TV FOR AMATEURS

JOHN L. WOOD G3YQC

VIDEO

SECOND IMPRESSION

BRITISH AMATEUR TV CLUB

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BRITISH AMATEUR TELEVISION CLUB

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by

John L. Wood G3YQC

EDITOR - CQ-TV MAGAZINE

CHAPTERS

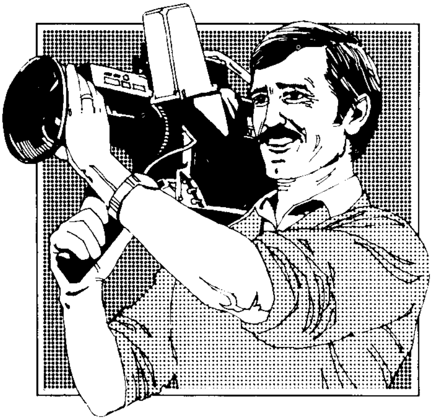
Introduction

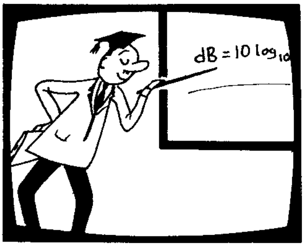
This booklet is intended to provide a practical introduction into the fascinating world of amateur television. Although written primarily to assist those wrestling with the (seeming) peculiarities of television transmission, it will nevertheless serve as a reference book for more experienced ATVers. Within these pages will be found all the information and designs necessary to understand the principles of amateur television and to assemble and operate successfully your own TV station.

Amateur television has always been looked upon as a highly specialized branch of amateur radio and practiced by technical "boffins". To a large extent this may have been true since relatively little was generally known about television for many years and none of the extensive equipment required for a complete station was available commercially until quite recently. Now of course TVs, video recorders, cameras and home computers are widely available as are commercially built transmitters and receivers, thus making life considerably easier for those who are new to ATV.

Amateur TV signals can be found primarily in the 70cm band between 434 and 440MHz. This band has been used for television for several decades and is the lowest frequency on which video modulation (fast-scan) is permitted. The use of the 24cm (1.3GHz) allocation for ATV is becoming increasingly popular now that equipment for that band is more readily available and construction techniques have been refined. 24cm has the advantage of space - especially when one considers that a full colour (AM) transmission, complete with an inter-carrier sound channel, occupies a total bandwidth of around 8MHz.

All amateur TV repeaters are in the 24cm band and as these become more widespread it is expected that a large proportion of active TV amateurs will become equipped for this band as well as for 70cm. Because the 24cm allocation is so wide, a bandplan detailing the dispersion of the various transmissions is shown in the chapter on 24cm TV. At the time of writing (spring 1983), this was the latest proposal put forward by the BATC and the RSGB. The plan had not been formally accepted then, so a check of the latest band details may be necessary before embarking on an equipment programme.





1

PRINCIPLES EXPLAINED

THE SIGNAL

Before considering the equipment needed to transmit and receive ATV, it is necessary to become familiar with the video and RF signals used.

NUMBER OF LINES PER PICTURE	625
INTERLACE	2 to 1
ASPECT RATIO	4 to 3
LINE FREQUENCY	15.625kHz
FIELD FREQUENCY	50Hz
COLOUR SUBCARRIER FREQUENCY	4.43361875MHz
VIDEO BANDWIDTH	5.5MHz
SOUND SUBCARRIER FREQUENCY	5.9996MHz
CHANNEL BANDWIDTH	8MHz
UPPER SIDEBAND WIDTH	5.5MHz
LOWER SIDEBAND WIDTH	1.25MHz
VISION CARRIER MODULATION	Amplitude (AM)
SOUND CARRIER MODULATION	Frequency (FM)
MODULATION SENSE	Negative (95% amp. =sync)

Fig.1 SPECIFICATION OF TELEVISION STANDARDS FOR 625-LINE SYSTEM I TRANSMISSIONS.

Amateurs in the UK have adopted the CCIR system I standard used by British broadcasting stations. Fig.3 shows a typical waveform for a single line of 'composite' video (combined video information and synchronising pulses). One complete line of a television picture takes 64µS to scan from left to right across a TV screen. There are 625 lines per frame and 25 complete frames occur each second. Each frame is divided into two interlaced fields of 312½ lines each which are scanned sequentially. A total of 50 individual fields therefore are scanned each second (50Hz). The line, or horizontal deflection frequency may be calculated thus:

$$50 \times 312.2 = 15.625\text{Hz}$$

When a line has completed its scan, the spot on the TV tube is re-traced very quickly to the start of the next line at the left hand edge of the screen, this operation is called 'flyback' (Fig.2). In order to avoid this trace from being visible on the screen the picture is blacked out (blanked) during the flyback period. Fig.3 shows this time period to be 12.05µS.

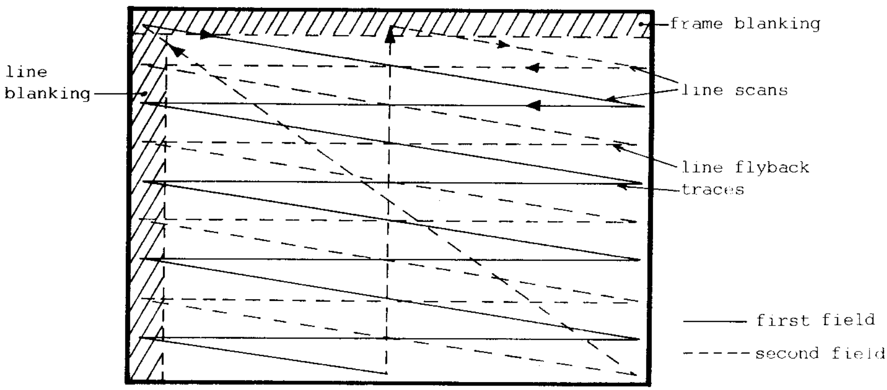


Fig.2. PRINCIPLE OF INTERLACED SCANNING

The synchronizing pulse to trigger the scanning spot is placed within the blanking period, this ensures that the sync pulses are not affected by the vision information. The period between blanking and the start of the sync pulse is called the 'front porch' and that from the end of the sync to the end of blanking is called the 'back porch'. A colour 'burst' signal may be contained within the back porch. The purpose of this signal will be discussed later.

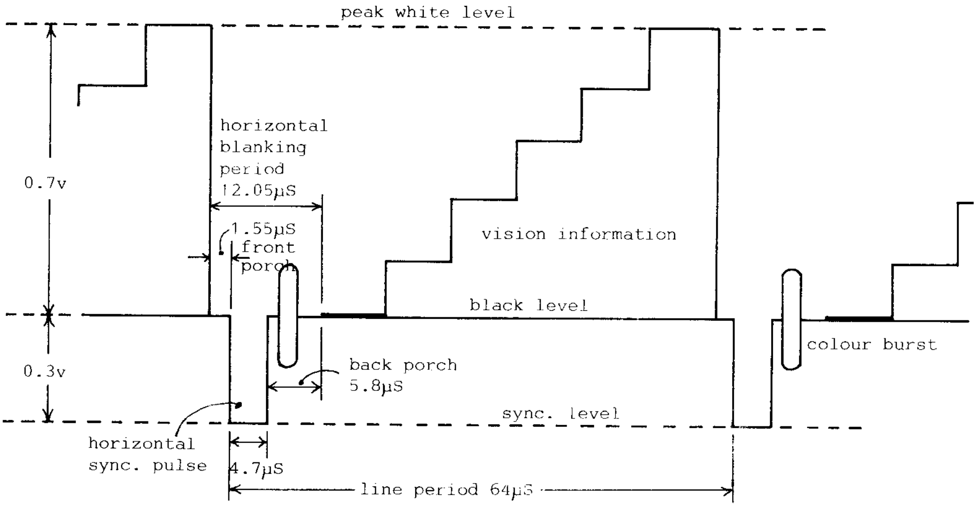


Fig.3. COMPOSITE VIDEO WAVEFORM

The composite video signal has a standard amplitude of 1 volt peak-to-peak, that is from the bottom of the sync pulse (sync tip) to the top of the vision information (peak white). Fig.2 shows the correct level at which sync information starts, this point is called 'black level'. A picture consists of black and white with many shades of grey in between, these shades are represented by different levels of video amplitude. The staircase (greyscale) waveform shown in fig.3, if displayed on a TV screen, would show a grey scale commencing with a vertical black bar on the left and ending with a pure white bar on the right.

Fig.4 illustrates the channel spectrum of a complete 625 line television signal.

System I dictates that the vision carrier be amplitude modulated. This form of modulation produces two identical sidebands. If both were transmitted, the total channel bandwidth would be unacceptably wide. Since both side-bands contain identical information only one is necessary for the reception of the TV picture, one of them therefore is normally filtered out resulting in a 'vestigial' sideband signal whose total bandwidth is around 8MHz.

Fig.4 shows the relationship between the three carriers present in a colour transmission.

Amateur TV transmissions do not all use vestigial sideband since it is somewhat difficult to construct and align suitable filters, however care must be taken to see that the transmission does not extend outside the band limits.

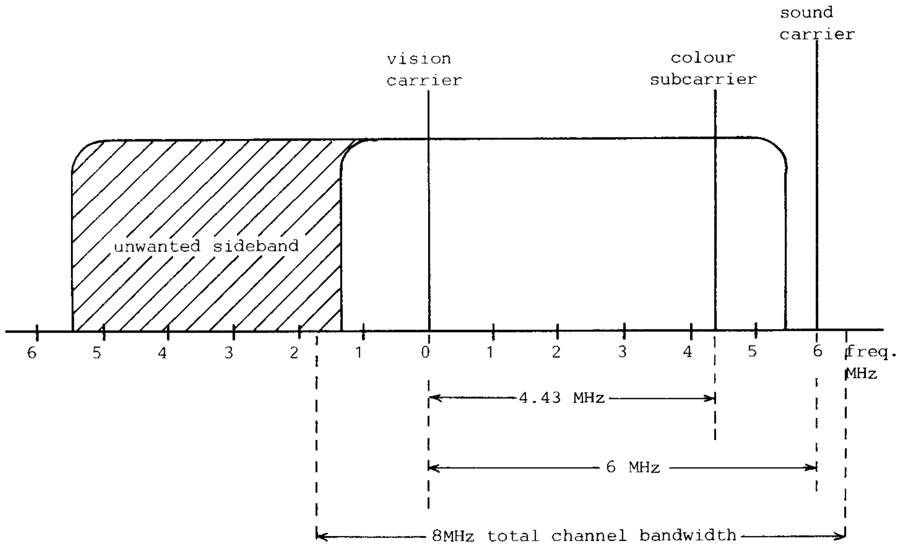


Fig.4. CHANNEL SPECTRUM OF A 625 LINE SYSTEM I COLOUR TRANSMISSION

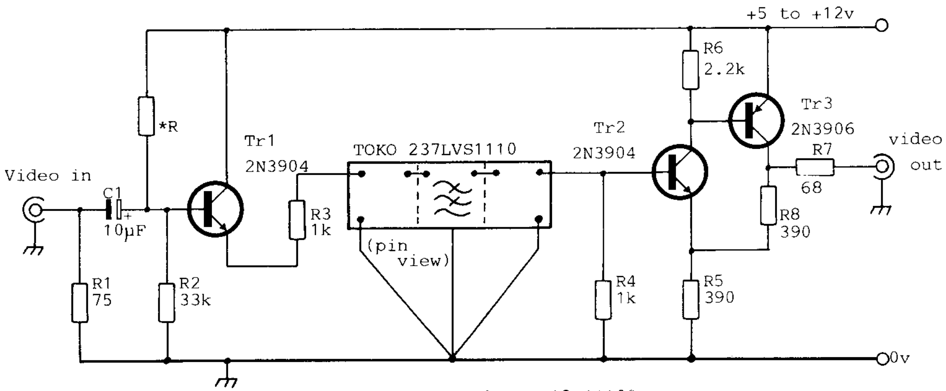
Restricted bandwidth may be acheived by passing the video signal through a low-pass filter which is designed to attenuate frequencies above about 4.5 MHz but pass all other frequencies of a lower value. The reason that 4.5 MHz is chosen is that since the colour subcarrier frequency is on 4.43 MHz, any attenuation below 4.5 MHz will reduce or eliminate the subcarrier causing any transmission to be in black and white only.

Toko market a range of inexpensive small block filters among which is a filter with a cutoff frequency of 4.5MHz. The beauty of using a pre-aligned filter is that no setting up is required necessitating the use of hard-to-come-by test equipment. The filters quoted response is;

-3dB	4.5MHz
-40dB	6.2MHz
-60dB	7.5MHz

Fig.5 shows the circuit of the video low-pass filter.
Since the source and load impedances are around 1k, matching to 75 Ohms is required. R3 and R4 provide matching in and out and Tr1 provides a medium input impedance together with a small amount of gain to overcome the loss through the filter. R4 provides correct matching to the filter output terminal. Tr2 and Tr3 buffer the output and provide a standard 75 Ohm video output at one volt peak-to-peak.

On test approximately 3 volts p-p of input signal can be tolerated without causing distortion. The overall gain is approximately unity and the unit is non-inverting. There is very little ripple in the passband and the basic response agrees with the manufacturers data.



Filter - Ambit-stock No. 18-11100

*R = 33k for 9volts
22k for 5volts
47k for 12volts

A PC board may be available for this unit. Please refer to Members Services.

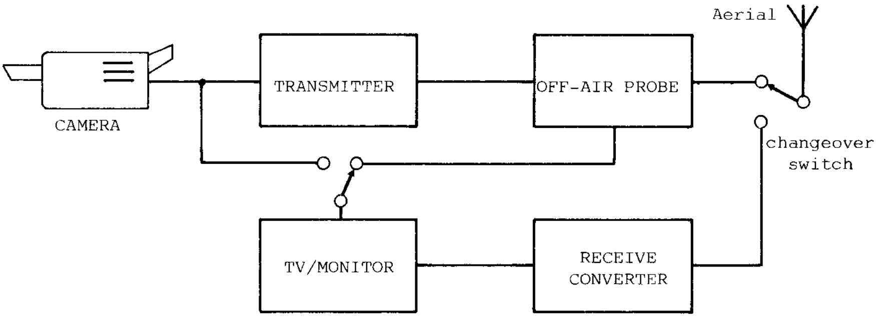
Fig.5 VIDEO LOW-PASS FILTER

2

THE STATION

An amateur TV station need only be as complex or comprehensive as the individual desires. Many stations employ no more equipment than a camera, a transmitter and a receiver. This basic system is adequate for normal communication and has the advantage of being easy to use and maintain.

Fig.1 shows the block diagram of such a basic TV station.



EQUIPMENT

Apart from the equipment needed for the simple station there are a number of other items which will prove useful in the station:

WAVEMETER
The amateur licence requires that you be able to determine whether or not the signal is within the correct band and to indicate whether any high-powered harmonics are being generated.

POWER METER
Used to check the output power from the transmitter and useful to obtain an approximate indication of modulation depth - when correct video modulation is present the meter will read between half and two-thirds of that indicated when modulation is absent.

OSCILLOSCOPE
One of the most useful pieces of test equipment. This will check to make sure the video signal is correct and is used to monitor adjustments to vision sources.

PICTURE MONITORS

A video monitor is, broadly speaking, a TV set without the normal RF circuitry. The purpose of a monitor is to enable the composite video signal from (say) the station camera to be displayed without the necessity of modulating the video onto an RF carrier then demodulating it again in a conventional receiver. The advantage here is that since the signal is not converted in any way before it reaches the screen, the resulting picture will be closer to the original.
Most colour monitors are of the 'RGB' type, that is they require four signals to operate them; the red, green and blue elements making up the complete picture plus a source of synchronising pulses to lock the monitor to the incoming picture. Pictures displayed in this way are far superior to those which have been encoded to a single signal and then decoded again in a receiver.
Although not essential to start with, a monitor will be found to have many uses around the shack particularly as the station becomes better equipped. It is possible to use a domestic TV set as a monitor in two ways:

a) by feeding the signal via a suitable interface circuit directly to the video and sync circuits of the receiver. However, unless the user is familiar with TV receivers, this method is not to be recommended since the TV chassis is usually live and can be dangerous. In any such modification a suitable mains isolating transformer should be used enabling the chassis of the set to be connected to the mains earth. The circuit to modify the Thorn TX-9 chassis was described in CQ-TV magazine No.119.

CAPTION GENERATOR

An easy way of transmitting callsigns and written information for station identification is to generate the letters digitally by using an electronic character generator. This has the advantage of being very small and easy to operate and is cheaper than dedicating a camera to this purpose. Another advantage is that such a caption may be inlaid into any other station vision source thus permitting the use of a wide range of backgrounds and so making the transmissions more interesting.
Home computers are being increasingly used these days and are proving very versatile in their use around the TV shack, especially machines such as the BBC and Atari which are capable of sophisticated colour graphics.

VIDEO RECORDER

This allows you to keep a record of good TV contacts as well as to transmit your own pre-recorded material over the air.

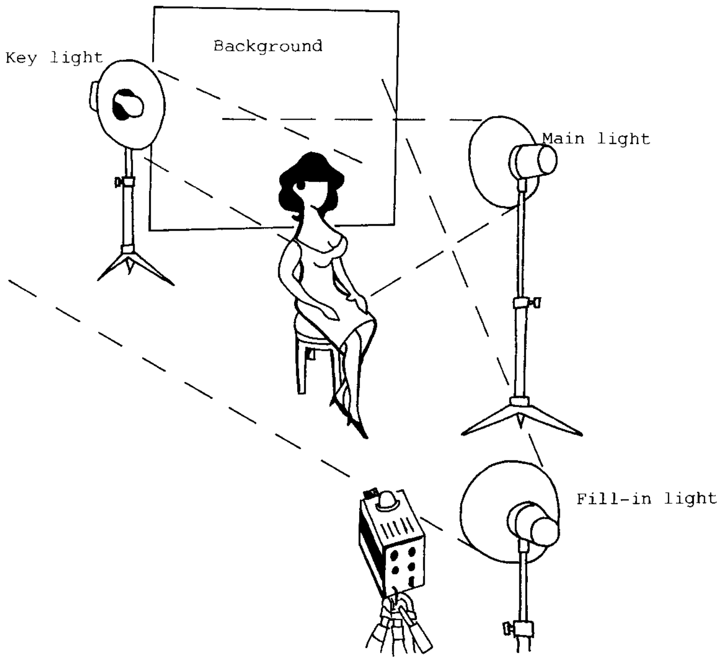
Station accessories could usefully include a caption holder to hold a test card or other station identification captions. The holder can be free-standing or fixed to a wall or bench and should be evenly illuminated by a couple of 100W bulbs. If colour is to be used the lights will need to be of a 'whiter' type to ensure the proper colour temperature. It is not unusual to use a second TV camera exclusively for caption display work. A typical caption measures around 12" x 9".

The main camera used in and around the shack should be mounted on a rigid tripod. There is nothing worse than seeing shaky, hand-held shots or the shack whizzing around as the cameraman struggles to line-up a suitable shot. Presentation really does count - remember TV is a VISUAL medium. You wouldn't transmit a sound signal which is horribly distorted - would you?

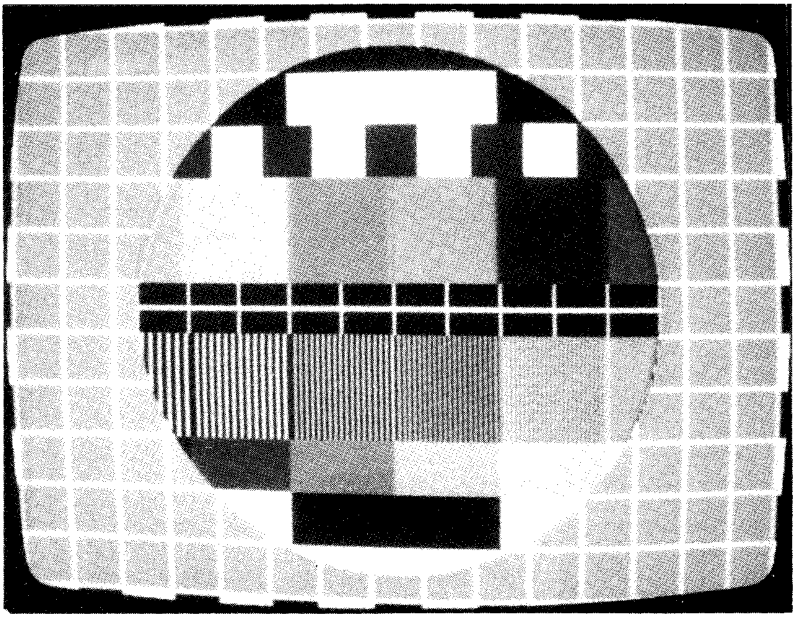
Another useful item is a throat or tie-clip microphone fitted with a long lead. This permits the camera operator to move about freely whilst speaking on the sound channel.

Lighting is very important in television studios and yet it remains probably the most neglected area in the amateur station. Good lighting can really make a big difference to the way your signal is received. It is not an over-exaggeration to say that the difference between receiving a poorly lit scene and a correctly lit one can be as much as one picture point (or more). In short, a good lighting set-up can mean as much to you as a linear amplifier.

If a black and white camera is being used then 150W domestic light bulbs can prove most effective. If possible the lamps should be fitted with spun aluminium reflectors which are available from photographic suppliers. Shown below is a typical lighting set-up using just three lamps. The key or 'hair' light is shown as a flood but is more often a spot or barn door type. The lights are shown on stands but they could just as well be fitted to walls or shelves.

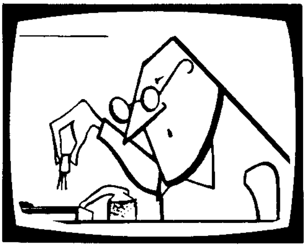


The station can be enlarged to include a sync pulse generator to which all other station vision sources are locked. This means that you may then cut or wipe between sources without disturbing the pulses and makes for a much more professional transmission. A vision switching system can then be added along with perhaps a mixing and special effects desk with full preview facilities. A range of alternative vision sources makes the transmissions much more interesting. In fact a complete TV studio can be built up if desired.



A DIGITALLY GENERATED COLOUR TEST CARD.

The design for this test card is published in volume 1 (blue) of the "Amateur Television Handbook". A set of three printed circuit boards and the special pre-programmed PROM,which generates the circle, are available from the Members Services department of the BATC. A full list of sales items available is published in each issue of CQ-TV magazine together with an order form.



3

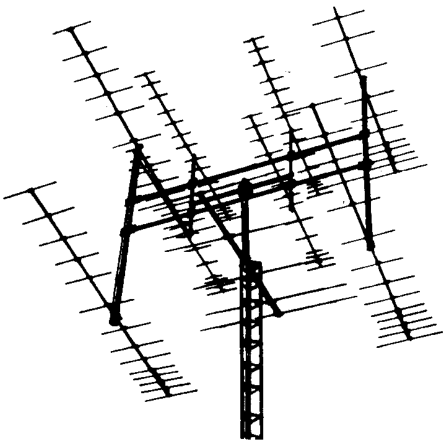
GETTING STARTED

AERIALS AND FEEDERS

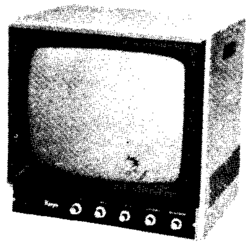
The first requirement of an aerial for amateur television purposes is that it should have sufficient bandwidth to permit operation in the TV part of the band, therefore narrow-band aerials such as the 14 element 'skybeam' (70cm) are not suitable. Common aerials currently in use include the 'Multibeam' range by JayBeam, the 18 element 'Parabeam' and as a small aerial, the 8 over 8 slot-fed Yagi is an excellent choice. It should be borne in mind however that a strong signal needs to be received to be able to lock in a television picture, therefore one should use as large an aerial as is practical.

One area where large signal losses can occur is in the aerial feeder and its coaxial connectors. Only the best low-loss coax should be used, particularly where the cable length is appreciable. UR67 is a good general cable for 70cm work although it is not generally thought good enough for 24cm except for short cable runs. In this case a helical-wound cable such as Heliax should be used together with the special 'N' type connectors made for it. With cables of the UR67 size type 'N' coaxial connectors are recommended. Belling-Lee plugs and sockets as used in domestic television installations should be avoided, the losses across these connectors at 436 MHz are considerable. The PL259 (UHF) series do not perform particularly well at this frequency either.

BNC connectors should generally be used with small diameter cables around the station, and they are suitable for both vision and RF purposes.
50 and 75 Ohm connectors, particularly in 'N' type, should not be mixed, otherwise damage to them may result.



RECEIVERS



There are several ways of receiving amateur TV on 70cm. Some domestic sets - particularly imported and portable ones - will tune directly to 70 without modification. The only problem here is that the tuner will be operating at the extreme end of its range causing an inevitable reduction in performance. For best results a good low-noise pre-amplifier should be used ahead of the receiver.

There are many surplus 'varicap' (varactor tuned) tuners currently on the market which can be easily converted to cover the 70cm band. One of the easiest and best is the type U321. Fig.6 shows the small modification required to bring the tuning range down to about 430MHz. Many domestic sets are fitted with this tuner in which case the modification may be made in situ, this will not affect the tuners' use for domestic viewing, but since the coverage will have been shifted slightly lower in frequency it will be necessary to re-tune for the domestic TV channels. If the tuner is to be used externally it should be wired as shown in fig.7. The IF output (36MHz) may be connected directly into a TV set but care should be taken first to ascertain whether or not the set has a mains transformer fitted or if it is of the more usual 'live chassis' type. If this is found to be the case then a mains isolating transformer of a suitable rating must be fitted in the AC mains supply.

Alternatively a complete IF module may be purchased or built and used separately. The output of such a unit will be of composite video suitable for connection (via a buffer) to a video monitor. Since the output from these modules is usually around 2 to 3 volts peak-to-peak across an impedance of about 1k it is necessary to use a single stage emitter follower such as that shown in fig.8, this will bring the output level to the standard one volt peak-to-peak across 75 Ohms.

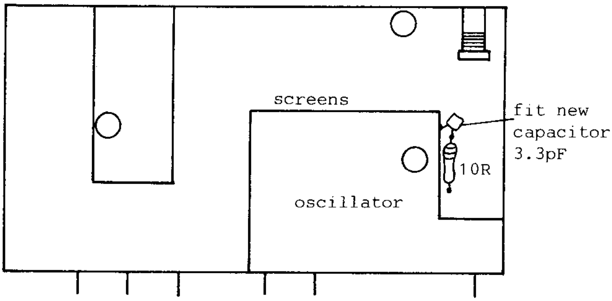


Fig.6 MODIFICATION TO THE U321 TUNER FOR 70cm COVERAGE

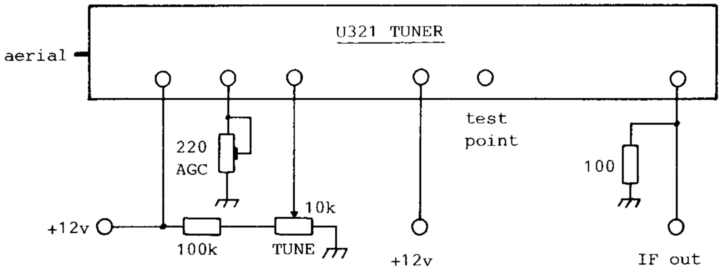


Fig.7 WIRING DIAGRAM FOR ATV OPERATION

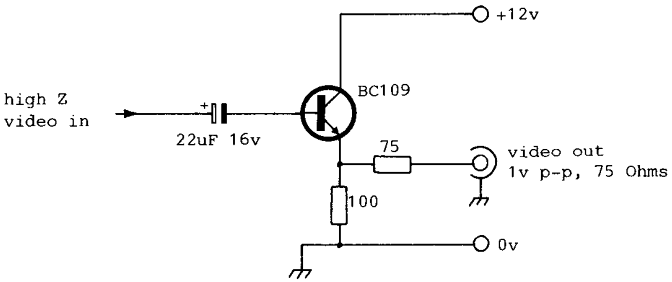


Fig.8 VIDEO EMITTER FOLLOWER

AN ATV UP-CONVERTER

Another way of receiving 70cm ATV is to use an up-converter. This, as the name implies, converts the incoming 70cm signal to a frequency within the broadcast UHF TV spectrum. Such converters are available commercially from specialist manufacturers such as Microwave Modules, Fortop Ltd, and Wood and Douglas. For those who prefer to build their own, this converter designed by G4DYP has proved very popular.

The converter is shown is fig's 9 and 10 and - if built as originaly designed - requires no special printed circuit board. The BATC however has designed and produced a printed circuit board for this design. The print and component layout may be found in fig's 11 and 12. The unit is intended to connect directly to the aerial socket of a standard broadcast TV set.

The 70cm aerial is coupled to the input tuned line L2 via a 22pF capacitor. The line is tuned to 70 by the 2-10pF trimmer capacitor at one end. A second tuned circuit is used at the amplifier output to further improve the selectivity of the converter and to provide a low impedance feed to the mixer. The mixer collector circuit is tuned to the chosen IF frequency and, although the tuned line L4 is the same size as L2 and L3, there is sufficient range on the 2-10pF trimmer capacitor to accomodate the higher frequency.

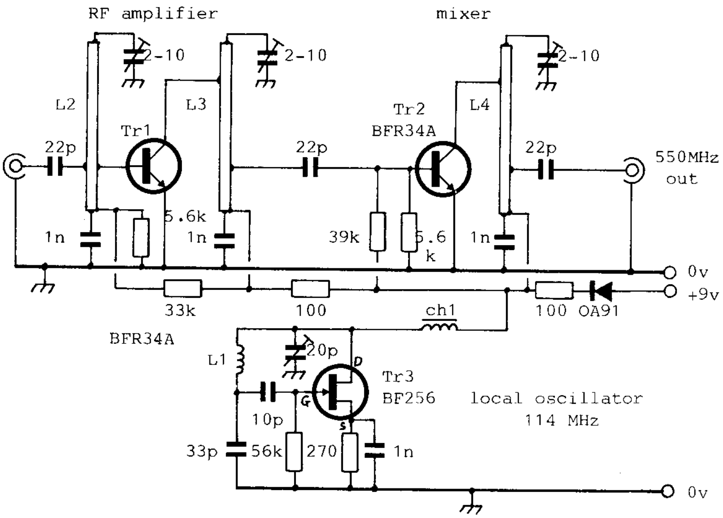


Fig.9 ATV UP CONVERTER CIRCUIT

The local oscillator employs a standard L/C circuit tunable over an approximate range of 100 to 150MHz. Other frequencies could be used by varying the coil L1 and/or the 2-20pF trimmer. Local oscillator injection is somewhat unconventional in that it relies on stray coupling into the mixer. This is achieved by the proximity of the components, especially L1 and for this reason the layout shown in fig.10 should be closely followed if that method of construction is chosen.

All capacitors should be good quality small disc or tubular ceramic types and resistors should be low noise ⅓W or smaller. Trimmer capacitors may be good quality film dialectric or ceramic types. Choke Ch1 is made by close winding as many turns of 34swg enamelled copper wire as will fit on a single layer wound onto a ⅓W 1M resistor. L1 is 6 turns of 20swg enamelled copper wound onto a 3/16" drill, 3/8" long and self-supporting.

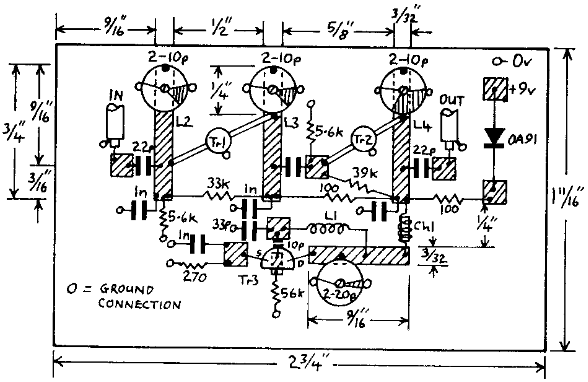
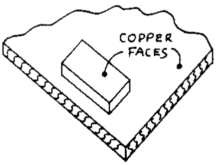


Fig.10 LAYOUT DIAGRAM



Component mounting pads cut from
PC board and 'instant' glued to
main copper laminate board.
Pads are shown as shaded areas.
All components are mounted on the copper side.

CONSTRUCTION

If you are not using the printed circuit board then take a piece of single sided copper laminate board $2\frac{3}{4}$" x $1\frac{11}{16}$" and place it copper side uppermost. Now cut out the pieces indicated by the shaded areas in fig.10 from another piece of similar board using a small saw. Glue these pieces, copper side up, to the main board so that the copper is insulated from the earth plane (position as shown in fig.10). The small pads are $\frac{1}{4}$" square, their actual positions on the board are not too critical but should be close to those in the illustration.

ALIGNMENT

First check that the oscillator stage is working correctly and that it will tune to the frequency required. Connect the output to the aerial socket of a domestic TV set adjusted to a convenient channel around number 30. Switch on the converter and adjust the oscillator and mixer trimmers for maximum noise on the screen. Connect a signal generator to the 70cm input (a local amateur TV signal may be used or, if neither of these are available, the third harmonic of a 2 metre transmission could be used). Carefully tune the oscillator trimmer to receive the signal, finally peak the RF amplifier and mixer trimmers for maximum signal - indicated by minimum noise (snow) on the picture.

The converter should be housed in a suitable screened box fitted with good quality coaxial connectors (N or BNC).

CQ-TV MAGAZINE

IS THE JOURNAL OF THE BRITISH AMATEUR TELEVISION CLUB AND IS RECOGNISED AS THE WORLDS LEADING SOURCE OF INFORMATION ON ALL ASPECTS OF AMATEUR TELEVISION.

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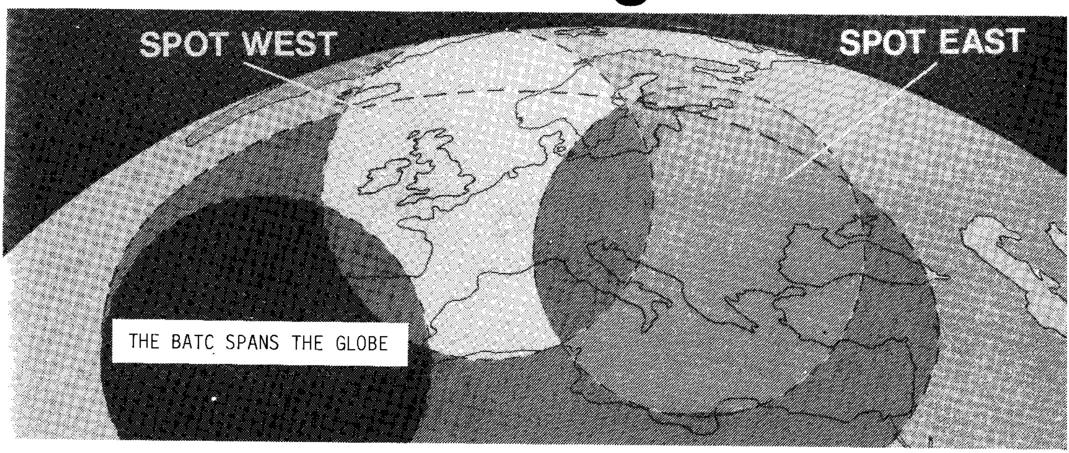
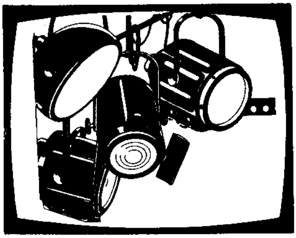




4

IN VISION

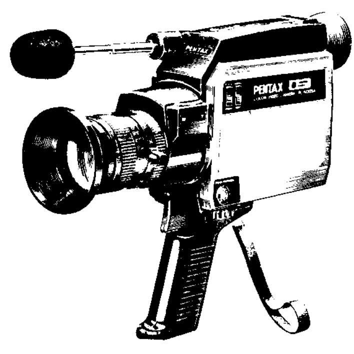
VISION SOURCES

Vision sources are many and varied. The most popular one naturally is the television camera. Cameras are not difficult to obtain, nor need they be as expensive as one might imagine. Cameras are often advertised in magazines and are generally of the surveillance industrial type used in security systems. They are periodically released onto the amateur market and a unit in good working order may be found at reasonable cost. Lenses are usually 'C' mount screw-on and are sometimes supplied with a second hand camera. There are also a number of budget priced new cameras to be found of which both ready built and kit versions are available. Now that colour cameras are becoming cheaper they are more attractive to the amateur as the main vision source, also, because of colour, new black and white video cameras can often be found at sale prices in the various video emporia.

The instrument to look for should be solid-state, use a vidicon tube (preferably the more modern tubes measuring less than one inch), and produce a standard 1 volt peak-to-peak composite video output across an impedance of 75 Ohms. If the camera has a UHF RF output then the picture may be viewed directly on a domestic television set.

Due to the popularity of home video systems the price of colour cameras is steadily falling. Such a camera may be used for amateur TV purposes and, since they have built-in colour coders, are an easy way of transmitting pictures in colour. When selecting a camera for amateur use be sure that a standard 1 volt composite signal is available. Video recorders are also very useful because they permit personal 'programmes' to be recorded at a convenient time which can be transmitted when needed. This method of pre-production greatly improves the content and interest of a TV transmission.

Electronically generated television pictures are widely used since they are relatively simple to design and build using readily available components. Generators can range from the very simple, such as a grey-scale or chequer board up to the complex, digitally produced, full colour test card. Home computers are also playing an increasing role in producing all sorts of pictures ready for transmission.



Details of these and other similar projects may be found in CQ-TV magazine, the current Amateur Television Handbooks, also by the BATC and in other amateur and electronic magazines and periodicals.

A GREY-SCALE GENERATOR

Fig.1 shows the circuit of a very simple grey-scale generator. The grey scale is a useful test pattern which, since it has components of black level, peak white and intermediate steps of grey, enables contrast levels and depth of modulation to be accurately set.

The unit shown is suitable for test purposes since it generates its own sync pulses. These pulses however do not conform to the full CCIR standard but are nevertheless adequate for a stand-alone test generator for use about the shack.

The circuit may be built onto a printed circuit board or on perforated stripboard, and layout is not critical. P1 sets the line frequency while P2 permits the composite video output to be adjusted to 1v p-p. It may be found necessary to add small value capacitors (say 560pF) between the 74141 output pins and ground in order to minimise switching transients which may be visible on the waveform.

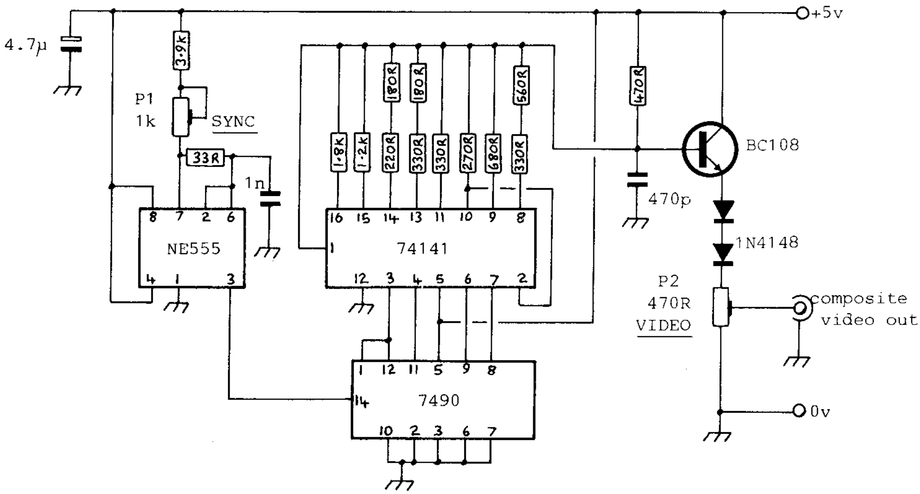


Fig.1. SIMPLE GREY-SCALE TEST GENERATOR

The test card is a very important item in the television station. Cards are used to check the performance of both cameras and receivers as well as providing an accurate means of assessing the quality of a picture without having to use expensive test equipment.

This card has been especially designed for amateur use and includes all the important features necessary for checking the station equipment.

ASPECT RATIO AND PICTURE CENTERING

The aspect ratio conforms to the standard 4:3 format. The castellated border permits accurate picture centering, the inside edges of the castellations should just be visible within the picture area of the tube.

PICTURE GEOMETRY

The large centre circle, together with the four corner circles permit precise settings of timebase amplitude and linearity. The coarse background grating comprising horizontal and vertical lines permits visual assessment of electronic scanning linearity.

RESOLUTION AND BANDWIDTH

Definition bars provide an aid to focussing and permit a check of video bandwidth. The five sets of bars correspond to approximate frequencies (left to right) of 1.2, 1.6, 2.0, 2.4 and 3.2 MHz.

TONAL RANGE

A six-step grey-scale is included to assist setting of the camera tonal range and to enable adjustments of brightness and contrast.

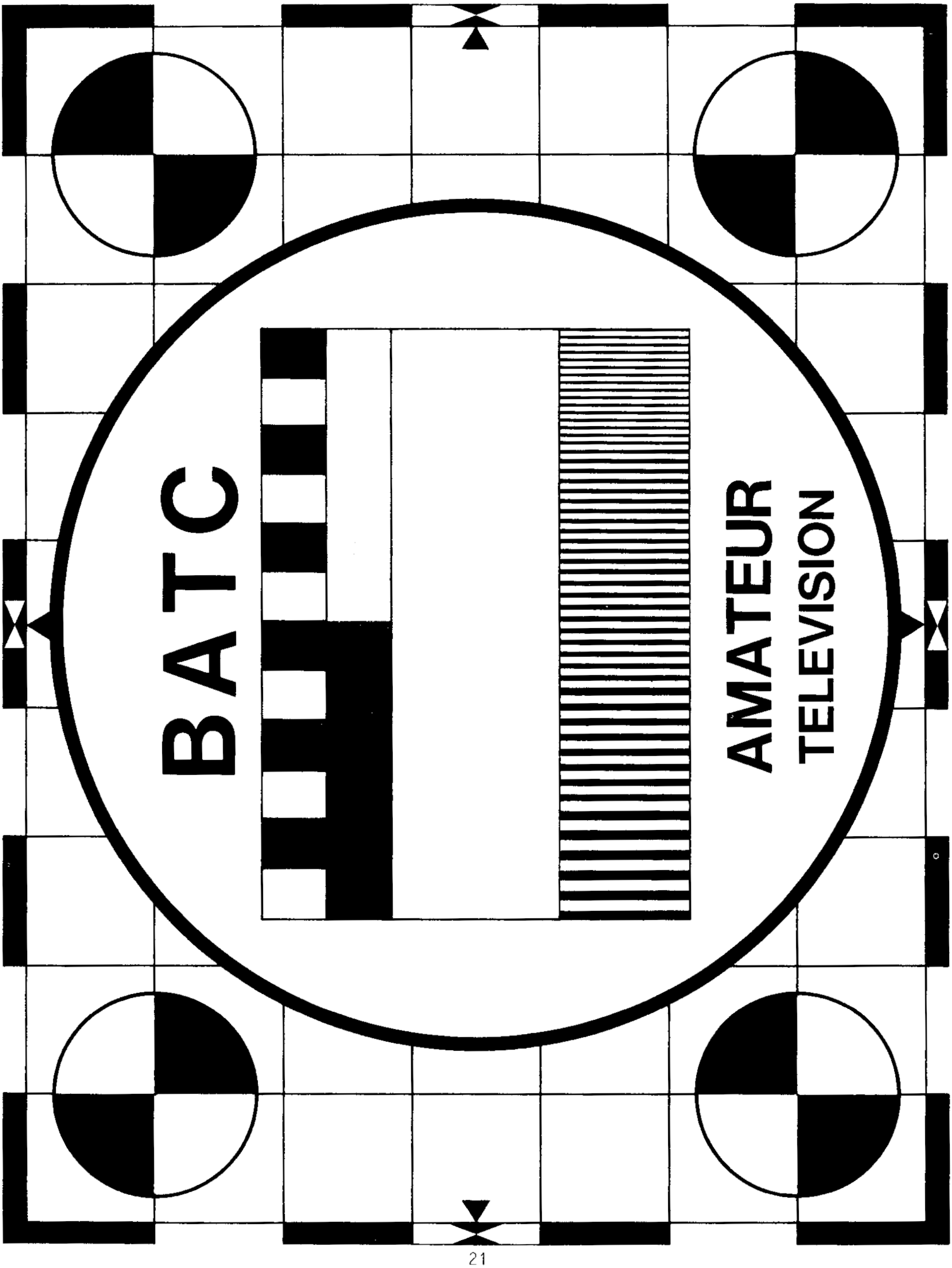
LOW-FREQUENCY RESPONSE

Alternate black and white blocks permit the observation of low and middle frequency response. Smearing on the right-hand edges indicate poor LF response. The vertical transitions between black and white in the corner circles may also be used for this purpose.

VISUAL IMPRESSION

To ensure that the test card is easily recognised under weak signal conditions, the following features have been incorporated: Corner circles exhibiting large, high contrast areas. A heavy main circle and the provision for large callsign letters within the centre rectangle. As a further aid to a visual assesment of a received picture, the lettering has been presented in four different sizes (including callsign).

The card is illustrated here for reference but a quality-printed, full size version on stiff card is available from BATC Members Services department.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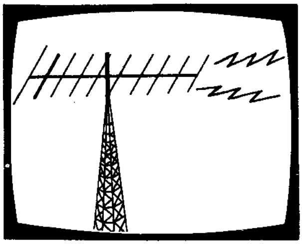
TELEVISION



5

TRANSMITTING

TRANSMITTERS

Transmitters nowadays are invariably solid-state, although valves are used for high output powers. Apart from the method of modulation, television transmitters differ little from those used for normal speech communications.

Fig.1 shows the circuit of a vision modulator suitable for use with ordinary FM or SSB transmitters up to about 2 Watts output.

The modulator is connected in series with the supply to the transmitter final RF stage or stages. It is important that a short lead is used between the modulator and PA and that any decoupling capacitors which exist in the original circuit be omitted, otherwise the video information may be lost or impaired. An RF choke may be used to prevent RF from feeding back to the modulator. Decoupling capacitors may be used if it is found to be necessary, but these should be kept to about 100pF or less.

If possible, two RF stages should be modulated in order to acheive maximum depth of modulation. Fig.2 shows how vision modulation may be applied to a typical RF amplifier.

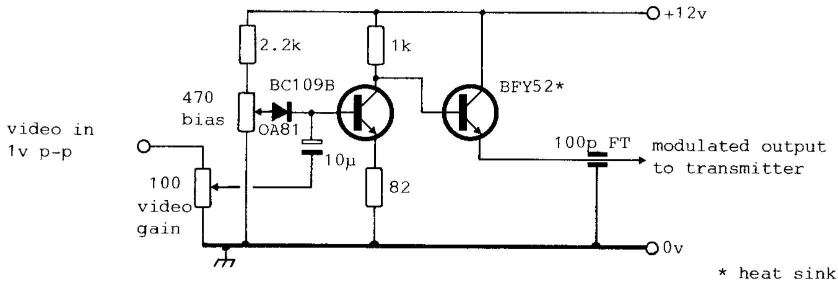


Fig.1 VIDEO MODULATOR FOR 2W TRANSMITTER

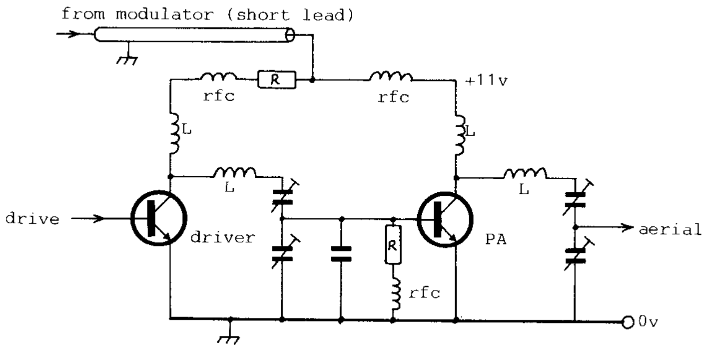


Fig.2 SHOWING A TYPICAL DRIVER/PA WITH VIDEO MODULATOR CONNECTED

AN R.F. MONITOR PROBE

The output signal from an amateur television station should be monitored with an RF probe and an oscilloscope to check that an un-distorted signal is being radiated. It is not sufficient to receive your own signal in the shack (except perhaps when only very low RF powers are being radiated), as you are then relying on stray RF fields within the shack which will themselves cause distortion, therefore you will never be certain whether or not your equipment is at fault or whether your monitoring system is suspect.

Fig.3 shows the circuit of such an RF probe. A pickup wire is connected to a demodulator diode to produce a video signal. This is fed to an emitter follower whose output is suitable for displaying on a video monitor.

Construction should preferably be on a printed circuit or plain copper laminate board. When complete the unit may either be secured to the aerial feeder, fitted in a position adjacent to the transmitter RF output socket or fitted into a small metal box with a coax socket at each end joined inside with a short length of coaxial cable in which the probe wire will be inserted (fig.4). The box may then be connected in series with the aerial lead.

To insert the pickup wire cut out a small square of outer covering from the coaxial cable and push apart the braiding. Thread a piece of thin insulated wire under the braiding for a distance of about half an inch and connect the free end to the diode using as short a lead as possible. The actual length of wire will vary according to the RF output power of the transmitter but will usually be between a quarter and a half of an inch.

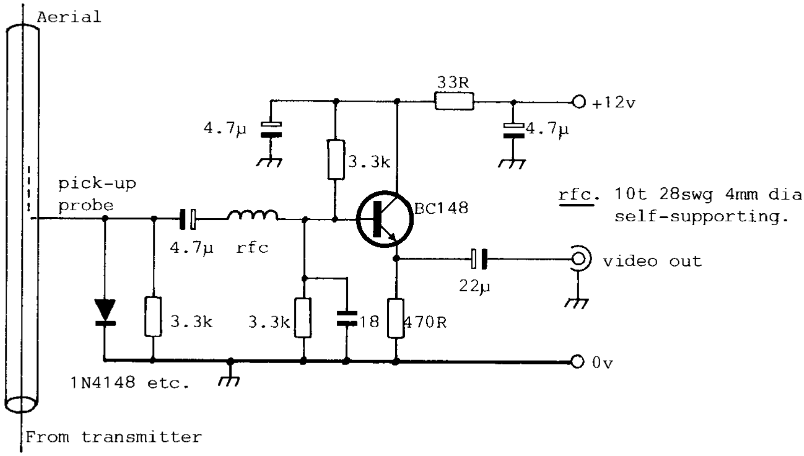


Fig.3 RF DEMODULATOR-SENSING PROBE

Connect the video output to an oscilloscope terminated in 75 Ohms. Transmit a properly modulated picture and adjust the input tuned circuit for maximum indication. Adjust the length of the probe pickup wire until about 1 volt peak-to-peak of video is obtained. Do not couple the probe in too tightly as this will overdrive the circuit and cause distortion of the demodulated signal. The resulting video may then be viewed on a monitor TV enabling you to keep an eye on the picture quality being radiated.

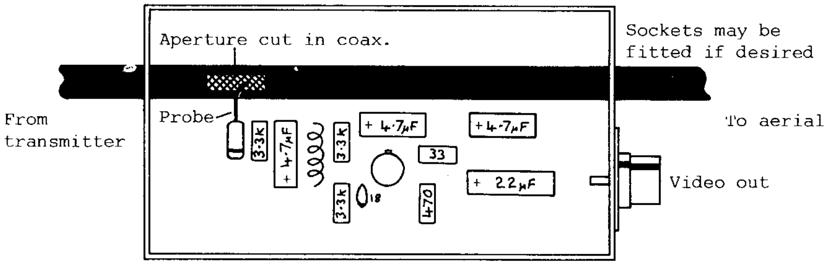


Fig.4 SUGGESTED METHOD OF INSTALLING OF-AIR PROBE

A 70cm transmitter

This transmitter, which has been specially developed for this publication is both easy to construct and align, and is capable of delivering up to 150mW of RF output in the 70cm band. It is intended either as a low-power self-contained transmitter or as a driver for subsequent linear amplifiers such as those detailed in CQ-TV 115. In this case the drive power may need adjusting by means of a simple resistive attenuator. The video modulator is included on the printed circuit board and requires only the addition of a 100 Ohm carbon potentiometer to provide adjustment of the video input level.

CIRCUIT DESCRIPTION

Tr1 forms a crystal controlled oscillator which operates at 108.875MHz. In order to ensure maximum stability and spectral purity, the oscillator is powered from a three terminal voltage regulator (IC1). The output is coupled directly to the base of Tr2 which operates as a frequency doubler. The collector tuned circuit (L2) resonates at 217.750MHz and, together with L3 forms a simple bandpass filter. Tr3 is another doubler stage and brings the signal to its final frequency of 435.50MHz.

The collector of Tr3 also connects to one half of a bandpass filter (L4) but derives its supply from the video modulator. Tr4 is the output amplifier and is also powered by the modulated rail. The collector connects to a simple Pi output stage which provides a low-impedance output suitable for matching into 50 or 75 Ohm coaxial cable.

Video modulation is applied to the base of amplifier Tr5 via a panel mounted 100 Ohm variable carbon control providing adjustment of the actual video level. Tr5 base is biassed from a potentiometer circuit fed from a zener stabilised voltage source. DC restoration is provided by a 1N4148 diode. Tr6 acts as an emitter follower and delivers up to 12 volts (modulated) to Tr3 and 4.

CONSTRUCTION

A double-sided printed circuit board is available for this transmitter from the BATC's "Members Services" department. The component side of the board acts only as an earth plane, and where possible component leads which are connected to ground should be soldered to both sides of the board. Although HC18 or HC25-U crystal packages are most often used for frequencies over 100MHz, provision is made to use the larger HC6-U style as well. Trimmers should be good quality PTFE film types. Try to use Mullard or DAU makes as these are among the high quality ones available. (note that this type of trimmer is not intended for lots of "twiddling" and may become unserviceable if subjected to too many adjustments). All lower value capacitors are miniature plate ceramic. One 100uF electrolytic is axial mounted whilst the other is a vertical radial type. A small heatsink should be fitted to Tr6.

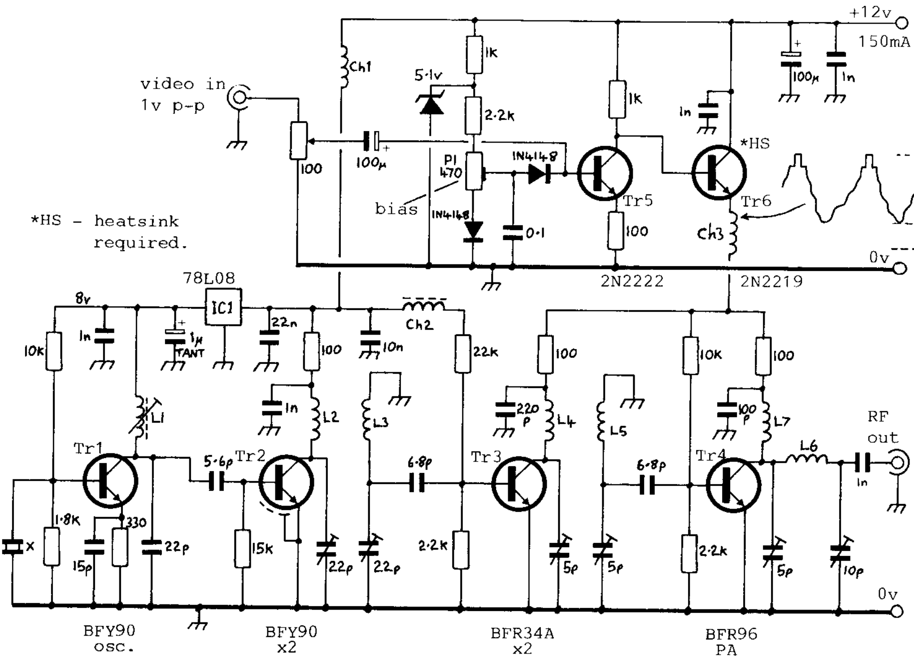
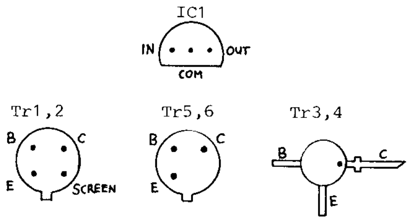


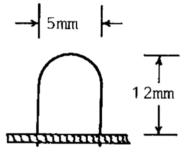
Fig.1 COMPLETE CIRCUIT FOR THE 70cm ATV TRANSMITTER

L1. 5½turns 26swg enamelled copper on 4.5mm former, with core.
L2,3. 1¾turns 20 swg enamelled copper, 5mm i.d. spaced 2mm from board.
L4,5. ¾turn 20 swg enamelled copper bent to shape as illustrated.
L6. 1¾turns 20 swg enamelled copper or silver plated, spaced 2mm from board.
L7. 3turns 26swg enamelled copper, 3mm i.d. close wound.

Ch1. 10turns 26swg enamelled copper wound on 3mm drill, self-supporting.
Ch2. 3turns thin wire on ferrite bead.
Ch3. 8turns 26swg enamelled copper wound on 3mm drill, self-supporting.



PIN VIEWS



Detail of L4 and 5.

THE BRITISH AMATEUR TELEVISION CLUB

GENERAL INFORMATION SHEET

and

MEMBERSHIP APPLICATION FORM

January 1987

THE BRITISH AMATEUR TELEVISION CLUB

The club was founded in 1949 to inform, instruct and co-ordinate the activities of amateur radio enthusiasts experimenting with television transmission, and to liaise with other enthusiasts engaged on similar work overseas. The club is affiliated to the Radio Society of Great Britain and has a representative on its V.H.F. committee.

Members are involved in many aspects of television including transmitting, receiving, closed circuit TV, video recording methods, special effects generation, colour TV and slow scan TV.

CLUB PUBLICATIONS

A quarterly magazine called CQ-TV is issued to all members, it features circuits, constructional articles, photographs, news of members activities, regular columns and news items. Contributions to the magazine are welcome and members are invited to send in news of their activities and in particular any articles or practical hints, tips and ideas that they may have. Some back copies of CQ-TV are available from BATC publications, details of how to order are given in the magazine.

CLUB FACILITIES

The club provides a service to its members by supplying various special items, such as vidicon camera tubes, bases, scanning and focus coil assemblies, special lens mounting flanges, vision reception reporting charts, test cards, printed circuit boards, headed notepaper, lapel badges etc. Full details of how to order these and other items are given in CQ-TV.

CLUB CONVENTION

The club holds a convention every year at which members are invited to display their equipment and have an opportunity to exchange ideas and discuss their problems with other members.

On alternate years the General Meeting of the club is held when the officers of the club are elected and any other business discussed.

CONTESTS AND AWARDS

The club organises television contests to help promote activity and has it's own graded award scheme for personal on-the-air achievement.

B.A.T.C. MEMBERSHIP APPLICATION FORM

Send this form together with your remittance to the Hon. Membership Secretary B.A.T.C.

I (BLOCK CAPITALS PLEASE)

Name	Call sign.
Address	
	Post Code

wish to join the British Amateur Television Club.

Tick	☐	All 1987 only (see note 4)	= £6.00	
Tick	☐	All 1987 plus all 1988	= £12.00	
Tick	☐	From May 1987 to Dec 1988	= £10.50	
Tick	☐	From Aug 1987 to Dec 1988	= £9.00	
Tick	☐	From Nov 1987 to Dec 1988	= £7.50	
Tick	☐	1988 only	= £6.00	. . . . £...:...

No ...... Lapel badges at 50p each . . . . £...:...

Total Remittance Enclosed £...:...

Please pay by cheque/P.O./M.O. made payable to the B.A.T.C.

Signed.................................Date..................

NOTES :-

1/ This form will not be valid after Jan 1988. Please write to the Membership Sec. for the current rates enclosing an SAE.

2/ Orders for other club sales items should be sent separately on the order form enclosed with CQ-TV magazine.

3/ Overseas applicants should pay by a cheque drawn against a London Bank.

4/ If you join during the year of 1987 and tick "all '87", back issues of CQ-TV will be sent accordingly.

FOR OFFICE USE

Date	Receipt No	Treasurer
Mags sent	Cash Received	Mailing list

READ CQ-TV

AND KEEP IN TOUCH WITH

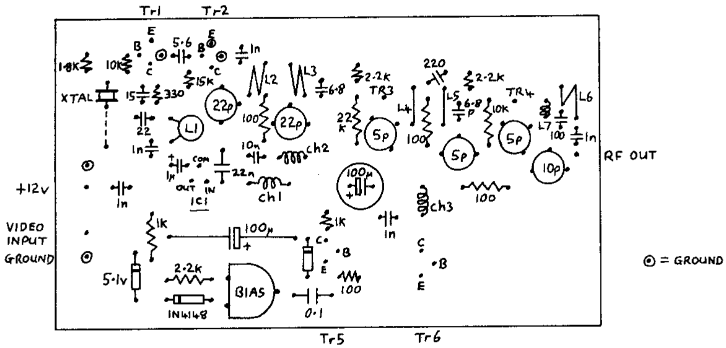
AMATEUR TELEVISION

THROUGHOUT THE WORLD

Join the B.A.T.C. by completing the application form and forwarding with your remittance to:-

HON. MEMBERSHIP SECRETARY - BATC

Mr. D.Lawton.
'Grenehurst',
Pinewood Road,
High Wycombe,
BUCKS HP12 4DD



PRINTED BOARD COMPONENT LAYOUT

L2 and L3 are wound in opposite directions and should be wound to fit the holes provided. The screen lead of Tr1 may either be clipped off or soldered to ground on the top of the board.

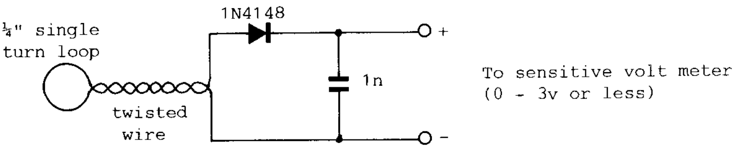
A suitable sized hole should be drilled to accept the former used for L1. The former should be glued into position. 3/16" holes should be drilled in the board at the places indicated for Tr3 and Tr4. These transistors are mounted on the print side of the board and carefully soldered to the tracks provided. Care should be taken to ensure that the devices are installed the correct way round. The printing on the transistor package should face downwards.

The completed unit should be housed in a screened metal box fitted with a BNC socket for the RF output. Power is fed in through a 1000pF feedthrough capacitor.

ALIGNMENT

Alignment is straightforward and may be carried out using the minimum of equipment.

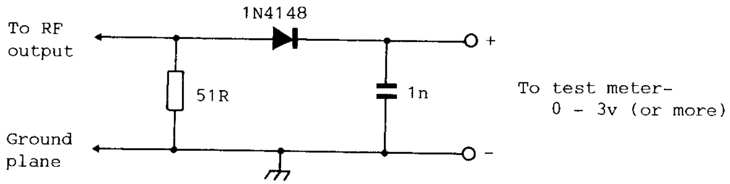
Temporarily up-end Ch3 and apply power to the unit. Check that there is +8 volts at the collector of Tr1. Using the RF "sniffer" probe described below place the loop over the oscillator coil former and adjust the slug until the oscillator starts, indicated by a reading on the test meter.



Mount on small piece of 'Vero' board.

Now place the probe near to L2 and adjust its trimmer for maximum indication. Whilst in this position, re-peak the oscillator coil for maximum output then withdraw the tuning slug about a quarter turn, this should ensure that the oscillator starts readily. Switch the unit on and off several times to check that it does.

Re-connect Ch3 and turn the 'bias' control (P1) fully clockwise. Set the video gain control to minimum. Make a test load/detector circuit as shown and connect it to the RF output.



Apply power and adjust L2, L3, L4 and L5 tuned circuits for maximum indication on the test meter. Adjust the Pi output tuned circuit for maximum output, (one capacitor should be played off against the other).

At this stage a variation in the output power should be noticed if P1 is adjusted. If all is well, apply a video signal and turn up the video gain control. Turn P1 slowly anti-clockwise and as you do this the output power reading should fall. This indicates that video modulation is present. Do not be troubled if, when modulation is applied the indicated power output falls considerably. This does not mean that the actual *peak* power is degraded, it is merely the effect of the power meter which is averaging the power indication. To establish the peak power level simply unplug the video signal and watch the power meter, it will be indicating the actual power output level.

Monitor the output signal either using a monitor probe or by receiving the signal on the station ATV receiver and adjust the bias control for correct video/sync ratio. In practice this is usually almost at the fully anti-clockwise position. The video gain control should be turned up 'till just before the whites start becoming over-white which would indicate that white crushing or 'flat topping' of the video waveform is occuring. In other words you are driving the amplifiers into non-linearity.

This transmitter has been carefully designed so that even when adjusted without the aid of a spectrum analyser all harmonics are better than 30dB down. However if equipment is available the transmitter should be aligned for minimum harmonic content. The following table shows the typical harmonic output levels from this unit after correct alignment.

½ x f	-42dB	(f = carrier frequency)
2 x f	-44dB	
3 x f	-38dB	
4 x f	-42dB	
5 x f	-38dB	
6 x f	-41dB	

TELEVISION INTERFERENCE

Television interference has bugged amateur radio for many decades and unfortunately, 70cm ATV is also capable of causing interference (although not often). This simple cure should clear-up all but the most stubborn cases.

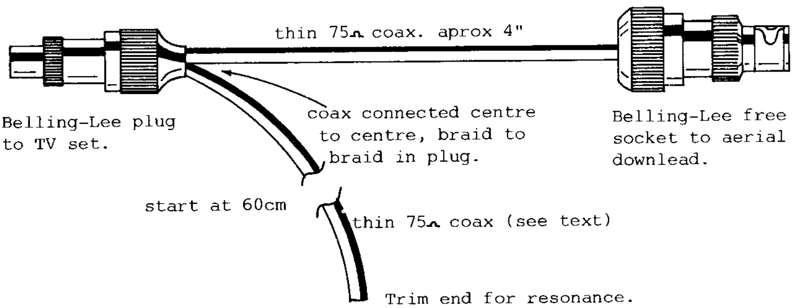
First make sure that the interference is coming down the TV aerial lead. To do this, switch-on the transmitter and monitor the interference on the set. Then simply pull out the TV aerial plug. If the problem disappears, along with the programme, then it is probable that the 70cm signal is "blasting" down the TV aerial.

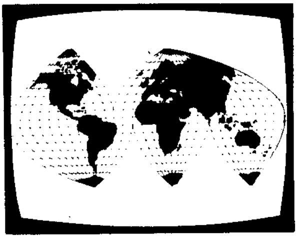
If this is the case a filter to remove the 70cm content but which does not attenuate the wanted TV signals is required. An easy way to do this is to simply use a $\frac{3}{4}$-wave coaxial stub at the TV aerial socket. Being a multiple of quarter-waves the 70cm signal will be "shorted" out but not the wanted signals since they are on different frequencies. A $\frac{3}{4}$-wave stub is used rather than $\frac{1}{4}$ as this will also be a $\frac{1}{4}$-wave at 2metres which means that you can do two bands at once.

The stub is made by cutting a piece of thin coaxial cable about 60cm long and connecting it to a cable link as shown in the diagram.

There are two ways of aligning the stub; either connect the device 'in situ'and trim the free end about 1/8 of an inch at a time until the interference disappears or, insert the stub at the aerial input of a 70cm receiver, tune in a fairly strong signal (beacon, repeater etc.) and trim the stub for minimum signal. Put this at the back of the TV set and the TVI should have gone.

To finish it off, the stub itself may be coiled around the coax link and taped over to make it neat. It is a good idea to lay in a stock of these so that they may be handed out if a complaint is received.





6

ON THE AIR

TALKBACK CHANNELS

Due to the lack of available space in the 70cm band, it is seldom that intercarrier sound is transmitted along with the picture. Instead, use is made of the 2 metre band for most sound talkback transmissions.
The reason that 2 metres is used instead of the phone end of 70 is that by splitting the bands it is possible to transmit both sound and vision simultaneously without the need for special equipment.

There are two calling channels allotted to ATV in the UK (and much of the continent), they are; 144.17MHz (SSB only) and 144.75MHz which is mainly used for FM transmissions but can be used for SSB (or CW!) if required. The latter channel is the most widely used and is therefore wherethe bulk of ATV activity can be found.

CALLING CQ

CQ calls for amateur TV stations are much the same as those for phone. The call should be made on the appropriate 2m calling channel. When a contact has been established, it is good practice (particularly for those in high activity areas and especially if propogation conditions are good) to QSY from the calling channel to release it for use by others. Normal practice is to QSY lower in frequency by multiples of 25KHz. Be sure however that you keep clear of other channels allocated to different modes and uses. Having said that, there are certain exceptions where it may be advantageous to occupy the calling channel with a QSO. If the channel has been unoccupied for a considerable time or your station is in a low activity area, you may consider it wise to conduct a contact on the calling channel itself. The reasons are:-

a) If the channel is left un-occupied for long periods, others may become used to QSYing from (say) the repeaters onto this usually 'quite' channel.

b) Being a TV frequency, other TVers will be listening on it. If they hear a QSO it often encourages them to come on the air themselves instead of just listening.

c) Since the RSGB has allotted the channel to us, it is in our interests to use it regularly otherwise the facility may be removed. ("use or lose" seems an appropriate maxim).

It is possible to call CQ by transmitting a picture. In this case the transmission should not be left on for too long (for the reasons below) and it should state where you are listening in case another station wishes to call you on phone. Such a transmission must also be identified by your call sign in order to comply with licence requirements.

DURING AN OPENING

Good propogation conditions normally herald the appearance of large numbers of TV stations. With so many on the bands, the above comments concerning frequencies and occupation of the calling channels are particularly relevant. The main practices which should be borne in mind are:-

a) Make your contacts short - holding on to a DX station means that others waiting to work him do not get the chance.

b) Keep your vision transmissions as short as possible - your picture may be blocking the band for other stations trying to receive weak DX pictures.

c) Try to consider other band users. If good operating practices are adopted, everyone gets a chance to work the DX.

THE ATV CONTEST

The main contest in the ATV year is the "International ATV Contest" which is sponsored by the main European ATV organisations. The contest is usually held over a weekend during early September and is open to all ATVers. The complete rules are published in CQ-TV magazine well in advance, together with entry details. There are other contests during the year which usually include a couple of cumulatives, organised by the BATC. These contests are designed to run over a period of time (normally five weeks) using different evenings for each session, or leg; (ie. first week-Saturday, second week-Sunday, third week-Monday and so on. This enables most people to operate for at least some of the contest. In a five week cumulative, only three sessions will count for entry points.

All contests have the same basic rules. Exchanges consist of a vision report (using 0-5 scale), serial number of contact and QRA locator - usually followed by the actual location to aid in points calculation. A typical contest report would therefore be; 4-Ø21-ZM54B-Rugby. This information may be sent either in vision or by phone. There is one further piece of information which should be sent by vision ONLY. This is a non-consecutive numeric code group (eg. 3729 or 4238 etc) the purpose of which is to determine whether or not the receiving station has correctly identified your vision transmission.

Although the number should not be read-back over the air, it is quite in order to add together the four digits and ask the originating station to confirm the total, in this way you can soon spot a receiving error and persevere until the code has been correctly received. A tip worth mentioning here is to make the size of the characters appear as large as possible on the screen. Ideally they should fill the frame. This gives the best chance to those stations receiving a weak picture from you to correctly read the code-group. Do not, as some stations do, type a tiny number using (say) a home computer, in the middle of the screen. It will only give the contact less of a chance of success and will waste time. Sometimes under very marginal conditions, it is necessary to move the camera in so close that only one or two of the digits are on the screen at any one time. If the receiving station still fails to read the number, at least you gave him the best chance. A final point on contest working; keep the contact time to a minimum, remember the other chap wants to work lots of stations which he will not be able to do if you tie him up for an hour.

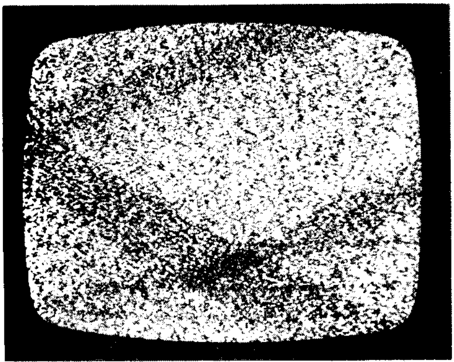
REPORTING THE PICTURE

As with sound amateur radio it is important to be able to give a meaningful report on the strength of the received signal. As television pictures become stronger or weaker you will observe that the amount of noise (snow) on the picture diminishes or increases accordingly. Since it is the picture strength that we are interested in it seems appropriate to have a set of specimen photographs of TV pictures showing different steps in signal levels. These steps are given a number starting at PØ - virtually no picture visible-up to P5 which is for absolutely noise free quality. The accompanying illustration shows a typical amateur reporting chart, although owing to the printing process the difference between (say) P4 and P5 may not be too evident. Therefore a certain degree of interpretation may become necessary.

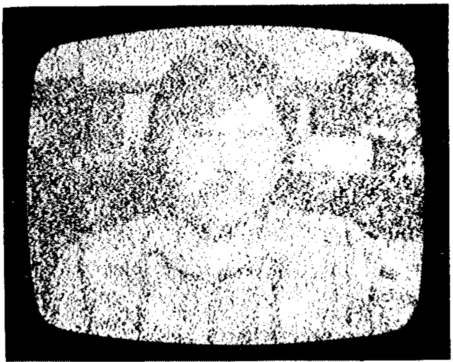
Sometimes a signal will fall between two pictures in which case it is quite in order to give half points in the report. Thus a signal between P2 and P3 should be reported as P2½.

With a little practice the system is very easy to use and you will find that after a while you will not need to refer to a chart to give an accurate vision report. A similar system of reporting is used by the engineers in broadcasting companies although they base their pictures on the fact that in the main only strong signals will be reported on. Thus our P2 would be approximately equal to their PØ

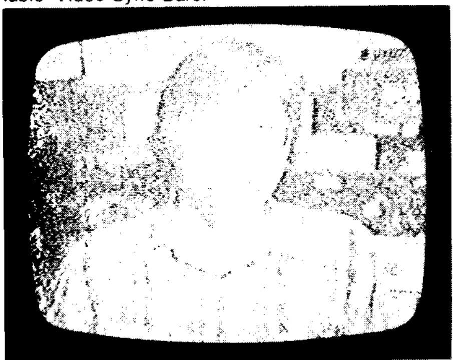
TV REPORTING CHART



P0 Total Noise Visible. No picture at all or detectable Video Sync Bars.



P1 High noise visible. Weak picture.

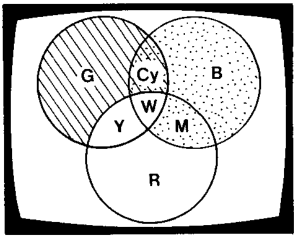


P2 High noise visible. Fair picture. Fair detail.

P3 Noise Visible. Strong picture.Recognizable detail.

P4 Slight noise visible. Very strong picture. Good detail.

P5 No noise visible. Closed circuit picture. Excellent detail.



7

COLOUR TV

Although colour TV may seem a little advanced for those unfamiliar with amateur TV, it is nonetheless an integral part of modern television and, although the newcomer may stick to monochrome at first, the urge will soon be upon him to graduate into colour. This chapter will therefore give a brief explanation of the principles involved, and in particular of the PAL system, which should serve as a general introduction into this form of TV.

Fig.1 shows the waveforms of one line of a monochrome signal. The diagrams show a ramp which will result in black, white and all intermediate shades of grey being displayed on the screen, the shades of grey being determined by the signal amplitude.

A colour signal can take two basic forms; the first consists of three non-composite signals. Each of these looks exactly the same as the non-composite monochrome signal shown in fig.1. One of these signals is allocated to red, one to green and the third to blue. By varying the amplitudes of these three signals it is possible to produce any colour which the TV system is capable of reproducing. For example; if a signal was present on the red channel only then a red picture is produced. If equal amplitudes of say, red and green were generated, a yellow picture would result. A peak white signal would be produced if the red, green and blue channels were all fed with their maximum amplitude (0.7v) signals. Furthermore, if the red green and blue amplitudes were kept equal it would be possible to display any amplitude of monochrome signal. ie; if R = G = B then a monochrome signal will always be produced. Fig.2 shows the colour equivalent of the monochrome signal shown in fig.1. Note that the red, green and blue (RGB) form of colour signal is ALWAYS non-composite, thus to feed a colour monitor four wires will be required, one each for red, green, blue and synchronizing pulses.

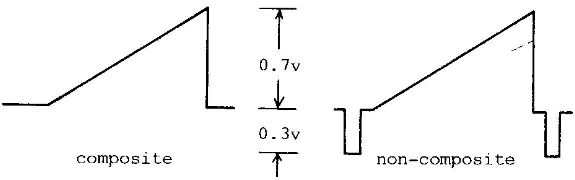


Fig.1

Fig.2

CODING AND DECODING

The colour signal in its RGB form differs little from a monochrome signal except that there are three of them instead of just one, this form is suitable for feeding a video monitor. Undoubtedly this is the best system since the signals do not become distorted due to deficiences in the coding and decoding circuits. If however the colour signal needs to be transmitted over the air or fed into a domestic receiver (via a modulator), or if there are several sources to be switched or mixed, then the RGB signal has to be coded. This process of coding produces a single composite signal which provides all the information necessary to reconstitute the original RGB signal after decoding.

It is now necessary to briefly explain how the PAL system was developed since it will assist in the understanding of the operation of colour coders and decoders.

THE 'Y' SIGNAL

Use is made of the very important fact that the human eye cannot resolve fine colour detail, only detail in terms of brightness, regardless of colour. In a monochrome system there is already a signal which defines the brightness of a scene. This signal (the normal video output of a monochrome camera) is of sufficient bandwidth to define the fine detail of a scene. In colour terms this signal (the black and white information) is called the LUMINANCE signal and is usually given the symbol 'Y'. To produce a compatible composite colour signal the colour difference must somehow be added to the Y signal. The various colour systems such as SECAM, NTSC and PAL all use some form of RF modulation of a carrier which is then superimposed onto the Y signal.

Use is made of the fact that the colour part of the signal need not be of such a wide bandwidth as the Y signal. In practice the Y signal bandwidth is of the order of 2.25MHz whereas the additional colour information has a reduced bandwidth of 1.5MHz.

The question now is that given an RGB colour source, how can the Y signal and colour information be obtained from it? Each colour has its own brightness level and the red, green and blue signals all contribute to the brightness levels of the scene. Therefore by adding together defined proportions of the R,G and B signals it is possible to obtain the Y signal. The actual relationship is;

$$Y = 0.299R + 0.587G + 0.114B$$

Fig.3 shows a circuit which will derive the Y signal from the RGB signal so that the monochrome component can be observed.

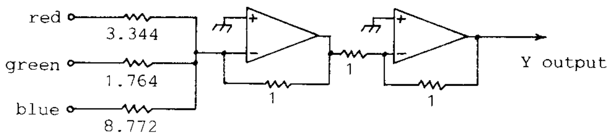


Fig.3 GENERATING Y FROM R,G & B

COLOUR DIFFERENCE SIGNALS

Having obtained a luminance signal, the colour information must be derived and added to it. There is no point in including the Y signal in the colour information, therefore it is subtracted from the RGB sources to provide signals containing only the colour information. The colour signals thus produced are R-Y, G-Y and B-Y. These are aptly called 'colour difference signals'.

A certain amount of study will show that it is only necessary to transmit two of these signals in addition to the Y signal for the necessary information to be recovered. This is shown by the following relationships; consider the three signals Y, (R-Y) and (B-Y), at the receiver R and B can be obtained by;

$$R = (R-Y) + Y, \text{ and } B = (B-Y) + Y$$

but $Y = R + G + B$, thus the green signal can be obtained from the other three signals, ie. $G = Y - R - B$.

To sum up so far, it is necessary to transmit two additional signals for colour; B - Y and R - Y each having a bandwidth of 1.5MHz. The PAL system is an adaptation of the NTSC system, so for the moment the NTSC system will be considered and then an explanation will be given to show how it has been modified to PAL to get over some of the initial problems.

To add the colour signals onto the Y signal, they are modulated onto a carrier. To explain how this is done first consider a double sideband suppressed carrier system modulated with a sine-wave source. Fig.4 shows the vector diagrams of the modulator output. (These diagrams are rotating at the carrier frequency). The resultant signal is seen to have a phase which is either Ø or 180 degrees with respect to the carrier. The amplitude is a function of the modulating signal voltage and its phase is a function of the polarity of the modulating signal. A second DSB modulator fed with a different modulating signal and a carrier which is 90 degrees out of phase with the original producing the resultant vector shown in fig.5. The outputs can now be added together, this produces a resultant signal of variable amplitude and phase, (fig.6).

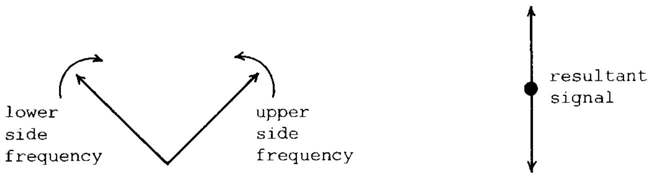


Fig.4

Fig.5

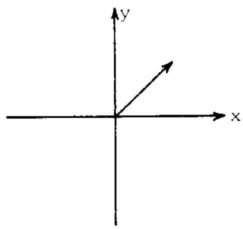


Fig.6

Since the two components x and y are in quadrature, it is possible to demodulate them back into two independant signals, this is achieved with two synchronous demodulators working in quadrature (ie. fed with Ø and 90 degree subcarrier). In the NTSC system, the (B - Y) signal is modulated onto the x axis and (R - Y) onto the y axis. Fig.7 shows, in block form, how the colour signal is generated.

A big advantage of using a suppressed carrier form of modulation, is that the lower the colour content of the picture (saturation) the lower is the amplitude of the subcarrier, and, in fact, in the absence of colour, the subcarrier disappears completely and the signal reverts back to its monochrome form. This fact is important as the subcarrier is within the video band and results in patterning on the television screen.

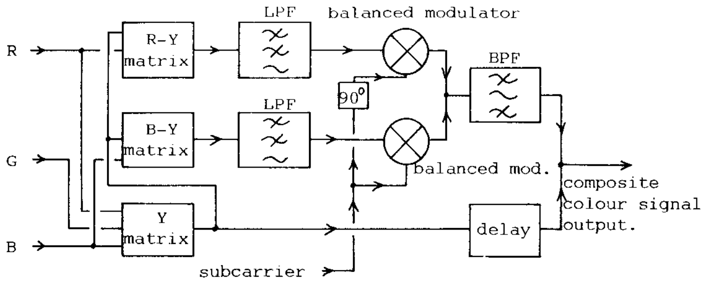


Fig.7

The spectrum of the colour signal is shown in fig.8 and illustrates how the chrominance occupies the upper part of the luminance bandwidths.

So far no mention has been made of how the subcarrier for the decoder synchronous demodulators is obtained. At the coder a 'burst' of subcarrier is added to the signal. As within the back porch period in NTSC, the phase of this burst is constant and is on the (B - Y) axis. At the decoder, a phase locked loop is used comprising a varactor controlled crystal oscillator and a gated phase detector. The phase detector is arranged to compare the phase of local and received subcarrier only during the period of the burst, this is called the 'burst locked oscillator'. Fig.9 shows the arrangement for decoding the composite NTSC signal.

The parts of the NTSC system so far described, are identical to PAL. The PAL system has, however, one distinct difference: In this system, the R - Y axis is reversed in polarity on alternate lines at the decoder. In the decoder, the subcarrier feed to the R - Y demodulator is reversed in phase in step with the decoder. It can be seen that this arrangement produces exactly the same signals as before, so what is the point? There is a distortion which a colour signal can suffer which is termed 'differential phase'. This is the effect whereby the phase of the subcarrier component varies depending on the level of the luminance signal it is sitting on. This means that a colour object in the picture could well have the 'wrong' phase with respect to the burst which is sitting at black level. In NTSC this error would result in an incorrect colour being reproduced. In PAL, on a given line, we have (assuming we have picked the right one out of the two) an identical situation as in NTSC where incorrect colour is reproduced.

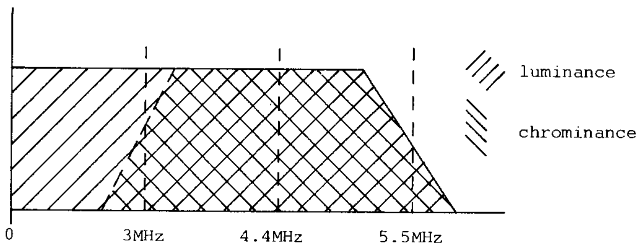


Fig.8 THE SPECTRUM OF AN ENCODED COLOUR SIGNAL

Observing the next line,the signal suffers the same phase error but, as the axis of R - Y has been reversed, the resulting colour error is in the opposite direction to the preceding line. This means, taking the average of two consecutive lines, results in the correct colour being reproduced. In a single system this averaging can be achieved by observing the picture at a distance where two lines tend to merge and the averaging is then done by the eye. If the errors are too great, an effect called 'Hanover bars' results produced by large colour differences on alternate lines. To overcome this problem, the signals on alternate lines are averaged electronically. This has the requirement that the signals from the two lines be available at the same time which means a one-line delay has to be used. Fig.10 shows how this is done. The arrangement shown also provides a rough separation of the signal into its R - Y and B - Y components prior to the synchronous demodulators.

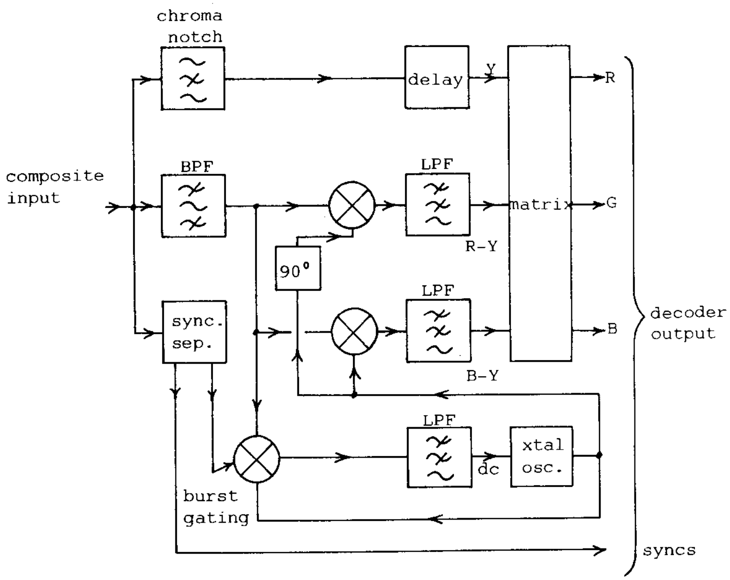


Fig.9 BLOCK DIAGRAM OF AN NTSC DECODER

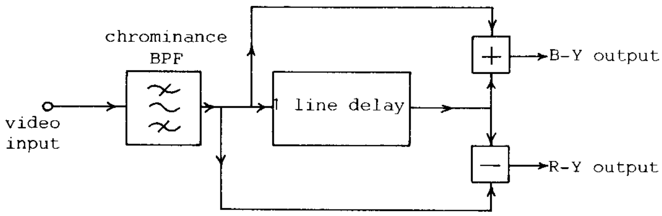


Fig.10 DELAY LINE ARRANGEMENT OF A PAL DECODER

COLOUR MONITORS

There are three basic ways of producing drive signals to a colour TV set:

1. Composite video PAL coded and superimposed onto an RF carrier.
2. Composite video PAL coded and matched to a 75 Ohm coaxial line.
3. Direct red, green and blue video drives with separate synchronising signals matched into a 75 Ohm line.

The first two systems would require PAL encoded signals to be generated, which is a relatively complex process and also requires wideband RF circuitry (in the first case). Both these systems rely on the monitor decoding the PAL signals, which is undesirable as it reduces the bandwidth of the final display signal.

Supplying the RGB and sync signals is the most direct method of driving the display. It gives the best quality picture and proves to be the most cost effective way of modifying a colour receiver. Encoding at the vision source and decoding at the monitor is not required, but linear wideband amplifiers are required between the driver and the display tube. With this system maximum resolution can be achieved, giving better performance than the alternative.

As this type of drive is not dependant upon a specific colour transmission standard (eg PAL NTSC SECAM), two-way exchange of data and material may be sent and received far easier by other countries, (especially computer programmes and the like).

Full details on converting an existing Thorn TX-9 TV chassis to work as an RGB monitor are contained in R & EW Magazine, January 1983. The article is also useful as a reference from which the techniques involved may be learned to help in modifying other chassis. RGB monitors are available commercially and are specially designed for this purpose. Although they are rather expensive due to their specialised nature, this would obviously be the best way of aquiring such an instrument. Many advertisements may be found in home computer magazines.

AMATEUR TELEVISION HANDBOOKS

THESE TWO HANDBOOKS HAVE BEEN SPECIALLY PRODUCED BY THE BATC TO OFFER A COMPREHENSIVE RANGE OF CONSTRUCTIONAL PROJECTS TO AID IN THE ESTABLISHMENT OF AN AMATEUR TV STATION.
PRINTED CIRCUIT BOARDS ARE AVAILABLE FOR MOST OF THE DESIGNS AND SOME OF THE HARD-TO-GET COMPONENTS SUCH AS PROGRAMMED PROMS ARE ALSO AVAILABLE.

HANDBOOK 1

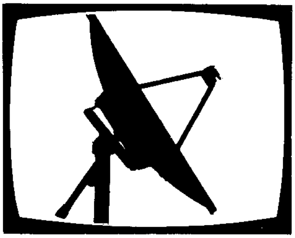
TV Receiver
70cm TV tuner
Electronic character generator
Character generator memory
Colour electronic test card.
TV camera
Video switching unit
PAL colour coder

plus lots more....

HANDBOOK 2

Slow-scan TV
ASCII keyboard
Character colouriser
Sync pulse generator
Colour vision switcher
Effects unit
Colour synthesizer
FM-TV

etc etc....



8

1·3 GHz TV

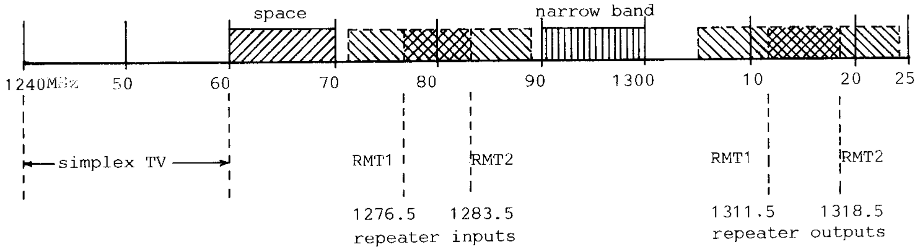
Although traditionally thought of as a band for more advanced work, 1.3GHz should now have a number of ATV repeaters operating within its allocation. Therefore this short chapter is included as an introduction to the band and to give constructional details of a simple receive converter to assist those who perhaps are drawn onto the band by the presence of a nearby repeater.

THE BAND

First, let me say that contrary to popular belief 1.3GHz operation should not generally be regarded as a purely local band. It does not necessarily have a much reduced range when compared with 70cm transmissions.
Having said that, I realise of course that this popular misconception must have roots somewhere. The probable answer is that, given a poor path between two stations, the lower frequency band will indeed out-perform the higher. The reason for this is that as frequency increases, obstructions along a path will increase the attenuation of radio waves. Therefore for 1.3GHz to be effectively used over long distances, it is important that stations are located on fairly high ground enabling a wide area to be 'seen' by the aerial.
This is not to say that all successful contacts are made over line-of-sight paths, far from it, but it does help. However, even if you are in a rather poor location you may be able to work through a local repeater, and you may be surprised at just how far your signal can reach - especially during an opening which tends to be more intense on this band.

THE BAND PLAN

As stated in the introduction to this booklet, a bandplan has been drawn up to guide users in the use of the band. Before ordering crystals though, do try and check that the frequencies are still current (especially those of the repeaters) since at the time of writing the plan had not received official approval. You will see from the plan that two simplex channels exist between 1240 and 1260 MHz. It is however perfectly acceptable for stations to use either of the repeater channels for simplex working, provided of course that you are not within range of a TV repeater on the same channel.



PROVISIONAL 1.3GHz BANDPLAN INCORPORATING ATV REPEATER AND SIMPLEX FREQ'S

MODES OF EMISSION

Much research has been carried out in recent years on whether to adopt the FM-TV standard for this band and above or whether to stick to the conventional AM mode. Tests and experiments have shown that there is a definite advantage in using FM, (not the least of which is with the equipment) and experience of direct comparisons between the two modes over an extended period has endorsed this view. Therefore the phase one repeater applications all request the use of FM, although at present two wish to retain a partial AM option as well.

REPEATERS

At the time of writing (February 1983) the repeater licences have not yet been received. However the proposals for phase one are as follows:-

GB3UT	BATH	RMT1
GB3GV	LEICESTER	RMT1
GB3TV	LUTON	RMT2
GB3VR	WORTHING	RMT2
GB3UD	STOKE-ON-TRENT	RMT2

It is proposed that, initially, the RMT 1 users will have their output in AM whilst RMT 2 users will be exclusively on FM. Access to a TV repeater will be by a carrier on the input frequency which contains a 625-line television signal.

CONTINENTALS

Vitually all French TV amateurs transmit and receive on 1255 MHz. Much of the near Continent also operate around this frequency therefore it would seem appropriate to concentrate UK simplex TV working around this part of the band. For this reason the two simplex channels are allocated at the lower end of the band. FM is the mode most used on the Continent.

A 1·3 GHz TV converter

This unit will convert amateur television signals in the 1.3GHz band to a frequency within the broadcast UHF TV spectrum, thus permitting any domestic 625-line TV set to be used for amateur TV reception without modification. The converter is connected directly to the TV aerial socket.

Design and construction techniques have been purposely kept simple in order that the converter may be built and aligned without the need for a special printed-circuit board and elaborate test equipment. Because of the simplicity, exceptional performance (when compared with profesionally engineered units) should not be expected although performance is adequate for most purposes.

SPECIFICATION

Input frequency:	1240 - 1330MHz (adjustable)
Output frequency:	Adjustable over UHF bands 4 and 5
Overall gain:	25dB (typical)
Noise figure:	around 4dB (optimised)
Bandwidth:	+20 -40MHz from centre frequency @-3dB (typical)
Power requirements:	11 - 14v DC (12v nominal)
Overall size:	100mm x 65mm

CIRCUIT DESCRIPTION

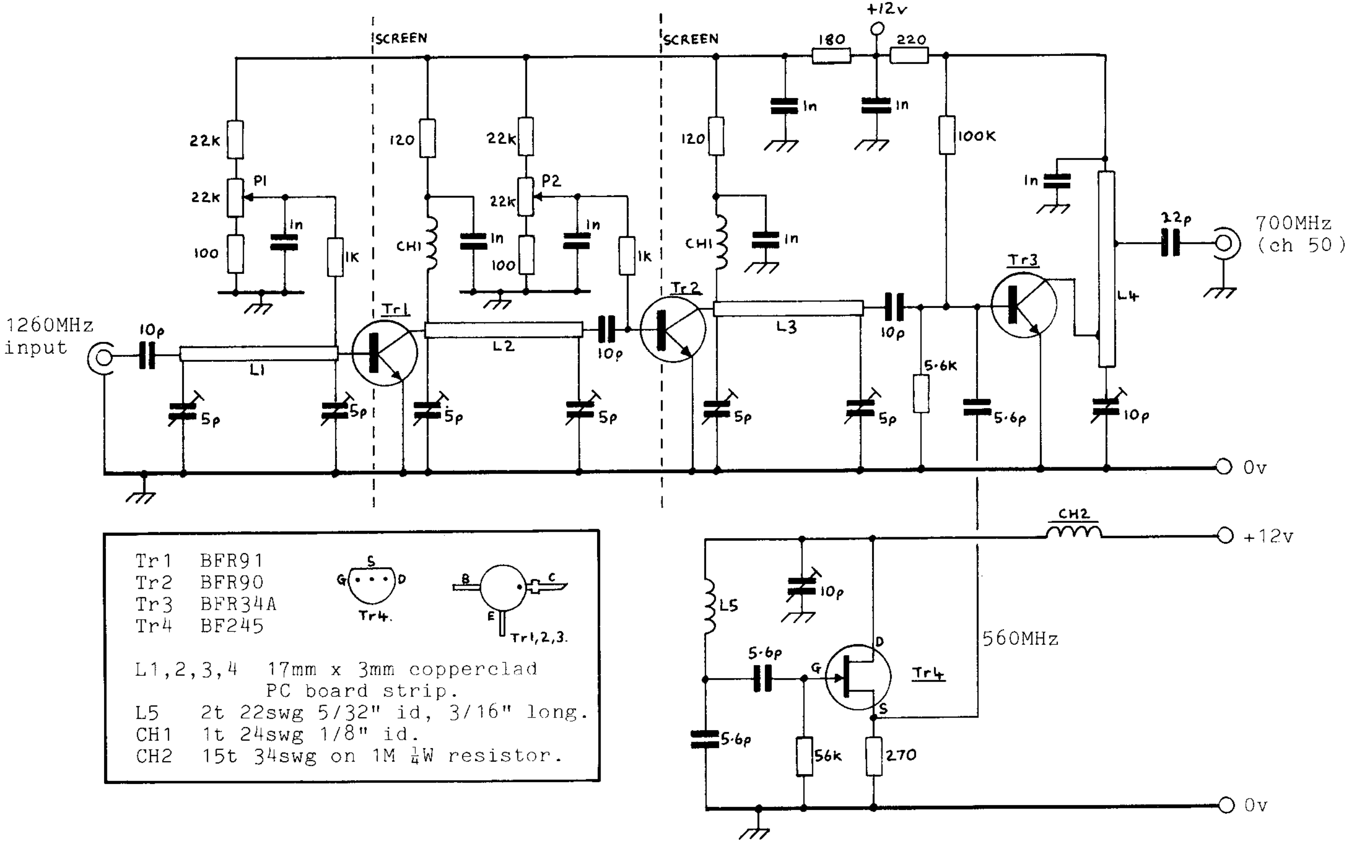
A BFR91 was chosen for the first signal amplifier which is adjusted for best noise performance. The second amplifier employs a BFR90 which is set for maximum gain. These transistors, although rather dated by todays standards, have proved among the easiest to use in this design, and are still readily available (Modular Electronics, Ambit International etc.) All the gain for the converter is obtained from the two signal frequency amplifiers.

The mixer Tr3 is, for simplicity, a single-ended transistor type which is biassed for unity gain. The IF is selected by the collector tuned circuit which will tune between 450 and 800MHz.

The local oscillator Tr4 uses a FET and is tunable over a wide range enabling virtually any IF in the UHF TV band to be used. The oscillator was found to be quite clean and to be sufficiently stable. It is quite important to use the specified FET, other types may not be very satisfactory.

COMPONENTS

All components should be of good quality. Fixed capacitors are subminiature ceramic. Trimmer capacitors may be good quality plastic PTFE types. DAU and Mullard makes are good. Do not try to use some of the cheaper types - they may not be PTFE.



Tr1	BFR91	
Tr2	BFR90	
Tr3	BFR34A	
Tr4	BF245	
L1,2,3,4	17mm x 3mm copperclad PC board strip.	
L5	2t 22swg 5/32" id, 3/16" long.	
CH1	1t 24swg 1/8" id.	
CH2	15t 34swg on 1M $\frac{1}{4}$W resistor.	

Fig.1 G3YQC 24cm ATV DOWN-CONVERTER

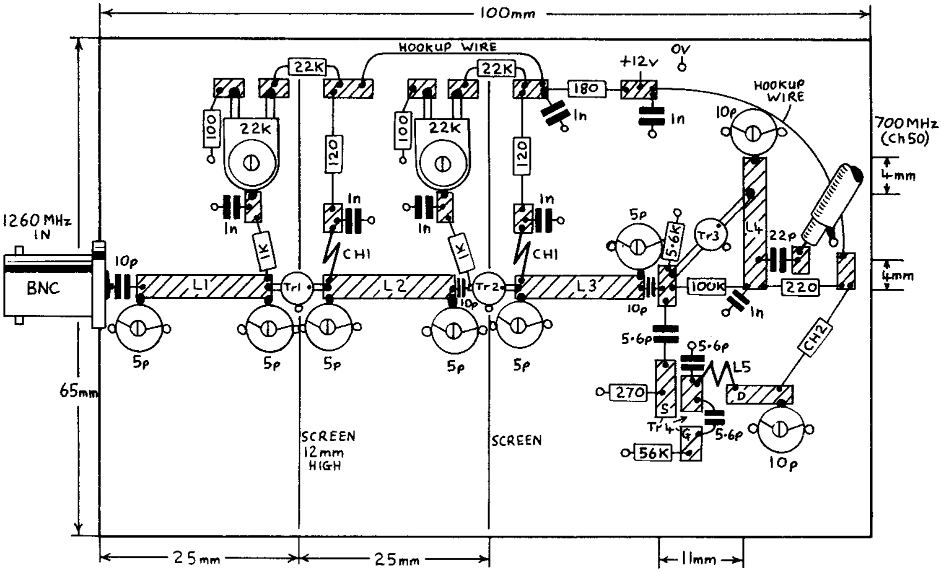


Fig.2 LAYOUT DIAGRAM, 24cm CONVERTER.

CONSTRUCTION

Although printed circuit techniques are used in order to ensure repeatability, it is not necessary to etch and drill conventional printed circuit boards.

Take a piece of good quality, single sided fibre glass board 100mm x 65mm and place it copper side uppermost. Cut out the pieces indicated by the shaded areas in Fig.2 from another piece of similar material using a small saw. Glue these pieces, copper side up, to the main board so that the copper is insulated from the earth plane. Position the pads as shown in fig.2. The small pads should be about 3mm wide and no longer than that required. 12mm high screens should be soldered to the ground plane in the positions shown. Thin gauge copper, brass or tin plate may be used for these.

It is strongly recommended that the converter be installed in a screened box before alignment. The box may be made from single sided PC board material. If possible the converter should be soldered around the edges to the box. If this is not possible, the enclosure should be large enough to allow at least a quarter of an inch between the edge of the board and the inside walls of the box. Failure to do this may result in a variation in tuning when the box is handled. Should neither of these techniques be possible and a small gap is unavoidable, the board should be bonded to the case in several places using either solder tags or copper fingers soldered to the board and bent up to press against the inside of the case.

Fig.2 illustrates the ideal input connection where the socket is adjacent to the end of L1. It is strongly recommended that either type N or BNC sockets are used, especially at the input. It is advantageous also to mount the output connector in such a way as to eliminate the need for a coaxial cable within the box.

All capacitors, with the exception of the oscillator injection, should be wired so as to keep their leads VERY short.

ALIGNMENT

Up-end the 180 Ohm resistor from the +12v input and apply power. Monitor the oscillator frequency on a TV receiver and, with the aid of a piece of wire soldered to a short length of coax, connect it to the TV aerial socket and place near to the converter. Tune the oscillator to the required frequency as indicated on the screen.

Re-connect the 180 Ohm resistor and connect a milliameter in series with the +12v supply to Tr1. Adjust P1 for around 3.5mA. Re-connect the resistor and repeat the operation with Tr2, adjusting P2 for about 4.5mA.

Connect the output to a TV receiver tuned to the IF frequency and adjust the output tuned circuit for maximum noise. Apply a 24cm signal, either from a test generator or from a local amateur, and tune it in on the TV set. Carefully peak all trimmers for best output. The first stage should be optimised for minimum noise whilst the second is set for maximum gain. The pairs of trimmers on the tuned lines are, to a certain degree, inter-dependent and the optimum position may be found by trial and error.

This tuneup procedure is often the most difficult since a strong enough signal must be found to pass through the converter befor it is properly aligned. It may therefore take a little patience to find the first signal, after which alignment will take a very short time.

NOTES

Because this converter is operating at such high frequencies, component tolerances become more significant if repeatability is to be assured. The problems most likely to be encountered are those associated with using widely differing base materials for the copperclad board. Experience has shown that some materials (particularly boards thinner than about a six-teenth of an inch) cause the resonant frequency of the tuned circuits to become lower, thus the converter will not be able to be tuned to a high enough frequency. The solution is to reduce the lengths of L1,2 and 3 by a sixteenth of an inch (or even more) until the circuits tune over the required band. Different trimmer capacitors, perhaps with a lower minimum capacity should also help.

As with any single-ended mixer, little attenuation of the local oscillator signal is realised, therefore the fundamental and second harmonics appear at the output at fairly high levels. In practice this does not affect the performance of the convertor although it is wise to space the oscillator and IF frequencies as far apart as possible.

A series tuned circuit at the oscillator frequency may be connected to the output socket, this should attenuate the oscillator signal by around 40dB. Obviously a balanced mixer would be more suitable but for simplicity it was decided to use the single ended system.

With this type of converter there is always the danger of other signals (particularly in the UHF TV spectrum) getting into the converter and appearing as unwanted signals at the output. A good deal of work has been carried out to ensure that the converter will handle such signals and will not add to them by spurious mixing. Users in very high signal strength areas adjacent to a local TV transmitter could still suffer however. One user, who is line-of-sight to the large Sutton Coldfield transmitter experienced this problem and promptly overcame it by installing a bandpass filter at the converter input, (see CQ-TV120).

The IF output level is fairly high and in general up to about 6dB of attenuation may be used before any noticeable degradation of the picture takes place.

This converter system may be considerably enhanced by adding a good quality low noise pre-amplifier in front. The Microwave Modules MMA1296 is a good choice. The amplifier should ideally be mounted at mast head to eliminate the losses in the coaxial feeder to the converter.

AERIALS

At present there are several aerials on the market for the 1.3GHz band. Unfortunately most operate over a relatively narrow band since they are designed for use between 1296 and 1298MHz. Some aerials do cover a wider range but even their performance falls of considerably towards the lower end of the band. As an example the gain of the popular J-Beam 15 over 15 slot falls to around 10dB at 1260MHz.

A good design which exhibits a fairly wide bandwidth is the Quad-Loop Yagi. Unfortunately these are not available commercially in the UK and therefore have to be home constructed. Designs for this aerial have appeared in (among others) Radio Communication magazine. If it is to be used towards the lower end of the band the normally quoted dimensions (which are for 1296) should be scaled to the required frequency.

Possibly the best aerial for our use is the Helix or helical-wound type. This has the advantage of being compact whilst providing high forward gain over a wide bandwidth. The aerial is not difficult to construct and further details may be found in CQ-TV117 which is also a 1.3GHz TV special issue.

At the time of writing an aerial manufacturing company - Selectronic Services- have started making the Helix for amateur use. Various sizes and gains are available and they are built to a high specification. All aerials supplied have right-hand circular polarisation, (the BATC standard).
There are numerous good reasons for using the Helix not the least of which is its insensitivity to signal fading, a good feature for TV use.
Cross polar discrimination between circular and linear aerials is around 3dB.

9

THE B.A.T.C.

The British Amateur Television Club was formed in 1949 and, initially, to provide contact with members, a circular newsletter was produced. Such was the interest in television at that time that the membership grew rapidly and the newsletter was soon replaced by CQ-TV magazine in 1950 which has continued to be published ever since. Membership at present is approaching 2,000 and, despite the clubs name, its members are spread throughout the World.

ADMINISTRATION

The BATC is affiliated to the Radio Society of Great Britain. It is administered by an elected committee which meets at least four times a year. Club officers include the President, Chairman, Treasurer and General Secretary. Many other administrative tasks are carried out by committee members. All posts within the club are honorary therefore club work is done voluntarily. Likewise all material used in CQ-TV magazine is given free. In this way it is possible to keep the membership subscription down to a minimum.
In general, the subscription covers just the cost of producing and processing the magazine. All other finance comes from sales of publications and printed circuit boards and other items handled by the members services departments. Again items available to members are priced only slightly above cost. The club is totally non-profitmaking and any surplus money is put back into the club in the form of office equipment etc. and in organising biennial exhibitions and conventions, entrance to which is free to members.

CQ-TV MAGAZINE

The mainstay of the club is its quarterly magazine. The journal is largely technical in content and is recognised as one of the most complete sources of amateur television information available today. The magazine contains various reviews and reports together with regular columns designed to keep members informed in all aspects of their hobby. It is through CQ-TV that the club keeps in close touch with its members.

There is always a demand for articles or shorts for inclusion in the magazine. No matter what the content is or how small, the Editor would like to see it. If help or guidance is needed in the preparation of material the Editor will be pleased to assist. A 'Market Place' section in each issue carries small ad's from members. This is a free service to enable members to buy and sell their surplus TV equipment. This is the place to pick up some of the professional equipment seen in many shacks. Each issue carries a pull-out centre section giving details and order forms for all Members Services sales items and for BATC publications including books and back issues of magazines.

LIBRARY

The club has its own library in which are many magazines, journals, books, manuals and other written material. Library items are available for loan to members. There are also some recorded talks and lectures on audio tape and, held separately, are some video cassettes of amateur television activities from other parts of the World as well as from the UK. These are also available for loan to groups and clubs.

PUBLICATIONS

The BATC publishes its own books to complement the material appearing in CQ-TV. Recent additions (apart from this one) have been "Amateur Television Handbook" vol.1 and more recently, a companion volume 2. These books expand on the information contained herein and are biassed towards the practical side of television. There are lots of projects in the books and printed-circuit boards and special hard-to-get components are available from Members Services.

EXHIBITIONS AND SHOWS

The club exhibits at many amateur radio rallies and shows throughout the year and members are on hand to offer help and advice if needed. Similarly at the BATCs own shows and conventions, officers and committee members are available to discuss topics concerning the club and amateur TV in general.

REPRESENTING YOU

Perhaps the most important function of the club since it began is to liase with the authorities on matters directly affecting amateur television. The BATC continually monitors the ATV service in the UK. It would be true to say that, were it not for the BATC, we probably wouldn't have amateur TV in this country now; and if we did we should certainly have lost the 70cm band long ago. Because the BATC is the only voice we have, it is important to keep that voice strong. The way to do that is to maintain the membership at a high level. It is the constant vigilance and work behind the scenes that has made amateur television what it is today, and to keep it like that and indeed to expand the facilities, we need YOU.

A membership application form is printed at the end of this book or, if you do not wish to deface it, a separate form is available by sending a SAE to the Membership Secretary whose address is on the form.

If you are new to television, may I welcome you to it and assure you that whatever path you tread in the hobby it will be liberally sprinkled with interesting and absorbing subjects and will give a great deal of pleasure and satisfaction to you and, hopefully, to others through your interest.

Good Luck.

J. L. Wood

John L. Wood. G3YQC
(Editor, CQ-TV magazine)

Spring 1983

Useful addresses

BLEAN VIDEO SYSTEMS. 4 Mount Pleasant, Blean Common, Canterbury, Kent CT2 9EU
ATV transmitters, video equipment.

FORTOP Ltd. 13 Cotehill Road, Werrington, Stoke-on-Trent, Staffs.
70 and 24cm transmitters and receivers. FM-TV equipment, Linear amplifiers.

MICROWAVE MODULES LTD. Brookfield Drive, Aintree, Liverpool L9 7AN
70cm transmitter and up-converter, filters.

SELECTRONIC SERVICES Unit BT50/55B, Perry Avenue, Teeside Industrial Estate, Thornaby, Stockton-on-Tees, Cleveland TS17 9LN
70cm and 1.3GHz helical aerials.

SILVERSTONE ELECTRONICS Ltd. High Street, Whittlebury, Towcester, Northants.
GaAs-FET amplifiers for 70 and 24, 24cm power amplifiers, 24cm double slug tuners. Microwave equipment.

WOOD & DOUGLAS 9 Hillcrest, Tadley, Basingstoke, Hants RG26 6JB
70cm TV transmitters - kit or ready built. 70 and 1.3GHz converters, 1.3GHz FM-TV equipment, Video generators etc.

SIRKIT PROJECTS "Benbow" Widecroft Road, Iver, Bucks.
70cm transmitter and receiver kits and ready-built.

PIPER COMMUNICATIONS 4 Severn Road, Chilton, Didcot, Oxon OX11 OPW
Everything to do with transmitters and ancillaries for 70cm and 1.3GHz.

MAGAZINES

A5 AMATEUR TELEVISION MAGAZINE. P.O.box H, Lowden, Iowa 52255 0408 U.S.A.

DER TV AMATEUR. (AGAF Germany - in German) Diethelm E Wunderlich DB1QZ, Im Springfield 56, D-4250 Bottrop, West Germany.

N.B.T.V.A. (Narrow Band TV Association) D.B.Pitt, 1 Burntwood Drive, Wollaton, Nottingham, NG8 2DJ

USEFUL REFERENCES

The following is a collection of references to articles which could be of interest to those who are new to amateur television.
The equipment articles are mainly of a constructional nature and provide extra information on topics covered in this book.

Both back issues of CQ-TV magazines and photo copies of articles are available from BATC publications (see current CQ-TV for details). The numbers in brackets after references indicate the number of copy pages required for the article in question:

CONVERTING THE THORN TX-9 TO A COLOUR MONITOR. CQ-TV 119 (4)
AN ELECTRONIC CHARACTER GENERATOR. Handbook 1
CHARACTER COLOURISATION. Handbook 2
A COLOUR CAPTION KEYER. CQ-TV 121 (2) (errata CQ-TV 122)
MICROWAVE MODULES 70cm ATV CONVERTER REVIEW. CQ-TV 113 (3)
A 70cm TV CONVERTER. Handbook 1
A TV TUNER/I.F. SYSTEM. Handbook 1
A 70cm VESTIGIAL SIDEBAND TRANSMITTER. Handbook 2
G4DYP ATV TRANSMITTER. CQ-TV 114 (3)
G4DYP LINEAR AMPLIFIERS. CQ-TV 115 (3)
¾Watt ATV LINEAR. CQ-TV 116 (2)
A 70cm LINEAR USING THE MHW 710 MODULE. Handbook 1
A VIDEO MODULATOR FOR 10 WATT TRANSMITTERS. Handbook 1
1.3GHz ATV SPECIAL ISSUE. CQ-TV 117
TV TUNER MODIFICATION FOR 1.3GHz. CQ-TV 118 (1)
THE 1.3GHz HELICAL AERIAL. CQ-TV 122
FM-TV DEMODULATOR. CQ-TV 118 (1)
FM-TV DEMODULATOR. Handbook 2
A FREQUENCY MODULATED 420MHz OSCILLATOR. Handbook 2
FM-TELEVISION. CQ-TV 119 (3)
AN FM-TV PLL DEMODULATOR SYSTEM (with PC board). CQ-TV 122
A 1.3GHz PA USING THE 2C39 VALVE. CQ-TV 119 (5)
A 1.3GHz OSCILLATOR. CQ-TV 121 (2)

***Hanbooks 1 and 2 refer to the current 'Amateur TV Handbooks' published by the BATC and which are available from BATC publications or the RSGB.*

ERRATA & ADDENDA

A 70cm TRANSMITTER - page 25.

A modification has been made to the oscillator circuit (Tr1) which appears on page 26.

L1 is now 10-turns of 26swg enamelled copper wire, close-wound onto a 4.5mm former with a tap at 3-turns from the supply end. The 5.6pF capacitor coupling into Tr2 should now be taken from the tap instead of Tr1's collector.

This modification should ensure that all crystals oscillate on the correct overtone.

ATV REPEATERS - page 43.

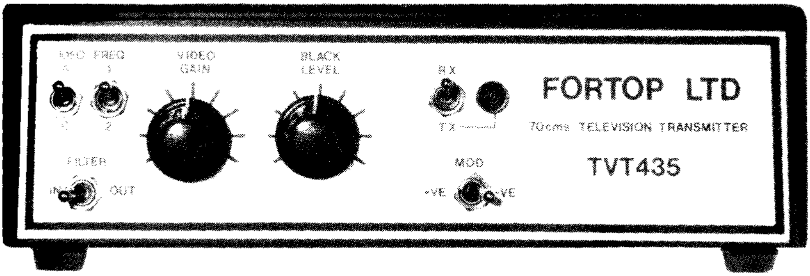
The five ATV repeaters proposed on page 43 are all in operation and GB3GV (Leicester) is now operating FM only on RMT-2. Further ATV repeaters are planned and the latest information may be found in CQ-TV magazine.

USEFUL ADDRESSES.

In the first printing of this volume page 51 carried a list of useful addresses. However so many have now changed or been discontinued that the page has been deleted. To assist readers though some current useful addresses are detailed below:-

COMEX SYSTEMS LTD	Comet House, Unit 4, Bath Lane, Leicester LE3 5BF. Tel: (0533) 25084. 24cm ATV equipment; Satellite TV equipment.
MICROWAVE MODULES LTD.	Brookfield Drive, Aintree, Liverpool L9 7AN. 70cm transmitters, filters, converters, 23cm pre-amplifiers.
WOOD & DOUGLAS.	Unit 12-13 Youngs Industrial Estate, Aldermaston, Reading, Berkshire RG7 4PQ. Tel: (07356) 71444. 70cm and 24cm transmitters, receivers, sound modules and some video products.
SANDPIPER COMMUNICATIONS	40 Trehafod Road, Trehafod, Nr.Pontypridd, Mid Glamorgan. Tel: Porth 685515. 70cm and 24cm aerials and aerial products.

November 1986



<u>TVT435 & TVT435/R</u>

The TVT435 is a high performance ATV transmitter comprising of a dual frequency exciter, video modulator and a linear amplifier producing 15 watts minimum RF output. The unit incorporates our sync-pulse clamp circuit, to ensure maximum RF output on sync pulses. Internal PIN diode changeover, switches the aerial through to the external receive converter (our TVC435/40 is designed for this) when the transmitter is swithed off. The transmitter has, video bandwidth filtering (now strongly recomended by the BATC) to reduce the transmitted bandwidth, and the facility to radiate positive or negative modulated signals. The TVT435 is unique in these two facilities. The filter in the TVT435 will restict the video bandwidth to approx 2.5MHz (a 4.5MHz version is available). Front panel controls are video input select, frequency select, filter in/out, modulation pos/neg, video gain, black level and power on/off.A transceiver with our receive converter built in is available, (the TVT435/R). With this version all that is required is an aerial, standard TV set, video source and a 12v power supply to produce a compact, quality ATV station.

<u>TVC435/40</u>

The TVC435/40 Amateur Television Receive Converter will allow the use of any standard UHF TV set for the reception of 70cms ATV signals. Two low noise RF stages greatly increase receiver sensitivity and a HI-Q filter is used to remove spurious responses from broadcast stations. Using the TVC435/40 converter is the easiest way to obtain a high performance receive system.

<u>TVL435/20 SERIES</u>

The TVL435/20 is a range of linear amplifiers intended for people who have purchased or built low power transmitters. Four versions are available for 300mw or 3W drive and with or without PIN diode output switching. The units are based on the linear amplifier section used in our TVT435 transmitter and will handle all modes of transmission. Minimum output is 15 watts for stated RF drive, (18 watts typ).

Other products are available please contact us at:-

<u>FORTOP LTD</u> first and best for ATV.

1[illegible], COTEHILL ROAD, WERRINGTON, STOKE-ON-TRENT, STAFFS.
TEL ASH BANK (078 130) 2607.

AMATEUR TV HAS SOMETHING FOR EVERYONE

THE BRITISH AMATEUR TELEVISION CLUB