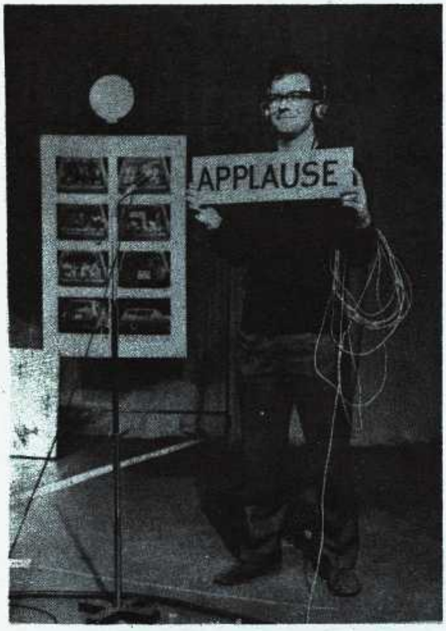

THE JOURNAL OF THE BRITISH AMATEUR TELEVISION CLUB.

cq-tv 51

THE BRITISH AMATEUR TELEVISION CLUB

CQ-TV, Journal of the British Amateur Television Club.

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Martin Salter, our new editor has very kindly asked me to write the Editorial in this, his first edition. It is also my first opportunity to write as the new Hon. Sec. - perhaps a word of explanation here; Don Reid has been forced to give up the duties of Hon. Secretary by his move to Sierra Leone for two years, and it is during this period that I have taken over on a temporary basis. I must record here my thanks to Don for all the work he has done in the past, particularly in connection with the Conventions and with the next Convention just under a year away perhaps I might take this opportunity to ask for any volunteers to help with the organisation?

Many queries are received on the subject of 625/405 - what standard to use when making equipment. This is a difficult problem, but perhaps a few words about the different aspects may help some to decide. First, consider colour - there are at least 12 shadow mask type tubes either in use or nearly in use by members of B.A.T.C., three in the London area already receiving the B.B.C. experimental transmissions. A few 405 line receivers have been made available to members, but with a colour service only a short time away it would appear logical to stay on 625 lines. However, for monochrome work - and that's nearly all of us - one important consideration is the large number of old 405 line receivers available already on the scrap market. This point should be taken into consideration by anyone starting from scratch who wants to get going with the minimum of trouble. Staying on the standard of the receiver sounds a strange idea, but remember that pulse generators, cameras etc are quite easy to make multi-standard compared with the problems of receivers and monitors. The final, and most important point to make is simply to state the obvious. Amateur Television is a hobby, and as such there are absolutely no rules or regulations to say what system of scanning is to be used, but it would be an unwise man who started transmitting a totally incompatible system in the hopes of being received by very many others!

J.E.T.

<u>In View</u> of the re-organisation of the Editor-Secretary duties the New Members and What the Other Chap is Doing items have been held over until CQ-TV 52.

<u>International Radio Communications Exhibition.</u>

We will be there again this year plans are for Dave Buck, G3PJE/T to show his station, and while there take 'off the air' pictures from G3OUO/T and G3NDT/T, and any other /T station willing to cooperate.

<u>Keep your eyes and ears open.....</u>
a chance remark overheard in a shop resulted in the purchase of 6 C.P.S. Emitron camera tubes recently - the first sign of Government Surplus T.V. gear.

<u>PLEASE NOTE</u>

All communications should be addressed to:-

4, Inwood Close,
Shirley,
Croydon,
Surrey.

and should be clearly marked wether the letter is intended for either the Editor or the Secretary.

S.O.S. - WANTED URGENTLY

Bob Mayo, Manchester, is very anxious to obtain a set of coils for the 5FP7. Can anyone help ?

<u>Front Cover</u> shows Mike Cox as floor manager at a demonstration last March. Photo: G.Tye.

DESIGNING RESONATORS FOR U.H.F.

By D.L. Jones. G3LYF/T

What do you do when you want a resonant circuit? Use an existing design or a G.D.O. on a few experimental turns of wire? These are solutions to the problem, but where do you start when you want a circuit resonating at 430Mc/s, where your G.D.O. will not tune , or there are no circuits to hand for the particular valve you wish to use? Circuits bases on distributed constants for U.H.F. work can be easily designed, and made properly, will resonate at exactly the frequency you intended ..... provided your arithmetic is good!

It is first required to know the characteristic impedance of the particular arrangement you wish to use. The formulae for calculating this can be obtained from any good textbook dealing with transmission lines, but to save time some of the more popular arrangements together with the appropriate formula are given at the end of this article.

The reader is warned that whilst the circular line in a square box, popularly known as the troughline, is easy to construct, the formula for its characteristic impeadance defies imagination!

It is next required to know the loading capacitance on the circuit. This will comprise the output capacitance of the valve together with any capacitance required for tuning adjustment. Once this capacitance is known the inductive reactance required from the line can be discovered from the formula:-

$$X_L = \frac{10^6}{2\pi fC} \qquad \text{........(1)}$$

Where C is in pF, f is in Mc/s, and X_L in ohms

It should be noted that the above gives data for a $1/4\lambda$ line. If a $1/2\lambda$ line is required the tuning capacitance will be at the oposite end of the line to the valve anode. In this case, the line should be treated as two seperate $1/4\lambda$ sections, one loaded with the anode capacitance, the other with the tuning capacitance. Of course, the the two sections will not necessarily be the same length.

The required length of line can be discovered using the formula:-

$$X_L = Z_o . \tan \frac{2\pi l}{\lambda} \qquad \text{....... (2)}$$

Where X_L is in ohms, Z_o is the characteristic impedance in ohms, l is the length of the line, and λ is the wavelength, the latter two measurements are both in inches, and the angle is measured in radians.

One thing remains, the capacitor for tuning purposes is usually two discs of copper, supported by some kind of screw and insulated from one another by air. With knowledge of, say, the spacing, and the required capacitance, the diameter of the discs can be easily calculated from the formula:-

$$C = \frac{0.226\pi r^2}{d} \qquad \text{..........(3)}$$

Where C is in pF, and r and d are the plate radius and spacing in inches.
Formula (2) requires the wavelength in inches, this can be calculated from:-

$$= \frac{11,790}{f} \text{ inches ......(4)}$$

Where f is in Mc/s.

WORKED EXAMPLE.

The author recently published in CQ-TV (No. 46) a design for a coaxial resonator for the 4X150A. The mathematics of that design are now reproduced below:-

Frequency = 440 Mc/s

$$\text{therefore } \lambda = \frac{11,790}{440} = 26.2'' \text{ (from 4)}$$

$1\frac{1}{2}''$ and $3''$ diameters where chosen for the diameters of the inner and outer coaxial conductors, on the basis of available material. As this resonator is a $1/4\lambda$ type no supporting dielectric media exist so that using the Z_o formula for coaxial cylinders, and substituting $\epsilon = 1$ we have:-

$$Z_o = 138.\log \frac{D}{d}$$

$$= 138.\log \frac{3}{1.5}$$

$$= 40\text{ohms.}$$

The output capacitance of the 4X150A is about 4.2pF and 0.5pF is allowed for tuning. Thus total capacitance is 4.7pF.

therefore required X_L

$$X_L = \frac{10^6}{2\pi\times440\times4.7} \qquad \text{(from 1)}$$

$$= 75\text{ohms.}$$

The length is now calculated by substituting values in the formula (2).

$$X_L = Z_o . \tan \frac{2\pi l}{\lambda}$$

$$75 = 40 . \tan \frac{2\pi l}{26.2}$$

$$1.88 = \tan \frac{6.28 l}{26.2}$$

since $\tan^{-1} 1.88 = 1.08$ radians

$$1.08 = \frac{6.28 l}{26.2}$$

therefore $l = 4.5$ inches.

CAPACITOR FOR TUNING PURPOSES.

$C = 0.5$pF

Assume plates separated by $\frac{1}{4}$"

$$C = \frac{0.226\pi r^2}{d} \qquad \text{(from 3)}$$

$$r^2 = \frac{0.25 \times 0.5}{\pi \times 0.226}$$

$$r^2 = 0.175$$

therefore $r = 0.418$"

therefore plate diameter $(2r) = 0.83$inches

SUMMARY.

Line dimensions.

Outer conductor dia.	=	3"
Inner conductor dia.	=	1.5"
Line length	=	4.5"
Loading capacitance	=	4.7pF

Capacitor dimensions.

Plate dia.	=	0.83"
Plate spacing	=	0.25"

CAN YOU HELP?

Greig Powell asks if anyone can provide any information on the following 'scope.

No. 11, A A predictor Mk. 1.

The adress for replies is:-

Weald Rise, Litmarsh, Marden, Herefordshire.

FOR DISPOSAL

Valve S.P.G. (similar to Mike Barlow's design).
Vision sync blanking mixer.
Test waveform generator.
All on 7" pan chassis, approx 25 valves.

Power supply unit for above ... rack mounting provides 180v regulated at 150mA, 6.3v at 6A.

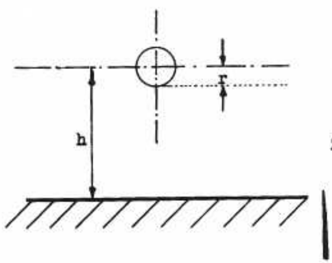
Iconoscope cammera with 5527 tube P.S.U. etc.

Offers to Mike Cox. 135, Lower Mortlake Rd. Richmond Surrey.

FORMULAE for CALCULATING Z_o of VARIOUS LINE

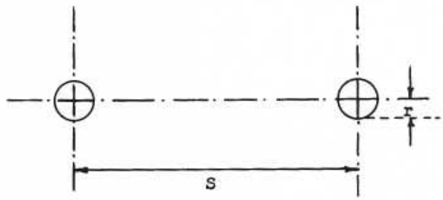
(all logs to base 10)

ARRANGEMENTS.



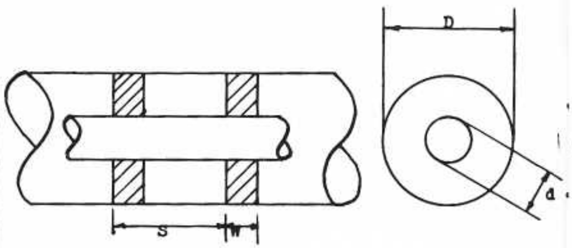
Single line above earth.

$$Z_o = 138 . \log \frac{2h}{r}$$



Twin lines away from earth

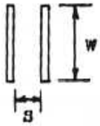
$$Z_o = 276 . \log \frac{s}{r}$$



Coaxial cylinders with inner conductor supported by solid insulating medium

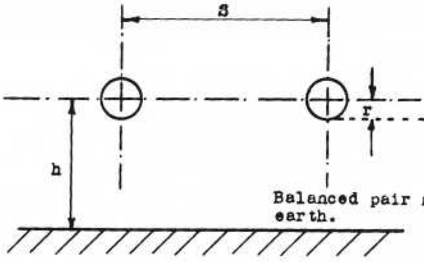
$$Z_o = \frac{138 . \log \frac{D}{d}}{\sqrt{1 + \left(\frac{\epsilon - 1}{S}\right) . W}}$$

Where is the relative dielectric constant for the insulating medium. for air $\epsilon = 1$



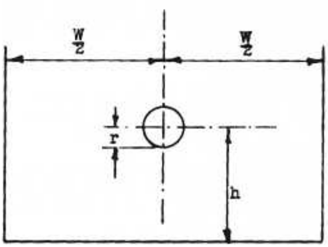
Parallel slabs
where W ≫ S

$$Z_o = 377\frac{S}{W}$$



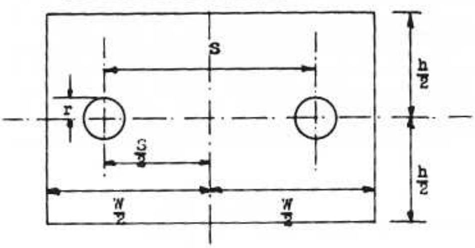
Balanced pair near earth.

$$Z_o = 276.\log\left[\frac{S}{r}\cdot\frac{1}{\sqrt{1+(S/2h)^2}}\right]$$



Single conductor in trough.

$$Z_o = 138.\log\left[\frac{4W.\tanh\frac{\pi h}{W}}{2\pi r}\right]$$



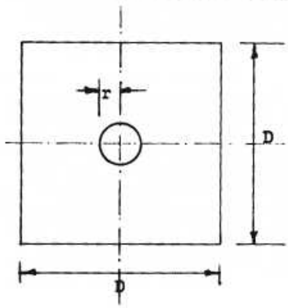
Balanced pair in rectangular enclosure.

$$Z_o = 276.\left\{\log.\left[\frac{4h.\tanh\frac{2\pi r}{2h}}{2\pi r}\right] - \sum_{m=1}^{\infty}\log\left[\frac{1+U_m^2}{1-V_m^2}\right]\right\}$$

Where

$$U_m = \frac{\sinh\frac{2\pi r}{2h}}{\cosh\frac{m\pi W}{2h}}$$

$$V_m = \frac{\sinh\frac{2\pi r}{2h}}{\sinh\frac{m\pi W}{2h}}$$



Single conductor in square enclosure.

$$Z_o \approx \left[138.\log\rho + 6.48 - 2.34A - 0.48B - 0.12C\right]$$

Where $\rho = \frac{D}{2r}$

$$A = \frac{1+0.405\rho^{-4}}{1-0.405\rho^{-4}}$$

$$B = \frac{1+0.163\rho^{-8}}{1-0.163\rho^{-8}}$$

$$B = \frac{1+0.067\rho^{-12}}{1-0.067\rho^{-12}}$$

Many other arrangements are shown on pages 588 - 594 of " Reference Data for Radio Engineers" fourth Edition. by I.T.T. printed by the Stratford Press Inc. New York.

A TRANSISTORISED LOW NOISE R.F. AMPLIFIER FOR THE 70cm. BAND.

By. D. Mann G3OUO/T

Circuit Description.

The amplifier described below is a single stage of of the grounded base type, and is intended for use infront of an existing 70cm converter/to improve the sensitivity.

The circuit of the amplifier is shown in Fig. 1. The heart of the amplifier is a Philco transistor type 2N1742 connected in the grounded base mode. The aerial input is taken straight into the emitter of the transistor without any emitter tuning. (The input impedance appears to be quite a good match to 75 ohms) The base of the transistor is earthed to R.F. and the collector is tuned with a quater wave line, from hwich the output is taken. To simplify construction the collector circuit is earthed to D.C. and the emitter taken to a positive supply of 12 volts, which may be obtained from the existing converter H.T. supply.

Construction.

The amplifier is constructed on a copper chassis measuring 1 inch square in section and 6 inches long. When constructing the the amplifier it is essential that tho wires of the input coupling capacitor and the base de-coupling capacitor are kept as short as possible. (See Fig. 2). The tuning capacitor can be one of the ceramic tube type of low minimum capacitance (0.5pF). The collector tuning line is made from $\frac{1}{8}$ inch diameter copper tube.

Performance

Comparisons were made between the transistor pre-amplifier and a grounded grid amplifier using the A2521 valve, without any cathode tuning. The noise factor of the transistor amplifier was noticably better but the gain is rather lower (about 12dB).

If more gain is required two transistor amplifiers may be cascaded, the whole assembly still costing less than a single A2521 valve. Another advantage of the transistor amplifier is its almost indefinite life compared to the fairly limited life of the A2521 valve.
The amplifier has a bandwidth of 12Mc/s.

Notes.

The amplifier has be'n in use for several mounths at the authors station, and when used in conjunction with a normal Londex coaxial relay and a transmitter input power of up to 100 watts, the transistor shows no sign of stress due to power leaking through the relay and into the amplifier.

Special note.

If the amplifier tends to break into self oscillation this could well be caused by one or more of the following reasons:-

1) The emitter coupling capacitor or the base de-coupling capacitor leads are too long.
2) The aerial impedance is a poor match compared to 75 ohms.
3) The input impedance of the converter is a poor match to 75 ohms.

If 2 or 3 is suspected, varying the length of the input and/or output coaxial cables by a few inches should cure the trouble.

CIRCUIT DIAGRAM

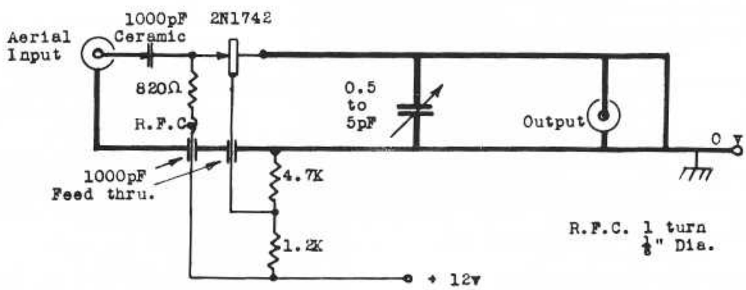
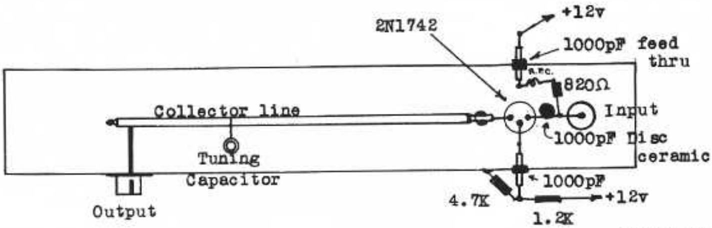


FIG. 1.

COMPONENT LAYOUT



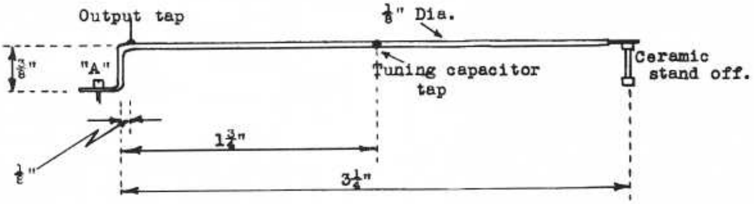
The case of the transistor should be earthed, and is mounted in a close fitting hole in the chassis.

FIG. 2.

The transistor may be obtained from:- Philco International Ltd.

The amplifier may be improved slightly by using a Philco T2028 transistor instead of the 2N1742 suitably modifying the biasing, but these transistors cost about four times asmuch as the 2N1742.

COLLECTOR LINE DETAILS



The line is fitted to the chassis at point "A" with a 8BA bolt.
Dimensions are not critical.

FIG. 3.

BOOK REVIEW .... J. E. Noakes.

"Transistor Manual" (6th Edition) produced by General Electric Company and available from The Modern Book Company at 16/-.

There are 440 pages of easily read text and clear diagrams. The contents are in keeping with the title being a general approach to most aspects of the use of semiconductors.

The book starts with semiconductor theory; methods of construction; specifications - explaining all the information contained in the specification sheet, and then goes on to deal with the small, large and switching characteristics of transistors. From the circuitry point of view there are examples of audio, R.F., pulse, servo and silicon controlled switch techniques. In the pulse section the design of multivibrators is set out in chart form followed by information on all forms of multivibrators, schmitt triggers and ring counter circuits. There is also a chapter on Binary Arithmetic and Logic.

This book is to be recomended as a source of general information on most transistor problems and the fact that it has been difficult to obtain speaks for itself.

J. E. Noakes.

ENCODING N.T.S.C. COLOUR SIGNALS.

by Hugh

As I was saying before the editor interrupted me ("Colour Fundamentals", CQ-TV 45), three signals are needed to transmit and receive colour TV. One, the LUMINANCE signal, consisting of a perfectly normal monochrome signal complete with syncs, which tells us how bright each part of the scene viewed is, and two other signals, called the CHROMINANCE signals, which tell us all about the colours of the scene. The chrominance (or "CHROMA") information consists of HUE and SATURATION ; both sets of information are modulated onto a carrier together, so that the phase of the carrier represents the hue, and the amplitude is related to the saturation. If the saturation is zero the carrier vanishes, so there is no colour signal, and the "colour" transmitted at that instant is black, grey or white, depending on what the luminance is doing ; this is nice, because it implies that if the scene transmitted is entirely in black, white or shades of grey, the television signal reverts to a standard monochrome one.

This brings us to the idea of COMPATIBILITY, an idea much flogged nowadays. In case you came in half way through, we'll flog it a bit more : briefly, the idea is that it must be possible to watch a monochrome programme (in monochrome) on a colour receiver ; it must also be possible to watch a colour programme (in monochrome) on a monochrome receiver, as there will be many millions of these about for a long time to come. For the system to be compatible, then, obviously we mustn't tamper too much with the standard luminance signal ; we can add the colour information so long as it doesn't upset the monochrome receiver. This we can do if the colour is on its own carrier at some high video frequency, the falling response in the monochrome receiver will probably help to render it invisible. We take advantage of the fact that to a monochrome television receiver, interference patterns are most visible if they come at multiples of the line-scan frequency (because then the bright and dark parts line up on adjacent lines). The receiver is quite blind to frequencies half way between multiples of line frequency (because then the interference tends to cancel out between adjacent lines). This is why subcarrier frequencies are specified to such an alarming number of decimal places ! They are invariably odd multiples of the half the line frequency. For the 525 line system the frequency chosen is 3·579545 Mc/s, or

$\frac{455}{2} \times 15750$ c/s ; for 405 line colour it is

2·6548125 Mc/s, or $\frac{525}{2} \times 10125$ c/s.

In professional equipment, line frequency and colour carrier frequency are locked together in the same crazy way that line and field frequencies are locked ; for amateur-type experimenting this may not be too important. However the colour carrier frequency has to be pretty accurate (crystal controlled in fact) as the system can't be locked to mains. So get the hum out of your equipment !

Did you notice the term SUBcarrier creep in just now ? A subcarrier is merely a carrier which is later modulated in turn on another carrier. This happens to our subcarrier of course when it eventually gets to the transmitter.

Let's go back to our carrier modulated simultaneously in amplitude and phase - a terrifying thought, but surprisingly easy to do, fortunately.

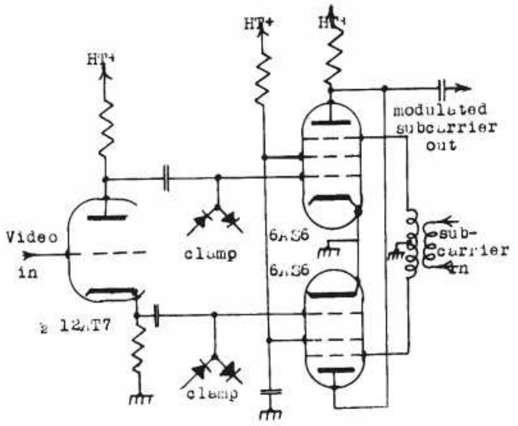


FIGURE 1.

Suppose we have two carriers of the same frequency, one 90° ahead of the other in phase. Let's add them together, after modulating them separately. The first we choose as our phase reference, and call the IN-PHASE or "I" carrier; the other is 90° away in phase, so we'll call it the QUADRATURE or "Q" carrier. If they are equal in amplitude the sum will be 45° from "I" phase and be $\sqrt{2}$ or 1·414 times greater in amplitude. If we switch off the Q carrier, the sum has 0° phase and unit amplitude ; again, if we reverse the Q signal, the resultant has 135° phase and $\sqrt{2}$ amplitude. Obviously if we vary both amplitudes we can produce a resultant with any amplitude we like and any phase we like right round the circle. To vary the amplitudes of our two carriers in this way we use a kind of balanced modulator rather like the arrangement used for SSB sound transmission, which produces no RF output if the modulating waveform goes to zero, and an output whose phase reverses if the input goes negative. Fig1 is a simplified circuit to show the scheme. The pentodes are usually type 6AS6, a type in which the suppressor has almost as much control of the anode current as the control grid.

Video is applied to the grid of a triode phase splitter, which feeds in push-pull the control grids of the pentodes, which must incidentally be clamped. Subcarrier is similarly applied in push-pullto the suppressors, but the anodes are in parallel, not push-pull. The video signals are equal and opposite and cancel out at the anodes if the things is properly balanced. In the absence of an input the subcarrier also cancels ; but if the input is not zero, one valve produces more subcarrier than the other, and there is an output. If the input has the opposite polarity, the other pentode takes over and the output phase reverses.

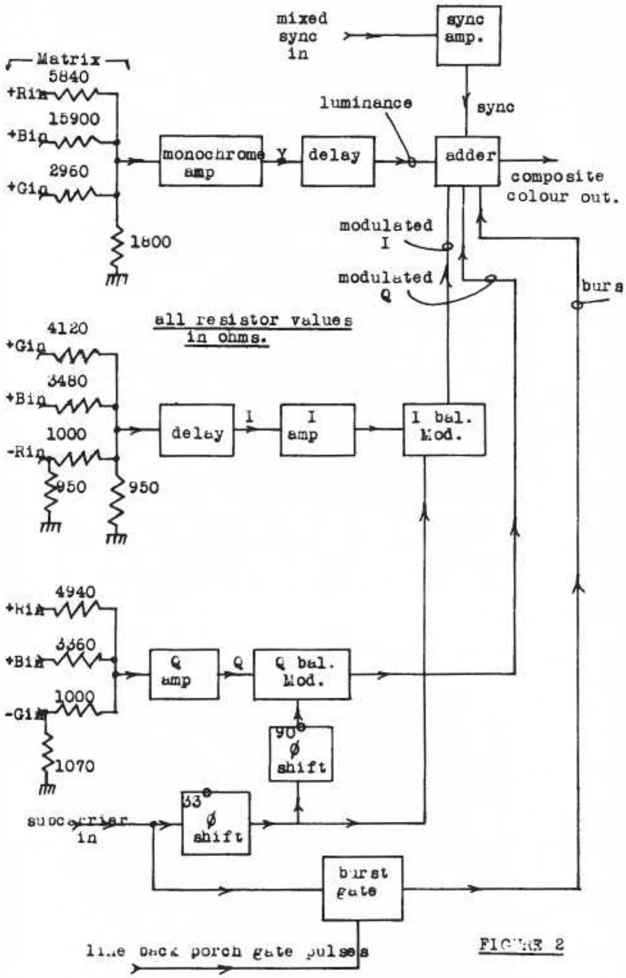


FIGURE 2

If we do this twice, we should be happy, because we then add the two modulated outputs together and put them on to the luminance signal. This is fine, but we still have to find our signals to put into these stages. It turns out that both I and Q signals are functions of the red and blue primaries ; if Y represents the luminance signal, these two signals are in fact

$\frac{R-Y}{1 \cdot 14}$ and $\frac{B-Y}{2 \cdot 03}$, the dividing factors

being introduced to make sure equal signals for the three colours give us a proper white, since different proportions of the three primaries are needed to do this. In fact this is not quite the whole story, because a 33° phase shift is introduced in the carrier fed to the two modulators - this has the effect of rotating the modulation axes 33°, but still keeping them at right angles to one another. It makes no difference to the electronics (a constant phase shift that we know about is neither here nor there) but it makes a difference to the eye of the viewer. Normal eyes are much less sensitive to detail in blue than, say, in green or yellow, so we can economize in bandwidth on the Q channel ; no point in transmitting detail we can't see, especially if it is likely to cause interfering beats, say, with the luminance channel, which we could see. After all, as far as the monochrome receiver is concerned, the colour information is interference. It's found that this 33° shift rotates the axes to where the Q channel bandwidth can be least.

So now we know what the input signals to the coders should be ; since it is now only a matter of adding R, G and B together to get Y, and then subtracting it from R (or B) to get R-Y and B-Y, and then potting down in a certain ratio, it can all be done in a resistance network quite passively. Actually a few valves will be used for isolation and to invert one of two of the signals which are required to be negative, but it's basically quite passive, and can be set up and forgotten. An outline of a professional colour encoder * is shown in Fig. 2, which also shows the resistance network (or MATRIX) in more detail. The relations between Y,I,Q and R,G,B are

Luminance	$Y = 0{\cdot}30R + 0{\cdot}59G + 0{\cdot}11B$
Chrominance	$I = 0{\cdot}60R + 0{\cdot}28G - 0{\cdot}32B$
	$Q = 0{\cdot}21R - 0{\cdot}52G + 0{\cdot}31B$

Notice that these are basically colorimetry and not strictly television, and so apply equally to colour TV systems on 405, 525 or 625 lines.

There is only one thing left to do now- burst ! In order to demodulate or decode the colour signal, the colour receiver must know what phase the reference subcarrier was at the transmitter to start with, and so a sample is included on the back porch of line sync, on every line except during frame sync. This sample is a BURST of about 8 cycles of subcarrier, and synchronises a colour subcarrier oscillator in the receiver, which runs continuously. One way of decoding the colour signal uses exactly the same circuit as the encoder, but in reverse as it were, to deliver I and Q out to a matrix which converts them back into the original R, G and B. However that's another story.

\- - - - - -

* Fink. TV Engineering Handbook. McGraw-Hill.

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TELEVISION TEST WAVEFORMS & THEIR APLICATIONS.

By M.A. Lilley.

SUMMARY.

When television equipment and systems are being tested it is desirable that the most suitable waveforms are applied to enable the characteristics of the apparatus to be determined. The purpose of this article is to describe the most commonly used test waveforms and their applications.

BLACK AND WHITE GENERATOR.

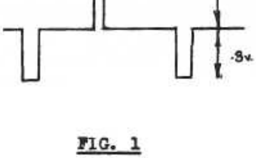
The black and white generator provides an output waveform consisting of normal blanking and synchronising pulses and either (a) black level (b) peak white level. Generators of this type are normally designed to maintain a constant level video signal for use as a standard level reference. This generator is usually combined with a Bump generator, which provides a video signal output alternating between preset white and black levels at a controlled rate. This rate of alternation can be varied typically between ½c/s and 250c/s and may also be locked to multiples or sub-multiples of the field frquency. Applications of the bump generator include the measurement of sync. pulse crushing, transmitter black level stability, L.F. resonance and the determination of the effects of signal varations on the performance of sync. separators.

CRUCIFORM GENERATOR

The cruciform generator produces a composite video signal which, when displayed on a monitor, consists of a black cross on a white background . the waveform is used mainly for the detection of poor low frequency responce of video amplifiers. Poor L.F. responce shows up as shading of the horizontal bar. The waveform, when displayed on a monitor also gives a very rough check of the high frequency responce by the condition of the edges of the vertical bar.

SPIKE GENERATOR (see Fig. 1)

This generator provides a line spike of a few microseconds duratipn and is used for checking for possible overshoot in video amplifiers.

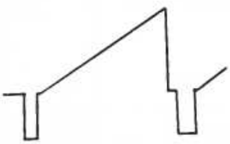


Line Spike Waveform.

FIG. 1

SAWTOOTH GENERATOR (see Fig 2)

This provides a composite output having a line frequency sawtooth increasing from black at the start of the line to peak white at the end. The sawtooth signal provides a simple means of amplitude linearity measurement of a video amplifier. To measure the linearity, a standard level signal is applied to the input of the amplifier under test. The output is then connected via an attenuator having attenuation equal to the gain of the amplifier, to an oscilloscope preferably with a differential input, or, failing this, a 'scope with a floating earth, is connected between the input of the amplifier and the attenuator output. The attenuator is adjusted to give a balanced trace, (i.e. the output waveform amplitude is the same as the input amplitude) and the curvature of the trace, which is due to any non-linear amplification, is usually expressed as a percentage of the input peak to peak signal level. This method may also be used to set up video amplifiers employing black stretch or gamma correction where the input signal is deliberately distorted by the amplifier. Other applications of the sawtooth signal include the adjustment of peak white clippers and the setting up of transmitter modulators to achieve a linear modulation envelope at the output.

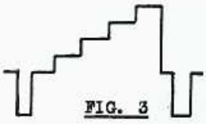


Line Sawtooth Waveform.

FIG. 2

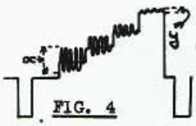
An alternative to the sawtooth is the gray-scale or step generator. The output waveform is very similar to the sawtooth except that the change from black to white is achieved in a variable number of equal steps. This linear line step waveform is useful for setting up film recording and telecine channels.

There are two other important applications of the step waveform when a high frequency sine wave is superimposed on each step. This enables measurement of the differential gain and differential phase to be made. Differential gain is the gain/amplitude characteristic of a unit and is measured by passing the step waveform with superimposed sine wave through the unit, the step information is then removed at the output by passing the signal through a high pass filter, leaving only the sine wave component. (see Figs 4 & 5)



Gray. Scale Waveform

FIG. 3



Gray Scale Waveform with H.F. sine wave added:- after passing through a non-linear amplifier

FIG. 4

Step information removed by passing waveform of fig 4 through high pass filter.

FIG.5

The differential gain is given by:-

$$\frac{\text{percentage change in amp. of n.th step wrt.1st.}}{n}$$

i.e. $$\frac{x - y}{n}$$

where n is the number of steps being considered

The differential phase is measured by comparing the phase of the sine wave at the output of the amp. with that of the input sine wave. The measurement is made on a given step which corresponds to a known level on the signal. The step information is again removed by means of a filter and the output of the amplifier compared with the input in a phase sensitive detector.

SINE SQUARED PULSE AND BAR GENERATOR.

This generator produces a waveform (Fig 6) devised by the British G.P.O. Research Dept. principally for the testing of television links but now extended to cover a wider range of aplications.

Television waveforms are essentially transient in nature and therefore the testing of t elevision equipment is best carried out using signals similar in nature to those which the system normally handles. The pulse and bar waveform is of carefully chosen parameters such as to limit the bandwidth of the test signal, and thus account does not have to be made of the components of the test signal that could lay outside the bandwidth of the test equipment, i.e. 'scopes etc. The waveform is displayed on a 'scope of sufficient bandwidth to handle the test signal. To the 'scope is fixed a graticule on which are engraved set limits of degradation of the signal, these degrees of degradation are expressed in K ratings. These preset limits were originally obtained from subjective tests.

The bandwidth is related to the "half amplitude duration" (see Fig 6) of the pulse.

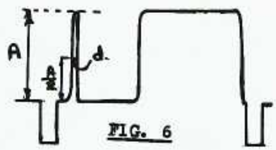


FIG. 6

d = half amplitude duration

Sine Squared Pulse And Bar Waveform

The relation is:-

$$\text{Upper frequency limit} = \frac{1}{d}$$

Where d is the half amp. duration.

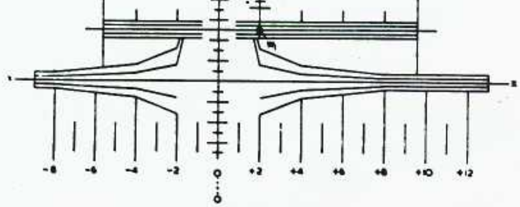
The half amplitude duration for the 405 and the 625 CCIR systems are as follows:-

	405	625 CCIR
T Pulse	0.17 μSec	0.10 μSec
2T Pulse	0.33 μSec	0.20 μSec

As can be seen from the above chart there are two pulses for each system, the 2T pulse contains frequency components up to the limit of the of the transmission system (i.e. 3 Mc/s for the 405 line system) whilst the T pulse contains frequencies in excess of these and is for checking systems right up to and beyond the limit of normal transmission bandwidth. When extreem accuracy of measurement is required it is usual to photograph the 'scope display and then examine it under a travelling microscope.

Symmetrical distortion of the bar or pulse is due to amplitude distortion through the system. When the pulse or the bar are not reproduce symmetrically about their mid axis, phase distortion must be present.

The height of the pulse relative to the bar amplitude is an indication of the H.F. responce relative to the L.F. responce. Tilt of the line frequency bar gives an indication of L.F. loss.



Typical Graticule for Pulse & Bar measurements.

CQ-TV