TECHNICAL HANDBOOK

MEASURMENT

OF

TELEVISION BROADCASTING

FACILITIES

OVERSEAS TECHNICAL COOPERATION AGENCY

PREFACE

We have the pleasure in publishing a book "Measurement of Television Broadcasting Facilities", thanks to the cooperation of the Technical Training Division of Japan Broadcasting Corporation (NHK).

This book aims at serving as a reference book for the adjustment and testing of TV broadcasting facilities by providing for a reader not only interpretations of principles and mensurations of the measuring equipments indispensable to the adjustment and testing of TV broadcasting facilities but also descriptions of the methods of measurement and performance specifications being applied to the television broadcasting facilities in Japan.

We hope that this book will be widely utilized among the engineers engaging in the television broadcasting.

S. Shibusawa

Sinichi Shibusawa
Director General
Overseas Technical Cooperation Agency

CONTENTS

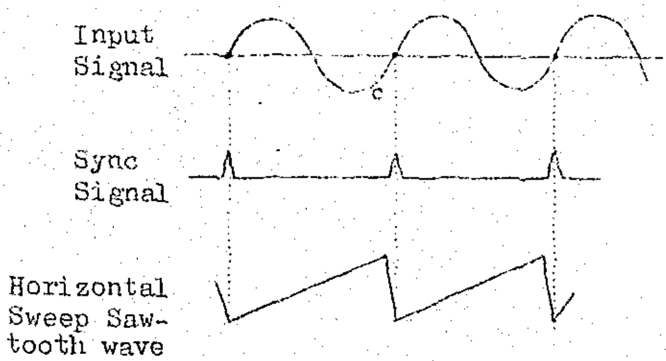
METHOD OF MEASUREMENT

I. Measuring Instrument

1. Oscilloscope

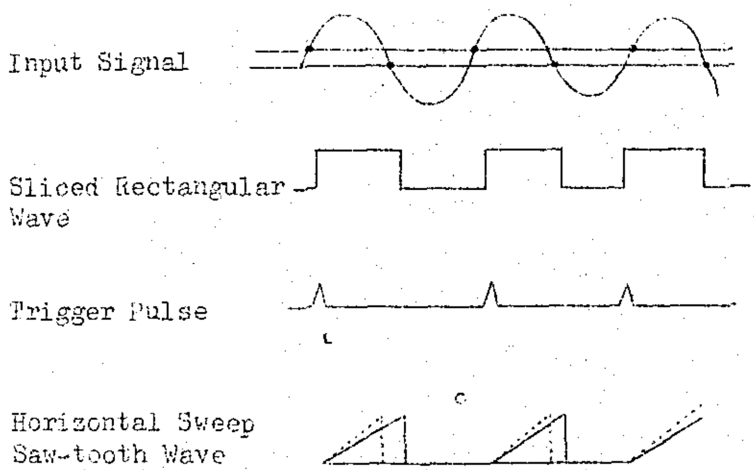
Oscilloscopes are classified roughly into a simple type and a triggered type. The difference between them is that the triggered type is made suitable for observing complicate wave forms such as pulses and others of Television, while the simple type is capable of observing only periodic waves. The triggered type is, in addition, designed possible for measuring levels of signals and widths of pulses, etc. quantitatively.

In case of the simple type oscilloscope, it shapes sync signals from the input signal, and with the sync signals as its trigger pulses, it makes saw-tooth waves. However, its shaping circuit is incomplete and that unless the period of a saw-tooth wave generating circuit coincides with the integral multiple of the period of the sync signal, sweep is not pulled into sync. Therefore, it has a defect that a wave form on the oscilloscope does not become stationary unless the input signal is a periodic wave.



On the contrary, in case of the triggered type, it creates square waves by slicing signals once with the Schmidt circuit, and by differentiating them makes trigger pulses, then makes saw-tooth waves by the multivibrator. Therefore, it will make a perfect trigger pulse even for an irregular signal, and also produce one sweep saw-tooth wave for a single trigger pulse so that perfect synchronization will result even if a signal is irregular, also arbitrary selection of sweep frequencies is possible.

Furthermore, such an advantages as being able to synchronize even with a single shot of pulse proves it very effective to the sync of TV signal.

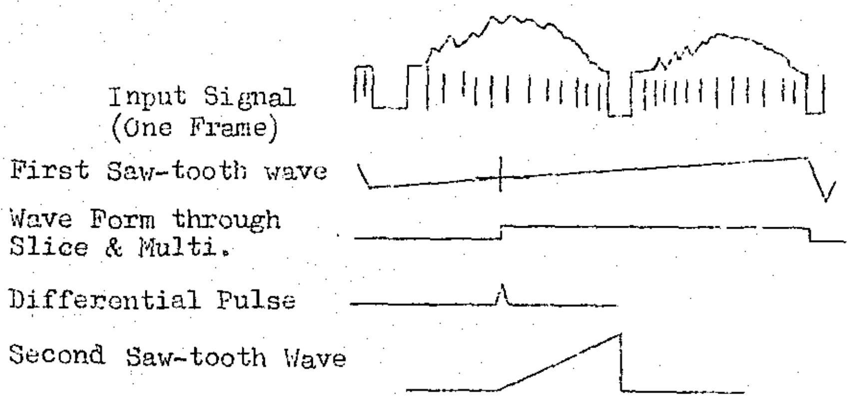


In case of the triggered type, the vertical axis amplifier is built as DC amplifier so that measuring DC levels are possible. It is also wide-band, and generally DC - 15Mc is the type popularly used, also such models as 50Mc or even higher are available.

In the triggered type, the sensitivity of vertical axis and horizontal axis is calibrated in advance so that quantitative measurements are possible.

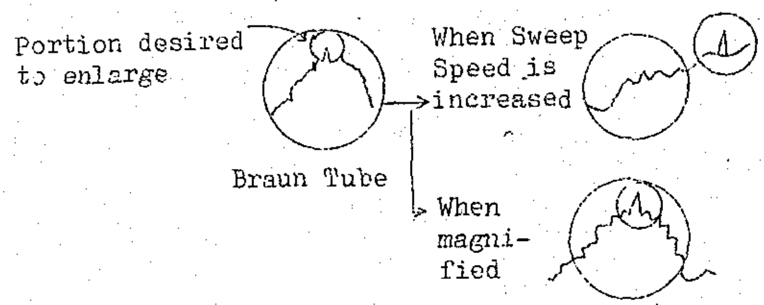
Among this type, one for TV use is able to perform the delayed sweep.

The delayed sweep means that it does not sweep in synchronizing with the input signal, but is devised to delay sweeping for the arbitrary time by lagging the generation of saw-tooth wave for the sweep of oscilloscope. For instance, while synchronizing with the vertical sync signal of TV at the time of actual sweep, it sweeps such arbitrary portions as the center of one field and next vertical sync signal, etc., which portion can be magnified for observation.



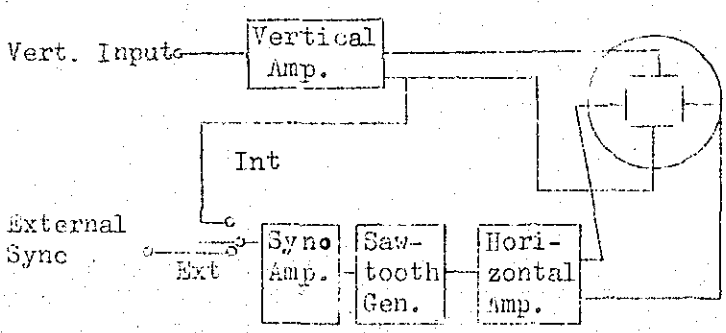
The principle is that a synchronized one frame saw-tooth wave made from the vertical sync signal is sliced at an arbitrary position, and the resultant square wave is differentiated, then acts as the trigger pulse to make the saw-tooth wave for sweep. On this occasion, the selection of slicing level makes it possible to choose the position of sweep.

The triggered type oscilloscope is able to perform an magnification sweep. The increase of horizontal sweep velocity is the general practice to cause the expansion to the horizontal direction. However, if a portion desired to be expanded for observation positions at the right end of a screen, the increase of a sweep velocity will cause the portion to move to the right simultaneously with the expansion, and eventually the portion would go beyond the screen to become invisible. Contrary to this, use of the magnification sweep will cause the expansion to go to left and right from the center, thus making it possible to attain the purpose.



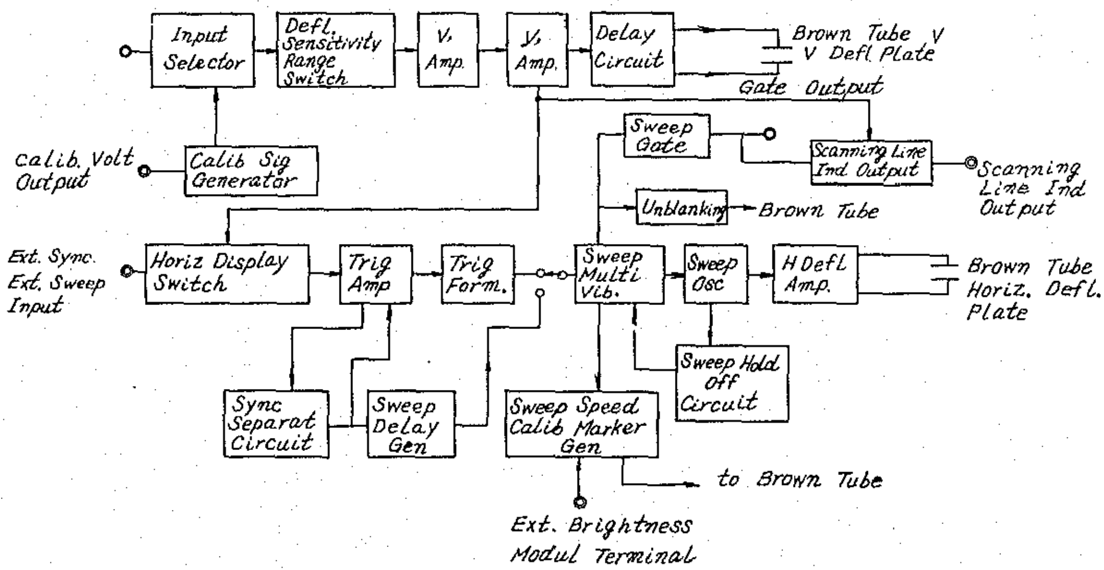
1.1 Synchroscope

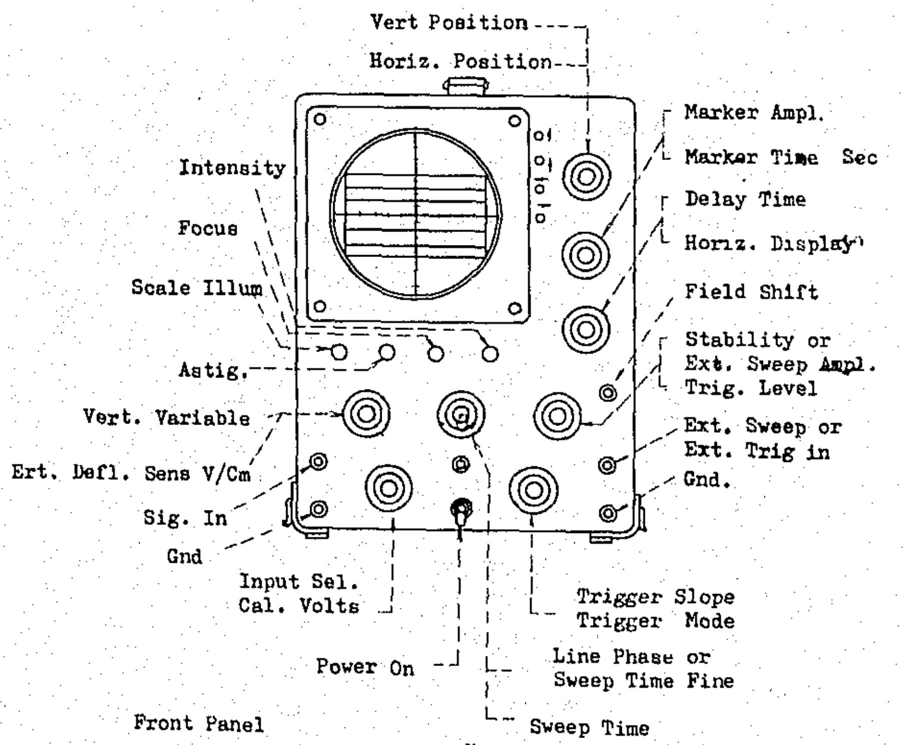
1.1.1 Principle



The general step is that signals from the vertical input are amplified at the vertical amplifier then fed to Y axis of Braun tube and part of the signals from the vertical amplifier is sync-amplified to use it for the sync of saw-tooth wave generator. As the result, produced are saw-tooth waves synchronizing with the input signal, which are amplified by the horizontal amplifier and fed to X axis.

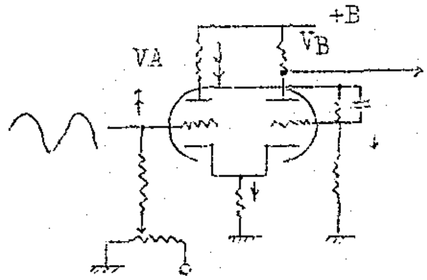
Among triggered types, there is a model commercially called synchroscope. Though being the same in principle as mentioned above, this synchroscope employs shaping circuit and sweep multivibrator etc. for the section of sync amp. and saw-tooth wave generator, besides various auxiliary circuits attached such as, for instance, voltage calibrator, calibration marker for sweep velocity, sweep gate, indication output of scanning line and delayed sweep, etc.

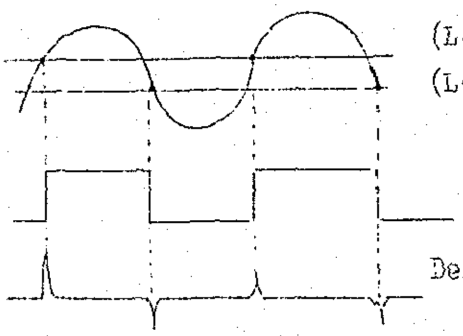




Front Panel

The trigger shaping circuit is a sort of multi-vibrator called Schmidt circuit, and the following is the diagram of its principle.

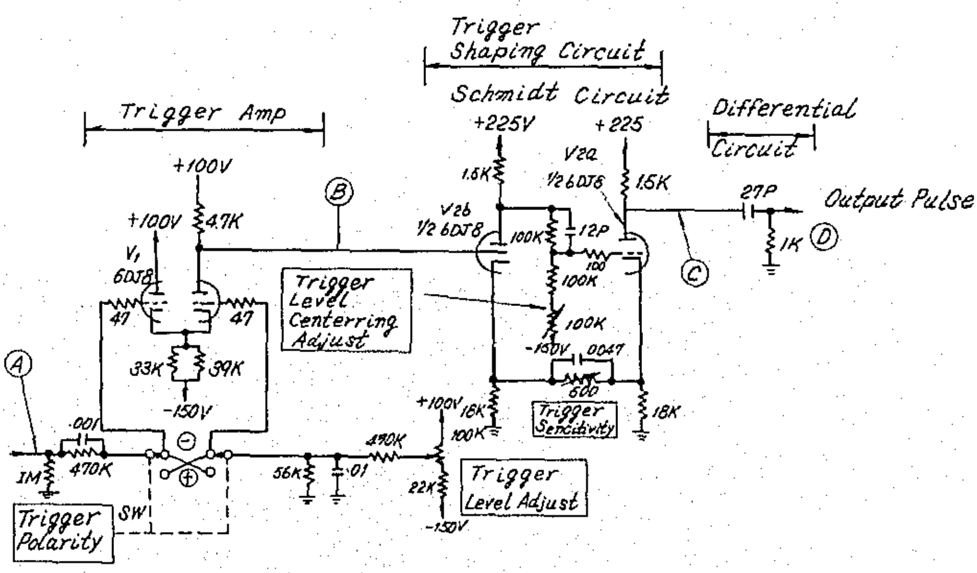




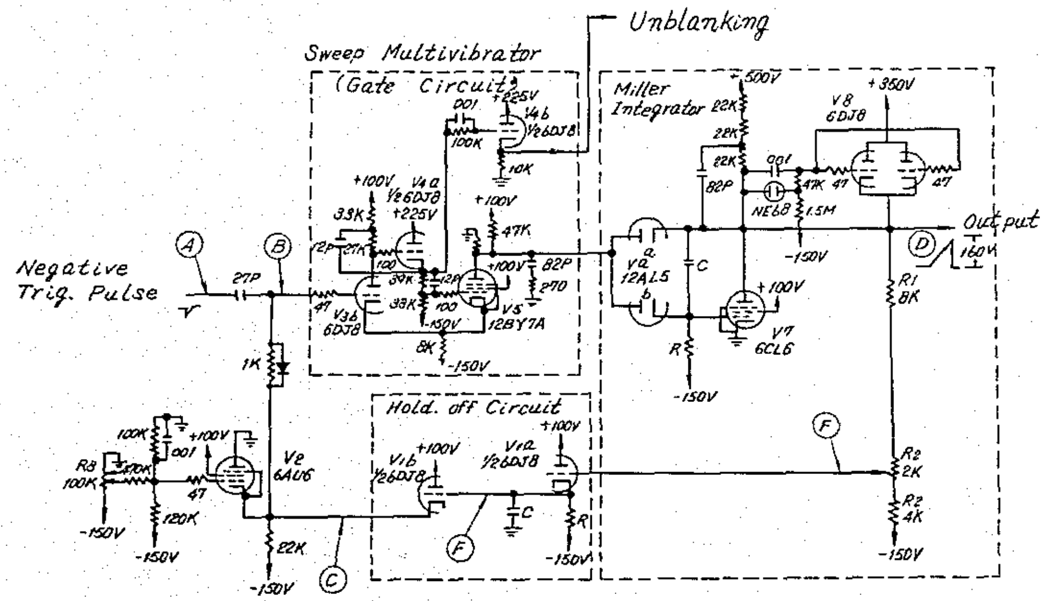
As shown in the diagram, suppose a signal enters to V_A grid and when the input signal rises to a certain level (level A), the risen part at the grid is conveyed to the plate causing the potential to decline. The declined potential is voltage-divided, then carried to V_B grid, and because of this, the common cathode potential intends to decline, and since the cathode is common to V_A and V_B, the V_A plate wants to decline further, which action will again cause the V_B grid to drop more. That is, feed-back is taken place for short time, so that at the V_B plate, the signal appears as a sharply rising rectangular wave.

Also, when the input signal drops to reach a certain level (level B), feedback directed opposite to the former is taken place, and when loops become cutoff, the feedback stops. Accordingly, V_B plate becomes a rectangular wave by repeating saturation and cutoff, which will be differentiated and used as the trigger pulse.

The above refers to the diagram of the principle, however, the actual circuit is built as follows:

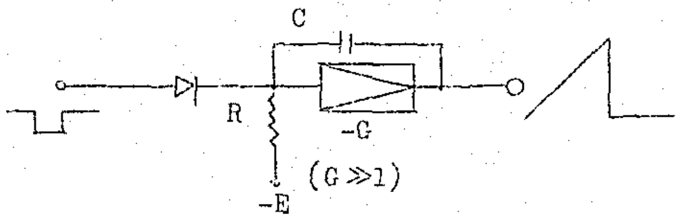


Example of Trigger shaping Circuit using schmidt Circuit



Example of Sweep Circuit

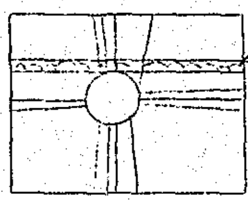
The sweep multivibrator in the above diagram generates square waves by the input trigger, and Miller integrator will vary the square waves into saw-tooth waves.



Suppose the gain of the amplifier is G, an equivalent capacity becomes (1+G)C due to Miller effect. The Miller integrator is a circuit making use of this concept and it has a feature of good linearity. Among models of this kind, Miller run-up circuit is chiefly used.

* <u>Hold-off circuit</u> is a circuit designed to prevent the sweep signal from regeneration due to the entry of trigger pulse during the sweep.

* <u>Scanning line indicating output</u> aims to easily discriminate an area being seen on the oscilloscope by turning the area to white stripe when the pulse of sweep multivibrator is superimposed on the input signal and fed to the monitor.



1.1.2 Each Knob of Synchroscope

Explanation on the meaning of each knob is given here because the synchroscope has many places to control and it is advisable to keep in mind those underlined.

Power On	Power source switch.
Scale illum.	Illumination for scale on Braun tube.
Astig.	Astigmatism control of Braun tube.
Focus.	Focus control of Braun tube.
Intensity.	Brightness control of Braun tube.
Marker time μsec.	Switching of time scale (marker) for the calibration of sweep time.
Marker Ampl.	Light spot control of time scale.
Horizontal display.	
Ext. sweep.	In case of sweep by the external signal.
Line sweep.	In case of sweep by the power source frequency.
Main sweep.	In case of doing normal sweep.
Delayed sweep.	In case of doing delayed sweep.
Delay time.	Control of delay time when to perform delayed sweep.
Vertical defl. sens. V/CM.	Switching of the sensitivity of vertical amplifier.
Vertical Variable.	Fine control of the sensitivity of vertical amplifier. Full turning to the right corresponds to the value indicated.

Sweep time.	Switching of internal sweep time.
Sweep time fine.	Fine control of internal sweep time. Full turning to the right corresponds to the value indicated.
or Line Phase.	Becomes the phase controller when set on the power source frequency.
Stability.	Synchronizing with a video signal to be observed. From the extreme left, turn gradually to the right and stop when synchronized to make the wave form stationary (Trigger Sweep). At this time, set the Trig Level on the center (zero).
or Sweep Ampl.	Becomes the sweep amplitude controller only on the occasion of external sweep or power source sweep.
Trig Level.	A slight shift of a wave form from the initial synchronizing point is noticed by varying the Trig. Level after controlling the stability to make the wave form stationary. Set it on the position easy to observe. When the stability can not be controlled satisfactorily, adjust it right before the start of sweep and try to vary Trig. Level. (Note) Trig. Level does not work at AC Auto and H.F. Sync. of Trig. Mode.

Input Sel.	Switching input impedance between 1 MΩ, (AC,DC) and 75 Ω (AC, DC). At the time of Cal (AC, DC), the calibration voltage enters to the vertical axis.
Cal Volts.	On the above occasion, calibration voltage indicated enter to the vertical axis.
Trig. Mode.	Select one of the following modes in accordance with the input signal to observe.
A.C. Auto.	100 - 500 Kc (Trig. Level does not work).
H.F. Sync.	More than 1 Mc.
D.C.	DC. and Ultra-low frequency.
AC. Slow.	30 c/s - 1 Mc.
AC. Fast	Above 100 Kc.
V	V Sync. of TV signal.
Trig. Slope.	Switching to Slope + or - when sweep is intended from the rise of input signal or the fall.

On the occasion of internal sweep.	INT.
On the occasion of power source sweep.	Line.
On the occasion of external sweep.	Ext.

The above-mentioned input signal will change to the power source and the external signal for the last two respectively.

1.1.3 Main Usage of Synchroscope

Connect the synchronizing signal to SIG. IN and put the synohroscope to work by the following precedures.

(1) Use of the internal sync (INT) at normal sweep.

a. Putting the power source switch "on", first initiates the low voltage on, then the high voltage on 30 seconds later.

b. Set each knob on the following position.

Trig Level	Center
Stability	Maximum Counter-clockwise Direction
Trig Slope	- INT
Trig Mode	A.C. Auto
Horizontal Display	Main Sweep x 1
Sweep Time Fine	Maximum Clockwise Direction
Vertical Variable	" "
Input Sel	A.C. (75Ω)

c. Increase Intensity to the extent that the spot becomes slightly visible.

By Horizontal Position and Vertical Position, try to have the spot appearing at the left end.

By Focus and Astigmatism, adjust the spot to become as small as possible.

d. Then, turn Stability gradually to the clockwise direction and stop when the sweep begins and the wave form becomes stationary.

Also, largeness of the wave form and sweep time are adjusted by Vertical sens and Sweep time respectively.

e. Next, switch Trig Mode to A.C. Slow and repeat the above operation. When the wave form becomes stationary, vary Trig Level to observe the variation of the position of left end of the wave from. (adjustment of the synchronizing point by Slope of trigger wave form)

(2) Use of the external sync (EXT) at normal sweep.

It is convenient to trigger the synchroscope by the external sync signal (for example H. D.) as it is free from causing a snatchy sweep by varying Vert. Defl. Sens.

a. Trig Slope EXT -

b. Trig Input Feed H.D. Signal

Same operation as in (1) will do.

(3) Use of the internal sync (INT) at delayed sweep.

It is convenient when to observe the area of V sync of TV signal.

a. Trig Slope INT -

Trig Mode V (or A.C. Fast)

Horizontal display Delay sweep x 1

Stability Maximum Clockwise Direction

Same operation as in (1) will do.

(4) Use of the external sync (EXT) at delayed sweep.

It is enough to vary the state of (3) in the following points, and similarly to (2), it is not affected by Defl. Sens.

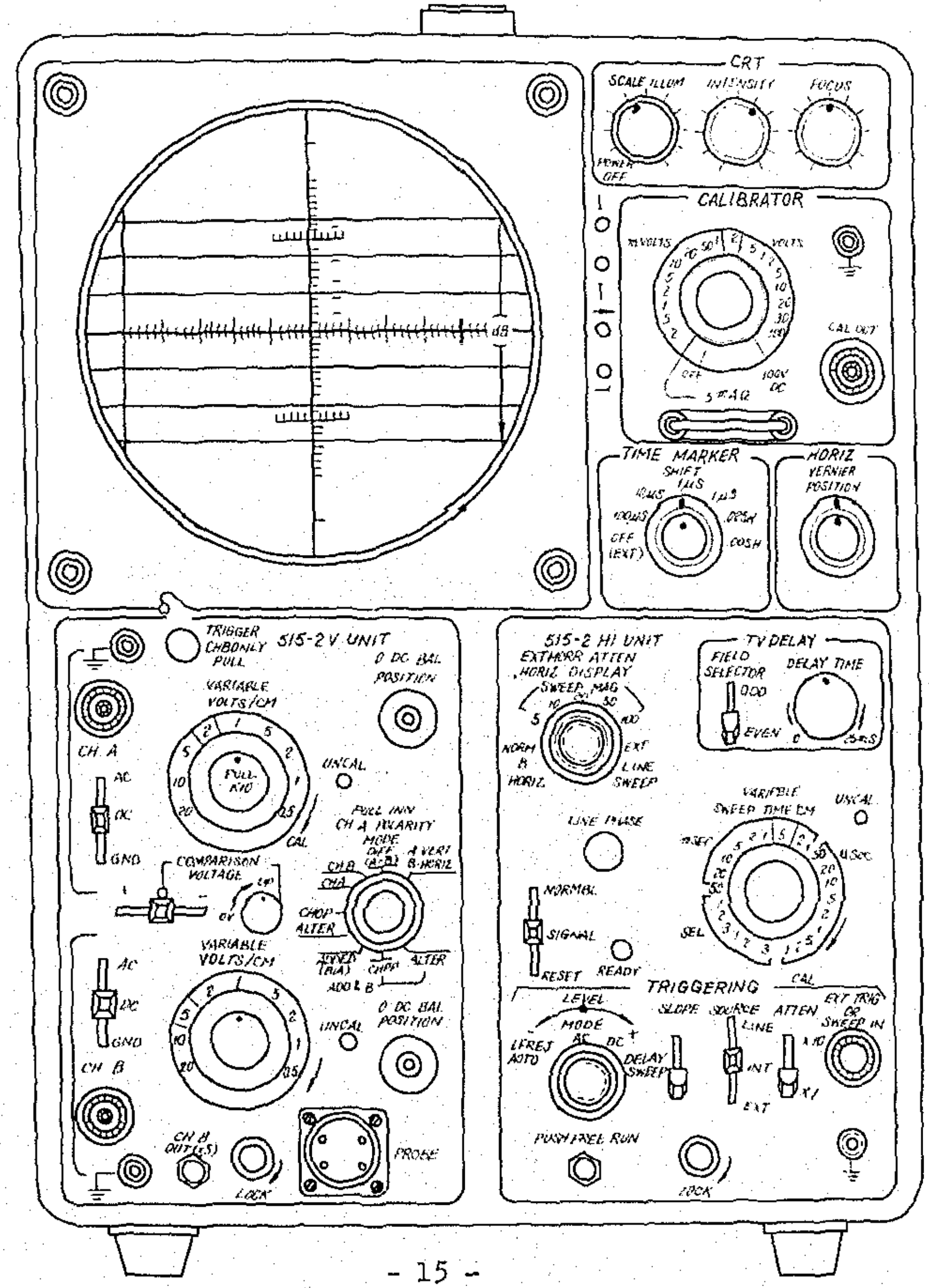
a. Trig Slope EXT -

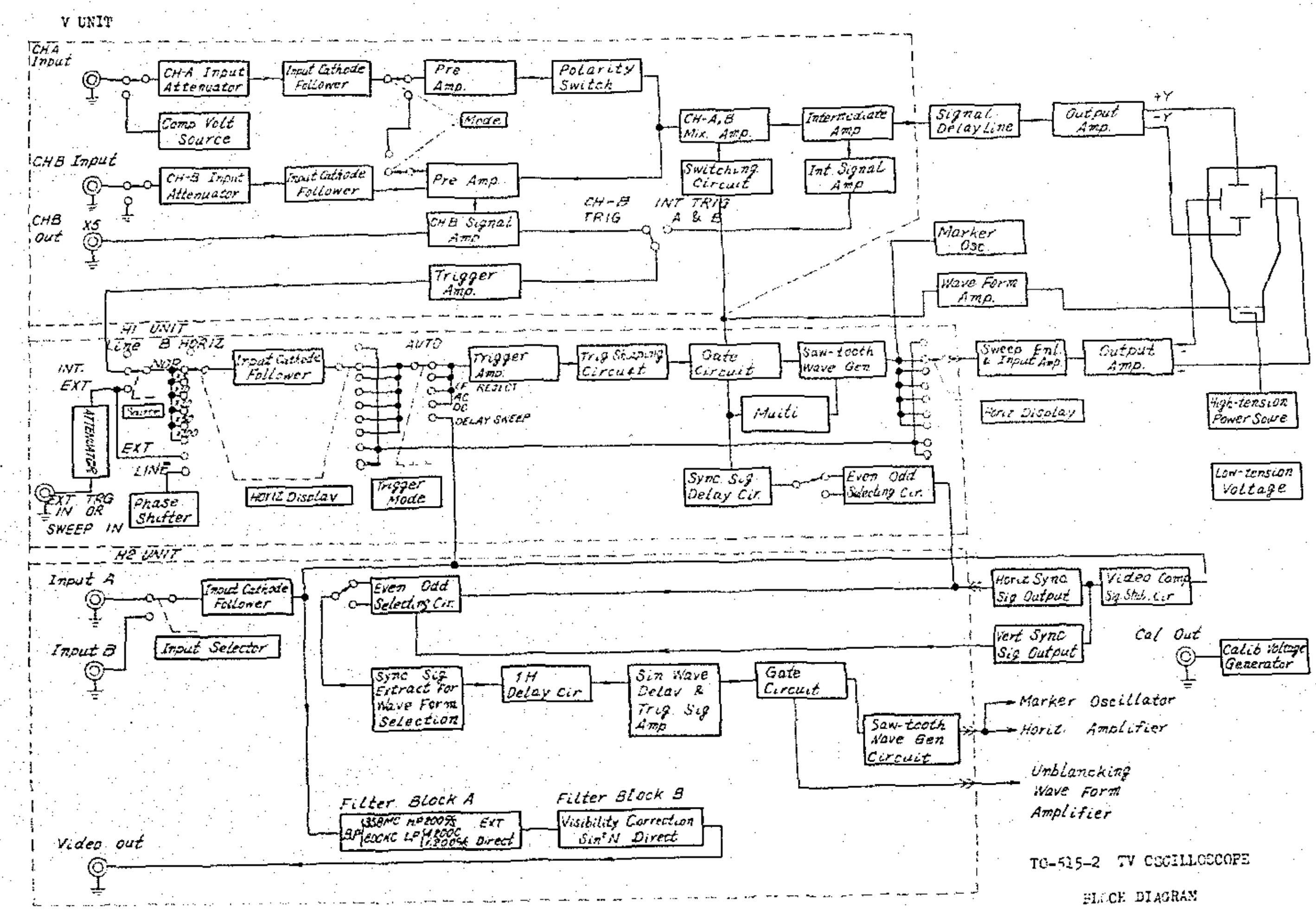
b. Trig Input Feed the synchronizing signal Sync.

1.2 Dual Trace Oscilloscope

As a new type, transistorized dual trace oscilloscopes are available.

TELEVISION OSCILLOSCOPE
TO-515-2 TYPE

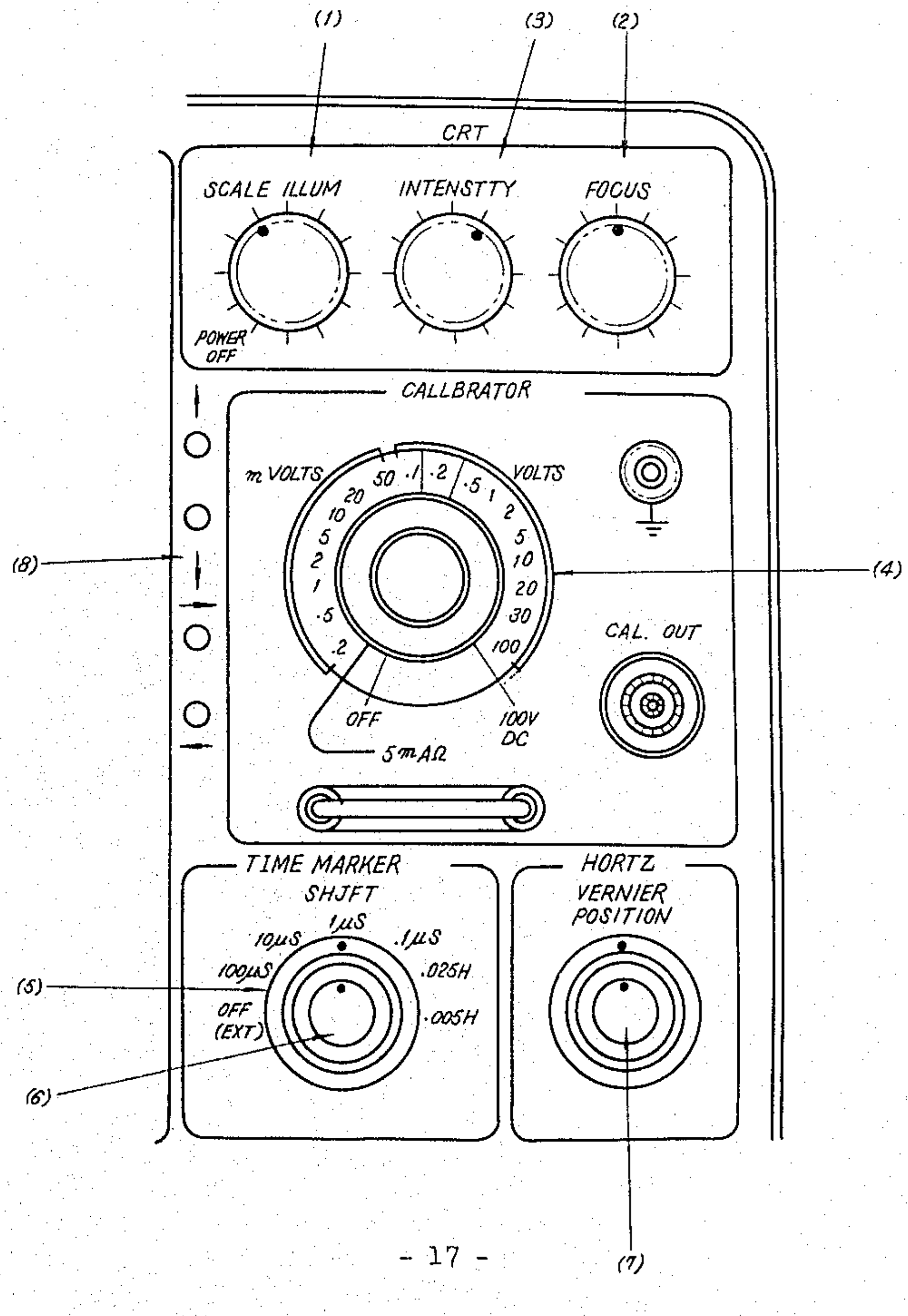




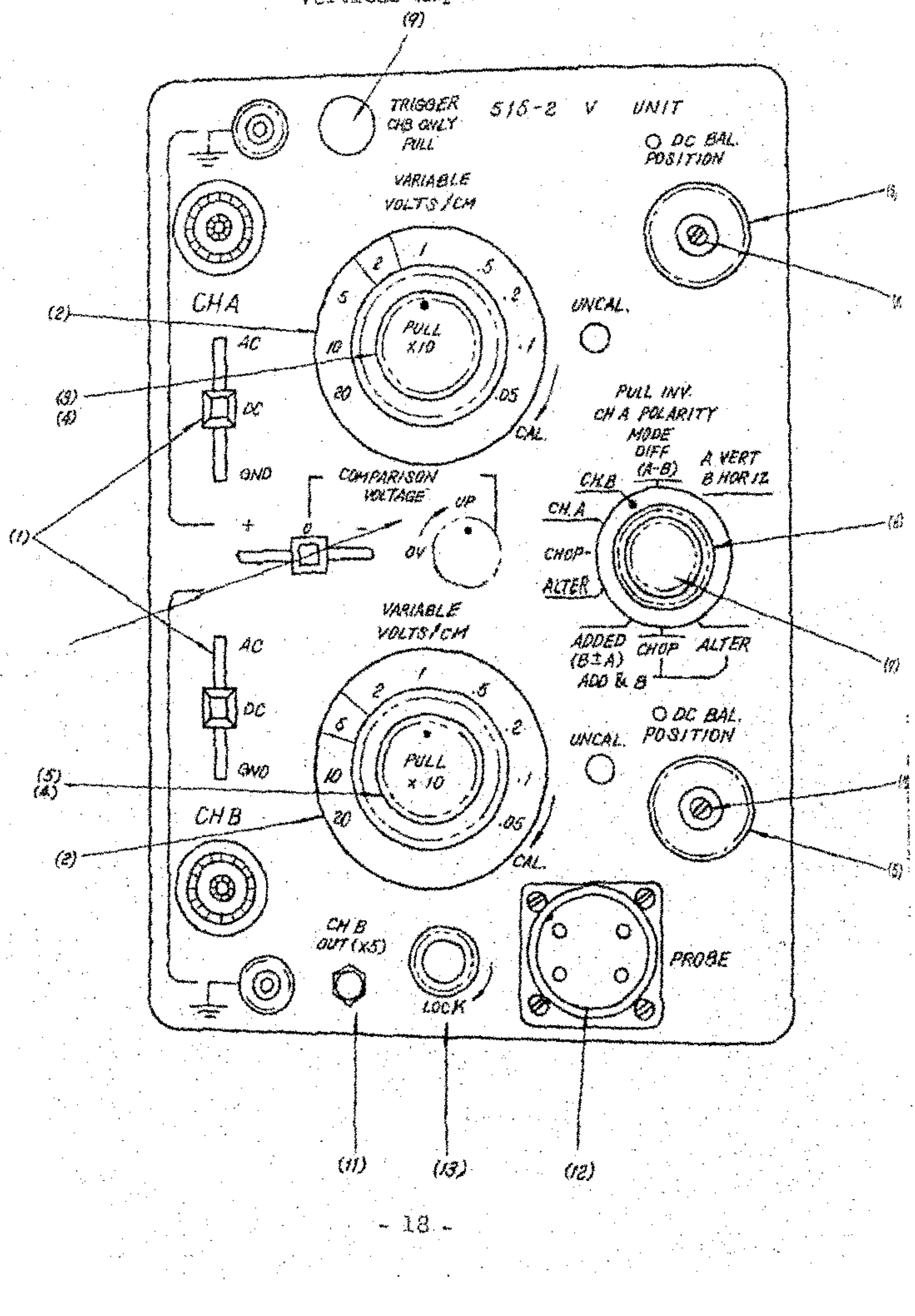
TG-515-2 TV OSCILLOSCOPE

BLOCK DIAGRAM

Upper Right Section



Vertical Amp Unit



This is a vertical amplifier unit built in two phenomena amplifier. The (6) knob is able to select CH-A only, CH-B only, Dual Trace (CHOP and ALTER), Addition (ADDED) and Difference (DIFF), etc.

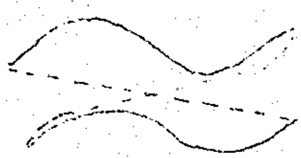
Of "Dual-Trace", "CHOP" provides such a sweep as it continues while the high-speed switch performs switchover between A and B, chopping them off in short space of time. Accordingly, each wave form, while a sweep speed is slow, appears to be a continuous wave form, however, when the sweep speed becomes rapid, the wave form is seen chopping, so that this is used when sweep speed is slowed down.

A

B

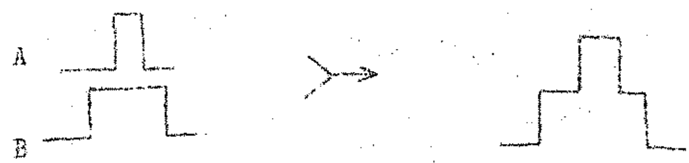
On the contrary, in case of "ALTER", that is the abbreviation of Alternate, sweep is conducted alternatively A and B. That is, it sweeps A first, then B and A again, which sweep will cause a flicker when the sweep speed is slow. Therefore, this is used when sweep speed is made quick.

A

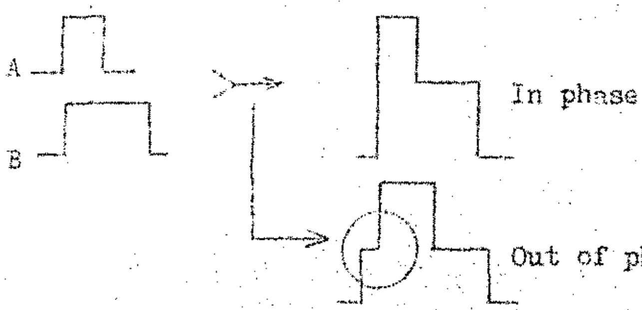


B

"ADDED" will offer a wave form which is the addition of two phenomena.

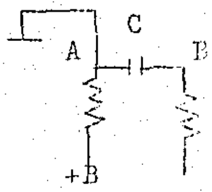


It is convenient to use this for making up the phase difference between two phenomena as shown in the following.



"DIFF", which is the abbreviation of Difference, is used for the case where equalizing the levels of two signals is desired, in addition to the same usage as in ADD.

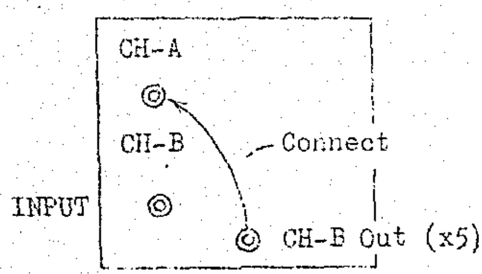
For example, the following diagram wants to find a potential difference between the both ends of C. In this case, apply "DIFF", so that a difference between A and B, that is, the potential difference between the both ends of C, can be seen.



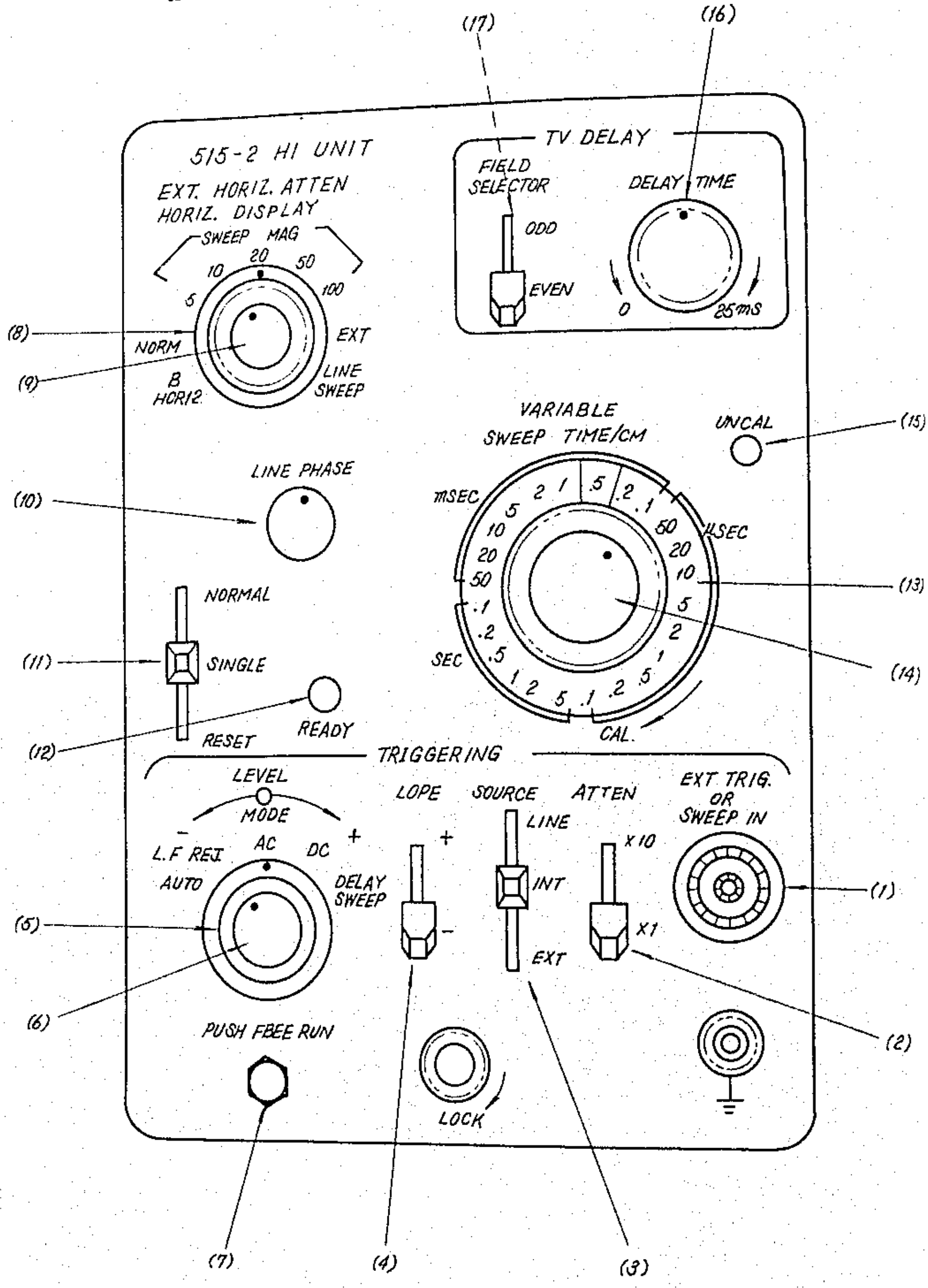
Also, "Comparison Voltage", when used, makes it possible to inset a comparison voltage to CH-B in case of attempting the observation of a DC phenomenon at a place like A where +B is being fed. In this case, put CH-A on DC Amp, then touch the A point, and by adjusting the comparison voltage cancel +B, so that the DC phenomenon can be observed.

"A VERT, B HORIZ" is able to make Lissagjous' figure by deflecting A and B vertically and horizontally. In this case, both CH-A and CH-B are wide-band and can be used as DC Amplifier, so that the equipment can be used as XY oscilloscope from DC to 15Mc.

Also, use of the terminal CH-B Out (x5) will offer amplification by CH-B and further amplification by CH-A, so that the equipment can be used as a very high sensitive oscilloscope.

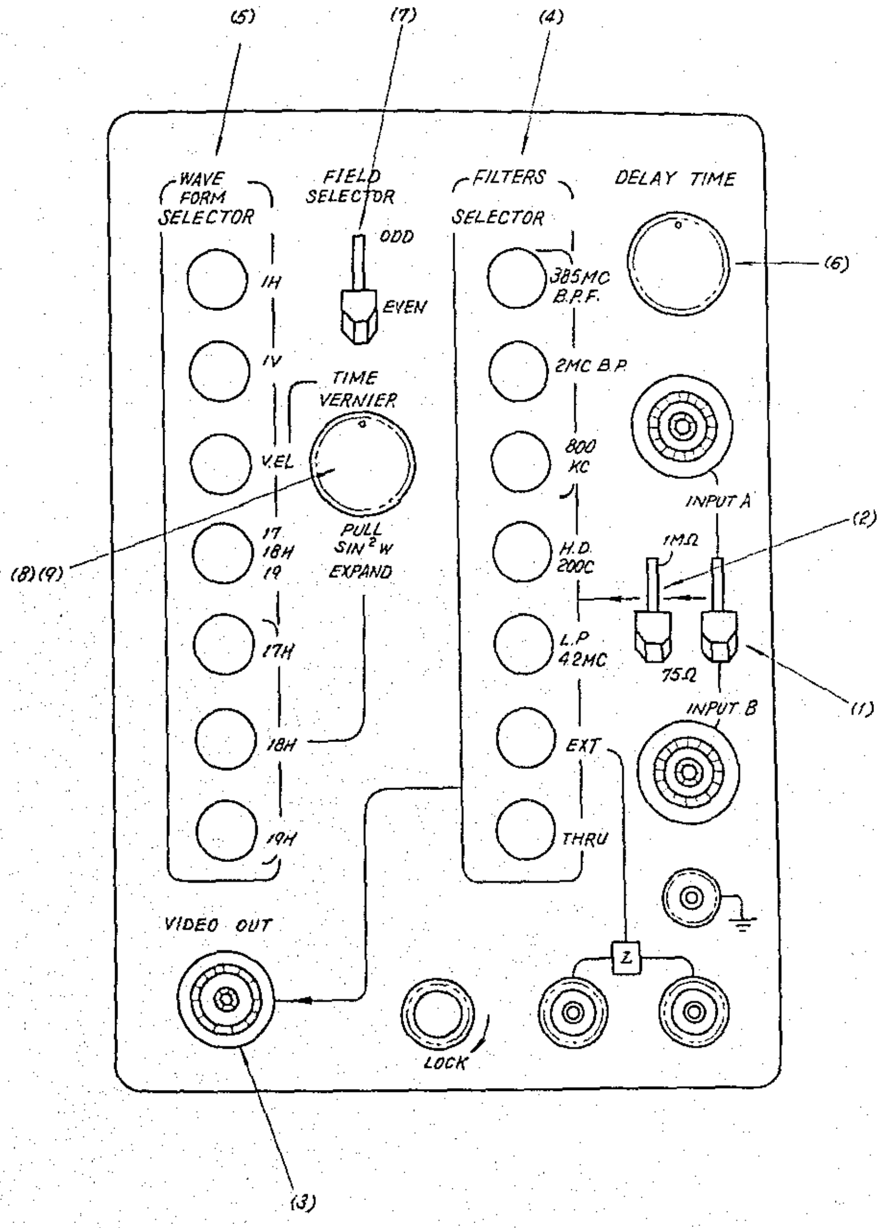


Horizontal Sweep Unit (for ordinary use)

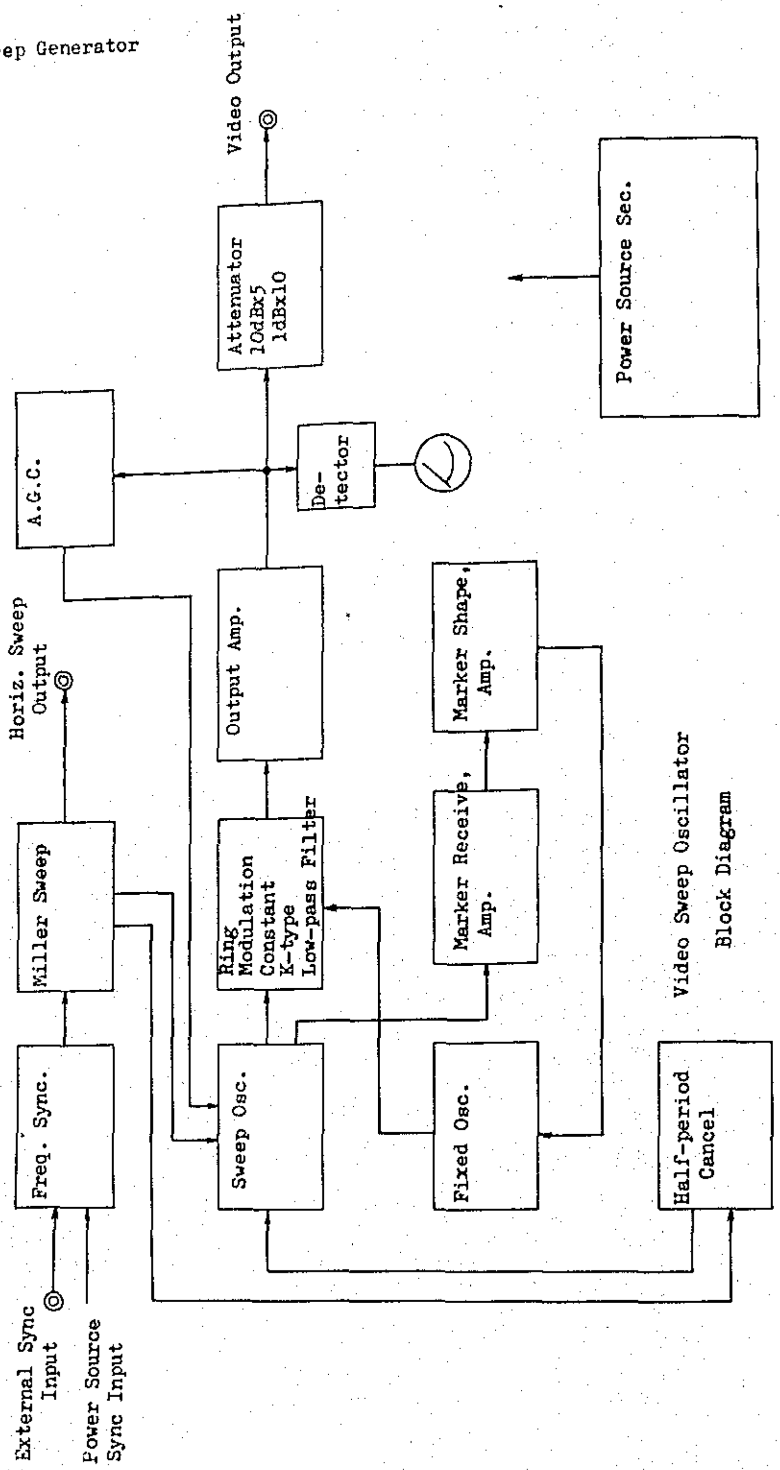


This is a special unit of horizontal sweep called H-2 Unit.

Pushing a push-button will perform delayed sweep where the vertical synchronizing signal is present.



2. Sweep Generator



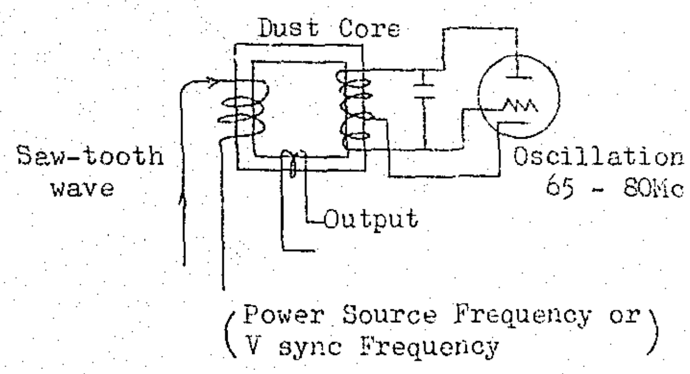
Video Sweep Oscillator
Block Diagram

The video sweep generator is the equipment which generates a kind of FM wave of the constant amplitude of about 0 - 15Mc. The above diagram shows its construction.

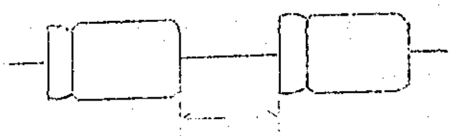
It generates 65Mc at the fixed oscillator and, on the other hand, performs the sweep oscillation of 65Mc - 80Mc at the sweep oscillator, and these two, when a beat is produced by the ring modulator, turn into the sweep signal of 0 - 15Mc, which is taken out through amplification by the video amplifier, eliminating VHF component by the filter.

The step to perform this sweep oscillation is that, while oscillating above-mentioned about 65Mc by an oscillation coil which is wound on the dust core, the saw-tooth current of power source frequency or vertical sync frequency is set to flow by the other winding. This action changes μ of the dust core and varies the oscillation frequency into the states of a saw-tooth wave to let it conduct the sweep oscillation.

The reason why the oscillation frequency is made high on this occasion is that a higher frequency provides a large frequency deviation with slight variation of μ.



And half period of the sweep stops the oscillation, so that, as the half-period blanking, the zero level of a signal is made understandable.



Sweep Half-period Elimination

Also, it is provided with the manual and fixed markers.
For example, there are markers of 1, 2, 4.5, 7, 10 and 15Mc.

Some old type generators perform the sweep by the sine wave, not by the saw-tooth wave.

There are other models that conduct the sweep by the horizontal synchronizing signal or by 960c/s, besides by the power source frequency and vertical sync signal. 960c/s sweep is devised to be capable of checking the characteristic of each head as it synchronizes with the number of rotations of VTR rotating heads and by means of conducting one sweep during one head of four reproduces a signal.

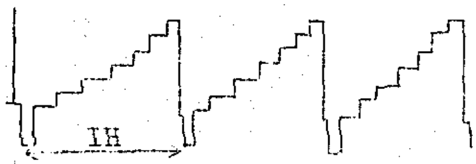
As a special type, there is one which mixes the blanking as in the case of passing through the synthetic pattern generator.

3. Synthetic Pattern Generator (Television Test Signal Generator)

This is the equipment which generates signals necessary for testing television circuits, attaching the blanking and composite sync signals as in the case of video signal.

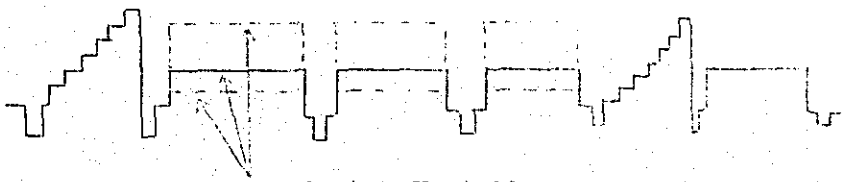
Signals possible to take out are:

(1) Stair-case Wave



In case of 50% mean value

The signal with 50% mean value as shown in the above figure and the one whose mean value (APL, Average Picture Level) is variable as seen in the following figure can be selected.

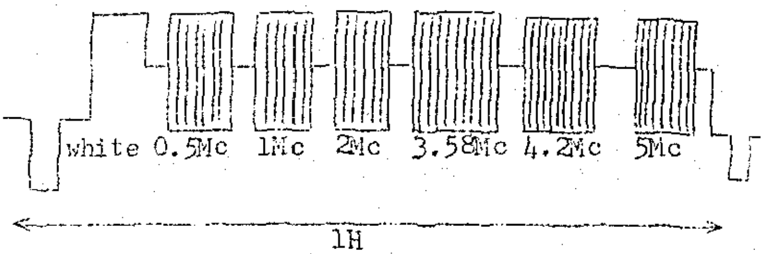


And, the sine wave of 800Kc or 3.58Mc can be superposed on this stair-case wave.

By these signals, checking of the linearity of an amplification system for the signal with an arbitrary mean value can be made.

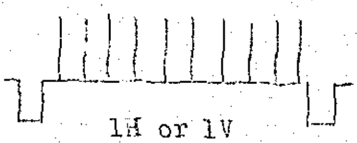
Especially, when 800Kc or 3.58Mc is superposed, the arrangement that, using a filter, extracts superposed wave components of the output and observes variations of its amplitude at each stair makes the measurement of DG (differential gain) possible.

(2) Multi-burst

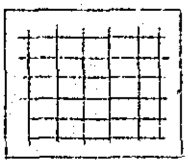


As illustrated, sine waves of different frequencies are arranged in this case, with which the frequency characteristic can be checked easily.

(3) Bar Signal



As illustrated, ten or more white pulses or black pulses are arranged between 1 H or 1 V, which look like a grid on the monitor, and by this, checking the linearity of monitor deflection can be made. (Switching of white grid and black grid is provided)

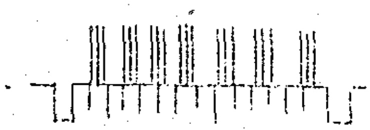


Monitor Screen

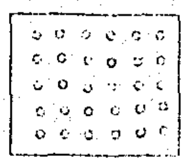
12 Lines

16 Lines

(4) Dot Signal

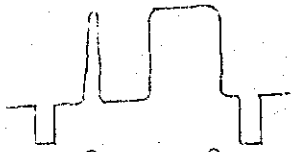


As shown in the figure, it is the signal with pulses arranged between 1 H or 1 V, and on the monitor it appears as the arrangement of dots, so that it is used for the convergence of color monitor.



Monitor Screen

(5) Sin^2 Bar, Sin^2 Pulse (cf. IV Explanation)



Shown here are pulse and bar whose rises are made proportional to sine square, and they are getting to be used since the conventional rectangular wave test proves too severe to fit the actual circumstances.

The width of a test pulse is expressed by the width when its amplitude becomes 1/2 and indicated by HAD (half amplitude duration).

In case of sine square pulse whose HAD is T, harmonics decrease to $\frac{1}{2}$ of the fundamental wave at the cut-off frequency expressed by f=1/2T and will become 0 at 2f. Various HAD are determined according to the cut-off frequency f of transmission system.

Pulse of T=1/2f is called T pulse, its twice 2T pulse and its $\frac{1}{2}$ $\frac{1}{2}$T pulse.

In Japan, as f = 4Mc.

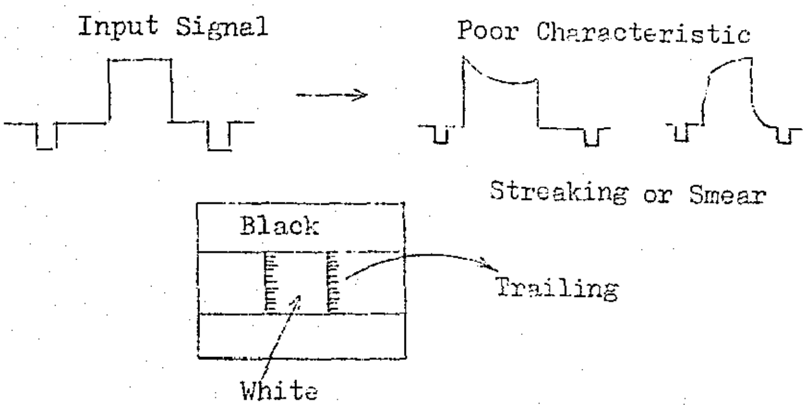
2T pulse	HAD = 0.25μs
T pulse	HAD = 0.125μs
$\frac{1}{2}$T pulse	HAD = 0.063μs

Sin^2 pulse is suitable for finding characteristic around the cut-off frequency, and sin^2 bar is fit to find characteristics in the medium and lower ranges.

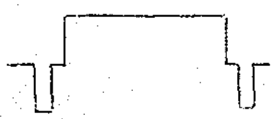
For the check, a special scale is held to the oscilloscope and the measurement is expressed by K (Rating Factor).

As to picture quality, it is understood that K = 3% is the limit and K = 5% is not fit for use.

And, $\sin^2$ bar is convenient for checking characteristics as it is devised to appear as a window signal on the monitor and will trail a streaking or smearing if the medium frequency range characteristic is bad.

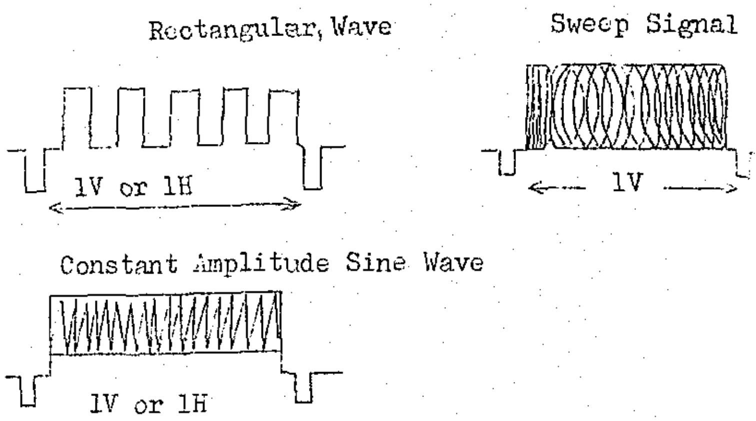


(6) White Signal



It is a signal like the above figure and can be used as a level control signal by setting the video on 0.7V and the sync on 0.3V.

(7) External Signal



As above-mentioned, the external insertion of rectangular wave signal, sweep signal and sine wave of the constant amplitude, etc. enables each signal to pass through the measured circuit which bears a clamp circuit.

4. Rectangular Wave Generator

As the name implies, this is the equipment that generates the rectangular wave forms of 60c/s, 1Kc, 15Kc, 250Kc and 1Mc, and these frequencies are normally fixed, however, slight variation is also possible. They are also able to synchronize with the sync signal fed from the outside, and there are other models with their frequencies made variable continuously, also symmetry is variable.

Among these frequencies, 60c/s rectangular wave, which is used for checking the lower range frequency characteristic of amplifier, measures so-called sag.

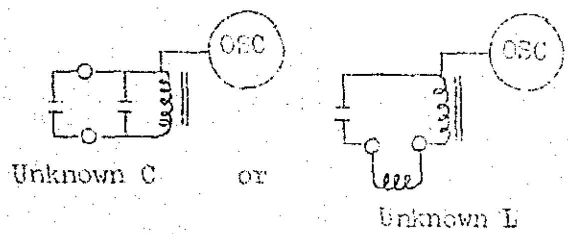
And, 250Kc rectangular wave, which is for checking the characteristic of high range frequency, measures rising time and overshoot, etc.

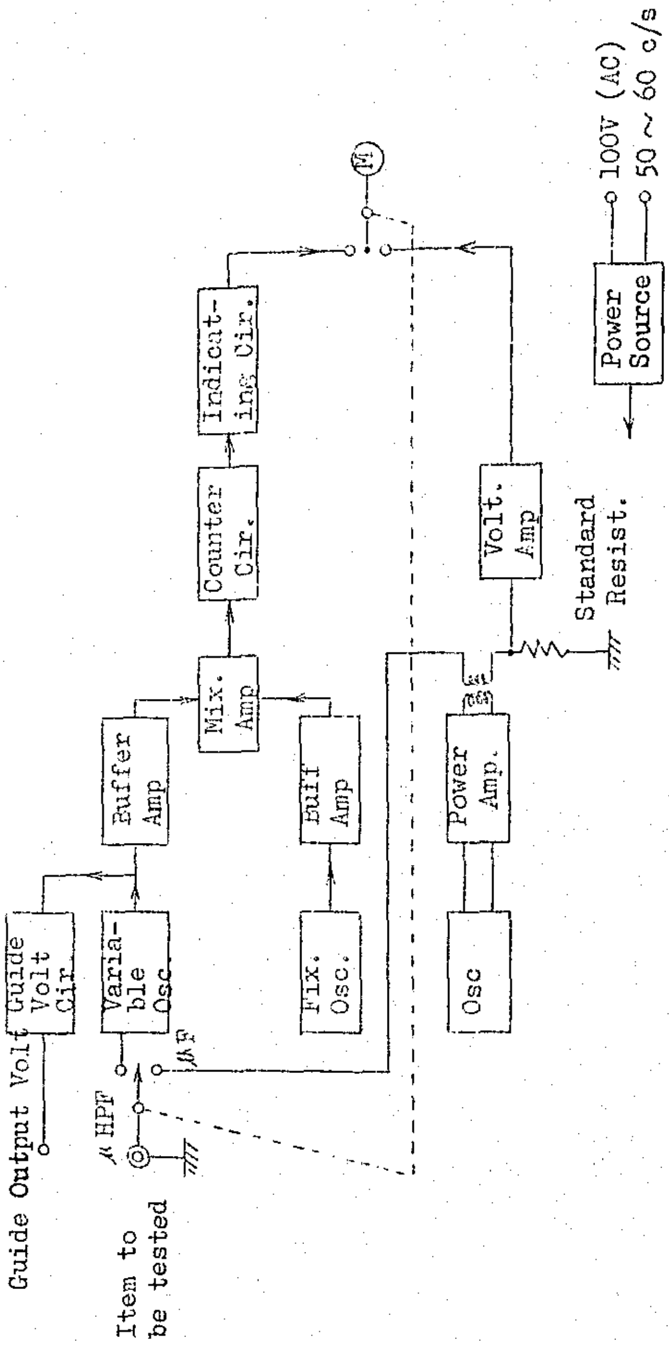
5. Wide-band Oscillator

It has two output terminals of 75 Ω and 600 Ω, and 75 Ω output takes out 10c/s - 10Kc, while 600 Ω output extracts 50c/s - 20Kc at balance. They are used to check the frequency characteristic by way of plotting and also applied for other usages.

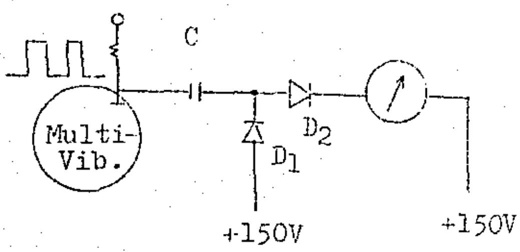
6. LC Meter

LC meter is a meter devised to read inductance or capacity directly. The principle is that it measures, by the pulse count detection, variations of an oscillation frequency introduced by connecting to the circuit C or L which is wanted to measure, and mixing




Guide Output Volt
Guide Volt Cir.
Item to be tested
μ HPF
μF
Varia-ble Osc.
Buffer Amp
Fix. Osc.
Buff Amp
Mix. Amp
Counter Cir.
Indicat-ing Cir.
M
Osc
Power Amp.
Standard Resist.
Volt. Amp
Power Source
100V (AC)
50 ~ 60 c/s

of this oscillator and local oscillator will cause beat down, which is then converted to rectangular waves by the multivibrator and fed to the pulse count detection circuit.



Utilized are such actions that, at first, C is charged through D_1, then D_2 will cause discharge when a pulse arrives, and the discharge current which flows in the meter is proportional to the charge charged in C and also porportional to a repeating period of the pulse, thus causing the meter indication to change according to the variation of input rectangular wave.

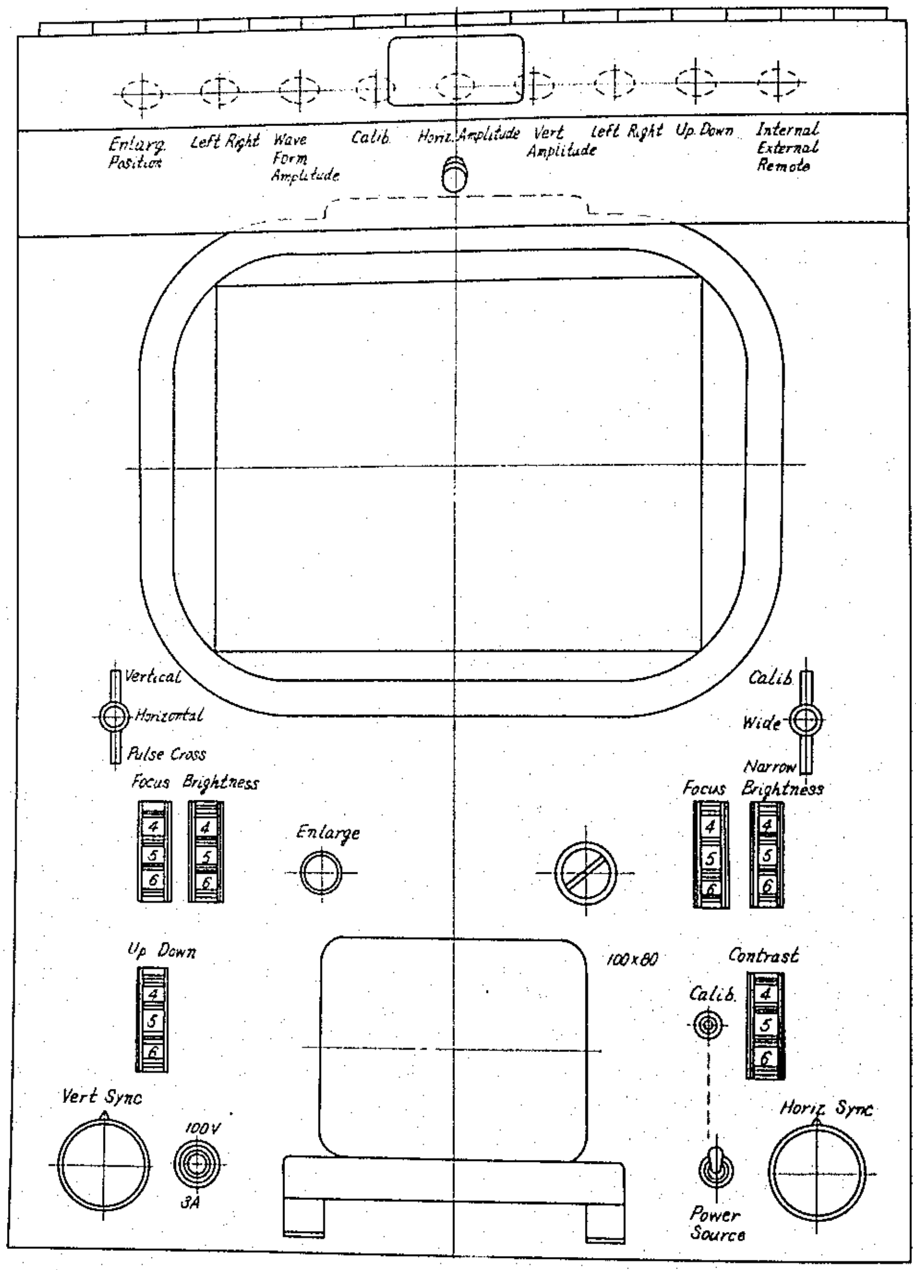
Also, for a high capacity C, the signal from the oscillator is added to C and at this time the meter will indicate the current flowing in the standard resistor.

7. Master Monitor

This is the equipment used for checking the picture quality and level, etc. of video signal and made up of the combination of picture monitor and oscilloscope.

The wave-form monitor performs deflections of 2-H and 2-V. Also, both the picture and the wave-form monitors are able to perform expansion to make the area of vertical sync signal well visible. Other models that separate the wave-form monitor and the picture monitor are also available recently.

Front View



Enlarg. Position
Left Right
Wave Form Amplitude
Calib.
Horiz. Amplitude
Vert Amplitude
Left Right
Up Down
Internal External Remote
Vertical
Horizontal
Pulse Cross
Calib.
Wide
Narrow
Focus
Brightness
Enlarge
Focus
Brightness
Up Down
100x80
Contrast
Calib.
Vert Sync
100V
3A
Power Source
Horiz. Sync

MEASURING INSTRUMENT

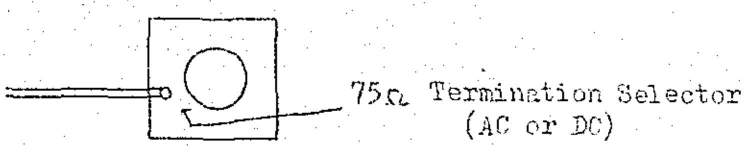
II. METHOD OF MEASUREMENT

1. Measurement of Level

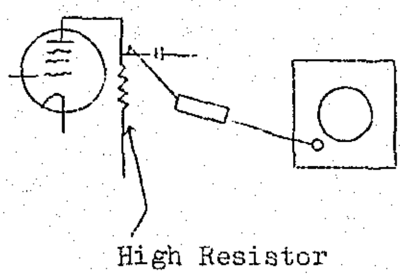
The television signal level is generally indicated by Peak-to-Peak (P-P) because its effective value and mean value will vary according to the wave form.

Since the calibration is made by the sine wave, vacuum tube voltmerter (VTVM) is unable to measure the television signal, therefore, oscilloscope or master monitor is generally applied for the measurement of level.

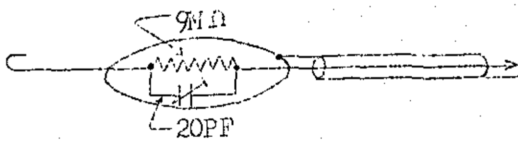
And, also when the measurement of level at the tip of a coaxial cable is intended, it is necessary for the measurement to terminate by 75 Ω characteristic impedance of the coaxial cable. Some oscilloscopes are equipped with 75 Ω terminating resistor in the inside. In such a case, select the input selector to "75Ω" as shown in the figure. For the oscilloscope without this, 75 Ω terminator of penetration type needs to be attached to the oscilloscope.



On the occasion of measuring amplifiers and between other stages, which are easy to suffer the influence of stray capacity because of being high impedance caused by reasons such as high load resistance etc., the direct connection of an oscilloscope may cause the level, wave form and frequency

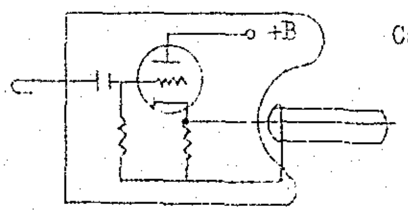


characteristic to change due to input impedance of (about 1M Ω 50PF) of oscilloscope. In this case, high impedance probe (10MΩ, 20PF) are employed for lessening the influence.



A high impedance probe like the above sketch works to increase the input resistance by ten times and to decrease the input capacity slightly, but as the level drops to 1/10, it must bear in mind that there exists a level which is ten times the value of actual measurement at the time of measurement.

Besides this kind, as a probe of low input capacity there is a cathode follower probe.

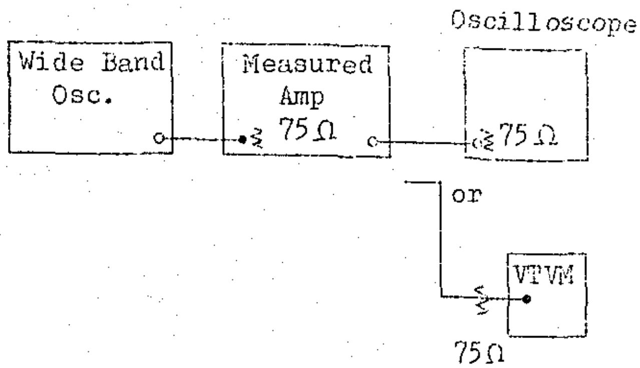


In this case, the input capacity becomes about 2 -5PF, however, power source for the probe has to be obtained from the oscilloscope side.

2. Measurement of Frequency Characteristics

(1) Plotting Method

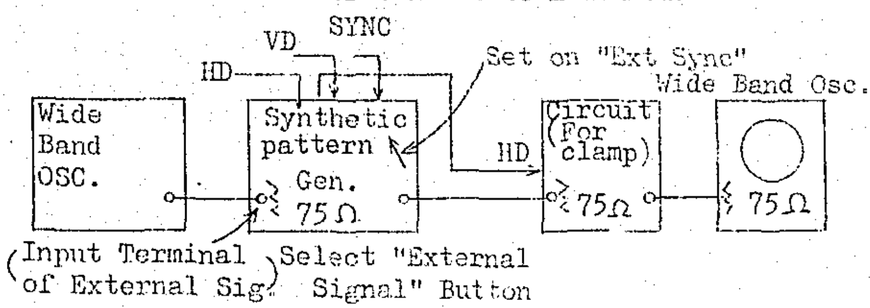
(a) In case of measuring a circuit without clamp.



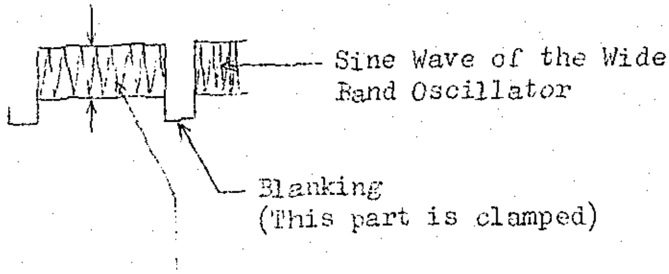
The step is that, by the above arrangement, vary frequencies of the oscillator, measure levels by the oscilloscope or by VTVM and draw the results on the graph. In this case, the output of the amplifier needs to be terminated by 75Ω and characteristics of VTVM or oscilloscope must be sufficiently flat in the range of measuring frequencies.

(b) In case of measuring a circuit with clamp.

In this case, if the oscillator signal is fed directly to the clamp circuit, the measurement becomes impossible because of the upsetting wave form due to clamp influence, therefore, the signal has to be mixed with the blanking signal by insetting the oscillator output to the external signal terminal of synthetic pattern generator and then fed to a circuit to be measured.



In this case, the output of the pattern generator becomes similar to the following sketch.

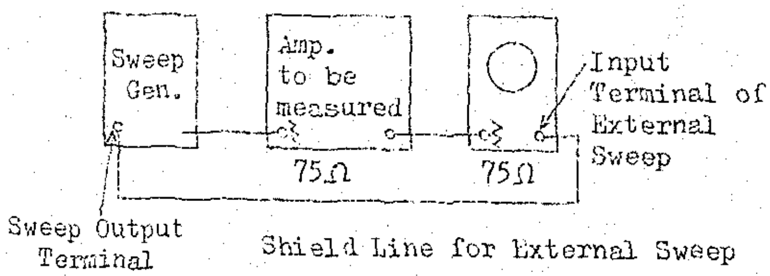


In case of measuring by the oscilloscope, amplitude of this part is measured on each frequency.

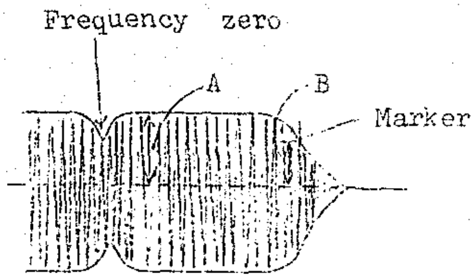
(2) Sweep Method

This is the way of using of sweep generator, and one convenience is that characteristics can be observed at one glance, however, characteristics below 100Kc are impossible.

(a) In case of without clamp

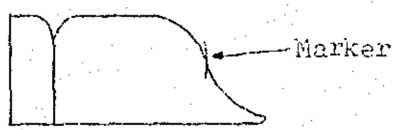


It is performed under the above connection and the wave form appearing on the oscilloscope is:



In this case, make the amplitude at the flat portion near zero frequency A, and tune the marker dial of the sweep generator to a frequency desired for the response measurement, then measure amplitude B at the position of the maker appearing on the wave form on this occasion, then take B/A, which becomes the response at its frequency. If 20 $\log_{10}$ B/A is taken, dB is its representation. Also, dB scale is generally attached to the scale of oscilloscope, therefore, direct reading of dB is possible by adjusting A portion to 6 cm.

The above referes to a case that uses a wide-band oscilloscope, however, when a narrow-band oscilloscope is employed, use of a detection probe will do, and the wave form appearing on this occasion will be as follows:

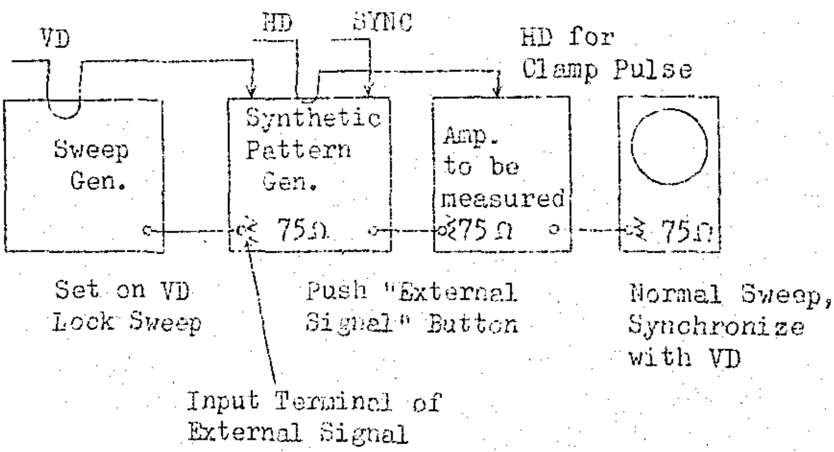


And, shield lines for the external sweep use are the lines for the purpose of performing sweep of the horizontal axis of oscilloscope by signals

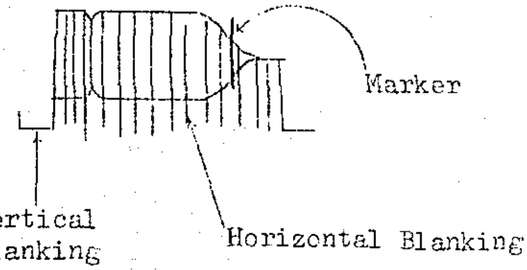
from the sweep generator. However, its application is not necessary when a commercial power source to be used for the sweep generator is the same with the commercial power source being used by the oscilloscope. In this case, it is convenient that the same wave form can be obtained by selecting the oscilloscope to the power source sweep (Line Sweep) and then by controlling "Line Phase". (Only in case of sinusoidal sweep)
Also, observation by internal sync or line sync becomes possible by turning the oscilloscope to the normal sweep.

(b) In case that clamp is present

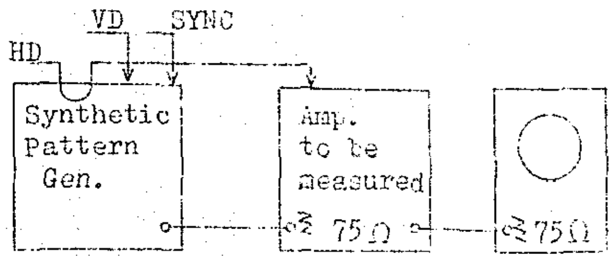
Connection in this case resembles to "in case of with clamp", that is, the synthetic pattern generator is used.



In this case, for the sweep generator, put in VD and make the sweep to be synchronous with VD by setting the sweep selector on "V".

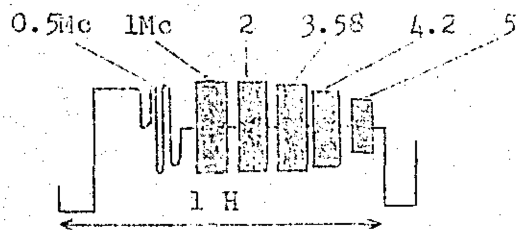


(3) Multi-burst Method



Select "Multi-burst" Button

In this case,



the result will show a figure like the above sketch to make frequency responses understandable.

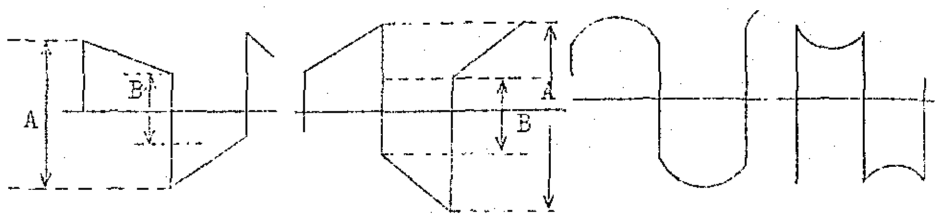
3. Measurement of Rectangular Wave Characteristic

It is measured by feeding the output of a rectangular wave generator to the amplifier to be measured and then by connecting its output to the wide-band oscilloscope.

(1) In case that the frequency of rectangular wave generator is set on 60c/s.

In this case, checking of low-band characteristics of the amplifier is possible, and four wave form distortions will rssult because of characteristics.

(a) (b) (c) (d)



(a)	(b)	(c)	(d)
Phase advance at low freq.	Phase lag at low freq.	Gain increase at low freq.	Gain decrease at low freq.

The cases (a) and (b) are called as occurance of sag and when viewed on the monitor it will appear as a vertical shading.

$$\text{Sag} = \frac{A - B}{A + B} \times 100\%.$$

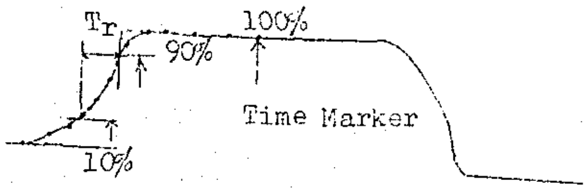
As shown, it is indicated by percentage.

In this case, it is necessary to use an oscilloscope which has no sag in itself. (It is advisable to put the oscilloscope on DC.)

(2) When frequency is made 250Kc

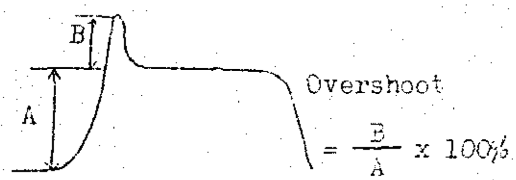
On this occasion, check of high band characteristics of the amplifier is possible.

(a) Rise Time



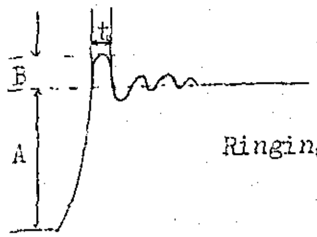
This is measured with time markers by enlarging the rising portion of rectangular wave. From the number of time markers at the portion of vertical amplitude from 10% to 90%, rising time will be known. Rising time is related to the band width of amplifier.

(b) Overshoot



This is caused due to a distortion appearing in the phase characteristic nearby the cut-off frequency in case high band cutoff characteristics are very sharp, and on the monitor, white or black slender lines will appear at the boundary between white and black.

(c) Ringing

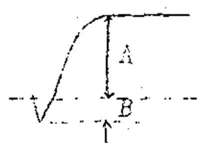


$$f = \frac{1}{2t}$$

$$\text{Ringing} = \frac{B}{A} \times 100\%$$

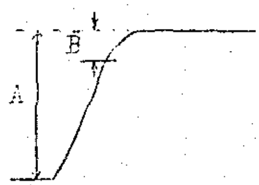
Similarly to overshoot, ringing is caused due to high band cutoff characteristics. Cutoff frequency can be found from f=1/2t

(d) Undershoot (leading white)



$$\text{Undershoot} = \frac{B}{A} \times 100\%$$

(e) Smear



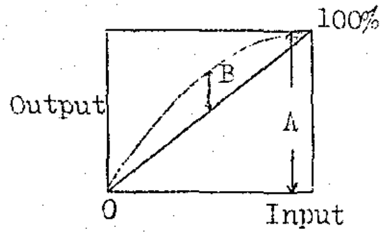
$$\text{Smear} = \frac{B}{A} \times 100\%$$

(3) 1Kc Rectangular Wave

This is used to check medium band characteristics.

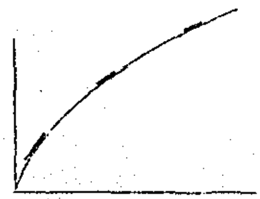
4. Measurement of Linearity

This is generally performed by the method called D.G. (Differential Gain). However, conventional practice was

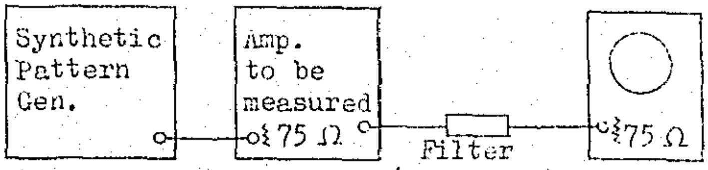


that it was indicated as $\frac{B}{A}$ x 100% by taking a portion of maximum deviation between a straight line which joines 0 and 100% and a cruve of the actual measurement and then presuming the portion as B.

D.G. is the ratio of slight variation of the output to slight variation of the input of this linearity curve (that is, inclinations of small portions).

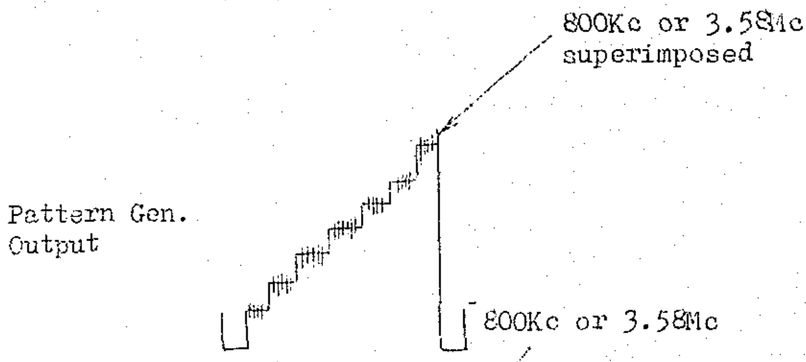


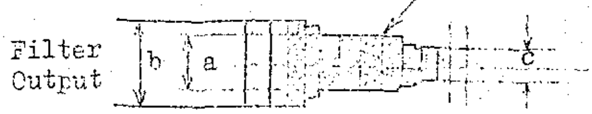
For this measurement, arrangement is to be made as follows:



Superimpose
800Kc or 3.58Mc

Select a button
to "Stair-case Wave"





Black Level DG

$$= \frac{b-a}{a} \times 100\%$$

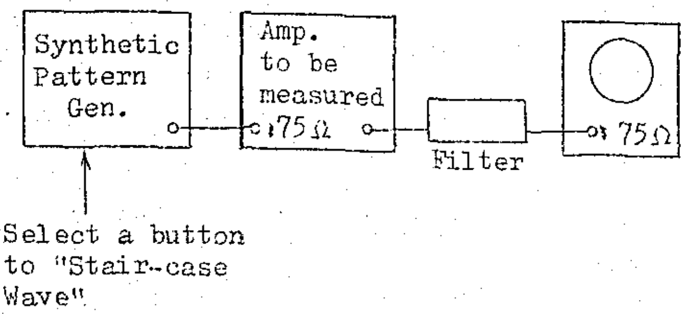
White Level DG

$$= \frac{c-a}{a} \times 100\%$$

(+ is stretch, - indicates compression)

5. Measurement of S/N

There are two cases that the measurement is performed by peak value or by effective value.



In the above figure, the oscilloscope employes a high gain amplifier (maximum 0.005 v/cm). First, measure P-P value of stair-case waves and convert the value to dB (1Vpp=0dB). Suppose this as A dB.

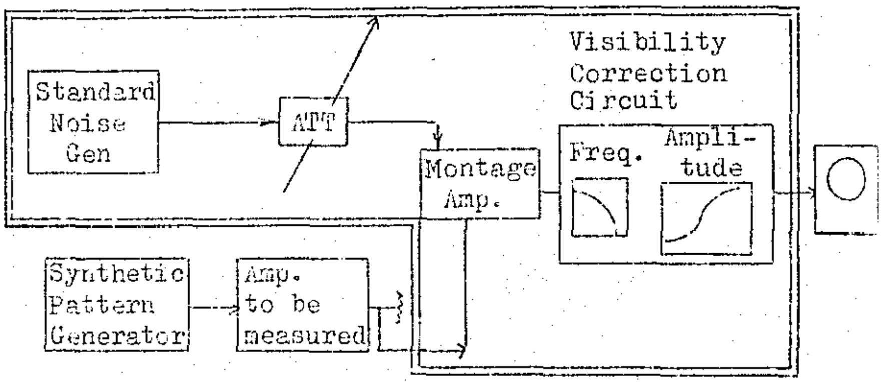
Next, increase the sensitivity of the oscilloscope and measure by enlarging noises on the stair-case waves and then convert to dB, and when they are supposed as B db (1Vpp=0dB), find out P-P S/N as:

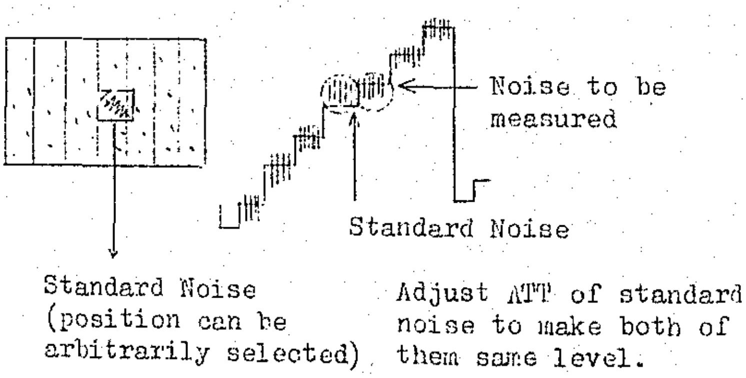
S/N = B dB - A dB

In case of indicating by effective value, make B dB - 16 dB. In addition, in case of actual observation by humans eye, the sensitivity will differ with frequency components of signal and also with white and black, therefore, the practice is further to add a correction factor of-(7 - 9)dB cadculated according to the visibility weighting curve. However, in this case, remarks (visibility correction) must be written after the data.

Also, in the above figure, for the filter, use 4.2Mc low-pass filter in measuring pulse noises. In case of measuring hum noises, use 200c/s low-pass filter. On this occasion, the input is, of course terminated by 75Ω as non-input. Next, remove the filter, then feed staircase waves from pattern generator and measure its output level, and suppose this as A dB.

Also, noise measuring instruments are being manufactured. They are devised to perform the measurement in such a way that calibrated ATT is fed to the output of standard noise generator, which output and the output signal of instrument to be measured are fed to a "montage amplifier" so as to insert the standard noise to an arbitrary portion of the signal which superimposes noises and after adjusting ATT to make the adjacent portion of both noises same level, S/N ratio will be known from the ATT scale. They are also attached correction circuits of visibility weighing.





TRANSMITTER PERFORMANCE AND METHOD OF TESTING

III. TRANSMITTER PERFORMANCE AND METHOD OF TESTING

1. Range of Application

This specification is applied to the performance and methods of testing of television transmitters for channel 1 to 12 of Japanese Television Standard.

2. Meaning of Symbol

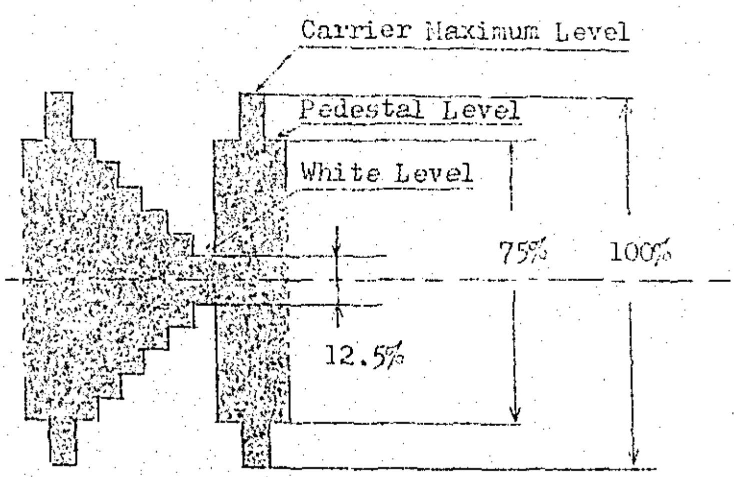
It is described in Appendix 1, however, those relevant to measuring instruments are shown in Appendix 2.

3. Meaning of Terminology

3.1 Normal Modulation of Visual Transmitter (V. TX).

It means that the visual transmitter shall be modulated to the levels shown in Fig. 1.

Fig. 1



3.2 Pure Black Modulation Time

It means the state that the pedestal is modulated to 75% of the carrier maximum level by the synchronizing signal.

3.3 Modulation Degree of Aural Transmitter (A. TX)

It means a frequency deviation expressed in percentage with the frequency deviation of ±25Kc as reference.

3.4 AC, DC Coupling

At the video modulator (V. MOD), the state in which a clamp takes place is called DC coupling and the state in which the clamp does not take place is called AC coupling.

3.5 VS Signal Wave Form

It means wave forms superimposing arbitrary picture signals on the synchronizing signal.

4. Conditions for Testing

4.1 Standard State of Testing

It means the state that temperature is 20°C and relative humidity is 65%, however, a state that lies in the temperature range of 5 - 35°C and humidity 45 - 85% may be regarded as the standard states of testing.

4.2 Power Source Voltage and Frequency

The voltage is specified separately, and frequencies shall be 50 and 60c/s. However, when the voltage variation is within 1.5% and the frequency variation is within 1c/s, it may be regarded as standard.

4.3 Load

The dummy load (DA) to be used for testings must have the following specification and performance.

4.3.1 Rating

(1) Input Impedance: 50Ω

(2) Frequency Range: (-)1.25 - 4.75Mc of the video carrier which is specified separately.

(3) Power: To be specified separately.

4.3.2 Performance

(1) Voltage Standing Wave Ratio.: To be below 1.07 within the specified frequency rage.

(2) Temperature Rise.: The temperature rise of a cooling medium (oil or water) when operated at the rated power is to be below 80°C.

4.4 Meter and Measuring Instrument

Meters and measuring instruments to be used for testings are as shown in Appendix 2, and they must be those calibulated previously.

4.5 Standard Prescription Power

4.5.1 Definition

For the visual, it means the power as much as 1.68 times the power to be consumed by DA at the time of pure black modulation, and for the aural, it means the power to be consumed by DA at the time of carrier.

4.5.2 Prescription : The classification of standard prescribed outputs is shown in Table 1, from which the power is specified.

Table 1

Visual	250W	1.0Kw	5Kw	10Kw	50Kw
Aural	62.5W	0.25Kw	1.25Kw	2.5Kw	12.5Kw

5. Performance and Methods of Testing

5.1 General

5.1.1 Vacuum Tube Loss and Filament Voltage

Definition : It means the loss to be consumed at each electrode of a vacuum tube, and the voltage to be fed to the electrode of a filament.

Prescription: Losses and filament voltages are subject to working standards specified separately.

Method : (a) Loss

(1) Class A amplifier Loss. Calculate by the following formula. (Specified Electrode DC Voltage) x (Specified Electrode AC Current).

(2) High Frequency Amplifier Loss.
Within the permissible loss, give already known DC loss, and measure in advance temperatures of the tube wall or cooling water and wind, etc., and draw calibration curves, of temperature versus loss, then from the temperature of the above-mentioned point in the operating state of the prescribed output, calculate the loss of each electrode at the time of operation.

Note As for the prescribed output, it is specified in 5.5.2 and 5.6.2.

(b) Filament Voltage

In principle, the filament electrode voltage is examined by the 0.5 class voltmeter.

5.1.2 Tolerance of Carrier Frequency

Definition : It means a deviation of the carrier frequency to the prescribed frequency.

Prescription: Unless otherwise specified, frequency deviation, both video and audio, are to be within ±500c/s from the prescribed frequency, and the frequency difference between video and audio is to be within 4.5Mc ± 500c/s.

Method : The operation state of the visual transmitter is set on the carrier level of about 50% of the carrier maximum level corresponding to the prescribed output, and the operating state of the aural transmitter is set in the prescribed output of non-modulation, then use the frequency counter for the measurement.

5.1.3 Maximum Temperature

Definition : It means an absolute value of the maximum temperature of each part of the equipment measured in operation or immediately after the operation in the standard state of testing and the prescribed output.

Prescription : To be below 90°C except specific heating elements, and do not exceed the limits for components whose maximum temperatures are specified.

Method : With each door tightly sealed and immediately after 6 hour continuous running, measure temperatures of components and inside the panel by the thermometer.

5.1.4 Insulation Resistance

Difinition : It means the insulation resistance of an insulated circuit which contains a power source input circuit or that of a component.

Prescription : To be as shown in Table 2.

Method : Measure between each circuits or between each circuit and earth by 1000V or 500V insulation resistance tester

Table 2

Classification by Circuit	Insulation Resistance	Remarks
Above DC 1000V	Above 30MΩ	Measure by 1000V Ins. Res. Tester
Below "	" 10 "	" 500 "
Above AC 250V	" 30 "	" 1000 "
Below "	" 10 "	" 500 "

5.1.5 Pressure Resisting

Difinition : It means that there should be nothing unusual with a test insulator after being fed a test voltage of severer value than its maximum working voltage.

Prescription: There should be nothing unusual when the voltages shown in Table 3 are fed for one minute.

Method : Feed between circuits a test voltage of DC or AC (commercial frequency and make it as close to a sine wave as possible and take the peak value), and examine whether to be bearable.

Table 3

Circuit	Test Voltage
Above DC 250V	Twice the maximum circuit voltage
Below "	DC 500V
Above AC "	Twice the max. circuit vol. + 1000V
Below "	AC 1500V
Above DC High Frequency Superimposition 250V	Three times the max. circuit voltage

Note: Both the insulation resistance and pressure resisting will exclude specific parts such as electrolytic condensers, shunt resistors and vacuum tubes, etc.

5.1.6 Stability

(a) Circuit Stability

Definition : It means the stability of a circuit to abnormal oscillations.

Prescription : There should be no abnormal oscillations.

Method : Stop an excitation and set on class A operation, then examine the presence of the oscillation by setting the plate loss to the rated state, also during the above testing, examine a case where variable turning elements are changed.

(b) Stability of Continuous Running

Definition : It means a stability of the output within the prescribed time operated in the state of prescribed output.

Prescription: The output variation in case of operating continuously for one hour is to be within ±5%, and there should be nothing unusual at each part.

Method : In the state of the prescribed output, run the transmitter for one hour continuously, and examine the presence of any abnormality at each part.

(c) Stability of Intermittent Running

Definition : It means a stability of the output in case of repeating intermittent runnings of the prescribed number of times at prescribed intervals in the running condition of (b).

Prescription: There should be no output variation and abnormality at each part.

Method : In the state of the prescribed output, insert a switch to the electric supply source of the transmitter, and manually repeat to switch on and off the electric supply source 5 times at intervals of about 5 seconds, and check the presence of any abnormality at each part.

(d) Stability for Variation of Modulation Degree

Definition	:	It means a stability of the output in case of repeating conditions of pure black and pure white modulations at intervals of prescribed time in the running condition of (b).
Prescription	:	There should be no output variation and abnormality at each part.
Method	:	In the state of the prescribed output, provide conditions of pure black and pure white modulations 5 times, each intermittently for one second, and examine the presence of any abnormality at each part.

(e) Stability at the time of start

Definition	:	It means a stabilized state of the output within the prescribed time when start is made from total suspension.
Prescription	:	To be stabilized at +10%, -20% of the prescribed output within one minute after starting from total suspension (except oscillators) and feeding a high voltage.
Method	:	Calibrate in advance the indication of the output meter and measure the output after prescribed time.

5.2 Video Modulator (V. MOD)

Method : In case of performing the test, adjust the gain of video transmitter in advance for making it possible to achieve the normal modulation at the standard prescribed output by the rated input level.

Note: Rated output levels are to be prescribed in the specification of visual transmitter.

Also, a sync amplitude of the input signal is to be matched to the rated input level except only 5.5.2 Non-linear Distortion.

5.2.1 Amplitude Frequency Characteristic

Definition : It means an amplitude frequency characteristics at the grid of a modulated power amplifier when it is treated as load with its high voltage and filament voltage cut off.

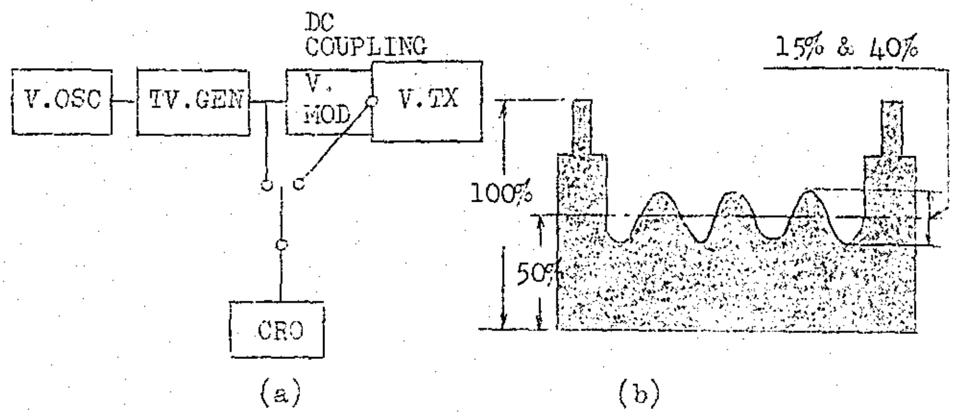
Prescription: To be within +0.5, -2.0dB inside the range of 50c/s - 6Mc with 100Kc as reference.

Method : By Fig. 2(a), set V. MOD to DC coupling, and measure input and output on CRO.

With the modulated wave forms in Fig. 2 (b) as reference, which are modulated by VS signal superposed 100Kc sine waves, keep both the modulation input level and the superposed sine wave amplitude constant, and measure by varying the superposed sine wave frequency. (Superposed sine wave amplitudes are to be two kinds of 15% and 40%).

Record : Appendix 3.

Fig. 2



5.2.2 Non-linear Distortion

Definition : It means a distortion to be caused at V. MOD output due to a non-linear distortion of V. MOD.

Prescription : To be below 2% for the picture signal and below 5% for the synchronizing signal

Method : In the state of not correcting differential gain and differential phase, by Fig. 2(a), make a ratio of picture components of the input signal to sync components to be a white signal of 7: 3, then increase the input signal progressively from 0 to 1.1 times the V. MOD output voltage necessary for the normal modulation, and draw the relation of input to output as Fig. 3 and measure the maximum deviation between a curve of the actural measurement and a straight line, then calculate by the following formula.

Picture Component Non-linear Distortion

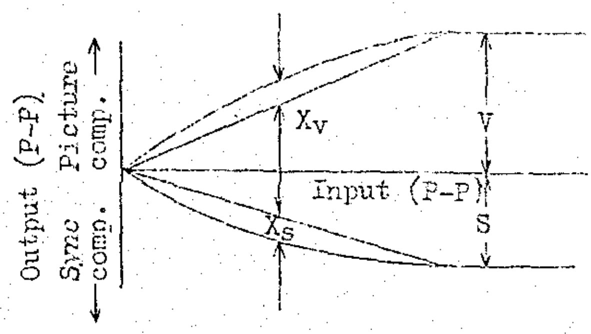
$$= \frac{Xv}{V} \times 100\ (\%).$$

Sync Component Non-linear Distortion

$$= \frac{Xs}{S} \times 100\ (\%).$$

Record : Appendix 4.

Fig. 3



Note: Xv Xs indicate maximum deviation.

5.2.3 Differential Gain (DG)

Definition : It means the percentage of a deviation of the superposed high-frequency on the other level with a portion as reference where an amplitude of the small amplitude high-frequency sine wave (3.58Mc) superposed on the staircase wave is regarded as constant.

Prescription : To be below 5%.

Method : In the state of not correcting differential gain and differential phase, perform according to a circuit corresponding to Fig.2 (a), and others shall follow the methods of testing of visual transmitter.

Record : Appendix 13.

5.2.4 Differential Phase (DP).

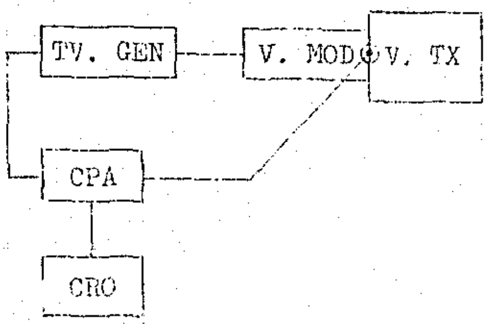
Definition : It means the phase difference of the small amplitude high frequency sine wave (3.58Mc) superposed on the other level of the stair-case wave form, with the phase of the sine wave at the pedestal level as reference.

Prescription : To be below ±5 degrees.

Method : In the state of not correcting differential gain and differential phase, perform by Fig. 4, and others shall follow the methods of testing of visual transmitter.

Record : Appendix 13.

Fig. 4



5.2.5 Improving Degree by Clamp Circuit

Definition : It means a degree of the improvement on pedestal level variation to be made by the clamp circuit.

Prescription: To be below -22dB at 60c/s.

Method : By Fig. 2 (a), make input signal to be the superposed wave of pure white signal and sine wave of 60c/s with more amplitude than that of sync signal, and by the following formula, calculate an improving degree of the hum when the amplitude of a residual 60c/s component at V. MOD output, which is superimposed on the pedestal level, is made to be e_n (P-P).

Hum Improving Degree

$$= 20\log \frac{e_n}{e_s} \text{ (dB)}$$

where, $e_s = e_h A_o$

e_h : 60 c/s component (P-P) at the pedestal level of the input signal.

Ao : Video Modulator Gain.

5.3 Vestigial Side Band Filter (VSBF).

5.3.1 Transmisstion Power (including Filter Plexer).

Prescription: The classification of transmission powers is to be made as shown in Table 4.

To be able to maintain each performance when the continuous running is performed with the power of +10% of both the video and the audio.

Method : Examine whether or not each performance can be maintained by transmitting a power (for video multiply 1.68) to be consumed at DA. at the time, regarding the video, modulated wave that is conducted pure black modulation and regarding the audio, carrier.

Table 4

Video	250W	1Kw	5Kw	10Kw	50Kw
Audio	62.5W	0.25Kw	1.25Kw	2.5Kw	12.5Kw

5.3.2 Temperature Rise (including Filter Plexer)

Definition : It means a difference between the temperature of each part of the equipment measured in use or immediately after the use and the peripheral temperature.

Prescription: To be as shown in Table 5.

Method : Measure by the thermometer immediately after the test of 5.3.1.

Table 5

Reflecting Element	Below 20°C
Split Baloon	" 15°C
Absorption Resistor	" 50°C
Others	" 20°C

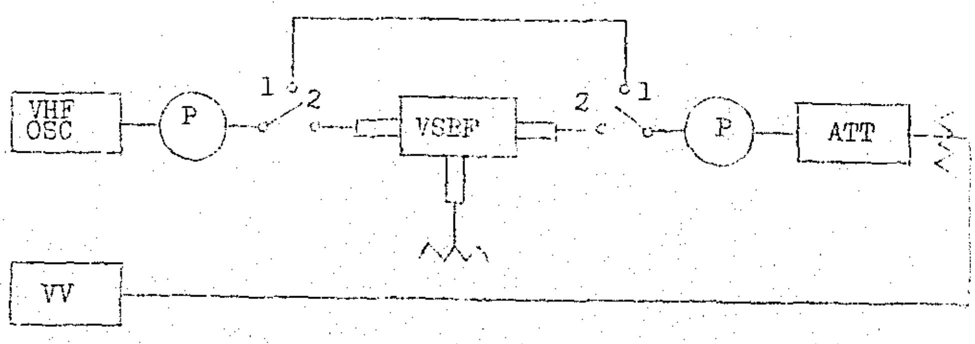
5.3.3 Insertion Loss (including Filter Plexer)

Definition : It means a ratio of the power fed to the input terminal at carrier frequency to the power which appears at the output terminal on this occasion.

Prescription: To be below 0.5dB. (The sound transmission circuit is included in case of filter plexer).

Method	:	By Fig. 5, in the state of connecting a standard resistor to the output terminal, connect the high frequency oscillator (VHF. OSC) to the input terminal, and control ATT to make the input terminal voltage of the valve voltmeter (VV) nearly constant, and measure by switching the output level for each frequency over 1 and 2. Also, calibrate VHF. OSC by the frequency counter, and make the pad (P) above 20dB.
Record	:	Appendix 6 and 7.

Fig. 5



5.3.4 Resonance Frequency of Reflecting Element (including Filter Plexer)

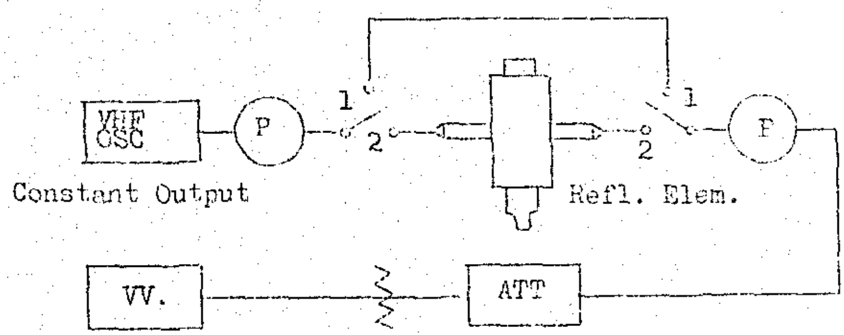
Definition : It means series and parallel resonance frequencies of a reflecting element.

Prescription: To be able to vary over 0.5Mc for the prescribed resonance frequency.

Method : By Fig. 6 and according to 5.3.6, measure the resonance frequency, then vary the resonance frequency of the reflecting element and examine whether to satisfy the prescription.

Also, calibrate each time the frequency of VHF. OSC by the frequency counter, and make P over 20dB.

Fig. 6



5.3.5 Input Voltage Standing Wave Ratio

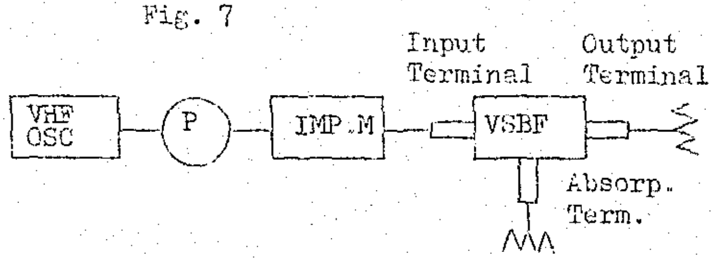
Definition : It means a ratio of the maximum amplitude to the minimum amplitude of a standing wave to be caused by impedance mismatching at the input terminal.

Prescription: To be within the permissible limits shown in Appendix 5.

Method : By Fig. 7, in the state of connecting a standard resistor to the output terminal, with the admittance measuring instrument (IMP. M) and within the prescribed frequency range, measure every 0.5Mc except where a variation is extremely conspicuous. Also, make P above 20dB.

Record : Appendix 5.

Fig. 7



5.3.6 Amplitude Frequency Characteristic

Definition : It means a deviation of the voltage which appears at the output terminal in case where an amplitude of the feeding voltage to the input terminal is made constant and the frequency is varied.

Prescription: To be within the permissible limits shown in appendix 6.

Method : By Fig. 5, control ATT to make the input voltage of VV nearly constant, then measure the output level for each frequency while switching it over 1 and 2 by SW. Frequencies for the measurement are those at maximum and minimum of the attenuation in the neiborhood of a resonance frequency of each reflecting element and -3.58Mc, -1.25Mc, -0.75Mc, -0.5Mc and 0Mc with the carrier frequencies, exceeding 0Mc are measured every 0.5Mc up to +4.2Mc.

Also, calibrate VHF. OSC by the frequency counter, and make P above 20dB in the pass band and above 10dB in the attenuation band.

Record : Appendix 6.

5.4 Filter Plexer (FP).

5.4.1 Input Voltage Standing Wave Ratio

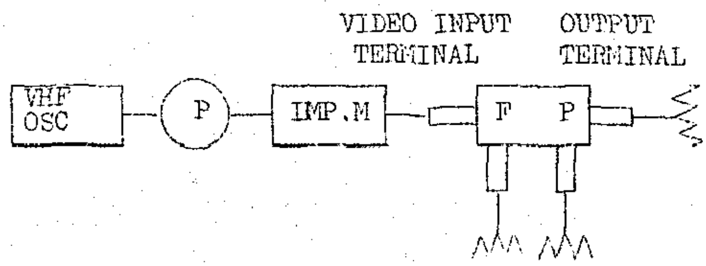
Definition : It means a ratio of the maximum amplitude to the minimum amplitude of a standing wave to be caused by impedance mismatching at the input terminal.

Prescription: To be within the permissible limits shown in Appendix 5.

Method : By Fig. 8, measure in the manner described in 5.3.5.
Also, when measuring an input standing wave ratio from the sound input terminal is intended, connect a standard resistor to the video input terminal and the admittance measuring instrument (IMP. M) to the sound (input) terminal.
Also, make P above 20dB.

Record : Appendix 5.

Fig. 8



5.4.2 Amplitude Frequency Characteristic

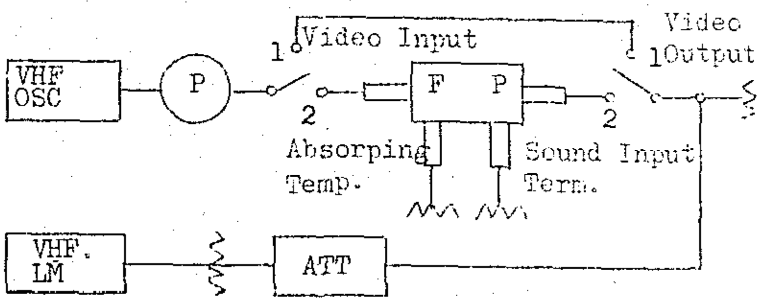
Definition : It means a deviation of the voltage which appears at the output terminal in case where an amplitude of the feeding voltage to the input terminal is made constant and the frequency is varied.

Prescription: To be within the permissible limits shown in Appendix 7.

Method : By Fig. 9 and in the manner described in 5.3.6, measure by connecting a standard resistor to the sound input terminal.

With the video carrier frequency as reference, frequencies for the measurement are +4.2Mc, +4.35Mc and +4.5Mc, and also +4.65Mc besides those in 5.3.6.

Fig. 9



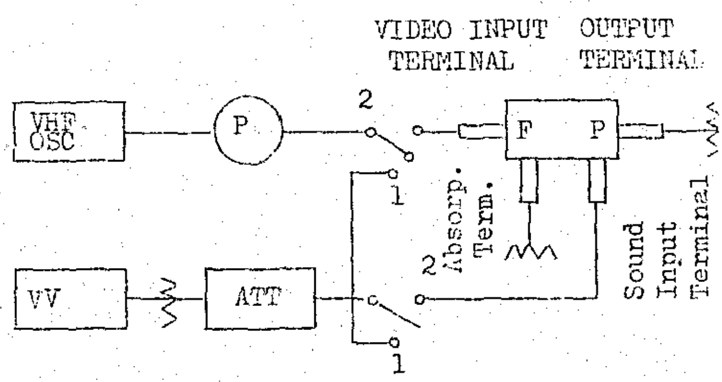
5.4.3 Leakage

Definition : It means a ratio of the voltage fed to the video input terminal to the voltage which appears at the sound output terminal on this occasion, and also means a ratio of voltages in the case opposite to the former.

Prescription: Leakage from the video input terminal to the sound input terminal is to be below -35dB in the range from -4.0Mc to +4.2Mc with the video carrier as reference, and leakage from the sound input terminal to the video input terminal is to be below -35dB in the range of ±100Kc with the sound carrier as reference.

Method : By Fig. 10, when measuring a leakage from the video input terminal to the sound input terminal is intended, connect a standard resistor to the sound input terminal, and measure a voltage of the sound input terminal each time the frequency is varied within the prescribed frequency range, and also when measuring a leakage from the sound input terminal to the video input terminal is intended, connect a standard resistor to the video input terminal and measure in the same way. And, make P above 20dB.

Fig. 10



5.4.4 Envelope Delay Time

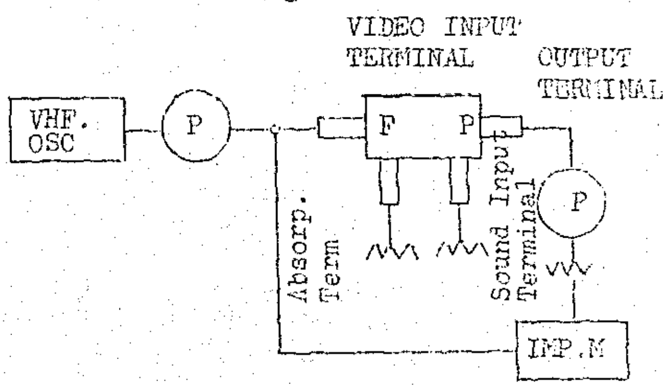
Definition : It means the primary differential characteristic of a phase to an angle frequency from video input terminal to output terminal

Prescription: To be within the permissible limits shown in Appendix 8.

Method : By Fig. 11, measure a phase angle between the video input terminal and the output terminal by admittance measuring instrument (IMP. M), and draw a curve of the angle frequency to the phase characteristic, then calculate a slope of the tangent line at the prescribed angle frequency, that is, the ratio (delay time) of phase to angle frequency.

Record : Appendix 8.

Fig. 11



5.5 Visual Transmitter

5.5.1 Adjusted State

Definition : It means a state when the transmitter is adjusted so that it satisfies various characteristics.

Prescription: (a) In principle, the meters must indicate about 1/2 - 2/3 value of full scale.

(b) The scale indication of such variable parts as regulators and tuning elements must be settled at about half of full range.

Method : Examine positions of meter indicator, and check graduation of tuned conditions of controllers and tuning elements.

5.5.2 Prescription Power

Prescription: In the state of connecting VSBF or FP output to DA.

1. Standard Prescription Power.

Power must be able to set within -0% - +10% of the prescribed power in Table 1, and the transmitter when continuously operated with this power must satisfy each characteristic.

2. The power of the transmitter must be adjustable in the range of +10% - 0% of the prescribed power.

Method : 1. A method to compare with the load power by the commercial frequency.

By the commercial frequency, prepare in advance a calibration curve of the temperature vs. the consumption power of DA and by the aid of this, measure the average power of the transmitter.

2. A method to find from a temperature rise of cooling water of DA.

Cool DA by water, and measure a temperature rise and flowing mass of water, then find the power by the following formula.

$P = 0.0698Q\Delta T$

Provided,
P = Power (Kw).

Q = Flowing Mass of Cooling water (l./min).
ΔT = Temperature Rise of Water (deg.)

5.5.3 Input Impedance

Definition : It is impedance that viewed from the input terminal of V. MOD (connection plug) to the inside.

Prescription: To be $75 \pm 1.5\,\Omega$ within the range of 50 c/s - 6 Mc, however, a portion that is regarded as the extention of external coaxial cable must be excluded.

Method : In the state of V. MOD in function, measure by using the impedance bridge (IMP. M).

5.5.4 Input Level

Definition : It means the level of an input signal necessary to perform the normal modulation at the prescribed output.

Presctiption: With 0.5 ± 0.015V(P-P) as reference, the variable range is to be 0.4 - 1.0V(P-P).
Refer to Explanation 3.

Method : Use VS signal wave forms of stair-case wave as the input signal, and measure the input on CRO and the high frequency output on envelope observation part (ENV. CRO) of CRO, then measure the input level which provides the normal modulation.

5.5.5 Amplitude Frequency Characteristic

Definition : It means the amplitude deviation of a modulating frequency at VSBF output when an amplitude of the modulating frequency of the input signal is made constant, and the modulating frequency is varied.

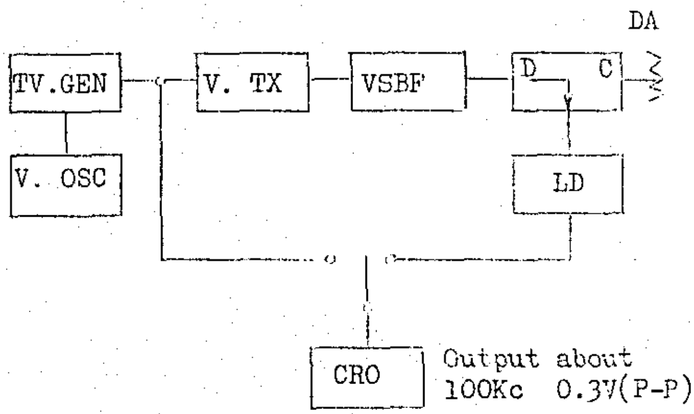
Prescription: With 100Kc as reference, the permissible limits are to be as shown in Appendix 9, and a notch. pertial characteristic, is to be below 0.3dB and should not vary over $\pm$ 1.5dB within the range of 2Mc to 4.2Mc with 3.58Mc as reference. The output of 3.58Mc is to be -8dB for 200Kc output.

Method : By Fig. 12 (a), set the visual transmitter, in principle, on DC coupling, and detect the output of the visual transmitter by the linear detector (LD), then measure input and output on CRO. On the occasion of 100Kc modulation, control the input so that LD output becomes as shown in Fig. 12 (b), then measure the output level for each frequency.

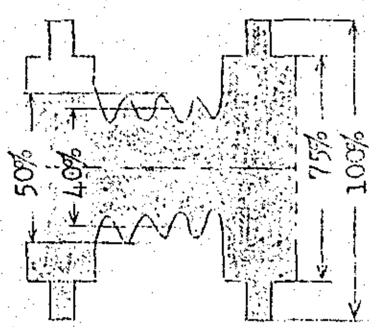
Note: The measurement by way of AC coupling must be made as follows.

By Fig. 13 (a), set the carrier amplitude on about 50% of the carrier maximum level, and vary the modulating frequency by such an input signal as it becomes 20 - 30% in the modulation degree at 100Kc, and measure LD output on CRO.

Fig. 12

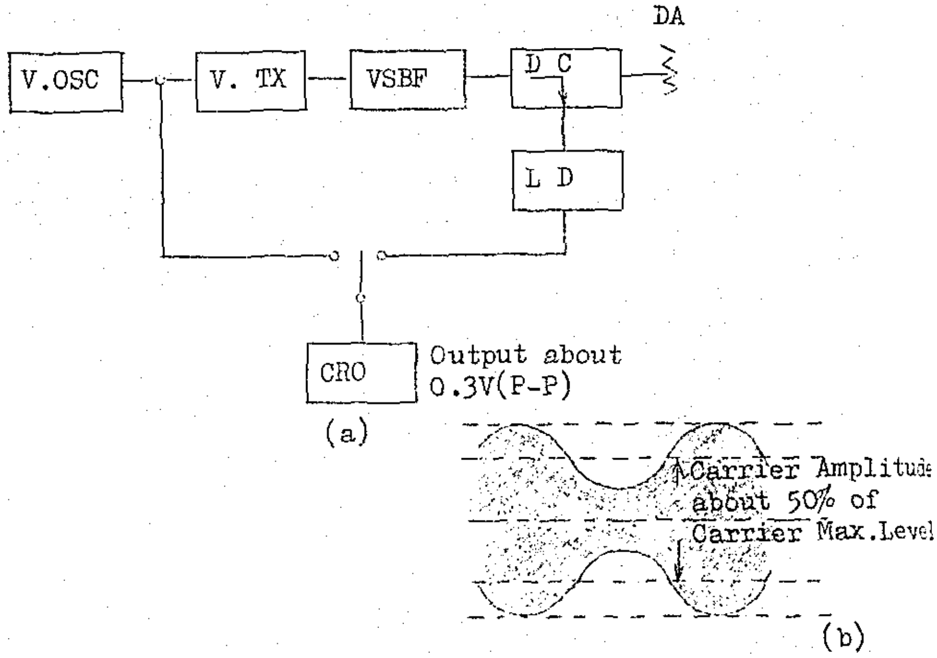


(a)



(b)

Fig. 13



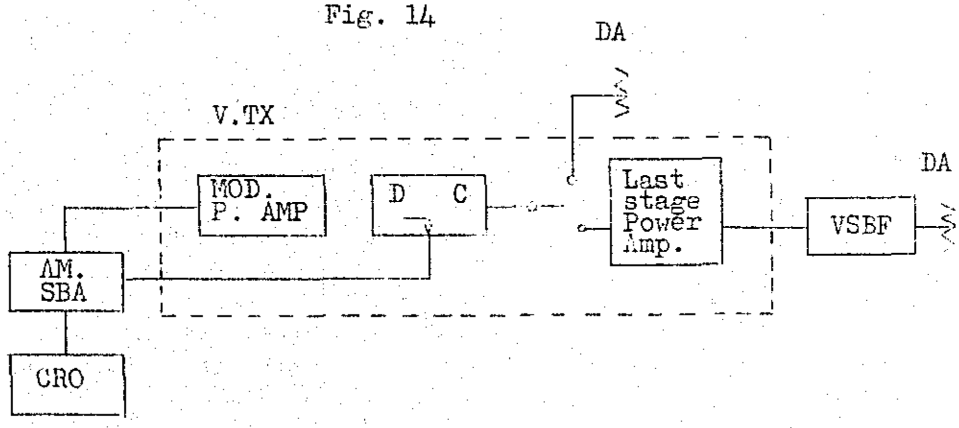
5.5.6 Amplitude Frequency Characteristic between Modulated Power Amplifier and Last-stage Power Amplifier (over 5Kw)

Definition : It means an input impedance and a band characteristic of the last-stage power amplifier in the visual transmitter whose standard prescribed output exceeds 5Kw.

Prescription : With the carrier frequency as reference, the deviation is to be within 2dB in the range of 2 - 5Mc.

Method : By Fig. 14, set the visual transmitter on 50% carrier of the carrier maximum level, AC coupling,and set the level so that the input signal of last stage will become as shown in Fig. 13 (b) when modulated by 100Kc sine wave, then measure the output of modulated power amplifier by the AM side band analyzer. First, connect the output of the modulated power amplifier to DA and adjust it to the satisfactory characteristic, and leaving every control point of the modulated power amplifier as it is, load the last-stage power amplifier, and compare an amplitude frequency characteristic of the output of the modulated power amplifier to the result obtained on the occasion of DA.

Fig. 14



5.5.7 Wave Form Distortion

Definition : It means a wave form distortion of the modulated wave at VSBF output when modulated by the square wave.

Prescription: In the state that the envelope delay distortion is adjusted to the permissible limits of Appendix 15 by the manner described in 5.5.20, settle as follows:

Sag	:	Below 2%
Rise Time	:	" ±0.15 μs
Smear	:	" 5%
Overshoot	:	" 8%
Undershoot	:	" 8%

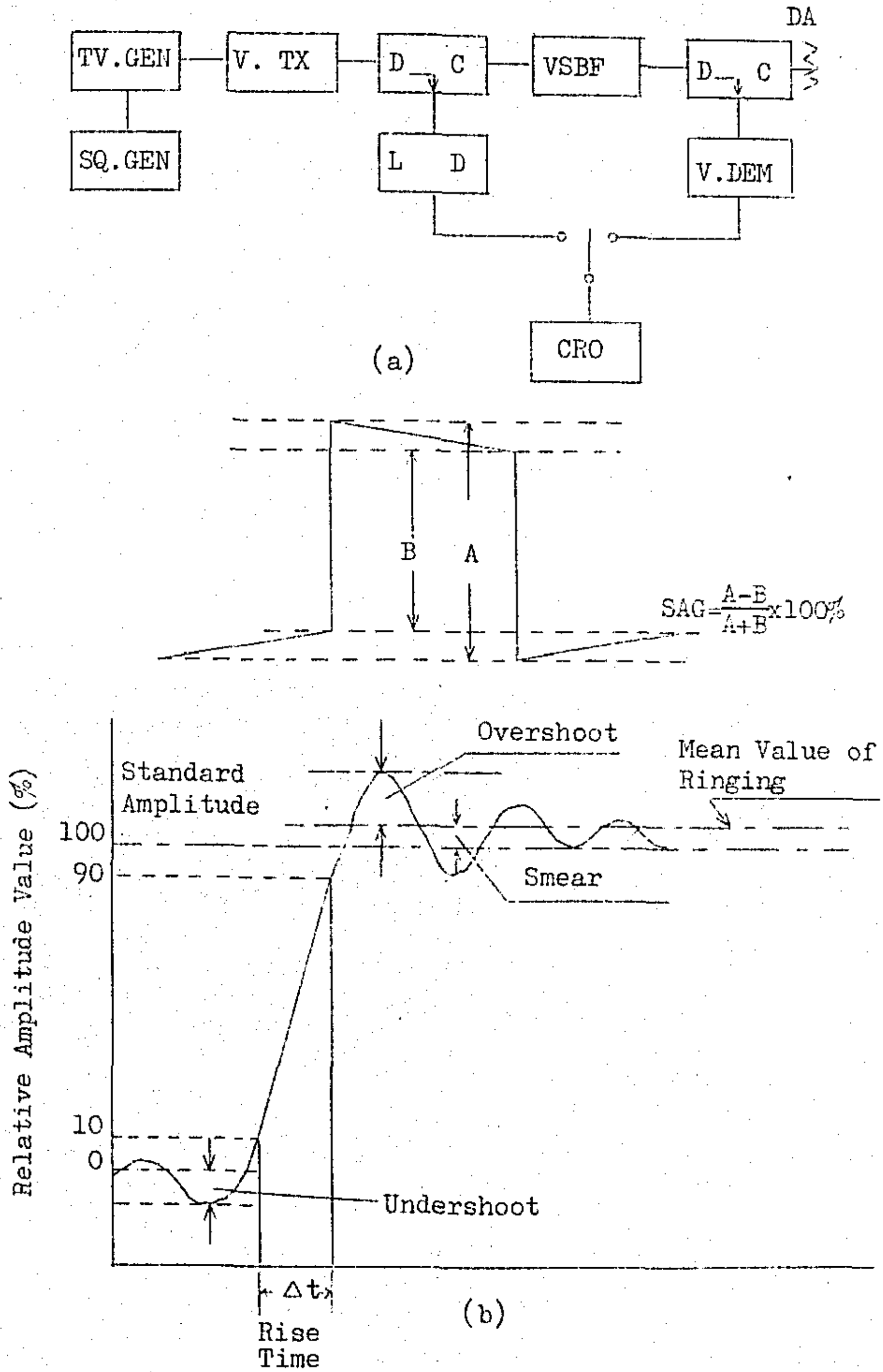
Also, calculation of wave form distortions of the input signal and the output shall be as shown in Fig. 15 (b).

Refer to Explanation (4)

Method : By Fig. 15 (a), demodulate the output of the visual transmitter by V. DEM and measure on CRO. Set the visual transmitter in the state of DC coupling and prescribed output, and the input signal is to be such a symmetric square wave (60c/s, 15Kc, 250Kc) as it becomes the same modulation level as shown in Fig. 12 (b).

For the measurement, use LD simultaneously and refer to its record.

Fig. 15



DA
TV.GEN
V. TX
D C
VSBF
D C
SQ.GEN
L D
V.DEM
CRO
(a)
B
A
SAG=$\frac{A-B}{A+B}$x100%
Overshoot
Mean Value of Ringing
Standard Amplitude
100
90
Smear
Relative Amplitude Value (%)
10
0
Undershoot
Δt
Rise Time
(b)

$$\text{Smear} = \frac{\text{Difference between mean value of ringing \& standard amplitude}}{\text{Standard Amplitude}} \times 100\%$$

$$\text{Overshoot} = \frac{\text{Difference between mean value of ringing and peak of ringing}}{\text{Standard Amplitude}} \times 100\%$$

$$\text{Undershoot} = \frac{\text{Difference between 0 value of standard amplitude \& peak of undershoot}}{\text{Standard Amplitude}} \times 100\%$$

Reference Test (*Measurement of a* wave form distortion by the sine square wave).

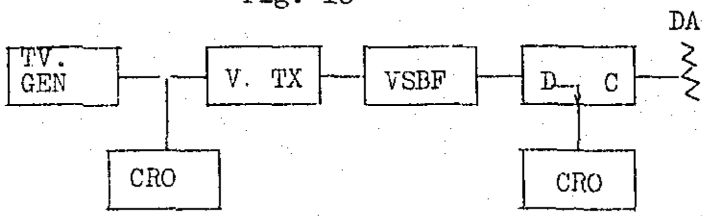
Using the sine square wave, and setting the visual transmitter in the state of DC coupling and prescribed output, measure input side and output side of VSBF by the aid of V. DEM.

Measuring items shall be amplitudes, half amplitude durations, ringing amplitudes and ringing frequencies for the pulses of sine square wave T/2 (half amplitude duration 0.0625us), T (half amplitude duration 0.125us) and 2T (half amplitude duration 0.25μs), and overshoots and streakings for the bar pulses of T/2, T and 2T.
The method of calculation of input signal and distortion is subject to Method of testing of video control equipment.

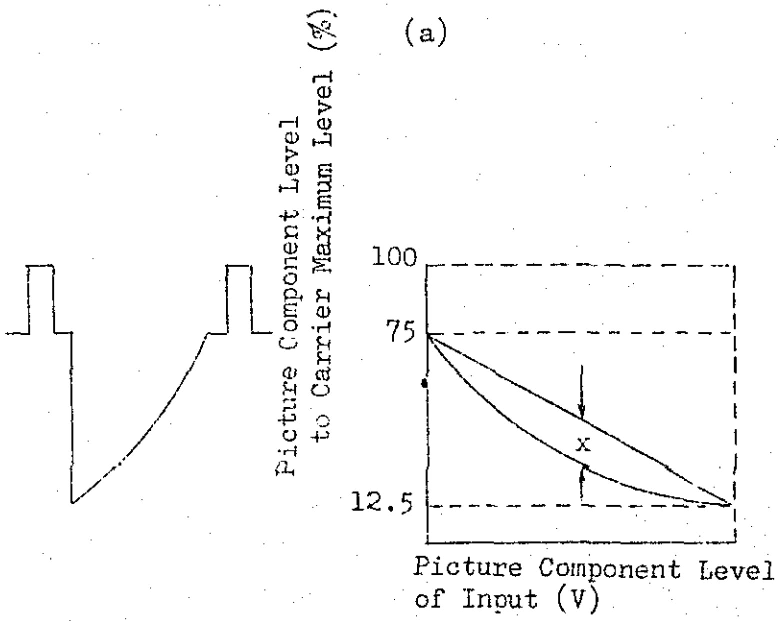
5.5.8 Non-linear Distortion

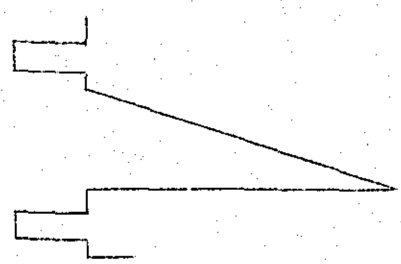
Definition	:	It means the distortion to be caused at VSBF output due to a non-linearity of the modulated wave amplifier that includes V. MOD.
Prescription	:	To be below 7%.
Method	:	By Fig. 16 (a), measure the input on CRO and the output by ENV. CRO. Varie the input signal progressively from pure black to pure white, and calculate by Fig. 16 (b).
Record	:	Appendix 10.

Fig. 16



(a)





Non-linear Distortion

$$= \frac{x}{62.5} \times 100\%$$

5.5.9 Signal-to-Noise Ratio

Definition : It means a ratio of the signal contained in the modulated wave at VSBF output to the amplitude-modulated noise (mainly the ham noise).

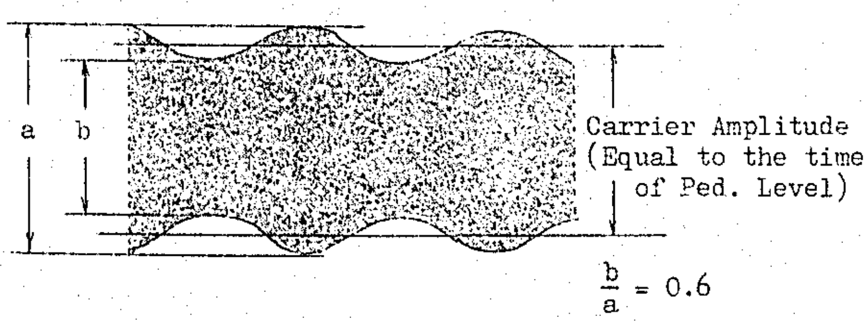
Prescription: To be above 50dB when given the prescribed modulation.

Refer to Explanation (5).

Method : By Fig. 13 (a), set the visual transmitter in the state of the carrier output corresponding to the time of AC coupling pedestal level, and by CRO measure e_s (P-P), which is detected by LD from the modulated wave (modulated state of sine wave 15kC shown in Fig. 17) to be used for reference. Next, set the visual transmitter in the non-modulation (terminate V. MOD input with 75Ω), and by CRO measure e_n (P-P) which is detected by LD from the output of this time, then calculated by the following formula.

$$S/N = 20\log \frac{e_s}{e_n} = +4.4(\text{dB})$$

Fig. 17



5.5.10 Modulation Noise of Different Kind

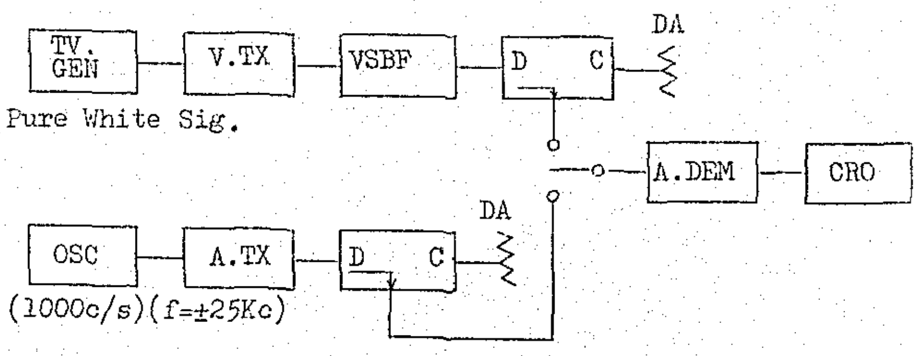
Definition : It means a residual phase modulation noise of the modulated wave at VSBF output.

Prescription : To be -40dB.

Method : By Fig. 18, make the input of the visual transmitter to be the white signal, and the modulation degree is to be 10% of the carrier maximum level.

Measure on the CRO the aural demodulator output (A. DEM) (in the state of applying deemphasis and, in addition, inserting 15.75Kc low-pass filter), then from its ratio to the demodulator output (p-p) at the time of modulating the aural transmitter 1000c/s 100%, determine the visual transmitter output.

Fig. 18



5.5.11 Side Band Attenuation Characteristic

Definition : It means an intensity of the side band at VSBF output.

Prescription: With the voltage of 200Kc lower side band as reference, an intensity of the lower side band when modulated by the frequency of 3.58Mc is to be below -44dB, and an intensity of the lower side band when modulated by the single frequency above 1.25Mc is to be -22dB, and an intensity of the upper side band when modulated by the frequency of 4.75Mc is to be below -2dB compared with the intensity of the upper side band when modulated by the frequency of 200Kc.

Method : Set the visual transmitter in the state shown in 5.5.5 (3), and take out the output of VSBF by the directional coupler, then in principle, measure by using the field intensity measuring instrument having such a sufficient selectivity as it is able to receive by dividing the output into upper and lower side bands.

Record : Appendix 11.

5.5.12 Spurious Radiation

Definition : It means an intensity of the higher harmonics, the lower harmonics or the parastic radiation at the output of VSBF.

Prescription : To be below -63dB to the prescribed output and below 0.8mW.

Method : Set the visual transmitter in the non-modulation and carrier output equal to the time of AC coupling pedestal level, and take out part of VSBF output by the directional coupler, and through the wide-band attenuator, measure its intensity by UHF, VHF field intensity measuring instrument.

Record : Appendix 12

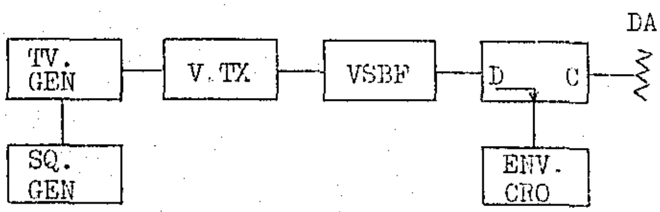
5.5.13 Dynamic variation of Output

Definition : It means a variation of the carrier maximum level when modulated by signals which repeat pure black, pure white every field.

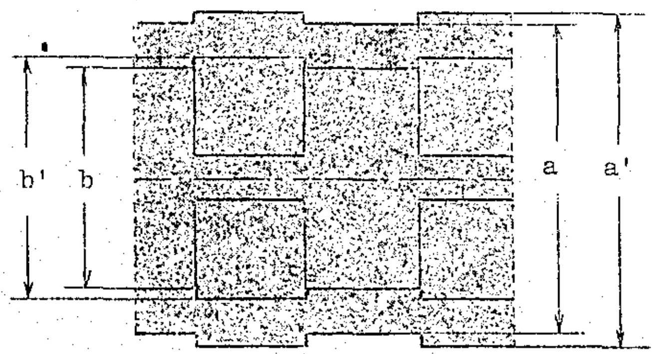
Prescription : To be below 2% to the mean value of the carrier maximum level.

Method : By Fig. 19 (a), set the visual transmitter on DC coupling, and as input signal, feed the VS signal superposing such a square wave of about 60c/s as it varies from pure black to pure white, then measure the output on ENV. CRO, and calculate by Fig. 19 (b), however, a variation due to sag is not counted.

Fig. 19



(a)



(b)

a : Minimum amplitude of carrier maximum level

a' : Maximum amplitude of carrier maximum level

b : Minimum amplitude of pedestal level

b' : Maximum amplitude of pedestal level

$$\text{Dynamic variation of output} = \frac{a - a'}{\frac{1}{2}(a + a')} \times 100\%$$

$$\text{Variation of pedestal level} = \frac{b - b'}{\frac{1}{2}(b + b')} \times 100\%$$

5.5.14 Static Variation of Output

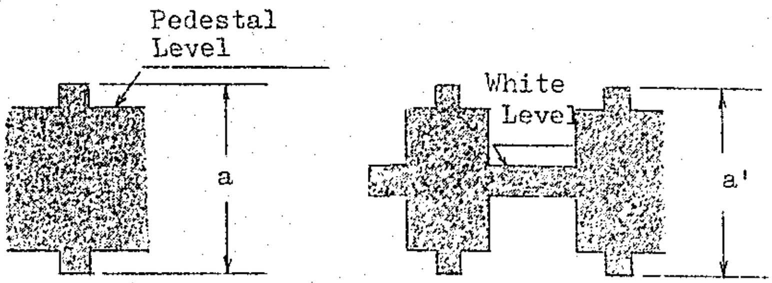
Definition : It means a variation of the carrier maximum level when modulated each continucusly by the pure black signal and by the pure white signal.

Prescription : To be below 2% to the mean value of the carrier maximum level.

Method : By Fig. 19 (a), set the visual transmitter on DC coupling, and measure by ENV. CRO an amplitude variation of the carrier maximum level respectively for the time of pure black modulation and pure white modulation, then calculate by Fig. 20.

Record : Appendix 12.

Fig. 20



Static Variation of output = $\frac{a-a'}{\frac{1}{2}(a+a')} \times 100\%$

5.5.15 Fluctuation by Modulation

(1) Fluctuation of Pedestal Level

Difinition : It means a variation of the pedestal level when the modulation level is varied from pure black to pure white.

Prescription: To be below 2%.

Method : By Fig. 19 (a), set the visual transmitter on DC coupling and the pedestal level on 75±1% of the carrier maximum level, then by ENV. CRO measure a modulation level difference which corresponds to the pedestal level at the time of variation made from pure black to pure white, and calculate by Fig. 19 (b).

Record : Appendix 12.

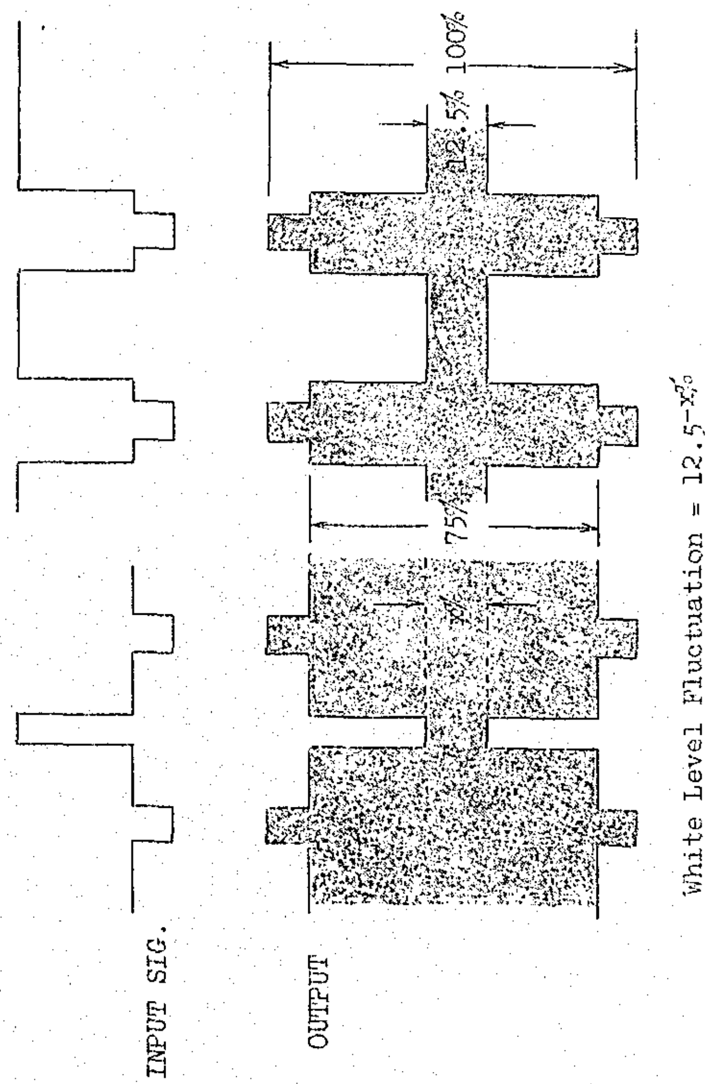
(2) Fluctuation of White Level

Definition : It means a level difference between the one modulated by the pure white signal and the other modulated by the white slit signal whose amplitude is equal to the former and DC component is negligible.

Prescription : To be below 3%, and it must be possible to make maximum modulation degree of the white level below 5% of the carrier maximum level.

Method : By Fig. 19 (a), set the visual transmitter on DC coupling, and by ENV. CRO, measure the difference of the modulation level between when modulated by the white signal and when modulated by the white slit signal, then calculate by Fig. 21.

Fig. 21



5.5.16 Differential Gain

Definition : It means the percentage of a deviation of the superposed high frequency on the other level with a portion as reference where an amplitude of the small amplitude high frequency sine wave (3.58Mc) superposed on the staircase wave is regarded as constant.

Prescription . To be below ±15% when performed the normal modulation with the average picture level (APL) 10, 50, and 90%.

Refer to Explanation (6).

Method : By Fig. 23 (a), set the visual transmitter on DC coupling, and for the input signal, use the special signal wave form shown in Fig. 22, and by LD, detect and measure VSBF output, then calculate by Fig. 23 (b).

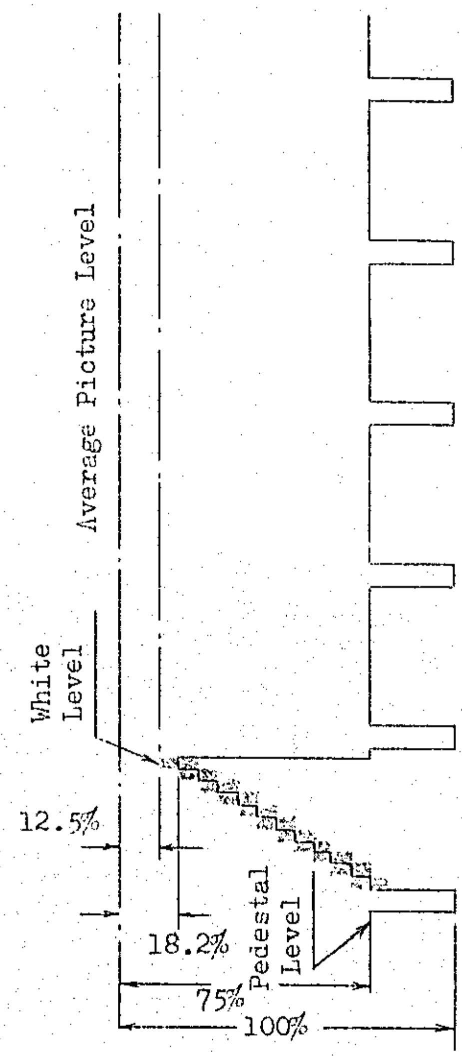
However, for c in the case of a curve, select a portion where the amplitude difference of the adjacent 3.58Mc is minimum out of a portion where the amplitude of the superposed 3.58Mc is regarded as constant.

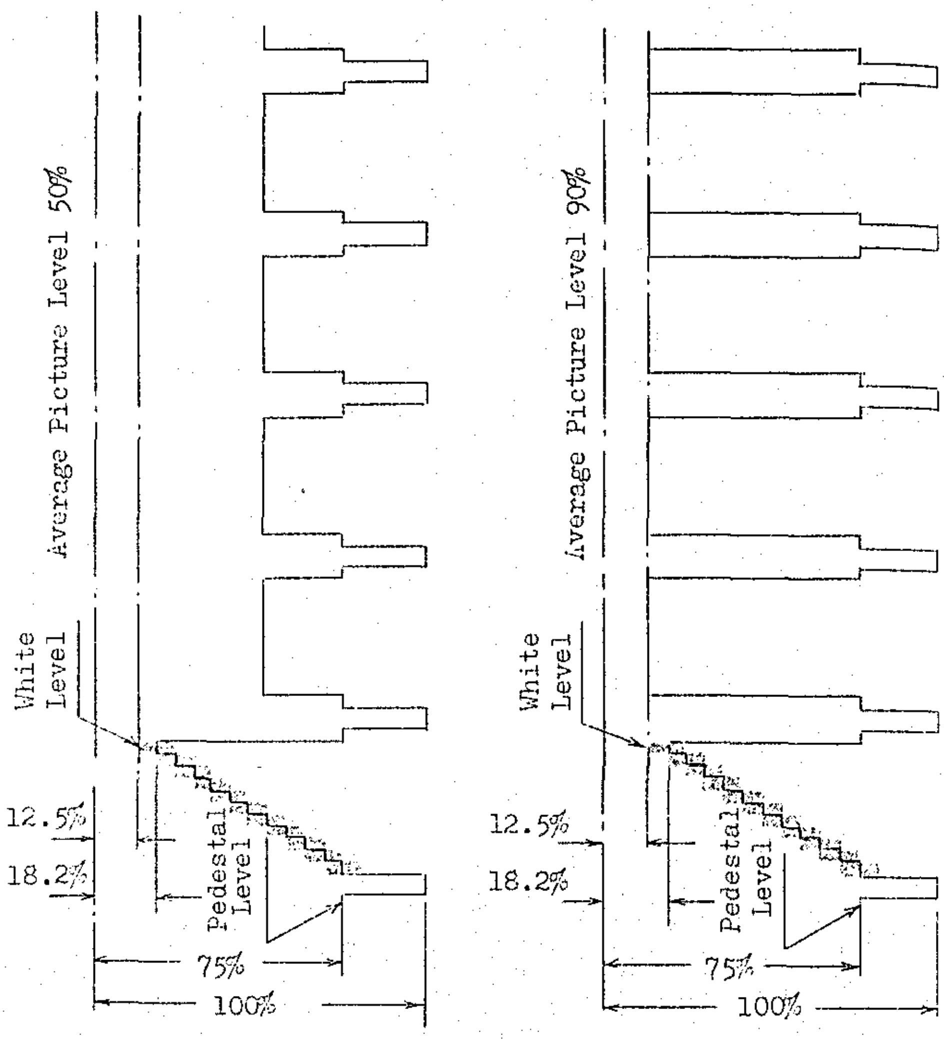
Also, for reference, measure the points shown in Appendix 13.

Record : Appendix 13.

Fig. 22

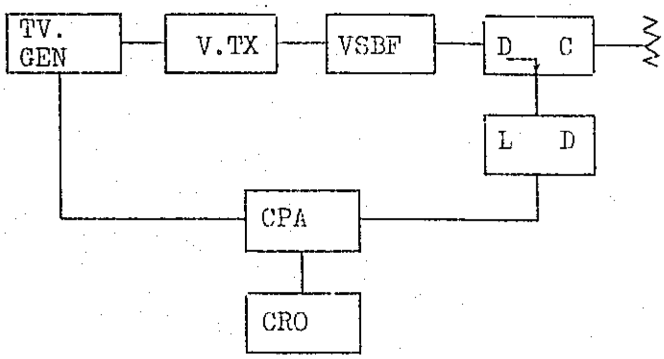
Special Signal Wave Form 1



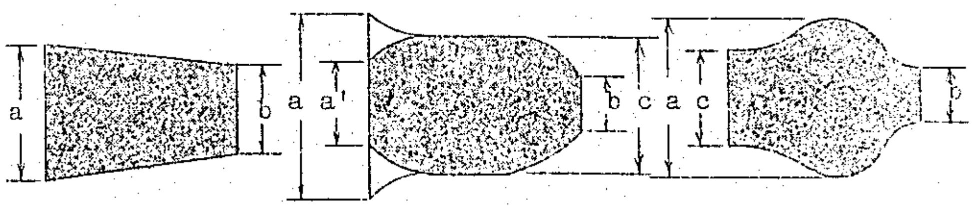


Note: In the video control equipment, the peak value of staircase wave forms corresponds to the white level, however, in the visual transmitter, when the high frequency is superimposed saturation may result if the modulation degree is intensified beyond white level. Therefore, in order that the peak value of high frequency corresponds to the white level when the high frequency is superimposed, adjust the peak value of stair-case wave forms in such a way as it will become 18.2% of the carrier maximum level.

Fig. 23



(a)



(1) In case of straight line

$$e = \frac{1}{2}(a + b)$$

$$DG = \frac{a - c}{c} \times 100\%$$

(positive)

$$DG = \frac{b - c}{c} \times 100\%$$

(negative)

(2) In case of curve

(a)

$$DG = \frac{d - c}{c} \times 100\%$$

(positive)

$$*DG = \frac{b - c}{c} \times 100\%$$

(negative)

* Where $a' < b$, calculate by a' instead of b.

(b)

$$DG = \frac{a - c}{c} \times 100\%$$

(positive)

$$DG = \frac{b - c}{c} \times 100\%$$

(negative)

5.5.17 Differential Phase

Definition : It means the phase difference of the small amplitude high frequency sine wave (3.58Mc) superposed on the other level of the stair-case wave form, with the phase of the sine wave at the pedestal level as reference.

Prescription: To be below ±10 degrees when the normal modulation is performed with the average picture level 10, 50, and 90%.

Method : Perform in accordance with 5.5.16.

Record : Appendix 13.

5.5.18 Amplitude of Color Video Signal

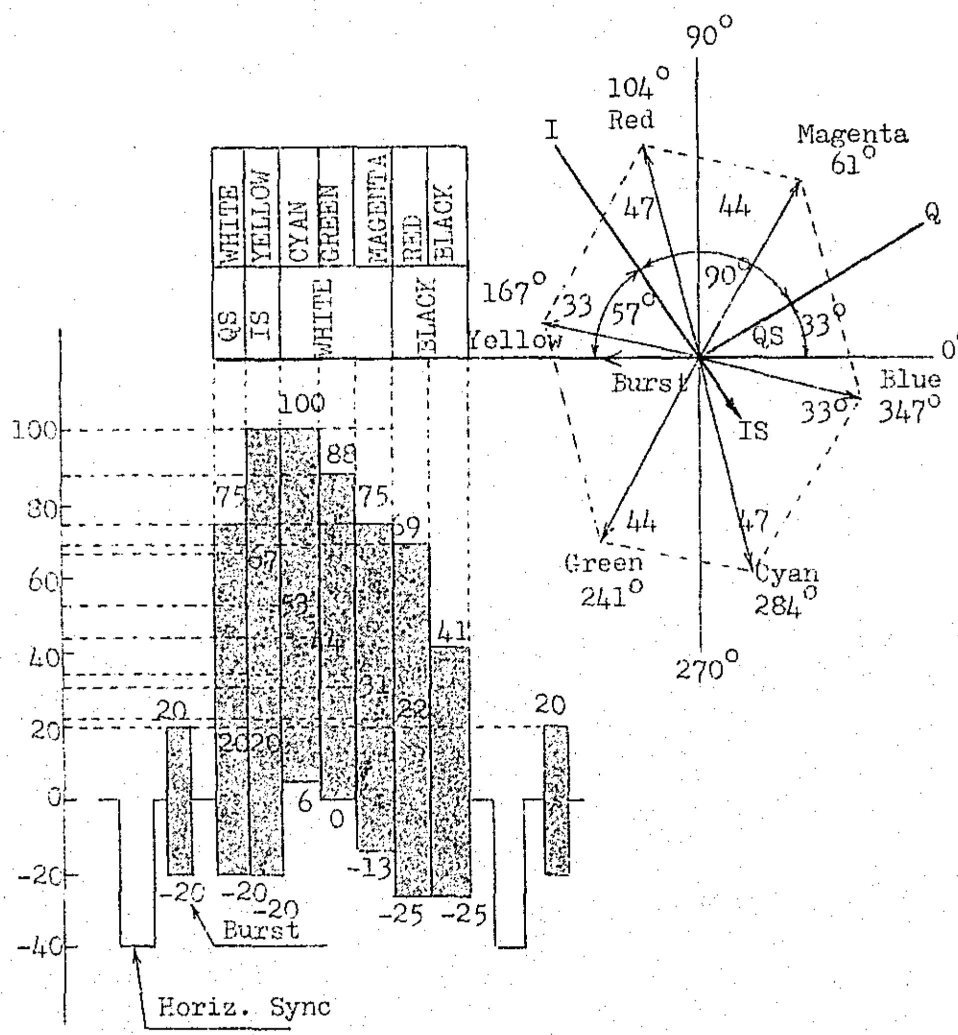
Definition : It means an amplitude deviation of the output signal in percentage for the input signal of color signal which is contained in the special signal wave form specified in Fig. 24.

Prescription: To be below ±15% when the normal modulation is performed.

Method : Subject to 5.5.16.
In this case, color signals that become reference for comparison are to be those superimposed on the luminance signal level which is obtained by 5.5.16 as reference for deviation.
Also, for reference, measure the points shown in Appendix 14.

Record : Appendix 14.

Fig. 24



WHITE
YELLOW
CYAN
GREEN
MAGENTA
RED
BLACK
QS
IS
WHITE
BLACK
100
80
60
40
20
0
-20
-40
100
88
75
75
69
67
53
44
31
22
41
20
20
20
20
6
0
-13
-20
-20
-20
-25
-25
Burst
Horiz. Sync
90°
104°
Red
I
Magenta
61°
Q
47
44
90°
167°
33
57°
33°
QS
0°
Yellow
Burst
Blue
347°
33°
IS
44
47
Green
241°
Cyan
284°
270°

5.5.19 Phase of Color Video Signal

Definition : It means the respective phase deviations of color signals when, of the phases of color signals which are contained in the special signal wave form specified in Fig. 24, the phase of the burst of input and that of output signals are made equal.

Prescription: To be below ±8 degrees when the normal modulation is performed.

Method : Perform in the manner described in 5.5.16.

Record : Appendix 14.

5.5.20 Envelope Delay Time

Definition : It means the first order differential characteristic of phase to angle frequency of the output signal when VSBF output is demodulated by the video demodulator (V. DEM).

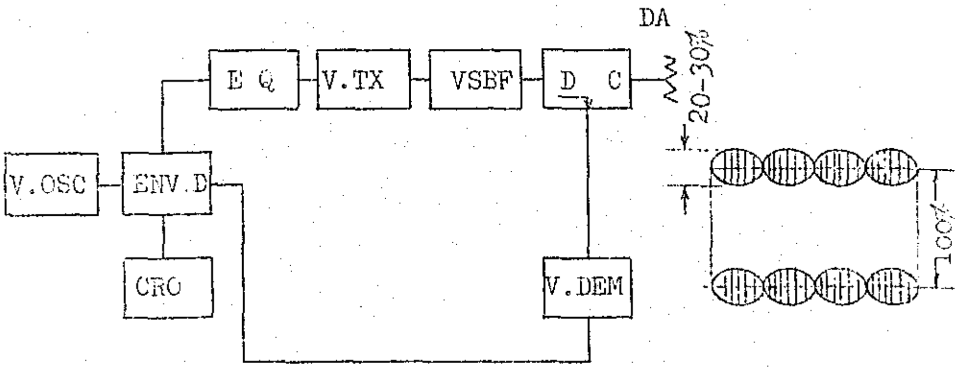
Prescription: In the state of low range and high range phase equalizers being connected to the input side of V. MOD, as a guide, adjust within the permissible limits shown in Appendix 15.

Refer to Explanation (7).

Method : By Fig. 25 (a), measure with V. DEM. Set the video transmitter on 50% carrier of the carrier maximum level and in principle, on AC coupling, and make 1Mc modulated wave form to be in the state shown in Fig. 25 (b).

Frequencies for the measurement are to be 0.5Mc and 0.75Mc, and 1Mc and also frequencies over 1Mc are, including 3.58Mc, to be every 250Kc up to 4.18Mc.

Fig. 25



(a) (b)

Note: 1. Using VS signal wave forms, measure the visual transmitter in the state of DC coupling and prescribed output. (Reference)

2. Perform this measurement immediately after the measurement of amplitude frequency characteristic.

5.6 Aural Transmitter

5.6.1 Adjusted State

(same as 5.5.1)

5.6.2 Prescription Power

Prescription: In the state of connecting FP output or transmitter output to DA.

1. Standard Prescription Power

   The power must be within +10, -0% of the permissible deviation of the prescribed values in (Table 1), and when the continuous running is performed with this power, each performance must be satisfied.

2. The power must be adjustable in the range of +10, -0% to the prescribed value.

Method : Measure in accordance with 5.5.2.

5.6.3 Input Impedance

Definition : It means the impedance that viewed from the input transformer terminal of a frequency modulator to the inside.

Prescription : To be 600±30Ω at 1000c/s and 600±90Ω within the range 50c/s - 10Kc.

Method : Measure by using the impedance meter in the range of 50c/s - 10Kc.

5.6.4 Input Level

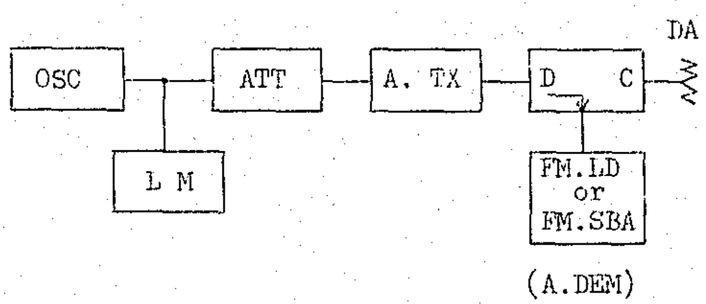
Definition : It means the 1000c/s input signal level of the aural transmitter which provides the carrier with the frequency deviation of ±25Kc.

Prescription Make it to be 4±1 dBm and -36±1 dBm, and the variable range is to be above ±6 dB.

Refer to (3) (8).

Method : By Fig. 26, measure 1000c/s modulation input level vs. frequency deviation characteristic, and find the input level which provides the frequency deviation of ±25Kc.

Fig. 26



5.6.5 Amplitude Frequency Characteristic

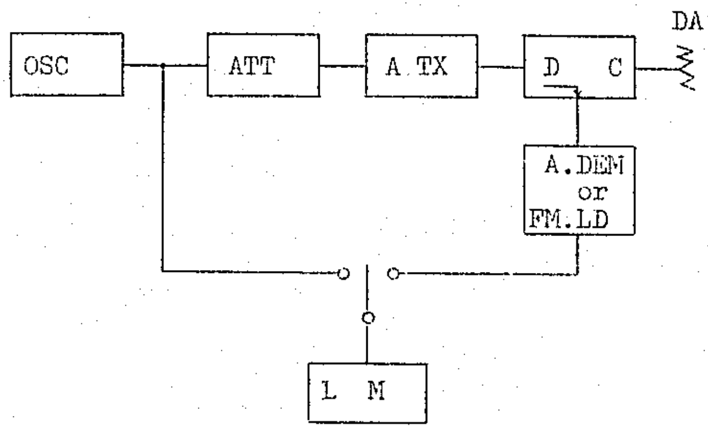
Definition : It means a deviation of the input level of the audeo modulator (A. MOD) in case that the modulation frequency is varied while keeping a modulation degree (frequency deviation) of the modulated wave in the aural transmitter constant.

Prescription: With 1000c/s as reference, it must be within the permissible limits prescribed in Appendix 17 in the frequency range of 50c/s - 15Kc.

Method : By Fig. 27, demodulate the output of the aural transmitter by A. DEM or FM. LD, (however, A. DEM or FM. LD is in the state of that deemphasis and 15Kc filter are off) and by the level meter (LM) measure A. MOD input and demodulation output. Keep OSC output constant, also measure in advance a demodulation output level when the frequency deviation of about 12.5Kc at 1000c/s is given, then adjust ATT so that the demodulation output will settle at the same level when the modulation frequency is varied, and find the difference from ATT reading at the time of 1000c/s.

Record : Appendix 17.

Fig. 27



5.6.6 Distortion Factor

Definition : It means the factor of a harmonic wave content contained in the demodulation signal of the modulated wave in case the sine wave modulation is performed.

Prescription : To make as shown in Table 9.

Method : By Fig. 26, measure the signal, which is obtained by demodulating the aural transmitter output with A. DEM (however, 15Kc filter is [illegible] with distortion factor meter (K[illegible]

Measure at the modulation degree of 20%, 50%, 100% and 130%, and the modulation frequencies of 50c/s, 100c/s, 200c/s, 1000c/s, 5000c/s, 7500c/s and 15000c/s respectively

Table 9

Modulation Frequency	20 - 100% modulation	130% modulation
Below 50c/s - 100c/s Above 5Kc - 15Kc	Below 1.5%	Below 2%
Over 100c/s less than 5Kc	Below 1.0%	Below 2%

5.6.7 Frequency Deviation

Definition : It means the variation of a frequency deviation of the carrier to the variation of a level of the modulation input signal.

Prescription: For each modulation frequency, with 1000c/s as reference, the deviation of the modulation input necessary for 100% modulation is to be 1 dB to an ideal curve of 75μs, and also should be able to linearly modulate up to 130%.

Method : By Fig. 26, using the FM side band analyzer (FM. SBA), and setting the modulation frequency on 1000c/s, 3000c/s, 5000c/s, 7500c/s, 10000c/s and 15000c/s, measure the output respectively by varying the input level.

Record : Appendix 19.

5.6.8 Signal-to-Noise Ratio

Definition : It means a ratio of A. DEM output signal of the modulated wave to frequency-modulated noise component.

Prescription : To be above 55 dB.

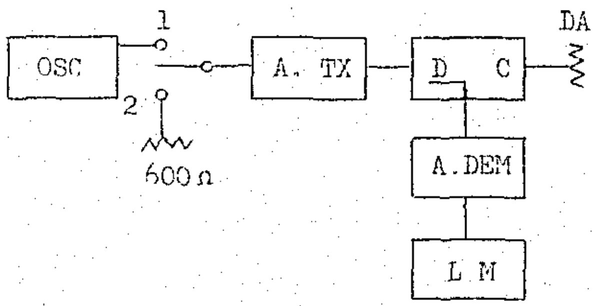
Refer to Explanation (8).

Method : By Fig. 28, close SW to 1, and by LM, measure the level of A. DEM output in case of 100% modulation by 1000c/s.

Next, close SW to 2, and by measuring the level of A. DEM output, measure its difference.

Record : Appendix 18.

Fig. 28



5.6.9 Residual Amplitude Modulation Noise

Definition : It means the component of amplitude modulation noise contained in the carrier and modulated wave.

Prescription: To be below -45 dB compared with the average DC voltage of the carrier in case of non-modulation and 1000c/s, 100% modulation.

Method : By Fig. 29, regarding 100% modulation time and non-modulation time, measure DC voltages and AC outputs respectively by the vacuum tube voltmeter and the detector shown in Fig. 29, then calculate by the following formula.

Residual Amplitude Modulation Noise

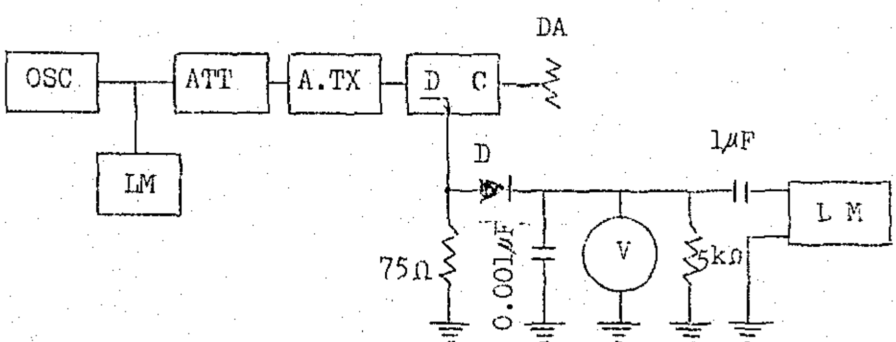
$$= 20\log_{10} \frac{E}{e} - 3+K \text{ (dB)}$$

E : DC Output Voltage (Reading of Voltmeter).

e : Effective Value of Residual Amplitude Modulation Noise (Reading of LM).

K : Correction Value (Constant to be determined by the amplitude of high frequency voltage fed to Diode D and the kind of diode).

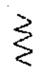
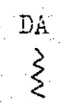
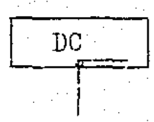
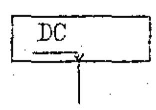
Fig. 29



5.6.10 Spurious Radiation

Definition	:	It means an intensity of the higher harmonics, the lower harmonics or the parastic radiation at the output of VSBF.
Prescription	:	To be below -63 dB to the prescribed output and below 0.8mW.
Method	:	In case of aural transmitter, by the directional coupler, take out part of the aural transmitter output at the non-modulation carrier output, and through the wide-band attenuator (ATT), measure its intensity by UHF, VHF field intensity measuring instrument.

Appendix 1

Symbol	Name
V. TX	Visual Transmitter
A. TX	Aural Transmitter
V. MOD	Video Modulator
VSBF	Vestigial Side Band Filter
F P	Filter Plexer
E Q	Phase Equalizer
(P)	Pad
	Terminating Resistor
	Dummy Load
 	Directional Coupler (arrow indicates the direction of pick-up)

Appendix 2

Measuring Equipment & Symbol

Symbol	Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
VHF.SBA	Band Width Direct-viewing Equipment (VHF Sweep Oscillator)	Freq. Range. Video Carrier Frequency ±6Mc of Channel 1 - 12. Output Level. Above 10V(rms) Output Impedance. 50 Ω Marker Housed, Variable	BW-2 type
AM.SBA	AM Side-band Analyzer	Freq. Range. Video Carrier Frequency ±7Mc of Channel 1 - 12 Video Output Impedance. with 75 Ω High Freq. Input Imped. with 50 Ω	AMS-2 type
FM SBA	FM Side-band Analyzer	Freq. Range. 50 - 223Mc Sweep Frequency Band Width. 10-150Kc Variable Resolution. 1Kc Above 15dB	FMS-6 type
V. OSC	Video Freq. Oscillator	10c/s - 10Mc Output Level. 75 Ω 4V(P-P) Max. 10c/s-10Mc 600 Ω 4V(rms) Max. 20c/s-20Kc	RC10M-1B type
V. SWP	Video Sweep Generator	Sweep Freq. 100Kc-15Mc Continuously Variable Sweep Output Level. Above 1.6V (P-P) (Max.) Output Control Range. 60dB Marker Housed, Variable	VS-3 type

Symbol	Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
TV.GEN	TV Test Signal Generator	Kind of Signal 1. Horizontal Gray-Scale Signal (Superposed Wave 0.8Mc and 3.58Mc On and Off Possible) 2. White Signal. With Simple Sync Signal. Attached Filter For High-pass. For 0.8Mc use For Band-pass. For 3.58Mc use	TG-4 type
SQ GEN	Square Wave Generator	Osc. Freq. 60c/s, 1Kc, 15Kc, 250Kc. Rise & Fall Time. 0.02, 0.03, 0.05 μs Output Level. Above 75Ω1V(P-P)	SW-3 type
SSQ GEN	Sine Square Wave Generator	Output Signal. Sine Square wave and Square Wave Width at $\frac{1}{2}$ Amplitude. Sine Square Wave Pulse 0.25μs 0.125μs and 0.0625 s Square Wave Pulse 15-35μs Output Level. VS 1.4V(P-P)	SS-1 type
OSC	Low Freq. Oscillator	Osc. Freq. 20-200,000c/s Output Level. 600Ω + 20 dBm Distortion Factor. Below 0.1%	OLD-3 type
L M	Level Meter	Range of Measurement. -70 - +40dBm Freq. Range. 20 - 200,000c/s	OLD-3 type
AMP ▷	Amplifier for Measurement use.	At 20 - 200,000c/s, it must be flat in the frequency characteristic and must be able to linearly amplify up to the output +20dBm.	OLD-3 type
KFM	Distortion Factor Measuring Instrument	50 - 15,000c/s To be able to measure up to the input impedance 10KΩ0.1%.	OLD-3 type

Symbol	Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
	Standard Variable Resistor	0 - 1,111Ω 0.1Ω Step Decimal System Non-inductive type 4 dial. Max. Allowable Power. 1 Watt	
ATT	Resistance Attenuator	121dB 0.1dB Step 150Kc	P-121S type
ATT	VHF Resistance Attenuator	51dB, 1dB step 0-250Mc Input Impedance. 50Ω or 75Ω Accuracy. Below 0.5dB at 0-100Mc " 1.0dB at 100-250Mc	
CRO	Cathode-ray Oscilloscope (Oscilloscope for Direct-viewing)	Vertical Freq. Band. 10c/s - 100Kc Vertical Input Level. 1.4V (P-P) Horizontal Freq. Band. 10c/s-20Kc	D05001-1 type
CRO (ENV. CRO)	Cathode-ray Oscilloscope	Vertical Freq. Band. DC-5Mc Sensitivity. 0.003 - 20V 1 cm Horizontal Freq. Band. 10c/s - 800Kc Sweep Velocity. 10 ms/cm - 0.3μs/cm Delayed Sweep Possible. Calibration Voltage 1V Envelope Observation Part. Frequency. Prescribed Channel	505-3 type
CRO	Cathode-ray Oscilloscope	Vertical Freq. Band. DC-15Mc Sensitivity. 0.02 - 20V/cm Horizontal Freq. Band. DC - 2Mc Sweep Velocity. 0.1μs/cm - 15.5 ms/cm Delayed Sweep Possible. Marker Generator housed. Calibration Voltage. 0.5 - 100V	515-1 type

Symbol	Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
VV	Vacuum Tube Voltmeter	Measuring Range. DC Voltage 0.3 - 30kV AC Voltage 0 - 1000V, 40c/s-1Mc " 0 - 20V, 0.5Mc - 250Mc DC & AC Current 0 - 300mA DC Resistance 0 - 300MΩ	VM-1 type
	Frequency Counter	Measuring Range. 10c/s-250Mc Decimal 7 Figures Gate Time. 1, 10ms, 0.1, 1, 10, 100s Input Level. Above 50mV Frequency Stability. Within $\pm 1 \times 10^{-7}$/day	TR-3247LS
CPA	Vector Scope	External Subcarrier Input. 3.579545Mc above 2V (P-P) Phase Variation Range. 0 - 200° Phase Angle Accuracy. Vector Indication ±2° Horizontal Sweep ±1° Chroma. ±2%	VSC-1 type
CPA	Phase Analyser	Video Input Level. 0.5 - 2V (P-P) Subcarrier. 3.58Mc 0.5 - 2V (P-P) Measuring Range. 0 - 360°±1.0°	CPA-1 type
ENV. D	Envelope Delay Time Measuring Instrument	0 - 1000mμs Measuring Freq. 100Kc & 500Kc-6Mc Input Level. 1V (P-P) Phase Measuring Angle. 500Kc-1Mc±50 mμs 1Mc - 6Mc ± 10 mμs	VD-3 type

Symbol	Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
LD	Linear Detector	Input Impedance 50Ω Input SWR. Within 1.1 Overall Freq. Response. +0, -1dB at 0 - 5Mc +0, -3dB up to 8Mc Input Level. 5V (rms) Output Level. VS 1.0V (P-P) Output Imped. 75Ω Wave Form Distortion. Sag less than 1% For 60c/s with sag less than 1%, 15Kc and 250Kc square waves with rise time below 0.03μs, Overshoot 2% Rise Time 0.05μs Linearity. Below 2% in the range of 0.7-6V (rms) Noise. To be below 0.5mV (P-P) in the state of feeding DC 5V to the high freq. input terminal.	
FM LD	FM Linear Detector	Freq. Range. 20 - 230Mc Input Level. 95 - 110dB Indication Range of Freq. Deviation. 0 - +200Kc Indication Range of Amplitude Mod. Degree. 0 - 50dB	RDA-101C type
V.DEM	Video Demodulator	Input Impedance 50Ω Input SWR. Within 1.1 Input Level. Below 1V (rms) Output Impedance 75Ω Output Level. Above VS 1V (P-P) Frequency Characteristic. Within ±0.5dB at 0 - 4Mc Vary linearly at 4 - 4.5Mc At 4.5Mc, +5 - -2.0dB Envelope Delay Time. As shown in Appendix 20	

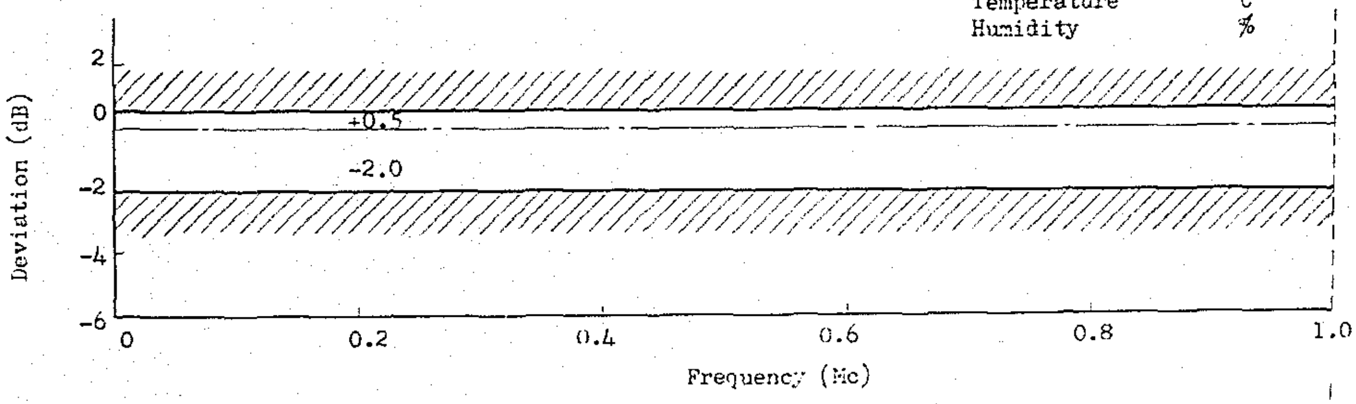
Symbol	Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
V.DEM	Video Demodulator (cont'd.)	Differential Gain. Within ±3% " Phase. Within ±2° Wave Form Distortion. Sag Below 1% Overshoot " 5% Undershoot " 5%	
A.DEM	Aural Demodulator	(Main Body) Input Impedance. 50Ω Input SWR. Within 2.0 Input Level. Below 1V (rms) Output Impedance 600Ω(balance) Output Level. At 400c/s and when frequency deviation is 25Kc, it is +10dBm±0.25dBm Frequency Characteristic. To be capable of switching on and off of the deemphasis circuit, and each characteristic is that, with 400c/s as reference, the deviation from ideal characteristic is to be within ±0.5dB at 50c/s - 7.5Kc. 7.5 - 15Kc Within ±1dB Distortion Factor. Below 0.5% at 100c/s-5Kc when the output is +10dBm. S/N Ratio. Above 60dB at 400c/s and when the frequency deviation is 25Kc. (Video Noise Measuring Part) Freq. Characteristic. Deviation from the ideal characteristic is within ±1.5dB at 100c/s-75Kc. IF Band. Within -1dB in the range of ±50Kc. Frequency Discriminator. Linear up to ±25Kc. Amplitude Suppression Degree Residual Amplitude is below 5%.	

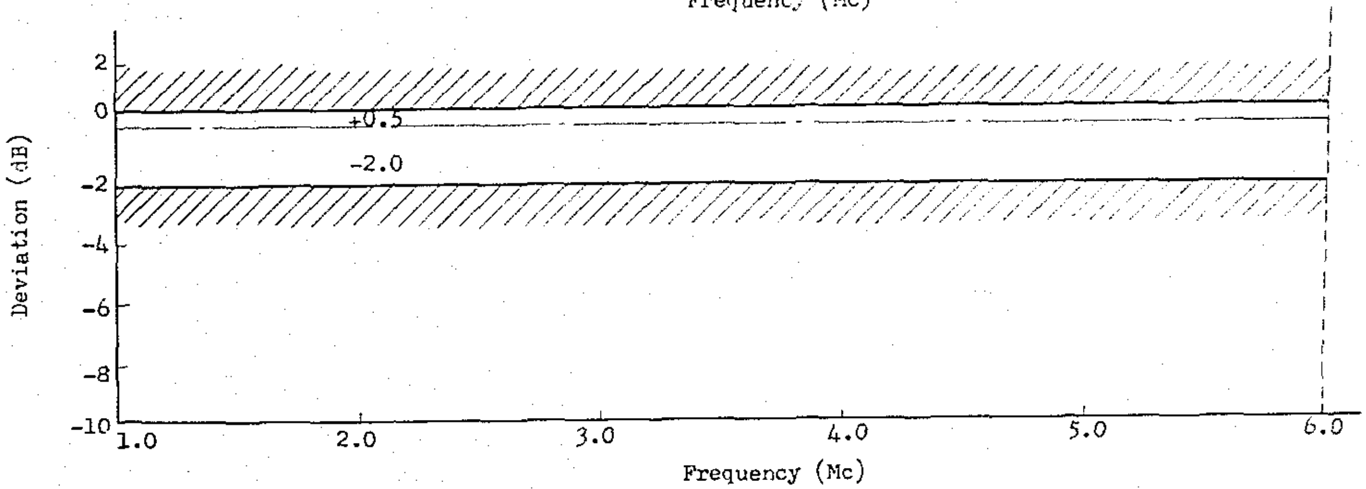
Symbol	Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
IMP.M	Admittance Measuring Instrument.		
	Bridge Part	Frequency Range. 40 - 250Mc. Admittance Measuring Range. Conductance. 0.1 - 1000m℧ Suceptance. ±(0.1 - 1000)m℧ Accuracy. ±(3%+0.2m℧) 0-20m℧ ± ($3\sqrt{M}$%+0.2m℧) Above 20m℧ Provided that M is magnifications of the admittance scale.	GR1602B
	Oscillation Part	Frequency Range. 50 - 250Mc Output. 80 - 200mW	GR1215B (50-250Mc) 1209C (250-960Mc) 1218A (900-2000Mc)
	Detect. Amp. Part (VHF. LM)	Frequency Range. 40 - 250Mc Intermediate Freq. 30Mc	Unit IF Amp GR: 1216-A Mixer GR: 874-MR
IMP.M	High Frequency Impedance Measuring Instrument	Frequency Range. 0.4 - 10Mc. Conductance Measuring Range 0 - 50m℧ Suceptance Measuring Range. 0 - 1.9Fm℧ (F means figures indicating a measuring frequency in Mc unit). 0 - 300pF(by capacity value) Accuracy. Conductance ± $[(2+\frac{F^2}{50})\%+50\mu ℧]$ Suceptance ± $[(2+\frac{F^2}{50})\%+6F\mu ℧]$ ± $[(2+\frac{F^2}{50})\%+1pF]$ (by capacity value)	
	VHF Field Intensity Measuring Instrument	Frequency Range: 27 - 500Mc Power Measuring Range. 0.1μW - 200W Field Intensity Measuring Range. 30 - 115dB Measuring Error. ±2dB Input Impedance. 50Ω or 75Ω	

Appendix 3 Video Modulator Amplitude Frequency Characteristic

For entry, refer to 5.2.1

Date: Name:
Weather
Temperature °C
Humidity %



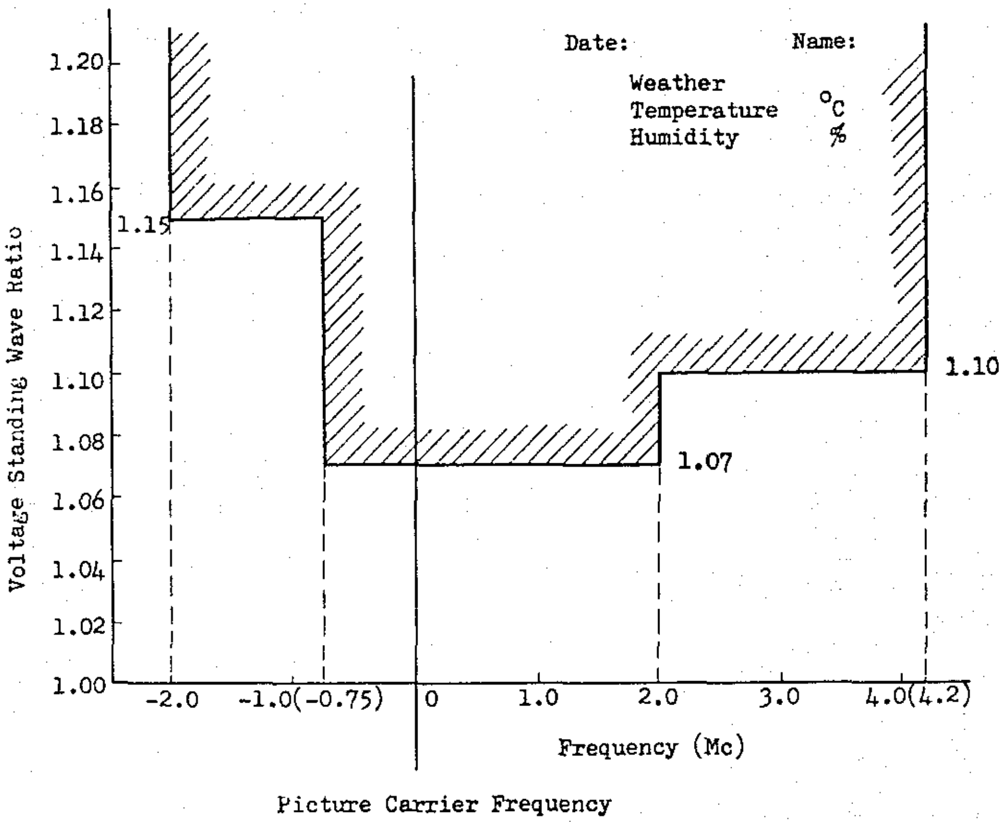


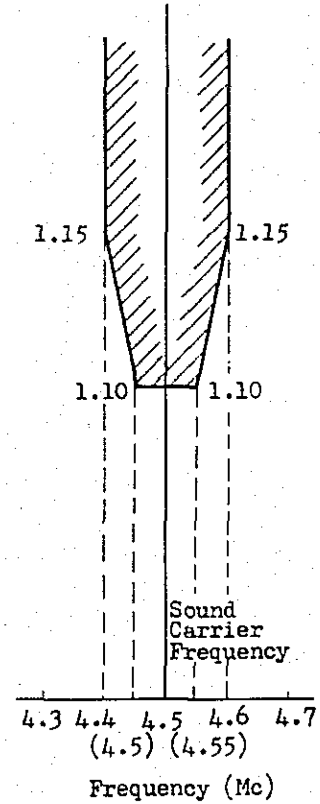
Appendix 5 Vestigial Side Band Filter, Filter Plexer Input Voltage Standing Wave Ratio

For entry, refer to 5.3.5 and 5.4.1.
As for Filter Plexer, Apply to the sound terminal side.

Date: Name:

Weather
Temperature °C
Humidity %





Appendix 4 Video Modulator Nonlinear Distortion

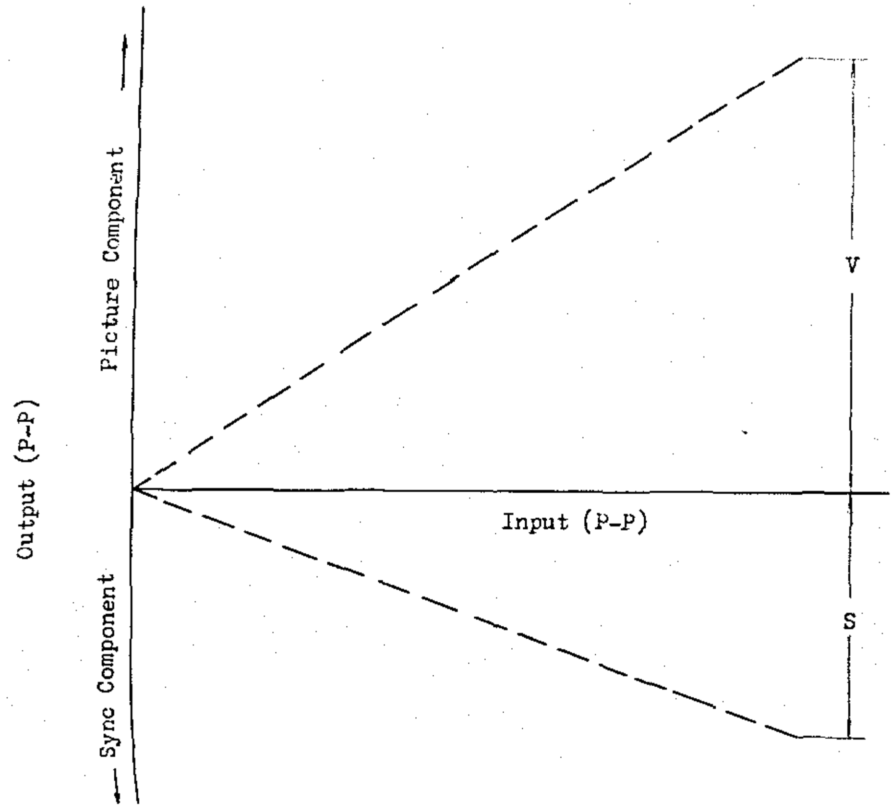
For entry, refer to 5.2.2

Date: Name:

Weather

Temperature °C

Humidity %

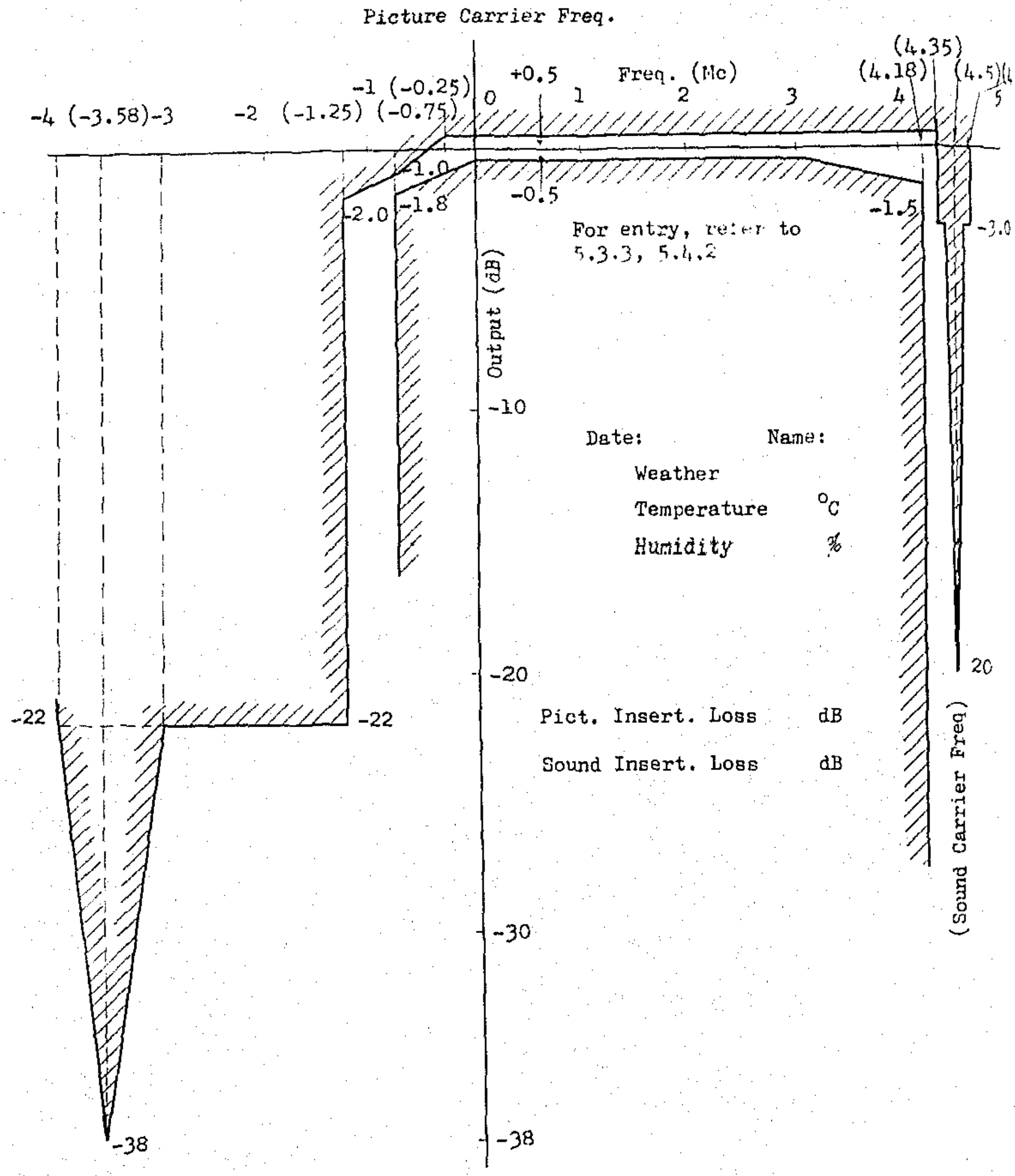


Ratio of Picture Component of Input Signal to Sync Component (%)

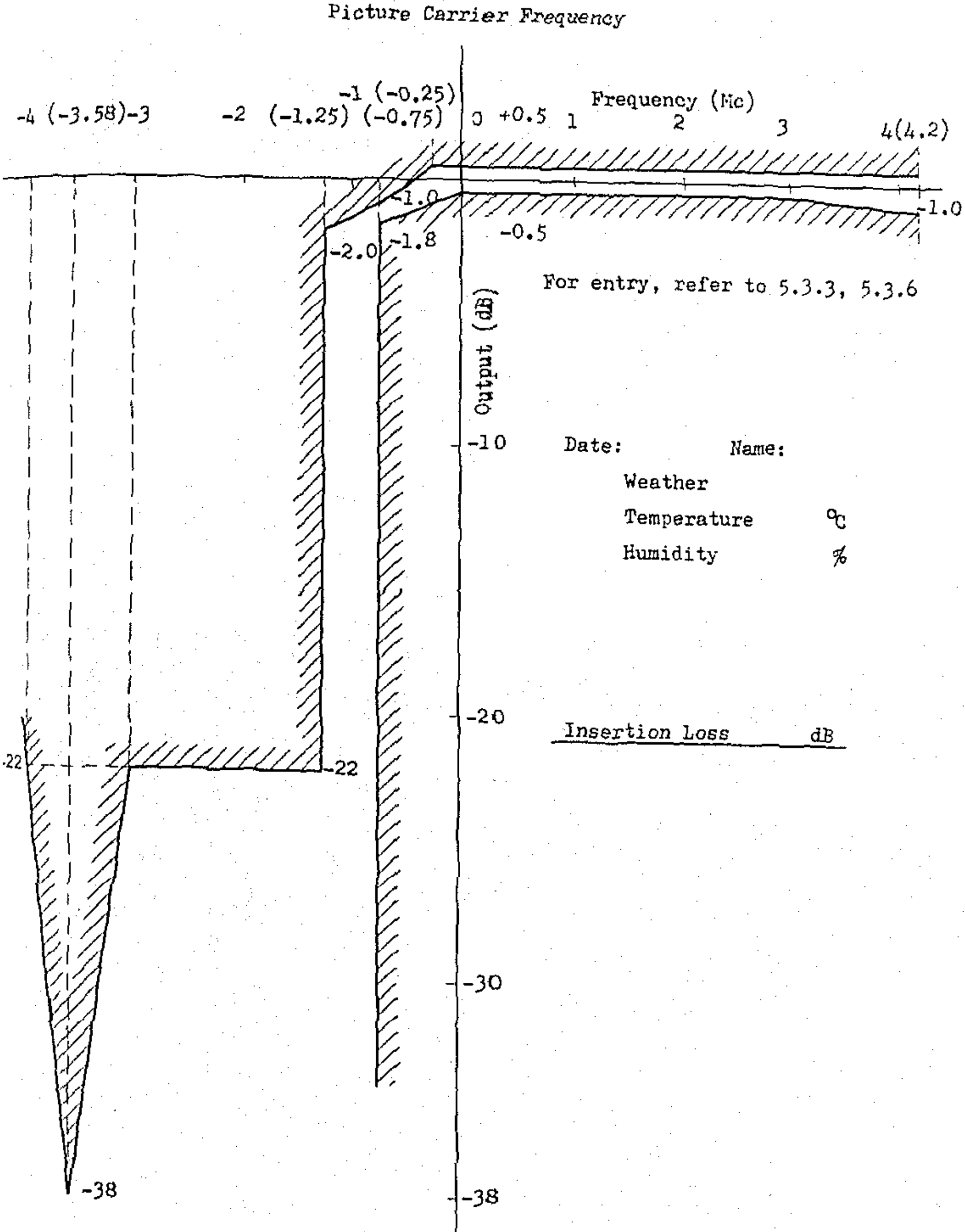
Input (P-P)V	Output(CRO Reading)	
	Sync Comp	Pict Comp

V + S = Amplitude of 1.1 times of V.MOD output voltage necessary for Standard Modulation.

Appendix 7 Filter Plexer Amplitude Frequency Characteristic



Appendix 6 Vestigial Side Band Filter Amplitude Frequency Characteristic



For entry, refer to 5.3.3, 5.3.6

Date: Name:

Weather

Temperature °C

Humidity %

Insertion Loss dB

Appendix 8 Filter Plexer Envelope Delay Time

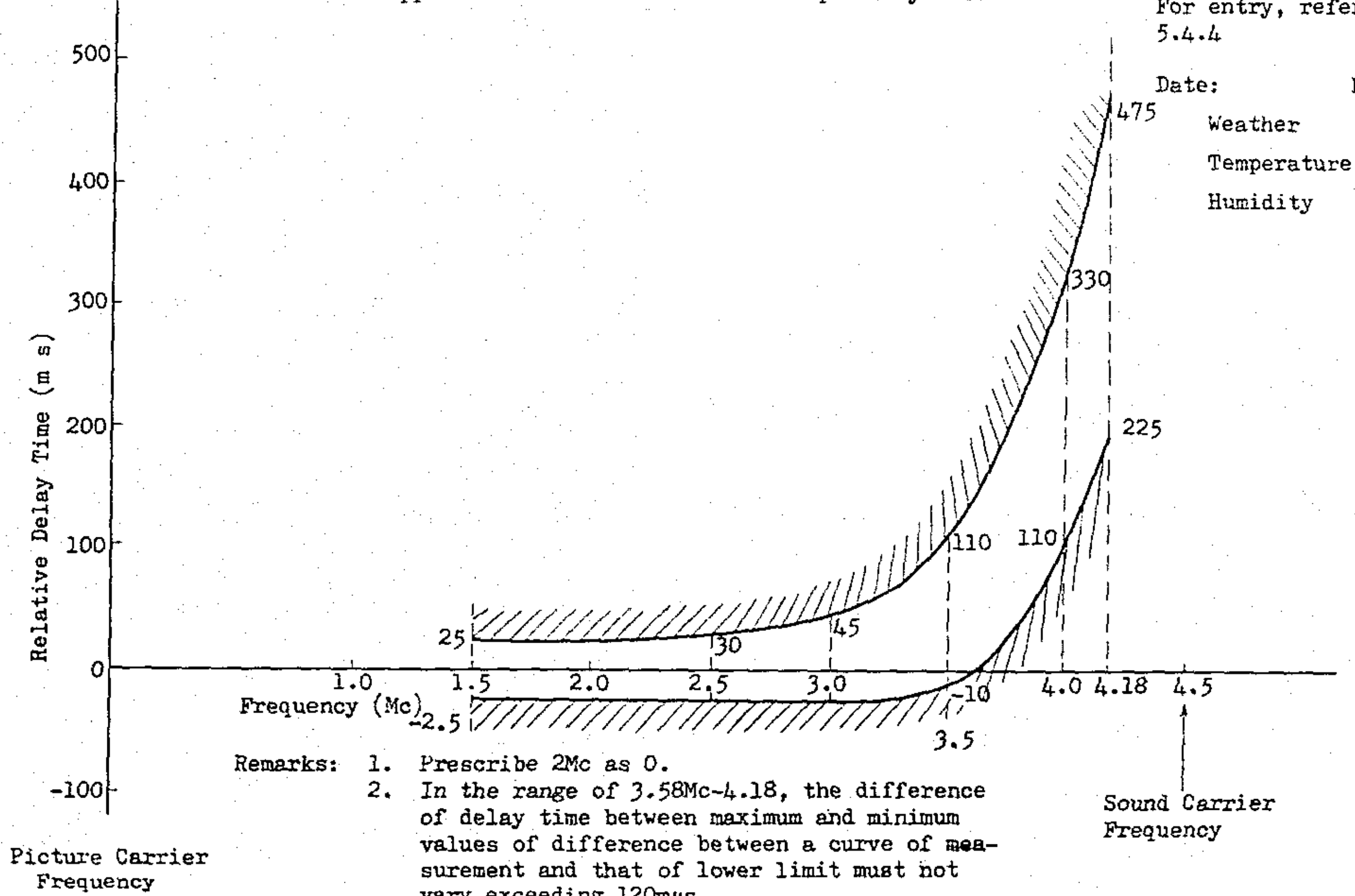
For entry, refer to 5.4.4

Date: Name:

Weather

Temperature ^{o}C

Humidity %



Remarks:
1. Prescribe 2Mc as 0.
2. In the range of 3.58Mc-4.18, the difference of delay time between maximum and minimum values of difference between a curve of measurement and that of lower limit must not vary exceeding 120mμs.

Appendix 9 Visual Transmitter Amplitude Frequency Characteristic

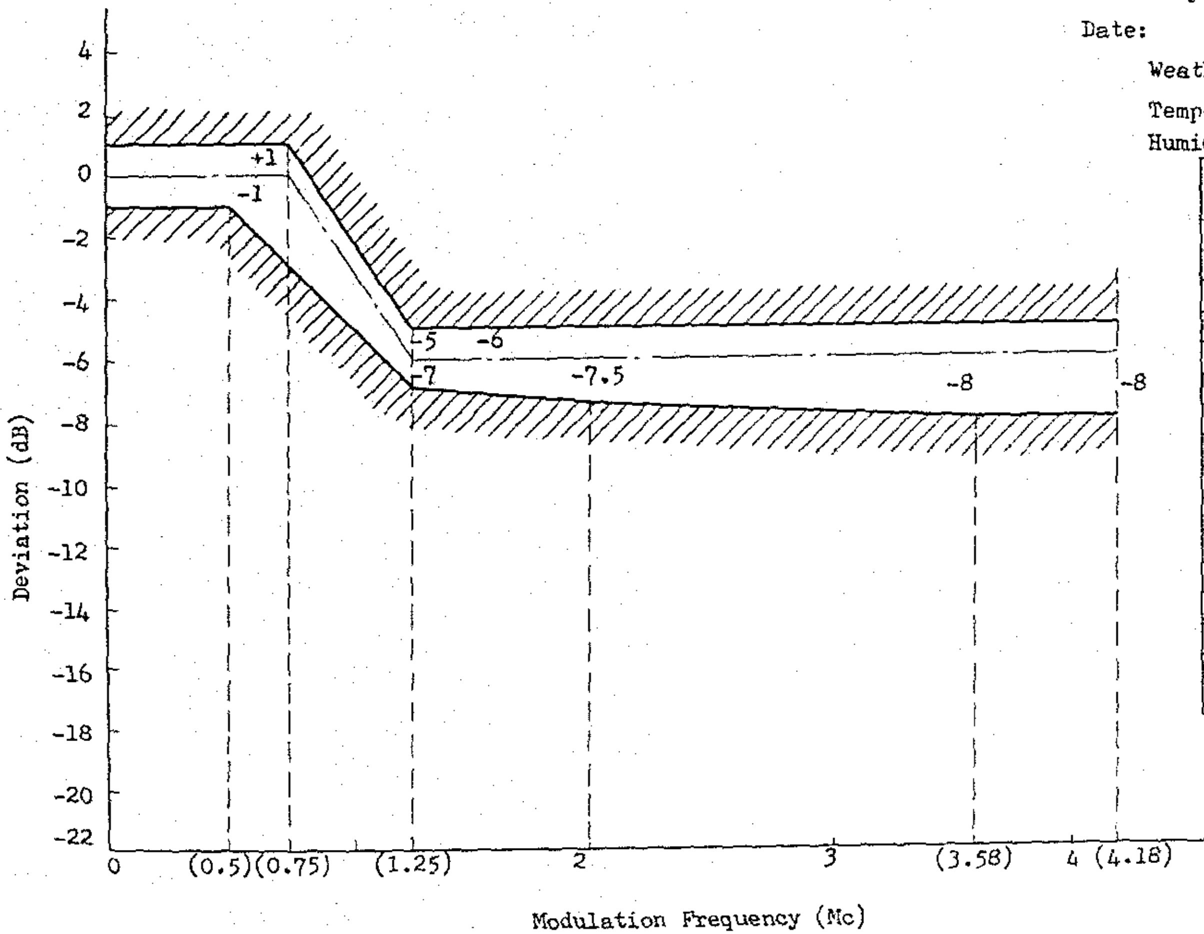
For entry, refer to 5.5.5.

Date: Name:

Weather

Temperature °C

Humidity %



0.1		
0.5		
C.75		
1.0		
1.1		
1.25		
1.5		
2.0		
2.5		
3.0		
3.58		
4.18		
4.5		
4.75		
5.0		
6.0		

Appendix 10 Visual Transmitter Non-linear Distortion

For entry, refer to 5.5.8

Date: Name:

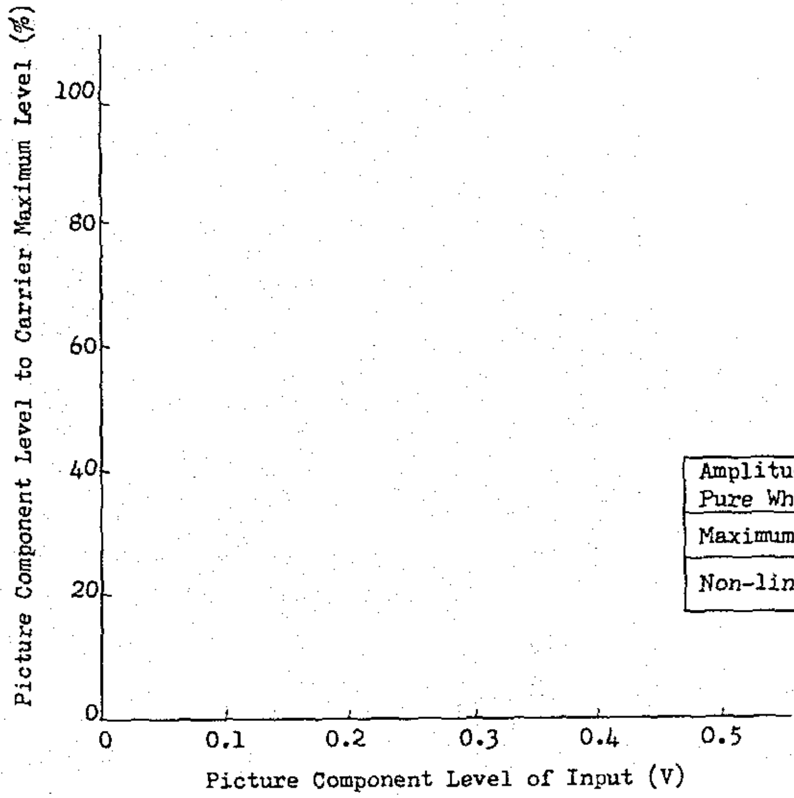
Weather

Temperature °C

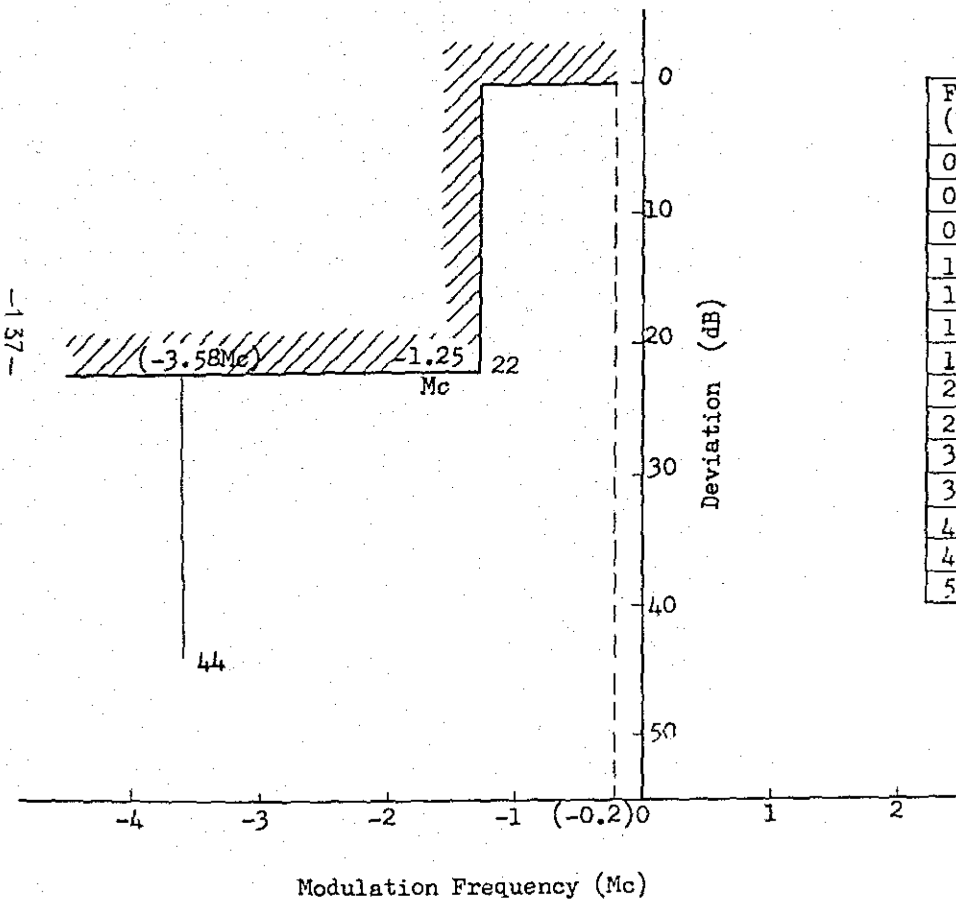
Humidity %

Input (V)	Sync (mm)	Pedes. (mm)	Pict. Comp (mm)
0			
0.1			
0.15			
0.2			
0.25			
0.3			
0.35			
0.4			

Amplitude of Carrier Maximum Level at Pure White Modulation Time A(mm)	
Maximum Deviation x(mm)	
Non-linear Distortion ($\frac{X}{62.5A}$ x 100%)	



Appendix 11 Visual Transmitter Side Band Attenuation Characteristic



For entry, refer to 5.5.11

Date: Name:

Weather

Temperature °C

Humidity %

Freq. (Mc)	Lower Side Band Amp(mm)	Lower Side Band Dev.(dB)	Upper Side Band Amp(mm)	Upper Side Band Dev. (dB)
0				
0.2				
0.75				
1.0				
1.1				
1.25				
1.5				
2.0				
2.5				
3.0				
3.58				
4.2				
4.75				
5.0				

Appendix 12 Visual Transmitter Dynamic and Static Output Variation, Fluctuation due to Modulation

For entry, refer to 5.5.13, 5.5.14 and 5.5.15

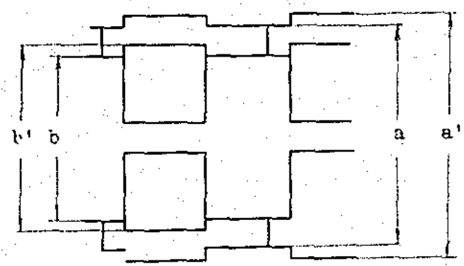
Date: Name:

Weather

Temperature °C

Humidity %

Horiz. Sync Signal



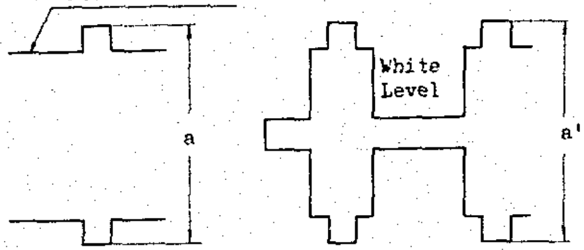
a : Minimum Amplitude of Carrier Maximum Level

a': Maximum " " "

b : Minimum " of Pedestal Level

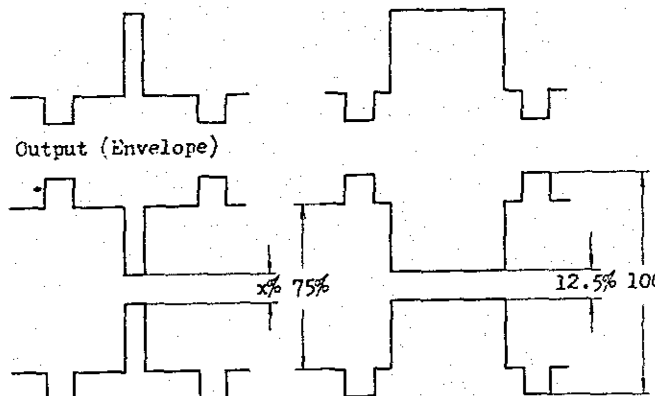
b': Maximum " " "

Dynamic Output Variation	$\left(\frac{a-a'}{\frac{1}{2}(a+a')}x100\%\right)$	
Fluctuation of Pedestal Level	$\left(\frac{b-b'}{\frac{1}{2}(b+b')}x100\%\right)$	



Static Output Variation	$\left(\frac{a-a'}{\frac{1}{2}(a+a')}x100\%\right)$	

Input Signal



Fluctuation of White Level (12.5-x%)	

Appendix 13 Differential Gain and Differential Phase

Place of Measurement	APL (%)	Diff. Gain a(mm)	Diff. Gain b(mm)	Diff. Gain c(mm)	Diff. Gain %	Diff Ph(%)	Diff Ph. (W. Form)
Modulator Monitor	10						
	50						
	90						
Modulated Power Amp (LD)	10						
	50						
	90						
Modulated Power Amp (DEMO)	10						
	50						
	90						
Last Stage Power Amp (LD)	10						
	50						
	90						
Last Stage Power Amp (DEMO)	10						
	50						
	90						
VSBF Output (LD)	10						
	50						
	90						
VSBF Output (DEMO)	10						
	50						
	90						

For entry, refer to 5.2.3, 5.2.4, 5.5.16 and 5.5.17.

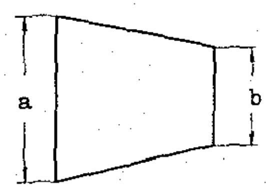
Date: Name:

Weather

Temperature ^{o}C

Humidity %

(1) In case of Linear Line



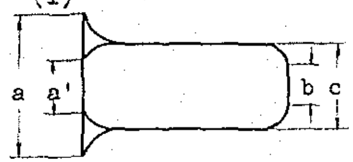
$c=\frac{1}{2}(a+b)$

$DG(Positive)=\frac{a-c}{c}\times100\%$

$DG(Negative)=\frac{b-c}{c}\times100\%$

(2) In case of Curve

(i)

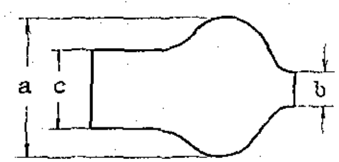


$DG(Positive)=\frac{a-c}{c}\times100\%$

* $DG(Negative)=\frac{b-c}{c}\times100\%$

*Incase a' < b, instead of b, calculate by a'

(ii)



$DG(Positive)=\frac{a-c}{c}\times100\%$

$DG(Negative)=\frac{b-c}{c}\times100\%$

Appendix 14 Amplitude and Phase of Color Video Signal

For entry, refer to 5.5.18 & 5.5.19

Date: Name:

Weather

Temperature °C

Humidity %

1. Amplitude

Place of Measurement \ Hue		Yellow	Cyan	Green	Magenta	Red	Blue
Input Amplitude (mm)							
Modulator Output	Ampl(mm)						
	Dev. (%)						
VSBF Output (L)	Ampl(mm)						
	Dev. (%)						
VSBF Output (DEMO)	Ampl(mm)						
	Dev.(%)						

2. Phase With Phase of Burst Signal as zero standard

Place of Measurement \ Hue		Yellow	Cyan	Green	Magenta	Red	Blue
Input Phase (Degree)							
Modulator Output	Phase (Degree)						
	Diff. (Degree)						
VSBF Output (LD)	Phase (Degree)						
	Diff. (Degree)						
VSBF Output (DEMO)	Phase (Degree)						
	Diff. (Degree)						

Appendix 15 Visual Transmitter envelope Delay Time

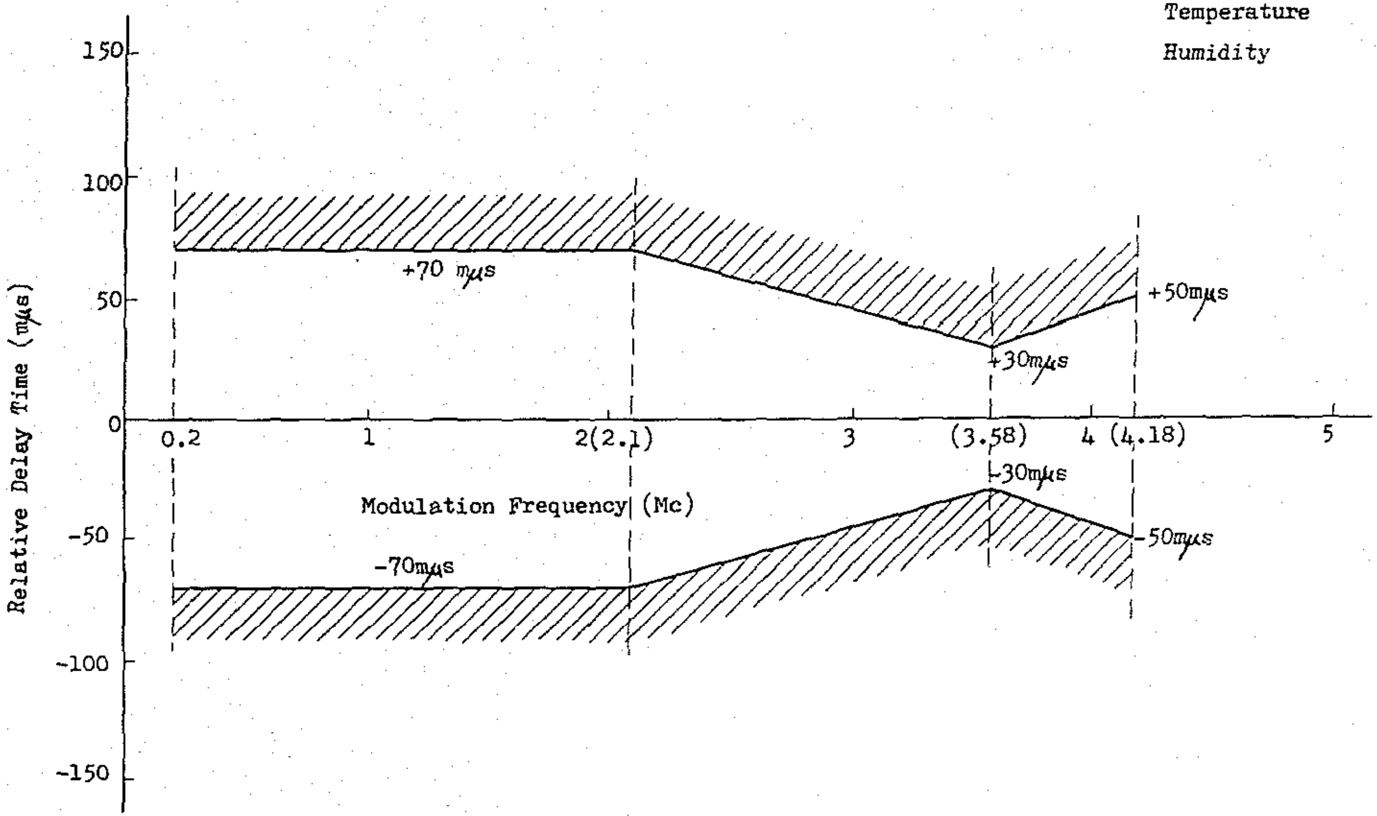
For entry, refer to 5.5.20

Date: Name:

Weather

Temperature °C

Humidity %



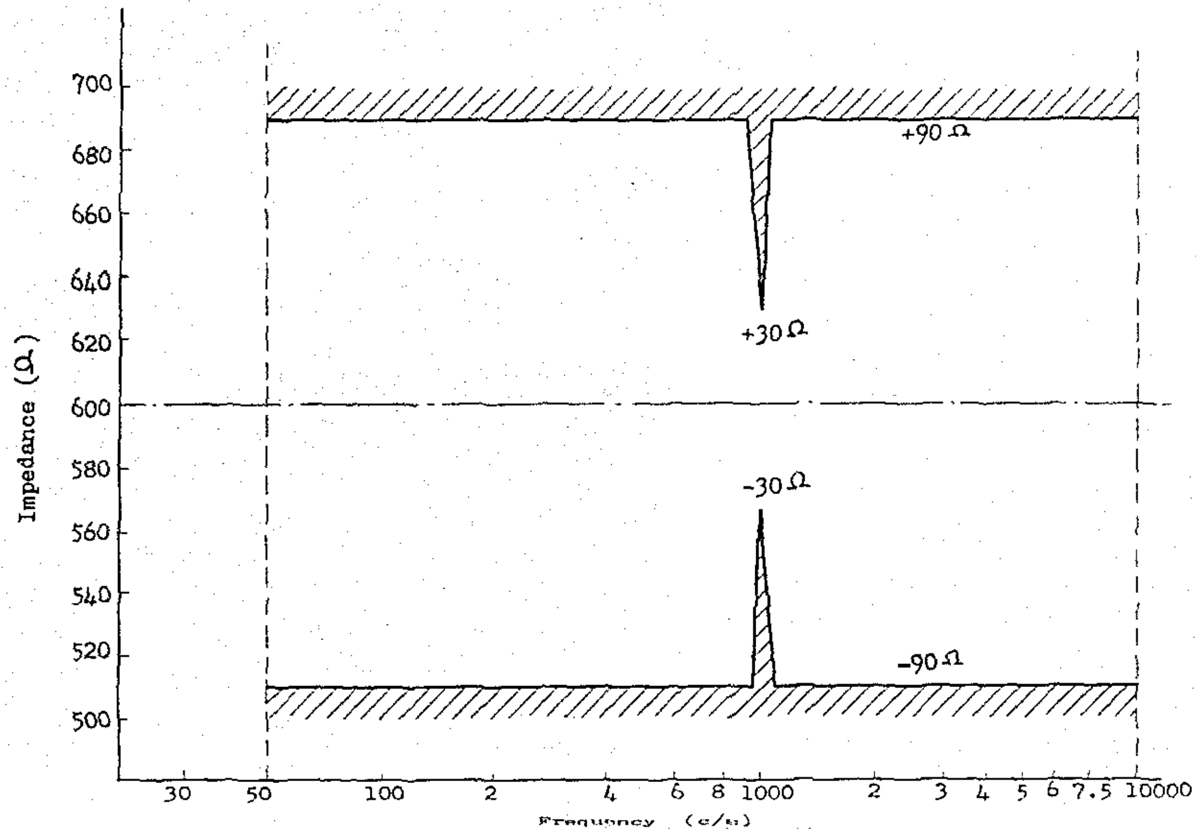
Appendix 16 Aural Transmitter Input Impedance For entry, refer to 5.6.3.

Date: Name:

Weather

Temperature °C

Humidity %



Freq. (c/s)	Impedance (Ω)
30	
50	
100	
200	
400	
600	
800	
1000	
3000	
5000	
7500	
10000	
15000	

Appendix 17 Aural Transmitter Amplitude Frequency Characteristic

For entry, refer to 5.6.5

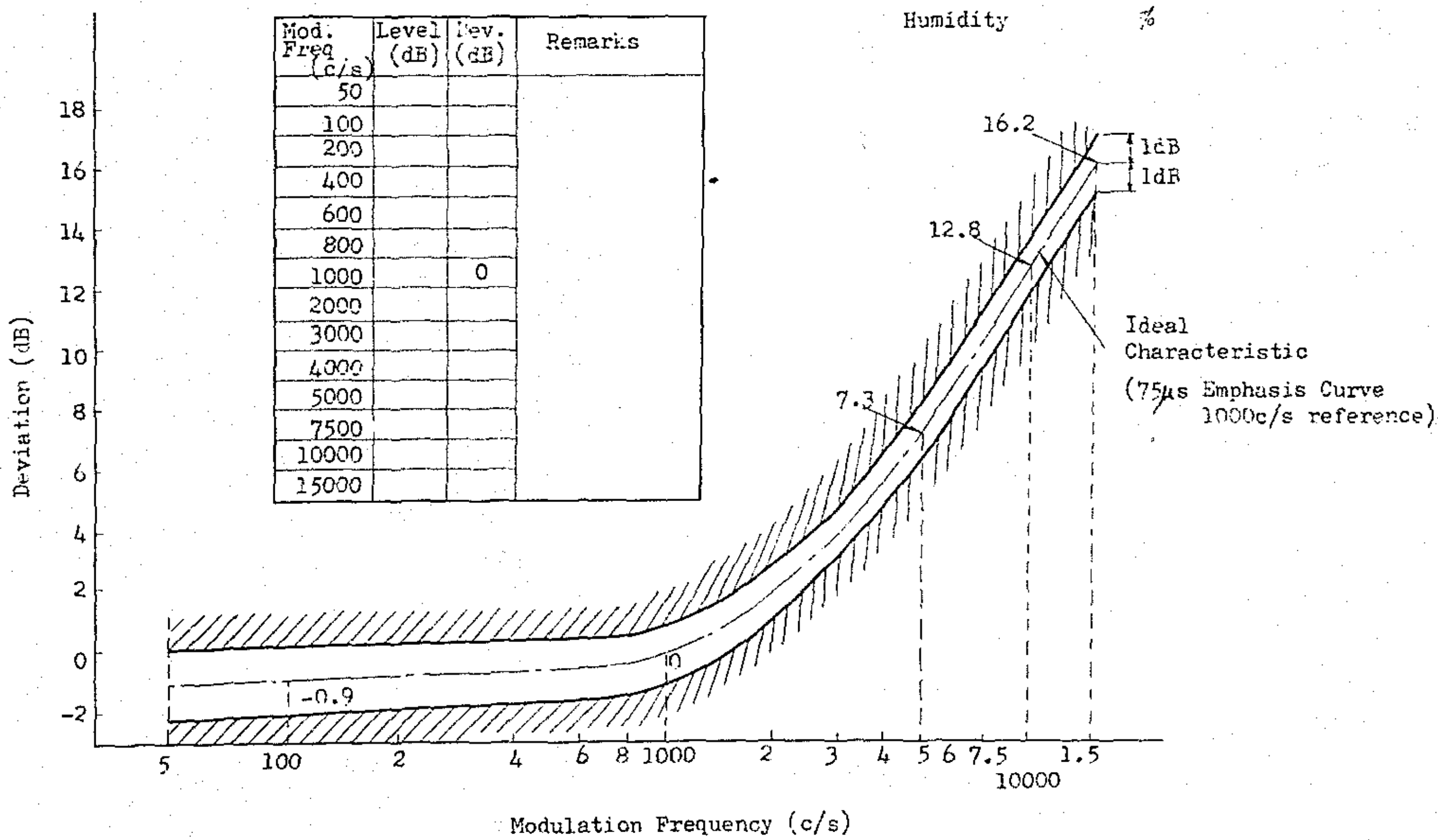
Date: Name:

Weather

Temperature $^{\circ}C$

Humidity %

Mod. Freq (c/s)	Level (dB)	Dev. (dB)	Remarks
50			
100			
200			
400			
600			
800			
1000		0	
2000			
3000			
4000			
5000			
7500			
10000			
15000			



Appendix 18 Aural Transmitter Distortion Factor

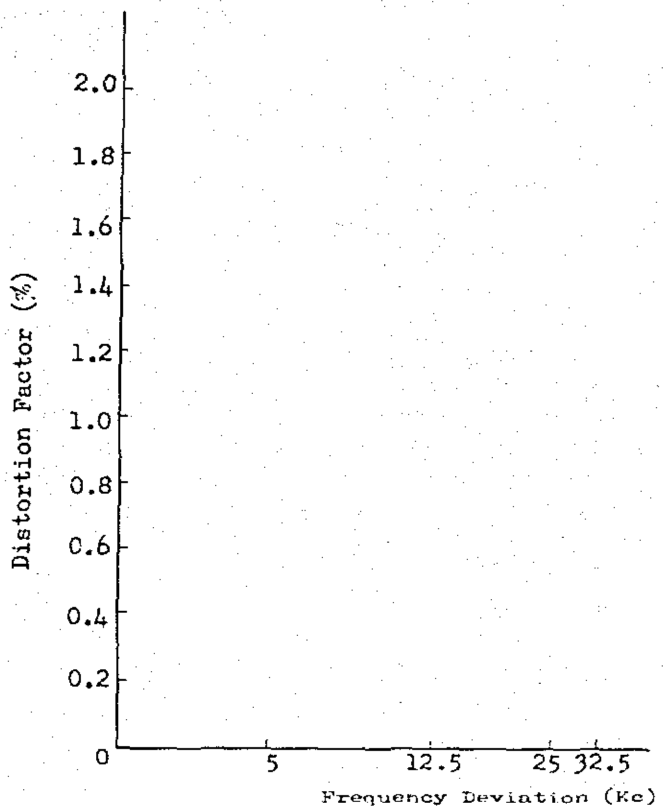
For entry, refer to 5.6.6 and 5.6.8

Date: Name:

Weather

Temperature °C

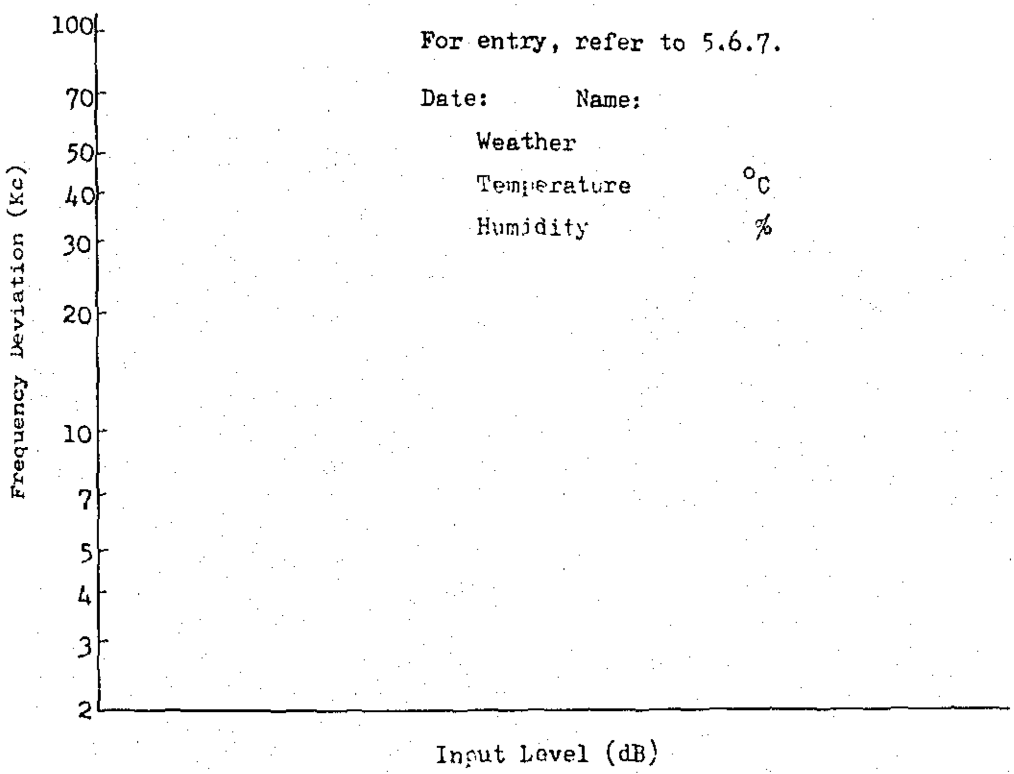
Humidity %



Freq.Dev.		Distortion Factor							S/N
(Kc)	%	50 c/s	100 c/s	200 c/s	1000 c/s	5000 c/s	7500 c/s	15000 c/s	(dB)
5	20								
12.5	50								
25	100								
32.5	130								
Remarks									

Appendix 19 Aural Transmitter Frequency Deviation

1000c/s		2000c/s		5000c/s		75000c/s		10000c/s		15000c/s	
Level (dB)	Dev. (KC)	Level (dB)	Dev. (KC)	Level (dB)	Dev. (KC)	Level (dB)	Dev. (KC)	Level (dB)	Dev. (KC)	Level (dB)	Dev. (KC)
Remarks											



For entry, refer to 5.6.7.

Date: Name:

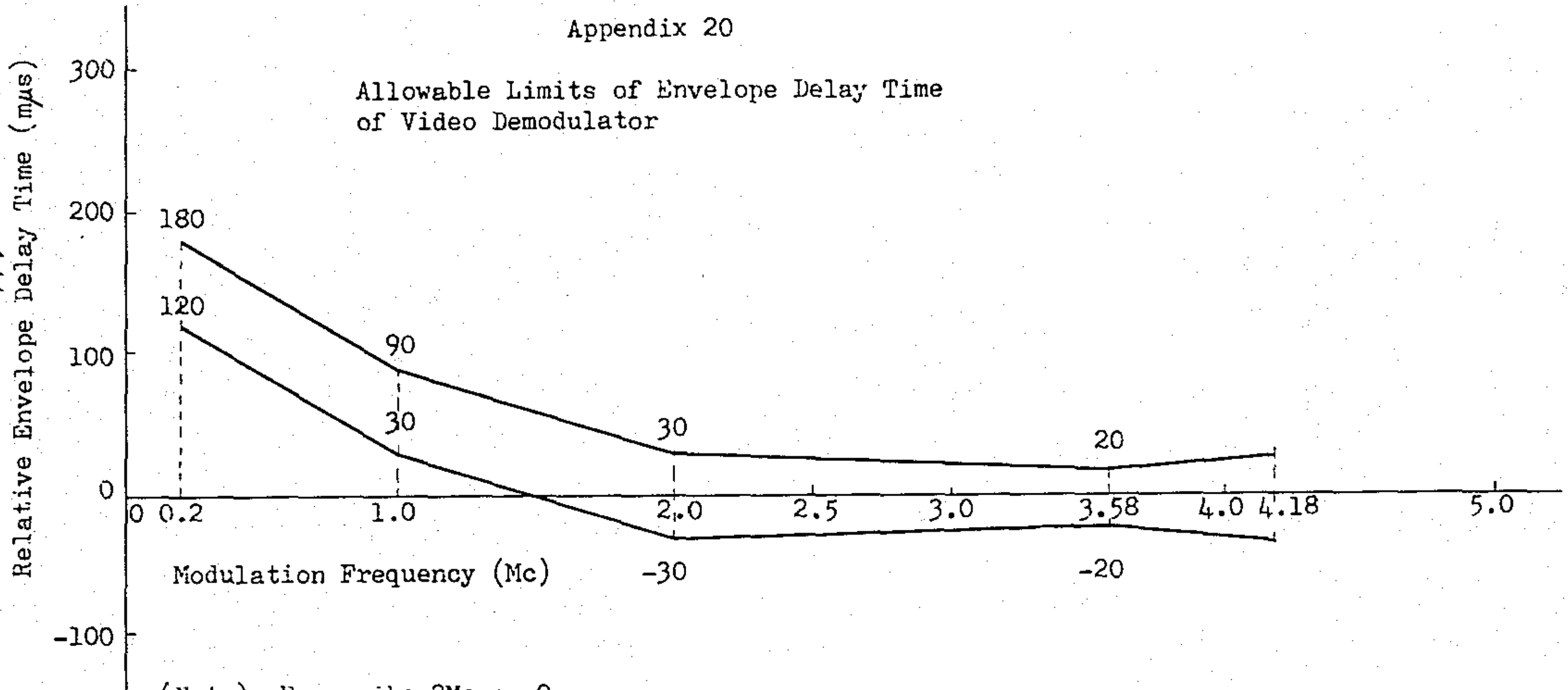
Weather

Temperature °C

Humidity %

Appendix 20

Allowable Limits of Envelope Delay Time of Video Demodulator



(Note) Prescribe 2Mc as 0.

Explanation

1. Introduction

This specification was prescribed for the purpose of integrating the performance and methods of testing of TV transmitters to be employed for Channel 1 to 12 with its contents made in accordance with present technical standards, and laws and regulations of radio wave in Japan.

2. Contents of the Specification

(1) The specification covers mainly "electrical performance", and "mechanical performance" shall be considered separately.

(2) Individual Performance and Overall Performance

Prescription of an overall performance alone would be possible for the overall characteristic to attain a satisfactory condition by mutual compensations even if the performance of each block is insufficient due to the electrical construction and mechanism of the equipment, however, the other one was also prescribed by considering possible occurances of a local overstrain on each block or a troublesome problem of maintenance.

(3) Input Level

As this is solely directed to the equipment for unattended stations (two unit system), reference for the video is set on 0.5V (P-P) because of the necessity of branching VS signal wave forms of 1V (P-P) to two transmitters, and +4dBm and -36dBm are considired as standard to branch +10dBm and -30dBm (in case of a station by cable) for the sound.

(4) Video Wave Form Distrotion

Testings by the aid of sine square waves seem to be reasonable, however, those using square waves are described this time in consideration of the preparation of measuring instruments, with minor description on the former for reference.

(5) Video Signal-to-Noise Ratio

Reduction figures of the video system were made to be 4.4dB by taking a large signal component within the permissible limits of linearity and simplifying the method of calculation of modulation degree.

(6) Differential Gain (How to determine the reference amplitude of superposed high frequency)

The method of determining a portion where superposed high frequencies can be regarded as constant is to find the portion where the linearity of the system is linear and for differential gain it is adequate to express by comparison of a curved portion to this portion. Since the portion where the linearity is linear is regarded as constant in the amplitude of the superposed high frequencies, this constant part will be treated as reference. In case of absence of the constant portion, generally the plotted line of superposed high frequency amplitude becomes non-linear and has a portion where the differential coefficient of this curve is smallest and this is the portion where the amplitude difference of the adjacent superposed high frequencies is smallest and the linearity of the system is closest to the linear line. Accordingly, this portion will be taken as reference and considered as a constant portion. In case no portion which is regarded as constant does exist at all (practically it is very rare), it means that the superposed high frequency is linearly increasing or decreasing, and for this, a method of calculation is specially described. In case that two places which are considered as constant exist (it is very rare), judgment on which the system represents the most linear portion will be made from a theoretical function of the circuit element.

(7) The performance of phase equalizer to be used for equalizing the envelope delay time is excluded from this specification.

In principle, use of "color signal phase compensating device (phase change passive circuit network system)" prescribed in the Broadcast Engineering Standard Specification (BSS) is a standard.

(8) Regarding a measuring frequency for the sound input level and the variation of signal-to-noise, etc.

The use of 1000c/s as reference was determined instead of 400c/s which had been used as reference in the past.

1000c/s is the frequency regarded as reference for almost all other sound equipments, which adaption was decided in consideration of operational standpoint of "front" service and simplification of measurement.

As a reference frequency, 1000c/s may be considered inadequate because of its rise due to 0.9dB emphasis (75μs) compared with the low range, however, between 400c/s and 1000c/s, emphasis is 0.6dB and the specification of frequency characteristic prescribed lies in the range of ±1dB, so that practically it will not cause any serious problem.

METHOD OF TESTING OF VIDEO CONTROL EQUIPMENT

IV. METHOD OF TESTING OF VIDEO CONTROL EQUIPMENT

1. Range of Application

This specification is applied to the method of testing video control equipment.

2. Meaning of Symbol

As described in Appendix 1.

3. Meaning of Terminology

(1) Video Control Equipment

It means the equipment which transmits video and synchronizing signals or their composite signals, with no conversion systems (1) contained.

Note (1): Such as photoelectric, magnetoelectric and frequency conversition systems.

(2) Normal State of Operation

It means the state set up, under the actual state of prescribed arrangements and connections, according to the prescribed power source and level diagram.

(3) Reference Frequency

It means the frequency specified in accordance with the purpose of a testing.

4. Condition of Testing

Unless otherwise specified, set up as follow.

4.1 Power Source

Following are the standards of power sources to be used for the testing.

4.1.1 A C Power Source

The power source must be of voltage and frequency specified for the equipment.

4.1.2 D C Power Source

(1) The voltage must be adjusted to the value specified for the test equipment.

(2) The regulation has to be below the value specified under the prescribed state of operation.

4.2 Measuring Instrument

Appendix 2 shall be treated as standard. Also, the indications of measuring instruments employed are to be made according to Appendix 3.

4.3 State of Testing

4.3.1 Temperature and Humidity

Standard temperature and humidity are to be 20°C in temperature and 65% in relative humidity. When temperature lies in the range of 15-25°C and relative humidity 45-85%, it may be regarded as the standard state of temperature and humidity. However, when they go off the ranges, temperature and humidity must be indicated.

4.3.2 Atmospheric Pressure

The standard atmospheric pressure is to be 1013mbar, however the range of 1003-1023mbar can be regarded as the standard state of atmospheric pressure.

4.3.3 Insolation

To be such state that direct rays of the sun do not fall.

4.3.4 Vibration and Impact

To be in the stationary state.

4.3.5 State of Setting of Test Equipment

Unless otherwise specified, it must be in the normal state of operation.

5. Construction Test

Examine whether the following each item conforms to prescriptions.

5.1 Appearance

Assembly, plating, coating, wiring, color code of wiring, parts & marks, etc.

5.2 Composition

Content of composition, quantity of spares and accessories and others.

5.3 Size and Weight

6. Test of Basic Performance

6.1 Performance Test

6.1.1 Test of Electric Performance

(1) Voltage, Current and Signal Wave Form

(a) Method of Measurement

Examine the presence of any abnormality in the function and the performance and, at the same time, record reading of the meters attached to the equipment and signal wave forms and voltages of every stage. And, as to voltage and current in the following each part, indicating meters of above 2.5 class must be used for measuring other places than the indicating meter measurement and also when indicating meters are not attached.

(i) Equipment electric supply source voltage and total necessary current, and power.

(ii) Receiving power voltage and current of the units such as amplifiers, etc, and voltage of each electrode of vacuum tube and transistor.

(iii) Voltage and current of the input and output of power source unit, and input power.

(b) Precautions for the Measurement

(i) Indicating meters attached to the instrument must be calibrated in advance.

(ii) For voltage measurement, try to use the valve voltmeter because sometimes the internal resistance of a voltmeter affects strongly. In case a valve voltmeter is not available, measure, for convenience sake, by the voltmeter of internal resistance of more than 10K Ω/V and describe the range of the measurement.

(2) Variation in the adjustment of various regulators

(a) Examine the presence of any abnormality on the following ocassion.

(i) In case various regulators are varied to maximum and minimum.

(ii) Transient abnormal function in case various regulators are varied suddenly.

6.1.2 Test of Mechanical Performance

(1) Method of Measurement

Examine whether or not the manipulations of various regulators and switches are normal and conform to prescriptions.

(a) Movements of knobs of various regulators (stiffness, mechanical click and discontinuity, etc.)

(b) Operational pressure of torque switch, etc.

(c) Manipulations and indications of knobs and switches of various regulators.

(d) Electrical shock and generation of noise at the time of the manipulation of regulator and switch, etc.

6.2 Continuous Running and Temperature Rise

6.2.1 Method of Measurement

Under the normal state of operation, run continuously for 6 hours and then measure the following each item.

(1) Check the wave form and the voltage of the signal of necessary point.

(2) Read the voltage and the current of each section by the attached indicating meter.

(3) Measure the temperature of the following each section.

Transistor, selenium rectifier element, electrolytic condenser close to heating element, heat resisting resistor, power source transformer, surface temperature of unit, room temperature.

6.2.2 Precautions for the Measurement

(1) Temperature rise means in terms of room temperature.

(2) In principle, use a thermister thermometer, however, when there is no worry of causing errors in the measuring result a bar-type alcohol thermometer may be used.

(3) The measurement is shall be performed at the time of starting the operation, after passing three hours and at the time of closing the operation.

6.3 Insulation Resistance

6.3.1 Method of Measurement

According to Table 2, measure by the insulation resistance meter.

Table 2

Measuring System			Insulation Resistance Meter Rating
System of Power Source Primary Circuit			500 V
Circuit Systems among Units and those among Panels	System of Power Source Circuit	Working Voltage above 100 V, below 500 V.	500 V
		Working Voltage below 100 V.	250 V
	Systems of Program & Control Signal Circuit		250 V

6.3.2 Precautions for the Measurement

In measuring circuits systems among units and those among panels, pay attention to the following items.

(1) Dismount a single unit and measure at the terminal of circuit.

(2) In the test circuit, if parts not for the measurement are included (vacuum tube, transistor, shunt resistor, electrolytic condenser & lamps, etc.), exclude them and measure.

6.4 Impedance (Input, Output)

6.4.1 Method of Measurement

(1) Bridge Method

In the prescribed frequency band, measure real part and imaginary part of impedance. However, except for low impedance connected directly with the coaxial cable, impedance may be indicated by the absolute value.

(2) S W R Method

In principle, it is performed by Fig. 1, and the method of calculation follows Table 3.

Fig. 1

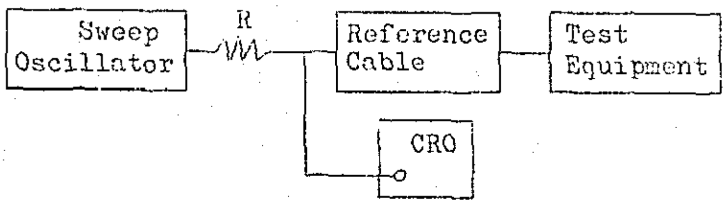
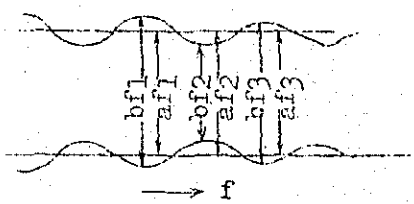


Table 3

Wave Form	Method of Calculation
 Prescribed Frequency Band	$\frac{\lvert af-bf \rvert}{2af} \times 100\%$

6.4.2 Precautions for the Measurement

(1) As a measuring method, bridge method is the principle, however, in case of measuring a relative value which does not require the absolute value, there is a method in 6.4.1 (2).

(2) In case of the bridge connection circuit, connect the matching load to the one end and then measure from the other end.

(3) When SWR method is applied, settle the value of R bigger than 1k Ω and the length of reference cable about 50m.

6.5 Frequency Characteristic

6.5.1 Amplitude Frequency Characteristic

(1) Measuring Circuit

In principle, it follows Fig. 2.

Fig. 2-1 In case of the equipment without clamp

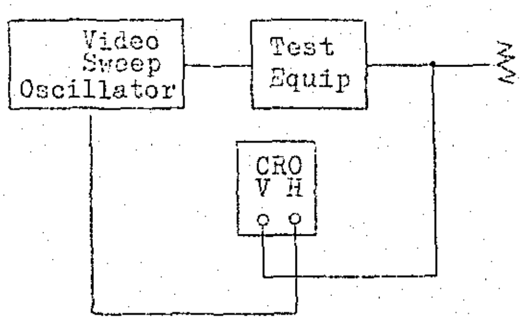
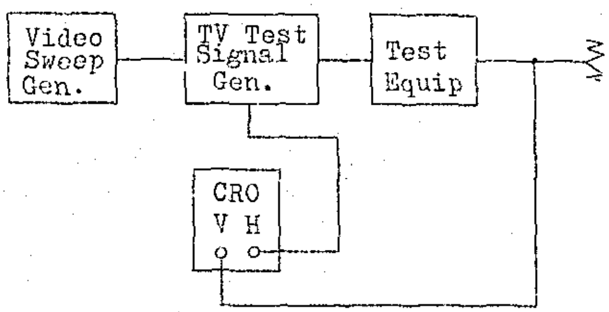


Fig. 2-2 In case of the equipment with clamp



(2) Method of Measurement

(a) Feed the output of video sweep generator to the input terminal of test equipment and measure its output by the oscilloscope.

(b) In measuring the equipment which requires synchronizing signals such as stabilized amplifier, etc., feed the output of sweep generator to the TV test signal generator and measure by attaching the synchronizing signal.

(3) Method of Indication of Measuring Result

Indication of the result of measurement is represented by deviation (dB) from the reference frequency.

(4) Precautions for the Measurement

(a) The amplitude of sweep signal is to be of the size in the range not suffering from non-linear distortion by the test circuit.

(b) According to necessity, perform the measurement by frequency plot method, and when this does not contain the blanking signal, a valve voltmeter may be used as detector.

(c) According to necessity, measuring by attaching a detector to the input of oscilloscope is no problem. However, in this case, the measurement has to be performed after confirming that the range lies in the limits not containing non-linear distortion according to precaution (a) for the measurement.

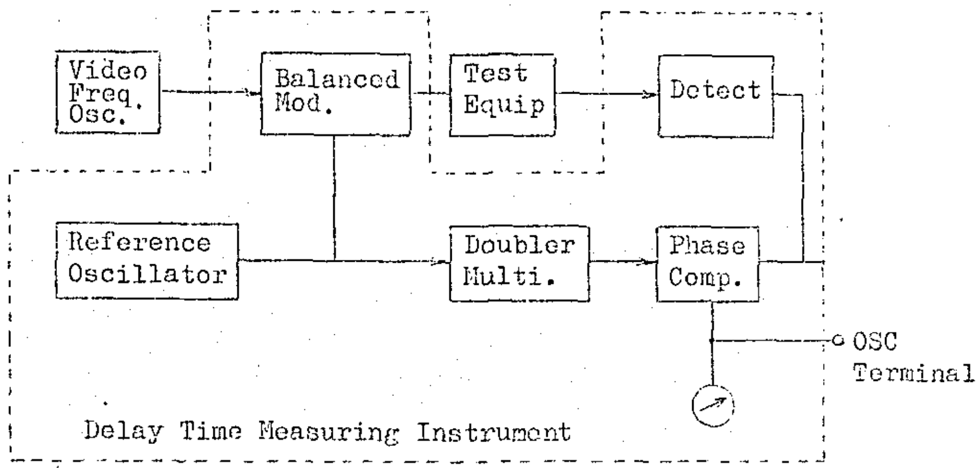
(d) Impedance of the signal source of a measuring circuit must be made equivalent to the signal source impedance of test equipment under the state of operation.

6.5.2 Delay Time Frequency Characteristic

(1) Measuring Circuit

In principle, it follows Fig. 3.

Fig. 3



(2) Method of Measurement

The signals from the signal generator is balance-modulated by the output of the reference oscillator, which signals is then fed to the input terminal of a test equipment and by comparing the phase of the detected envelope of the signal at the output with the phase of the signal wave form obtained by multipling the original output of the reference oscillator twofold, measure the envelope delay time.

(3) Precautions for the Measurement

(a) According to necessity, when the blanking signal is inserted, the frequency of the reference oscillator must be selected in the neighborhood of the first zero point (95.4Kc) of frequency spectrum of the blanking signal.

(b) Instead of video frequency oscillator, video sweep oscillator may be used, however, in this case, oscilloscope must be employed as phase indicator.

6.6 Wave Form Distortion

6.6.1 Wave Form Distortion of Video Signal

(1) Measuring Item

(a) High Band Distortion (Overshoot, Ringing, Rise Time or Half Amplitude Duration of Sine Square Wave).

(b) Medium Band Distortion (Streaking, Smear).

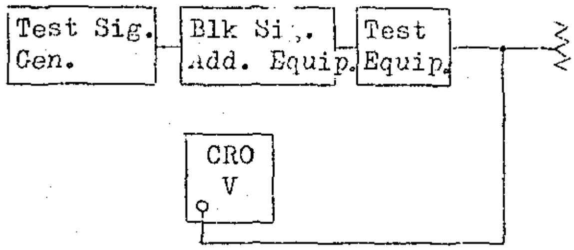
(c) Low Band Distortion (Sag).

(d) Ultra-low Band Distortion (DC Step Response).

(2) Measuring Circuit

In principle, it follows Fig. 4.

Fig. 4



(3) Method of Measurement

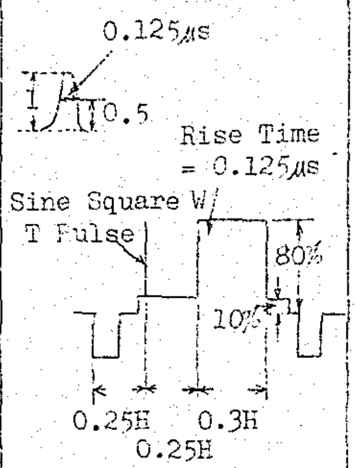
Feed the input signal shown in Table 4 to the input terminal of a test equipment and measure its output by the oscilloscope. And, calculate wave form distortions according to the right column of Table 4.

(4) Precautions for the Measurement

(a) In case of intending to measure DC step response, use pen oscillograph or memory scope, or do it by photographing.

(b) According to necessity, use sine square wave 2T pulse, ½T pulse as input signal, however, as simultaneous performance with 250Kc square wave test is not necessary, perform either one.

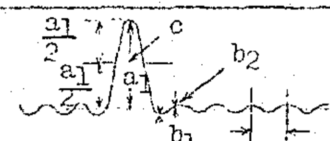
Table 4-1

<table>
<tr><th rowspan="2">Measuring Item</th><th colspan="2">INPUT</th><th rowspan="2">Method of Calculation</th></tr>
<tr><th>Wave Form</th><th>Wave Form Distortion</th></tr>
<tr><td>High and Medium Band Distortion</td><td>
</td><td><u>Sine Square Wave</u>

Deviation of Half Amplitude Duration & Amplitude Deviation:
Below 1% of Prescribed value.
Ringing:
Below 1%

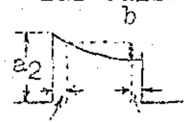
<u>T Bar Pulse</u>

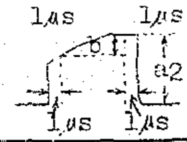
Overshoot:
Below 1%

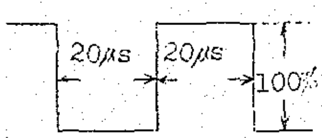
Streaking:
Below 1%</td><td>

Half Amplitude Duration: C
1st Ringing Amplitude= $\frac{b_1}{a_1}$ x100%
2nd Ringing Amplitude= b2/a1 x 100%

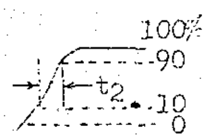
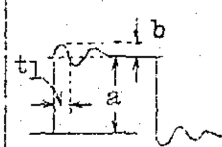
Ringing Freq. = $1/t_1$
(3c/s after main signal)
(Only T Pulse)

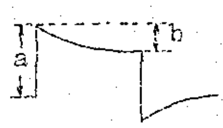
Bar Pulse Ratio = $\frac{a_2-a_1}{a_1}$x100%


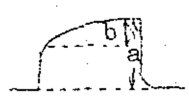
Streaking = $\frac{b}{a_2}$x100%


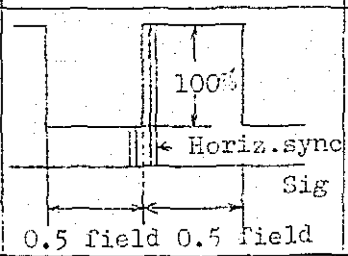
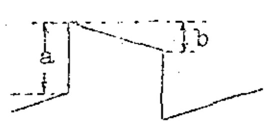
Smear = $\frac{b}{a_2}$x100%</td></tr>
<tr><td>High & Medium Band Distortion</td><td>

250Kc Square Wave</td><td>Overshoot:
Below 1%

Rise Time t_2:
Below 0.03µs

</td><td>

Overshoot= $\frac{b}{a}$ x 100%
Repeating Freq. = $1/2t_1$
<hr>

Streaking = $\frac{b}{a}$x 100%
<hr>

Smear = $\frac{b}{a}$ x 100%</td></tr>
<tr><td>Low Band Dist.</td><td>
</td><td>Sag: Below 0.5%</td><td>Sag= $\frac{b}{a}$x100%

</td></tr>
</table>

6.6.2. Wave Form Distortion of Synchronizing Signal

(1) Measuring Item

(a) Rise Time

(b) Overshoot

(c) Sag

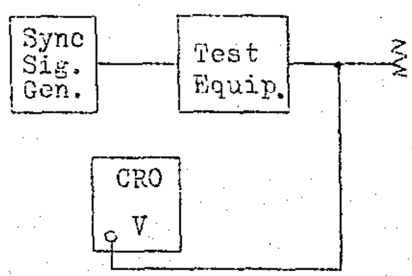
(d) Pulse Width

(e) Phase of Front Porch

(2) Measuring Circuit

In principle, it follows Fig. 5.

Fig. 5



(3) Method of Measurement

Feed synchronizing signals at the input level specified by the standard system to the input terminal of a test equipment and measure its output by the oscilloscope.

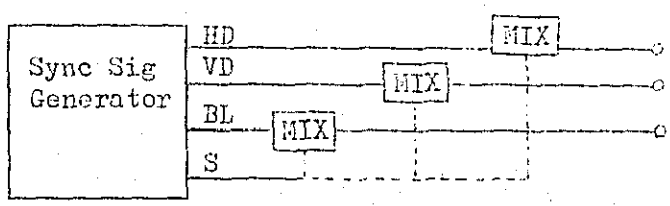
And, methods of calculations of (a), (b) and (c) of 6.6.2 (1) shall be as shown in Table 4.

(4) Precautions of the Measurement

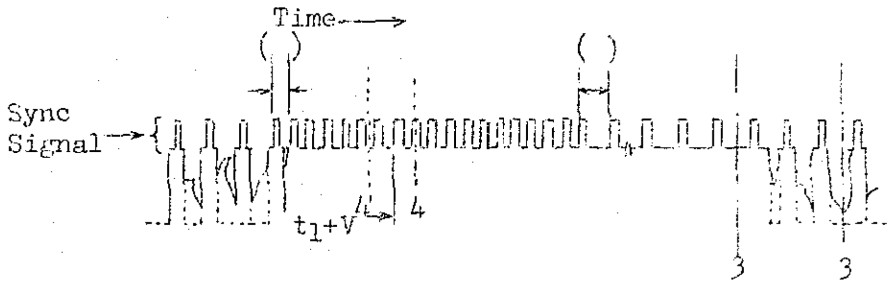
(a) For pulse width and phase, measure places of (   ) shown in Fig. 7. The mensuration of driving signal shall be the same as that of horizontal sync signal.

(b) In case that a test equipment is the sync signal generator, as shown in Fcg. 6, perform the measurement at the output terminal of resistance mixer.

Fig. 6



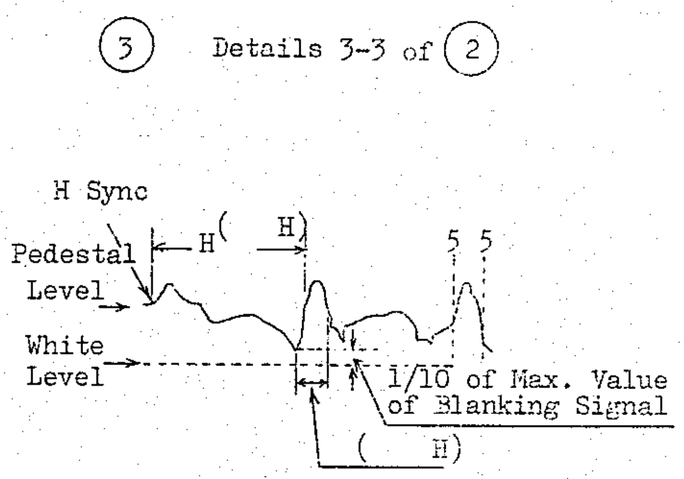
(2) Next Field.

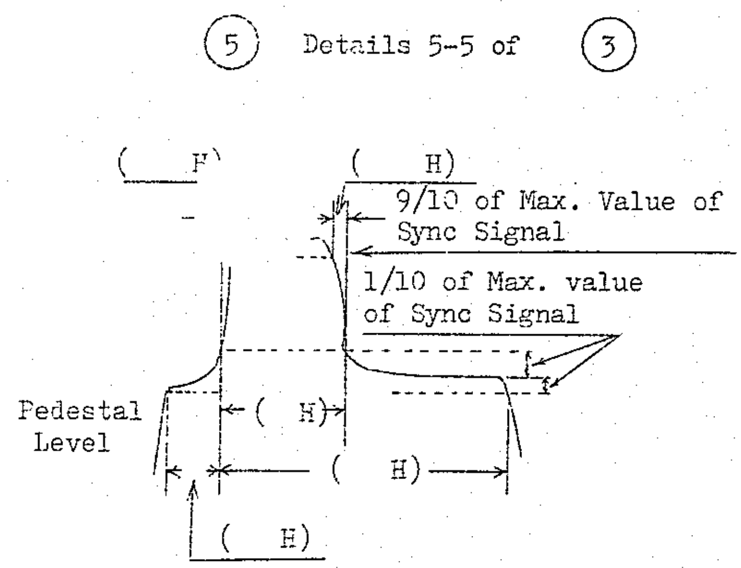


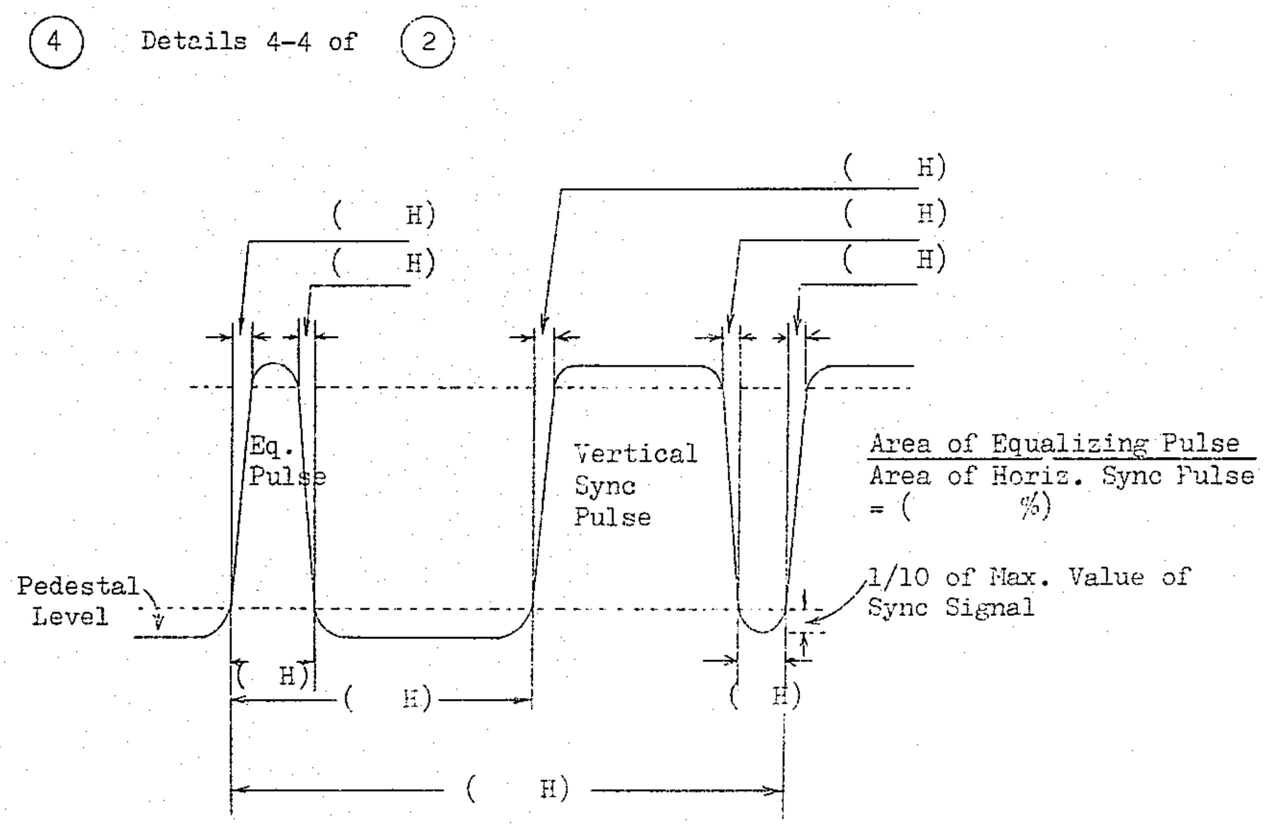
* Note 2: H means time from the beginning of one scanning line to the beginning of next scanning line.

* Note 3: V means time from the start of one field to the start of next field.

Fig. 7-2


3
Details 3-3 of 2
H Sync
Pedestal Level
White Level
H(H)
5 5
1/10 of Max. Value of Blanking Signal
(H)


5
Details 5-5 of 3
(H)
9/10 of Max. Value of Sync Signal
1/10 of Max. value of Sync Signal
Pedestal Level
(H)
(H)
(H)

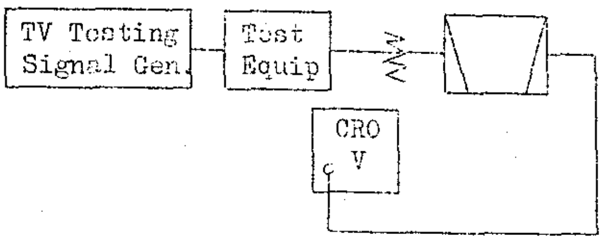

4
Details 4-4 of 2
(H)
(H)
(H)
(H)
(H)
Eq. Pulse
Vertical Sync Pulse
Area of Equalizing Pulse / Area of Horiz. Sync Pulse = (%)
1/10 of Max. Value of Sync Signal
Pedestal Level
(H)
(H)
(H)
(H)

6.7 Linearity

6.7.1 Defferential Gain

(1) Measuring Circuit   In principle, it follows Fig. 8.

Fig. 8



(2) Method of Measurement

As an input signal, feed to the input terminal of a test equipment the stair-case wave superposing 3.5Mc sine wave as shown in Table 5, and as reference, take a constant portion in the amplitude of the superposed wave separated by the band-pass filter at the output and then represent by the ratio of this amplitude to the amplitude of the portion of maximum deviation of the output superimposed wave amplitude. Make the ratio of a period of staircase wave to that of square wave 1 : 4, and settle the level of the square wave at 0%, 50% and 100% of the level of video signal. (each corresponds to APL 10%, 50% and 90% respectively). The method of calculation shall be as shown in the lower column of Table 5.

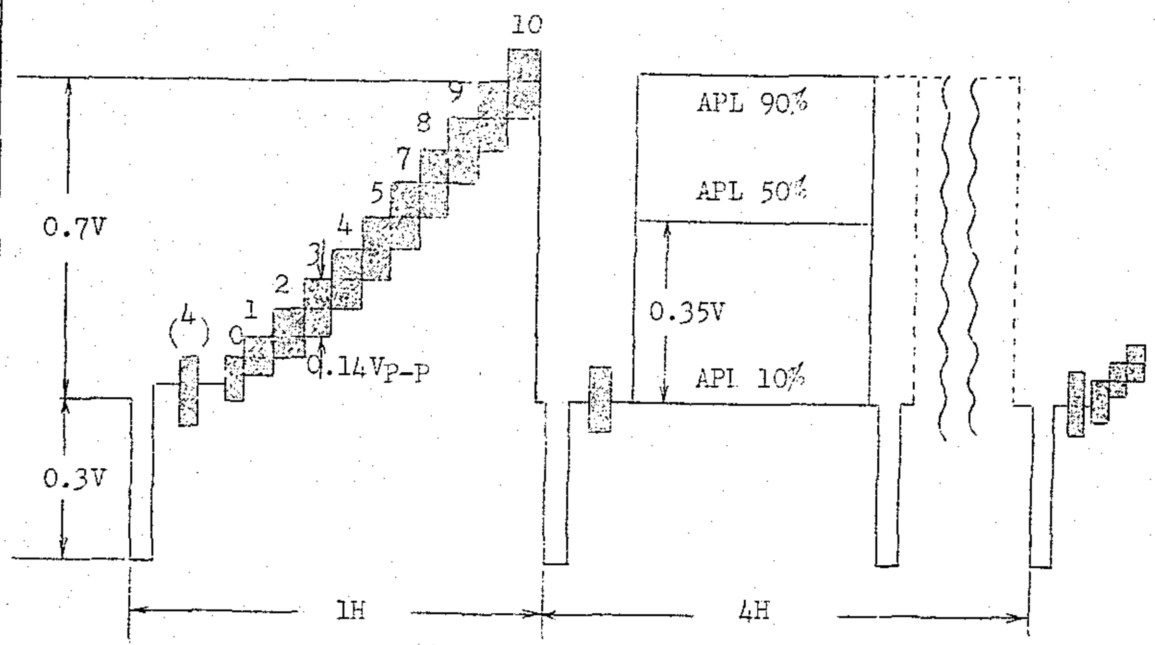
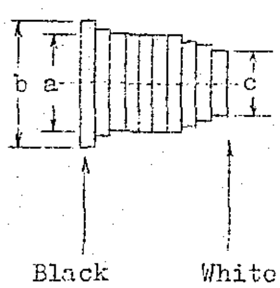
(3) Precautions for the Measurement

(a) According to necessity, conduct measurement for the wave superposing 800Kc sine wave

(b) In case of monochrome equipments, do not add color borst signals

(c) When it is particularly specified, add setup

Table 5

Input Signal	
Method of Calculation	 Differential Gain of Black Level = $\frac{b - a}{a} \times 100\%$ Differential Gain of White Level = $\frac{c - a}{a} \times 100\%$ (+ indicates stretch, - means compression)

* Note 4: Color Burst Signal

6.7.2 Differential Phase

(1) Measuring Circuit

In principle, it follows Fig. 9-1 or Fig. 9-2.

Fig. 9-1

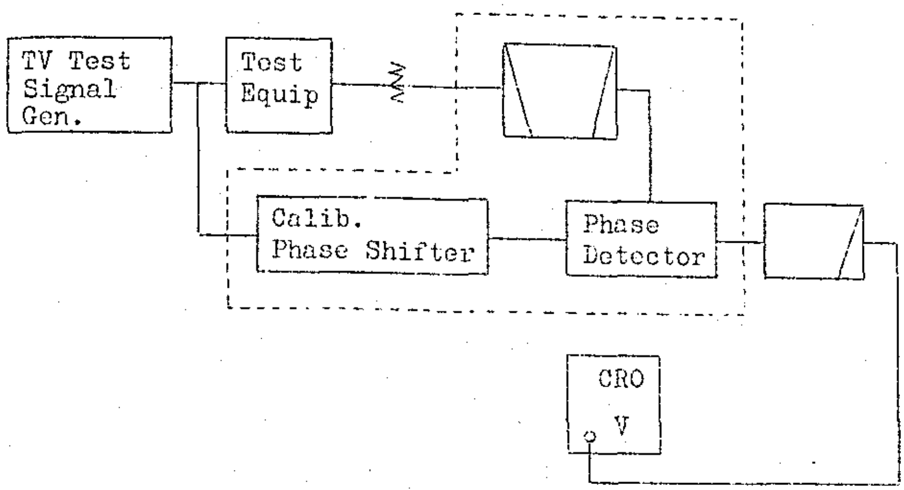
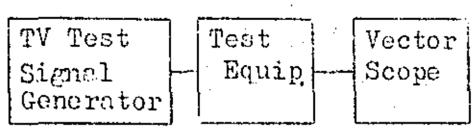


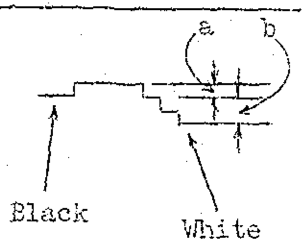
Fig. 9-2



(2) Method of Measurement

Feed the input signal in Table 5 to the input terminal of a test equipment, and with the phase of a superposed wave at the black level at the output as reference, measure the maximum phase shift of the superposed wave. The method of calculation shall be as shown in Table 6.

Table 6



Differential Phase of Mid-level $+a^0$

" of White Level $-b^0$

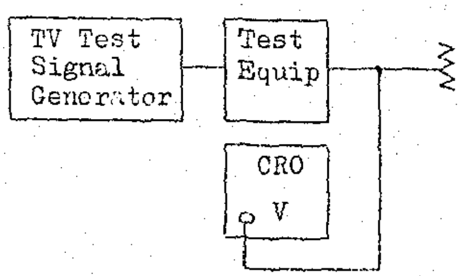
(+indicates advanced phase and - delayed phase)

6.7.3 Linearity of Sync Part

(1) Measuring Circuit

In principle, it follows Fig. 10.

Fig. 10



(2) Method of Measurement

Feed the input signal in Table 5 to the input terminal of a test equipment and vary the level during the period of square wave to 0%, 100% (each corresponds to APL 10% and 90% respectively) of the specified picture level then measure variations of the sync signal amplitude at the output. The method of calculation shall be as follows.

$$\text{Variation Ratio} = \frac{|A - B|}{B} \times 100(\%)$$

A: Sync Output Amplitude at picture level 100% (corresponds to APL 90%).

B: Sync Output Amplitude at picture level 0% (corresponds to APL 10%).

(3) Precaution for the Measurement

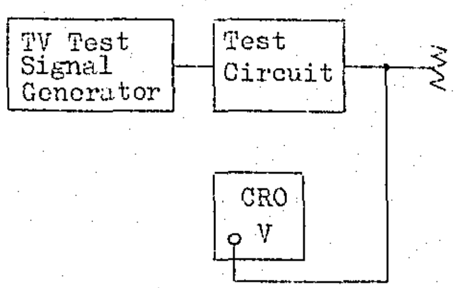
It is not necessary to superpose the superposed sine wave of the input signal shown in Table 5.

6.8 Limiting coefficient of White Peak

6.8.1 Measuring Circuit

In principle, it follows Fig. 11.

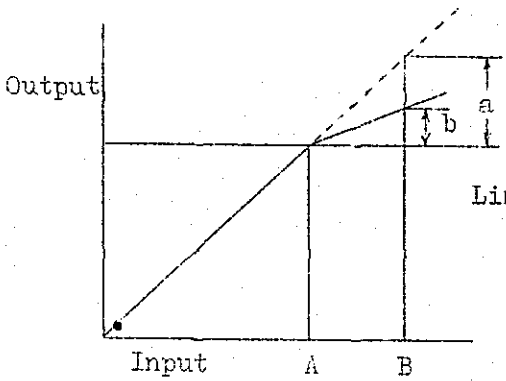
Fig. 11



6.8.2 Method of the Measurement

Measure by the oscilloscope the amplitude characteristic of input to output of the white peak limiting circuit. The method of calculation follows Fig. 12.

Fig. 12



$$\text{Limiting Coefficient} = \frac{a - b}{a} \times 100(\%)$$

6.9 S N Ratio

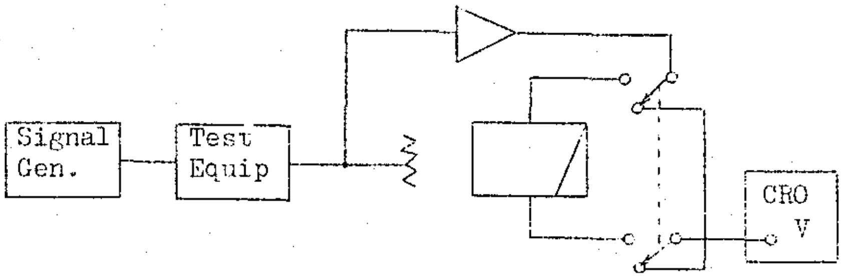
In case of a periodic noise, measure its peak value, and for continuous noises (white, triangular, etc.) measure effective values.

6.9.1 Measurement of Peak Value

(1) Measuring Circuit

In principle, it follows Fig. 13.

Fig. 13



(2) Method of Measurement

Measure a noise at the output terminal of a test equipment by the oscilloscope through filters for the measurement use. And, as for the method of indication, take the peak value (P-P) of noise for the peak value (P-P) of video signal (only V) and represent by SN ratio.

(3) Precautions for the Measurement

(a) In measuring, measure after eliminating a ham inclination of the horizontal axis.

(b) The inserting filter must employ 4.2Mc low-pass filter for pulse noise and 200 c/s for ham noise.

6.9.2 Measurement of Effective Value (I)

In principle, it employs the following method, however, in case of need, 6.9.3 may be applied for the measurement.

(1) Measuring Circuit

In principle, it follows Fig. 14.

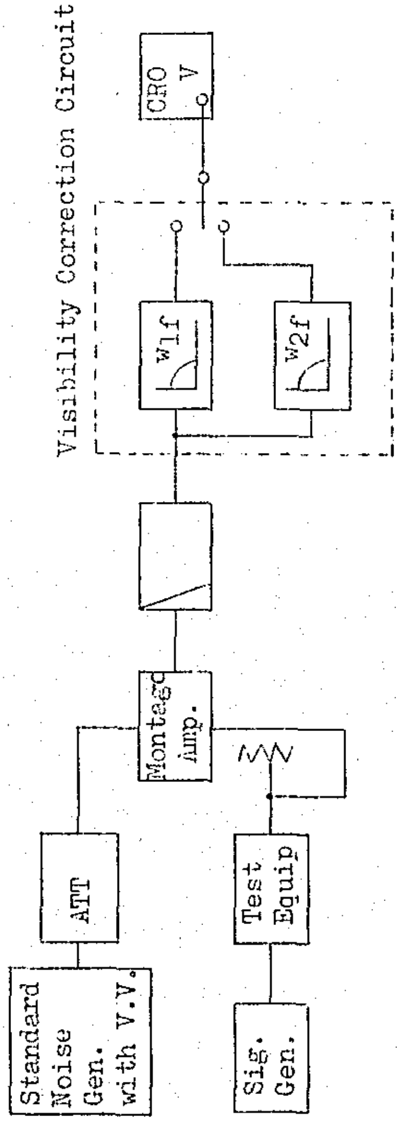


Fig. 14

(2) Method of Measurement

Through the montage amplifier and the visibility correction circuit, indicate simultaneously on the oscilloscope the output signal of the system consisted of a standard noise signal generator, the effective value indicating level meter and variable attenuator, with the noise signal from a test equipment, and by seeking a point to become the equal brightness measure the effective value of equivalent noise (r.m.s.).

And, as for the method of indication, take the effective value of noise (r.m.s.) to the peak value (P-P) of video signal (only V) and represent by SN ratio. When corrected by a visibility weighting curve, describe it as S/NdB (visibility correction) in a parenthesis.

(3) Precautions for the Measurement

(a) As for the visibility correction circuit for frequency, use visibility correction filters prescribed in Appendix 2. In case of not performing visibility corrections, use the sine square filter (w_{2f}) of T=0.05us specified in Appendix 2.

(b) In order not to suffer the influence of ham noises, pass through the high-pass filter of cutoff frequency 200c/s.

(c) When there is a difference of spectrum distribution due to signal amplitude, measure by dividing a measuring signal level into typical three stages (high, medium, low) and find the average value.

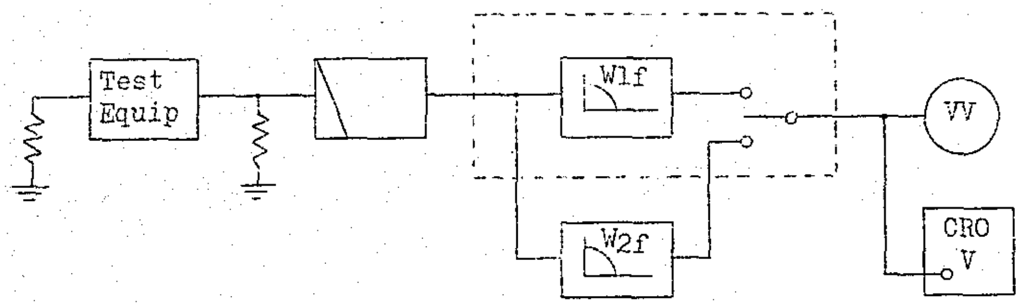
6.9.3 Measurement of Effective Value (II)

(1) Measuring Circuit

In principle, it follows Fig. 15.

Fig. 15

Visibility Correction Circuit



(2) Method of Measurement

Terminate input and output terminals of a test circuit by the prescribed resistors and measure the noise level of the output terminal by the effective value type valve voltmeter. The method of indication follows 6.9.2(2).

(3) Precautions for the Measurement

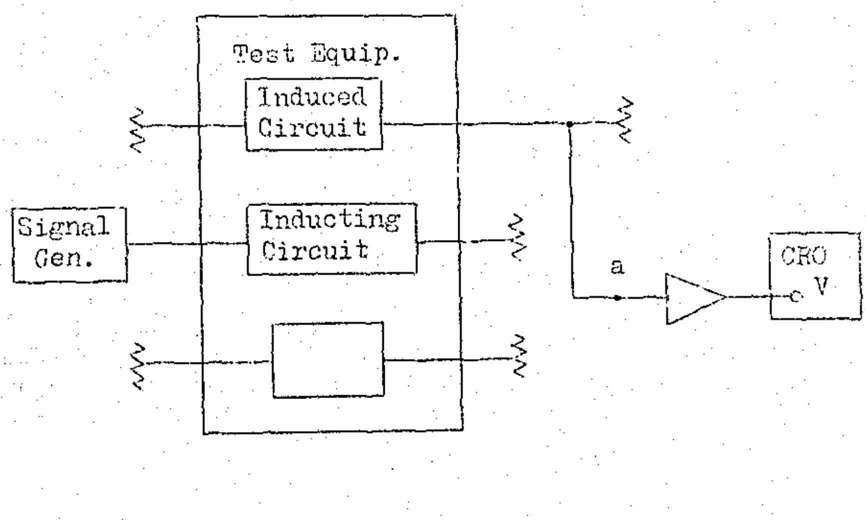
Apply (a) (b) of 6.9.2(3). In addition, the measurement is generally performed at very low level. Therefore, pay attention not to pick up spurious signals to the measuring lead wire and at the same time it is desirous to observe wave forms by the oscilloscope.

6.10 Leakage

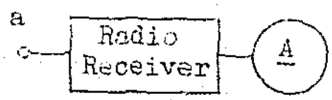
6.10.1 Measuring Circuit

In principle, it follows Fig. 16.

Fig. 16



Remarks: An amplifier for the measurement use is to be employed according to necessity, and in addition, in case of using a radio receiver as the amplifier of the measurement use, the points below a shall be as following.



6.10.2 Method of Measurement

To each input system, feed sine waves of the specified frequency, and at the output circuit measure a leakage from the other each system (5) respectively according to the following.

(1) Adjust each system to the respective levels of input and output specified for each system.

(2) To the inducing circuit feed input signals specified for the system and measure a leakage to the induced circuit.

(3) Feed the induced circuit the signal which is adjusted to the specified level of the system by the variable attenuator, and adjust the variable attenuator attached to the signal generator to make it possible to obtain the output voltage equals to the leakage mentioned in the preceding clause, then find the leakage from the difference of values of the variable attenuator.

* Note(5): The other each system means the system not connected to a output circuit.

6.11 Noise

6.11.1 Method of Measurement

At the prescribed position from a noise source, fix a microphone for the measurement use and measure the number of NC of a noise generating from a test equipment.

However, in case of need, the indicating noise meter prescribed by JIS (Japanese Industrial Standard) C 1502 may be used for the measurement.

And, record the measured value on the paper specified in Appendix 4.

6.11.2 Precautions for the Measurement

(1) In principle, measure in the anechoic room. However, the measurement may be also performed at the site of installation of the test equipment or at a place where the acoustic condition resembles to the above mentioned site.

(2) Also measure in advance the number of NC when no object is attended.

7. Test of Circumstances

In addition to items specified in each clause, in principle, examine the basic performance shown in Appendix 5.

7.1 Power Source Voltage Variation Test

7.1.1 Test when the power source voltage is caused to vary relatively slow.

(1) Method of Testing

By such a voltage regulator as auto transformer or IVR and according to the order shown Table 7, vary the input power source voltage within the limits of specified values and test transient variations of the performance at the time of voltage variation.

Table 7

Order	Power Source Voltage	Operation Time
1	Specified Value	
2	Upper Limit of Specified Value	5 Min.
3	Specified Value	5 Min.
4	Lower Limit of Specified Value	5 Min.
5	Specified Value	

(2) Precautions for the Measurement

(a) For operation time, put time in the preheating until stability results.

(b) Tests of specified values in the order 3 and 5 are for the purpose of checking the result of measurement.

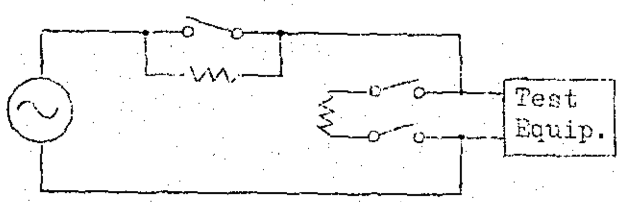
(c) When measuring results of order 1, 3 and 5 do not correspond, put more time in the operation time.

7.1.2 Test when the power source voltage is varied suddenly

(1) Measuring Circuit

In principle, it follows Fig. 17.

Fig. 17



(2) Method of Measurement

In principle, it follows the short-circuit method of series resistor. To be tested here is whether or not a transient performance variation appearing right after a momentary variation of the input power source voltage caused in the specified limits will restore to the normal state within the specified time.

(3) Precautions for the Measurement

As for instruments with poor input current wave forms, it is also good to insert a dummy resistor in parallel with load or trans-tap switching system (constructed not to cause a transient disturbance such as switching spark, etc.).

7.1.3 Momentary Interruption Test of Power Source

(1) Method of Measurement

In the normal operating state, cut off the power source for about 2 seconds, and after re-switching, examine whether or not it restores to the normal state within the specified time.

(2) Precautions for the Measurement

In case high-tension and low-tension switches are provided, cut off only high-tension switches.

7.1.4 Overvoltage Continuous Test

(1) Method of Measurement

Keep the input power source voltage at the upper limit of a prescribed value and run continuously for specified time to examine the presence of any abnormal phenomenon in the performance and the temperature rise of specified places and parts, etc.

Remarks: 1. Clause 7.1 is, in principle, applied to AC power source input variations, however, DC power source shall be also treated the same as AC power source.

2. Prescription that specified time in 7.1.3(1) is 0 is also conceivable. However, in this case, it means that the influence by the test in clause 7.1 does not exist at all.

7.2 Input

7.2.1 Overinput Test

Make the signal input of an unit which is in the rated operating state excessive (Table 8) and in principle examine the presence of any abnormality, and also at the same time conduct measurement of the prescribed items.

Table 8

Input Signal		Time of Monitoring	Frequency of Test
Voltage (P-P, V. S.)	APL	10 Minutes	5
1.4V	10-90%		

7.2.2 Input Short and Open Test

By the suitable method, for the input circuit, repeat short and open ten times and then examine the presence of any abnormality.

7.2.3 Test for Fluctuations of Input Driving Signal

(1) Method of Measurement

Vary amplitude, width and phase of input driving signals (HD, VD, BLK, SYNC and Subcarrier, etc.) within the prescribed limits and examine prescribed performances.

7.2.4 Testing for Mixing of Noise

(1) Method of Measurement

(a) Superimpose on the driving signal (HD, VD, BLK, SYNC and Subcarrier, etc.) sine waves having a specified frequency and amplitude or specified wave forms and examine prescribed performances.

(b) Superimpose on the video signal input sine waves having a specified frequency and amplitude or specified wave forms and examine prescribed performances.

7.2.5 Test for DC Level Fluctuation

(1) Measuring Item

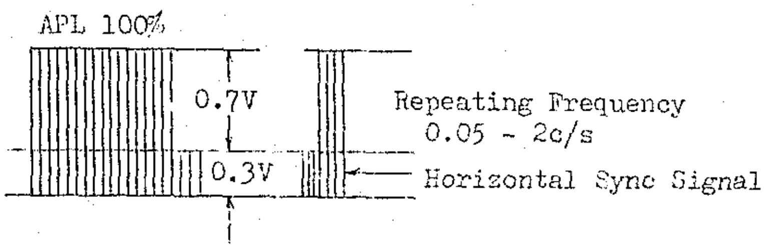
(a) Non-linear Distortion of Synchronizing Signal.

(b) Separation Characteristic of Sync Signal Separator Circuit.

(2) Method of Measurement

Feed the test signal shown in Fig. 18 to a test equipment and examine compression and separation characteristic of the sync signal.

Fig. 18



(3) Precautions of the Measurement

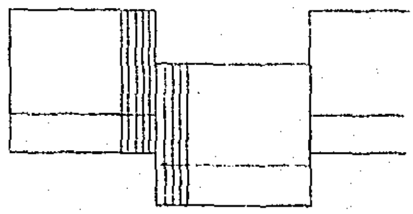
(a) A repeating frequency with varying DC components must be properly selected by the time constant of a test equipment.

(b) When necessary, perform the testing by the test signal with excessive video signal component and too little sync signal component.

(c) For a sync signal compression, clamping the output of a test equipment on the pedestal level makes the measurement easy.

(d) When the test signal generator in Fig. 18 is not available, the pseudo signal shown in Fig. 19 may be used, however, this must be carefully handled because its result does not always correspond to the result of testing by the test signal in Fig. 18.

Fig. 19



7.2.6 Test for Protection Circuit

(1) Method of Measurement

For a protection circuit, examine a performance of the protection circuit when it is provided with the specified conditions.

7.3 Output

Examine the presence of any abnormality in the following items.

(1) Cut off the termination of the output terminal and examine oscillation and the other abnormalities.

(2) Short the output terminal for the specified time and examine the presence of any abnormality in parts and others.

7.4 Induction and Interference

7.4.1 Induction

Examine an inductive interference in case of operating near the source of induction.

7.4.2 Interference

(1) Method of Measurement

Operate in the TV strong electric field and the medium wave strong electric field and test that the interference level is below the prescribed value.

(2) Precautions for the Measurement

(a) Unless otherwise specified, perform the testing in the field intensity corresponding to 120dB.

(b) In case of the medium wave strong electric field, exclude the connecting cable.

7.5 Temperature, Humidity Test

7.5.1 Test of Performance Sustention

(1) Method of Measurement

Put a test equipment in the chamber of constant temperature and humidity and operate it in the specified limits of temperature and humidity and test specified characteristics (Refer to Classification No. 1 and No. 2 of Table 9).

7.5.2 Test of Operation Sustention

(1) Method of Measurement

Put a test equipment in the chamber of constant temperature and humidity and operate it in the specified limits of temperature and humidity (Refer to Classification No. 3 of Table 9) and test the quality of sustention of the operation.

(2) Precautions for the Measurement

When temperature and humidity cycle test mentioned in 7.6 is intended, this test may be omitted.

7.5.3 Non-operative Shelf Test

(1) Method of Measurement

Put a test equipment in the chamber of constant temperature and humidity and leave it under the specified limits of temperature and humidity for the specified time, then perform the test of operation.

7.5.4 Precautions for the Measurement

(1) Use a chamber of constant temperature and humidity of sufficiently large capacity, and do not test the equipment which exceeds the specified capacity.

(2) Temperature distribution in the chamber of constant temperature and humidity must be settled at ±2deg.

(3) When use of a small chamber of constant temperature and humidity is obliged, a chart of the interior temperature difference must be shown clearly.

(4) In case of varying temperature, humidity has to be kept at the standard relative humidity, and when attempting to vary the humidity, the temperature must be kept at the standard temperature.

Table 9

Classification	Outdoor Equipment	Indoor Equipment	
		Attended	Unattended
No. 1 Performance sustention without control	10-30°C 45-85%	15-35°C 45-85%	10-30°C 45-85%
No. 2 Performance sustention with control	-10(7)-40°C(8) 45-85%	5-40°C 45-85%	-10-40°C 45-85%
No. 3 Operation sustention (6)	-15(9)-40°C(8) 45-85%	0-40°C 45-85%	-15-40°C 45-85%
No. 4 Non-operative shelf test	-20(9)-40°C(8) 20-95%	-10-40°C 20-95%	-20-40°C 20-95%

Note (6) No problems in function for practical use.

(7): To be at 0°C when a heat retaining apparatus is not employed.

(8): Use of a sunshade is also allowable.

(9): Use a heat retaining apparatus.

7.6 Temperature, Humidity Cycle Test

7.6.1 Method of Measurement

Install a test equipment in the chamber of constant temperature and humidity, and after operating it for a suitable time, perform the initial measurement of specified items, then vary the degrees of temperature and humidity according to Table 10, and under each condition, in principle, test the presence of any abnormality in the operation. Also, perform the measurement of specified items when particularly specified.

Each condition of temperature and humidity in Table 10 shall be made as shown in Table 11.

Table 10

Measuring Order	1	2	3	4	5	6	7	8	9	10
Condition of Temperature	Standard	High	High	Low	Low	High	High	Low	Low	Standard
Condition of Humidity	Standard	High	Low	Low	High	High	Low	Low	High	Standard
Time of Sustention (Min.)	Properly	45	45	45	45	45	45	45	45	Properly

Table 11

Degree of Temperature, Humidity. / Classification of Equipment	Temperature		Humidity	
	Low	High	Low	High
Equipment for Indoor Use	0°C	40°C	Below 50%	95%
Equipment for Outdoor Use	-20°C	40°C	Below 50%	95%

7.6.2 Precautions for the Measurement

(1) It is also good to perform the cycle test by dividing it into two parts, 1-5 and 6-10.

(2) Time for shifting a condition shall be within the first 30 minutes in the sustaining time time of 45 minutes.

(3) The measurement of a specified item must be made right before shifting to the next condition.

(4) Allowable difference for the temperature and humidity in Table 11 shall be settled as follows:

Temperature: -3 - +0°C

Humidity: -5 - +0%

(5) Misfunctioning and trouble during the cycle test must be treated according to instructions to continue the testing.

7.7 Atmospheric Pressure Test

7.7.1 Method of Testing

Atmospheric pressure test is performed by using an atmospheric pressure test chamber. Especially when the atmosphric pressure is not specified, examine a test equipment at the atmospheric pressure of 500 ±10mm Hg (corresponding to altitude 3000m) for the presence of any abnormality in the function.

7.8 Water Pressure Test

7.8.1 Method of Testing

Sink a test equipment into the specified depth of water for the specified time and check the presence of any abnormality and leakage of water.

However, if an equivalent method of increasing the pressure and testing the water pressure corresponding to the above depth of water is available, testing by it will do also.

7.9 Insolation Test

7.9.1 Method of Testing

(1) With the ambient temperature at its specified maximum temperature, in principle, operate continuously under summer-time direct rays of the sun and check the presence of any abnormality in the function.

And, it is good to perform the testing by either method (2) or (3).

Note (10): Summer-time direct rays of the sun mean that the direct reaching amount of insolation shall be made 1.2 ±0.2cal/cm^2/min.

(2) To be carried out by C light source (color temperature 6740°K) direct reaching insolation (11) equivalent test method.

Note (11): C light source equivalent direct reaching amount of insolation is made to be 1.2 ±0.2 cal/cm^2/min.

(3) Perform by using Weather Tester.

7.9.2 Precautions for the Measurement

Continuous running must be tested until the saturation of temperature-rise can be confirmed.

7.10 Vibration Test

Vibration test is performed by using the vibration testing machine under JIS C 0911. The test shall be the following three kinds.

7.10.1 Resonance Test

(1) *Method of Testing*

Of the vibration ranges prescribed in Table 12, use more than one and apply them to a test equipment and then test whether or not resonance takes place at a specific part. On this occasion, the number of vibrations (12) must be continuous to the extent not missing the resonance point and that has to be varied in equal speed.

Table 12

Kind	Vibration Range(c/s)	Double Amplitude (13) (mm)
A	1 - 20	0.5
B	5 - 40	0.3
C	10 - 55	0.1
D	30 - 100	0.05
E	70 - 150	0.02

Note(12): The number of vibrations is expressed by the number of cycles per second.

Note(13): Double amplitude means the distance between two extreme positions.

7.10.2 Endurance Test of Constant Number of Vibrations

(1) Method of Testing

Of the combinations of the number of vibrations and double amplitude (13) prescribed in Table 13, use more than one kind and apply it to a test equipment and check the degree of damage or the variation of performance.

Table 13

Kind	No. of Vibrations (c/s)	Double Amplitude (mm)		
		L	M	H
A	10	2	5	10
B	20	0.5	1.2	2.4
C	30	0.3	0.6	1.2
D	50	0.1	0.2	0.4
E	100	0.02	0.05	0.1

7.10.3 Endurance Test of Variable Number of Vibrations

(1) Method of Testing

Of the combinations of the number of vibrations and double amplitude prescribed in Table 14, use more than one kind and apply it to a test equipment, and check the degree of damage or the variation of performance. In this case, the number of vibrations, while being varied in equal speed, is made to repeatedly move to and from the inside of the vibration limits during the time of testing. Also, there is no harm in extending the lower limit of the vibration range properly.

Table 14

Kind	Vibration Range (c/s)	Double Amplitude (mm)			
		L	M	H	E
A	2 - 15	3	5	10	15
B	10 - 25	1	2	3	5
C	20 - 55	0.2	0.3	0.5	1

7.10.4 Precautions for the Measurement

(1) How to attach an equipment to be tested and to provide the vibration must be made as follows.

(a) Unless otherwise specified, attach the equipment to be tested in the normal working state, then perform the testing.

(b) For linear vibrations, give vibrations in the specified directions of up and down, left and right and front and back. Unless otherwise specified, perform the testing only in the direction of up and down.

(c) For circular vibrations, give the specified vibrations of horizontal plane and vertical plane. Unless otherwise specified, omit this.

(2) As for clauses 7.10.2 and 7.10.3, time of testing shall be 4 kinds of 30 minutes, one hour, 2 hours and 3 hours.

7.11 Impact Test

In principle, it shall be performed by using the impact tester under JIS C 0912. In case of need, however, it is good to perform by the equivalent methods in (2) and (3).

7.11.1 Method of Testing

(1) Perform the testing by using the impact tester, and check the degree of a damage of the equipment or the variation of performance. The extent of a testing impact shall be following 5 kinds.

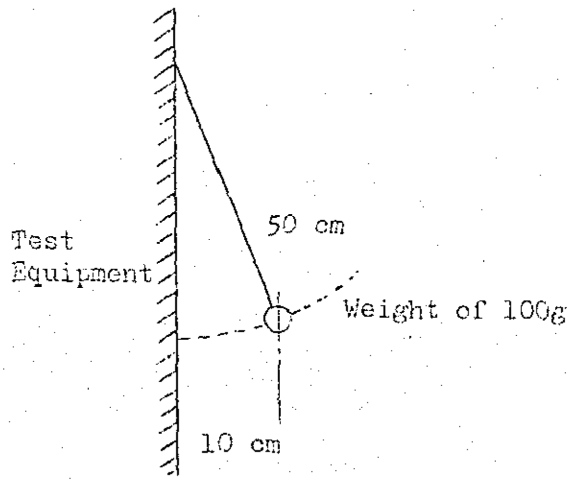
10 g, 15 g, 20 g, 30 g, 50 g.

Unless otherwise specified, directions of the impact shall be 3 directions of up and down, left and right and front and back, and the number of times shall three times respectively in each direction.

(2) Lift up a testing equipment to the specified hight and drop it to the hard wood floor 5 times for testing.

(3) As shown in Fig. 20, hang a 100 g weight by a 50 cm string and fix the other end of the string to the surface of a test equipment, then from the position of 10 cm off the equipment and to the direction of circumference, have the weight make the circular motion of 0 starting speed to give impact to the test equipment for the testing.

Fig. 20



7.12 Drip-proof Test

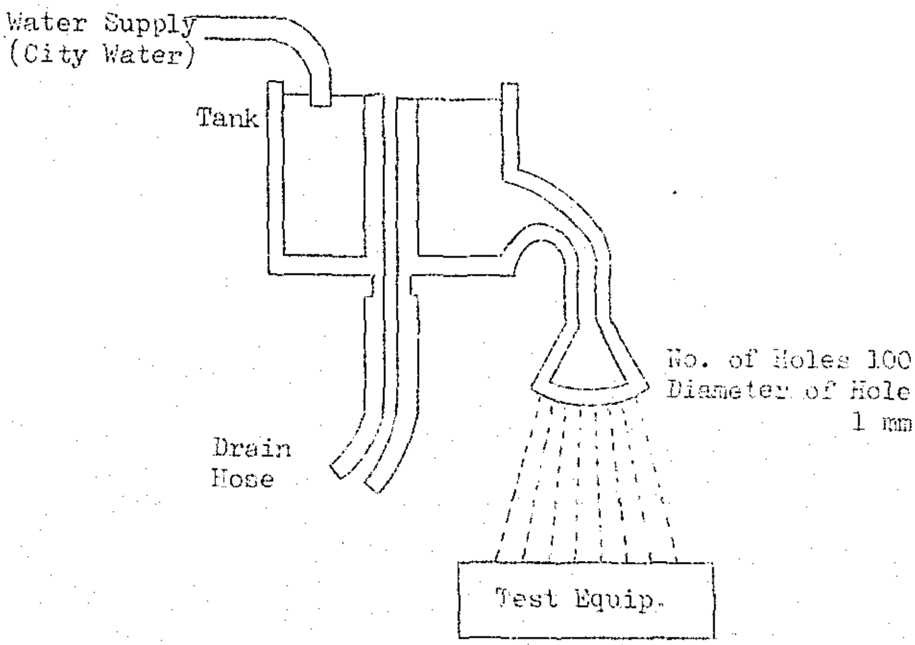
7.12.1 Method of Testing

In principle, test it by the drip-proof testing equipment. Unless otherwise specified, pour water corresponding to the precipitation of 20 mm/h and after performing 2 hours, operate the equipment to check for any abnormality.

7.12.2 Precautions for the Measurement

As an example, perform the testing by the drip-proof testing equipment shown in Fig. 21.

Fig. 21



7.13 Dust-proof

7.13.1 Method of Testing

In principle, it is performed by using a dust-proof tester. After applying a test equipment to the dust-proof tester for the specified time, test particularly for the presence of any abnormality in the mechanical function.

7.13.2 Precautions for the Measurement

The following method can be applied also in case the dust-proof tester is not available.

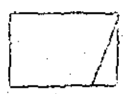
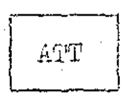
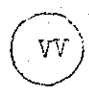
Keep a sand dust, which is mainly composed of SiO_2 of less than 100-mesh, containing less than 325-mesh 3/4, at the density of 3.5-17.5 g/m^3, humidity below 30% and temperature of the inside of the chamber 25°C, and test for 6 hours at the wind velocity 0.5 - 2.5 m/s.

8. Maintenance of Video Control Equipment

This is to apply to the entire main system ranging from camera control unit output, flying spot output or VTR output up to main control output or video recording input.

Period	Item	Operation	Values, Maintenance Reference & Special Remarks
When abnormality is found by the picture monitor and others.	Gain Deviation	Utilize shading generator output	±0.5dB
	Sag	Use Square waves of 0.4 V_{p-p}, 60c/s and 150Kc as input	60c/s 1%(Note) 150Kc 2% (Note) In case of immediately after clamp. For other cases, make 3N%, and maximum 12% (N means number of amplifiers after final clamp)
	High Frequency Band Gain Characteristic	By video sweep (0.4VP-P)	With 100Kc as reference, it is ±1dB until 5Mc, and is flat or slowly declining characteristic for the above.
	Differential Gain	Follow 6.7.1 (Method of Testing of Video Control Equip.), however, in this case, for superposed sine wave, 800Kc is principle.	10%
	Differential Phase (Color only)	Follow 6.7.2 (b) (Method of Testing of Video Control Equipment).	±10 Degrees
	Noise	Measure S/N for the output Video 0.7Vp-p	Hum 45dB p-p Synchronism 30dB p-p Others 50dB rms
	Clamp Stability	Switch input signals alternatively pure white & pure black	Do not cause the clamp to get out of place
	Ultra-low band response character-istic	Make use of battery and feed unit step voltage, and observe wave forms (DC fluctuation) at the output	It must be good for practical use.
	Place of Control	In the operating state, put to work various regulators and switches, etc.	To be smooth in mechanical touch and no electric noise must be generated
	Stability by power source voltage variation	Vary power source voltage 5%	Should work normaly.

APPENDIX 1

Symbol	Name
	Braun Tube Oscilloscope
	Terminating Resistor
	Resistance Mixer
	Band-pass Filter
	Low-pass Filter
	Amplifier for measurement use
	Variable Resistance Attenuator
	Valve Voltmeter
	DC Ammeter

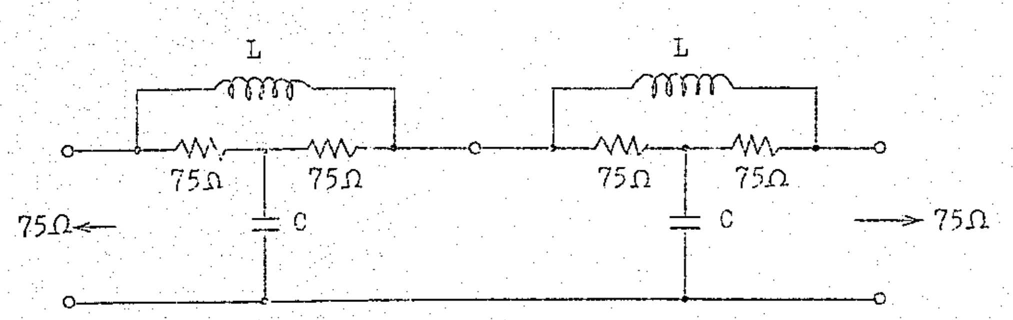
Remarks: The above are based on BTS 0131 (symbol).

APPENDIX 2 Measuring Instrument

Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
Video Frequency Oscillator	10c/s-10Mc Output 75ohm 4V(p-p) Max. 10c/s-10Mc 600Ω 4V (r.m.s.) Max. 20c/s-20KC	RC 10M-1B Type
Video Sweep Oscillator	15Kc-15Mc Repeating Freq. 40c/s-70c/s Output 75ohm 1.6V(p-p) Range of Adjustment 60dB	VS-2 Type
TV test Signal Generator	Kind of Signal 1. Bar Signal 2. Horizontal Gray-Scale Signal (Switching on and off of superposed wave 0.8Mc and 3.58Mc is possible) 3. Multi-burst Signal 4. White Signal With Simple Sync Signal. Attached Filter; High-pass Filter for 0.8Mc use Band-pass Filter for 3.58Mc use	TG-3 Type
Low-pass Filter	For 200c/s For 4.2Mc	
Band-pass Filter	For 3.58Mc	
Sine Square Wave Generator	Output Signal Sine Square Wave Pulse and Square Wave Sine Square Wave Pulse Width at 1/2 Amplitude 0.25μs, 0.125μs, 0.0625μs Square Wave Pulse Width 15 - 35μs Output V.S. 1.4V (p-p)	SS-1 Type
Delay Distortion Measuring Instrument	0 - ±1000 mμs Measuring Freq. 100Kc and 500Kc-6Mc Input Level 1v (p-p)	VD-3 Type

Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
Vector Scope	External Subcarrier Input 3.579545Mc, Over 2V(p-p) Range of Phase Variation 0-200° Accuracy of Phase Angle Vector Indication ±2° Horizontal Sweep ±1° Chroma ±2%	VSC-1 Type
Braun Tube Oscilloscope	Vert. Freq. Band DC - 5Mc Sensitivity 0.003-20V/cm Horiz. Freq. Band 1Cc/s-800Kc Sweep Velocity 10ms/cm-0.3μs/cm Delayed Sweep Possible Calib. Voltage 1V	505-3 Type
	Vert. Freq. Band DC - 15Mc Sensitivity 0.02-20V/cm Horiz. Freq. Band DC - 2Mc Sweep Velocity 0.1μs/cm-15s/cm Delayed Sweep Possible Housing Marker Generator Calibration Vol. 0.05 - 100V	515-1 Type
Valve Voltmeter	DC-1Mc 1.5 - 600V Up to 40 Mc 1.5 - 150V Up to 200Mc 1.5 - 15V By probe, up to 250Mc, 300V	PM-8
	DC-1Mc 0.3-1000V Up to 10Mc 0.3-10V By probe, up to 500Kc-250Mc, 0.3 - 20V	VM-1
Decimal Resistor	0 - 1111 Ω Decimal System Non-conductive 4 Dial Maximum Permissible Power 1W	REC-402

Visibility Correction Filter



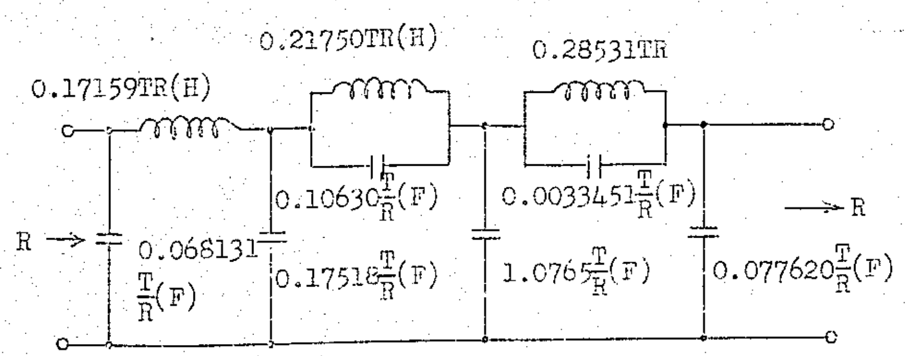
$L = 75T(\mu H)$

$L = \frac{T}{75} \cdot 10^6$ (pF)

When $T = 0.08\mu s$, $L = 6.0\mu H$

$C = 1060PF$

Sine Square Filter



Provided $T = 0.05\mu s$

APPENDIX 3 MEASURING INSTRUMENT USED

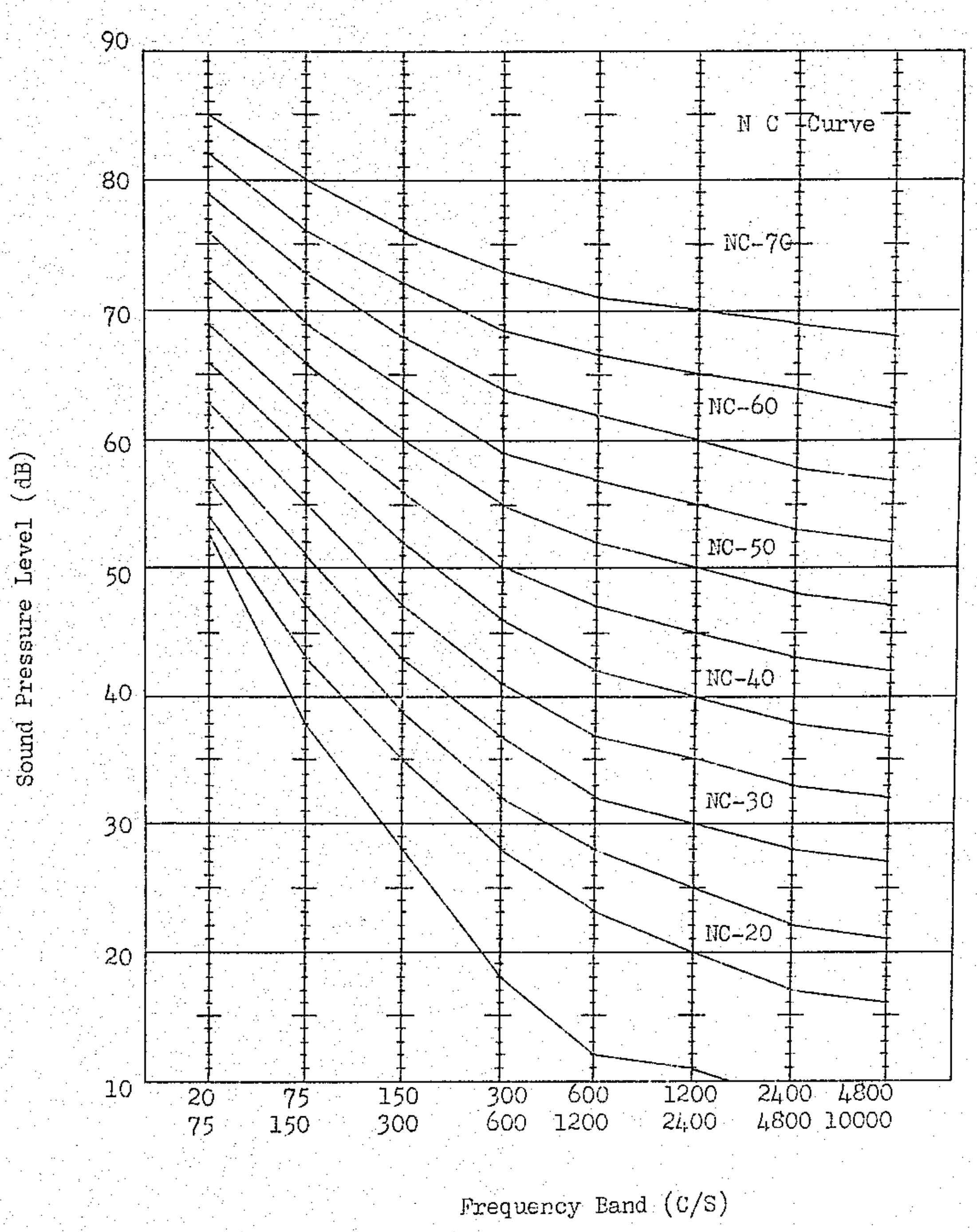
Name of Measuring Instrument	Name of Maker	Type	No. of Mfg.	Remarks
Video Frequency Oscillator				
Video Sweep Generator				
TV Test Signal Generator				
Low-pass Filter				
Band-pass Filter				
Sine Square Wave Generator				
Delay Distortion Measuring Instrument				
Vector Scope				
Visibility Correction TV Noise Level Measuring Instrument				
Braun Tube Oscilloscope				
Valve Voltmeter				
Impedance Bridge				
Decimal Resistor				

APPENDIX 4

Place of Measurement
Measuring Instrument
Indication of Noise Meter
Main Source of Noise
Remarks

Date & Time of Measurement

A__________ B__________ C__________



APPENDIX 5

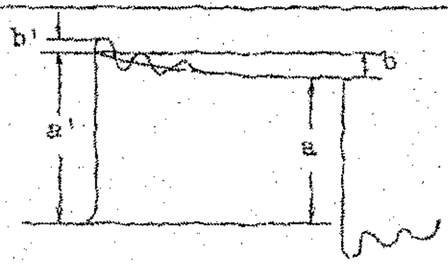
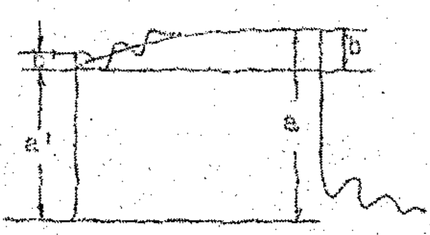
Item \ Testing Item	Insulation Resistance	Pressure Resisting	Impedance	Gain	Frequency Response	Wave Form Distortion	Linearity	Black Clip Level	White Limiting Factor	Noise	Oscillation Margin	Mechanical Function
Power Source Vol. Variation				◎	○	○	○	◎	○	○	○	○
Temperature	○	○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎
Humidity	◎	◎										○
Atmospheric Pressure		◎										
Water Pressure												◎
Insolation												○
Vibration												◎
Impulse												◎

Remarks: ◎ Test in principle.

○ Test is preferable.

Reference

1. In the Wave Form Distortion of Paragraph 6.6, when ringing and streaking or smearing are in mixed presence, calculate by Table 1.

Wave Form	Method of Calculation
	Ringing = $\frac{a'}{b'}$ x 100% Streaking = $\frac{b}{a}$ x 100%
	Ringing = $\frac{b'}{a'}$ x 100% Smear = $\frac{b}{a}$ x 100%

2. Usage of a Mask for Measuring K (Refer to Reference Appendix 1)

(1) *Bar Response and Bar Pulse Ratio*

(a) Adjust a sweep time and a horizontal position of the oscilloscope and make the centers of ri and fall of the sine square wave bar correspond to points M_1 and M_2 respectively.

(b) Control vertical gain and vertical position so that the middle point of the top of the bar corresponds to B point and a point almost the center of the black level part corresponds to A point.

(c) Measure the value of K from peaks of sine square wave pulse and sine square wave bar respectively. (However, with B point in the upper part of the bar as center, when a line is drawn in the range of horizontal 18 μs, a portion that swells out to left and right must be excluded from the object of the measurement since it is due to the effect of high frequency band characteristic.

(2) 2T Pulse Response

(a) By the aid of time marker or oscillator, etc., adjust oscilloscope sweep time, and match precisely so that one scale of the horizontal axis (especially in the neighborhood of 0 position) becomes 0.125 μs.

(b) Feed signals to be measured and by adjusting horizontal and vertical positions and also vertical sensitivity, make the peak of the pulse correspond to the top of the case frame at the center of mask outline and the black level correspond to the horizontal line which passes through A point.

(c) Measure the value of K from half amplitude duration of the pulse, stretch of the bottom and each peak of the ringing, etc.

3. Regarding the Test 7.5 Temperature and Humidity

(1) In Japan, the average maximum and minimum temperature at the outside by months range, according to a chronological table of science, from -15 to +37°C. On the other hand, the maximum range of temperature

variation in a day is 13deg. Therefore, the prescription of a stability of characteristics to ±10deg, namely, temperature variation range of 20deg, will make it free from adjustment.

(2) Relation between Altitude and Temperature (1959 ARDC Model Atmosphere),

Altitude	1000 meters,	temperature drops	6.5 deg.
"	2000	"	13 deg.
"	3000	"	19.5 deg.

That is, temperature falls 0.65deg per 100m., therefore, care should be taken for the temperature test of machinery and tools loaded on an airplane.

4. With regard to the method of analyzing the effect by the text 7.6 Temperature, Humidity Cycle Test, in every measuring item, analyze temperature and humidity effects and calculate respective ratios of contribution.

5. With regard to Atmospheric Pressure

That the video control equipment is particularly discussed for the atmospheric pressure is mainly because of the disturbance of discharge in the high-tention circuit. The relation between voltage of starting discharge V and atmospheric pressure b can be shown by the following formula.

$$V = K_1 \delta \left(1 + \frac{K_2}{\sqrt{\delta}}\right)$$

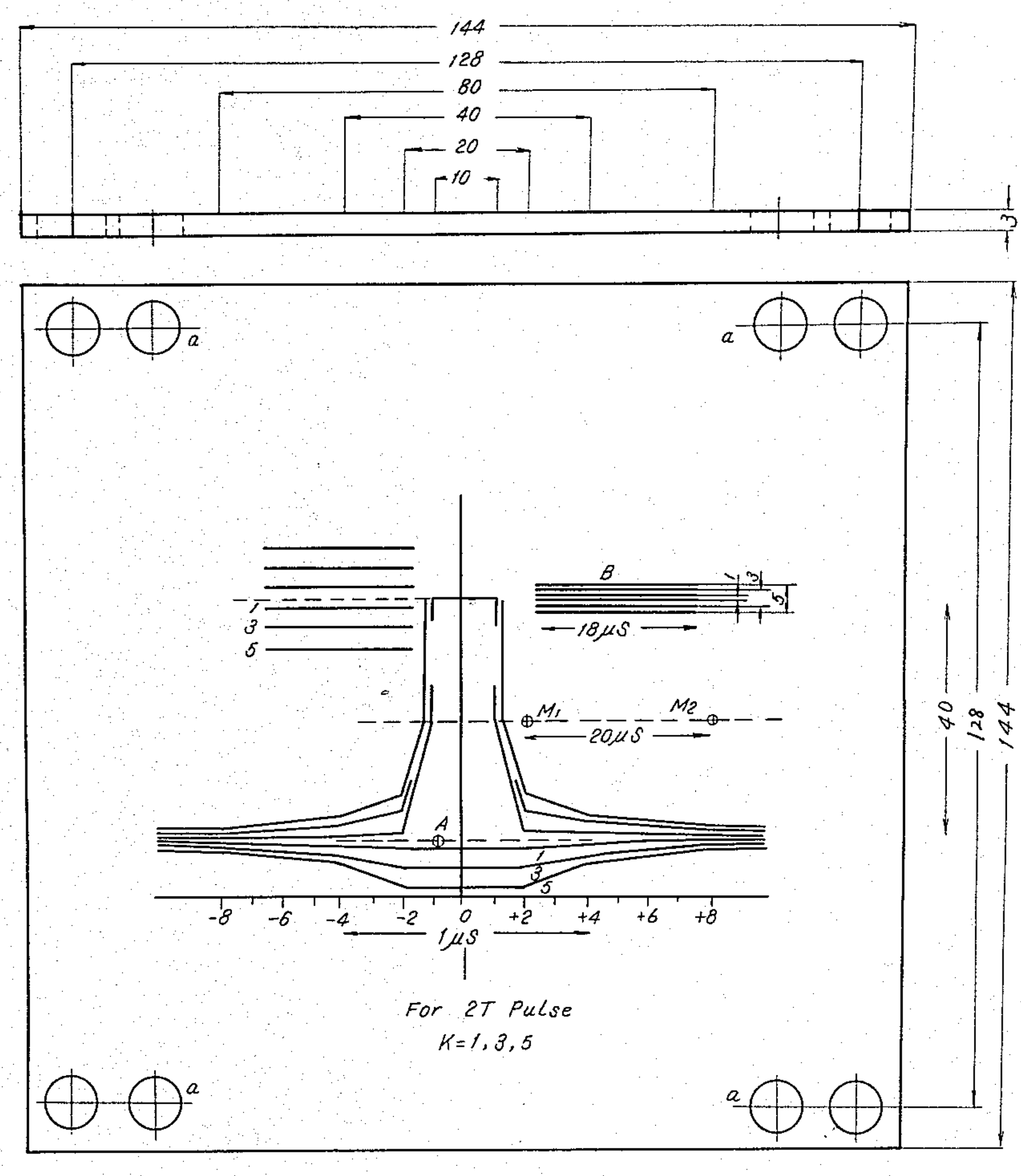
K_1, K_2: Constant

$$\delta = 0.392 \times \frac{b}{273 + b}$$

t: Temperature (^{o}C)

b: Atmospheric Pressure (mmHg)

Reference Appendix 1



Remarks: 1. Material is to be a board of acrylic acid resin.

2. The inside of hole a is to be coated by a transparent paint (red).

3. The scale line is to be carved from the back with the width less than 0.1mm and the depth about 0.26mm.

Reference Appendix 2

Measuring Order		1	2	3	4	5	6	7	8	9	10
Condition of Temperature		Standard	High	High	Low	Low	High	High	Low	Low	Standard
Condition of Humidity		Standard	High	Low	Low	High	High	Low	Low	High	Standard
Time of Sustention(min)		Properly	45	45	45	45	45	45	45	45	Properly
Measuring Item	Ya	Ya_0	Ya_1	Ya_2	Ya_3	Ya_4	Ya_5	Ya_6	Ya_7	Ya_8	Ya_0'
	Yb	Yb_0	....	....	....	....	....	....	....	Yb_8	Yb_0'
	Yx	Yx_0	....	....	....	....	....	....	....	Yx_8	Yx_0'

Correction Factor $CF = \frac{1}{8}(Ya_1+Ya_2+\dots\dots Ya_8)^2$

Temperature Effect $S_t=V_t=\frac{1}{4}\left[(Ya_1+Ya_2+Ya_5+Ya_6)^2+(Ya_3+Ya_4+Ya_7+Ya_8)^2\right]-CF$

Humidity Effect $S_h=V_h=\frac{1}{4}\left[(Ya_1+Ya_4+Ya_5+Ya_8)^2+(Ya_2+Ya_3+Ya_6+Ya_7)^2\right]-CF$

Mutual Effect $S_{txh}=V_{txh}=\frac{1}{2}\left[(Ya_1+Ya_5)^2+(Ya_2+Ya_6)^2+(Ya_3+Ya_7)^2+(Ya_4+Ya_8)^2\right]-CF$

Total Fluctuation $S_T=Ya_1^2+Ya_2^2+\dots\dots Ya_8^2-CF$

Error Fluctuation $Se=(S_T-St-Sh-Stxh)$

Error Fraction $Ve=Se/4$

As for the ratio of contribution, one whose dispersion rate is $\frac{Vt}{Ve}, \frac{Vh}{Ve}, \frac{Vtxh}{Ve} > 3$ is calculated as shown in the following.

In case of Temperature $Pt = \frac{St - Se}{S_T}$

In case of Humidity $Ph = \frac{Sh - Se}{S_T}$

Mutual Effect $Pt = \frac{Stxh - Se}{S_T}$

EXPLANATION

1. As to the measurement of wave form distortion by sine square wave

As a test signal to be used for measuring the wave form distortion of video equipment,

(1) The frequency component must position mostly within the transmission band and not being suffered distortions due to characteristics of the outside of the band.

(2) To be capable of measuring wave form distortions easily.

(3) To be capable of generating signals readily and steadily.

are required, and as one which meet these requisites, the combination of sine square wave pulse and bar pulse is the concept mainly suggested in England.

The sine square wave pulse is useful for observing the high frequency band characteristic of transmission equipment, while the sine square wave bar proves to be helpful for observing medium frequency band characteristics, and the sine square wave pulse will measure

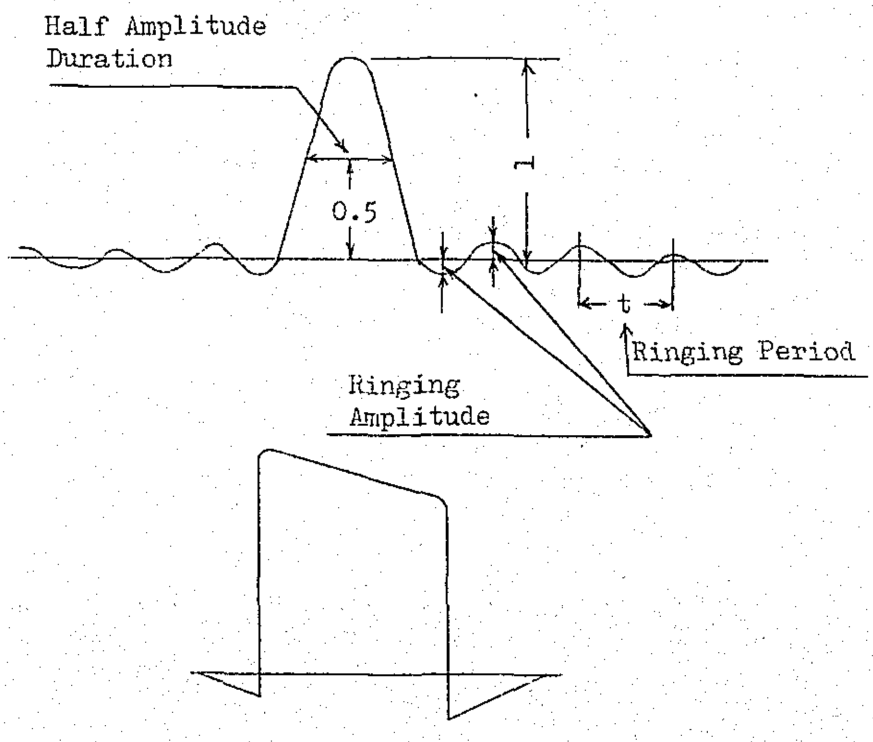
(1) Half amplitude duration.

(2) Maximum amplitude (Measure by comparing with the amplitude of sine square wave bar).

(3) Frequency and amplitude of ringing.

as shown in Fig. 1 and evaluate characteristics.

Fig. 1


Half Amplitude
Duration
0.5
1
t
Ringing Period
Ringing
Amplitude

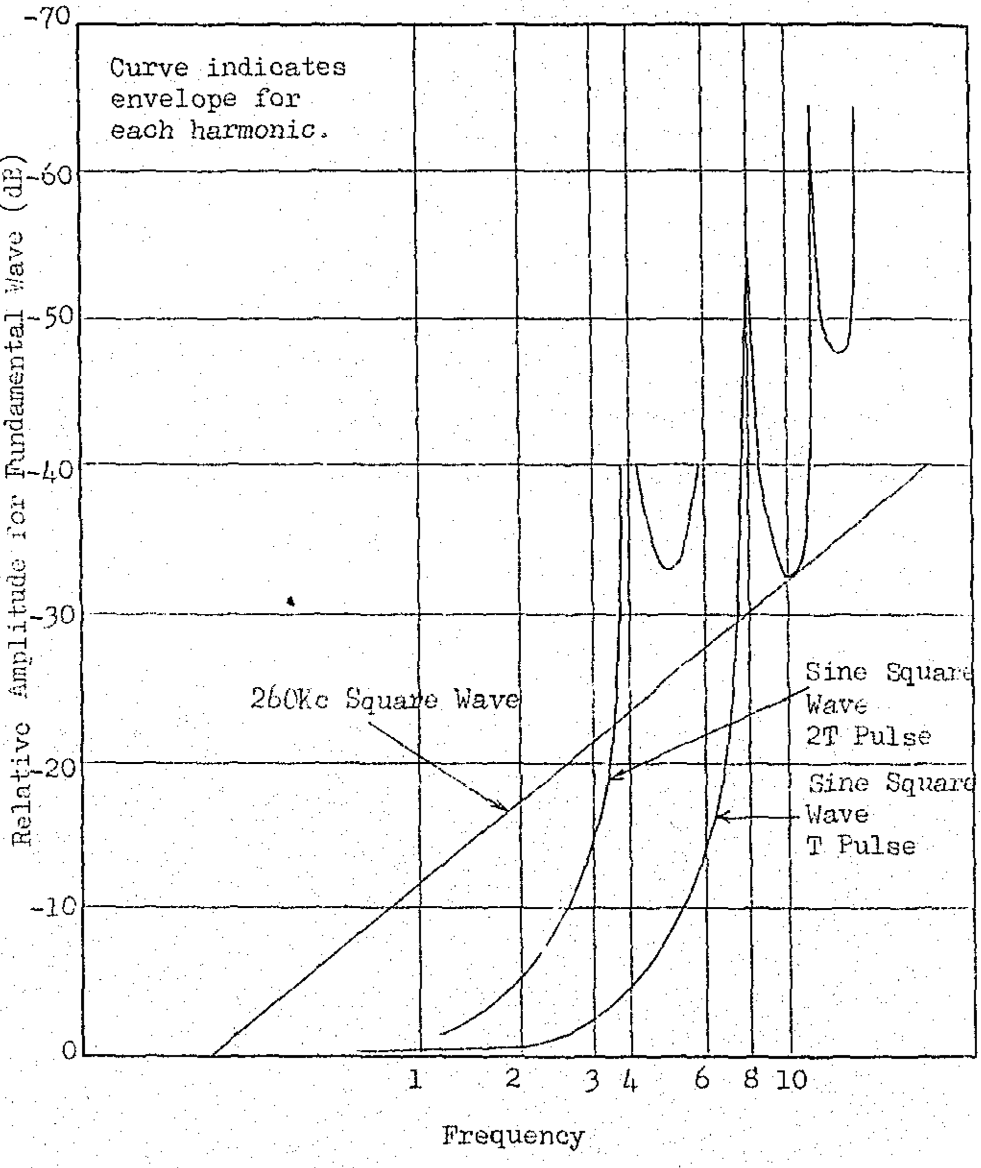
The half amplitude duration is equal to the rise time of conventional square wave response, and its value is inversely proportional to the band width.

The ringing corresponds to the overshoot and the ringing in the conventional square wave response and is related to amplitude and phase characteristics in the neighborhood of cut-off frequency.

The sine square wave bar is used for measuring streaking or smearing.

The sine square wave is classified according to the size of half amplitude duration, and in the transmission system of 4Mc band width, the pulse with half amplitude duration 0.25 μs is called 2T pulse and the pulse of 0.125 μs T pulse. These pulses have such frequency distributions as shown in Fig. 2.

Fig. 2


Curve indicates
envelope for
each harmonic.
Relative Amplitude for Fundamental Wave (dB)
-70
-60
-50
-40
-30
-20
-10
0
260Kc Square Wave
Sine Square
Wave
2T Pulse
Sine Square
Wave
T Pulse
1
2
3
4
6
8
10
Frequency

By comparison here with the method of measuring wave form distortions by the conventional square wave, it will know that the method of measuring by the sine square wave has the following features.

(1) As seen in Fig. 2, in case of frequency components of square wave, many frequency components are present even over the outside of the band, which fact is responsible for causing the characteristic not affecting the actual transmission of video signal to appear as a wave form distortion. However, the measurement by the sine square wave proves reasonable because of its positioning within the frequency band directed for the measurement and being free from measuring unnecessary frequency characteristics.

(2) Frequency components in the neighborhood of cutoff frequency are larger in the sine square wave and because of this, ringing by the cutoff characteristic will appear largely and the measurement becomes easy.

(3) Direct evaluation of picture qualities is made possible by the wave form distortion. The attempt to relate picture qualities to wave form distortions had been made in England and other countries and Rating Factor K was decided. The quality of a characteristic can be readily checked by applying a scale board on which these K value are written like Appendix 1. The Reference Appendix 1 shows an example of K = 1,3,5 at the time of 2T pulse.

(4) As to signal generation, the rise time of a square wave fluctuates with characteristic variations of a vacuum tube, thus requiring constant checks, however, in case of the sine square wave, as it is shaped by Passive Network, variation of the wave form can be regarded as very small.

The sine square wave pulse proves, as mentioned, to be useful for checking high frequency band characteristics, however, being low in the measuring sensitivity for the measurement of transmission characteristics of the medium frequency band, it is combined with the square wave for the measurement of streaking and smearing, etc.

This square wave signal is limited in the band through the network used for shaping sine square waves in order not to suffer the influence of characteristics of the outside of the transmission band, and it is called T bar pulse or 2T bar pulse according to the kind of filter applied.

Also, by combining with these square waves, deterioration of the amplitude of a sine square wave resulted from characteristics of transmission equipment can be distinguished from the level deterioration.

2. As to the Text 6.11, Noise Measurement by NC Number

In measuring a noise, as also specified in JIS Z 8731, the method of measuring a noise level "No. of Horn" by the indicating noise meter is common. In this method, however, as the difference of noise spectrum is not taken up, many cases result in a discrepancy from the actual sense of hearing. That is, even though the level of a noise is the same, if its spectrum differs, the degree of disturbance becomes generally different.

Considering this, a method that analyzes a noise into octave bands and allows a noise tolerance level for each band spectrum is more practical.

This is called the measurement of noise by NC number , and this specification follows, in principle, this method of measurement. Text Appendix 4 shows noise criterion curves of permissible noise (NC Curve), and comparison of values of noise criterion curve "Number of NC" with values of permissible noise level "Number of Horn" is shown in Table 1.

Table 1

Room	Criterion Curve (NC)	Noise Level (Horn)
Broadcasting Studio	15 - 20	20 - 30
Music Hall	20	30 - 35
Theater, stage	20 - 25	30 - 35
Hospital	30	35 - 40
Conference Room	25	35 - 40
Apartment, Hotel	25 - 30	35 - 40
Theater, movie	30	35 - 40
Library	30	40 - 45
Small Office	30 - 35	40 - 45

METHOD OF TESTING OF PICTURE MONITOR

V. METHOD OF TESTING OF PICTURE MONITOR

1. Range of Application

This specification is applied to the method of testing monochrome picture monitors such as master monitor and program monitor, etc.

2. Meaning of Terminology

(1) Normal State of Operation

It means the state set up under the actual condition with prescribed connections, according to prescribed power source and level diagram.

(2) V means video signal.

(3) S means synchronizing signal.

(4) VS means the composite signal of video and sync.

3. Conditions of Testing

Unless otherwise specified, set up as follows:

3.1 Power Source

AC power source to be used for the testing must be of voltage and frequency specified for the test monitor, and use the normal wave form.

3.2 Measuring Instrument

Adopt Appendix 1 as standard, and measuring instruments applied have to be listed as Appendix 2.

3.3 State of Testing

3.3.1 Degree of Temperature and Humidity

Standard temperature and humidity are to be 20°C for temperature and 65% for relative humidity. The state that temperature lies inside 15°C - 25°C and relative humidity is within 45 - 85% may also be regarded as the state of standard temperature and humidity, however, in case of deviating from the limits, temperature and humidity must be stated.

3.3.2 Atmospheric Pressure

The standard atmospheric pressure is to be 1013mbar, however, when it positions in the range of 1003 - 1023 mbar, it may be also regarded as the state of standard atmospheric pressure.

3.3.3 Insolation

To be such state that direct rays of the sun do not fall.

3.3.4 Vibration and Impact

To be in the stationary state.

3.3.5 State of Setting of Test Monitor

Unless otherwise specified, set it in the normal state of operation.

4. Structure

Check if the following each item conforms to prescriptions.

4.1 Appearance

Assembly, Plating, Coating, Wiring, Color Assorting of Wiring, Parts, Marks and others.

4.2 Composition

Content of composition, quantities of spares and accessories and others.

4.3 Size, Weight

5. Overall

5.1 Performance

It follows Clause 6.1 "Performance Test" of Method of Testing of Video Control Equipment.

5.2 Continuous Running and Temperature Rise

It follows Clause 6.2 "Continuous Running and Temperature Rise" of Method of Testing of Video Control Equipment.

5.3 Pressure Resisting

Supply specified voltage to high tension circuits for 5 minutes and examine the presence of any abnormality in following items:

(1) Discharge phenomenon by the visual and auditory senses.

(2) Inducing noise on the picture screen.

(3) Insulation Break-down.

(4) Other harmful phenomena to the performance.

5.4 Insulation Resistance

It follows Clause 6.3 "Insulation Resistance" of Method of Testing of Video Control Equipment.

5.5 Noise

It follows Clause 6.11 "Noise" of Method of Testing of Video Control Equipment.

6. Video Section

6.1 Input Impedance

It follows Clause 6.4 "Impedance" of Method of Testing of Video Control Equipment.

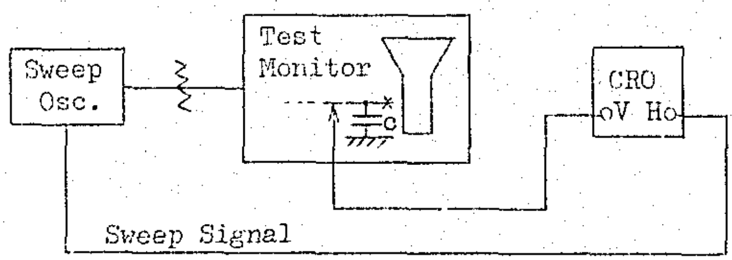
6.2 Frequency Characteristic

6.2.1 Amplitude Frequency Characteristic

(1) Measuring Circuit

In principle, it follows Fig. 1.

Fig. 1



(2) Method of Measurement

Feed the output of sweep oscillator to the input of test monitor, and measure the input signal level of Braun Tube by the oscilloscope.

(3) Precautions for the Measurement

(a) C is the equivalent capacity for use of correction to be added at the time of the measurement, and in such case that the electrode capacity of Braun tube is C' and the input capacity of the oscilloscope is C", make

$$C = C' - C''$$

(b) Cut off a place of x mark and then measure.

6.2.2 Delay Time Frequency Characteristic

It follows Clause 6.5.2 "Delay Time Frequency Characteristic" of Method of Testing of Video Control Equipment.

6.3 Wave Form Distortion

It follows Clause 6.6 "Wave Form Distortion" of Method of Testing of Video Control Equipment.

6.4 Linearity

6.4.1 Method of Measurement

It follows Clause 6.7 "Linearity" of Method of Testing of Video Control Equipment. However, the frequency of superposed waves is to be 800 Kc.

6.4.2 Precautions for the Measurement

It follows Clause 6.7 "Precautions for the Measurement" of Method of Testing of Video Control Equipment, plus

(1) Signal level of Braun tube deflecting plates or amplitude on the Braun tube is to be specified.

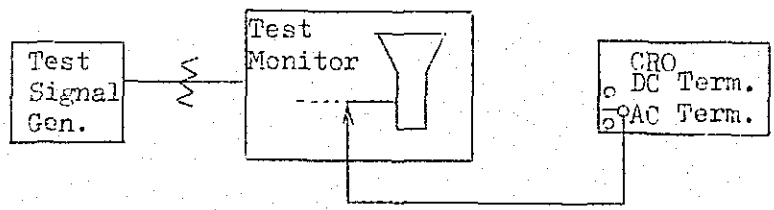
(2) For band-pass filter, use a high-impedance type for both input and output.

6.5 DC Restoration Characteristic

6.5.1 Measuring Circuit

In principle, it follows Fig. 2.

Fig. 2



6.5.2 Method of Measurement

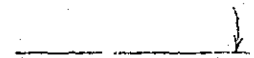
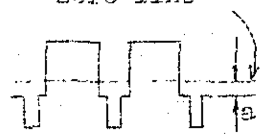
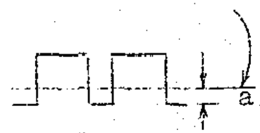
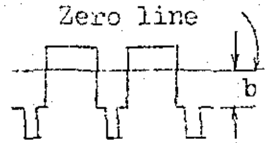
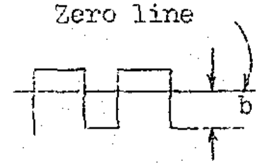
Feed white signals of the specified level to the input or, by setting S constant, feed VS signal to the input of the test monitor, then measure variations of the level of blanking signal (zero line) by Table 2.

Further, calculation method follows lower column of Table 2.

6.5.3 Precautions for the Measurement

Impedance of the DC input terminal of the oscilloscope must be more than 10Mohm.

Table 2

Order of Measurement	AC or DC terminal of Oscilloscope	At the time of VS signal	At the time of V signal
Make input signal zero to set zero line	DC	Zero line 	Zero line 
Feed white signals of the specified level and measure variations of the zero line	DC	Zero line 	Zero line 
	AC	Zero line 	Zero line 
Method of Calculation		DC Restoration Factor $= \frac{b(^1)-a}{b(^1)} \times 100$ (%)	

Note (1): For the wave form section, b is to be determined by values of calculation.

6.6 S N Ratio

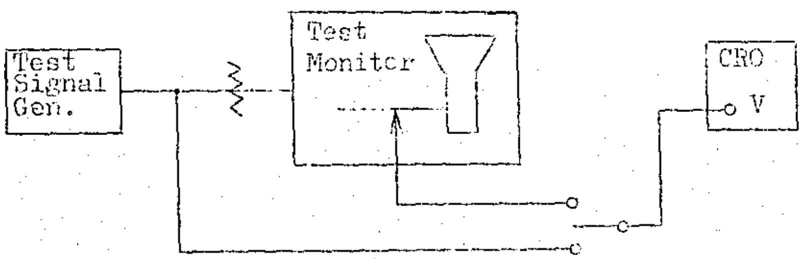
It follows Clause 6.9 "SN Ratio" of Method of Testing of Video Control Equipment.

6.7 Voltage Amplification Degree

6.7.1 Measuring Circuit

In principle, it follows Fig. 3.

Fig. 3



6.7.2 Method of Measurement

As the input signal, feed a test signal (Stair-case wave or square wave) to the input terminal of test monitor, and measure the level of the input signal of Braun tube, then determine by the following formula.

$$\text{Voltage Amplification Degree} = \frac{E_2}{E_1} \text{ (Multiple)}$$

E_1: Input Signal Level

E_2: Output Signal Level

6.8 Picture Frame

By vernier calipers, measure height, width and diagonal line length of the picture frame of protecting board and find deviations from the following.

$$\text{Deviation} = \frac{b - a}{a} \times 100 \text{ (\%)}$$

a: Prescribed Value

b: Measured Value

6.9 Amplitude Variation Degree

Vary the deflection amplitude and within the range conforming to specified conditions, measure hight and width of the picture which become maximum or minimum, then calculate its defference from the prescribed picture frame.

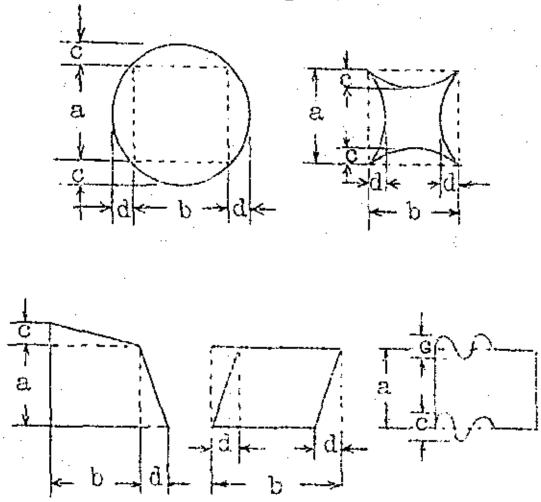
6.10 Deviation

With the prescribed picture frame as reference and within the limits conforming to specified conditions, deviate the picture up and down and left to right to measure maximum deviating size.

6.11 Picture Screen Distortion

As shown in Fig. 4, adjust the extent of the picture to the diagonal points of the prescribed carving frame of protecting board, and measure the deviation, then find it from the following formula.

Fig. 4

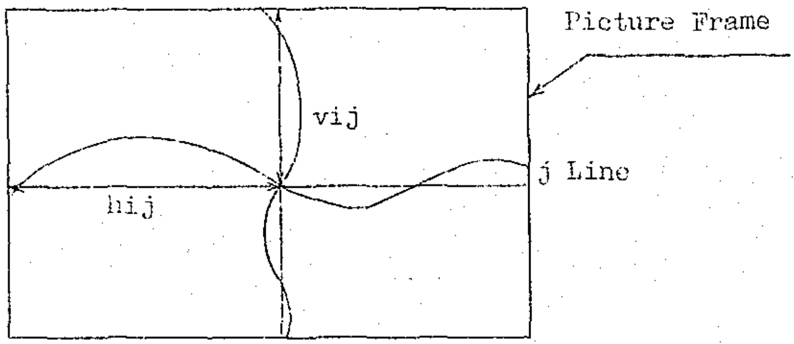


$$\text{Distortion} = \frac{c}{a} \times 100\ (\%) \quad \text{or} \quad \frac{d}{b} \times 100\ (\%)$$

6.12 Deflection Distortion

Adjust the picture to the diagonal points of picture frame, and modulate the Braun tube by the bar signals of 12 horizontal lines (eliminate upper end of the picture frame and contain one line of the lower end) and 16 vertical lines (eliminate left end of the picture frame and contain one line of the right end), and for the right or lower edge of each horizontal or vertical strip of picture, measure the distance from the picture frame, at every cross point of the vertical and horizontal strips then by 6.12.1 and 6.12.2, determine the respective distortion and space variation factors respectively.

Fig. 5



6.12.1 Distortion Factor

Suppose from left to right the vertical line 1, 2,........, i, ..., m line, and from top to bottom the horizontal line 1, 2, ..., j, ..., n line, and for the arbitorary i or j lines of vertical and horizontal lines, calculate as follows:

$$\text{Distortion Factor of i line} = \frac{\Delta hi}{Hmean} \times 100\ (\%)$$

$$\text{Distortion Factor of j line} = \frac{\Delta Vi}{Vmean} \times 100\ (\%)$$

6.12.2 Space Variation Factor

It shall be as follows.

Horizontal Space Variation Factor regarding j line

$$= \left| \frac{hij}{\text{Horizontal Distance of j line}} - \frac{j}{16} \right|_{max} \times 100\ (\%)$$

Vertical Space Variation Factor regarding i line

$$= \left| \frac{vij}{\text{Vertical Distance of i line}} - \frac{i}{12} \right|_{max} \times 100\ (\%)$$

Note:

Suppose

m: Number of Vertical Lines.

n: Number of Horizontal Lines.

i: ith Vertical Line from the left.

j: jth Horizontal Line from the top.

(i,j): Cross Point of i Line and j Line.

hij: Horizontal Distance from Picture Frame to (i,j) Point.

vij: Vertical Distance from Picture Frame to (i,j) Point.

Also, for i vertical line and j horizontal line, suppose its respective mean value from the picture frame $h_{mean\ i}$ and $v_{mean\ j}$,

$$h_{mean\ i} = \frac{(hi1 + hi2 + \dots + hin)}{n} = \frac{\sum_{j=1}^{n} h_{ij}}{n}$$

$$v_{mean\ j} = \frac{(v1j + v2j + \dots + vmj)}{m} = \frac{\sum_{j=1}^{m} v_{ij}}{m}$$

Using them, symbols and definitions are determined as follows.

$$\Delta hi = \max \left| hij - h_{mean\ i} \right|$$

$$j = 1, 2, \dots n$$

Δhi: Maximum deviation between i line and its average line.

$$\Delta vj = \max \left| vij - v_{mean\ j} \right|$$

$$i = 1, 2, \dots m$$

Δvj: Maximum deviation between j line and its average line.

$$Hmean = \frac{\text{Picture Frame Horizontal Distance}}{16}$$

Hmean: Average space

$$Vmean = \frac{\text{Picture Frame Vertical Distance}}{12}$$

Vmean: Average space.

6.13 Deflection Swaying

6.13.1 Method of Measurement

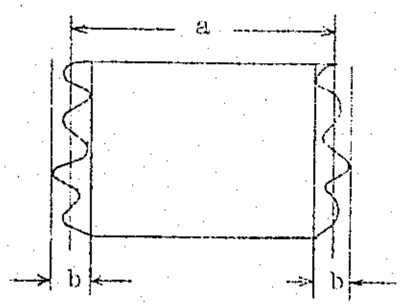
For the vertical deflection swaying, measure it by magnifying its amplitude optically at the center and both ends of top and bottom of picture screen, and for the horizontal swaying, measure in the same manner of magnifying its amplitude also at the center and both ends of left and right of picture screen, then determine by the following formula.

$$\text{Swaying} = \frac{b}{a} \times 100\ (\%)$$

a: Horizontal or Vertical Length of the Prescribed Picture Screen.

b: Amplitude of Swaying.

Fig. 6



6.13.2 Precautions for the Measurement

By free oscillation or synchronizing signal, cause the raster to synchronize, and settle the Braun tube in the state of no modulation.

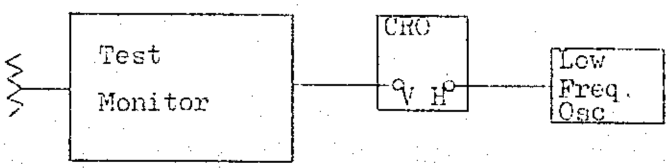
6.14 Sync Stability

6.14.1 Range of Frequency Control

(1) Measuring Circuit

It follows Fig. 7.

Fig. 7



(2) Method of Measurement

In case that the horizontal and vertical sync regulators are varied, by Lissajous' figure, measure variations of the free oscillation of the deflection oscillator over the entire variable range.

6.14.2 Minimum Sync Level

Feed a standard signal of the specified level and control it to the best condition, then under the following conditions, measure the input level of synchronizing signal at the point where the horizontal sync or the vertical sync gets out of phase.

(1) Internal Sync

Both V and S vary.

(2) External Sync

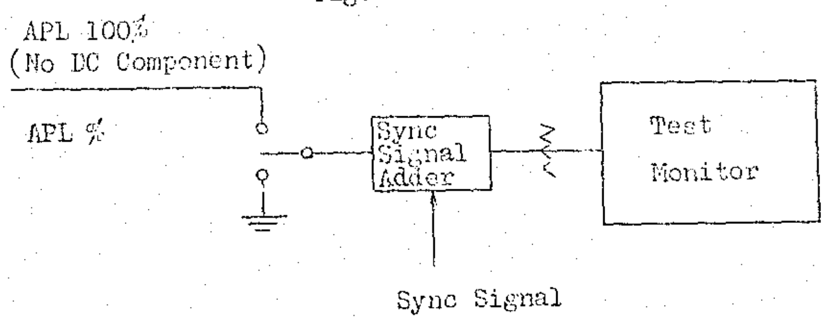
Varies S.

6.14.3 Dynamic Stability of Sync

(1) Measuring Circuit

In principle, it follows Fig. 8.

Fig. 8



(2) Method of Measurement

Switch APL 100% V signal wave form (Blanking Signal Wave Form 100%) of the specified level and APL 0% V signal wave form (0 signal) and examine the stability of horizontal or vertical sync., however, the level of synchronizing signal is to be at specified level.

(3) Precautions for the Measurement

(a) The test monitor is to be at the internal sync.

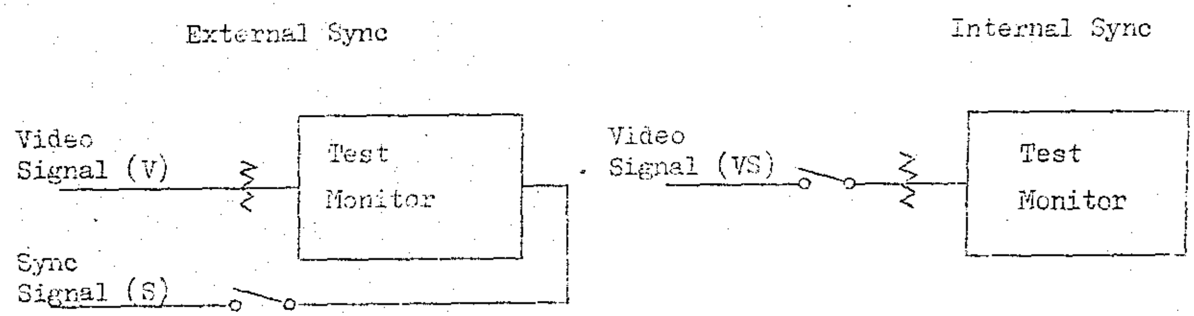
(b) As the alternative to this method of testing, it is also good to test, using the video switching amplifier, the stability of dynamic sync by feeding to the input 100% blanking signal wave form and switching it on and off.

6.14.4 Sync Pull-in Characteristic

(1) Measuring Circuit

In principle, it follows Fig. 9.

Fig. 9


External Sync
Internal Sync
Video
Signal (V)
Sync
Signal (S)
Test
Monitor
Video
Signal (VS)
Test
Monitor

(2) Method of the Measurement

On the ocassion of switching external sync signal(S) or video signal(VS) from "off" state to "on" state, measure time until when horizontal and vertical syncs become stable (Sync Pull-in Time).

6.15 Interlaced Scanning

Using the magnifying glass, measure every space of scanning line, and also observe the stability of the interlaced scanning.

6.16 Retrace Time

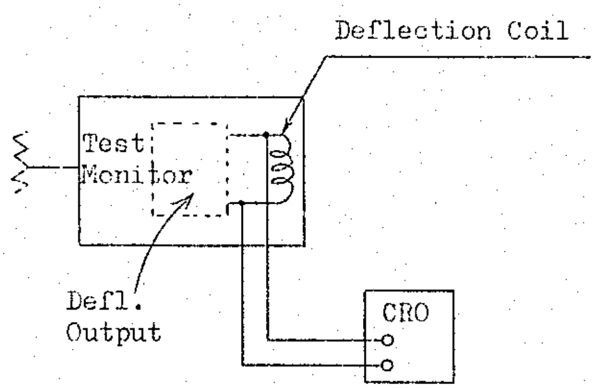
It follows either one of generating pulse method, pick up resistance method and signal width variation method, and what to select is subject to the prescription.

6.16.1 Generating Pulse Method

(1) Measuring Circuit

It follows Fig. 10.

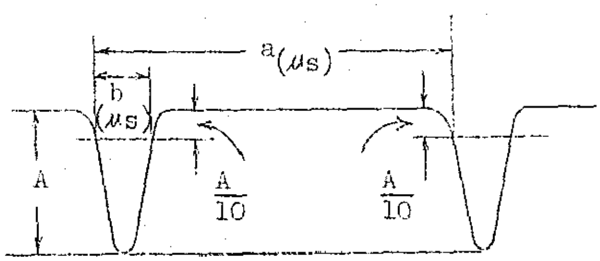
Fig. 10



(2) Method of Measurement

By the Brau tube oscilloscope, measure a pulse voltage which appears at the both ends of horizontal or vertical deflection coil during the retrace period, then determine by the following formula.

Fig. 11



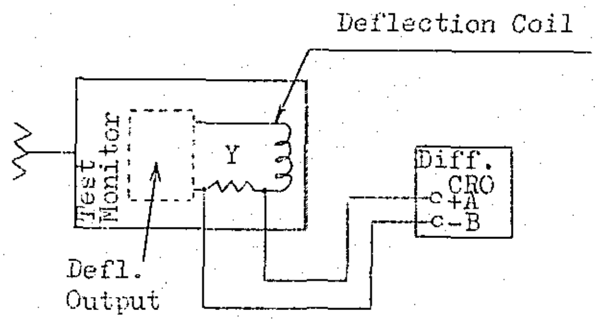
$$\text{Retrace Time} = \frac{b}{a} \times 100(\%)$$

6.16.2 Pick Up Resistance Method

(1) Measuring Circuit

In principle, it follows Fig. 12.

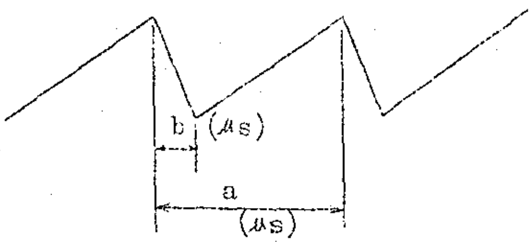
Fig. 12



(2) Method of Measurement

Feed to the differential oscilloscope a voltage between both ends of a resistor Y which is for pick up of deflection current and inserted in series to the deflection coil, and measure retrace time of the deflection current.

Fig. 13



$$\text{Retrace Time} = \frac{b}{a} \times 100(\%)$$

(3) Precautions for the Measurement

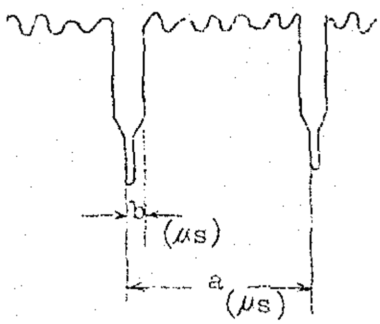
(a) As the resistor Y for pick up use, apply one whose value of resistance is less than 1/10 of the resistance of deflection coil.

(b) In case the differential oscilloscope is not available, it is also good to measure by the ordinary oscilloscope, but pay attention to the earth side potential.

6.16.3 Signal Width Variation Method

From the normal state of operation, vary the width of the horizontal or vertical blanking signal of a standard sync signal generator, and by the oscilloscope, measure width b at a point where the overlap starts on the picture screen, then determine by the following formula.

Fig. 14



$$\text{Retrace Time} = \frac{b}{a} \times 100(\%)$$

6.17 Focus

In the state of settling aberration minimum, when sine wave signals having specified amplitude and frequency locked to the horizontal sync frequency is fed to a Braun tube which is given a bias equal to cutoff measure spot distribution and area distinguishable on the picture screen.

6.18 Brightness

6.18.1 Method of Measurement

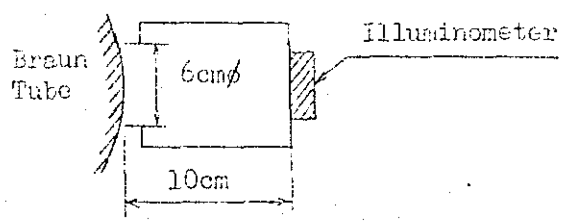
In the adjusted state described in 6.17, feed to the Braun tube a bias which corresponds to the white peak of sine wave, and measure by using the illuminometer.

6.18.2 Precautions for the Measurement

(1) The illuminometer must be one using photo electric cells adjusted to match visibility characteristics or one which uses photo-electric tube.

(2) As to photometric distance and light receiving area, unless otherwise specified, use a shading cylinder shown in Fig. 15, or apply a method of measurement equivalent to it.

Fig. 15



6.19 High-tension

6.19.1 Generating Voltage

In the specified condition, measure plate voltage by the voltmeter.

6.19.2 Voltage Regulation

Suppose E_1 and E_0 are the respective voltages on the ocassion of varying the bias voltage of Braun tube from specified bias voltage to cutoff voltage, the regulation is determined by the following formula.

$$\text{Regulation Factor} = \frac{E_0 - E_1}{E_1} \times 100\ (\%)$$

6.19.3 Precautions for the Measurement

For the voltmeter, use those of internal resistance more than 1000Mohm.

7. Wave Form Section

7.1 Wave Form Amplification Circuit

7.1.1 Input Impedance

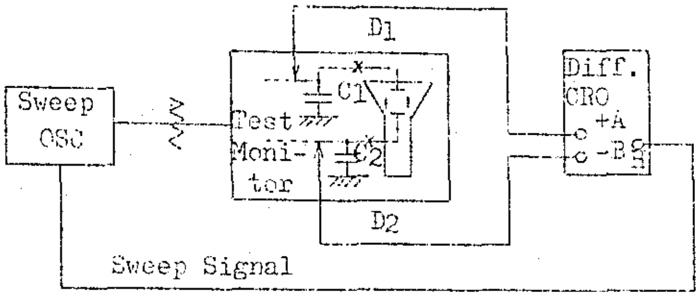
Same as 6.1

7.1.2 Amplitude Frequency Characteristic

(1) Measuring Circuit

In principle, it follows Fig. 16.

Fig. 16



(2) Method of Measurement

Feed the sweep generator output to the input terminal of the test monitor, and add 2 signals of the deflection electrodes (D_1, D_2) of the Braun tube to the 2 terminals (+A, -B) of the differential oscilloscope and then measure.

(3) Precautions for the Measurement

(a) C_1, C_2 are the equivalent capacities for correction use to be attached at the time of the measurement, and suppose electrode capacities of the Braun tube C'_1, C'_2 and input capacities of the oscilloscope C''_1, C''_2, each

$$C_1 = C'_1 - C''_1$$

$$C_2 = C'_2 - C''_2$$

has to be used.

(b) Disconnect points of x mark, then measure.

(c) In case the differential oscilloscope is not available, it may be also good to measure the 2 signals of D_1 and D_2 separately and take their total, however, in this case, pay attention that an error will result if delay characteristics of the two signal do not correspond.

(d) It is also good to measure directly from wave forms on the wave form monitor without using oscilloscope.

7.1.3 Wave Form Distortion

Same as 6.3, or it is also good to measure directly from wave forms on the wave form monitor without using oscilloscope.

7.1.4 Linearity

Same as 6.4.

7.1.5 DC Restoration Characteristic

Same as 6.5, or it is also good to measure directly from wave forms on the wave form monitor without using oscilloscope.

7.1.6 S N Ratio

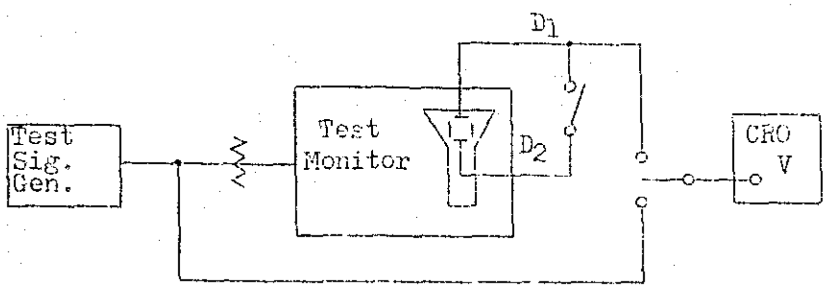
Same as 6.6.

7.1.7 Voltage Amplification Degree

(1) Measuring Circuit

In principle, it follows Fig. 17.

Fig. 17



(2) Method of Measurement

As the input signal, feed a test signal (stair-case or square wave) to the input terminal of the test monitor, and measure the output level at the deflection electrodes (D_1, D_2) of the Braun tube, then determine by the following formula.

$$\text{Voltage Amplification Degree} = \frac{E_2 + E_3}{E_1}$$

E_1: Input Level

E_2: Output Level (D_1)

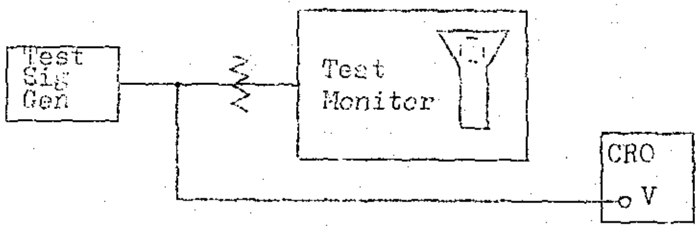
E_3: Output Level (D_2)

7.1.8 Deflection Sensitivity [2]

(1) Measuring Circuit

In principle, it follows Fig. 18.

Fig. 18



(2) *Method of Measurement*

As the input signal, feed a test signal (stair-case or square wave) to the input terminal of the test monitor and measure the amplitude of a wave form on the Braun tube, then determine by the following formula.

$$\text{Deflection Sensitivity} = \frac{E_1}{a} \ (\text{V/cm})$$

E_1: Input Level (V)

a: Wave Form Amplitude on the Braun tube (cm)

Note (2): Deflection sensitivity means the input voltage necessary to deflect 1 cm on the Braun tube.

7.2 Time Axis Deflection Circuit

7.2.1 Deflection Distortion

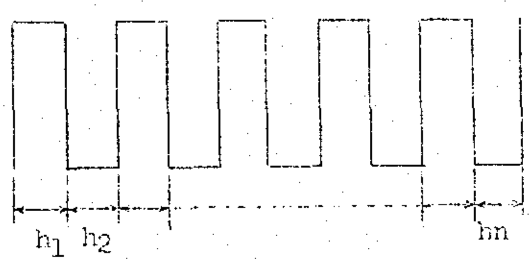
Feed a signal to the input of wave form amplification section, and measure the space of wave forms in the inside of the effective frame of a scale plate, then suppose maximum space h_{max}, minimum space h_{min} and average space h_{mean}, and the distortion is found from the following formula, provided that either one of the following must be applied for the input signal wave form.

(1) Square Wave Signal

(2) Bar Signal

(3) Sine Wave Signal

Fig. 19



(Make h about 5 mm)

$$\text{Distortion} = \frac{1}{2}\,\frac{h_{max} - h_{min}}{h_{mean}} \times 100\ (\%)$$

$$h_{mean} = \frac{(h1 + h2 \ldots\ldots + hn)}{n}$$

7.2.2 Enlargement

(1) Enlargement Factor

Suppose the respective widths of sync in the normal state and enlarged state a and b, measure the respective size, then find from the following.

$$\text{Enlargemement Factor} = \frac{b}{a} \text{ (multiple)}$$

(2) Position of the Center of Enlargement

Measure the distance between the center of sync width when enlarged and the center of scale plate.

7.2.3 S N Ratio

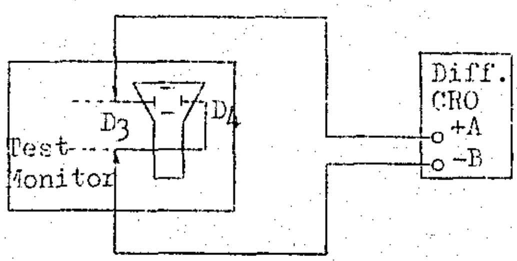
Same as 6.6.

7.2.4 Retrace Time

(1) Measuring Circuit

In principle, it follows Fig. 20.

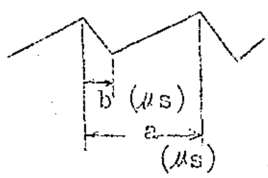
Fig. 20



(2) Method of Measurement

In the operating state, feed two signals of Braun tube time axis deflection electrode D_3, D_4 to the two terminals (+A, -B) of the differential oscilloscope and calculate by the following formula.

Fig. 21



$$\text{Retrace Time} = \frac{b}{a} \times 100\ (\%)$$

(3) Precautions for the Measurement

In case the differential oscilloscope is not available, it is also good to measure two signals of D_3, D_4 separately and take the average of the two, however, pay attention in this case that an error will result if the wave form and the phase of the two signals do not correspond.

7.3 Scale Dimension of the Scale Plate

In principle, it is to be performed by the magnifying projection scope with the reading accuracy 1/10 mm, 1/10 degree.

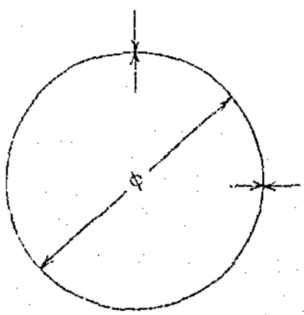
7.4 Deviation

With a zero line of the scale plate as reference, deviate a bright line up and down and left to right and measure the size of maximum deviation.

7.5 Focus and Aberration

Make a bias voltage of the wave form tube to be 1/2 the voltage of cutoff, and feed a sine wave voltage of less than 60 c/s to the inputs of vertical and horizontal deflection circuits, then cause to draw a circular Lissajous' figure to measure the width of its bright line. Size of the Lissajous' wave form and places of measuring the bright line width are to be as follows.

Fig. 22



In case the wave form tube is 120mm, ϕ is 70mm.

" 75mm, ϕ is 50mm.

7.6 High-tension

7.6.1 Generating Voltage

In the specified condition, measure plate voltage by the voltmeter.

7.6.2 Voltage Regulation

Suppose E_1 & E_2 are the respective voltages on the ocassion of varying the bias voltage of wave form tube to 1/4 and 3/4 of the cutoff voltage, the regulation is determined from the following formula.

$$\text{Regulation} = \frac{E_2 - E_1}{E_2} \times 100\ (\%)$$

7.6.3 Precautions for the Measurement

For the voltmeter, use those of internal resistance of more than 60M Ω

8. Test of Circumstances

To be performed according to Method of Testing of Video Control Equipment.

Appendix 1

Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
Video Frequency Oscillator	10c/s-10Mc Output 75ohm 4v(p-p)Maximum 10c/s-10Mc 600ohm 4v(r.m.s.) Maximum 20c/s-20kc	RC 10M-1B Type
Video Sweep Generator	15kc-15Mc Repeating Frequency 40c/s-70c/s Output 75ohm 1.6v(p-p) Range of Adjustment 60db	VS-2 Type
TV Test Signal Generator	Kind of Signal 1. Bar Signal 2. Horizontal Gray Scale Signal (Possible to switch Superposed Wave 0.8Mc and 3.58Mc) 3. Multi-burst Signal 4. White Signal With Simple Sync Signal attached Attached Filter High-pass Filter for 0.8Mc Band-pass Filter for 3.58Mc	TG-3 Type
Sine Square Wave Generator	Output Signal Sine Square Wave Pulse and Square Wave Pulse Width of Sine Square Wave at $\frac{1}{2}$ Amplitude 0.25 μs, 0.125 μs, 0.0625 μs Pulse Width of Square Wave 15-35 μs Output VS 1.4V (p-p)	SS-1 Type

Name of Measuring Instrument	Necessary Specification	Name of Reference Instrument
Delay Distortion Measuring Instrument	0- ±1000mμs Measuring Frequency 100Kc & 500Kc-6Mc Input Level 1V (p-p)	VD-3 Type
Vector Scope	Input of External Subcarrier 3.579545Mc, More than 2V(p-p) Phase Variation Range 0-200° Phase Angle Accuracy Vector Indication ±2° Horizontal Sweep ±1° Chroma ±2%	VSC-1 Type
Braun Tube Oscilloscope	Vertical Frequency Band DC-5Mc Sensitivity 0.003-20V/cm Horiz. Frequency Band 10c/s-800Kc Sweep Speed 10ms/cm-0.3μs/cm Delayed Sweep Possible Calibration Voltage 1V	505-3 Type
	Vertical Frequency Band DC-15Mc Sensitivity 0.02-20V/cm Horiz. Frequency Band DC-2Mc Sweep Speed 0.1μs/cm-15s/cm Delayed Sweep Possible Housing Marker Generator Calibration Voltage 0.05-100V	515-1 Type

Appendix 2

Name of Measuring Instrument	Maker's Name	Type	Mfg. No.	Remarks
Video Frequency Oscillator				
Video Sweep Generator				
TV Test Signal Generator				
Sine Square Wave Generator				
Delay distortion Measuring Instrument				
Vector Scope				
Braun Tube Oscilloscope				
Impedance Bridge				

Appendix 3

Video Amplifier Characteristics

		Frequency Characteristic	Wave Form Distortion				Noise		Linearity	Gain (Gain Control)	Prescribed Level	
			60c/s	15Kc, 250Kc								
			Sag	Sag	Rise Time	Over-shoot	Ham	Others			Input	Output
Master Monitor (25G 71 Type)	Picture Monitor Part	5Mc ±0.5dB		3%	0.07μs	5%	-60dB	-50dB (Synch-roneus)	2% (V) 5% (S) (Output 25V)	35 ± 1dB (-20dB)	0.7V	25V
	Wave Form Monitor Part	W 4.5Mc ±0.5dB 4.5-6Mc +0, -3dB N 0.5Mc -0.75dB (±0.6dB) 1Mc -2.5dB (±1.5dB) 3.58Mc -20dB (-3dB, +5dB)		1%	0.07μs	3%	-60 (Scale 60mm)	-50 (Synch-ronous) (60mm)		37dB (-15dB)	0.7V	Scale 55mm
VDA (TAD-6 Type)		7Mc ±0.1dB 7-8Mc -0.5dB	1%	1%	0.07μs	3% (Ringing Below 11Mc) 10% (Above 11Mc)	Below 1mV		DG±0.5% DG±0.5°	0dB (±1dB)	VS 1V	VS 1V
Video Equalizing Unit (EU71 Type)		7Mc ±0.5dB 7-8Mc +0, -1dB										
Stabilized Amplifier (RT-72 Type)		7Mc ±0.5dB 7-8Mc +0dB, -1dB		1%	0.06μs	5%	Ham-Below 1mV Cont.-1mV Sync.-20mV		DG5%(800Kc) DG1%(3.58) DP ±1°	0dB	VS 1V	VS 1V
Video Mixing Amplifier (8CB-71Type)		Ditto	1%	1%	0.06μs	3% (Except 10Mc Ringing)	Ham - -60dB Sync- -40dB Subcarrier Leak - -40dB Others -50dB		DG ±2% DP ±2°	0dB	V 0.7V	VS 1V

Monochrome TV Camera

	Frequency Characteristic	Wave Form Distortion				Noise		Linearity	Gain (Gain Control)	Prescribed Level	
		60c/s	15Kc, 250Kc								
		Sag	Sag	Rise Time	Over-shoot	Ham	Others			Input	Output
Overall	7Mc ±1dB	2%	1%	0.1μs	5% (Except ringing above 10Mc)	-60dB (p-p)	-35dB (rms)	±5% (Output 1V)	80dB(Max) 60dB(Nor) (Current Gain)	10μA	0.7V
Camera Head Pre-amp.	7Mc ±0.5dB		1%	0.07μs	5%	-60dB (p-p)	-40dB (rms)	±5% (Output 1.5V	70dB (Current Gain) (-14dB)	10μA	0.5V
View Finder	5Mc ±1dB	2%	1%	0.1μs	5%	-60dB (p-p)	-50dB (p-p) (Synch-ronous)	±5% (Output 45V)	40 ±2dB (-∞)	0.5V	40V
CCU Video Amp	7Mc ±0.5dB	2%	1%	0.07μs	5%	-60dB (p-p)	-40 (Synch-ronous) -50 (Others)	±5% (Output 1V)	13 ±2dB (-∞)	0.5V	0.7V
Video Monitor V. Amp	5Mc ±0.5dB	[illegible]	1%	0.1μs	5%	-60	-50 (Synch-ronous)	±5% (Output 35V)	33 ±2dB (-15dB)	0.7V	25V
Wave Form Monitor Wave Form Amp		1%	1%		5%	-60 (Scale 35mm)	-50 (Synch-ronous) (35mm)	3%(V) 5%(S) (40mm)	Scale 40mm (-20mm)	0.7V	Scale 25 mm

Appendix 4

Output Signal Wave Form
of
44ET/EB-71 Type Sync Signal Generator

	Synchronizing Signal			Blanking Signal		Horiz. Driving Signal	Vertical Driving Signal
	Horiz. Sync	Serration of V. Sync.	Eq. Pulse	Horiz.	Vertical		
Pulse Width	0.075H (4.76)	0.07H (4.44)	0.038H (2.41)	0.170H (10.8)	21H	0.1H (6.35)	9H
Tolerance for the above	±0.002H (0.127)	±0.002H (0.127)	±0.002H (0.127)	±0.004H (0.254)	+0 -0.1	±0.004H (0.254)	±0.65H
Position of leading edge	0	-	0	0.025H (1.58)	3.025H	Same as Blanking Signal	
Tolerance for the above	-	-	-	0.002H (0.127)	±0.002H (0.127)	Same as Blanking Signal	
Variable range of Pulse W.	0	0	0	0.11(7.0) ~ 0.21H (13.3)	0	0.07(4.45) ~ 0.13H (8.25)	5-13H
Rise Time	Below 0.003H (0.19)						
Overshoot	Below 2%						
Sag	Below 1%						

Note (1): Values in ( ) are μs.

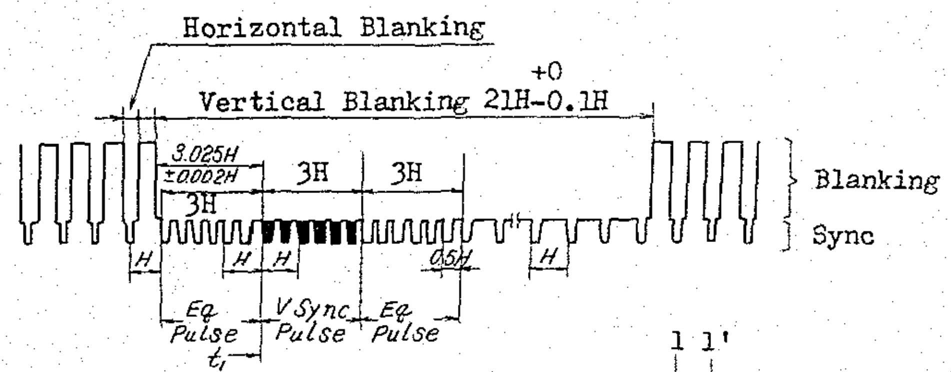
(2): Pulse width and phase of front porch have to be prescribed for the following part of output signal wave forms.

Sync Signal, Driving Signal ---- Point of 10% of total amplitude.

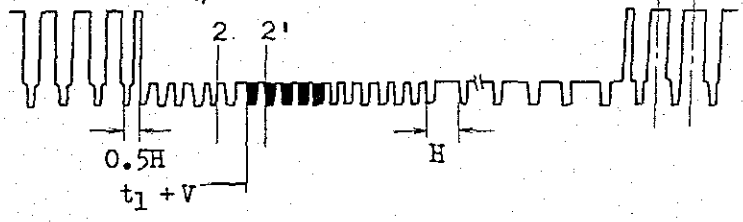
Blanking Signal ---------------- Point of deducting 10% of whole amplitude of sync signal from total amplitude.

(3): The phase of a leading edge is indicated by the time of advance from leading edges of vertical and horizontal sync signals.

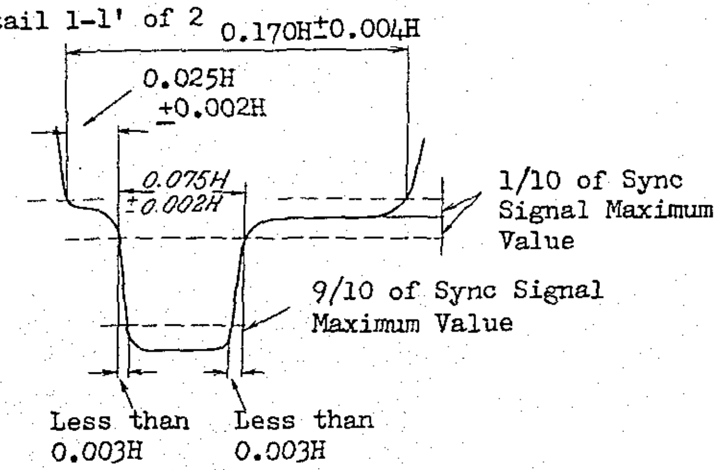
1. First Field



2. Next Field

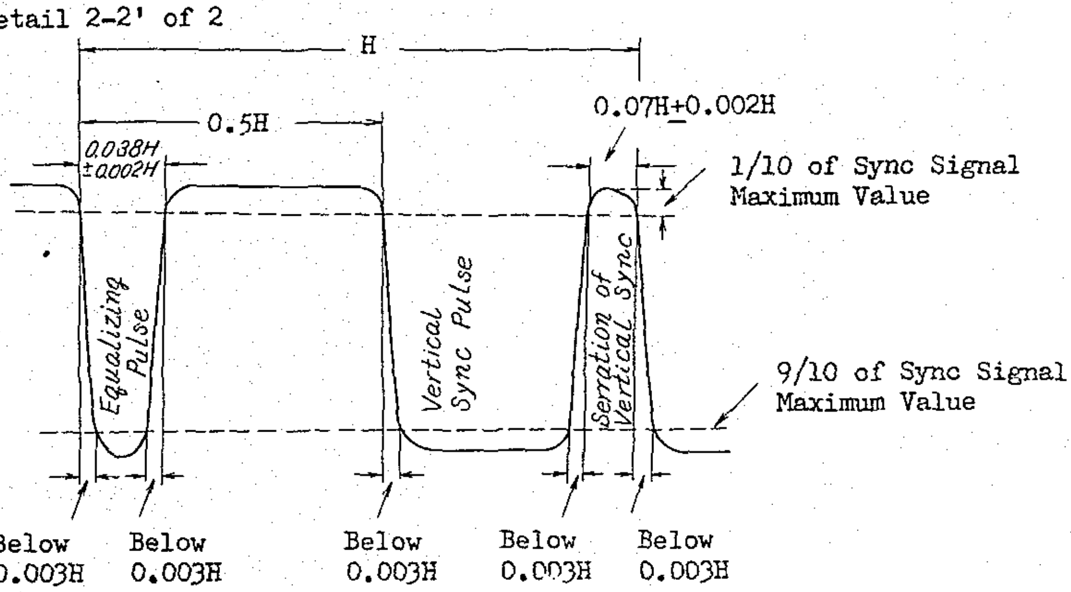


3. Detail 1-1' of 2



Note:
1. H = Time from the start of one scanning line to the start of next scanning line.
2. V = Time from the start of one field to the start of next field.

4. Detail 2-2' of 2



WAVE FORM OF SYNCHRONIZING SIGNAL

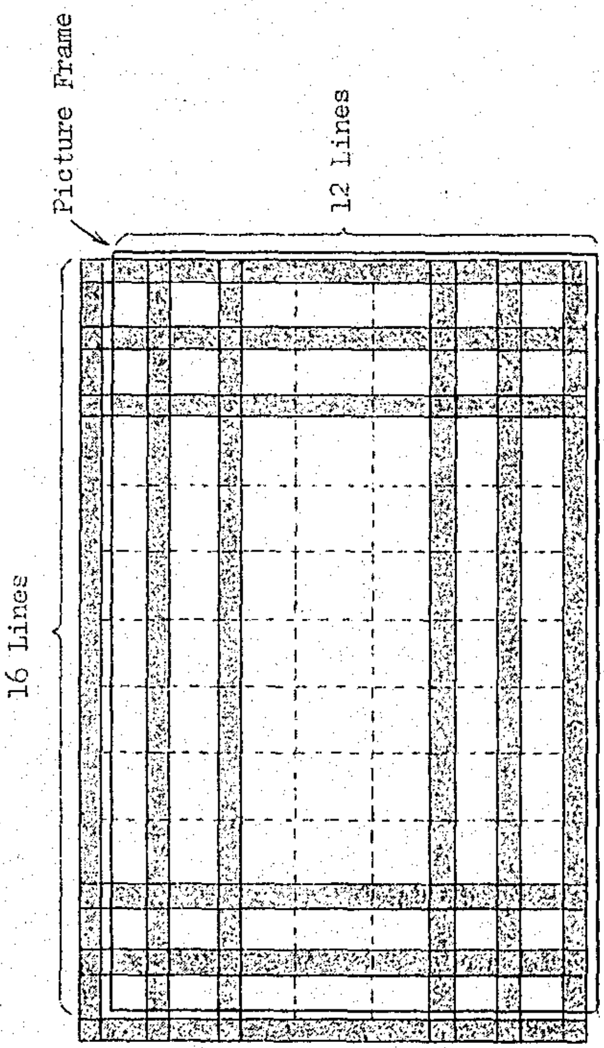
Explanation

6.12 With regard to Deflection Distortion

It is prescribed in the text that a Braun tube is to be modulated by the bar signals of 12 horizontal lines (eliminate the upper edge of picture frame and contain one line of the lower edge) and 16 vertical lines (eliminate left edge of the picture frame and contain one line of the right edge), which, to be concrete, means as follows.

As shown in the following sketch, in the horizontal direction, eliminate a bar signal of the upper edge and contain a bar signal of the lower edge by matching upper edge and lower edge of the picture frame nearly to the edge of the lower side of bar signals, and in the vertical direction, eliminate a bar signal of the right edge by matching left edge and right edge of the picture frame nearly to the edge of the right side of bar signals.

It also means the state that will contain, in the picture, frame bar signals of 12 lines in the horizontal direction and bar signals of 16 lines in the vertical direction.


Picture Frame
12 Lines
16 Lines