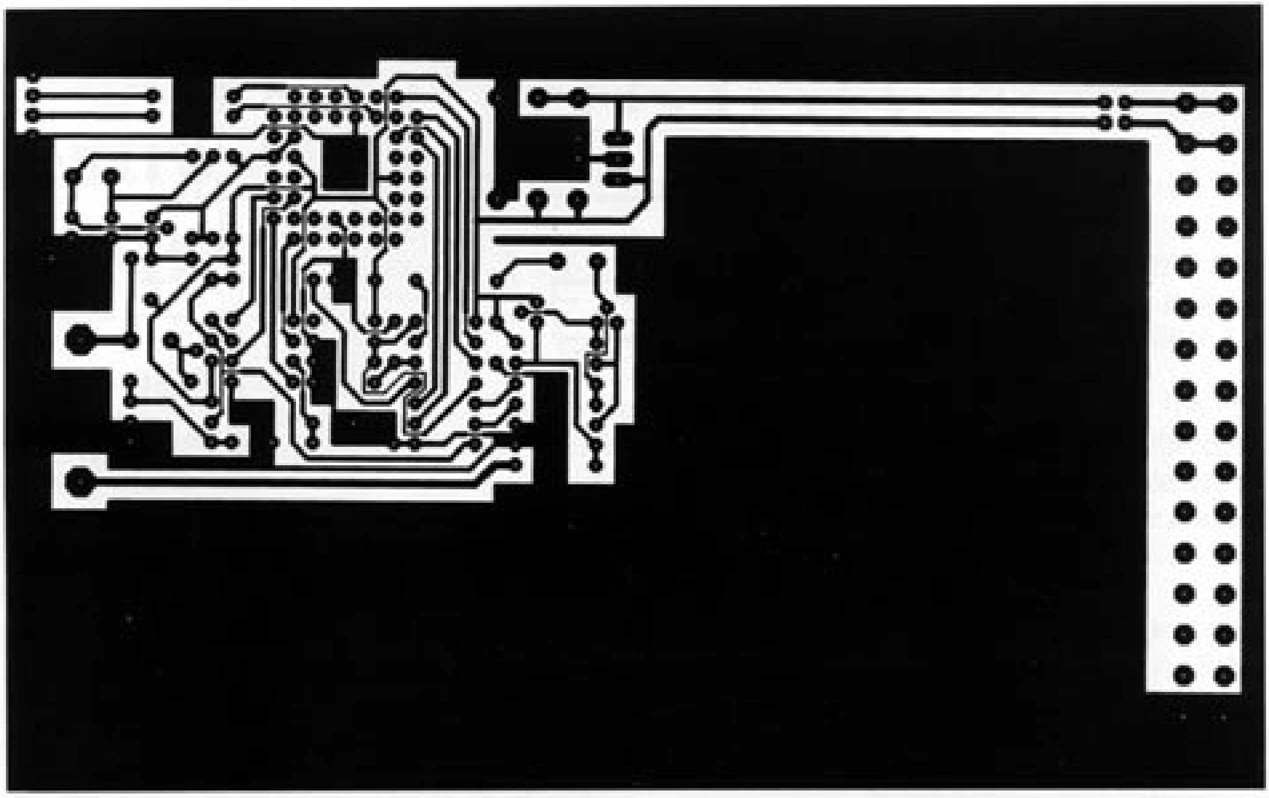
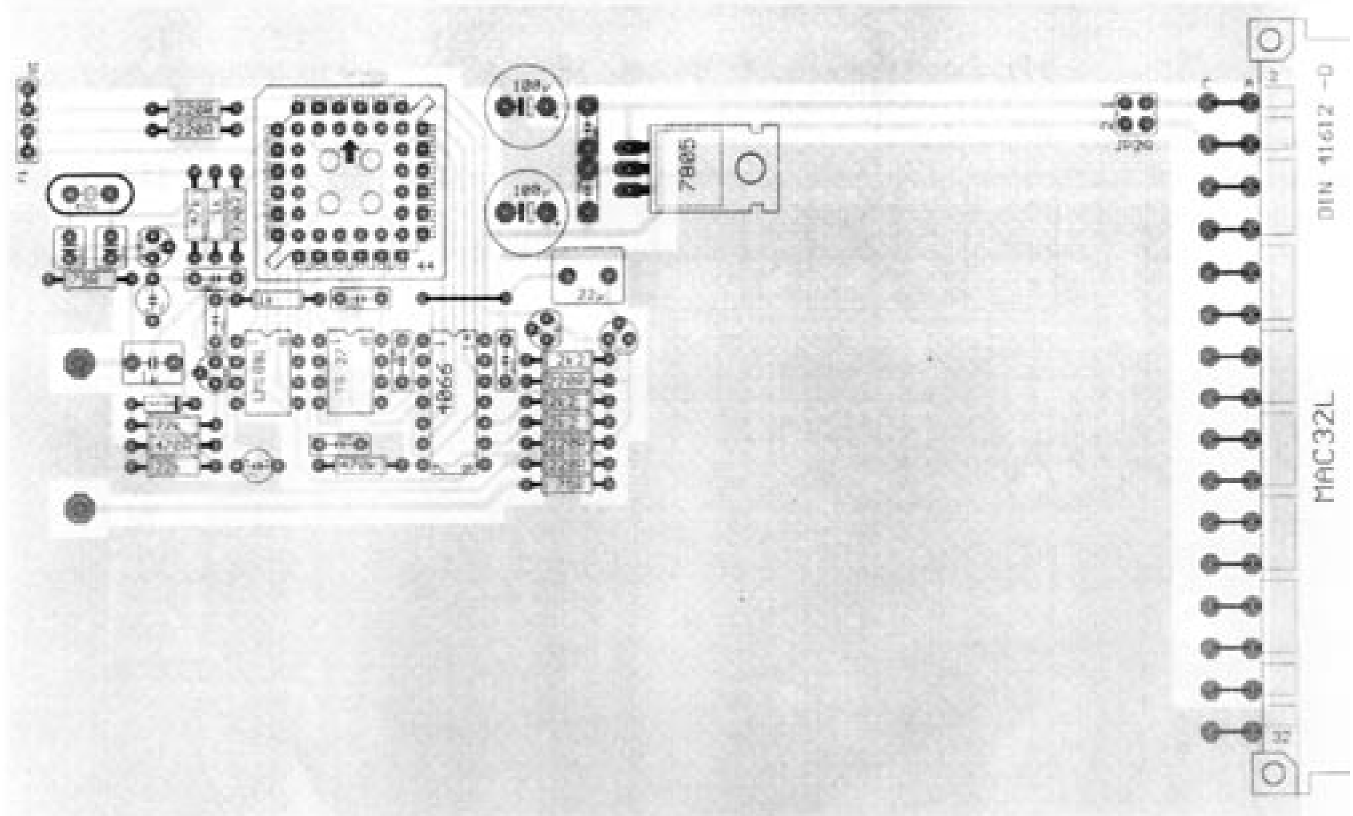




Components list

C1,C2,C5,C6,C9 C10,C13,C14	100nF
C3,C4	22pF
C7,C11	10µF
C8	1µF
C12,C15	100µF
D1	1N4510
D2	LED red
D3	LED green
Jp1	Link - 2 off
L1	22µH
Q1	Quartz 4MHz
R1,R10	470k
R2,R3,R15,R16,R17	220
R4	330
R5	47k
R6,R11	1k
R7,R8	22k
R9,R18	75
R12,R13,R14	2k2
ST1	DIN44612
T1,T2,T4	BC547
T3	327
U1	LM1881
U2	LSI1016E
U3	NCF4046
U4	TS27M2CN
U5	7805

TV on the Air

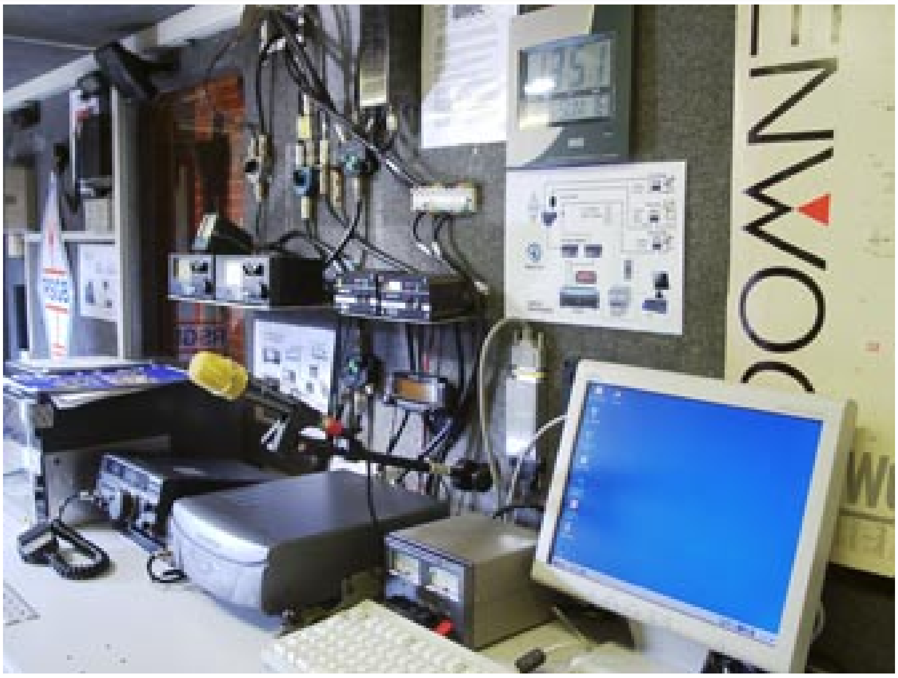
By Graham Hankins

GB4FUN

The RSGB mobile station, GB4FUN, is an educational vehicle to demonstrate the hobby, technology and capabilities of amateur radio to schools, colleges and other venues where potential and particularly young potential radio amateurs may be found. RSGB RMC chairman Carlos Eavis G0AKI looks after the development and deployment of the travelling exhibition and emphasises that 'FUN is licensed for education, not as a 'shop'; there is no promotion of any national club or society, manufacturer or supplier of equipment.

Presently housed in a modified motor caravan, GB4FUN is entirely self-contained. The roof supports masts and various antennae for HF and VHF transceivers and a computer controlled transceiver tracks and displays the paths and coverage footprints for satellites in low earth orbit, together with operating data – times of coverage, Acquisition of Signal (AOS) and Loss of Signal (LOS). Carlos is keen to add amateur television to the range of modes that can be experienced, so I have volunteered to help him to do that.

As part of National Science week, GB4FUN was in position at a family outdoor forestry centre in Derbyshire. As this was quite close to Birmingham (better than Aberystwyth, anyway, hi) I went to see the van again, meet Carlos and discuss the ATV possibilities. Even before a forthcoming refit, there is adequate space for a basic ATV station; transmitter, receiver, monitor, a couple of cameras and maybe simple vision mixing. The initial thoughts are to provide ATV transmitted from the van to a local receiving point, with 2M talkback. Therefore, I have volunteered to construct a transmitter and receiver, from kits, to be part of the GB4FUN setup.



These pictures show the interior of FUN at present; various voice kit, the blue screen on right is the satellite computer

The van must also be able to receive ATV of course, but the tricky bit is to find or provide a signal to be sent back to GB4FUN. Even if the demonstration station were to be within the coverage of an ATV repeater, activity would probably be unpredictable and infrequent unless specific arrangements were made. At the moment, arrangements for sending ATV into GB4FUN are still under consideration.

Meanwhile, if you happen to hear GB4FUN on air and decide to 'work' it, a vital point should be emphasised, whether the contact is voice or ATV. There could be schoolchildren within the van listening, eventually watching, even eventually becoming radio amateurs themselves. Keep your 'overs' short, but CLEAR and TRY to make them interesting, this 'audience' is not interested in listening for an hour of your 'life history' for example. When ATV does arrive, avoid too much of the 'mug shot' – maybe show some of the kit – even take a lid off perhaps!

Some 'non-ATV' but TV related bits

After many weeks of poor (non existent) Digital Terrestrial TV reception via an ITV Digital box of all ITV channels here in south east Birmingham, and NO BBC 4, ALL DTV free-to-air TV and the radio channels now being RELIABLY received, no blocking or freezing, thanks to replacing the 75ohm feeder! Old co-ax was solid, new is semi-air spaced low loss.

An on-screen announcement was made on Sunday evening (16th March) that Radios 1, 2, 3, 4 and 5 are now available via DTV. BBC had previously stated that these "would not be available on DTV due to lack of bandwidth and already on F.M." What's changed I wonder?

There have been concerns about 'screen burn'. With press stories about plasma screens 'burning' relatively quickly from fixed 'on-screen' station idents. The industry states that plasmas are being improved to reduce this. I notice that the screen always carries mostly static vision when radio channels are selected. Will future TVs need a 'take vision to black level', or 'go to standby on vision only' button?

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TV History: Little Televisions

Peter J. Stonard takes a look at the hisory of micro TV sets, and explores the tiny CRT technology.

Chester Gould (1900 – 1985) drew cartoons in pre WW-II America. He invented the crime fighter figure "Dick Tracy" whose cartoon adventures were published in the Sunday Chicago Tribune newspaper.

Chester gave Dick Tracy a two-way radio wristwatch in 1947, the same year that the "transistor effect" was discovered at Bell Labs. Dick Tracy's radio was replaced with a wristwatch two-way picture phone in 1964. What fan of science fiction didn't want to have a wristwatch TV!

This gadget captured the public's imagination, and has since appeared as a US postal stamp. To see an image of Dick Tracy with his two-way wristwatch, go here: http://www.trussel.com/detfic/tracy.htm

(The Author and the BATC are unable to reprint the copyrighted Dicky Tracy images here. Pity).

As is often the case, science fiction and science fact feed off each other, and so it was for the development of micro TVs and other portables that we have quickly taken for granted today. Practical micro TVs have just turned twenty-five years old.

Sir Clive Sinclair

A name much more familiar to CQ-TV readers, especially in the UK, is Clive Sinclair (1940 -). About the time Dick Tracy was sporting a new TV watch, news broke in the UK of the Sinclair personal television set project. That was 1963, and the company was Sinclair Radionics, which got it's start in 1961. A prototype TV, dubbed the Microvision, was shown at the Radio and Television Show at Olympia in 1966, with a production release promised for the following year. The tiny set (about 50 x 65 x 114mm) and running from six pen light batteries, used a 2 inch CRT obtained from 20th Century Electronics, and the TV drew 450mW

Sinclair did not loose focus on miniature televisions, and the fruits of that labour will be explored later in this article.

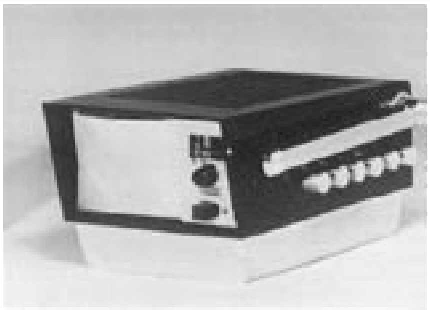

Photo 1 Sinclair Prototype 1963 (Courtesy of Enrico Tedeschi)

Sinclair optimistically advertised the Microvision for forty-nine guineas and to be available in 1967. Sadly, production of a Sinclair micro TV didn't happen until 1977. Making a prototype is one thing, doing it in volume production is quite another!

Photo 2 Philco Safari 1959 (Courtesy of Tom Genova, TV History)

Who Was First?

Some years earlier, American home electronics company Philco, had beaten everyone to the punch with the world's first all-transistor portable TV which was offered for sale in 1959. Called the Safari, it used a two-inch electrostatic tube, and a clever mirror system to magnify the image to about 12 inches equivalent size. It was hardly a wristwatch, or even a pocket-sized unit!

The Japanese Invasion

The 1960s were exciting times for new consumer products from Japan. In that era much of the Intellectual Property (IP) came out of Europe and the States, while the Japanese got the miniaturisation and production part of the story correct. In the Japanese culture anything in the public view is thought of as free for the taking, and having a competitor copy your work was a sign of flattery. (You should be one step ahead – let them waste their time reverse engineering your last year's model). Inherent in Japanese goals were consistent, reliable, and repeatable performance. Perhaps this is because the Japanese market for electronic goods was a long way from Japan? Sony quickly got high marks from owners for their first portable battery TV set, the 8-301W, which was introduced in 1961. As we will see here, the Japanese ultimately won that race, and dominated the market for micro TVs through the end of the TV tube technology era in the late 1900s.

Photo 3 Sony 8-301W 1961 (Courtesy of Tom Genova, TV History)

Power Crisis

The hurdles to overcome were not just miniaturisation of existing components, but also reduction of the electrical power consumption, because the television operated from batteries. (Also from optional AC adapters or 12V vehicle power).

For Sinclair the biggest challenge was finding a suitable picture tube (CRT or Cathode Ray Tube). No other technology existed; the LCD (Liquid Crystal Display) was still about ten years into the future (University of Hull, UK. 1973). The choices were straightforward – use an existing tube, if one could be found. Or, use a new design and pay for development and tooling.

There were no integrated circuits for TV sets at that time, although IC technology was available but costly. New IC designs for TV sets eventually added greater circuit density and still lower power operation to micro TVs.

Without costly development of new custom ICs, the first generation micro TVs used discrete transistors.

Miniature CRT Tubes

If limited to existing CRT technology, the next design decision facing creators of micro TV sets, is whether to use Electrostatic (ES) or Electromagnetic (EM) deflection of the CRT beam. Early TV set pioneers had tried both, as did WW-II era radar tubes, with a slight lead to ES types. Early micro TVs have also used both technologies. The biggest power consumption in the CRT is the heater, and operating at a lower beam current also reduces power. Unfortunately, it greatly dims the picture – not good for a set that likely will be taken outdoors in daylight.

Choosing a screen size is also a trade off; bigger size negates portability, power, and weight. Smaller sizes reduce these factors but create problems of resolution (viewability). Sinclair and Philco used 2inch tubes at first, Sony started at eight inches and dropped to about four inches later. Panasonic started at 40mm (about 1 3/8 inches) and stuck with it. Their sets typically came with a clip-on magnifier lens.

A new market with the same requirements was emerging about that time; portable TV camera viewfinders – but in the 1960s it was limited to low volume, high performance (and therefore costly) professional kit.

Miniature CRT viewfinder technology ruled the day well into the 1990s, for consumer camcorders, even going as far as a full colour display. Eventually TFT LCDs took over, after a brief showing by other non-CRT display (such as Electro Luminescent) types. The 1980s was the golden age for video display and similar technological development - thanks to volume consumer demand.

Hitachi was lined up to supply tubes for the Sinclair production model, likely an EM type destined for camera viewfinders. The Japanese also stuck with EM types, but Sinclair went back to ES deflection to further reduce power demand.

Sinclair MTV1

Sinclair kept the name Microvision from the prototype, but the actual production unit was quite a design departure. Other Sinclair products of the day, which were aimed at the masses and priced accordingly, were often sold in kit form, too.

Photo 4 Sinclair MTV1A

The production Microvision TV was very costly to make, and the typical buyer would therefore be a professional businessperson who likely would want to take the TV with them overseas. The set was designed for worldwide reception with user selections of locale (switches are labelled "US", "EUR" "UK",), which changed the scanning format (525/60 and 625/50), as well as the FM intercarrier sound channel spacing (4.5, 5.5, or 6MHz, respectively).

Photo 5 Sinclair MTV1 Internals

Continuous tuning on VHF and UHF bands, and built-in VHF rod and UHF loop aerials added even more complexity! German AEG Telefunken manufactured the two inch electrostatic deflected CRTs, operating with about 1250V acceleration, while the electronics used three custom-designed ICs built by Texas Instruments, along with two other TV ICs of the day. The four PCBs (with one sub PCB) interconnect with rows of metal pins and sleeves, avoiding wires.

Unfortunately, the MTV1 CRT faceplate is made by closure of the tube glass, and had optical imperfections that the CRT used by the Japanese did not. Also, to lower power even further this CRT does not have an aluminiumized screen, which would require a higher accelerator voltage to operate, but produce a much brighter picture.

The densely packed case, 100 x 150 x 36mm (4 x 6 x 1.5 inches) W x D x H, with built in NiCad rechargeable batteries (plus a vehicle cord, and an external AC mains adapter) weighs a hefty 740mg (26 ounces) and sold for about 200 GBP ($400 when introduced in the USA), in 1977. Making it "more costly than solid silver".

Demand was very strong, rapidly outstripping supply of this hard to manufacture product. Problems persisted with internal electrical shorts and high voltage leakage. The factory added what seems like miles of red sticky tape, all chopped up and strategically placed.

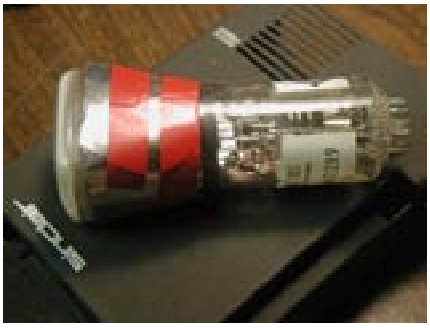

Photo 6 Telefunken D5-100W CRT

Production hiccups were a familiar story for Sinclair Radionics, who had a history of tapping markets that no one else knew about, offering revolutionary products, but not meeting initial demand. When production finally hit the breakeven point, of about 4,000 TVs per month, the market had vanished and units remained unsold. So much so, that the company took a loss of almost a half-million pounds sterling that year, and was forced to sell off the excess units cheaply.

A new and improved TV1B model, followed by other country specific and simplified models, was launched in late 1978, along with a video monitor version.

Sadly, this business case failed miserably, and so Sinclair the man, left Sinclair the company, in mid 1979 with a 10,000 GBP golden handshake. Sir Clive went on to set up Science Of Cambridge, while the TV set business was passed to Binatone, who soon dropped it completely.

Novel CRTs

Because the CRT is the key component, and all other circuitry, housing plastics, and electronics are built around it, novel CRT development was attempted by both Sinclair and Sony during the late 1970s.

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Also, the research labs at RCA (and likely others that have not been so widely touted) worked to make flat screen TVs a dream from as long ago as the 1950s, that didn't materialize. At least not until today's plasma TV displays, which do indeed hang on the wall. Along the way RCA also boasted of a pocket size flat tube colour TV, which was featured in the USA Popular Mechanix magazine, and published in 1966.

As natural competitors both Sinclair and Sony developed flat tubes concurrently and in secrecy, but like other human endeavours, where the challenges were the same for both parties, the solutions are quite similar. They arrived on the market about the same time (Sinclair FTV1/TV-80 in 1983, Sony Watchman FD210 in 1982).

Breaking with a CRT tradition, that of a viewing screen on the end of a glass cylinder (or flask), both Sinclair and Sony achieved practical tube designs featuring a short depth but at the expense of much greater width (Sinclair) or height (Sony). The viewing screen is still a phosphor that emits light when stimulated by an electron beam, but now the beam arrives from the side. The image is also on the same side of the screen as the viewer, instead of behind the screen as in conventional tubes.

This means the beam must bend almost 90 degrees off axis to strike the screen. The RCA labs flat tube employed a similar concept, a decade earlier.

Sony Watchman 1982

Sony solved the beam-landing problem with a curved screen, one that's tipped up at the top.

Photo 7 Sony FD CRT with Yoke

In keeping with Sony's personal music Walkman of the 1980s the personal TV was called the Sony Watchman. The tube can be mounted in the case 'gun-up' instead of 'gun-down', and tubes with three different screen sizes (50, 75, 100mm) were made.

Later, the tubes were used in home security systems called WatchCam, and professional handheld video monitors that were popular behind the scenes on movie and TV sets.

Photo 8 Sony Watchman micro TVs (with 50 & 100 mm CRTs)

The first Sony FD tube used EM horizontal, and ES vertical deflection, together with a relatively low accelerating voltage. Later tubes switched to all EM deflection.

Additional circuitry is required to modulate the horizontal scan (to correct keystone distortion), while also modulating the vertical scan (to correct for the curved screen linearity).

The Watchman internal construction follows typical PCB assembly with a mix of through hole and surface mount parts, and reduced wiring through the use of flat flex-circuits in the later models. This certainly reduced assembly labour even further.

Sinclair FTV1 (aka TV80) 1983

Photo 9 Sinclair FTV1 w/Flat CRT

Sinclair solved the CRT deflection problem by drawing the beam from a horizontal axis to the parallel screen with electrostatic attraction. The phosphor screen is only one third of the TV picture height; a clever Fresnel lens design takes care of expanding the image to normal height for the viewer.

The FTV1, which was also named TV-80 for the target selling price of eighty pounds sterling, is built around a CRT that uses ES deflection and even less parts count than the Sony offering! Sinclair was said to have designed the CRT production tooling and handed the manufacturing over to Ferranti in Scotland. The lessons learned on the former MTV1, which was almost impossible to assemble or service, had hit Sinclair hard.

Once the Flat CRT allowed the shape of the packaging to change, another piece of technology fell into place – flat batteries. While flat battery jokes mock motorists who don't understand that 'flat' also refers to the charge state (at least in UK English), the FTV1 used the new 6volt non-rechargeable lithium battery; that also appeared in some Polaroid cameras about the same time. Sadly, these were very costly; a pack of three spares costing 10% of the price of the TV itself.

Photo 10 Sinclair FTV1 Internals

Panasonic – Nothing Fancy

Japanese electronics giant Matsushita, better know by brand names National (Japan, Australia), Panasonic (USA) and National Panasonic (in Europe) were well respected for mass-produced complex products. They entered the micro TV market with a fairly conventional set, the TR001 in 1971. While they called it an "integrated circuit", the design was actually IC free.

Photo 11 1971 Model TR-001 (German National brand model shown) (Courtesy of Frank Guenthoer)

This company is a classic study of Japanese "Kaisen". The art of continuous improvement, starting with the simple and progressing steadily onwards.

While the TR001 was probably not a big hit, making examples rare today, Matsushita withdrew from the market until the redesigned and much-improved model TR1010P was ready in 1981.

Photo 12 TR-1010A Kit 1982 (Australian National brand model shown)

All the monochrome TR series employ the popular 40CB4 CRT, a 40mm monochrome EM deflected type, with a nice flat (pressed glass) faceplate and very good resolution. It was likely developed for ENG camera viewfinders, and makes a very bright display with about 4700V acceleration.

Photo 13 1984 Models: TR-1020P with AM/FM Radio (L) & TR-1030P

Some models added features such as AM/FM radio, and versions for 525/60 and 625/50 (with 120 or 240V AC adapters). These were sold in respective countries, but the sets did not have the world travel ability of the Sinclair MTV1 that they originally targeted.

Photo 14 TR-1020P TV with AM/ Stereo FM Radio Internals

In Living Colour

Once micro TVs reached the mass market, even though they were priced as high as typical tabletop TV models, the obvious next step was to add a colour display. The flat CRT tubes did not lend themselves to colour, so the later colour Sony Watchman models were all TFT LCDs.

There was a growing market for miniature CRTs in the home video cameras of the 1980s, where they served as viewfinder and VCR playback monitor. Average folks tried their hand at TV production with these home cameras, and a major issue surfaced – colour balance. If manufacturers could solve this (and add auto focus) likely it would open the market further.

Without training the average hobby level camera operator got colour balance wrong much of the time. So some manufacturers (Panasonic, Hitachi, RCA) added optional colour viewfinders to high-end hobby camera models for operator awareness. While very ‘cute’ the colour viewfinder was not affordable, gave up resolution, draws more power, and probably didn’t help the colour balance adjustment issue very much either. Automatic colour balance circuits were added in the 1990s and appear on all contemporary camcorders, most of which also have TFT LCD colour screens as well.

Panasonic CT-101 1984

Photo 15 Rare CT-101A (1984)

Panasonic applied this colour CRT technology to a micro TV. It is basically a colour version of the existing 40CB4 monochrome CRT. Boasting a three-gun tri-phosphor PIL (Precision In Line) design, it even has a micro sized internal shadow mask. The screen is the same size, but the tube body becomes slightly larger. The micro TV also needs an NTSC decoder to receive USA and Japanese colour TV broadcast signals. (Anyone know if a PAL version exists?).

The extra electronics - (compared with the B/W versions) pushed it into a larger case, about the same size as the B/W micro TV with built-in stereo radio.

Photo 16 CRTs (L) BW: 40CB4 Colour: A04JGM09X with yoke

Power consumption was also up, so the internal power was increased to eight penlight (USA AA) cells or their NiCad equivalents.

CRTs Demise

When the small area passive LCD technology emerged from the research lab in the 1970s, it was quickly adopted for micro TV applications. The first LCD sets were crude, with low contrast and lower resolution than CRT versions, starting with trade show demonstrations in 1977. The LCD panels were flat (great for handheld packages) and the LCD devices took very little power.

Because a LCD modulates external light, such as sunlight or room ambient light, it doesn’t use much power compared to the CRT. CRTs are also more bulky than LCDs, even in the new flat variation. When required, a backlight can be added behind the LCD, but usually at greater (than equivalent CRT) power consumption. Also, the viewing angle is limited, making them a bit difficult to see without constant shuffling by the viewer.

Photo 17 First LCD Micro TV Casio TV-10 (1983) (Courtesy of Frank Guenthoer)

In mid-1983, at almost the same time as the flat CRT Sinclair FTV1 was launched, Japanese Casio introduced

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an LCD portable TV, the TV-10, with a huge 67mm diagonal screen. Only one year later Epson introduced the ET-10, with a much-improved active matrix LCD, and in colour too!

Photo 18 First Colour LCD Micro TV Epson ET-10 (1984) (Courtesy of Frank Guenthoer)

Dick Tracy Finally Gets A TV Watch!

Remember Dick Tracy? He had a cartoon wristwatch two-way radio, and later a cartoon two-way video phone. Well, the TV watch finally emerged for sale (in receive only format) in late 1982, when the LCD watchmaker Seiko introduced the Seiko TV Watch. The display is actually a monochrome blue and black.

While the self-powered quartz watch with TV display screen was worn on a wrist, the TV receiver portion required an outboard box, about the size of a Sony Walkman, and powered by a pair of penlight (USA AA) batteries. Quite the collectors item!

Photo 19 Seiko TV Watch (1982) (Photo by Eric Long. Courtesy of the Smithsonian Institution.)

Wanted:

The author is seeking any technical information on the early Sinclair MTV1. Do you have a circuit diagram (schematic)? The author has merged parts from three salvaged MTV1 units to get a working one! (They were all slightly different inside, too).

Acknowledgements:

The author would like to thank some fellow collectors, and also the Smithsonian Institute in Washington DC, for permission to reprint photos. Their respective web sites are well worth a visit:

Enrico Tedeschi, Brighton, UK

http://www.etedeschi.ndirect.co.uk/

Tom Genova, Michigan, USA

http://www.tvhistory.tv/index.htm

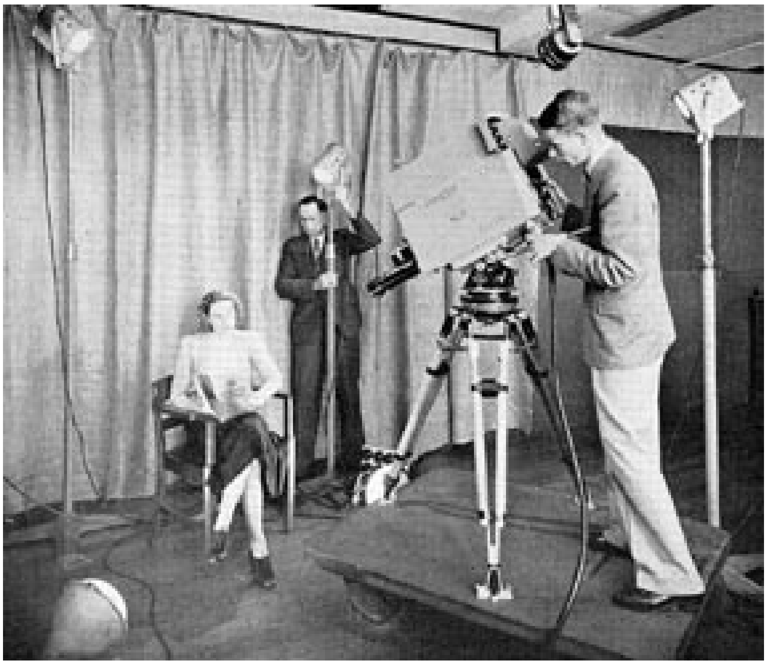
Frank Guenthoer, Bavaria, Germany

http://www.guenthoer.de/index-e.htm

Smithsonian Institute, Lemelson Collection, Washington, DC, USA

http://www.si.edu/lemelson/Quartz/coolwatches/tvwatch.html

Photos by the author, unless noted otherwise. The author lives in California, and is best reached by email: pstonard@ix.netcom.com



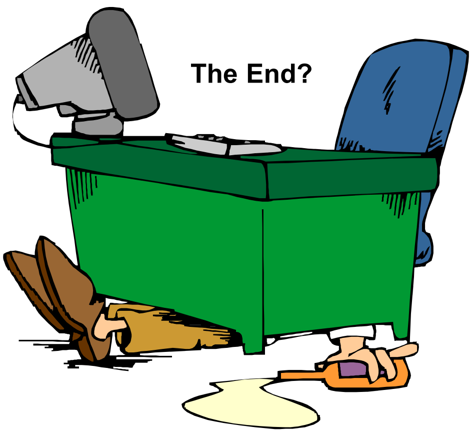
Dicky Howett writes: Here's a shot taken in 1949. It shows an original perambulating Marconi Mk One 3 " IO camera. The place, Australia and the occasion, a demonstration for the benefit of Marconis' associates, the Amalgamated Wireless (Austrialia) Ltd and the Oz Institute of Radio Engineers. As the photograph indicates, the elaborate school-hall lighting and natty curtain probably detracted not a bit from the novelty of seeing a trim young lady reading a copy of the AWA's very own exciting Technical Review magazine. The Marconi Mk One is sitting on a Vinten J gyro pan head. All this heady stuff meant that Australia was rushing headlong to begin broadcast tv which began a mere seven years later with the 1956 Melbourne Olympics. As you might have guessed, the equipment for this was supplied by Messrs PYE.

Electronic CQ-TV

This quarter's settings for access to the electronic versions at www.cq-tv.com/electronic are -

Username: amember **Password:** springtime

Hi De Hi! Who's this little chap? No not Dicky Howett. It's none other than future holiday camp riding instructor Felix Bowness handing out the prizes on Clacton Beach in 1956. Dicky and his mum look suitably amazed, as well they might.



AMSAT-UK 18th ANNUAL COLLOQUIUM

At the University of Surrey 25th – 27th July

Find out about another side of the hobby - amateur radio satellites.

Come for the whole weekend and stay overnight in the University Student accommodation, or pick your day, and just come to hear the presentations or use the antenna range, etc.

- Open to all – whether you are an AMSAT member or not, non-members are very welcome.
- An antenna test range for 1.3GHz and 2.4GHz will be available on the Saturday together with suitable test gear.
- Find out from the gurus how satellites really work!
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- Over twenty new presentations and demonstrations will take place over the weekend and Control Room tours around the SSTL satellite "factory" will be available
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A booking form and full details are available on our web site, or can be obtained from the address below.

This is your opportunity to find out how satellites work, what you need to work through them, and to rub shoulders with the radio amateurs who design, build, and control amateur spacecraft.

For more information about the Colloquium, or about joining AMSAT-UK, visit: www.uk.amsat.org/colloquium.htm or send an sae to J D Heck, G3WGM, Hon Sec AMSAT-UK, Badgers, Letton Close, Blandford, Dorset DT11 7SS. UK Email: g3wgm@amsat.org

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GH Engineering

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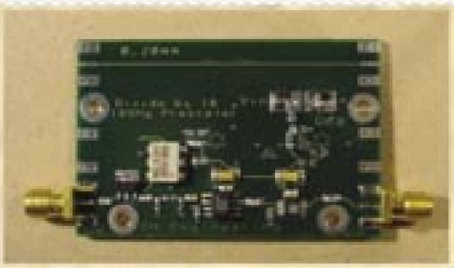
10GHz, divide by 10 prescaler



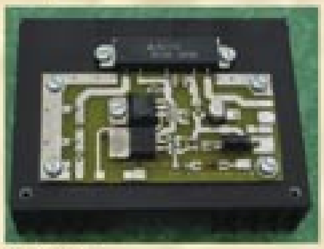
A true divide by 10 prescaler which allows a 1GHz frequency counter to be used at microwave frequencies with no loss of accuracy. Frequency range DC – 12GHz (typical). Input power –15 to +10dBm. SMA input/output sockets.
£95 built & tested, or £72 as a kit.
Also available – 12GHz divide by 8 prescaler – same PCB as above, only £74 built & tested, £54 as a kit. (Note that the kits are for advanced constructors only and require special SMD re-flow soldering.)

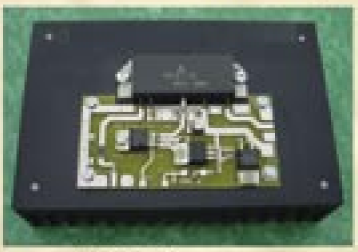
1.3GHz Power Amplifier kits

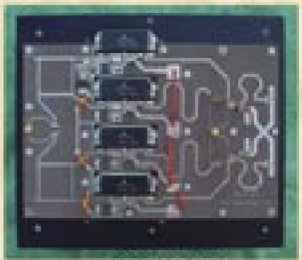
All 1.3GHz PA mini-kits have recently been reduced in price

12 – 13.8V DC supply. Mini-kit contains PA module, PCB, all PCB mounted components & undrilled heatsink. Drilled & tapped heatsink - extra £9. PA1.3-16 & PA1.3-18 are similar apart from power levels.

2W and 16W Power amplifiers for G1MFG Tx | **18W for Solent/Worthing** | **72W – DXATV**







PA1.3-2		PA1.3-16		PA1.3-18 (shown built, in case)		GH *QUAD*	
Mini-kit	£70	Mini-kit	£118	Mini-kit	£105	Mini-kit	£450
Diecast box	£3.50	Built & tested	£270	Built & tested	£258	Built & tested	£715

PA2.3-1 – 13cm 1W Power Amplifier for G1MFG Tx

1W output power for 25mW input 5V or 12 – 13.8V DC supply @1.1A
SMA plug on input connects directly to Tx
Supplied built & tested on baseplate - £65
Optional N-type output socket available – only £4 extra

PA432-17 70cms 17W linear amplifier

Same as PA1.3-18 above, but giving 17W PEP output at 70cms for 200mW PEP input. Mini-kit – only £83

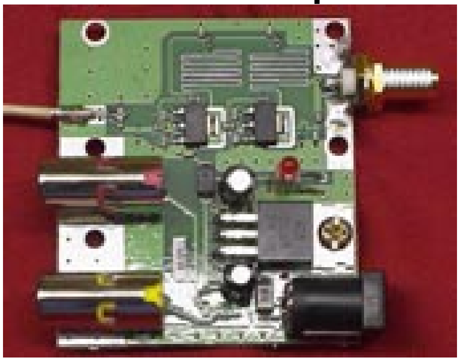
Also available – full range of RF semiconductors from Agilent, Mitsubishi, Hittite and Mini-Circuits, plus N-type and SMA connectors, cables etc.

The Forge
West End
Sherborne St. John
Hants RG24 9LD

Tel 01256 889295
Fax 01256 889294
ghengineering.co.uk
email :- sales@ghengineering.co.uk

G1MFG.com *The best ATV gear in the world...*

NEW 1W 23cm amp £48.00



This new amplifier gives up to 1W output from our 23cm transmitter. The input is via a SMA plug on a 4" flying lead (not shown in photo) and the output is via a SMA socket. Built & tested, just plug it in for more power!

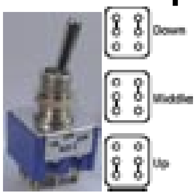
6W 13cm amplifier

New lower price **£199.00**

Requires around 25mW in for 6W out, typically gives 5W from our 13cm Tx. Fully built and tested - just add 12V!

Tx/Rx sequencer switch

£3.50



Special switch for simple Tx/Rx sequencing. Full details on web site.

NEW Scanning receiver BOXED £125.00

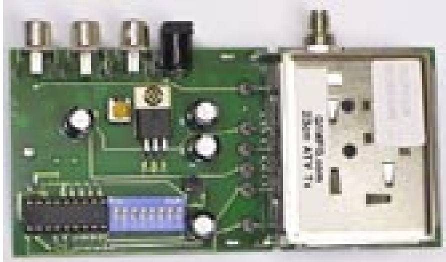
Comprises a receiver and backlit LCD controller in a brand new custom-made case. 10 memories, two scan modes. Wide frequency range:

- 13cm version covers 2.2-2.8GHz
- 23cm covers 800-1800MHz and also has CCIR de-emphasis.

Specify type when ordering.
Case only - £29 including all hardware

All the following transmitters and receivers operate from 12V DC (nominal) and are fully synthesised, using onboard DIP switches (or an LCD controller) to set the frequency. All have 6.0 & 6.5MHz sound, use SMA RF connectors, phono for video & audio, are built and tested and come with full instructions.

23/24cm ATV Tx £42.50

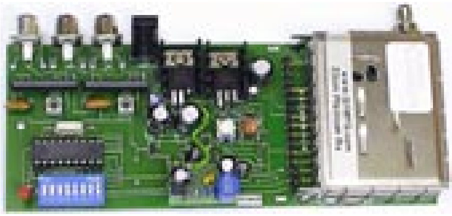


Covers the whole 23/24cm band in 500kHz steps, 50mW output (nominal).

13cm ATV Tx £42.50

Covers the whole 13cm band in 1MHz steps. Power output 20mW (nominal). Looks identical to the 23/24cm ATV Tx.

23/24cm Platinum Rx £60.00



Our most popular and most sensitive 23/24cm receiver. Covers whole band in 500kHz steps. Includes CCIR de-emphasis. Our exclusive G1MFG modifications give SUPERB sensitivity - up to 2 P-grades better!

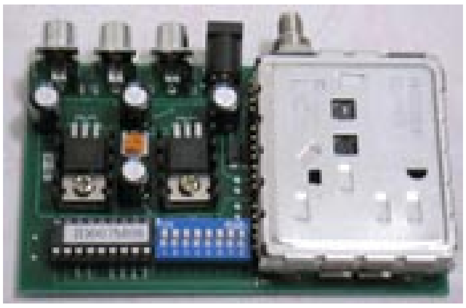
"ENG" Rx £55.00

Receives 2.2-2.7GHz in 2MHz steps.

13cm Advanced Rx £55.00

As ENG Rx, but covers13cm amateur band in 1MHz steps. *Better for ATV.*

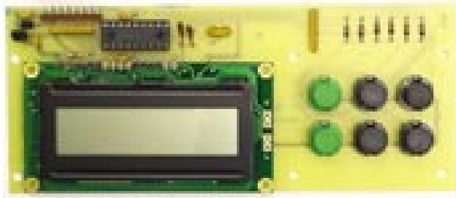
NEW 13cm 250mW Tx £99.00



Covers the whole 13cm band in 1MHz steps - just like the standard 13cm Tx but higher power output of 200-250mW across the band.

LCD controllers

With green backlight **£49.00**
Without backlight **£42.00**

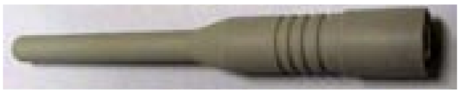


23/24cm version connects to Rx & Tx for easy pushbutton frequency control in 125kHz steps, 3 VFOs, auto-tune Rx to Tx frequency & much more. Enables wideband Rx too!

13cm version similar to above but for 13cm Tx & Rx (Advanced or ENG).

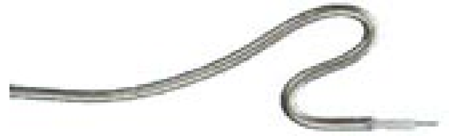
ENG version connects to Advanced or ENG Rx, provides 10 memories and scanning features.

13cm rubber duck £9.00



Sleeve dipole with integral SMA plug.

Quickform 086 equivalent £2.50/m



Interchangeable with RG405 semi-rigid co-ax, but much more flexible.
SMA plugs for Quickform 086 **£1.25**

SPECIAL OFFER 2m Quickform 086, 6 MA/**COM** SMA Plugs - **only £9.99**

Bits and pieces

N 'free' socket to 0.5m UR43 open end, ideal for aerial termination £3.50
SMA plug to BNC socket, aerial adapter cable for Tx or Rx £2.95
SMA plug to N socket, aerial adapter cable for Tx or Rx £3.95
SMA plug to SO239 socket, aerial adapter cable for handheld £4.95
BNC chassis socket with short length of thin indifferent quality co-ax attached, believed unused 5 for £4

How to order: send a cheque or P.O. **payable to G READ** to G1MFG.com, L'Eglise, Durley Street, Durley, Southampton, SO32 2AA

Prices include UK P&P
Minimum order £10.00 (sorry!)

Telephone 01489 860 318
email sales@G1MFG.com.

Visit our web site at www.G1MFG.com