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Chairman's Column

Welcome to CQ-TV 195. A lot has happened since we last went to press, starting with our annual rally. This was held at Bletchley Park, or Station X as it is better known. There were the usual ATV trade stands and a very well supported car boot sale (see the colour pictures). The highlight of the day was the lecture programme. Noel Matthews G8GTZ explained the various TV digital systems and provided a live demonstration of an OFDM system. Mike Cox, the BATC President, took everyone through "The Story of COX Electronics" from Vision mixers to PAL coders. Paul Marshall, BATC Secretary, presented the final lecture, "Big Bertha". This was the story of his renovation of the Southern TV mobile control room, which is now virtually complete. We were able to site three TV cameras in the lecture room and a small vision switcher that enabled simple camera cuts. It took to some time to get all three cameras genlocked, but eventually this was achieved and the switcher output was routed, along with sound, to the BT and ITN uplink trucks brought along by Tony Kempton G1BYS and Ashley Booth G3TQE. The BT and ITN truck uplinked the televised lectures on Intelsat 801 328.5deg E. and Intelsat 21.5E. Renns Maas in Holland down linked and relayed the proceedings onto the local repeater PI6ALK - this repeater is also on satellite W2 16deg E. Many amateurs as far afield as the Middle East watch PI6ALK via this satellite. Back at Bletchley, we were also able to monitor the output of PI6ALK from the W2 satellite. The live lectures arrived back without any discernable quality loss, but some four seconds later. Paul Andrews G6MNJ and Mike Hasting G8ASI of Three Rivers Communication brought along a terrestrial TV links truck, which provided 13 cms signals that could be viewed on various stands. Ian Waters G3KKD had his car based ATV station running. The traders had a chance to show some of the equipment in operation, so that you could judge its performance for yourself. I hope everyone who attended enjoyed the day out and that some of our more remote members may have seen some of this activity through PI6ALK.

For some time now the discussion

forum provided by CQ-TV in the form of letters and emails has been diminishing and we have been searching for an alternative way of answering questions and airing points of view. The main problem is that if you ask a question via CQ-TV then, because we only publish 4 times a year, you may have to wait some time for an answer; the same goes for using CQ-TV to air points of view. I hope we now have the answer, at least for our cyber members. This will be a live discussion forum on our website, where you can ask questions and join interactive debates about our hobby. The software chosen is only available as a beta version at the moment, but it has been tested by a number of committee members and the results fed back to the author. By the time you read this, we should have the final version installed and a link called **FORUM** on both websites.

We need to select moderators to police each forum and wipe old and outdated comment, in order to keep it up to date. Please be patient with the new software and let's hope it becomes a valuable tool in communicating with each other.

CQ-TV has also had a few changes, including the paper and, this time, a colour supplement. I hope we can print colour pages a little more frequently in the future, but they are expensive. The newly published advertising rates have also been implemented in CQ-TV 195, which will help a little in subsidizing the printing costs. Sorry to all those that I contacted with this bad news, but I think most of you know that the costs are very reasonable compared to other publications.

Last, but not least, the radio microphone featured in CQ-TV 193 apparently suffered a typographical error, and has a range of 8 - 10 metres, and not 80 to 100 as published. It shows the power of a decimal point! We would remind readers that they need to check that operating an item such as this will not infringe the local regulations for transmitting devices.

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See previous adverts for details.

Television in a Parallel Universe – Part 1

By Paul Marshall

Once upon a time, many years ago (not that many, actually) there was another Super Power in the World and things there were done a little differently. Not only in terms of the organisation of society, but in terms of science, engineering and technology.

Happily, we can now see and experience some of these different approaches for ourselves and see where things were similar and where they differed.

In 1991 the USSR (Union of Soviet Socialist Republics) was dissolved and the Republics of the Former Soviet Union (FSU) have since gone their own way. The dominant republic in the old USSR was of course Russia, and now Russia has reverted to the traditional flag of Peter the Great and is a way down the road to becoming a very different country than in Soviet times. One of the strengths of the old USSR was in science and technology. This lead to a development of similar, but often radically different, pieces of hardware and of technological infrastructure. This is graphically illustrated when we turn our gaze to SOVIET TELEVISION.

It's a happy consequence of being an engineer that you are often able to see and experience things in foreign lands that you might not otherwise. In the last few months I have been fortunate in visiting both Moscow and St



Author and Prof Maxim Tomilin alongside the Gagarin memorial statue at the GCTC

Petersburg in the 'new' Russia and whilst there have been able to explore some of these different aspects of television technology. This article is relatively brief and can not hope to cover anything like all of the interesting things I've seen over there. I present it merely as a flavour of what there is, across a wide spectrum covering 'television' in its broadest definition.

Just watching Russian television in your hotel room is an experience – ever seen 'Who Wants to be a Millionaire?' in Russian? Yes, the format is exactly the same, right down to the lighting plot and graphics. Even the presenter uses the line 'Are you sure?'. It's out and about in some of the museums and institutions that the really interesting things are to be seen. Some of them are not open to the public (yet) or are 'by appointment', or 'with permission', but generally everything seems pretty normal.

Some of the institutions that I visited are: -

Gagarin Cosmonaut Training Centre (GCTC), just outside Moscow

Not open to the public, by invitation only. Helen Sharman and Dr Michael Foale studied and trained here for the missions on board space station MIR. Fascinating place but I can't share the photos with you, it's not allowed!

A S Popov Museum, St Petersburg

One for wireless fans. Popov was the Russian Marconi, closely shadowing many of Marconi's early successes. He died relatively young in the early 1900's and has never received the credit due to him in the west. The museum is in the Electrotechnical University and open by appointment.

S I Vavilov State Optical Institute Museum, St Petersburg

Another area of technology that Russia is strong in is optical science and engineering. Here is to be found an important collection relating to the



history of this dominant institute. Honours include the invention of the white light hologram.

Open by appointment only.

The Television Museum, St Petersburg

Based in the buildings of the Television Institute, it displays the most fascinating collection of television technology. Ranging from space cameras, through domestic televisions to broadcast cameras.

All of these places produced a very knowledgeable guide (Russian speaking only; you need an interpreter), all of whom seemed genuinely pleased to see interest and who were very happy to show things of special interest.

In addition, I was fortunate to see Outside Broadcast Trucks in operation



Author with THAT camera, picture of Major Gagarin on the right

in both Moscow and St Petersburg (where I was also able to talk to a cameraman about his work there).



General View of one room of the Television Museum. 'Dark Side' camera is on bottom left.

Two things were missing: –

A visit to the St Petersburg Television studios did not materialise, and the other thing was a visit to the famous Ostankino TV tower in Moscow (still closed to the public after the fire but fully operational again technically).

On the next few pages I would like to share some of my recollections and photographs of my thought provoking visits there.

Continuing the Gagarin theme, The Television Museum had on show the actual TV Camera used by the man himself on that historic first trip into space. A small, ordinary little green box containing a vidicon camera relayed pictures of this historic event back to Earth. The camera runs with only 100 lines in order to keep transmission bandwidth to a minimum. Major Yuri Gagarin made his historic flight on board the Vostok 6 capsule on April 12th 1961 and this little camera was there to witness it.

Imagine my surprise when the museum guide said that we (myself, and a work



KT-87 4½ in Image Orthicon camera.

colleague) could have our pictures taken holding this camera! Anywhere else in the world and this camera would have been behind a glass screen and never touched.

Whilst on the subject of space TV cameras (of which there were many different types on show, including impressive 'spy' types I wasn't allowed to photograph!), it's worth noting that there was one of the type used to photograph the dark side of the moon for the first time. This used a film camera to take the pictures which were then developed, fixed and then scanned by a flying spot scanner and transmitted to Earth once the satellite had returned from the radio shadow of the dark side. A space version of the 'Intermediate Film' system from the 30's!

Moving on in the Television Museum and most of the Soviet made broadcast television cameras can be seen, but sadly no examples of their 2in and 1in VTR equipment, except in photographs.



KT-116 4 tube colour TV camera, 1968 (side covers open).

Soviet Television opened after World War II (they call it the 'Great Patriotic War') in 1948 on 625 lines 50 field. It was intriguing to see 1950's TV sets at the museum picking up current day television off air with a few inches of wire in the aerial socket!

The first broadcast cameras (no examples on show unfortunately) used Iconsocopes, of course, but Image Orthicon based cameras rapidly became the norm. Indeed, the Soviet Union was one of the few countries in the world to master the intricacies of 4½ in Image Orthicon tube manufacture. They called it the 'Super Orthicon'. A few examples of such cameras were to be seen, including the KT-87, which looks externally very like a Marconi MkIII. Internally, apart from the 4½ in IO, the KT87 seemed very different.



KT-132 3 tube colour TV camera.

By the coming of colour TV to the Soviet Union in 1967, cameras still seemed to be based in external styling and general architecture on the Marconi ones. Hence, sat in a corner was a very Soviet looking Marconi MkVII. Opening up the side covers revealed four tubes right enough, but everything else was *completely* different. This particular example even sported the same Rank Taylor Hobson Varotal V Zoom Lens and a Vinten MkIII Pan and Tilt head! Later versions of this camera apparently used their own Pan and Tilt head and their own Zoom Lens.



KT-178 studio colour camera

Marconi influence in styling can again be seen in the later KT-132 3 tube colour camera. For those familiar with the Marconi MkVIII it has a very familiar look (apart from that very Philips LDK5 looking viewfinder). Internally again very different to a

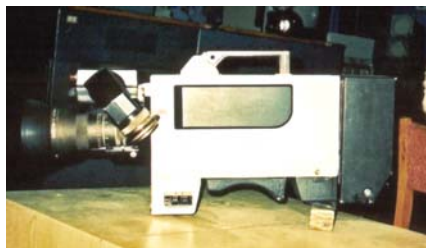


Gagarin's 100 line Television Camera with description alongside.

MkVIII or the LDK5.

As things begin to change in the world of broadcast television, so the 'Parallel Universe' also changed. Japanese ideas about camera shapes and sizes begin to play a more significant role.

To anyone who has ever used an Ikegami HL79 the picture below of a KT-190 will look familiar.



KT-190 portable colour TV camera.

Back to studio based cameras and two radically different looking channels bearing, so far as I am aware, no resemblance to any other camera.

The KT-178 (shown on the previous page) is an example of the last generation of tubed studio camera. The Soviet made Pan and Tilt head had a good feel to it and the electronics seemed to be largely in the camera head. The zoom lens is a 35:1 locally designed and made unit.

The second 'oddball' is a KT-170. I failed to gather any more information on this one.

Finally on cameras is an example of a BETACAM based product, the KT-221 that seems to have been one of the last cameras produced. This is a 3 CCD camera with a docked beta recorder. The CCDs for it were apparently designed and manufactured in the Soviet Union.

Sadly, the Television Institute is now a shadow of its former self with the workforce cut from around 3,000 down to a few hundred. Today, all broadcast equipment manufacture has ceased

and work is centred around space based programmes.

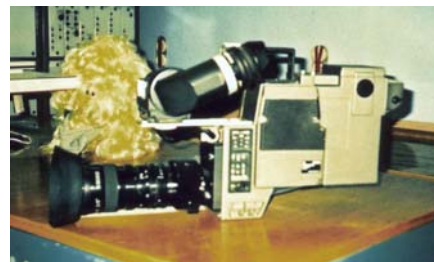
The last major broadcast activity seems to have been in the early 90's with investigations and sample production of 1250 line HDTV equipment.

Just like everyone else, Russian Television companies use mainly Japanese equipment with a few smatterings of Philips and Thomson.

In Part 2, I will turn towards some of the Outside Broadcast photographs and look at the domestic television side of the Television Museum. In addition, a quick tour of the AS Popov Museum and a look at how television broadcasting is organised in the modern Russia of 2001. Incidentally, the year 2001 is actually the OFFICIAL start of the new millennium there, so all you



KT-170 colour TV camera.



KT-221 with docked Betacam recorder

pedants can take heart that somebody agrees with you!

If there is sufficient interest a quick guide to Russian technical terms and a cross reference from Cyrillic to Latin characters could be included (commonly known as *transliteration*). So, anybody with a burning desire to dust off that old RIGONDA that needs fixing please contact me.

Russian websites are particularly interesting; many have English versions (look for the Union Flag). Your browser may not recognise Cyrillic text; Windows and WORD can both be adapted to read and generate all this. I'm typing this on a Cyrillic adapted keyboard – but I don't understand much of the language, yet (if ever).

Some interesting websites (first two in English and very interesting links):

<http://www.moscowtimes.ru/>
<http://www.tvtower.ru/>
<http://www.ostankino.ru/>



Ostankino TV Tower, Moscow. Photo from <http://www.tvtower.ru/>

AFD's and Aspect Ratios

By Tony F Dunstable

What's it all about?

There is currently a great deal of confusion about the different ways in which widescreen programmes are 'flagged' on Digital Terrestrial Television in the UK. This web page is to provide some information to help people to understand how and why the various methods are used. The information is factual and not based on assumptions although there is of course the possibility of small mistakes.

Why do we need it?

One of the biggest stumbling blocks for UK broadcasters in implementing widescreen has been concerned with the difficulties of transmitting a wider picture using the existing network while retaining compatibility for viewers with conventional sets. The introduction of digital TV has finally given the TV broadcasters the opportunity to transmit widescreen.

The argument over whether or not we need widescreen is out of the scope of this document but, like it or not, it appears that the broadcasters' aim for the future is for all television to be 16:9.

Chicken and Egg situation - Which comes first, the widescreen receiving equipment or the widescreen programming?



4:3 picture in a 4:3 coded frame

Now that the technology is there (or nearly there), with digital TV having Active Format Descriptors etc., programmes can finally be broadcast in a 16:9 ratio even though the majority of the audience are watching on 4:3 television sets.

Active Format Descriptors are equally important for 4:3 standard format sets as they are with 16:9 widescreen sets.

Aspect Ratio Information

Two parts to the information

Whatever method is used for transmitting the aspect ratio signal there needs to be two parts to the information.

1. Coded Frame Descriptor

The first part to the information is the aspect ratio of the source (or coded frame). The aspect ratio of the coded frame describes the aspect ratio of a television tube if the entire frame was to fill the width and height of the tube (without any aspect ratio conversion or letterbox generation). It is most obvious by looking at the example screenshots.

All the aspect ratio signalling systems currently in use allow for only 2 different coded frame ratios: 4:3 or 16:9. The data is generally carried as a Boolean flag.

2. Active Format Descriptor (AFD)

The second part of the aspect ratio signal is called the Active Format Descriptor. The AFD refers to the programme content of the picture and it contains information about how the



4:3 picture in a 16:9 coded frame

signal has been produced, how the cameras were framed and how the programme is intended to be viewed.

All material whether 4:3 or 16:9 will have to be subject to an aspect ratio conversion on somebody's receiving set. For example if the source material is 16:9 it will need to be converted to 4:3 for display on a 4:3 TV whether this involves cropping the edges of the picture, 'letterboxing' the picture or a combination of these techniques. If the source material is 4:3 it will need to be converted to 16:9 for widescreen TV's and this will involve cropping the top/bottom of the picture, 'pillar boxing or adding curtains' or a combination.

Currently produced programme material must try to support both aspect ratios. This has led to a number of compromise formats including 14:9 letterbox, 14:9 shoot and protect, 4:3 in 16:9 shoot and protect, 14:9 with curtains. The AFD reflects which compromise has been made in the production of the programme.

The AFD is used by the receiving television (or digital set-top box) to display the picture in a form most suitable and most likely to be preferred by the individual viewer. The receiving television (or STB) chooses an aspect ratio and how to convert the ratio by using the AFD in combination with the viewers' preference and the aspect ratio of the television (4:3 or 16:9).

Possible values for AFDs are shown below: -

Video Index and Widescreen Signalling

How is this information carried?

There are two methods for carrying the information which both use a line in the VBI (vertical blanking interval).

1. WideScreen Signalling (WSS)

Also known as WideScreen Switching, this is information carried in a similar way to standard teletext. The first half of line 23 is used (the other half is the start of a PAL frame) and although this carried digital data it can be thought of as an analogue waveform. The waveform contains 14 bits of data that contain the coded frame format (source aspect ratio) and the active format

descriptor. The data is similar to the PAL Plus switching signal and the WSS shares a common method of representing the coded frame format with PAL Plus.

Since WSS uses the same method of indicating the coded frame format as PAL Plus, widescreen receivers designed and built before the advent of digital TV are still able to switch aspect ratios correctly between 16:9 and 4:3 coded frame. WSS passes through analogue and digital systems and being on the first line of the active picture it is unlikely to be stripped by any equipment in the transmission chain.

2. Video Index Information

The video index information mechanism (formalised in SMPTE RP186) consists of 90 bytes of data carried in the chrominance time slots of the line reserved for DVITC (Digital Vertical Interval Time Code). The vertical index is on lines 11 and 324 for a 625-line signal or lines 14 and 277 for a 525-line signal.

The video index data is organised into three groups known as classes: -

Class 1 Information related to the display of the signal, including aspect ratio, pan scan information, colour coding, field rates etc. Class 1 is sub divided into classes 1.1, 1.2 and 1.3, each comprising 3 bytes of data.

Class 2 Technical information about how the video was originated (component, PAL) or previously processed. Class 2 is sub divided into classes 2.1, 2.2 and 2.3, each comprising 3 bytes of data.

Class 3 Other information relating to the video (not needed for display). Class 3 is a single block of 24 bytes.

The data for class 1.1 is mandatory for equipment complying with this recommendation.

The first byte of class 1.1 is relevant to the subject of aspect ratio information. This always contains the coded frame

format (along with the scanning information i.e. how many fields per second). Within the UK, broadcasters have agreed an extension to the scanning system byte that uses bit 3 - 5 to carry the active format descriptor (AFD).

Video index can only be used in digital systems because the data cannot be carried within a standard television waveform but is read by aspect ratio converters (ARC's) and MPEG encoders from most manufacturers.

Implementation

How has this been implemented in UK digital services?

UK DSAT

So far British Sky Broadcasting (the operators of DSAT in the UK) have only used the source aspect ratio (16:9 or 4:3) part of the line 23 widescreen signalling code for aspect ratio switching. In fact the current DSAT set top boxes do not include video index or the processing of active format descriptors in their specification.

UK DTT

The UK Digital Terrestrial Television system has provision to use both widescreen signalling and video index information. At launch, the set top boxes and integrated digital TV's could only decode the widescreen signalling and were only able to use the source aspect ratio (coded frame format) of this information. The receiving equipment has recently (April 2000) been upgraded by over-the-air software updates so that the video index information can also be decoded and the AFD's within the video index can be used.

At the time of writing, only some of the services on multiplex 1 (BBC mux) are using the AFD data contained within the video index information. Other channels are switching the coded frame format signal and swapping between a 16:9 and a 4:3 coded frame (using an aspect ratio converter in the final stages of the transmission chain).

Do AFD's lead to a reduction in horizontal resolution?

Format	AFD	How the receiving set interprets it
0	As coded frame	The material is intended to be shown in the aspect ratio indicated by the coded frame flag.
1	4:3 area	The 4:3 central area of the image is intended to be shown. If the coded frame is 4:3, then the whole of the 4:3 image is intended to be shown. If the coded frame is 16:9, then the 4:3 central area is intended to be shown.
2	16:9 area	The whole 16:9 area of the image is intended to be shown i.e. the programme is of 'true widescreen' origin and losing the edges would be a significant loss to the programme. The coded frame is most likely to be 16:9 in which case the whole of the picture should be shown. The coded frame could be 4:3 in which case the transmitted signal will contain horizontal black bars therefore a 16:9 set must zoom the image.
3	14:9 area	A 14:9 area of the image is intended to be shown. If the coded frame is 4:3, it will have thin horizontal black bars. A 16:9 should 'zoom-in' this picture. If the coded frame is 16:9, it will have thin vertical black bars. A 4:3 set should 'zoom-out' this picture.
4	reserved	
5	4:3 coded image with a Shoot & Protect 14:9 area	This is where 4:3 material is shot but without important picture information in the top and bottom of the frame. A 4:3 set can display this image without converting it because the programme material is fundamentally 4:3. A 16:9 set can 'zoom-in' to the image i.e. cropping a small amount from the top and bottom to produce a picture of 14:9 ratio (ie. thin vertical bars on a widescreen set) <i>Viewer preference determines whether or not a 16:9 set crops the top/bottom of the picture.</i>
6	16:9 coded image with a Shoot & Protect 14:9 area	This is where 16:9 material is shot but without important picture information on the left and right edges of the frame. This is currently the most common aspect ratio compromise. A 4:3 set can display this image as a narrow letter box with narrow black bars to the top and bottom of the image. A 16:9 set can display the entire image without any conversion and the picture will fill the frame. <i>Viewer preference determines whether a 4:3 set crops the edges of the picture to display a 4:3 image, crops the edges slightly to display the picture as a 14:9 letterbox (often the best compromise) or displays the entire image as a letter box (with broad horizontal black bars)</i>
7	16:9 coded image with a Shoot & Protect 4:3 area	This is where 16:9 material is shot but with the important picture information contained within the 4:3 central area of the frame. This is commonly used in sports coverage. If the viewing set is 16:9 then the whole of the image is shown. If the viewing set is 4:3, then the central area of the image can be shown without any great loss of programme content (the widescreen edges are considered 'a bonus' for 16:9 viewers) <i>For 4:3 sets - viewer preference determines whether the whole image is shown as a letterbox, or a 14:9 letterbox compromise, or 4:3 image shown as a centre cut-out.</i>

AFD's themselves do not lead to a reduction in horizontal resolution because an AFD is simply a signal providing information to a receiver how best to display a particular programme.

However, broadcasters wish to use a standard format within their transmission areas and as more and more material becomes widescreen it is understandable that the broadcasters wish to use 16:9 coded frame at all times. If the transmissions consisted of a mixture of 4:3 and 16:9 material it is inevitable that aspect ratio mistakes would be frequent and we would spend

a great deal of time watching squashed or elongated pictures.

For example, within the Digital Transmission Area of the BBC, all channels are in a 16:9 coded frame from the earliest possible stage and are kept that way until the very last stages of the transmission process. Therefore all 4:3 programme transmitted are subject to a reduction in horizontal resolution. Soon after the launch of the

BBC DTT services, aspect ratio converters were inserted into the final stages of the digital transmissions so that set top boxes which did not understand AFD's would still display a

4:3 picture correctly on a 4:3 receiver (as opposed to have black borders on all four sides - 'postage stamped'). Now that set top boxes can understand AFD's, these ARC's are unnecessary because it is preferable to keep the whole transmission in 16:9 coded frame and have the aspect ratio conversion performed by the receiver in the viewer's home.

But 4:3 pictures look soft now that AFD's are in use - I hear you say.

This is because the aspect ratio conversion in the first generation of DTT set top boxes is not of the same quality as the broadcast quality ARC's.



4:3 picture in a 16:9 coded frame

So, broadcasters should continue sending us a 4:3 frame until the boxes are improved? AFD's have a great deal more to offer than a simple switch between 4:3 and 16:9. DTT is still a very new technology. As second generation set top boxes are produced, we are likely to see features that take

advantage of the AFD. Given the choice between relying on just the coded frame format switch or AFD's where the viewer can choose from a range of options for best displaying a programme - is it not better to live with slightly soft 4:3 pictures on 4:3 TV sets in the short term?

I would be grateful to receive any comments / corrections regarding this article. Please send email to a-f-d@usa.net

Thanks for taking the time to read it.

Tony F Dunstable (April 2000)

Analogue switch-off plan 'looks set to fail'

The government's plan to switch off analogue TV transmissions in five to ten years is "fatally flawed", says the Consumers' Association. Its research reveals that 32% of those currently without digital TV (DTV) believe that they will never need it. The association found that 48% of analogue households want only free-to-air channels after analogue switch-off, while 50% of retired terrestrial non-adopters, who knew about DTV said that they had no interest in switching over.

The research was published just days after a House of Commons select

committee criticised the government and broadcasters for failing to educate the public about digital TV. (*Electronics Times* 19/3/01).

Adam Scorer, the association's senior public affairs officer, said: "Consumers have shown that the overwhelming reason to switch to digital is more channels, but many will reject digital TV for precisely the same reason."

He adds that there is also a confusion among viewer about the need to pay for the five analogue terrestrial channels

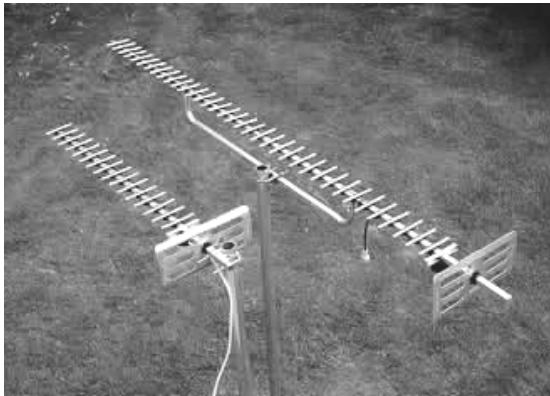
- BBC 1, BBC2, ITV, Channel 4 and Channel 5 - after the switch off. Only 29% correctly responded that these channels will not cost any extra.

"If the government wants an all digital UK, it has some hard choices to make: coercing consumers to go digital, persuading them to do so or delaying the switch-off date," said Scorer.

Electronics Times 26th March 2001.
www.electronics.com

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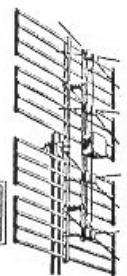
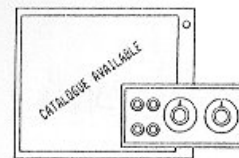
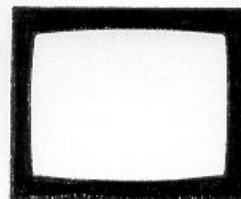
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Versatile Pulse Tester

By John Stockley, G8MNY

This tester based on ideas in recent magazine articles [1 & 2] and has been developed to have several useful functions.

- Coax or Balanced Cable Fault Locator.
- Coax or Balanced Cable Impedance tester.
- Wideband Crystal Calibrator.
- Spectrum Analyser Calibrator.
- Filter Plotting (like a Tracking Generator).

Needle Pulse Generator

The heart of the unit is transistor T4 using its avalanche characteristics, which is actually just an ordinary high speed low voltage switching transistor run well over its voltage. A 100-ohm base resistor keeps the transistor off, but with high voltage applied to the collector, the transistor will conduct in avalanche mode. With a transmission line capacitance and pulse quenching reflection from the length of unterminated coax on the collector and a high value charging resistor, the transistor can be made to generate a stream of very narrow pulses on its own. These can be used as they are for coax cable time domain reflection testing, with just a suitable T4 emitter network and a good scope. With a 6-inch length of 50-ohm coax as the capacitor and very short wiring to the output socket, I found that the pulse width was around 3ns wide [1].

A very narrow pulse has wide bandwidth and, if repeated with precise timebase, can provide good RF markers up to the 1st null frequency determined by the pulse width. A 3nS wide pulse gives a 1st order null at 333MHz.

Crystal Clock

Using a 1MHz crystal oscillator and divide chain to obtain clocks of interest (other crystals & divide options can be used) to trigger the avalanche transistor T4, enables the output to be of more use than a free running circuit. As the transistor can be made to free run as a pulse generator with just high voltage,

only low energy pulses are needed to start the avalanche effect, so a low power CMOS 4040 divider IC can be used as a driver. Trigger sensitivity is a function of both the supply voltage and the size of the trigger pulse.

With 250kHz pulse repetition frequency, cable lengths of up to 500m can be pulse tested and with a wide 300kHz IF filter in a spectrum analyser reasonably smooth graphs could be drawn of VHF filters etc.

High Voltage

A stable voltage from a 30-100V is required for the avalanche effect. This comes from a voltage controlled DC-DC converter driven by a medium speed clock. A 64kHz clock output feeds narrow edge pulses through a 1nF to a 12k pull up provide light bias, then via a diode, to stop problems with the negative going pulse, on to the base of a BFX84, T. This has a small choke of around 1mH as the collector load. When T1 turns off, high back emf from the choke goes through a high PIV diode to a 0.1µF capacitor to store the positive HT volts. A 100k potentiometer samples some of this voltage, which is applied via a 24V zener to the base on an NPN transistor that shorts out the base drive of T1. The result is that the drive pulse length is shortened giving simple but very efficient voltage control.

Testing and Adjustment

The project takes only 10mA when working correctly. So with a current limited supply, check the oscillator is running with a scope, then the divider IC. The BFX84 should have high voltage pulses on it to give an adjustable avalanche DC HT from 25-100V. With the trigger drive trimmer set to minimum, connect the scope probe to the test coax port (not directly on the avalanche transistor's emitter). Adjust the HT (40-80V) to make the narrow pulses start up; the scope should be set for 5V pulses and a fast or maximum timebase frequency. If there are no pulses check the HT is present at the transistor and coax capacitor. If it is still not firing up, then change the transistor for another fast switching NPN one. Adjusting the voltage higher

should increase the free run repetition rate. Now turn down the HT until the pulses just stop (30-40V); turn up the clock drive trigger pulse trimmer, the pulses should re-appear, but at 250kHz (4µs) period. Adjust the HT voltage and drive trimmer for best pulse reliability.

If the spectrum analyser/scanner shows any "in-between" frequencies [2] (narrow analyser filter needed), or a properly locked scope pulse display has other pulses faintly present, then there is some false triggering, or the oscillator is being affected by the HT DC-DC converter etc. Align the crystal trimmer so that the RF marker frequency zero beat with a known RF source or measure the pulse frequency on a good counter.

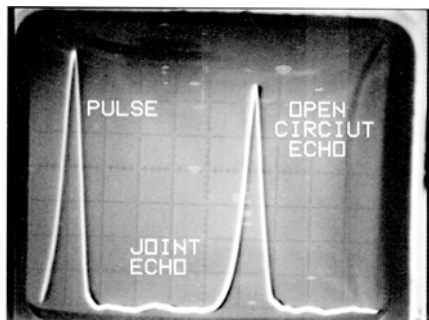
Cable Fault Location

Using the pulse source, faults can be seen on the monitor scope as positive pulse reflection for high impedance fault (eg breaks) and negative pulse reflection for a low impedance fault (eg shorts). To minimize false echoes the scope should either have a good 1:10 probe connected to the monitor port or be connected with a terminated cable tied to the scope input.

How well the fault pulse echo can be seen and time measured will depend of your scope's pulse performance; small height display can be more accurate, but generally a 20MHz scope can see down to about 2 metres, a 100MHz 20cms etc. The location is the time difference between the initial pulse and the fault pulse, multiplied by the cable velocity, times 2 (there and back). Cables have velocity factors of between 0.66 of the speed of light (300m/µs) for solid coax, and 0.78 for semi air spaced types. Open balanced line velocity factor can be as high as 0.95.

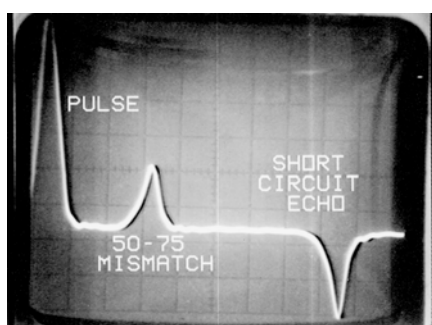
If the fault is intermittent or not extreme (not O/C or S/C), or an identical cable length is available, then a calibration of the scope can be done with the far end open and shorted representing 100% cable length. Then the fault location can be measured off as a percentage of that length; this can be more accurate than unknown velocity factor and scope timebase accuracy.

Coiled up cable and odd drum lengths up to 3µs (500m) can be measured, but only if the cable loss is not too great as the reflection pulse weakens and spreads out.



Variable Coax Termination

This is needed to measure coax impedance. The requirement is for a zero to open circuit variable load that is good to VHF; this is not that straight forward. I used a small 500-ohm carbon tracked potentiometer - large ones and wire wounds are too inductive. I took it apart and modified the start of the track with silver conductive paint to give a good zero ohms and about 75 ohms half way around; I also slashed across the far end track with a sharp knife several times to make the high resistance end more resistive. The potentiometer is mounted in a tin box, wired up with short leads to a BNC socket with the low resistance track end to the BNC centre and the rotating wiper to ground. Then it is a simple matter to DC calibrate the knob with an ohms scale.

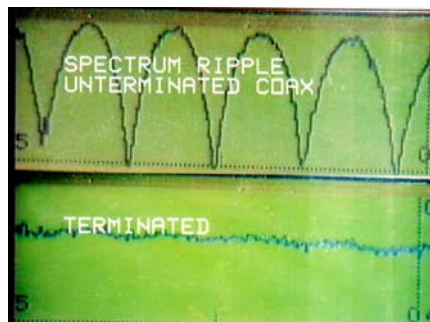


With this variable load it is easy to check the impedance of any coax cable by either making the reflected pulse disappear on a scope trace for long cables, or for short cables where the close in pulses merge, then the uneven spectrum ripple due to end mismatch echo on an spectrum analyser/scanner will flatten out at termination matching point. Cable impedance is then the value of the termination; it is nearly always resistive unless you have a lapped screen cable! With a cable made

of mixed impedance coaxes no null is possible. This will stop you using bits of non 75-ohm cables for video feeds!

Balanced Line Testing

This needs a small pulse transformer in an add-on box to isolate and match to a balanced line. A turns ratio of 1:2 will drive the line with about 200 ohms floating source. This is quite correct, as most balanced lines are around 140 ohm at HF, even if used as 600 ohms at AF. For the transformer I used a small 2 hole ferrite core testing it with 1/2/3 turns to see which did not reduce the overall height of the DC pulse (not saturating) and did not cause too much negative pulse response (L too low); 3 turns was what I ended up with for the primary and therefore 6 turns for the secondary in slightly thinner enamelled copper wire. Avoid too many turns as this will reduce the magnetic coupling, increase winding capacitance & cause unwanted ringing etc. The same variable termination as above can be used to find the Z of any balanced line.



Crystal Calibrator

As the narrow pulse has very high harmonic content strong signals can be heard into the GHz bands. The use of 250kHz as the pulse rate give 4 markers per MHz. Do not put the pulse output into a radiating aerial, as it will cause wideband QRM locally!

Spectrum Analyser Calibration

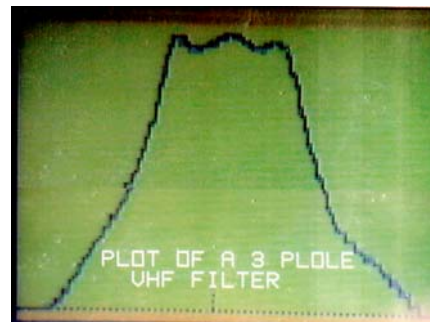
In theory the pulse spectrum is in the form of (sine x)/x [1] and if the terminated DC pulse height is measured with a peak detector (fast diode & cap, mine was 8V which is 1.28 Watts of peak pulse power!) the true power level of any of the RF markers is then: -

$$HV = \frac{V \times T \times Fr}{0.707} \times \frac{\text{Sine}(Fh/Fn)}{Fh/Fn}$$

- HV = Harmonic Voltage
- Fh = Freq of a Harmonic
- Fn = Freq Null = 1/T
- Fr = Repetition Frequency
- T = Pulse width
- V = Pulse height

A spreadsheet can be loaded with this formula and pulse data, and then graphs can be plotted of the ideal spectrum for comparison. This assumes perfect terminations and ideal pulse shape etc. but is a good starting point.

For UHF-SHF use, surface mount components "chip Rs and Transistor" are soldered directly across threaded BNC sockets with no wires or tags, this does give better results but with a lower pulse size of around 4V peak with a sub 0.6 ns pulse length with 2" of coax, with no visible spectrum null up to 1750MHz.



Filter Plotting.

When this fairly broadband signal source is put via a VHF/UHF filter into a spectrum analyser with a 300kHz wide IF, the shape of the filter can be seen immediately and the filter performance easily adjusted. This is normally only possible with a tracking generator or a high power noise source. Although this noise source should not be put into an effective radiating aerial, handheld ¼ wave & helical whips do immediately give their frequency band away where they match the RF.

Be aware that this broadband pulse can easily overload wideband equipment (often only 2 tone calibrated), so a band-limiting filter should be used before testing response of preamps etc.

References

[1] Rx Calibrator and Tx Mon, by G4COL, Radcom June 1998.

[2] Cable Fault Locator, D.Huddart, Electronics World March 2001.

In Retrospect

CQ-TV 193

Mini 23cms aerial, page 15. The person who made the tests was G8CKN, Roy Powers, and not G8CNK

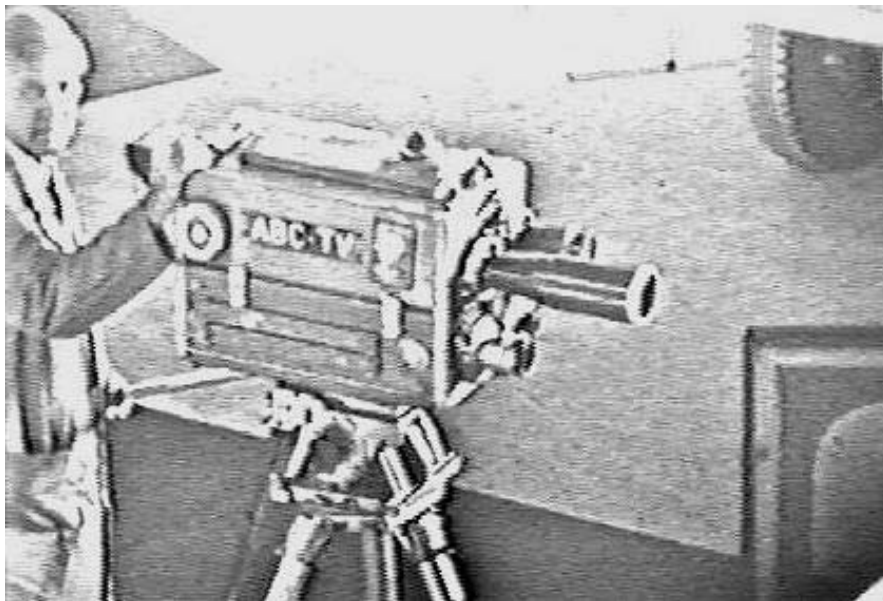
as stated. Due to finger trouble by your editor ☺.

Rubber Duck, page 30. The range of the microphone should be 8 to 10 metres and not 80 to 100 meters as stated.

OZ OB VAN meets the Queen

Dicky Howett writes: -

As reported in various issues of CQ-TV, the Australian ABC TV restored Pye 1956 vintage OB van is now on display at the National Museum of Australia in Canberra. Two Pye MkIII 3 inch image orthicon cameras are now functioning and in May of last year, both cameras went 'live' to cover an occasion when the Queen visited the then unfinished Museum site. One of the original ABC TV Pye van cameramen Barry Lambert manned one of the two Pye cameras and captured the shots reproduced. Lambert adds, *"We had a terrible time with contrasts. The sun was blazing through the unfinished holes in the roof, with the light reflecting off loads of dangling silver sheeting used in the construction. I put in N.D. filters and stopped right down. The picture was still very lively. At one point the Queen's hat looked to be on fire!"*



In fairness, the images seen here are off a VHS copy, captured on a JPEG. However a typical 3in IO

monochrome picture is evident, from a camera nearly fifty years old!



Rubbish in Rubbish Out

By H R Skelhorn, G8BPU

Have you ever given any thought as to how a video recorder handles non-standard audio and video input signals (for example a video level from half to two volts and the audio over even greater levels) and still correctly modulates the FM carrier or not seriously over load the audio input?

The solution is simple. They all use good quality input processors to maintain a constant signal level of the audio and the video signals as well as correcting other video signal problems. The following are the circuits I use for my transmitter. No rubbish in no rubbish out.

The Video Input

The IC AN302 was used in an AGC circuit in a CQ-TV article [1].

It produced poor results; when cut to black the AGC responded stretching the sync and lifting black level to one volt.

Additional circuitry fig 1 [2] is required in order to get it to perform correctly and produce an output of one-volt p-p into 75 ohms, while maintaining a picture to sync ratio of 70/30 with levels varying from half to two volts on the input.

Set up is very easy. Feed a standard one-volt grey scale video signal to the input and terminate in 75 ohms. This must have the picture to sync ratio correct of 70/30 [remember rubbish in rubbish out]. With the scope on Tp2 set the AGC pulse to be three times the amplitude of the sync pulse using the pre set pot Rv1. Reduce the video input to 0.5 of a volt (ie double terminate) - the output should remain at one volt. Remove the double termination from the input - this will provide a two-volt input, again the output should remain at one volt. Change to black level. The sync should remain at 0.3; go through this procedure a few times to perfect. Rv2 is adjusted to give a one-volt output into 75 ohms.

Now we need to restore the video DC

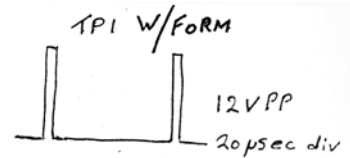
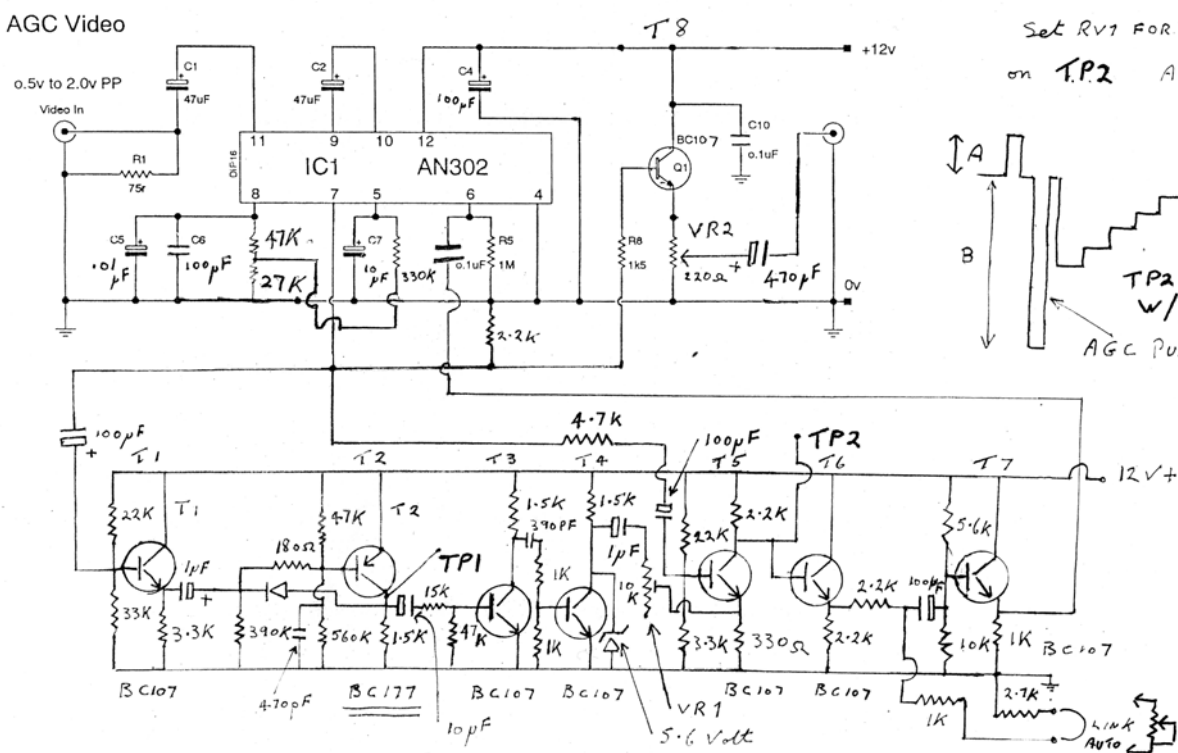
component, remove LF tilt, and any DC voltage that may be present on the video signal. This is done using a black level clamp fig 2 [3]. The circuit performs extremely well delivering a video output of one volt into 75 ohms at zero volts DC [i.e. chassis of the transmitter]. Any voltage change now will be the result of changes to the video signal only; peak white will be 0.7 volts above zero volts; the sync will be 0.3 below. It is this signal we now feed to the modulator of the transmitter via the pre-emphasis network.

Using both of these circuits prior to the transmitter input will modulate the transmitter correctly. Fig 7 is the waveform of the transmitted signal after it has been demodulated by the deviation checker [5].

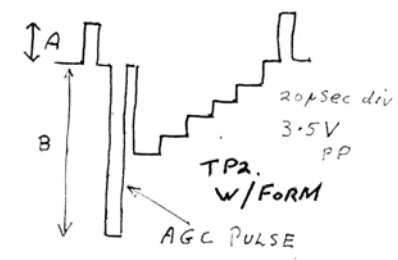
The audio input.

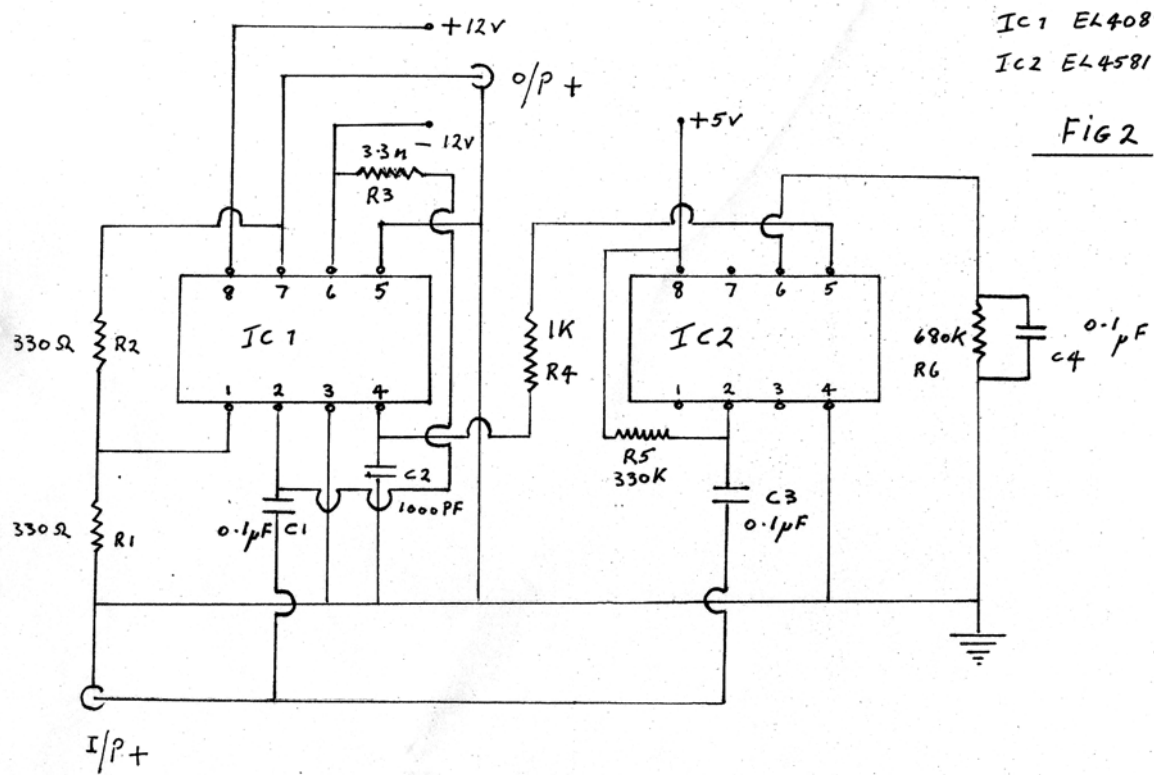
I built Bob Platts' audio sub-carrier generator [4] with a modification to the input, as the AGC circuit will produce an output at line level. A 150 k was fitted in R1 to provide a line input. Two

FIG 1



Set RV1 FOR W/FORM on TP2 A:B = 1:3





IC1 EL4089 RS 112 428
 IC2 EL4581 RS 112 434

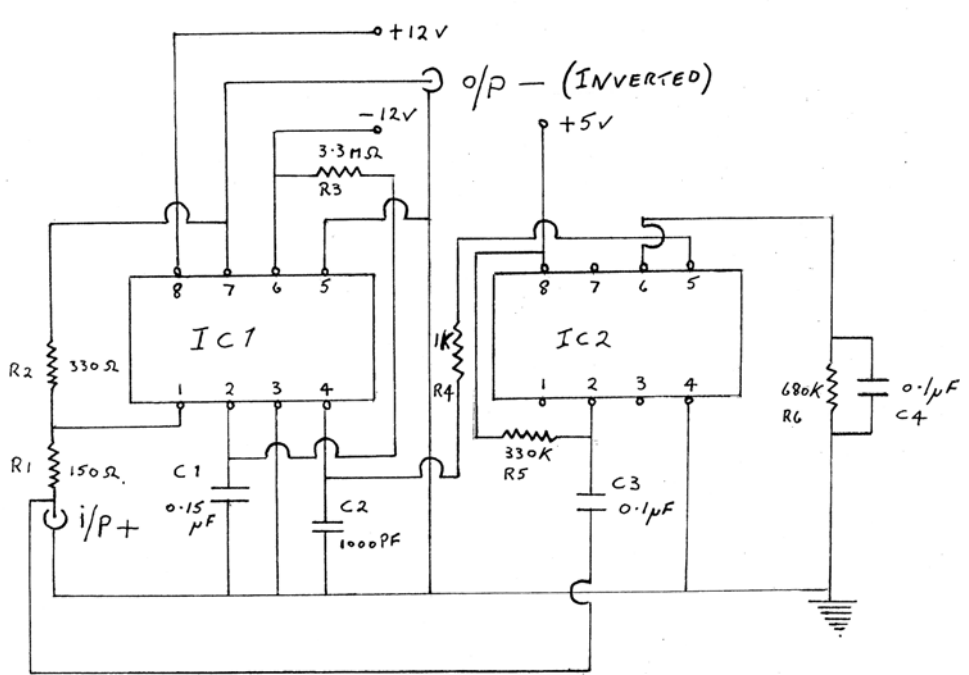
FIG 2

additional circuits are required, a microphone pre amp, and an AGC circuit.

The pre-amp fig 4 [6] is a simple circuit using a 741, designed to be used with a pro M5 capacitor microphone. The potential divider R1 and R2 supplies the

ring of the jack socket with a voltage of one to one and half volts for the pre-amp built into the pro M5. R5 and C2 have been selected to lift the gain to line level, in addition to providing a response that cuts off at 16 kHz.

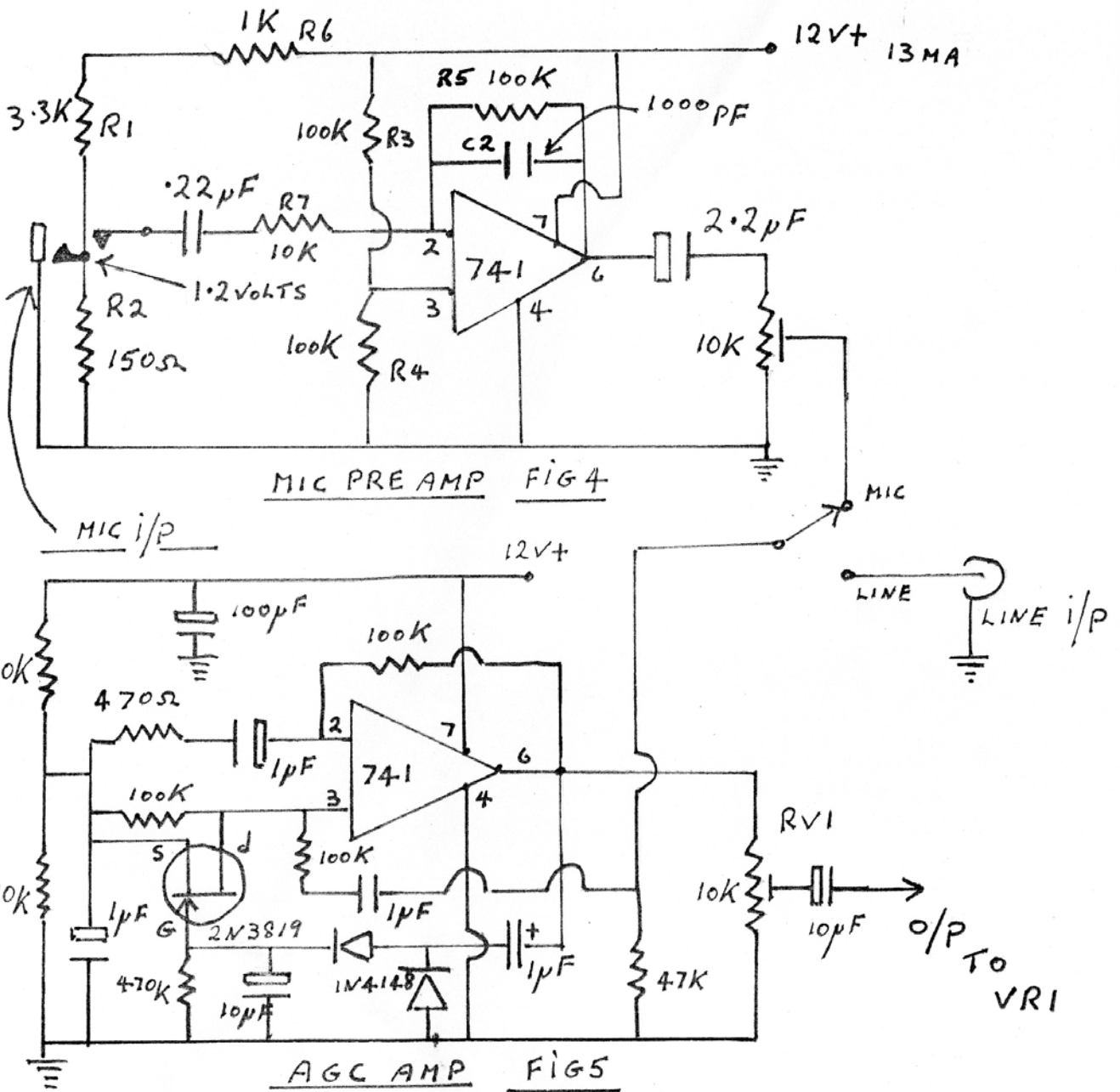
The AGC fig 5 [7] designed by Dave Miller NZ9E for DSP work is excellent for this application, using a 741 and a 2N3819 FET. The AGC amplifier will handle signals from 80mV to 2.5 volts with the output remaining at line level. The pot Rv1 will pre-set the output to match other outputs.



IC 1 EL4089 RS. 112.428
 IC 2 EL4581 RS 112.434

FIG 3

**EL4089 and EL4581
 DC Restored Video Amplifier**



With a 1 kHz input at one volt, the frequency response was plotted at Tp3 of the sub-carrier modulator Fig 6

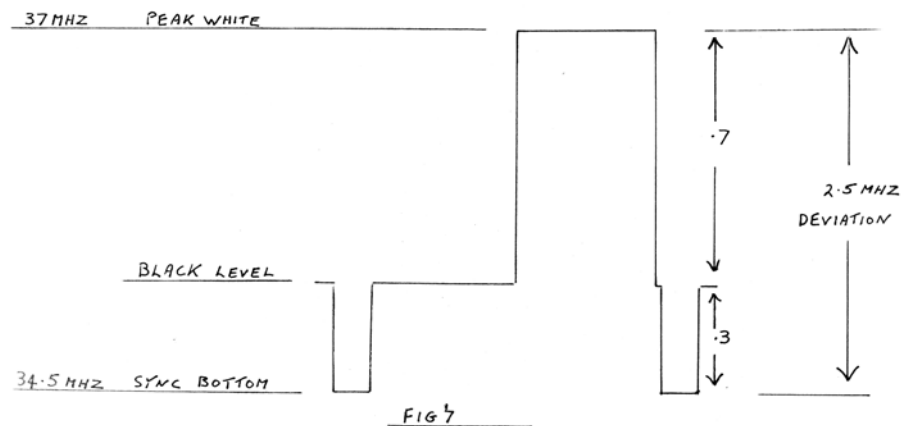
A subjective test was finally carried out using a CD player. The output of the 50mW transmitter was received across the room, with the audio output fed to the Hi-Fi system; switching from the received audio and back to the Hi-Fi system, no discernible difference could be detected.

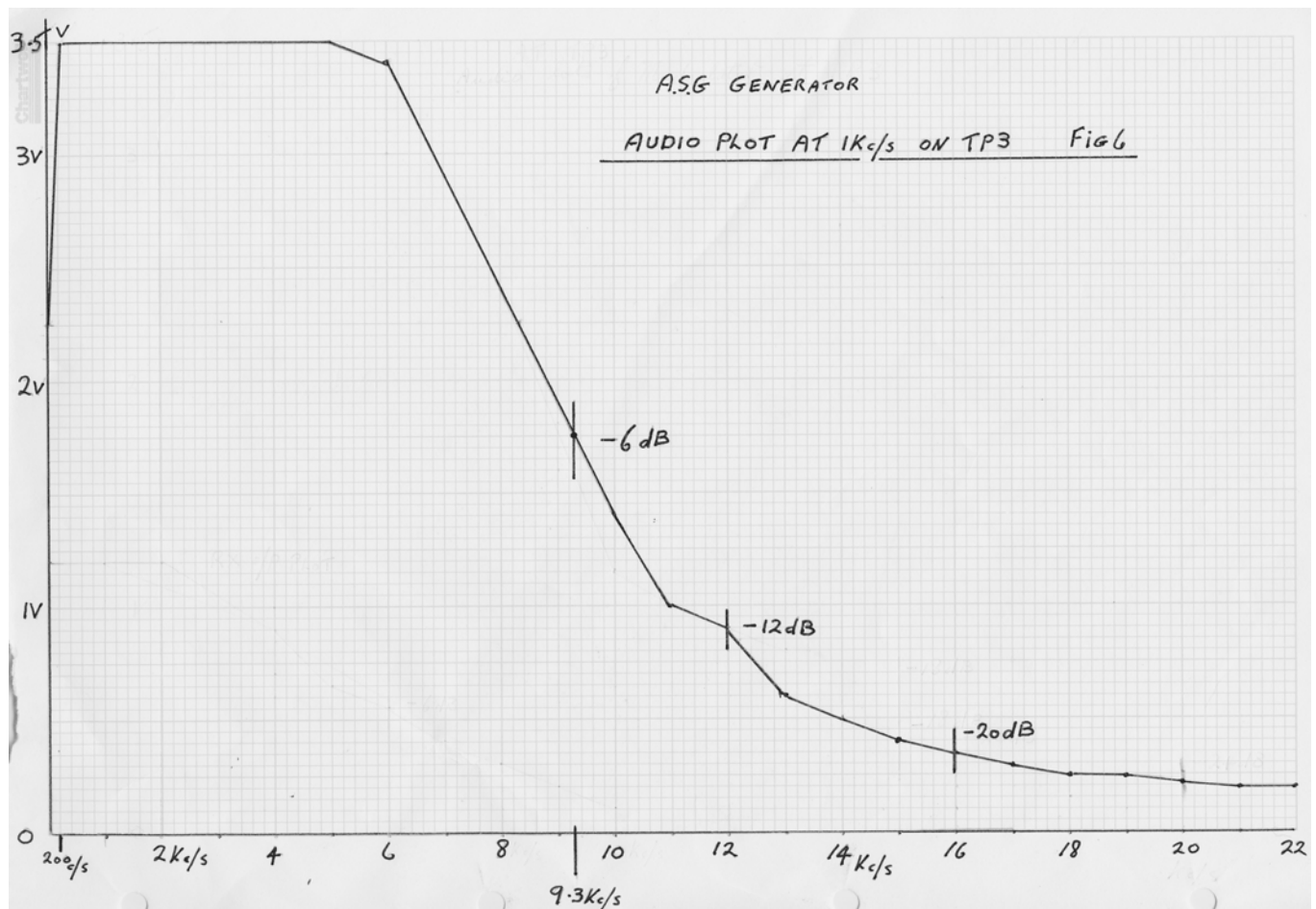
Finally the black level clamp fig 2 should now be installed in the receiver's output just after the de-emphasis; as the level black is lost in the transmission it will be restored, correcting LF tilt, and deliver a video signal of one volt into 75 ohms at zero

volts DC. No rubbish in, no rubbish out.

Should you have a requirement for a negative video output, the circuit fig 2

can be modified to that of fig 3, giving the same performance. This is the one I use for my transmitter. More on that next time.





References

1 CQ-TV 172 -179.

2. NV- 9210 U-matic service manual.

3. Elantec analog integrated circuits.

4. CQ-TV 173 p47

5. CQ-TV 194 p 27

6. Electronic Circuits Handbook.

7. AGC Audio Preamp Technical Topics May 1995.

Silent key

It is with sadness that I have to inform you of the passing of one of amateur televisions midland stalwarts, Arthur Bevington, G5KS.

He died on February 5th, after a short stay in hospital, aged 89, leaving his wife Maude (of tea making fame to all his visitors) sons Brian G0KJG and John G7UNB, and daughter Patricia.

His life as a radio amateur stretched for over 70 years, pioneering the study of propagation in the 1930s', teaching communications and Morse the Royal Naval Reserves at the outbreak of WW2

He also experimented with the application of fast scan TV for amateur use during the 1950's, building a camera and transmitter around this time.

By the '70s he had slow scan gear running, using ex-radar gear and home brew (of course) SSTV generation.

Central TV came to his home and their interview on amateur radio, FSTV and SSTYV was broadcast using his own camera (a MkIII by that time).

A long standing member of the BATC his health did not allow him to travel to rallies or conventions so he was known mainly from "off air" contacts, but his contribution to ATV articles on the midland area was intense and willingly given.

He will leave a gap no one can fill. - Howard Parker G8GUN

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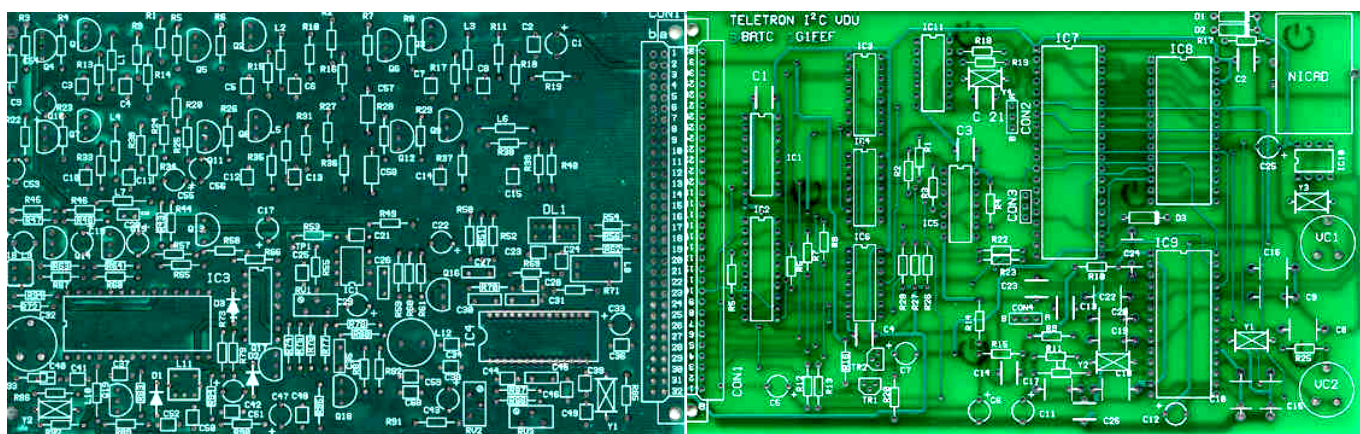
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A description of the various PCB's and components can be found in the 'What's What' guide, or on the CQ-TV Internet pages at www.cq-tv.com (A printed copy available on request, if you send a S.A.E.). Components for club projects are not available from Members Services unless contained within these lists. All club crystals are HC18/U (wire ended). To avoid delay and inconvenience, please be careful to include the correct payment with your order – please do **NOT** send stamps or cash. Post and packing costs are for despatch of one item to United Kingdom members.



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Circuit Details can be found as follows:

An Introduction to ATV: PCB's 10, 40, 41, 47, 86. **CQ-TV 174:** PCB 7

CAMERA TUBES A tube guide appears in CQ-TV 149 and 150. Tubes are now difficult to obtain and members requesting information on availability, prices or other types of tubes or equivalents are asked to send a stamped addressed envelope for their reply.

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The latest handbook full of detailed information on how to set up your ATV station, plus lots of new video and RF construction projects.			
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ATV Macintosh Style

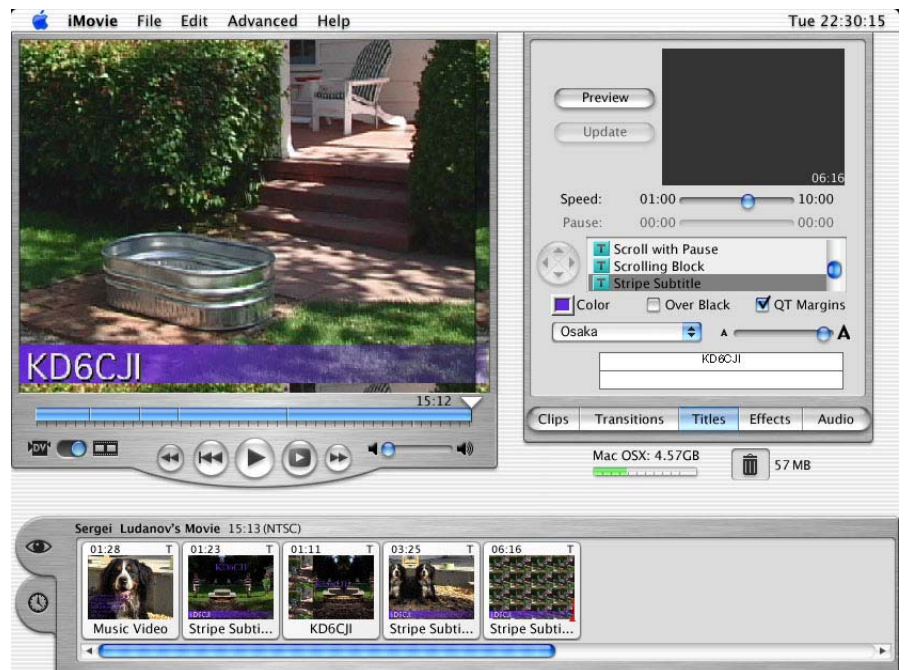
By Sergei Ludanov, KD6CJI

Initially, I wanted to write an article just about video editing on Macintosh computers, but after a brief e-mail exchange with Trevor Brown and Ian Pawson, I have decided to broaden the topic somewhat and include a little more general information about Mac machines, as well as explain what you can do with them in Amateur Radio and Amateur Television.

The current line of Macintosh computers includes a wide range of models, from the \$895 iMac to over \$3,500 G4 Power Mac and everything in between, including the G4 Titanium professional laptop and recent iBook consumer notebook. Apple machines are built based on architecture completely different from IBM compatible PCs. As a result, they do not use Intel type processors (x86), but rely on PowerPC chips (manufactured by IBM and Motorola). There are 2 types of those - G3 and G4. Both are 32 bit RISC processors, but the G4 in addition has AltiVec or as Apple calls it Velocity Engine, which is a 128-bit vector-processing unit, which makes video and graphics processing extremely fast. Newer G4s (like in the 733 MHz Power Mac) have 4 Velocity Engines on the chip. As you could have guessed already, because of the difference in hardware, Mac computers do not "do Windows" - instead they run MacOS. If you will ever have a chance to compare Windows (any flavour) to MacOS, you immediately understand



Transitions editor



The whole iMovie screen

why Mac users are so loyal to their chosen platform. Macs are easy and fun to use. I got rid of my Windows PC at home (I have to admit that I am still forced to use PC at work) over 2 years ago, and I am very happy with my decision. However, I think it is enough of Apple evangelism for this short article. Those interested can always visit the Apple Web site (www.apple.com) and get a wealth of information first hand.

Now back to or actually forward to Amateur Radio and ATV use of Macs. For many computer users, whose world does not extend beyond their Wintel (Windows + Intel - an acronym used among non Windows users) box, it would be a surprise to learn how many software titles are out there on the Mac platform. And, yes, there are also quite a few ham radio and ATV related programs around too. Furthermore, one of the best ham communication programs I ever seen on any platform is MultiCom by Black Cat Systems (www.blackcatsystems.com). It can send and receive just about any amateur radio mode from plain CW to SSTV. There is also a selection of satellite tracking, propagation prediction, electronic design, PCB design software, to name a few, available for Macintosh either as shareware or commercial products. With the introduction of the

new Mac operating system OS X (this is Roman 10) earlier this year, we can expect a growth in the number of titles, because the new OS is based on Unix and many Unix applications can be easily ported to OS X. To make things even better, Apple ships Developer CD with the OS X with full, unrestricted versions of development tools and documentation, so that any user of OS X could start developing his own applications right away if inclined to do so.

Although I have not yet found the program that was specifically written for ATV use on Mac, I use Apple Works to create slide shows, which I then run full screen and feed as video to my 24 and 13 cm FM ATV transmitters, which work as low power ATV beacons. When I get more familiar with the internals of OS X, I plan to write some applications useful for ATV. The encouraging fact that the MPEG 2 codec written by Apple is capable of nearly real time compression purely in software when working with DVD quality movies leads me to believe that it is possible to do real time MPEG compression for VHS quality video. That makes inexpensive digital ATV a possibility!

OK, I think I went far enough and it is time to get to the main topic - digital

video editing. True to the vision of a home computer as a digital hub of the future, Apple pre-installs some interesting programs on every modern Macintosh computer. The one of interest to ATV enthusiasts is iMovie 2, video editing software. It may not be as powerful as Adobe Premiere or Apple's own Final Cut Pro, but it does not have a nearly \$1000 price tag either. Besides, it can do everything that an average amateur will ever need. I have worked with - or better to say tried out - various video and image editing packages on both Windows and Mac platforms, but when I launched iMovie for the first time I was surprised by the power and ease of use of this program. In fact, Apple is so confident in the intuitive nature of iMovie that they do not even supply a manual for it. There is, of course, on-line help, but you will hardly need it. It took me a little more than 15 minutes to get familiar with the program and start editing the first video. Everything is drag-and-drop. There are 3 main windows: Design Board (switchable between Clips Shelf, Transitions, Effects, Titles and Audio), Clip/Timeline Editor and Monitor. You can capture video and audio from your digital camcorder through built-in FireWire port (also called IEEE 1394) previewing it at the same time in the monitor window. While transferring video you can control your camcorder remotely through on-screen buttons. The program also has an interesting feature called Automatic Scene Detection, which creates separate clips of each scene that you shoot by detecting the picture changes. Captured clip's thumbnails will appear on the scrollable clip shelf. From here you just drag the clips that you want to the



Importing 'clips'

clip/timeline editor, arrange them in any order you want (here you can also trim clips, removing unwanted footage), add various transitions (switch to 'transitions' in design board, select desired transition from the list, set parameters, drag it from the list and drop between clips in clips editor) and special effects (it is done the same way, only you choose 'effects' and drop onto the clip), edit and add sound (import MP3 or AIFF audio clips, record music from CD, synchronize it with video, record voice narration). Currently available transitions are: circle opening/closing, fade in/out, cross dissolve, overlap, push, radial, scale down, wrap in/out, wash in/out. Among video effects is soft focus, sepia tone, black and white, water ripples and others. All transitions and effects are implemented as program plug-ins. Apple recently released the first plug-ins pack for iMovie 2 and I am sure more will follow. The titles design board let you add all sorts of titles and captions with different effects using included templates. After the work is finished you can play the movie at your Mac in full screen resolution, export video back to your digital camcorder, save it as Quick Time video for the web or writing to CD, or export it to high resolution digital format and continue processing with iDVD (another freebie from Apple that let you create DVDs). Of course, you can also save any frame from the movie as a still image in either PICT or JPEG format.

Hardware requirements for iMovie are very modest: 300 MHz or faster PowerPC G3 or G4 processor, 128 Mbytes of RAM, 2 GB of unused hard disk space, at least 800 X 600 pixel monitor, Quick Time. However, with this type of application, the faster hardware you have the better, but even 400 MHz G3 iMac (entry level machine in current Apple offerings) will do an excellent job. In fact, I ran iMovie on my old 266 MHz G3 Power Mac under OS X and the only problem I experienced was frame drops during full screen playback, which made video to look a little jerky, but iMac worked smoothly. Of course, a G4 machine (I use a G4 Cube) really shines; it renders almost in real time without any additional hardware, while 266 MHz G3 machine could never exceed 3 frames per second rendering speed. It is mainly the AltiVec engine on the G4 that makes a difference, because the



The titler

processor clock on the Cube (450 MHz) is less than two times faster than the old G3. I ran a fractal test program on all 3 of my Macs to see the actual performance difference with the following results: G3 266 MHz - 254 M flops sustained, 301 M flops peak, iMac 400 MHz G3 - 384 M flops sustained, 469 M flops peak and G4 Cube 450 MHz - 2.4 G flops sustained, 3.2 G flops peak. The facts speak for themselves. If you are going to be involved in any kind of DSP processing, a G4 based machine is your ultimate choice, however, even a 400 MHz iMac will beat any GHz range Pentium machine in DSP applications, thanks to the more efficient RISC architecture and hardware one-cycle MAC (multiply-accumulate) instruction.

In conclusion I would like to say that any modern Mac is a ready-to-go video-editing studio (among other built-in applications). The only additional hardware you will need is a digital camcorder with FireWire (IEEE 1394, iLink) interface or if you are not willing to invest in one yet, you can use a FireWire camera that sells for about \$120, but then you will be limited in shooting in your house or will have to carry a notebook computer with you and you also lose the ability to export movies to VHS or digital tape. If you ever outgrow iMovie, you may consider upgrading to Final Cut Pro, but that means spending quite a lot of cash. With that software and the PCI card that comes in the bundle, you can do Hollywood class videos with true real-time video editing. Not being professional I doubt I will ever need that though.

MIR Splashdown

By Keri Allan

We have reached the end of an era in space research. Last month (*March 2001 - Ed*) saw Russia's Mir space station finally plummet to Earth after 15 years of service. During its lifetime, the craft was subject to a number of technical problems and the powers-that-be finally decided that enough was enough, the ageing station had become too hazardous and it was time to bring it home.

On 20 February 1986, the former Soviet Space Agency put in orbit the core module of the Mir space station (also known as Salyut 7) that was originally scheduled to be operational for a maximum of five years. It was launched at the height of the cold war, lasted through the collapse of the Soviet Union, and brought together astronauts from all over the world to

research all matter of subjects while in orbit.

Mir (Russian for 'peace') was originally launched to improve understanding of the difficulties faced in establishing a permanent presence in space. The experience derived from the extended stays of international crews on Mir was used to prepare the way for the International Space Station (ISS).

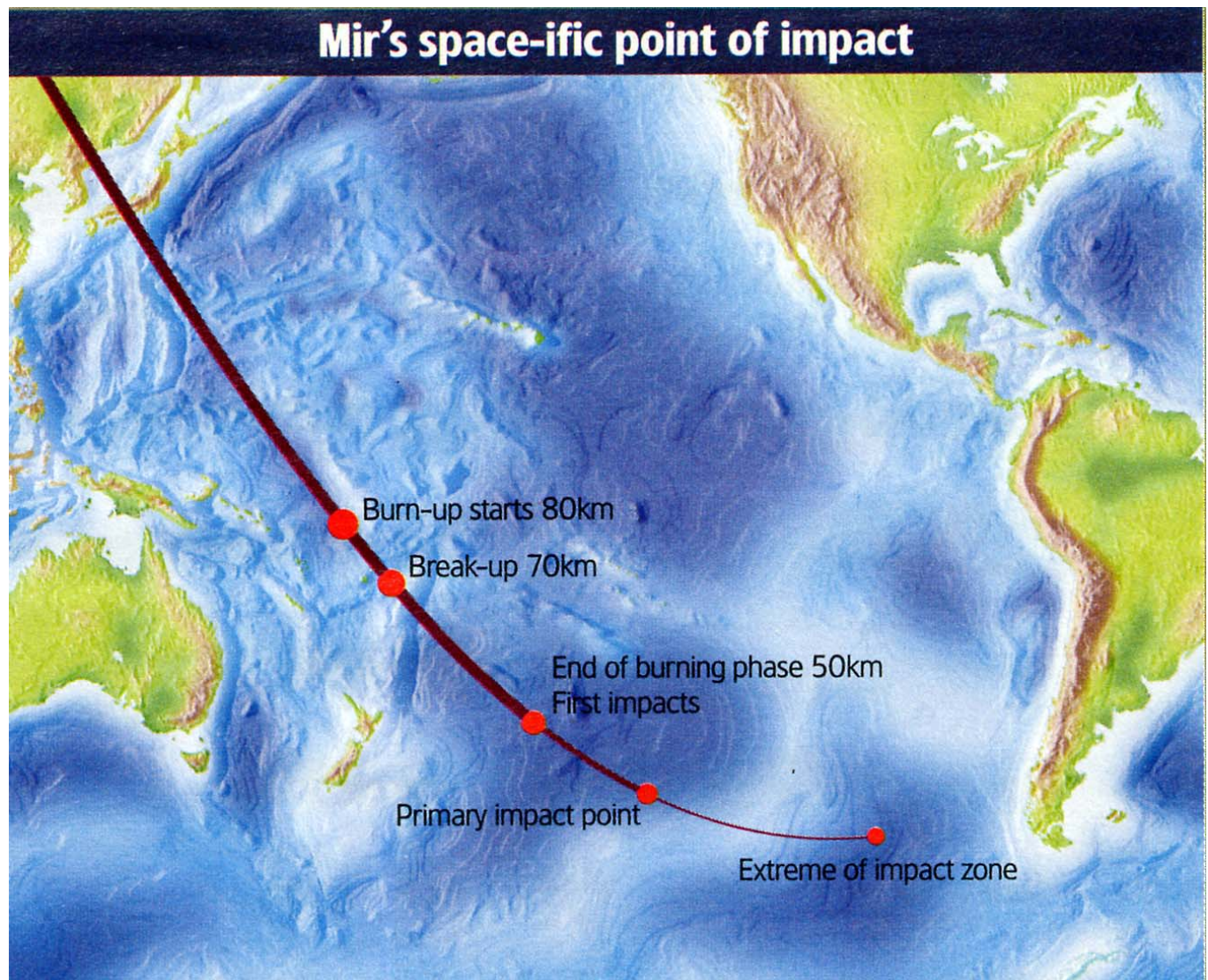
After its launch, Mir grew in size, with many modules being added over time, the last addition being deployed in 1996. Due to the fall of the Soviet Union in 1991, the Russian space industry went into decline and consequently Mir's active life was extended, as this was a cheaper option than building another station.

Throughout the 15 years that Mir was orbiting the Earth, research was

undertaken into all areas of technology - from biotechnology to space technology. The first two modules that were added to the core, Kvant 1 and 2 in 1987 and 1989 respectively - were research modules where many of the 105 astronaut visitors to the station worked.

The extensive research carried out in these modules was focused on two main areas: human life in space (micro gravity sciences, life space sciences and space technology development) and observational sciences (Earth observation and sciences, and space sciences).

Experiments in fluid mechanics, combustion, materials sciences and processes and biotechnology require detailed step-by-step procedures to yield high-quality scientific data. The results of this led to the design and



development of a range of technology that focused on building space platforms as well as creating new debris protection devices and materials. Space observation technology has also been improved, because of research on Mir, and has helped us to see further into the Universe than we have been able to in the past.

As well as the development of technology being beneficial to us here on Earth, the work was also integral to keeping Mir in service - with each of the station's new modules came improved technology.

The Kristall module was deployed in 1990, and was the main research module for electronics. Along with housing the Earth observational equipment, it was the home of semiconductor and biotechnology experiments. It also integrated docking ports that allowed US space shuttles to dock on Mir.

The next technological highlight from Mir came in early 1993 when a progress cargo ship deployed a 66ft foil reflector near the station. This was probably the first testing of solar sail technology.

Remarkable achievements have occurred on Mir and records have been broken. For almost 10 years, between September 1989 and August 1999, the Russian space station was constantly manned, and a world record of 22 months continuously living in space was recorded.

But all good things come to an end, and all that is left of this once mighty research station are a few parts somewhere in the Pacific Ocean that did not burn up on re-entry. Mir will be remembered as the first real step towards colonising space. It will also be remembered as the inspiration for the 155, a joint endeavour that has brought together Russia, Japan, the US, Canada and 10 European countries. Mir will not be forgotten.

All eyes on splashdown

A number of scientists, dignitaries and journalists gathered at Moscow's mission control centre to oversee the final hours of the Mir space station.

The ageing Russian station re-entered the Earth's atmosphere just after 6am GMT, and landed in the predicted splashdown zone in the South Pacific.

The last signal from Mir was received at around 5.30am GMT before it started re-entry.

Frank Longhurst of the European Space Agency's manned space flight directorate, said: "Mir's safe return to Earth has been executed safely and accurately - a fitting end to its impressive record."

From Electronics Times. 2nd April 2001. www.electronicstimes.com

PIC programming – additional notes

Brian Kelly. GW6BWX

Thanks to those of you who contacted me with PIC related issues after reading my recent tutorial series. Some aspects of the 16C84 have caused some confusion so I'll try to explain a little more.

The primary source of misunderstanding is something I didn't cover in much detail, that is, the difference between the device varieties. The chips come in two speed versions; 4MHz and 10MHz. They are identical in manufacture but graded differently when tested. Chips that run at 10MHz are labelled as such; ones that can't keep up with that speed are retested to see if they run at 4MHz. If at 4MHz they operate properly they are marked and sold as 4MHz devices. If they can't manage even at that speed they are not marketed, at least not through normal channels. You can run the chip at any speed from almost DC up to the maximum marked on the chip, in other

words the clock doesn't have to be 4 or 10Mhz, it can be anything up to that speed. It is usually possible to "over clock" the chip, making it run faster than it is rated and I've heard of 10MHz devices being used as high as 16MHz but performance is likely to be unreliable.

The differences between 16C84 and 16F84 have also been queried. For most applications their differences are transparent and whatever works for the "C" will work equally well on an "F" version. Inside the chips the technology used to fabricate the program memory is different but functionally equivalent. The EE memory and instructions are the same in both types. The "F" is an upgraded version of the "C" type with slightly lower current consumption while running at slow clock speeds or in sleep mode. It also has some minor changes to the voltage requirements on some pins and needs a slightly longer (1mS instead of 300nS) "low" on the MCLR pin to make it reset. From a

programming point of view there are two differences. The "F" has more file registers, instead of finishing at register H'2F' it extends to H'4F'. All the extra registers are general purpose and are mapped in page zero and page one so there is no need to switch bank bits to reach the new ones. The other programming difference is that the polarity of the "PWRTE" bit in the Configuration register is reversed.

Finally, the WDT or Watchdog timer. The purpose of this is to force the chip to reset, as though the MCLR pin had been pulled low (except for leaving some status bits set) if your program runs out of control. If the WDT is enabled you **must** periodically reset the register with the CLRWDT instruction to prevent the processor resetting itself. If you have program loops that can take more than about 18mS to complete, for example continuously reading a port while looking for a pin to change logic level, put a CLRWDT instruction inside the loop.

BBC Research and Development Labs Open Day

By Graham Hankins

What a brilliant day out this was!

Located in magnificent grounds just a few miles off the M25, south of London, BBC Research at Kingswood Warren held its biennial display of 'cutting edge' developments for broadcast television.

Digital TV and Radio, spectrum planning, transmitter maintenance, virtual studios, HDTV and many, many more displays and lectures were within the truly 'warren' of rooms - large and small - within the historic mansion, that now houses the degree standard men and women who are inventing the BBC's technological future.

'Barcodes on the ceiling'. Yes, circular pads high above a TV studio carried patterns of dark rings, detected by a vertically mounted camera attached to the main studio camera. Software processes this barcode pattern to determine the position of the main camera on the studio floor to within a millimetre, enabling the image of the 'virtual background' to remain in its true relative position as an artist or camera moved.

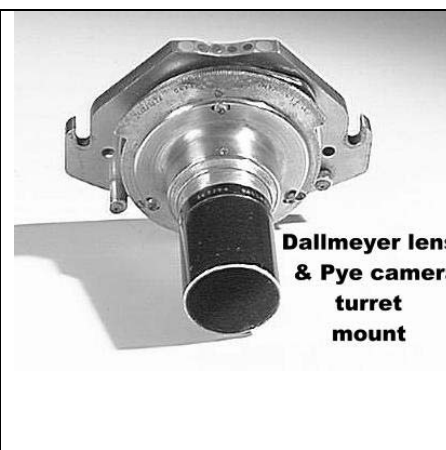
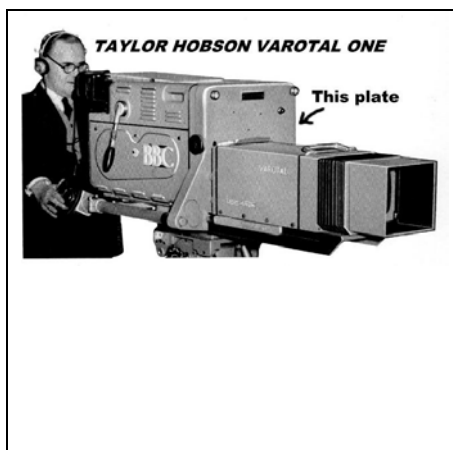
Digital Terrestrial TV (DTV) and digital satellite TV were on view. The 'big question' with DTV is, of course, when will the analogue transmissions be switched off? The many constraints and problems of providing the DTV service between existing analogue UHF channels were thoroughly explored and

explained. It is clear that analogue is going to be with us for a few years yet. The claim that digital provides a 'better' picture is arguable. What it certainly does enable is more channels (by compression) and enhanced or extra services (by embedding data within the vision stream). Additional signing or subtitling for the deaf, or an audio commentary for the visually impaired, are all under development at Kingswood Warren. But the data 'budget' is not infinite - the greater the picture data, the less available for other channels and services to utilise. 'The Tweenie's or other Children's TV may be much enjoyed by the under 5s, but not by the broadcasters! Lots of high colour, lots of movement and lots of sound to keep the kiddies amused. But this all means lots of data too, for what may be not the most demanding of audiences!

When surrounded by the present and the future, it's easy to forget the past. Not at BBC R and D. The BBC has over 50 years of programming on analogue tape - entertainment and information of the highest standard but in desperate need of archiving onto a digital format with the minimum of transfer loss. And the most significant distortion happens in the process of PAL decoding. Cross luminance and cross colour are inherent in the PAL decoding process, which relies heavily on signal filtering; these patterns can be significantly present in domestic receivers using simple decoders - but usually go unnoticed by viewers and can be minimised by careful studio production. Professional decoders

installed by the broadcasters produce decoded results that are 'as good as PAL decoding gets', but some cross interference is still present. So the team at BBC R and D decided that a decoder for archiving master analogue tapes needed a new approach to what was, basically, a simple process. The final design, using mathematical Fourier Transforms in the filtering process, demonstrably achieved levels of cross patterning hardly visible even under the most testing of on-screen subjects.

Next door to PAL decoders was the demonstration of High Definition TV. The UK still broadcasts at 625 line 50Hz, the Americans at 525 line 60Hz. There was talk, years ago, of going above 1000 lines eg 1250 to approach 35mm film definition. Is 1000 + to come, or is a four-digit line standard now 'dead in the water'? Certainly not coming to UK broadcast - yet. The BBC is heavily committed to HD productions, but for the DVD market, which has become the accepted medium for high quality pictures. HD pictures require HD displays too, on really large screens, which will only become practicable for the domestic market when plasma display technology is affordable. But plasma displays are on sale, prices are in four figures at the moment but these things have a tendency to change! So, the immediate future for HD is home DVD; maybe, if there is ever widespread public demand for high definition broadcast picture quality, HD Broadcast could be considered.



Dicky Howett writes "I'm currently preserving a 1950s TTH VAROTAL One zoom lens used originally by Associated-Rediffusion but require the front and base mounting plate rig. (see illustration). Any condition sought. Also a PYE Mk3 camera lens base plate (see illustration) with or without lens. Cash offered. Will collect"

Contact Dicky Howett on 01371 820155 or email: dicky.howett@btinternet.com

70 cm Comb Filter

By Ian Waters

This 70 cm comb line filter may be used in several ways.

- It can be used at the input of a receiver to protect against blocking and intermodulation due to strong unwanted signals.
- It can be used after RF stages and before the mixer of a receiver to remove image noise.
- It can be used after the up-conversion mixer in an IF modulated transmitter to reject the local oscillator and unwanted mixing products.

Construction.

The general form of the filter may be seen from Fig 1.

The frame is made from stock aluminium bar one inch wide by a quarter inch thick, screwed together to make a rectangle. The four rods are turned to be 9.5 mm in diameter and screwed to the frame in the positions given. The tuning capacitors are discs of 16 SWG aluminium 20 mm in diameter held on to the rods and tuning screws with countersunk screws. The tuning screws can use any suitable fine thread, i.e. 32 tpi, and should be provided with lock nuts. The connectors, which may be BNC, TNC or N, are mounted on plates provided with slotted holes to enable them to be slid up and down to vary the tapping points by + and - 5 mm to give the best match to 50 Ohms. Contact is made by small pieces of finger stock soldered to the plug centre contacts. The side plates are made from 16 SWG aluminium fastened to the frame by screws at about 25 mm centres.

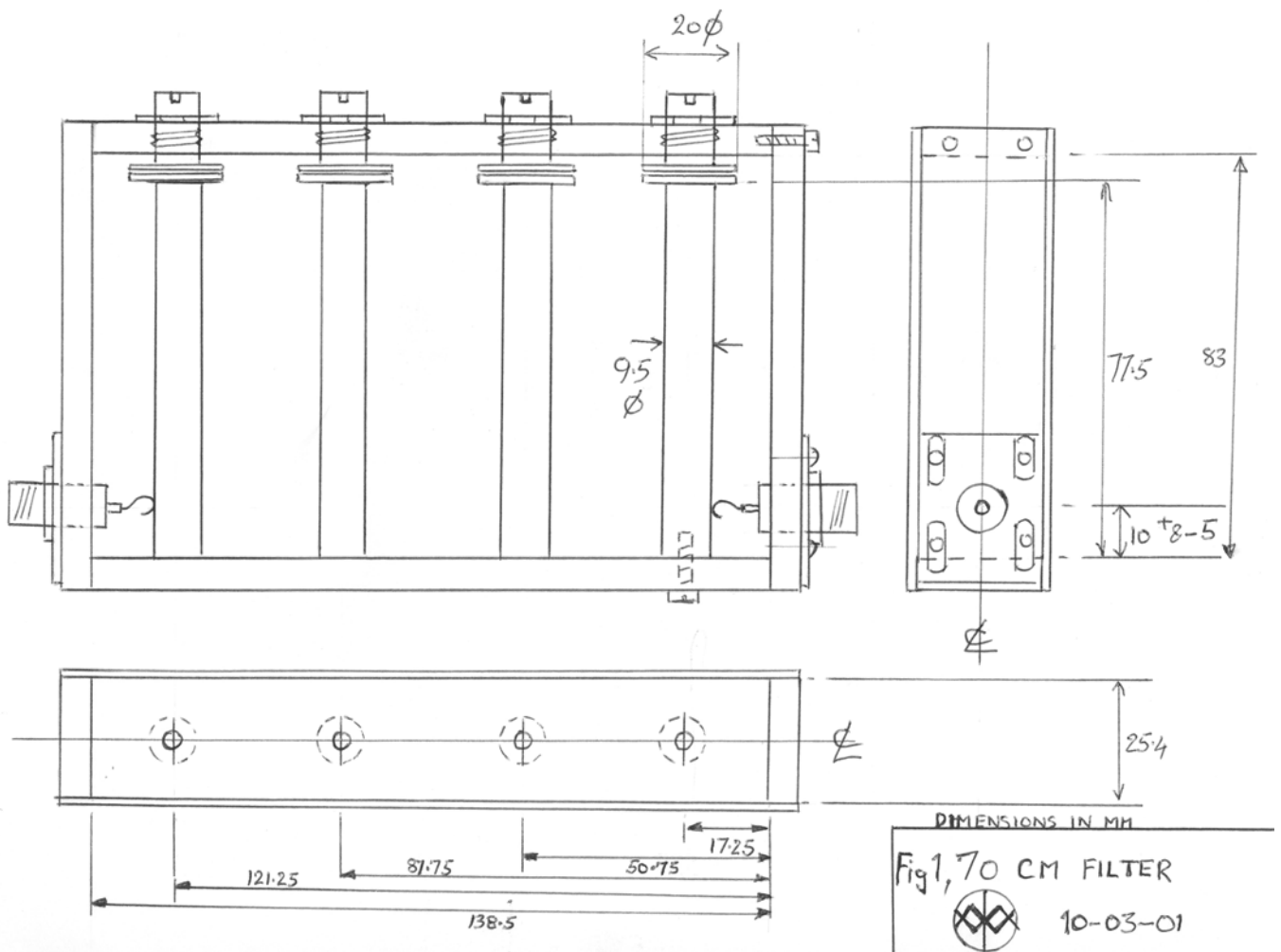
Performance

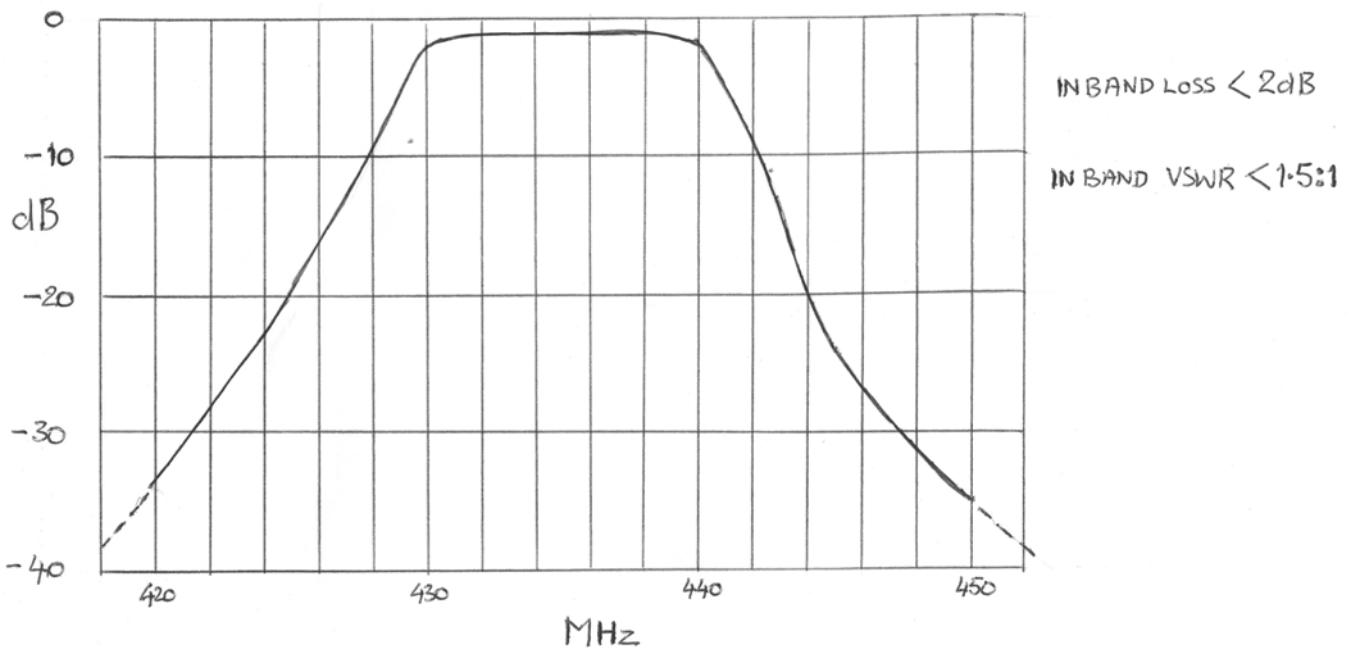
The measured performance of the filter is given in Fig 2.

Timing up

The filter tunes up very easily. A signal from a generator at 435 MHz was fed into the filter, while the four screws were adjusted for maximum output observing the result on a spectrum analyser. A communications receiver with S meter could also be used.

The passband shape was then optimised using a sweep generator. Other ways of doing this have been described in CQ-TV. The match was adjusted and measured using a sweep generator and a Rhotector. This is not very important and a good match should be obtained with the connector adjustments in mid position. If anybody makes this filter and has difficulties in tuning it, I could help.





What are we doing to our hobby?

By Howard Chapman G3NZZ

The latest CQ-TV surely had too much digital content to be in ATV's current best interests and I feel that BATC needs to develop a strategy to balance the overall needs of its members.

1) Activity is definitely down in most areas of Amateur Radio at the moment – the computer is (rightly or wrongly) blamed for this, yet we seem hell-bent on encouraging everybody to increase computer usage – “Not logical Captain”!

2) A significant proportion of members are past the first flush of youth (like me!) and regard ATV as one of their hobbies. The complexity and frightening initial digital costs stated in CQ-TV 194's articles, are therefore likely to have an adverse effect, because they will be beyond the reach of many (who will also not be prepared to throw-away the results of many years' hard work, to “go digital”).

3) Technical advances should always be encouraged but the effect of these

can be less than desired, due to what I consider to be wrong priorities (which have resulted in the UK's failure to obtain a level playing field with the rest of IARU Region 1). – Our local situation illustrates what I mean:-

- a) We are fortunate in having some of the world's best digital know-how in this area (e.g. over half the world's DTV goes through Southampton-designed encoding equipment) and spin-offs have resulted in important digital “firsts” for SCART/GB3AT (which I'm sure will be reported elsewhere, so I won't repeat them here).
- b) Hampshire's peculiar terrain severely limits 23cms coverage, so GB3AT's 25W ERP mainly covers rural areas but not the big cities (except for odd pieces of high ground on the fringes), therefore the number who can participate is severely limited by “tree dB attenuators” combined with the (too rigid) UK restrictions on both frequency and power. - Think what

could be achieved if we had 70/23 cross-band operation combined with sensible repeater power (as in other parts of Region 1). Some may say that this is possible and all you have to do is apply to the authorities, but my experience with repeater applications is that the UK bureaucratic process needs so much time and effort that it is often the deterrent to progress.

4) My location overlooking Southampton illustrates another adverse effect of digitising: I have been told that local tests have proved that about an analogue P3 without ghosting is needed before the current MPEG system is reliable – this would reduce me to working one active station (who is probably fed-up with my face already!), so I will continue with 70 & 23cms analogue whilst watching for developments with great interest, but I will be unable to join the current rush to “go digital”.

Worthing Video Repeater Group



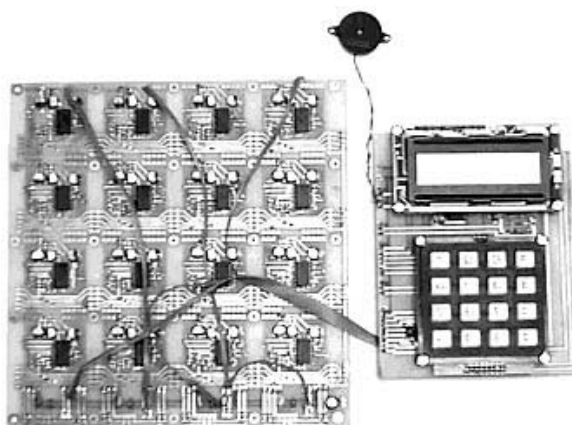
GB3VR GB3RV GB3SR GB3BR

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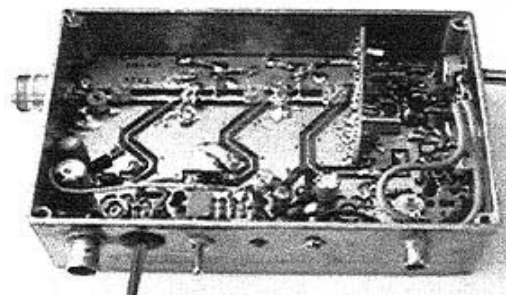
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Cheques payable to "WVRG".

North Sea 2001

By Bob Platts G8OZP

Last Augusts 3cms transmissions across the North Sea to Holland via sea surface ducting was a great success. On the Saturday I travelled to Southwold, where from the car park by the harbour P5+ signals were exchanged with two groups in Holland. Hans PE1ECO and his friends were located at Westkappeller, the most westerly point of Holland and Peter and his group at Hook Van Holland near Rotterdam. Simplex and duplex contacts were maintained for over five hours. Peter G8LXE set up his station on the east coast of Kent and also exchanged excellent signals.

Sunday I set up my station on the sea front at Bridlington again exchanging superb pictures with both Dutch station.

This years event will be on Saturday and Sunday the 11th & 12th of August

couple of occasions when voice contact is needed. 2 meters is available and has



Operating duplex from Bridlington, August 2000



Bob operating from Bridlington seafront

(This picture is also on the front cover)

so if you can operate portable and get to the coast why not join in this year.

Hans PE1ECO and friends will again be operating from Westkapeller and probably Peter PE1DCD again from the Hook Van Holland.

I plan to be operating from the sea front at Bridlington again.

I will only be operating on 3CMs but both Dutch station also have 24CMs. Mobile phones are now used for the

been used but contact on such a low frequency has in the past not proved dependable over some of the longer paths.

Check on a map as there are many points along the south east coast from Dungeness up to just North of Great Yarmouth and a few miles in the Bridlington area which have a sea path to Holland. If you know of any stations along the Belgium or French coast invite them to join in

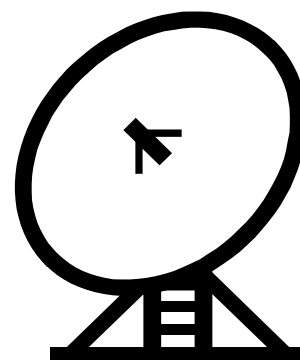
You do not need super equipment as if condition are OK signals can be VERY strong. All being well multi link ups could be possible by re-transmissions.

For further details contact me on 01283 813392 prior to Friday 10th August.

My mobile on site will be 07767 600807.



Operating from Bridlington seafront



Use of the Maxim Max459 Switching IC

By Mike Cox, El Presidenté

Introduction

Routing Switchers are not the most glamorous bits of kit, until you need one for the shack, editing rig or OB truck. Then they take on a whole new importance.

In CQ-TV 191, I described the Technical Facilities at IBC, including the Message Service. Not specifically mentioned is the Preparation Area, which is where the DPS machines are located and which need record input feeds from each other and from at least one of the Aston machines. Hence we either needed a patch panel or a matrix to allow any machine to record the output from any other, and any matrix had to be 3 layer as the interface is analogue component (CAV or YPbPr).

Around this time, I received data from Maxim of a new 8x4 switcher IC, MAX459. It looked promising although control needed some thought.

On approaching Maxim, they very kindly sent me 3 sample ICs, so I had the makings of a 3-layer switch matrix.

(Note that the price of a single MAX459CPL is £29.41. Maxim are on 01189 303388).

This price may seem high, but you are getting a lot of electronics for your money. The MAX459, in addition to the crosspoints and latches, carries 4 x 75 ohm output amplifiers with a fixed gain of 2. It seemed sensible to provide

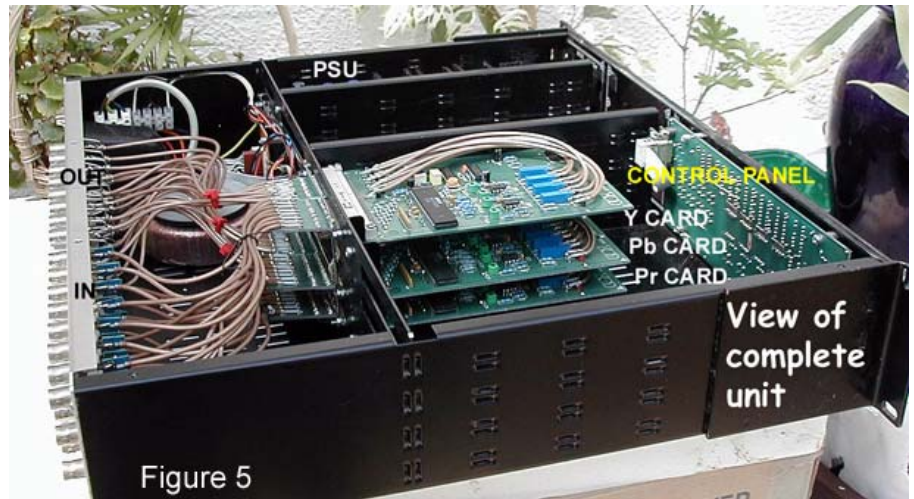


Figure 5

at least two 75 ohm outputs of each output, with gain and response control provision.

The IC is available as a 40 pin DIP, or as a 40 pin PLCC. It requires +/-5 volt rails, consuming around 75mA from either rail.

The block diagram of the IC is shown in Fig. 1, with the additional components for the evaluation switcher added.

Evaluation

The first step was to build an evaluation board to get the feel of the device, shown in Fig. 2 and Fig. 3. The board was assembled on a spare piece of copper clad laminate, and is a complete 8 x 4 single layer switcher. The only additional device was a 74HC14, used as a simple delay for the /Update signal following the Take button. Two hex switches select the Destination and Source signals. This rig

proved the worth of the device, and work could start on PC layout of the final card.

It was decided to fit an OP. Amp IC for the final outputs to allow for gain and response adjustments, and a useful device is the CLC416. This is a dual device in an 8-pin package made by National/Comlinear (available from Farnell, stock no. 641-339, £4.64 each), and which also runs from +/- 5-volt rails. It will comfortably drive two 75-ohm outputs with an adequate bandwidth (is about 30 MHz enough for you?)

Once the devices to use were chosen, how was the matrix to be put together, and more important, how was it to be controlled?

Mechanical Layout.

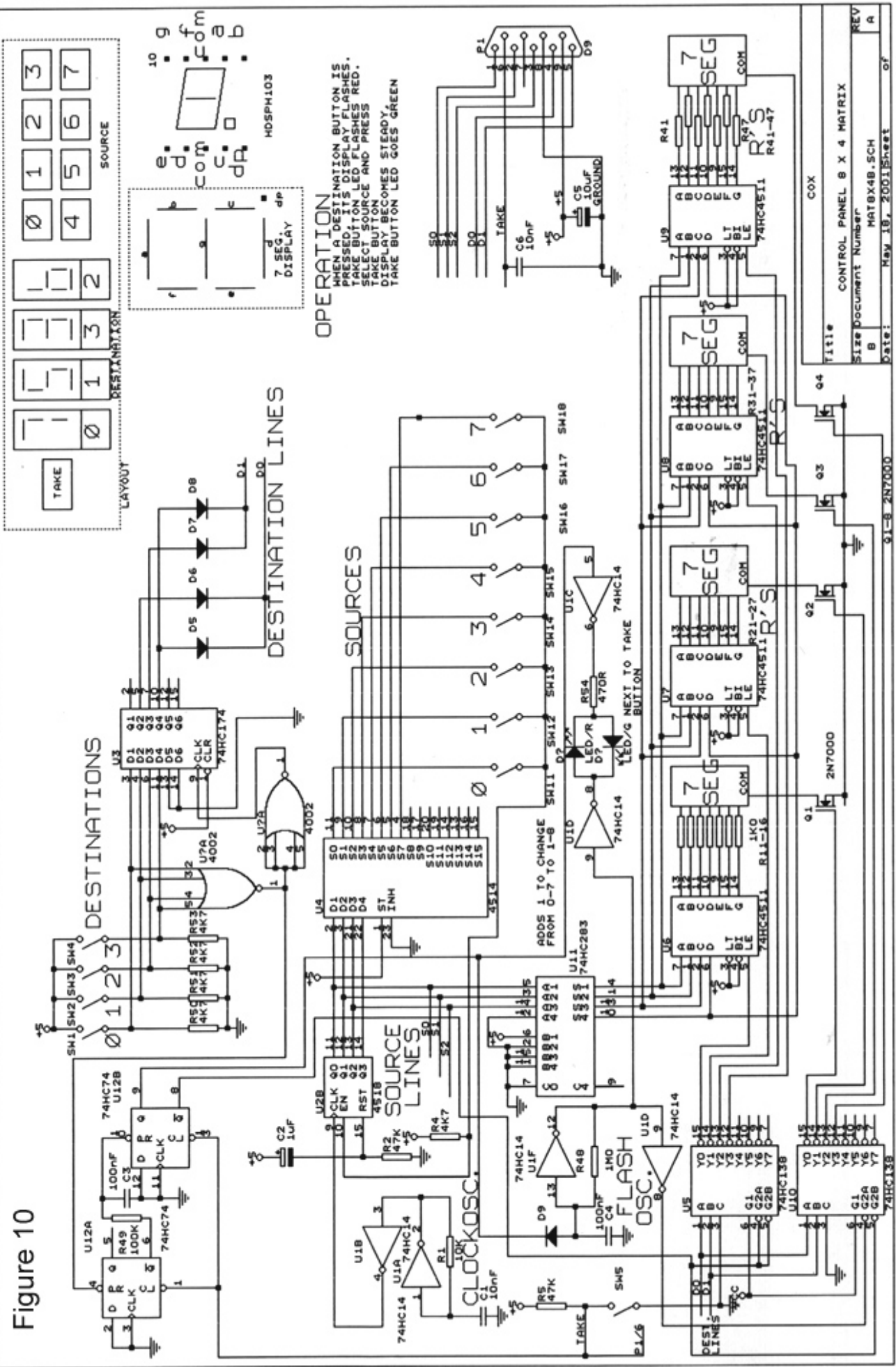
A spare 2U frame was available, together with an appropriate power card. A 2U frame is necessary to fit the 48 BNC connectors with enough space to get your fingers in to fit or release. A small cosmetic point was that a Perspex front panel was available with it.

It was then decided to lay out a 100 x 160 mm Eurocard to take the MAX459 IC and the 2 CLC416 output amps. See Fig. 4. Should there be a need for a single or two-layer switch, the card is available. Controls for gain and response for each of the 4 output channels are mounted on the card edge. To minimise crosstalk, the inputs to the IC are taken directly to the appropriate pins, while the outputs from the CLC416s are taken via short lengths of

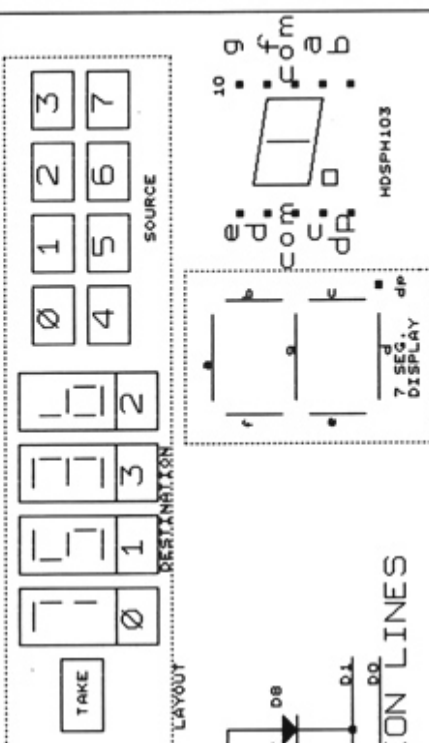


Switcher Card - 1 of 3 (Y) Figure 4

Figure 10

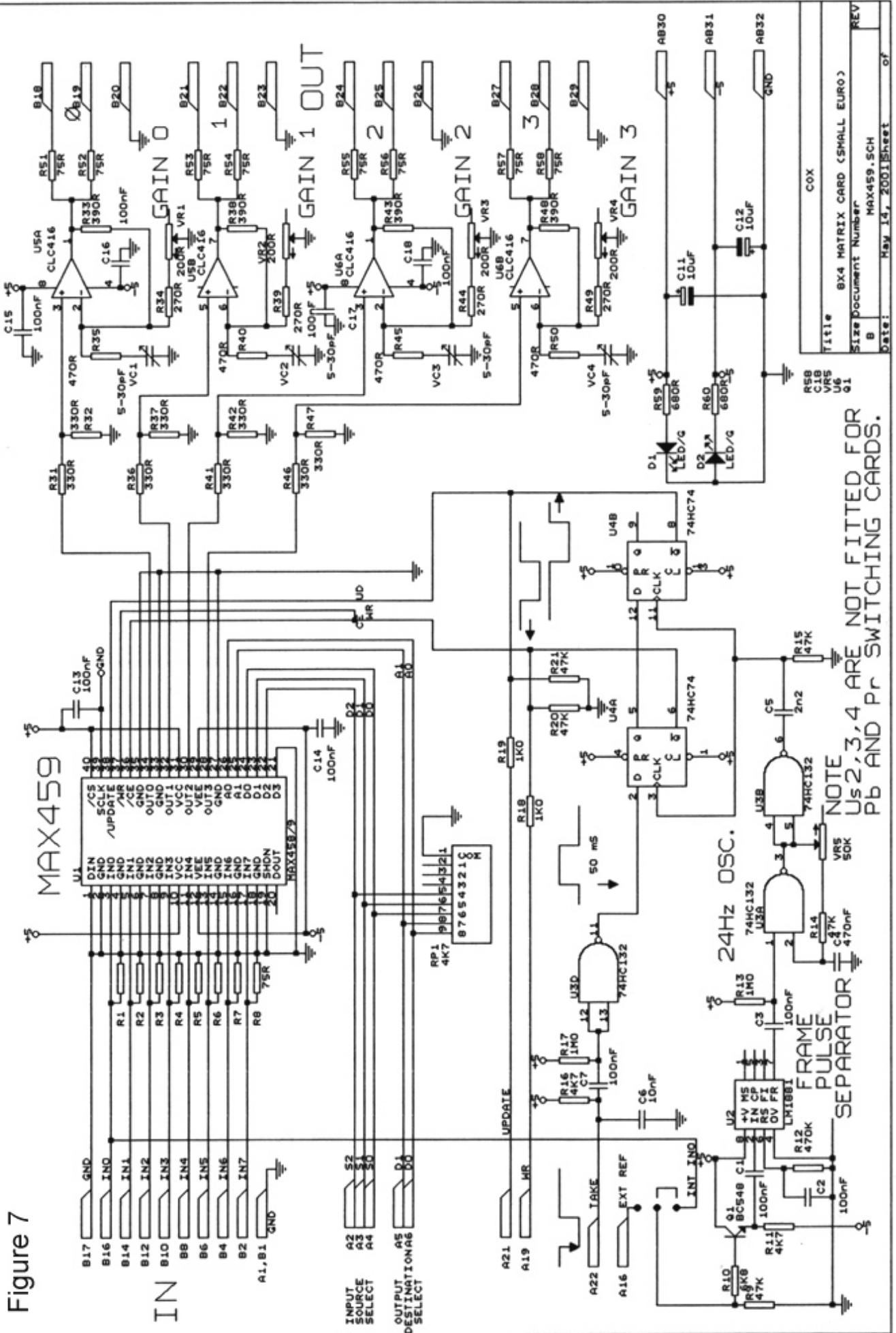


OPERATION
 WHEN A DESTINATION BUTTON IS PRESSED, ITS DISPLAY FLASHES. TAKE BUTTON ON LED FLASHES RED. TAKE BUTTON ON AND PRESS DISPLAY BECOMES STEADY. TAKE BUTTON LED GOES GREEN.



Title CONTROL PANEL 8 X 4 MATRIX
 Size Document Number B MAT8X4B.SCH
 Date: May 18, 2001 Sheet 1 of 1
 REV A

Figure 7



Title	BX4 MATRIX CARD (SMALL EURO)
Size	Document Number
REV	B
Date:	May 14, 2001 Sheet

COX
 R5B
 C1B
 VRS
 U6
 U8
 Q1

NOTE
 Us 2,3,4 ARE NOT FITTED FOR
 Pb AND Pr SWITCHING CARDS.

RG179 cable to very near to the pins of the DIN41612 card connector. See Fig. 5.

Three identical cards are mounted one above the other in the frame. A length of RG179 cable connects the mating card connectors to the BNC connectors on the rear panel.

Control

Control of the MAX459 is interesting. There are options for parallel (6 bit) or serial control. I chose to use parallel, as it fitted in with ideas for a source/destination type facility that could be fitted to the front panel of the 2U frame. The front and rear panel views for the switcher are shown in Fig. 6. There are readouts above each destination button to remind the operator what source is currently selected. Pressing any destination button causes its readout to flash; now choose the source.

Pressing the *Take* button does the final *Execute* - the readout will revert to steady and the new source goes to its destination.

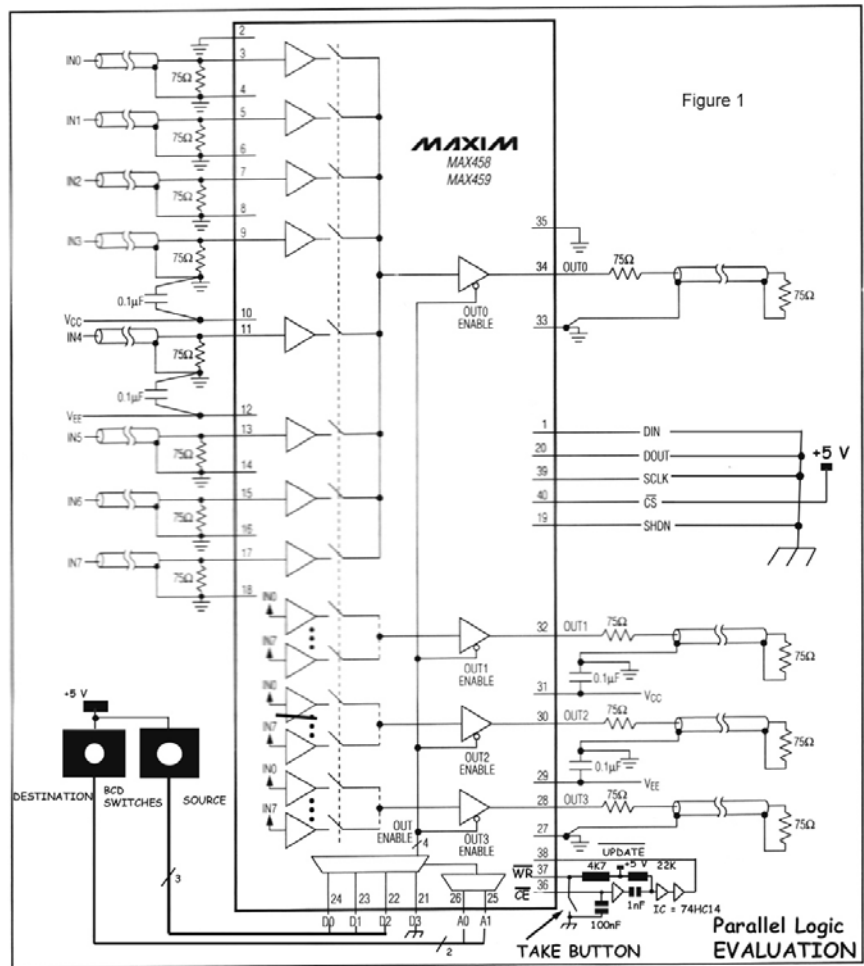


Figure 1

See Fig. 7 - circuit diagram of switching card, and Fig. 8 - parallel logic block diagram.

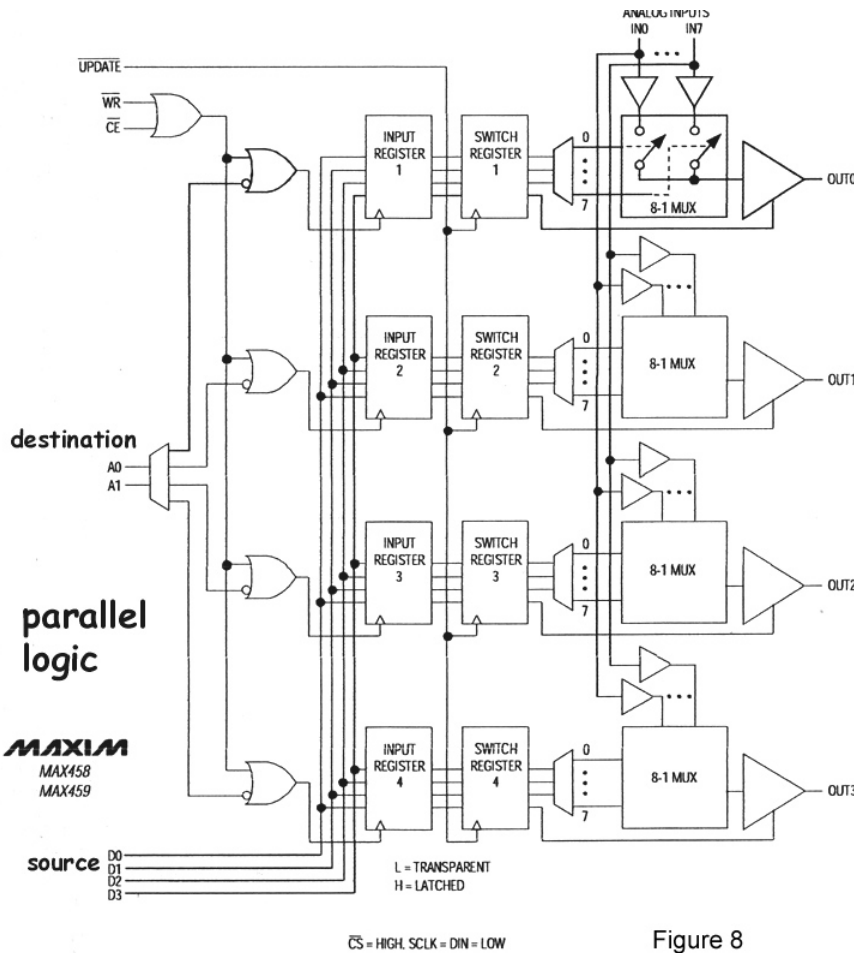


Figure 8

From the control panel, the 3 source lines D0-D2 (BCD) and the 2 destination lines A0-A1 (also BCD) come into the card and hence to the IC pins. The *Take* line goes to a pair of D flip-flops with their clock fed with a frame derived pulse (U2, U3). This pulse comes from a sync separator, the ubiquitous LM1881, which in turn is fed either from an external reference, or from the Y signal of input 0. In the event that there is no signal, a 24Hz oscillator is running, normally synchronised by the reference frame pulse. This provides the necessary latch signal for the *Take* input.

Take latched by U4a writes (/WR) the new set-up to the MAX459 input register, and a frame later, the switch register is updated (/UD). In a 3-layer switcher, the sync separator and latch circuitry need only be fitted to one card, usually the Y one. The /WR and /UD lines are taken to card connector pins and are linked together on all three cards.

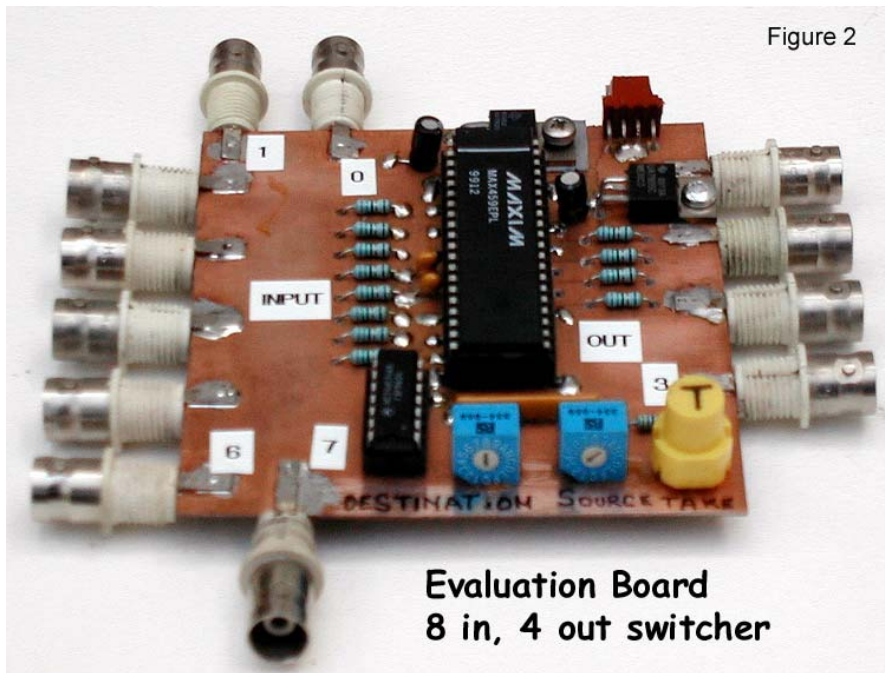


Figure 2

**Evaluation Board
8 in, 4 out switcher**

Control Panel

See Fig. 9 and Fig. 10 for picture of the panel circuit board, and for the circuit diagram.

The destination button signal is latched in U3 and coded by diodes to form binary lines D0 and D1.

A slightly more complex circuit latches the source selection, and feeds the appropriate 7-segment driver, via an adder (U11) that adds 1 to 0 - 7 to give 1 - 8 indications on the read-out.

In the steady state, the LED in the TAKE button shows a steady green. Following the circuit, Q of U12b is low. Via D9, the Flash Oscillator is held off. When a Destination button is pressed, U12a is toggled, and after a short delay, U12b. Q of U12b goes high, the Flash Oscillator is allowed to run, and the LED now flashes red. The flash signal goes via the 3 to 8 line

decoder U10 and one of MOSFETs Q1 - Q4 to the common cathode of the appropriate 7-segment readout. The

display then flashes to remind the operator to select a Source. Once this has been done, the Take button is pressed. The /Take signal goes to the crosspoint card, and also restores U12a and U12b to the steady state condition, (Q is low) and the Flash Oscillator is stopped.

Alternative Control Methods

One is to use two BCD switches for Destination and Source, and a Take button. This was used on the simple experimental card used to check out the MAX459.

The other is to use the MAX459 in its 3-wire serial control mode, perhaps controlled by a PIC. (See CQ-TV 189 - 193 for PIC description and programming articles.)

The video path is short and dc coupled. As most video sources have black level

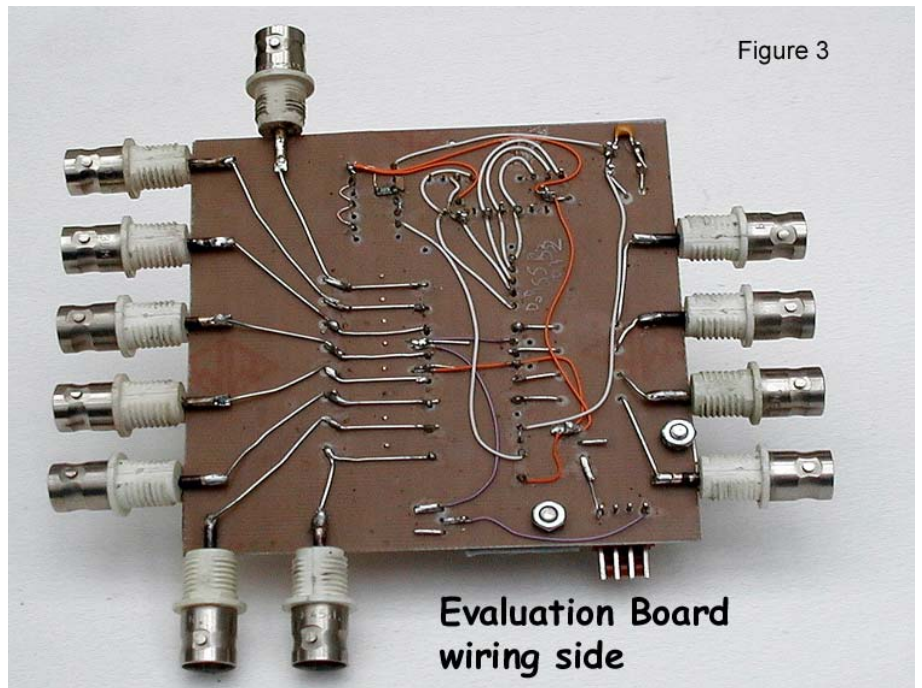


Figure 3

**Evaluation Board
wiring side**



Figure 6

**Front and rear panel
8 in, 4 out, 3 layer switcher**

set to roughly 0 volts, this should not be a problem. If there is, it is simple to fit a C-R network between the 75R terminating resistor on each input, and the appropriate MAX459 input pin. The chip has a relatively high input impedance, and values such as 470nF and 220k ohm should give a reasonable LF response.

This unit has now done 3 IBCs without problem, and is gearing up for its fourth. It has been used in a mixed mode where some inputs and outputs were Y/C, and others YPbPr. There were no crosstalk problems of any sort.



It is a safe system, because the *Take* button must be pressed to effect a change of Source to any Destination. A key switch could be fitted to lock out control to all but the key-holder.

If any one wants any further information, or a card PC layout, please get in touch.

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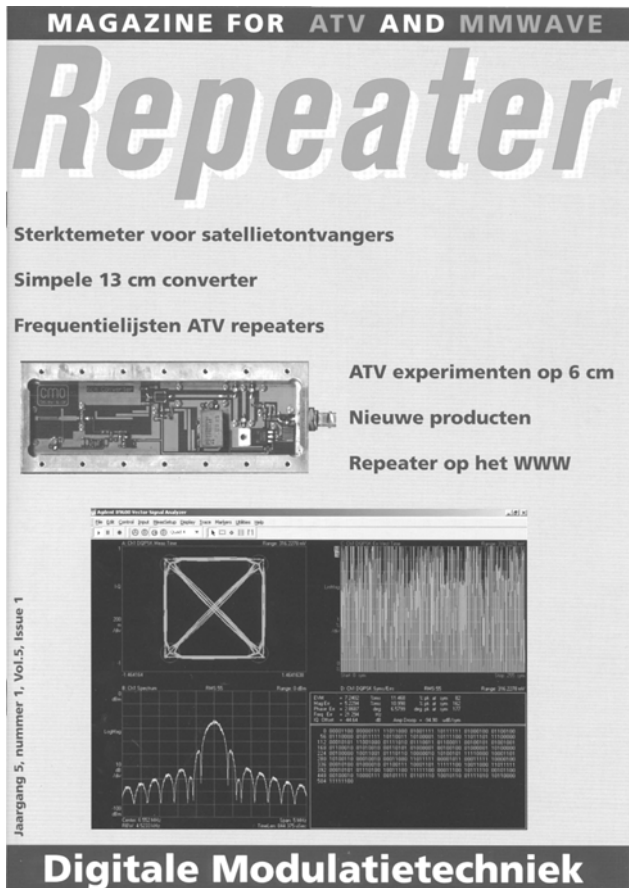
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Modifications to the G1MFG.com receivers and transmitters

By Giles Read (G1MFG) and Roy Powers (G8CKN)

Introduction

Firstly, let's declare an interest: Giles (G1MFG) is the man behind G1MFG.com, purveyors of the G1MFG range of ATV receivers and transmitters. These modules have gained widespread acceptance within the ATV community and encouraged many newcomers to dabble in our hobby of ATV. On the other hand, there are a couple of well-known deficiencies with the units (originally identified in CQ-TV 192 by Brian Kelly). Briefly, the lack of CCIR de-emphasis on the receiver causes 'ringing' on the received video signal. On the transmitter, the lack of pre-emphasis and the poor low-frequency response cause less than ideal transmissions. In this mini-series of two articles, we will explore these deficiencies and provide solutions. This first article describes the history of the transmitters and receivers and details a de-emphasis circuit for the receiver; the second article details cures for the transmitter problems.

History

In the beginning, there was a 2.4GHz transmitter and receiver, which operated on four fixed frequencies at the top end of the ATV band (within the licence-free allocations). These were on sale from various sources in Europe and the USA. Giles obtained a small quantity from the manufacturer and - with the invaluable assistance of Dave (G0GMK) - came up with modified versions which would transmit anywhere in the 13cm band, and receive a number of spot

frequencies. People often ask the reason behind the particular receive frequencies, and the honest answer is that they were simply chosen as a reasonable spread across the amateur allocation, plus the original four "licence-free band" frequencies for compatibility with transmitters acquired elsewhere!

Next on the scene was a version of the transmitter and receiver designed for the 1394MHz band. A little tickling later and the modules were coaxed into life on the 23/24cm amateur band. At this point, G1MFG.com was launched on an unsuspecting world and the rest is history!

Troubles

The transmitter and receiver were originally designed for short-range surveillance use, probably with a view to NTSC rather than PAL operation. It's almost certain that the transmitter and receiver were intended for use as a pair (like domestic "videosender" units) and so the lack of pre- and de-emphasis was fine. For our ATV purposes, though, the lack of pre- and de-emphasis can be a problem.

Another problem on the transmitter is that for some reason the original design has rather poor low-frequency response, being a good few dB's down at our field frequency of 50Hz. We suspect that this is less of a problem on 60Hz NTSC, but that is another story. The net result of the "LF Tilt" is that one often finds poor frame lock on signals sent by a G1MFG.com 23/24cm transmitter.

Early cure

GW3MEO provided a standard set of pre- and de-emphasis circuits for the

transmitter and receiver, which were published (with permission) on the G1MFG.com web site and latterly with the documentation that accompanied the transmitter and receiver. Unfortunately, these standard circuits require reasonably accurate 75-ohm input and output impedances - something that is sadly lacking in the modules!

An additional problem was that the pre-emphasis circuit did nothing to address the LF tilt problem in the transmitter. Some partial solutions have been posted on the G1MFG.com web site, but they did not completely eliminate the trouble.

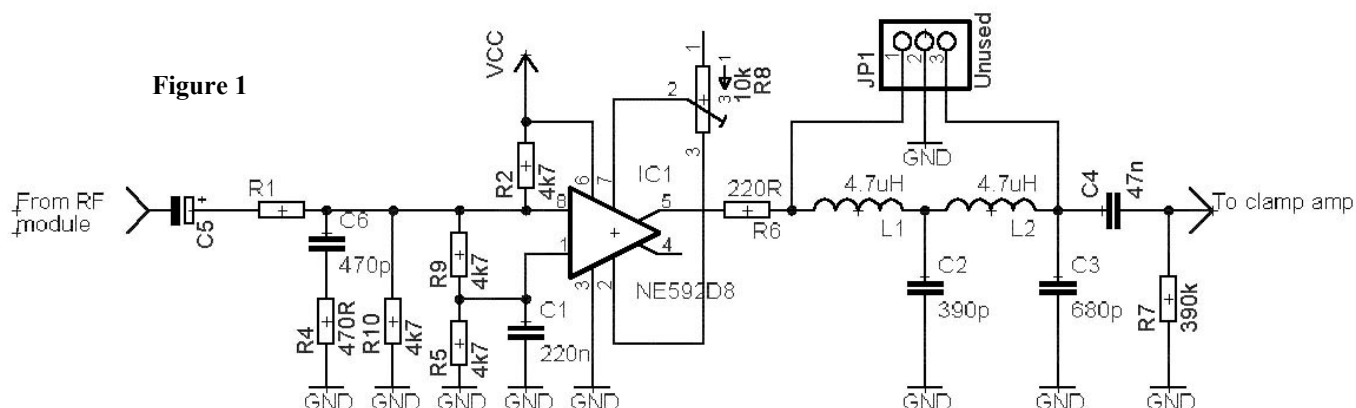
A proper fix

To overcome these problems, we have developed proper solutions for both the transmitter and receiver. On the receive side, the cure comprises a drop-in PCB containing a properly matched CCIR de-emphasis filter which, in association with a couple of other minor changes, provide a proper answer to the de-emphasis problem. On the transmitter side, the solution consists of another small PCB with impedance matching and pre-emphasis circuits, plus a couple of modifications inside the transmitter module to cure the LF problem. In the spirit of amateur radio, we'll be publishing full details of both circuits, and G1MFG.com will be able to supply specialist parts like PCBs.

Receiver fix

The original video processing circuit is shown in figure 1 below.

Incoming low-level baseband video from the RF module is AC coupled by C5. R1 and R2 provide bias for one input of IC1, while the other input is



biased by R5 and R9 and decoupled by C1. R4 and R10 provide a simple low-pass filter (or rather, top-cut!) to shave off some of the highest frequencies such as the intercarrier sound (which would otherwise give patterning on the screen. The gain of IC1 is set by R8.

Amplified video from IC1 is fed via R6 to a simple low-pass filter formed by L1, L2, C2 and C3. The purpose of this filter is a little unclear, but it is believed that it's intended to cut off the remainder of the sound subcarriers. The output of the filter is AC coupled via C4 to load resistor R7, whereupon it feeds the clamping and output circuit.

Anyone who reads the value on L1 and L2 will be surprised to learn that they claim to be 6.8µH - in fact, they're 4.7µH. No one knows whether this is due to a production marking error or just components that are (consistently) well out of spec!

The deficiencies with this circuit are fairly straightforward. In order to achieve the required gain, IC1 is being operated 'flat out'. If you use R8 to turn up the gain just a little more than necessary, you'll see distortion on the picture as the IC simply runs out of steam. The other real deficiency is of course the lack of de-emphasis.

The circuit shown in figure 2 was developed to provide a drop-in de-emphasis for the receiver. Based on a standard pre-emphasis circuit, it also adds T1 and associated components to provide impedance matching and a

certain amount of gain (to relieve stress on IC1, the NE592).

Connector JP1 fits directly in to the equivalent locations provided on 23/24cm receivers and some 13cm non DIP-switch receivers. Incoming video is AC coupled via C3 and fed to the standard de-emphasis circuit formed by R1-R4, L1, C1 and C2. R7 provides an accurate 75-ohm load for the network, and also provides the emitter load for grounded-base transistor T1. Bias for T1 is provided by R6, and the base is decoupled by C4. T1 amplifies the video signal and the output is developed across R5 and R8. Please note that there are several variants of the receiver in circulation, and it may be necessary to select the values of R5 and R8 to suit. The primary determining factor is the type of variable resistor on the main PCB:

VR type	R5	R8	Found on
10k (103)	0R	470R	Most 13cm and standard (non-Gold) 23/24cm receivers
1k (102)	270R	220R	Some Gold receivers
500R (501)	390R	82R	Most Gold receivers

In fact, these values are not critical but they do set the effective gain of the output stage. The circuit was originally designed with just R8 (470R) but we found that on some Gold receivers it was impossible to use the onboard preset to back the gain off far enough to be compatible with wide (satellite) deviation signals (as used in some parts

of the country). The values shown above are optimum for the particular preset pot values, but you won't go far wrong if you make R5 = 270R and R8 = 220R.

Layout considerations

A professional, drilled PCB is available from G1MFG.com. You can also download a PDF (Portable Document Format) file containing a foil pattern at www.G1MFG.com/PCB/

Alternatively, you can make up the circuit on a piece of Veroboard or using any other techniques you fancy, such as dead-bug construction. There are no particular precautions required in laying out the circuit.

Installation

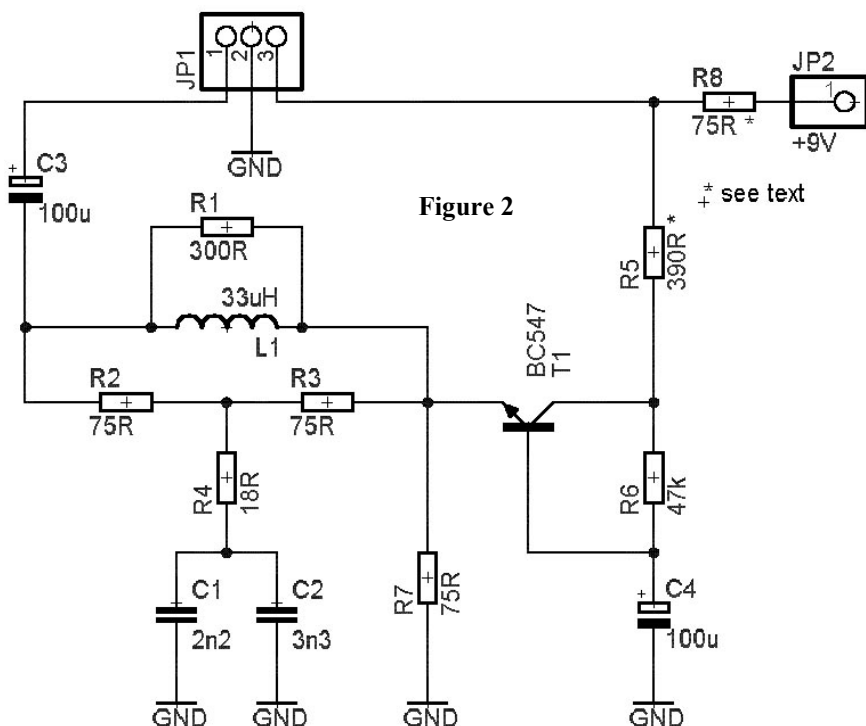
This de-emphasis circuit is not the end

of the story, though. In order to fit it, some modifications are required to the main PCB. These are:

- 1 Remove L1
- 2 Remove L2
- 3 Remove C3 (located between the rightmost pad of JP1 and the 22µF electrolytic capacitor on 23/24cm receivers)
- 4 Change R7 to 75 ohms (already done on 23/24cm Gold receivers)
- 5 Add 470p in parallel with R4 (already done on 23/24cm Gold receivers). Note that this capacitor is NOT used to 'flat-top' the frequency response: it's required to make the NE592 amplifier more stable.

Now you can add the de-emphasis circuit. Make sure you add a link from JP2 to the 9V regulator to pick up the supply.

If you're using the G1MFG PCB then the board will fit in the space directly above the three pads of JP1 (just above "Remove" in the picture Figure 3, below).



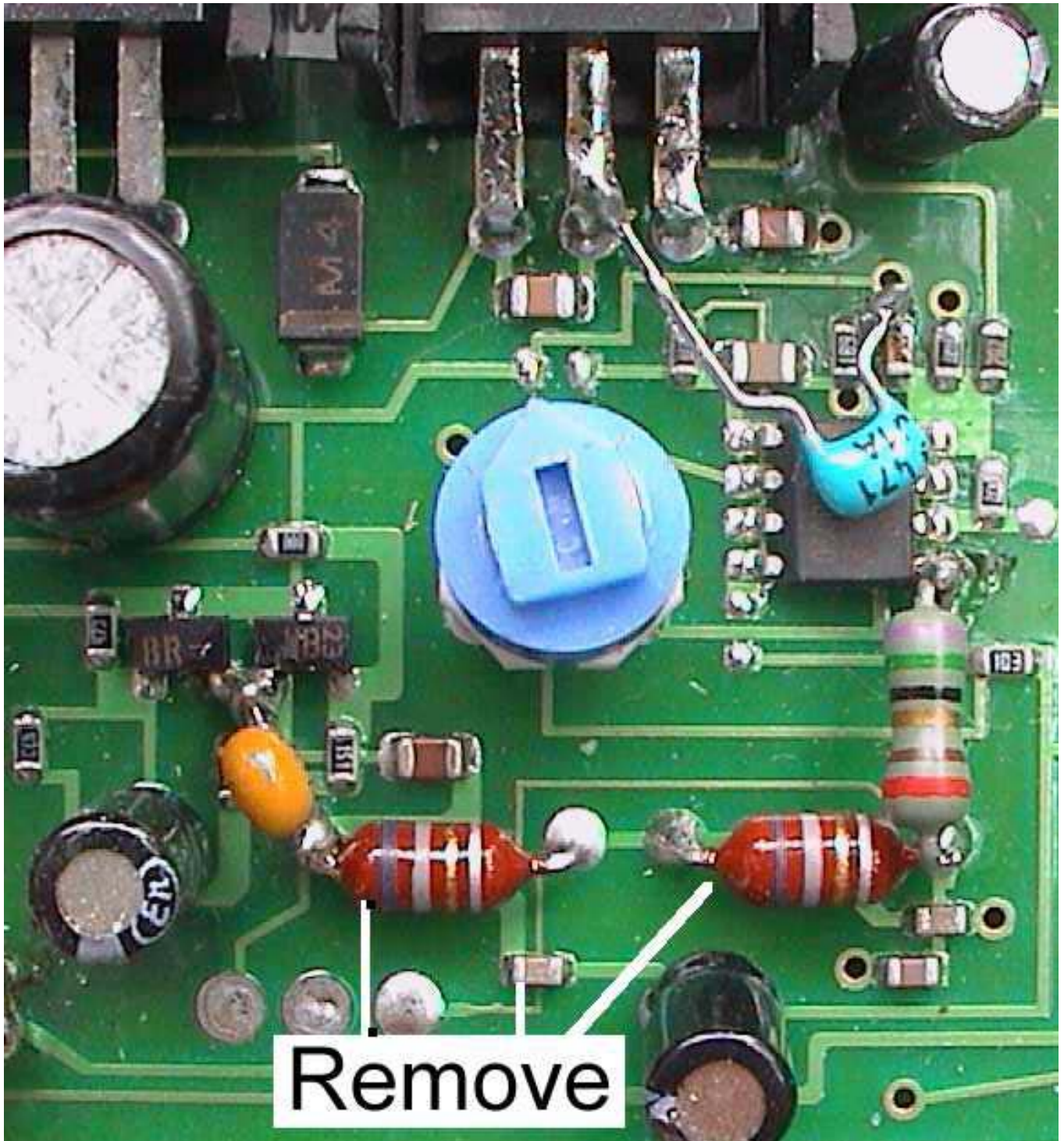


Figure 3

And finally...

In the next issue of CQ-TV we'll

describe the pre-emphasis filter and other modifications to the transmitter. Till then, good DX!

Members only!

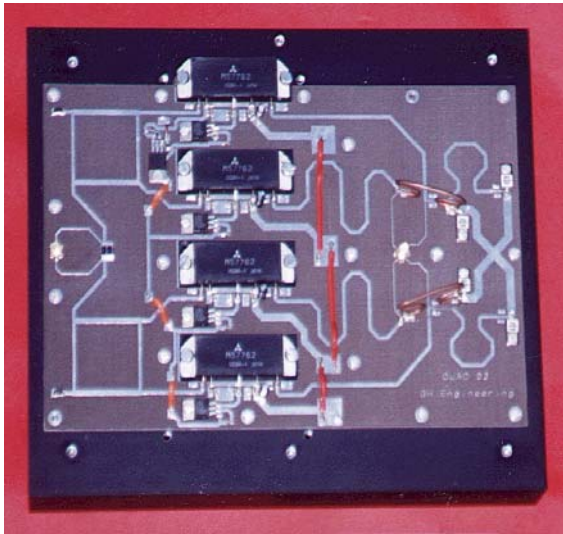
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GH Engineering



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 Built & tested £215.00



Operating from an external 12-13.8V DC PSU (1.5A for PA.13-18, 5A for PA1.3-18) – not supplied.
 Features: - Both amplifiers have reverse polarity protection, solid state DC switching, selectable PTT polarity (either 0V on Tx or +12V on Tx) and optional input attenuator. Heatsinks can be supplied drilled & tapped for an extra £8. Mini-kit consists of PCB, PCB mounted components and PA module. Full kit (PA1.3-18 only) also consists of front panel labels, switches and LEDs, aluminium case and DC & RF connectors.

PA2.3-1 – 1W 2.3GHz amplifier – available soon



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M57762 - £50	M67715 - £56	M68719 £87
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BFQ34 - £10.50	BLV93 £20
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All other Mitsubishi and Mini-Circuits products available, many in stock – ask for details

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A simple 23cms ATV receiver

By L. W. Smith G7GNA

A simple ATV receiver using the remains of two old SRX 200 satellite receivers

The circuits have been taken from other articles of CQ-TV, put together here to make a cheap, workable receiver for 23cms. I won't go into detail here regarding the circuit diagrams, as they can all be found in CQ-TV magazines. There are a few mods to the original designs, but not enough to write home about (hi). The pcb shown is full size and the components are taken from the two duff receivers (SRX 200). The chunky heatsinks were taken from the old Rx and then used for the new PCB, including the regulators, some of the transistors and the main building block - the tuner/de-mod unit.

The audio amplifier heatsink was made from a piece of tin plate and bent to fit

inside the top of the amplifier, with the tabs of the amplifier bent upwards, then soldered to the heatsink. The heatsink stands about 2.5cm above the IC and is the same length as the chip, and is fitted using heatsink compound onto the top of the IC.

The PCB is double-sided and through-hole wire links are used for the upper and lower connections to the ground plane, indicated by the little dots on the layout(s). The total cost of the finished unit was less than £3.00, and most of that was the PCB, the rest coming from the junk box.

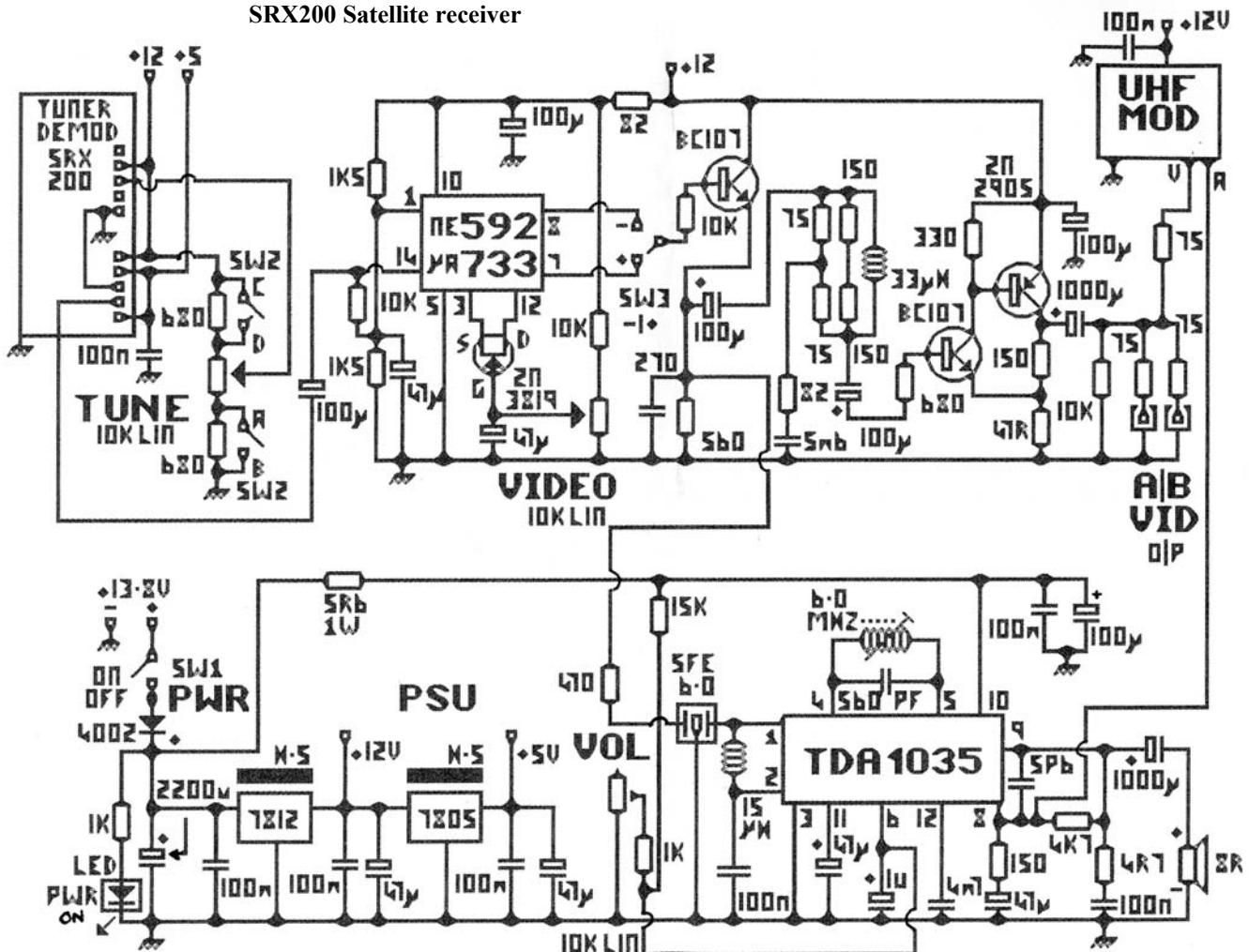
In use, I found it to be very good when used with one of Bob Platts' 23cms pre-amps (not using the supply via the TUNER/DEMOD). Separate supply leads were used to power them.

On testing the unit(s) from Portsdown Hill, GB3VX gave a P4 to P4.5 while



GB3VR gave a P5+ with the pre-amp connected. The same tests were carried out without the pre-amp, when GB3VX gave a P3+ and GB3VR gave a P5. All in all, good results. GB3HV was either on it's 'off-air' mode or I was unable to pick it up (possibly being in the wrong location). Other repeaters were not tried.

SRX200 Satellite receiver



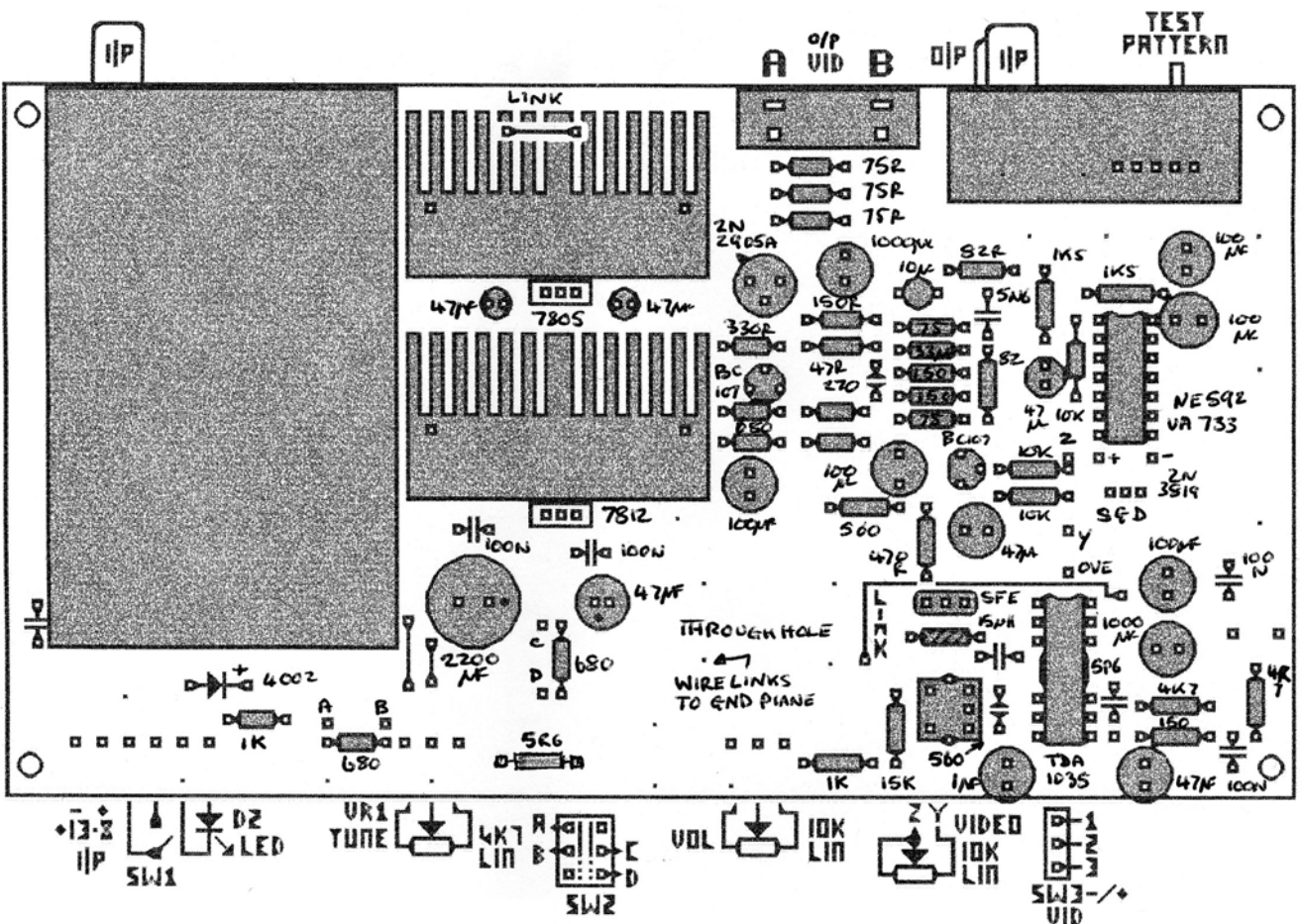
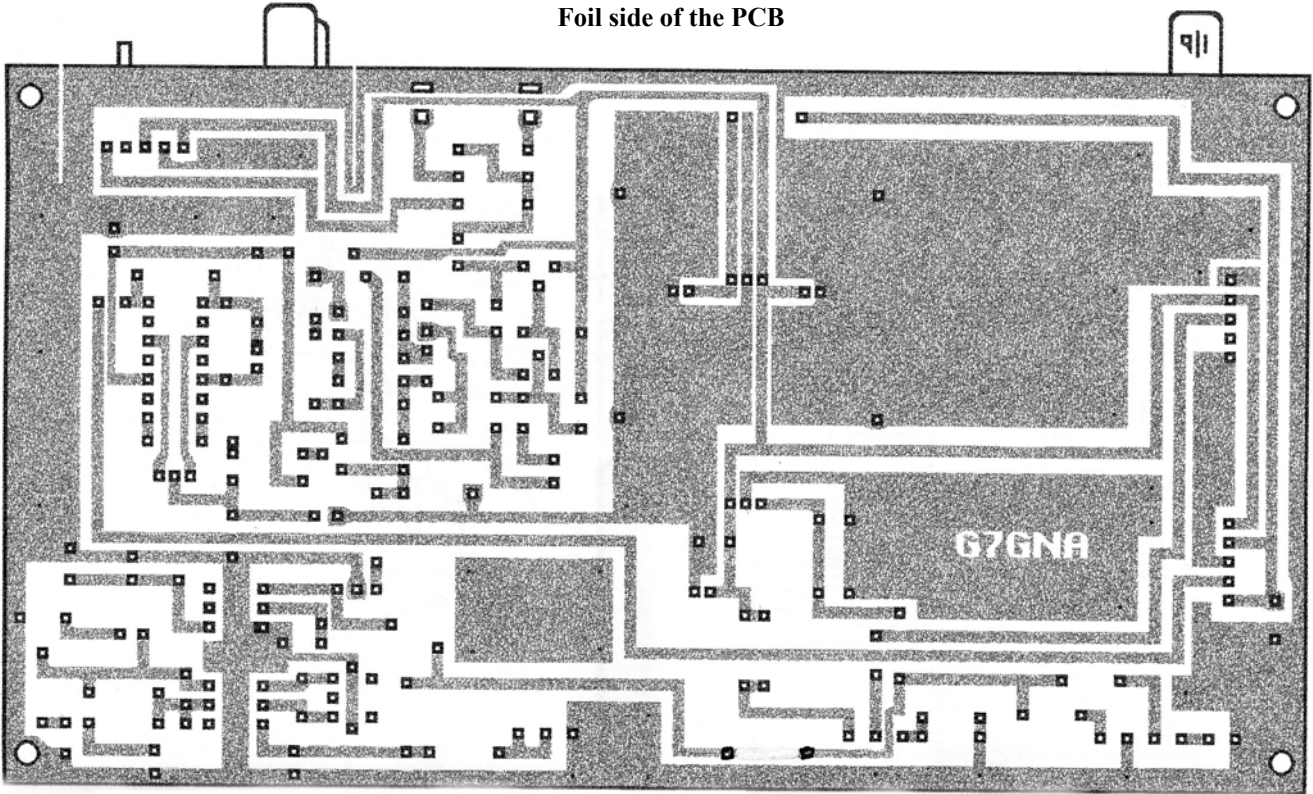
References

CQ-TV 135, Page 12 (TVRO) article 1986 Aug.

The ATV Compendium Page 99 Fig 16 (Modified BATC FM Demod, by Bob Platts) 3cms ATV Transceiver.

The Best of CQ-TV. Page 16 FM-TV Receiver by John Good. (Circuit, original).

Foil side of the PCB



FX to TR and Back Again

Dicky Howett visits THE COMPUTER FILM COMPANY and also conducts a short history of Tele-recording.

Think of movies like 'Con Air', 'Event Horizon', 'Godzilla', 'Mission Impossible', 'The Avengers'. The one thing they have in common is they all made use of an old imaging technique called 'tele-recording'. If that leaves you suitably amazed, in its original form, tele-recording was a system of storing television images onto film direct from a tv screen.

The latest facility is far removed from the fuzzy, liney tv system of the 1950's. Today, the London-based COMPUTER FILM COMPANY can offer a unique, dedicated, hi-tech, custom-built video-to-film image recording system, in full colour and anything up to IMAX. It just so happens that the movie cameras they use are well over 70 years old!

Full Quality

It would make John Logie Baird black and white with envy. Back in the TV stone-ages, pioneer Logie Baird actually devised a system of recording TV images. This prescient invention was simply a converted audio disc recorder that cut a 30-line low-band tv signal. Good idea, but in practise the low definition picture quality subverted any serious commercial application.

When all-electronic broadcast tv arrived, (1935/1937) high definition video recording systems didn't exist. The most obvious solution was to point a film camera at the tv screen and shoot the image. This was attempted, (notably a BBC 1938 production of 'The Scarlet Pimpernel' – since destroyed) but 'scan bars' and general picture instability were apparent.

For a full-quality recorded image, both fields of the British TV interlace (50th sec) have to be recorded by the film camera (running at 25 frames per second). The first stumbling block is that half of the time a movie camera film transport intermittent is blanking out the TV image, to allow for the film

to be pulled down. Engineers had to overcome little problems like that; losing half the picture information.

Initially, an attempt was made to record the full interlaced tv picture. In Feb. 1939 at EMI Research Labs, C.O.Browne and Gordon Newton linked a 35mm Mechau film mechanism with a projection CRT and an image sourced from an Emitron camera. (The Mechau film system used a drum of eight mirrors that followed and held stationary an image relative to the moving film for the duration of a complete scanning cycle). This Full Field system was further investigated and developed by the BBC in 1947. Brief recordings of the 1948 London Olympic Games were made using this system.

The Americans also were fully apprised of 'kinescope' recordings, as they termed them. North American continental time differences precluded simultaneous tv networking even after the introduction in 1952 of an East Coast-West Coast co-axial link. Film recordings were a convenient 'time shift' solution and also an easy way of showing potential advertising clients the finished tv 'product'. However, American video engineers had the interesting task of first devising a

viable method of recording an interlaced monochrome 525 line image of 30 f.p.s. at a cine rate of 24 f.p.s. and then re-transmitting at 30 f.p.s. It worked and the results were of good quality.

RANK Outsider

In the late 1940's the British and American film industry were also becoming interested in the possibilities of using video as a production tool. Rank at Elstree sought to produce entire movies via telerecording techniques. It was a bold, (or perhaps desperate) measure, with the promise of a quick turnaround and the enticing prospect of cutting studio costs. Bill Vinten (of the Vinten Company) who was a cameraman at the time, recalls, "Rank shipped from the USA three DuMont TV cameras. These cameras used early 3 inch image orthicon pick-up tubes and four-lens turrets to record the TV image. A 35mm back-projector was modified and positioned in front of a TV monitor. Results were atrocious. The DuMont tv cameras weren't really up to it. The tubes weren't easy to light for, all halos and crushed whites. Also, the image would occasionally stick on the tube. However, we did make a 35 minute children's film called 'Mr Marionette' using just one of the tv



Paul Lucas filmed from the screen in 1939. Note the appalling 'engineers' lighting

cameras and editing it like an ordinary film”.

Because of Bill Vinten’s experience at lighting these early telerecordings, in 1949 he was invited to light some special recording trials being undertaken by the Pye Company at Cambridge. Pye at the time were pushing into all areas of broadcast technology (including colour) and these video recording trials were an attempt to overcome the serious loss of definition associated with existing monochrome film/tv recording systems. The ultimate aim was for a system that could be applied successfully to full-scale movie making using two or more linked high-resolution cameras, recording onto 35mm film. The result had to be suitable for projection onto a large cinema screen. Initially, the cameras used in the Pye experiments were Pye Photicons (image iconoscope types). Later, an improved version, the Pye P.E.S. Pesticon camera was used. Progress was swift but the results were not altogether satisfactory.

High Def

During 1950, the old Highbury Film Studios in North London were acquired by Norman Collins and Terence Macnamara (formally both of BBC Television).

With the backing of Pye, they continued Pye’s experiments, re-naming the enterprise HIGH DEFINITION FILMS. The idea was to



The royal wedding. The BBC's murky attempt at telerecording in 1947.

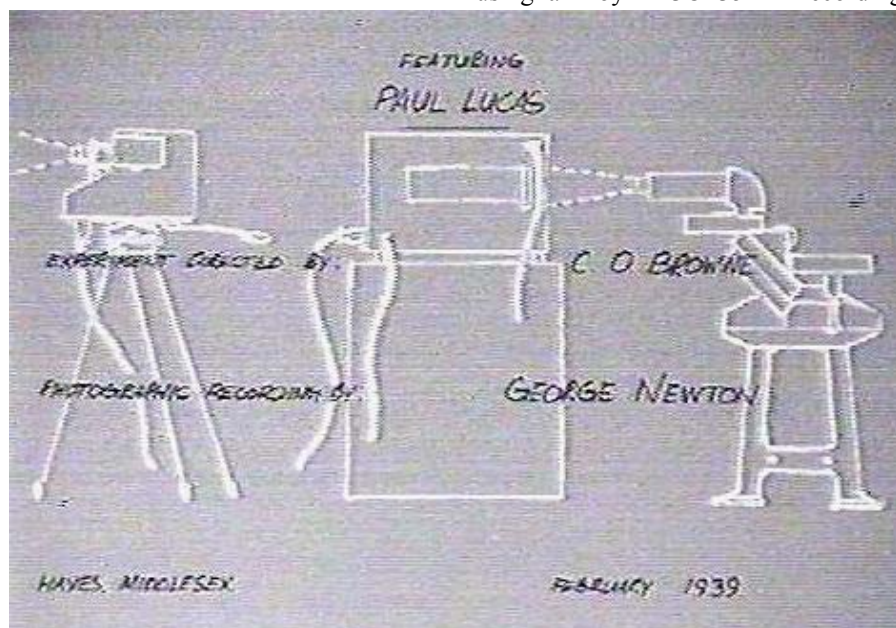
produce exportable tv programmes on film using multicamera techniques and efficient studio practices. The high definition film system differed from the conventional 405-line British broadcast standard in several important areas. To simplify the recording system, HDF used a sequential non-interlaced frame rate of 24fps scanning at between 625 and 834 lines per frame. In practice there wasn’t much point in going higher than 650 lines as the cameras then in use, offered no useful information above that figure. The monochrome pictures were recorded using a Moy RP30 35mm recording

camera. The overall bandwidth of the system was 12MHz, a big achievement in those days. Several HDF productions were attempted, including short tests and commercials which were made to a high standard with real products. These commercials were later shown to members of Parliament to give them a taste of what Commercial Television would look like.

By the end of 1955, High Definition Films ceased production. Several programmes had been recorded ‘in the can’ for use by commercial television including “Double Your Money”, “Take Your Pick” and a drama series called “Theatre Royal”. Other video-to-film ideas surfaced during the 1950s. One was called THERMOPLASTIC RECORDING which involved deforming the surface of a special transparent tape. The video signal was used to modulate the intensity of a fine electron beam in a vacuum, laying down a pattern of variable density charges on the surface of the thermoplastic. This was achieved in 1959, way before recordable CDs came along!

During the 1960s, monochrome telerecording quality reached a fine peak.

The BBC occasionally telerecorded plays shot-by-shot and then edited them like a motion picture. Results could be



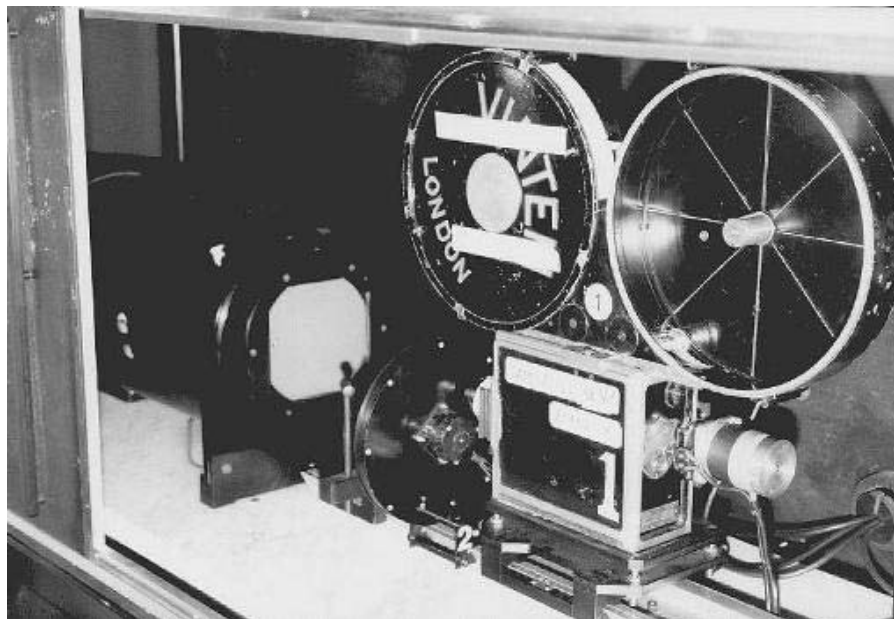
The EMI system

dynamic, much better than the (then) laborious video-tape, cut and splice system. When colour TV arrived in 1967, further problems arose with tape-to-film transfers. The existing shadow mask colour picture tube wasn't of sufficient resolution and quality to provide good colour CRT recordings. The Technicolor VIDTRONICS system using three separate colour strips was quite successful. However, in 1969 CBS Laboratories devised their LASERSCAN machine which, as the name suggests, eliminated altogether the phosphor CRT and instead introduced three monochromatic lasers. This system produced a direct colour negative using laser light as the prime source. The advantages were that there was the complete elimination of phosphor grain, colour cross modulation, and scanning non-linearity. Also, the system was capable of recording a much higher picture resolution than that currently prevailing.

During 1985, Dr. Mike Boudry devised a high quality tape/digital-to-film recording system and launched THE COMPUTER FILM COMPANY. Mike Boudry continues, "We were the first to devise a very high quality digital system. We design and build in-house, although we don't re-invent the wheel when we can buy off-shelf parts. However, existing equipment is very heavily modified to accommodate our electronics. We can offer the highest scanning available, up to 8,000 lines, plus all our compositing expertise."

Art DECO CFC

Today, CFC inhabits an imposing 1929 Art Deco building in Wells Street, London. Formally used by Columbia Tristar, the building has been



The film system at CFC. A Bell & Howell movie camera is lined up to the raster

extensively refurbished to accommodate CFC's specific requirements. Mike Boudry. "The special effects process usually starts when a client, after consultation brings in some film footage for manipulation. We always like to use the original negative (the client is advised to make a safety copy) and then the images are scanned on our special projector which tracks each gated frame down past a static CCD sensor array. Likewise, tape images are re-racked, graded and enhanced up to 4,000 lines. No useful information is obtained at higher resolutions, particularly with video. The digital information is stored via fibre optics in our disc 'memory bank' two floors up."

Net result

CFC was the leading originator of the 'Soho Net' This was devised as a joint

venture between local special effects houses to transfer images via fibre optics, at very high speed and at very high band widths. Saving time for companies like CFC is paramount. Although the speed of software is phenomenal, the hardware exists firmly in real time. Mike Boudry, "Once all the fancy effects work has been completed, the digital image is returned again to film. This is achieved by displaying the image on a very high resolution CRT and filming frame by frame (RGB three times) using our wonderful Bell and Howell movie cameras. These were used originally on silent pictures, but even today you can't get a better mechanism. The gate and register pins are completely accurate. But it's all slow motion. We film at seconds per frame, not frames per second. To get through the work we have to run this facility 24 hours a day, seven days a week."

Contest Calendar

International ATV Contest 2001 (REF France)

Saturday September 8th to Sunday September 9th

1800 GMT Saturday to 1200 GMT Sunday

Fast Scan TV all Bands

For Sale

For sale - Ex TVS MVTR vehicle - W reg, Ford D7010 chassis - converted to OB unit. Air conditioning, mains distribution and racking. Also, by negotiation, some equipment including colour preview monitors, vision mixer, sound mixer etc.

Enquiries and further details to simon@bigtimes.powernet.co.uk or telephone Simon on 01234 852789

ABC TELEVISION LIMITED. A technical description. ABCTV 1962. A mimeographed booklet detailing the ABC technical equipment and studio centres, Didsbury, Alpha & Teddington. Main illustrations of control room and studio layout (Teddington). A few pencilled inscriptions. Invaluable research material. **£3**

LIGHTING FOR OUTSIDE BROADCASTS. BBC Engineering

Training Supplement No.11. 1957. pp 71. Well-illustrated BBC tv publication. Covers a little marked o/w VGC. **£6**

SOUND & VISION BROADCASTING. Vol 1 No. 1. Large format Marconi product & publicity magazine dated Spring 1960. Illustrated articles include 'The Producer In Television' by Rudolph Cartier and 'The Marconi Mk4 Camera' by B.M.Poole. Also articles about transmitters, Australian Tv, lighting in studios. Lots of photos. Period item rarely offered. **£12.**

TELEVISION The First Fifty Years. Geddes & Bussey. 1986. Well-illustrated NMPFT booklet presenting tv since 1936. **£3.**

ONE DAY IN THE LIFE OF TELEVISION. Ed. Sean Day Lewis. BFI 1989. Fascinating account of one complete day in the life of British broadcast tv (Nov. 1st 1988.) Plenty of

photos, cameras, studios, deceased tv personalities/ tv companies. **£5**

GIRL FILM & TELEVISION ANNUAL No1 1957. No d/w. **£5.** 1st of this attractive series

EAGLE COMICS. from Vol 2 no.17 1951. 195 to choose from. All intact **£2.50** each.

All VGC. Postage minimum on all items **£1.50**

*Contact Dicky Howett. 01371 820155
Email: dicky.howett@btinternet.com*

CQ-TV Back issues, no. 119 to present date, except 122, 135 and 181-188. Offers? *Contact Terry Maton GAGHU, email GAGHU@excite.com or telephone 020 8220 5720*

Wanted

Wanted – Pre 1975 television receivers and parts, including home built receivers. *Contact Keith Parker on 020 8361 8896*

VIDEO SWITCHING PANEL Rack mounted. At least 8 inputs. Video mixer considered.

PYE Mk3 camera viewfinder hood.

REMOTE ZOOM CONTROLS for Canon J13x9B & Schneider Variogon 9-126. Ikegami fitting. Any items above considered in any state of repair.

*Contact Dicky Howett 01371 820155
email: dicky.howett@btinternet.com*

Any PCBs with reference to the G8CMQ Solent Scientific TX 10mW, 200mW, 1W transmitters. RX boards RC24 converter and the G8CMQ receiver. Synthesiser board and any board relating to G8CMQ. Working, non-working, or half built boards. *Contact L. W. Smith, G7GNA, Tel: 02392 232097, email g7gna@zoom.co.uk*

Tektronix Vectorscope (PAL), Model 1421, as used with the Ampex VPR2-B 'C' format 1" helical scan VTR. National 1/2" helical scan VTR Model, NV1020EK. Non working machine considered provided the video heads are in good condition and/or a set of replacement video heads. *Dave, G8TVW (QTHR - all issues of callbook). Phone (after 8pm or weekends): 01707 325347. Email: dyoung@amrad.freeserve.co.uk*

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