SVKM's NMIMS
Mukesh Patel School of Technology Management and Engineering, Vile Parle, Mumbai- 400056

Department of Electronics & Telecommunication

Lab Manual

Basic Communication Lab

Academic Year-2013-14

Programme: B. Tech EXTC

Semester – VI

Course: - Television and Video Engineering

SVKM'S NMIMS
Mukesh Patel School of Technology Management & Engineering

Department of Electronics &Telecommunication Engineering

Basic Communication Lab

Course: Television and Video Engineering

Course Objectives:

1. To provide knowledge of Monochrome, Colour TV and Advanced TV systems.
2. To teach fundamentals of Monochrome and colour signal transmission.
3. To introduce principles of display technologies like LCD TV and LED TV.
4. To give an insight of the concepts of digital signal transmission and principle of Digital TV, Plasma, HDTV, IPTV, 3D TV.

Course Outcomes:

After the successful completion of this course, the student will be able to

1. Explain different parameters of Sound and picture transmission.
2. Describe the working of monochrome CRT TV systems.
3. Explain principle and working of various Colour CRT TV systems.
4. Recognize the principle of various advanced TV technologies.
5. Compare various display technologies.
6. Analyze the fundamentals of digital signal transmission.

LIST OF EXPERIMENTS

LAB ASSISTANT **SUBJECT FACULTY** **HEAD OF DEPARTMENT**

Mr. Brahmanand Mhatre Prof. Sonal Parmar Dr. Vaishali Kulkarni

Mapping of Experiments to Course Outcomes

Experiment No.	CO1	CO2	CO3	CO4	CO5	CO6
1	√	√				
2	√	√				
3	√	√	√			
4	√	√				
5	√		√			
6	√		√			
7				√	√	
8	√	√	√	√	√	
9				√	√	
10			√			
11				√	√	√

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Basic Communication Lab

Subject- Television and Video Engineering
EXPERIMENT NO. 1

Monochrome Television Receiver

Aim :- To understand working of various stages of monochrome TV receiver.

Apparatus:- Monochrome Television receiver trainer kit.

Theory: -

Figure1. Illustrates block schematic of Monochrome Television receiver. The explanation of different stages of Monochrome TV receiver is as follows:-

1. Antenna:
The main function of the antenna is to accept the electromagnetic waves coming from the television transmitter. All TV antennas are mounted in horizontal position for better reception and favorable Signal to Noise Ratio.

For channels located in the VHF band, a half wave length antenna is mostly used. Various antennas in use are dipole type with reflectors and directors. A Yogi antenna i.e. a dipole with one reflector and two or more directors is also used.

For channels located in UHF band, special antennas Fan dipole, rhombic and parabolic reflector type are used.

2. **RF Section : RF Tuner OR Front end:**
This section consists of RF amplifier, Mixer and Local oscillator. The function of this section is to amplify both the sound and picture signals picked up by the antenna and to convert the carrier frequencies and their associated bands into the intermediate frequencies and their Sidebands. The setting of the local oscillator frequency enables Selection of desired station.

The standard intermediate frequencies for the 625-B system are:-
Picture IF = 38.9 MHz
Sound IF = 33.4 MHz

3. **IF Amplifier Section : Video IF Amplifier**
This section is also called Video IF amplifier since composite video signal is the envelope of the modulated picture IF signal. All the gain and selectivity of the receiver is provided by the IF section. The main function of this section is to amplify modulated IF signal over its entire bandwidth with an input of about 0.5 mV signal

form the mixer to deliver about 4V into the video detector. This needs an overall gain of about 8000.

4. AGC Section :

AGC circuit controls gain of RF and IF stages to deliver almost constant signal voltage to the video detector, despite changes in the signal picked up by the antenna. The change in gain is achieved by shifting the operating point of the amplifying devices used in the amplifiers. The operating point is changed by a bias voltage that is developed in the AGC circuit.

5. Sound IF section:

The Picture and sound signals on their respective carriers are amplified together in the IIF section. In Video detector the picture IF 38.9 MHz acts as the carrier and beats with the sound carrier 33.4 MHz and its associated FM side band frequencies to produce difference 5.5 MHz $\pm$ 50 KHz components.

This is called Inter carrier beat signals which is amplified by the IF amplifier and then given to FM detector.

6. Audio Amplifier:

The output of FM detector is amplified by the Audio amplifier stage.

7. Loud Speaker :

The loudspeaker converts the electrical output of audio amplifier Stage into sound signal.

8. Video Pre-amplifier :

The output of IF section is given to video detector stage to recover the composite video signal and to transform the sound signal to lower carrier frequency.

9. Video Amplifier:

The picture tube needs video signal with peak to peak amplitude of 80 to 100 volts for producing picture with good contrast. Video amplifier provides gain of 40 to 60 to the output of video detector having 2 volts magnitude. The response of the amplifier should be ideally flat from dc to 5 MHz to include all essential video components.

Contrast Control:

It is used to adjust contrast between black and white parts of the picture.

10. Picture tube circuitry:

The output from the video amplifier can be fed either at the cathode or control grid of the picture tube . The cathode drive is preferred and grid is left free to receive retrace blanking pulses to ensure that no retrace lines are seen on the screen.

11. Sync Separator circuit:

This circuit separates horizontal and vertical sync pulses from Composite video signal.

12. Horizontal Frequency Oscillator:

It is set to develop sweep drive voltage at 15625 Hz. Its frequency is controlled by dc control voltage developed by the AFC circuit.

13. **Horizontal output amplifier:**

The oscillator output is wave shaped to produce linear rise of current in the horizontal deflection coils. As deflection coils need about one 1 ampere of current to sweep the entire raster, the output of the oscillator is amplified by the amplifier and then given to the horizontal deflection coils.

14. Vertical Frequency Oscillator:

Blocking Oscillators and cathode coupled multivibrators are used as Vertical deflection oscillators. The output of this stage is saw tooth waveform having frequency 50 Hz. The controlling time constant are chosen to develop output according to trace and retrace periods.

15. **Vertical output amplifier:**

The output from the oscillator cum wave shaping circuit is fed to power amplifier which is then fed to the vertical deflection coils to produce vertical deflection of the beam on the picture tube screen.

16. E.H.T Supply:

An anode voltage of the order of 15 kV is needed for sufficient in Black and white picture tubes. This is known as HV or EHT (Extra High Tension) supply. This is obtained from the Horizontal output transformer.

17. Low voltage Power supply:

The B+ or low voltage power supply is obtained by rectifying and Filtering the ac mains supply by stepping it up or down before rectification and then provided to various sections.

Observation:-

Understanding function of various circuits in monochrome television receiver.

Conclusion: Thus we have understood functions of each stage of CCIR-B monochrome television receiver.

Block Diagram:

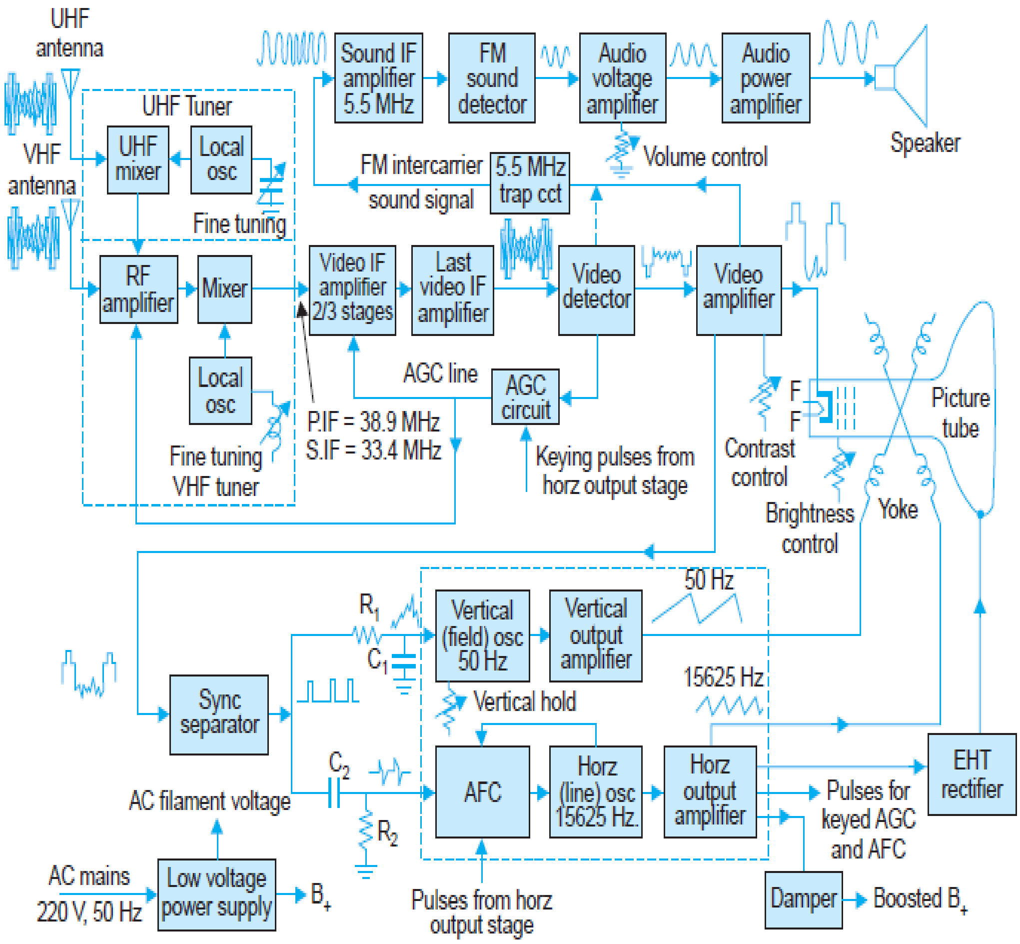

Figure 1 Block schematic of Monochrome Television receiver.

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Subject- Television and Video Engineering
EXPERIMENT NO. 2

Monochrome TV receiver Signals

Aim:- Study of Composite video signal and corresponding sweep Waveform in the Monochrome TV receiver.
Part a) By providing RF signals through Antenna.
Part b) By providing different patterns using Colour Pattern generator.
Part c) By providing signal from colour camera.

Apparatus:- Monochrome TV Receiver, Cathode Ray Oscilloscope CRO), Pattern Generator, Colour camera, CRO probes and Connecting Wires.

Theory:-

1. In the 625 line monochrome system, for successful interlaced scanning, the 625 lines of each frame or picture are divided into sets of 312.5 lines and each set is scanned alternately to cover the entire picture area.

2. To achieve this the horizontal sweep oscillator is made to work at a frequency of 15625 Hz (312.5 X 50 = 15625) to scan the same number of lines per frame (15625/25=625 lines) , but the vertical sweep circuit is run at a frequency of 50 instead of 25 Hz.

3. Since the beam is deflected from top to bottom in half the time and the horizontal oscillator is still operating at 15625 Hz, only half the total lines i.e. 312.5 (625/2=312.5) get scanned during each vertical sweep.

4. **Scanning Periods :-**

The retrace time involved in both horizontal and vertical scanning are due to physical limitations of practical scanning systems and are not utilized for transmitting or receiving any video signal.

HORIZONTAL DEFLECTION CURRENT

The nominal duration of the horizontal line is 64 μs out of which the active line period is 52 μs and the remaining 12 μs is the line blanking period.
The beam returns during this short interval to the extreme left side of the frame to start tracing the next line. Figure 1 shows horizontal deflection current waveform.

VERTICAL DEFLECTION CURRENT

Similarly with the field frequency set at 50 Hz, the nominal duration of the vertical trace is 20 ms (1/50= 20 ms). Out of this period of 20 ms, 18.72 ms are spent in bringing the beam from top to bottom and the remaining 1.28 ms is taken by the beam to return back to the top to commence the next cycle.

Since the horizontal and vertical sweep oscillators operate continuously to achieve the fast sequence of interlaced scanning, 20 horizontal lines (1280 µs /64 µs =20 lines) get traced during each vertical retrace interval. Thus 40 scanning lines are lost per frame, as blanked lines during the retrace interval of two fields.

This leaves the active no. of lines Na, for scanning the picture details equal to 625 -40 = 585 instead of the 625 lines actually scanned per frame. Figure 2 illustrates vertical deflection current waveform.

COMPOSITE VIDEO SIGNAL

The composite video signal consists of :-

- Camera signal corresponding to the desired picture information.
- Blanking pulses to make the retrace invisible
- And synchronizing (sync) pulses to synchronize the transmitter and receiver scanning

1. A horizontal sync pulse is needed at the end of each active line period whereas a vertical sync pulse is required after each field is scanned.

2. The amplitude of both horizontal and vertical sync pulses kept the same to be different for separating them at the receiver

VIDEO SIGNAL DIMENSIONS

1. Figure 3 shows the composite video signal details of three different Lines. Each corresponding to a different brightness level of the scene.

2. **Peak white level:**
   The level of the video signal when the picture detail being transmitted corresponds to the maximum whiteness to be handled is referred to as Peak White level. This is fixed at 10 to 12.5 % of the maximum value of the signal.

3. **Black Level:**
   It corresponds to approximately 72 %.

4. **Sync Pulses at blanking level :**
   They are added at 75 % called the Blanking level.

5. **Pedestal :**
The difference between the black level and blanking level is known as the “Pedestal”.

6. The picture information may vary between 10 % to about 75 % of the composite video signal depending on the relative brightness of the picture at any instant.

7. The lowest 10 % of the voltage range whiter than white range is not used to minimize noise effects.

8. **D.C. component of the video signal :**
In addition to continuous amplitude variations for individual picture elements, the video signal has an average value or dc component corresponding to the average brightness of the scene.

9. In the absence of dc component the receiver cannot follow changes in brightness, as the ac camera signal, say for grey picture elements on a black background will then be the same as a signal for white area on a grey background.

10. The break shown in the illustration after each line signal is to emphasize that dc component of the video signal is the average value for complete frames rather than lines since the background information of the picture indicates the brightness of the scene.

11. Average brightness can change from frame to frame and not from line to line.

12. **Pedestal height:**
It is the distance between the pedestal level and the average value (dc Level) of the video signal. This indicates average brightness since it measures now much the average value differs from the black level.

13. **The blanking pulses:**
These pulses are used to make retrace line invisible by raising the signal amplitude slightly above the black level (75 %) during the time the scanning circuits produce retraces.
The composite video signal contains horizontal and vertical blanking pulses to blank the corresponding retrace intervals.
The repetition rate of horizontal blanking pulses is therefore equal to the line scanning frequency of 15625 Hz. And the frequency of the vertical blanking pulses is equal to the field scanning frequency of 50 Hz.

14. **Sync Pulse and Video Signal Amplitude ratio:**
The final radiated signal has a picture to sync signal ratio (P/S) equal to 10/4.

Diagram:-

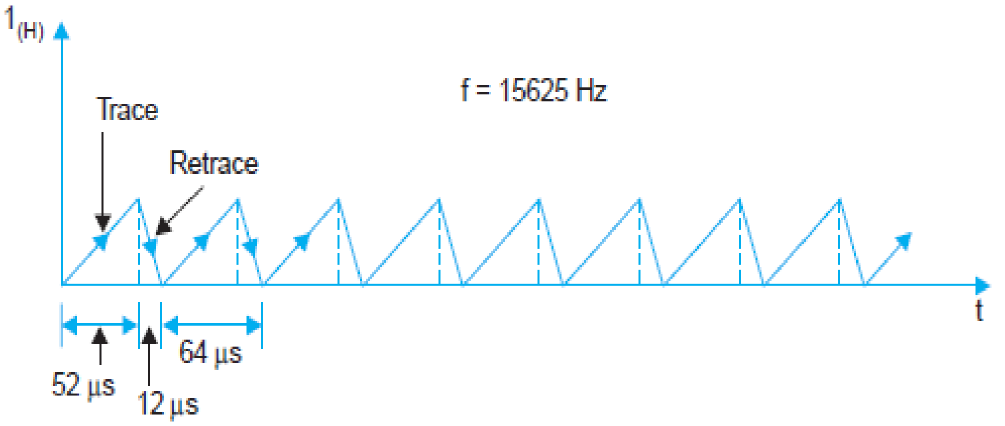

Figure 1 Horizontal Deflection current

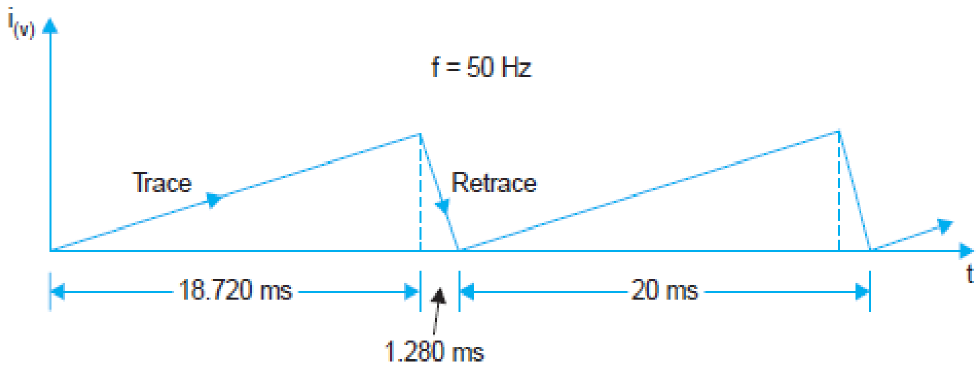

Figure 2 Vertical Deflection current

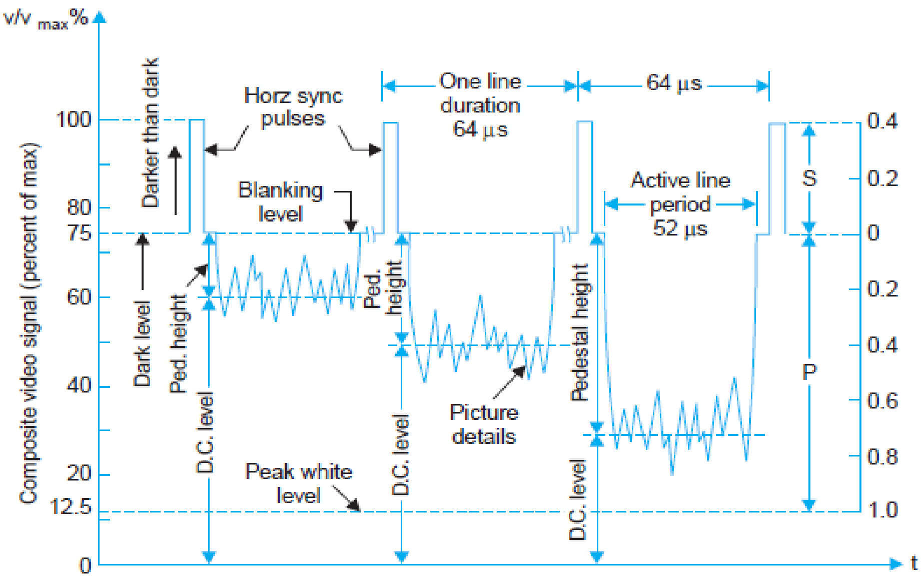

Figure 3 Composite Video signal for three scanning lines from three separate frames

Procedure:-

1. Connect external points given on monochrome TV trainer kit by connecting wires.
2. Connect Pattern generator/Antenna output to the RF input of Monochrome TV receiver.
3. Tune the TV receiver and get the bar pattern picture on TV screen.
4. Connect dual trace CRO to observe the following waveforms:-
    a. Composite video signal for a line
    b. Horizontal Sweep Waveform
    c. Composite video signal for a field
    d. Vertical sweep waveform

Observation:**-**Observe and measure amplitude, time period on CRO for the following signals:

By providing RF signals through Antenna:

1. Observe and study composite video signal for live signal coming from antenna.

2. By providing different patterns using Colour Pattern generator.

3. Observe and study composite video signal for various patterns provided by colour pattern generator (figure 4 to Figure 11).

By providing signal from colour camera:

4. Observe and study composite video signal for video signal coming from colour camera. Observe the following waveform on various stages of monochrome TV receiver.

5. Sync Separator circuit output(figure 12)
6. Horizontal Oscillator stage output(figure 13)
7. Vertical oscillator stage output(figure 15)
8. Vertical deflection coil current waveform(figure 14)

Conclusion:- Thus in this experiment we have observed and measured composite video signal for various video patterns generated by pattern generator and live signal from indoor antenna.

We have also observed and measured sync separator output, horizontal oscillator output (15625 Hz), vertical deflection oscillator output (50 Hz) and vertical deflection coil current (50 Hz).

Observations:-

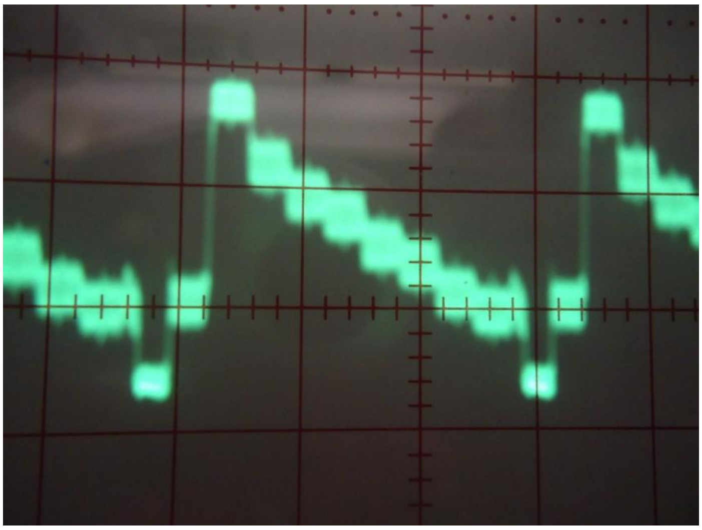

Figure 4 Composite Video Signal for Colour bar pattern

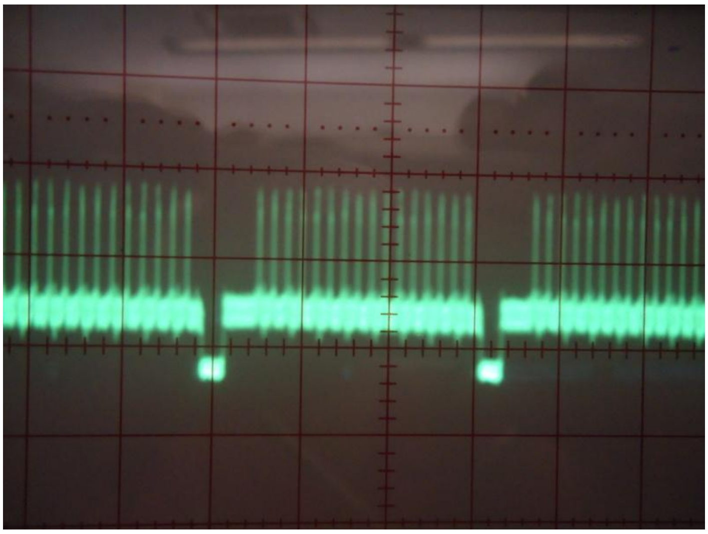

Figure 5 Composite Video Signal for Cross Hatch pattern

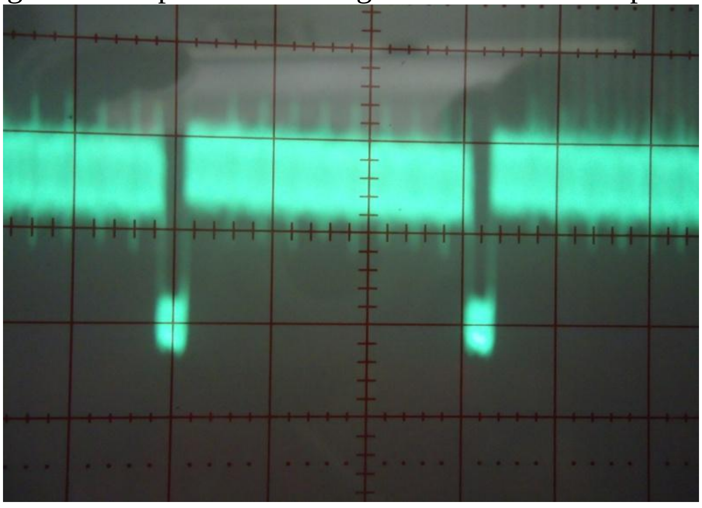

Figure 6 Composite Video Signal for Dot pattern

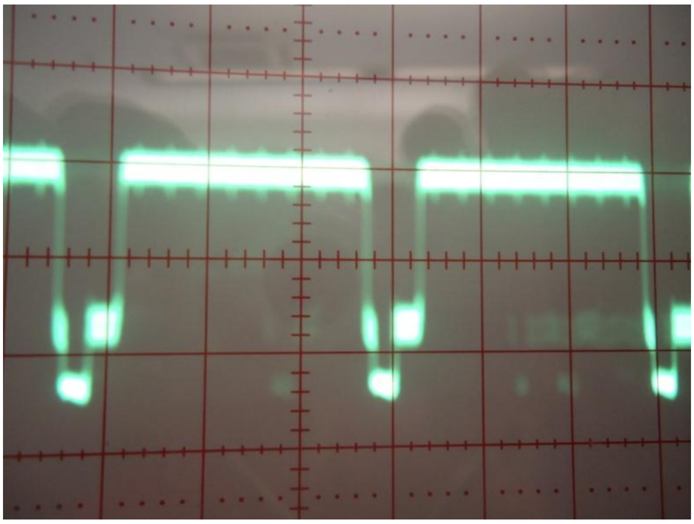

Figure 7 Composite Video Signal for White colour pattern

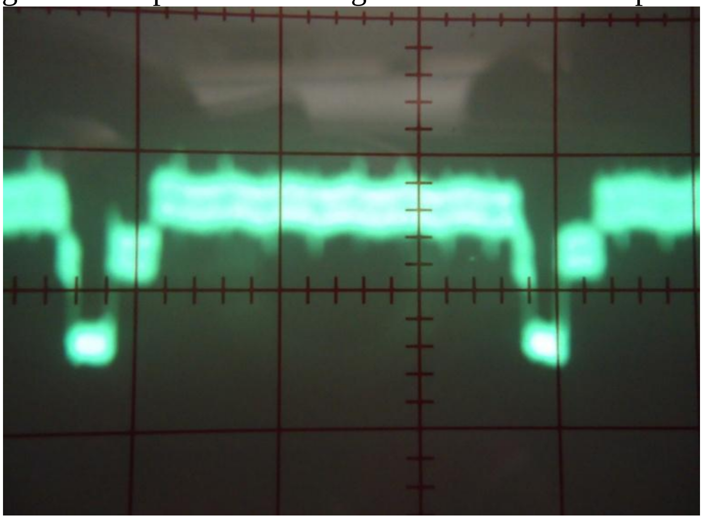

Figure 8 Composite Video Signal for Red colour pattern

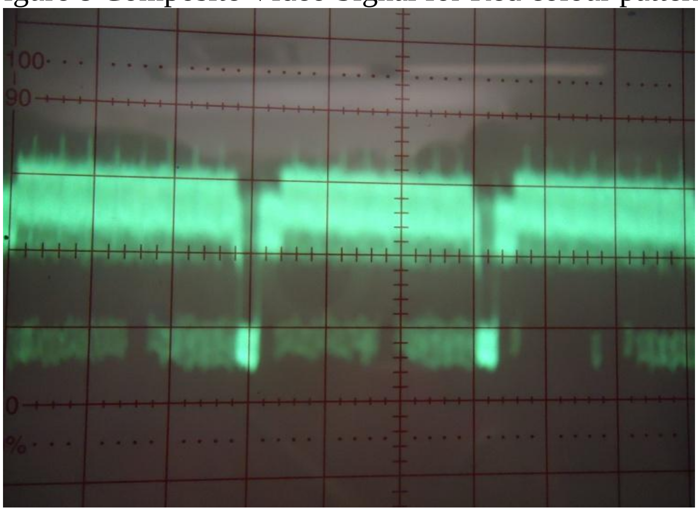

Figure 9 Composite Video Signal for Green colour pattern

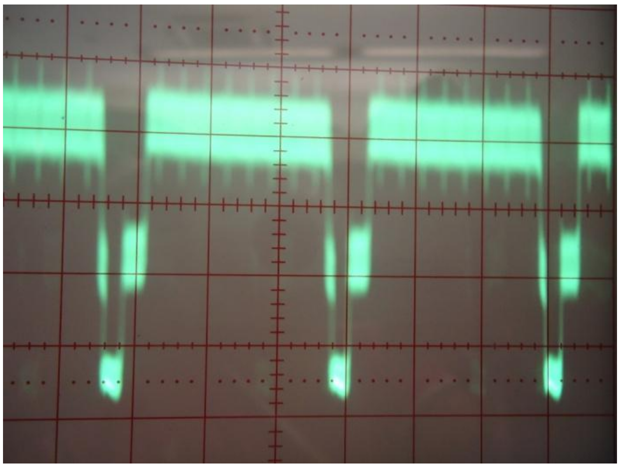

Figure 10 Composite Video Signal for Blue colour pattern

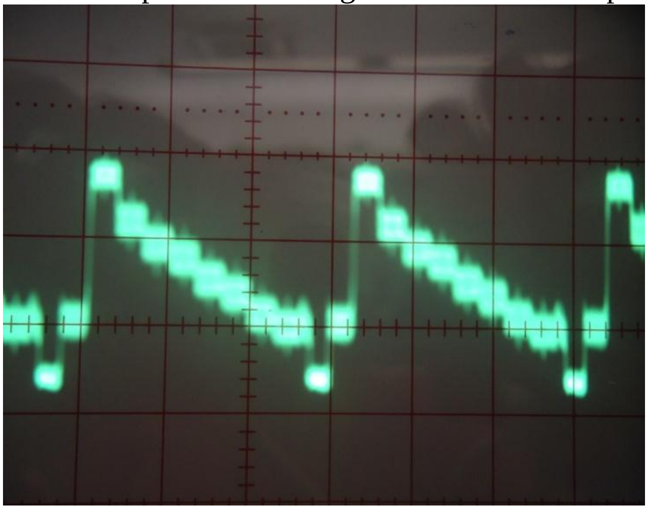

Figure 11 Colour Decoder output

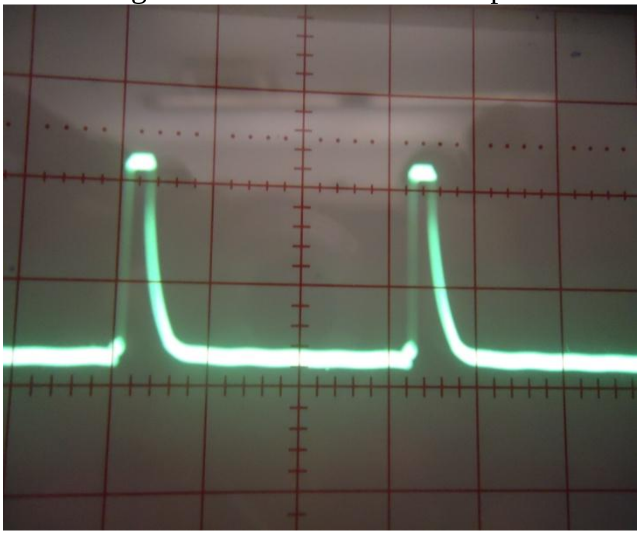

Figure 12 Sync Separator Circuit output pulses

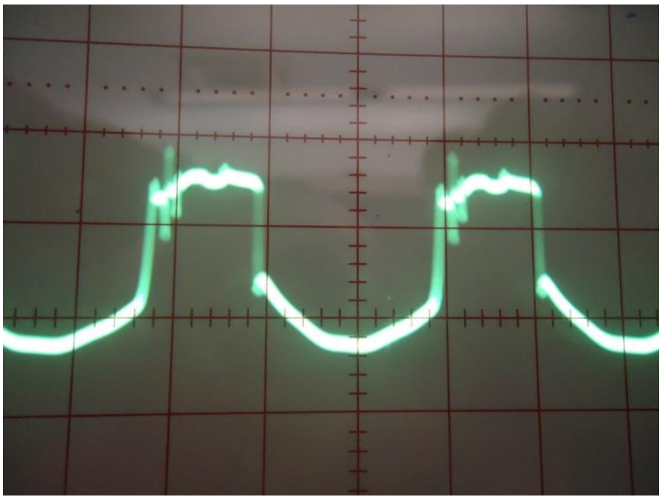

Figure 13 Horizontal oscillator circuit output (15625 Hz)

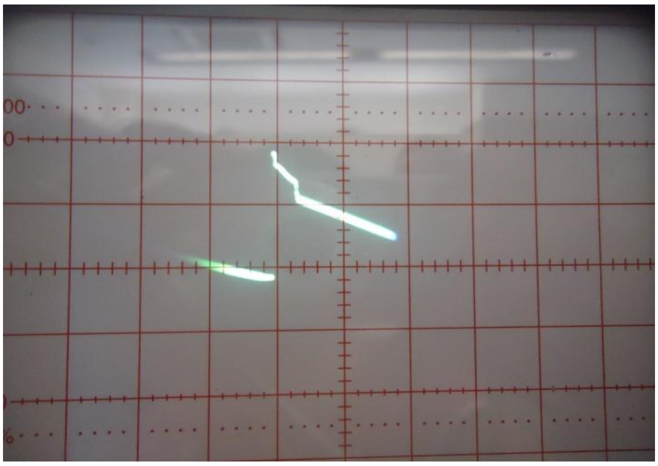

Figure 14 Vertical Deflection coil current (50 Hz)

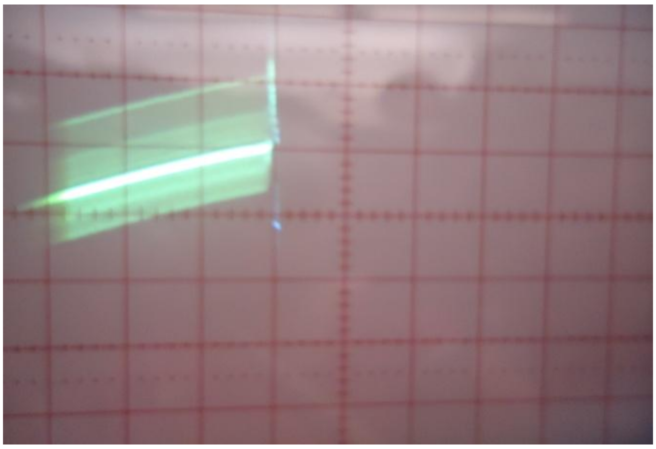

Figure 15 Vertical Deflection Oscillator output (50Hz)

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Subject- Television and Video Engineering
EXPERIMENT NO. 3

Monochrome Picture tube, Camera Tube & Colour Picture Tube

Aim:- To observe the construction of Monochrome and colour picture tube, and Vidicon camera tube and measuring various voltages.

Apparatus:- Monochrome Picture tube, Colour Picture tube, Vidicon camera tube, Colour pattern generator and multimeter.

Theory:-

In this experiment construction details of Monochrome picture tube, delta gun colour picture tube and Vidicon camera tube. Measurement of various voltages in monochrome and colour picture tube is also taken.

TELEVISION CAMERA TUBE

1. It is the eye of a TV system. The important functions are:
   a. Sensitivity to visible light
   b. Wide dynamic range with respect to light intensity
   c. Ability to resolve details while viewing a multi element scene.

2. **Basic Principle:**

   a. Any picture appears to be composed of small elementary areas of light and shade, which are known as picture elements. These elements contain visual image of the scene.
   b. TV tube senses each element independently and develops a signal in electrical form proportional to the brightness of each element.
   c. Light from the scene is focused on a photosensitive surface known as the image plate, and the optical image thus formed with a lens system represents light intensity variations of the scene.
   d. The photoelectric properties of the image plate then convert different light intensities into corresponding electrical variations.
   e. With the help of scanning process, electron beam moves across the image plate line by line, and field by field to provide signal variations in a successive order.
   f. This scanning process divides the image into its basic picture elements. Through the entire image plate is photoelectric; its construction isolates the picture elements so that each discrete small area can produce its own signal variations.

3. Types of camera tubes:--

i. Image Orthicon
ii Vidicon
iii Plumbicon

Vidicon Camera tube:-

1. It works on the principle of photoconductivity, where the resistance of the target material shows a marked decrease when exposed to light. Figure 1 illustrates construction of Vidicon Camera Tube.
2. The target consists of a thin photo layer of either selenium or antimony compounds. This is deposited on a transparent conducting film, coated on the inner surface of the face plate.
3. This conductive coating is known as signal electrode or plate. Image side of the photo layer, which is in contact with the signal electrode, is connected to DC supply through the load resistance Rl.
4. The beam that emerges from the electron gun is focused on surface of the photo conductive layer by combined action of uniform magnetic field of an external coil and electrostatic field of grid No. 3.
5. Grid no. 4 provides a uniform decelerating field between itself and the photo conductive layer, so that the electron beam approaches the layer with a low velocity to prevent any secondary emission.
6. Deflection of the beam for scanning the target is obtained by vertical and horizontal deflecting coils, placed around the tube.

Applications of the Vidicon camera tube:-

1. Slides, pictures, closed circuit TV.
2. Education, medicine, industry, aerospace, and oceanography.
3. It is a short tube with a length of 12 to 20 cm and diameter between1.5 to 4 cm. Its life is estimated to be between 5000 and 20,000 hours.

Three different types of colour

These are the different types of colour picture tubes:

1. Delta-gun colour picture tube
2. Guns-in-line or Precision-in-line (P-I-L) colour picture tube.
3. Single sun or Trinitron Colour picture tube.

Delta gun picture tube:

1. Figure 2 shows construction details of Delta Gun Colour picture tube. It employs three separate guns, one for each phosphor. The guns are equally spaced at 120° interval with respect to each other and tilted inwards in relation to the axis of the tube. They form an equilateral triangular configuration.

2. As shown in the tube employs a screen where three colour phosphor dots are arranged in groups known as triads. Each phosphor dot corresponds to one of the three primary colours. The triads are repeated and depending on the size

of the picture tube, approximately 1,000,000 such dots forming nearly 333,000 triads are deposited on the glass face plate.

3. About one cm behind the tube screen is located a thin perforated metal sheet known as the shadow mask. The mask has one hole for every phosphor dot triad on the screen. The various holes are so oriented that electrons of the three beams on passing through any one hole will hit only the corresponding colour phosphor dots on the screen. The ratio of electrons passing through the holes to those reaching the shadow mask is only about 20 percent. The remaining 80 percent of the total beam current energy is dissipated as a heat loss in the shadow mask.

4. While the electron transparency in other types of colour picture tubes is more, still, relatively large beam currents have to be maintained in all colour tubes compared to monochrome tubes.

Generation of Colour Rasters

5. The overall colour seen is determined both by the intensity of each beam and the phosphors which are being bombarded. If only one beam is ‘on’ and the remaining two are cut-off, dots of only one colour phosphor get excited.

6. Thus the raster will be seen to have only one of the primary colours. Similarly, if one beam is cut-off and the remaining two are kept on, the rasters produced by excitation of the phosphors of two colours will combine to create the impression of a complementary colour.

7. The exact hue will be determined by the relative strengths of the two beams. When all the three guns are active simultaneously, lighter shades are produced on the screen. The is so because red, green and blue combine in some measure to form white, and this combines with whatever colours are present to de-saturate them.

8. Naturally, intensity of the colour produced depends on the intensity of beam currents. Black in a picture is just the absence of excitation when all the three beams are cut-off. If the amplitude of colour difference signals drops to zero, the only signal left to control the three guns would be the Y signal and thus a black and white (monochrome) picture will be produced on the screen.

<u>Monochrome picture tube.</u>

1. The picture tube or ‘kinescope’ that serves as the screen for a television receiver is a specialized from of cathode-ray tube. It consists of an evacuated glass bulb or envelope, inside the neck of which is rigidly supported an electron gun that supplies the electron beam. A luminescent phosphor coating provided on the inner surface of its face plate produces light when hit by the electrons of the fast moving beam.

2. A monochrome picture tube has one electron gun and a continuous phosphor coating that produces a picture in black and white. The deflection coils are mounted externally in a specially designed yoke that is fixed close to the neck

of the tube. The coils when fed simultaneously with vertical and horizontal scanning currents deflect the beam at a fast rate to produce the raster.

3. The composite video signal that is injected either at the grid or cathode of the tube, modulates the electron beam to produce brightness variations of the tube, modulates the electron beam to produce brightness variations on the screen. This results in reconstruction of the picture on the raster, bit by bit, as a function of time. However, the information thus obtained on the screen is perceived by the eye as a complete and continuous scene because of the rapid rate of scanning.

Electron Gun

1. The various electrodes that constitute the electron gun are shown in Fig. 5.2. The cathode is indirectly heated and consists of a cylinder of nickel that is coated at its end with thoriated tungsten or barium and strontium oxides. These emitting materials have low work-function and when heated permit release of sufficient electrons to form the necessary stream of electrons within the tube.

2. The control grid (Grid No. 1) is maintained at a negative potential with respect to cathode and controls the flow of electrons from the cathode. However, instead of a wire mesh structure, as in a conventional amplifier tube, it is a cylinder with a small circular opening to confine the electron stream to a small area. The grids that follow the control grid are the accelerating or screen grid (Grid No. 2) and the focusing grid (Grid No. 3).

3. These are maintained at different positive potentials with respect to the cathode that vary between + 200 V to + 600 V. All the elements of the electron gun are connected to the base pins and receive their rated voltages from the tube socket that is wired to the various sections of the receiver.

Observations:-

Table 1 Measurement of voltages in monochrome TV receiver

PIN NO.	VOLTAGE(V)
1	O
2 (Cathode)	13.5 V(brightness Maximum) 41.5 V(brightness Minimum)
3 (Filament)	9.2 V
4(Ground)	Zero (V)
5 (Grid)	-5.5V(Brightness Maximum) -5.9 V(Brightness Minimum)
6(Focusing Anode)	75.3 V(contrast minimum) 75.4 V(contrast maximum)
7 (Focusing Ground)	Zero (V)
8 (Ground)	Zero (V)

Measure voltage between Pin no.2 (Cathode) and Pin no. 5 (Grid)

Voltage	Brightness	Contrast
Minimum	32 V	12.5 V
Maximum	12.5 V	12.5 V

Conclusion:-
Thus we have observed construction details of monochrome picture tube, Vidicon camera tube and colour picture tube and measured various voltages in monochrome picture tube.

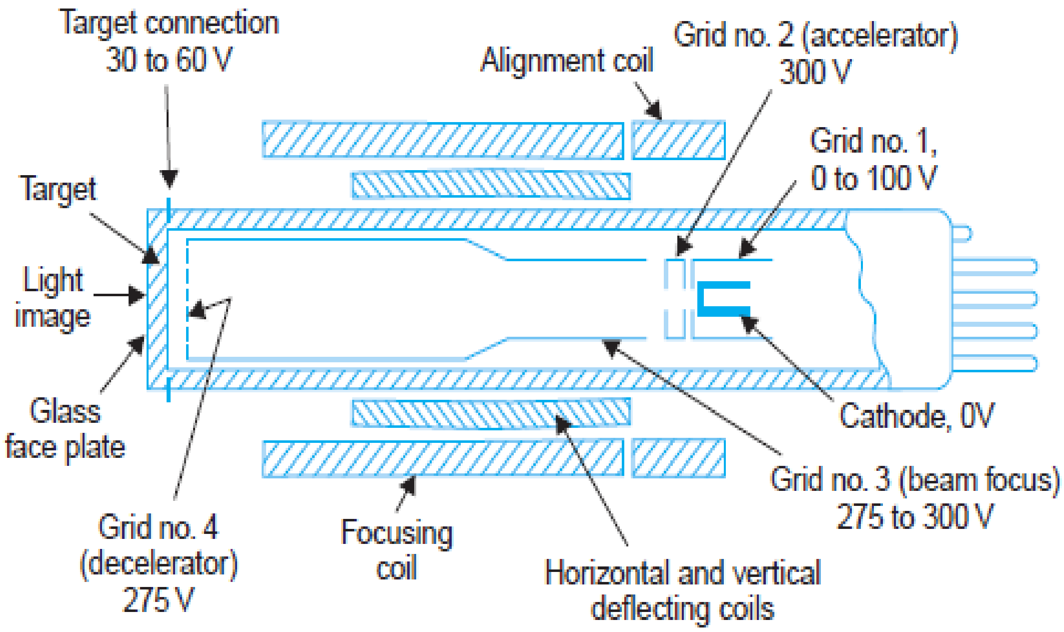

Figure 1 Vidicon Camera Tube

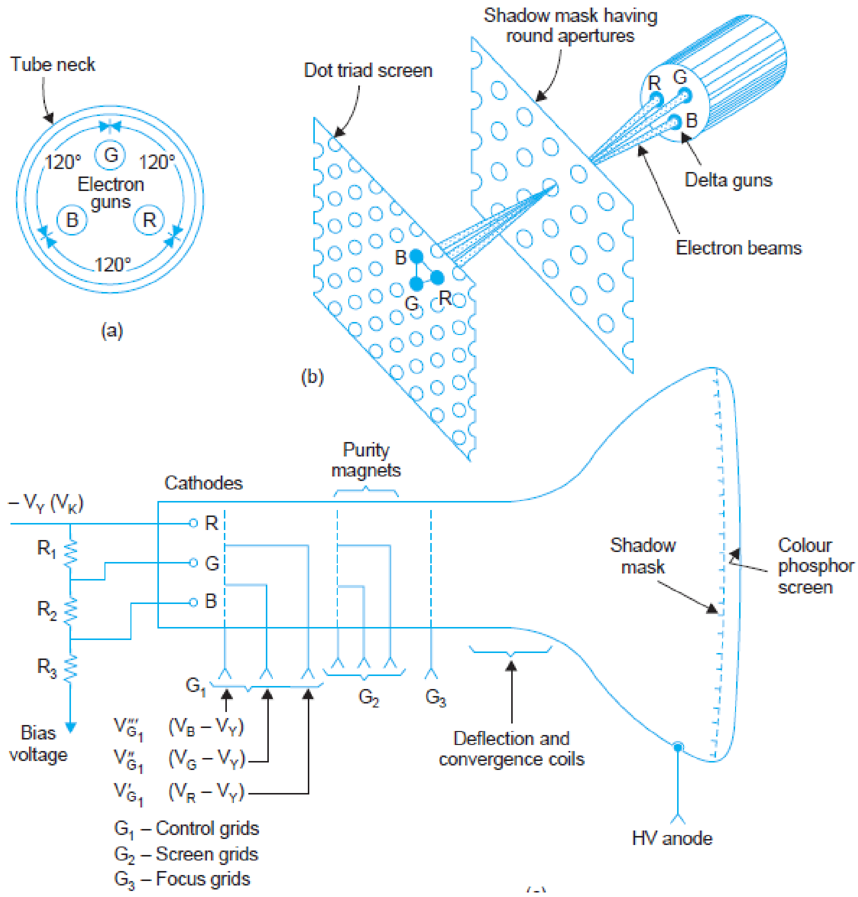

Figure 2 Delta Gun colour picture tube

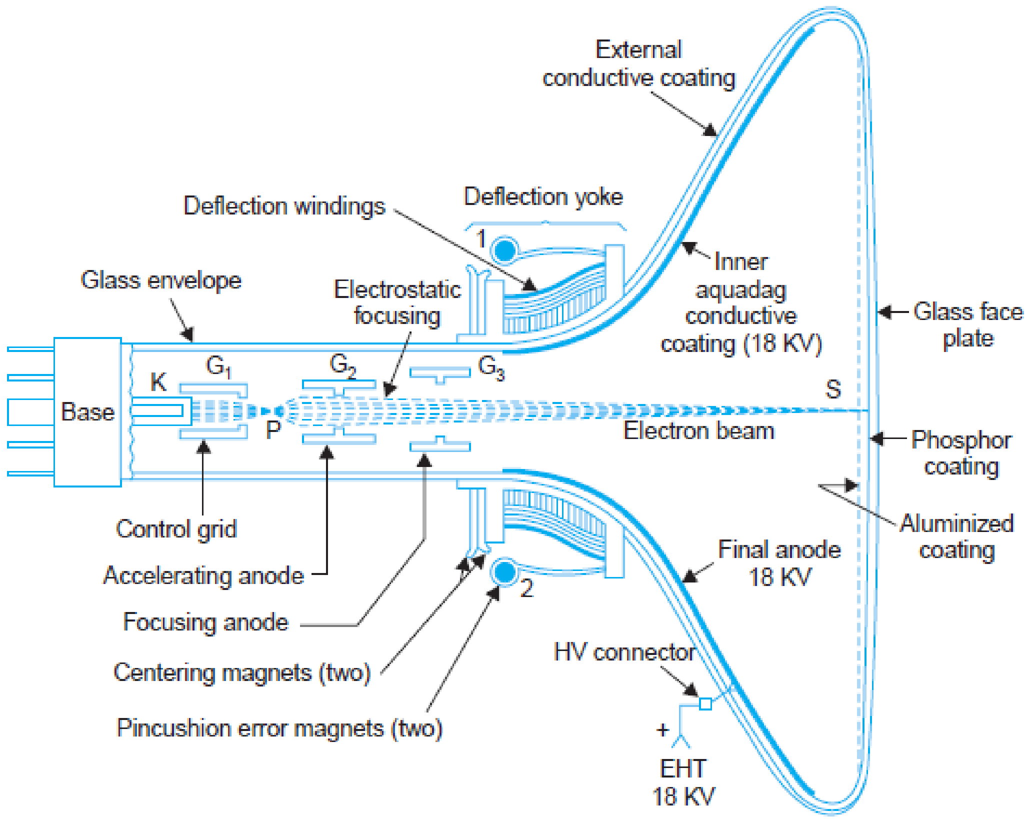

Figure 3 Monochrome Picture Tube

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EXPERIMENT NO. 4

Monochrome Television Receiver Fault Finding

Aim:- To find out various faults and trace circuits in monochrome TV receiver.

Apparatus:- Monochrome TV receiver, CRO, CRO probe, digital Multimeter.

Theory :-

The first step towards finding the cause of failure of a receiver is visual inspection of the components, tubes, transistors and ICs mounted on various printed circuit boards, modules and chassis of the receiver. Such an inspection sometimes leads quickly to the defective device or part in the receiver. For example, burnt or charred resistors can often be spotted by visual observation. Similarly overheated transformers, oil or wax filled capacitors and coils can be located by a peculiar small caused by overheating and shorting. In addition a disoldered wire of a coil or component, broken load of a transistor or other similar faults can be found out by a preliminary visual inspection.

Fault Localization

1. The picture and sound signals have a common path from antenna to the video detector after which the two separate out to their respective channels. Another section of the receiver provides necessary signals for producing the raster and maintaining synchronism between the televised scene and reproduced picture. Thus the known path of the video, audio, and sync signals together with the symptoms observed on the screen and noted from the sound output can form a basis for localizing any trouble in one or more sections of the receiver.

2. If a receiver exhibits a distorted picture accompanied by a distorted audio output, it becomes obvious that the defect is in a circuit which is common to both the signals. Thus the fault is localized to the RF and IF sections of the receiver. On the other hand, if only the sound output is missing or appears to be distorted, the fault lies in the sound section following the point of separation of the two signals.

3. Similarly if nothing but a white horizontal line appears on the screen, it becomes evident, that the trouble lies somewhere in the vertical circuit. However, if the picture holds vertically but tears diagonally, the trouble probably lies either in the horizontal sync or horizontal sweep circuit. Thus the method of observing symptoms from picture and sound is very efficient for fault location and saves much servicing time.

Signal Source for Observing Faults

1. Though any transmission from a local TV station can be used for observing possible faults but continuous change of picture details on the screen makes it difficult to observe minor irregularities in the reproduced picture.
2. A test pattern obtained either from a test chart generator or an analyst generator shows much more than a picture and so is very useful for detecting all types of faults in the picture.
3. However, if these instruments are not available, a pattern generator set to produce a cross-hatched pattern on the screen can be used as input signal source. In any case, an initial observation by tuning in any one of the local channels is helpful for localizing trouble to one of the major functional areas of the receiver.
4. Once this has been done, the normal trouble shooting tools can be used to isolate defective component or components of that section.

SAFETY PRECAUTIONS IN TELEVISION SERVICING

The following general safety precautions should be observed during operation of test equipment and servicing of television receivers:

(i) A contact with ac line can be fatal. Line connected receivers must have insulation so that no chassis point is available to the user. After servicing all insulators, bushes, knobs etc. must be replaced in their original position. The technician must use an isolation transformer whenever a line connected receiver is serviced.

(ii) Voltage in the receiver, such as B+ and EHT can also be dangerous. The service man should stand or sit on an insulated surface and use only one hand when probing a receiver. The interlock and the back cover of the receiver must always be replaced properly to ensure that the receiver’s high voltage points are not accessible to the user.

(iii) Fire hazard is another major problem and must get the attention it deserves. Technicians should be very careful not to introduce a fire hazard in the process of repairing TV receivers. The parts replaced must have correct or higher power rating to avoid overheating. This is particularly important in high power circuits.

(iv) The picture tube is another source of danger by implosion. If the envelope is damaged, the glass may shatter violently and its pieces fly great distance with force. It can cause serious injury on hitting any part of the body. Though in modern picture tubes internal protection is provided but it is necessary to handle it carefully and not to strike it with any hard object.

(v) Many service instruments are housed in metal cases. For proper operation, the ground terminal of the instrument is always connected to the ground of the receiver being serviced. It should be made certain that both the instrument box and the receiver chassis are not connected to the hot side of the ac line or any point above ground potential.

(vi) All connections with test leads or otherwise to the high-voltage points must be made after disconnecting the receiver from ac mains.

(vii) High voltage capacitors may store charge large enough to be hazardous. Such capacitors must be discharged before connecting test leads.

(viii) Only shielded wires and probes should be used. Fingers should never be allowed to slip down to the meter probe tip when the probe is in contact with a high voltage circuit.

(ix) The receiver should not be connected to a power source which does not have a suitable fuse to interrupt supply in case of a short circuit in the line cord or at any other point in the receiver.

(x) Another hazard is that the receiver may produce X-radiation from the picture tube screen and high voltage rectifier. It is of utmost importance that the voltages in these circuits are maintained at the designed values and are not exceeded.

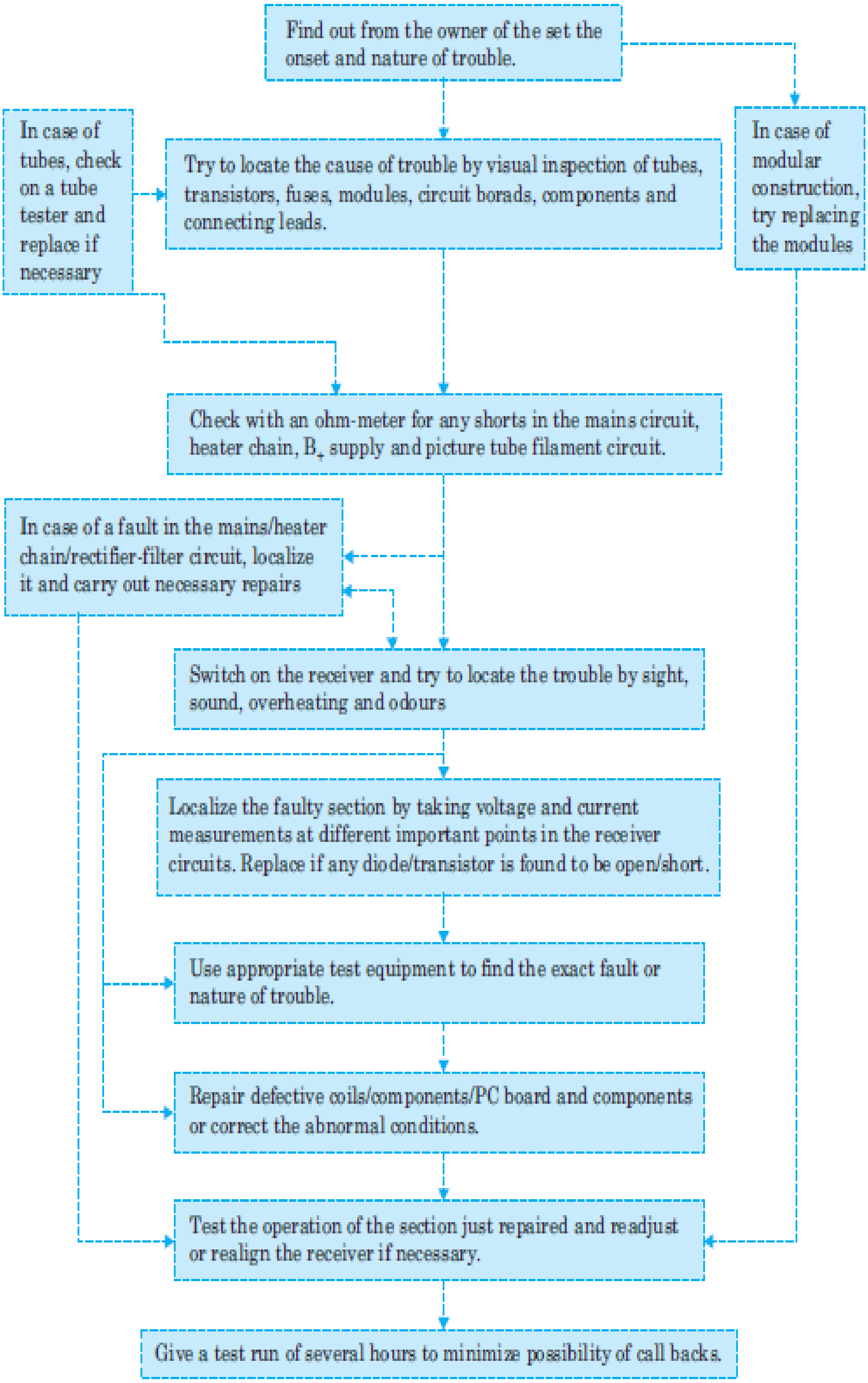
Following flow chart (1) illustrates General procedure for trouble shooting a monochrome or colour television receiver.

In this experiment we have localized five faults in monochrome TV system illustrated in flow chart related with various circuits as listed below in Table 1.

Table 1 Faults in Monochrome TV system

Sr. No	**Name of Faults in monochrome TV receiver**	**Related Circuits in monochrome TV system**
1	No sound but picture normal	Video pre amplifier and video amplifier
2	No sound but picture normal	Sound IF circuit to the audio amplifier circuit
3	Vertical rolling of picture on TV screen	Sync separator circuit to Vertical frequency oscillator circuit
4	Set dead	Power supply section / horizontal output stage
5	No sound but picture normal.	Sound IF section to the audio amplifier circuit

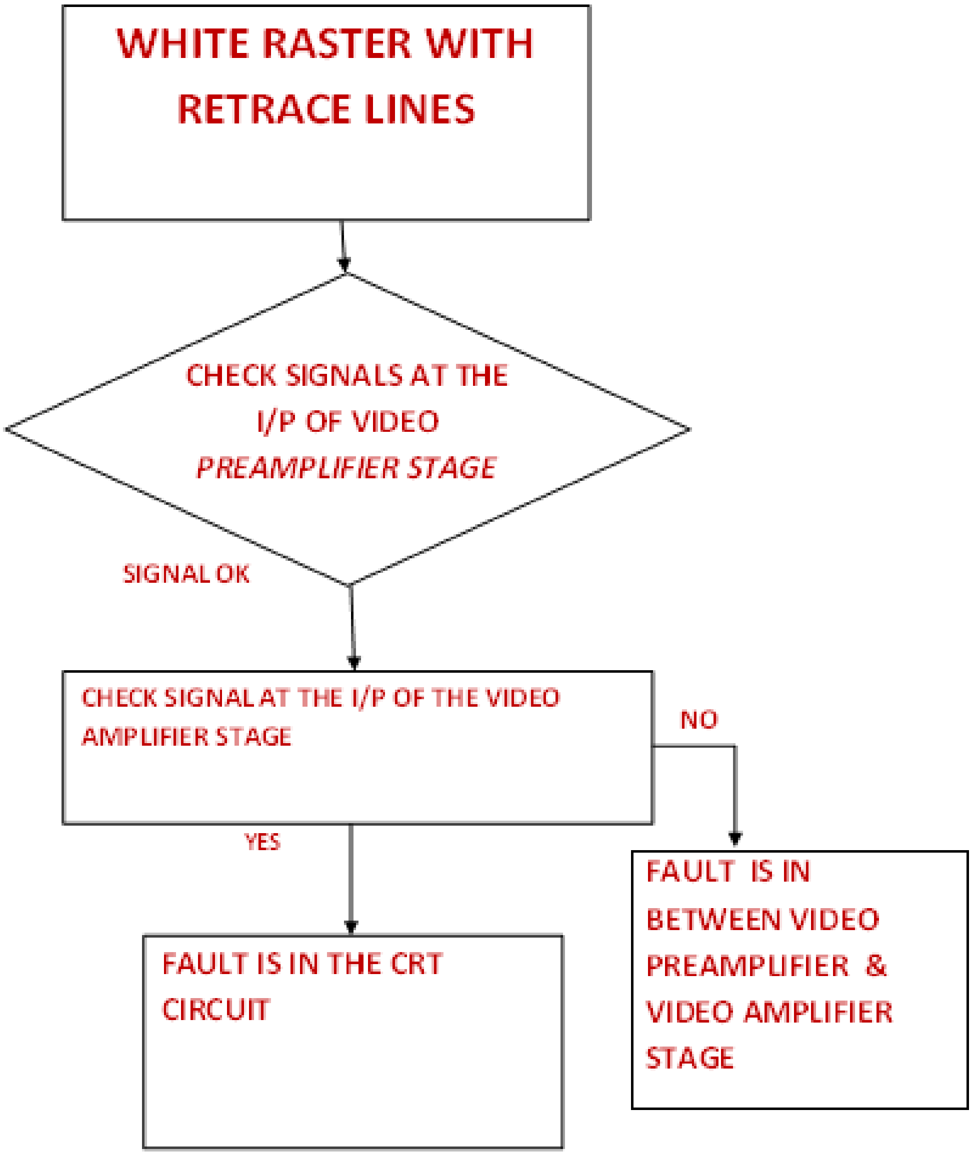
Flow Chart (1) General procedure for trouble shooting a Monochrome or Colour Television receiver.



Fault 1: White Raster with retrace lines

Stages: From video pre amplifier to video amplifier stage

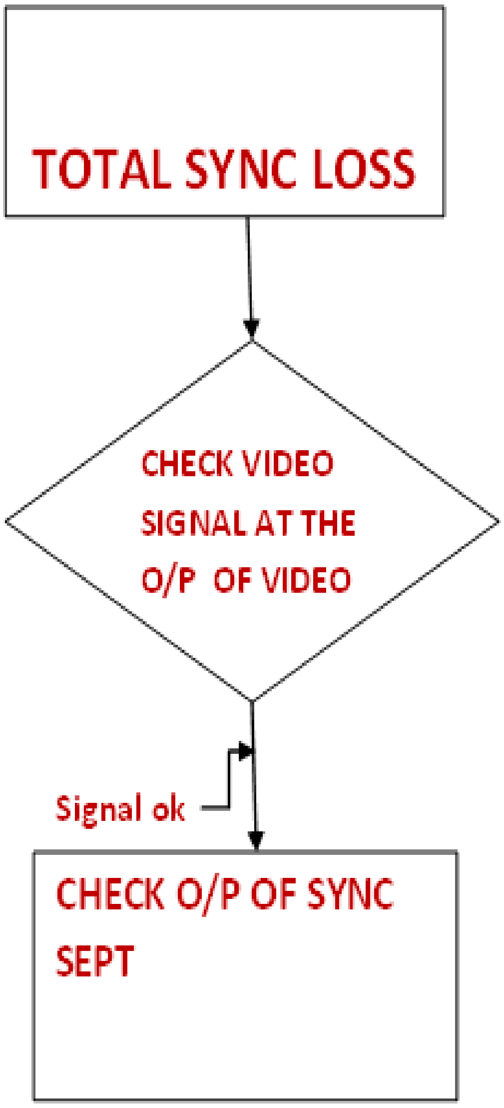
Flow Chart (2) Fault White Raster with retrace lines



Fault 2 : No sound but picture normal

Stages: From sound if section to the audio amplifier section

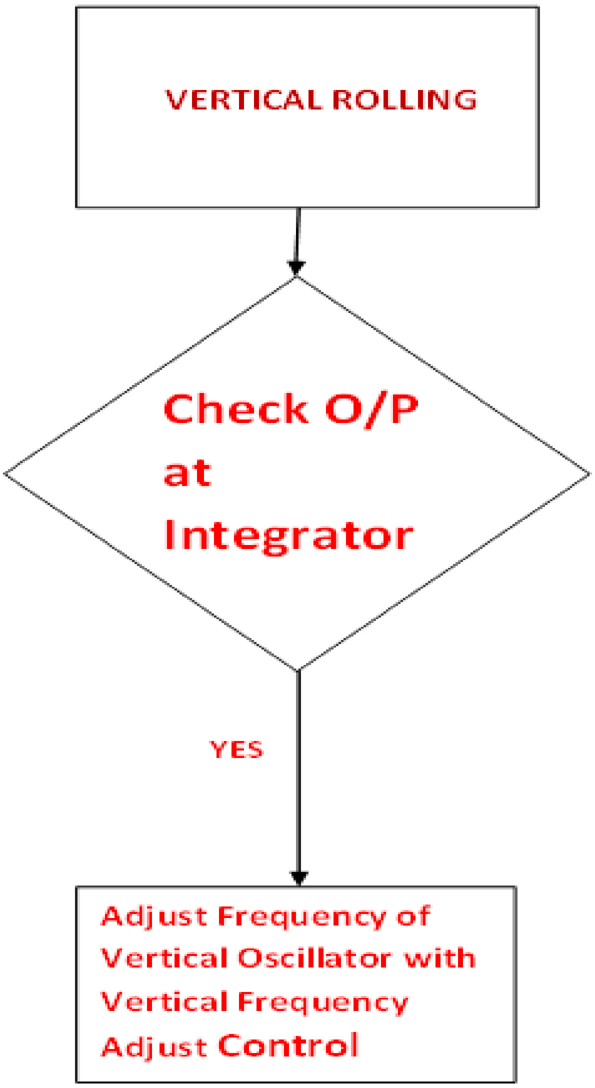
Flow Chart (3) No sound but picture normal



Fault 3 : Vertical rolling of picture on TV screen

Stages: From Sync separator circuit to Vertical frequency oscillator

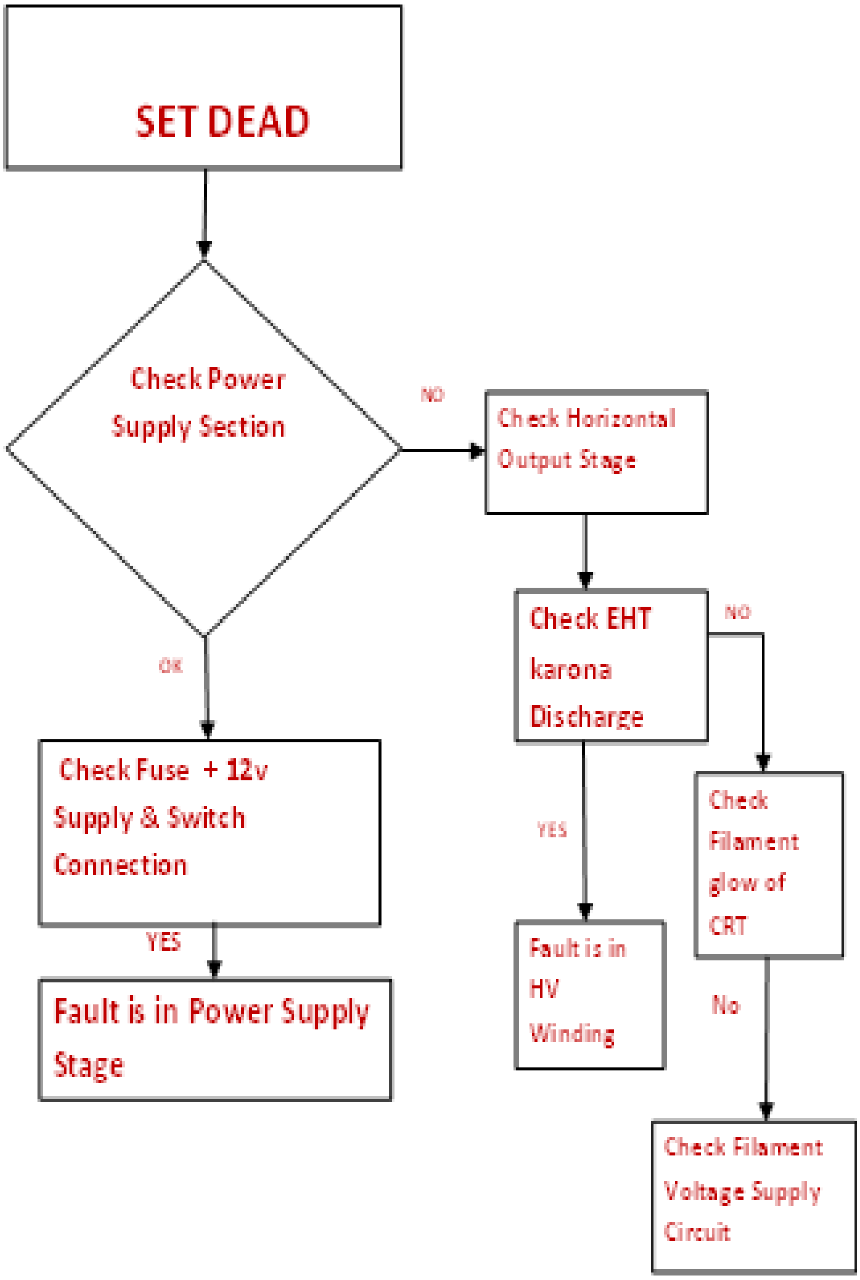
Flow Chart (4) Vertical rolling of picture on TV screen



Fault 4 : Set dead

Stages: Power supply section or horizontal output stage

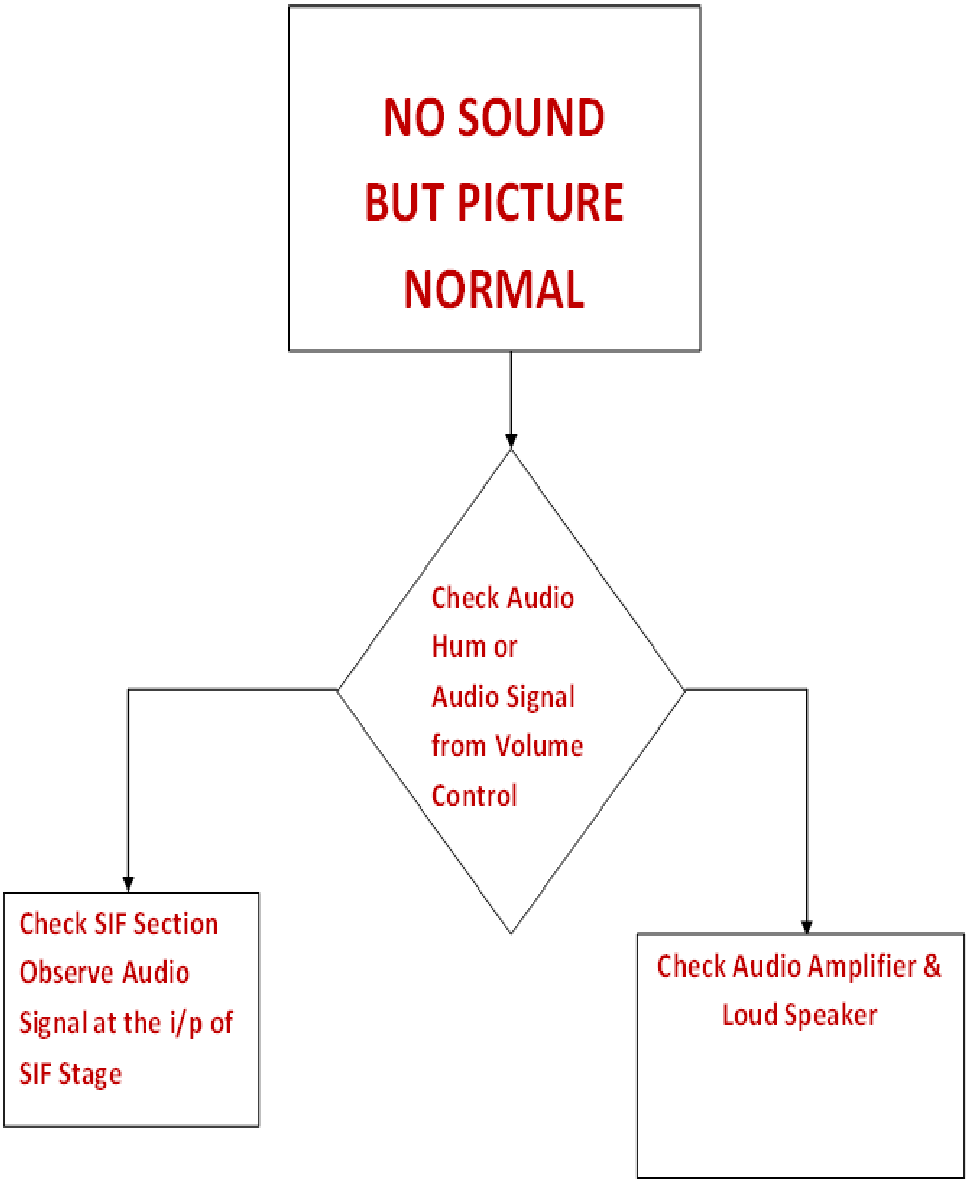
Flow chart (5) Set Dead



Fault 5: No sound but picture normal.

Stages: From sound if section to the audio amplifier section.

Flow Chart (6) No sound but picture normal



Conclusion: Thus in this experiment we have gone through procedure of troubleshooting of monochrome television receiver localized five faults in monochrome television system.

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EXPERIMENT NO. 5

Colour Television Receiver

Aim:- To observe the Composite video signal for various Patterns generated by Colour pattern generator in Colour TV receiver.

Apparatus:- Colour TV trainer kit, Colour Pattern generator, CRO, CRO probes.

Theory:-

The colour video signal contains two independent information:

i) Hue
ii) Saturation

WEIGHTING FACTORS:

1. The chrominance signal phasor "C" is added to the luminance signal (Y) before modulating it with the channel carrier for transmission.
2. The amplitude level line of Y signal becomes the zero line for this purpose. Figure 1 shows such an addition for a theoretical 100 % saturated, 100 % amplitude colour bar signal.
3. The peak to peak amplitude of green signal ($\pm$ 0.83) gets added to the corresponding luminance amplitude of 0.59.
4. For the red signal the chrominance amplitude of $\pm$ 0.76 adds to its brightness of 0.3.
5. Similarly other colours add to their corresponding luminance values to form the chroma signal.
6. But this is not practicable to transmit this chroma waveform because the signal peaks would exceed the limits of 100 % modulation.
7. On modulation with the picture carrier some of the colour signal amplitudes would exceed the limits of maximum sync tips on one side and white level on the other. This cause a high degree of over modulation.
8. To avoid this, it is necessary to reduce the amplitude of colour difference video signal before modulating them with the colour sub carrier. So both (R-Y) and (B-Y) components of the colour video signal are scaled down by multiplying them with "weighting factors" as illustrated in figure 3.
9. Figure 2 shows the formation of the chroma signal for a colour bar pattern after the colour difference signals have been scaled down in accordance with corresponding weighting factors.

OBSERVATIONS:

1. To observe composite video signal on CRO for the following patterns generated by the colour pattern generator:
   a. 8 Colour bars (figure 4)
   b. White
   c. Red
   d. Blue
   e. Green

2. To observe composite video signal of live transmitted signal by connecting the oscilloscope for C.V.S. signal coming at video output terminal of set up box connected to the satellite system.
3. Luminance signal processor output (Figure 5)
4. Red colour signal voltage for red colour pattern (Figure 6)
5. Green colour signal for Green colour pattern (Figure 7)
6. Blue colour signal for Blue colour pattern (Figure 8)
7. Sync Separator circuit output (Figure 9)
8. Vertical Deflection coil current (50Hz) (Figure 10)
9. Horizontal Deflection coil current (15625 Hz)(Figure 11)
10. Vertical Oscillator output (50 Hz) (Figure 12)
11. Composite video signal for colour bar pattern (Figure 13)
12. Colour Burst at back porch of Horizontal Sync pulse (4.43 MHz) (Figure 14)

CONCLUSION: We have observed composite video signal in Colour TV receiver.

(1) Observed the changes in Luminance and Chroma signals for various Colour Patterns and live TV channels.

(2) Sub-Carrier burst is observed in composite video signal on the back porch of blanking pulses.

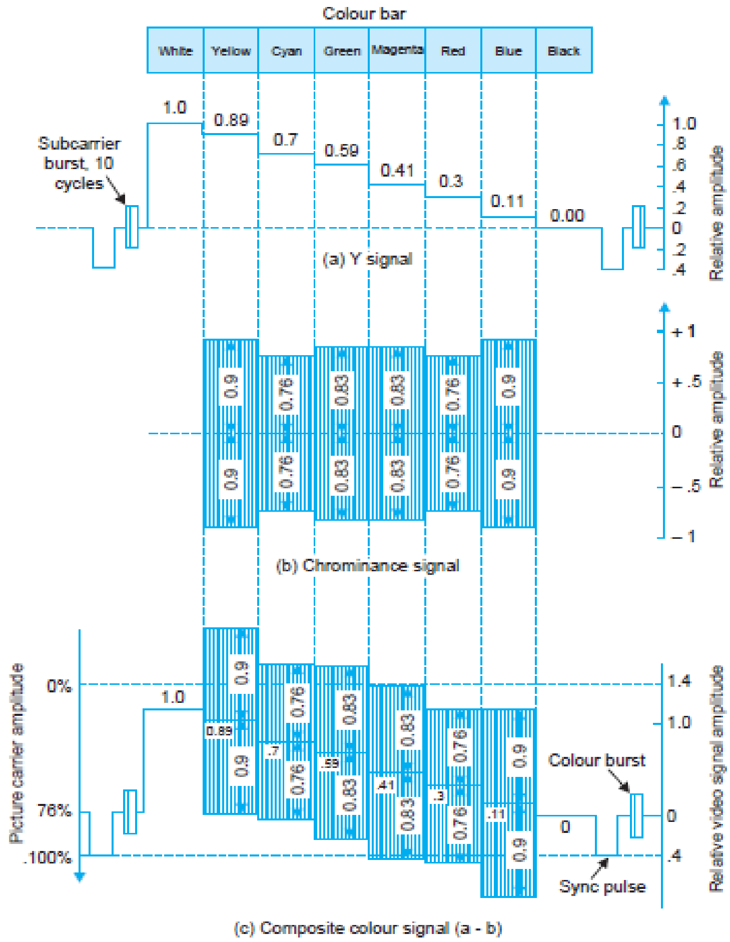

Figure 1 Generation of composite colour signal for a theoretical 100% saturated, 100% amplitude colour bar signal.

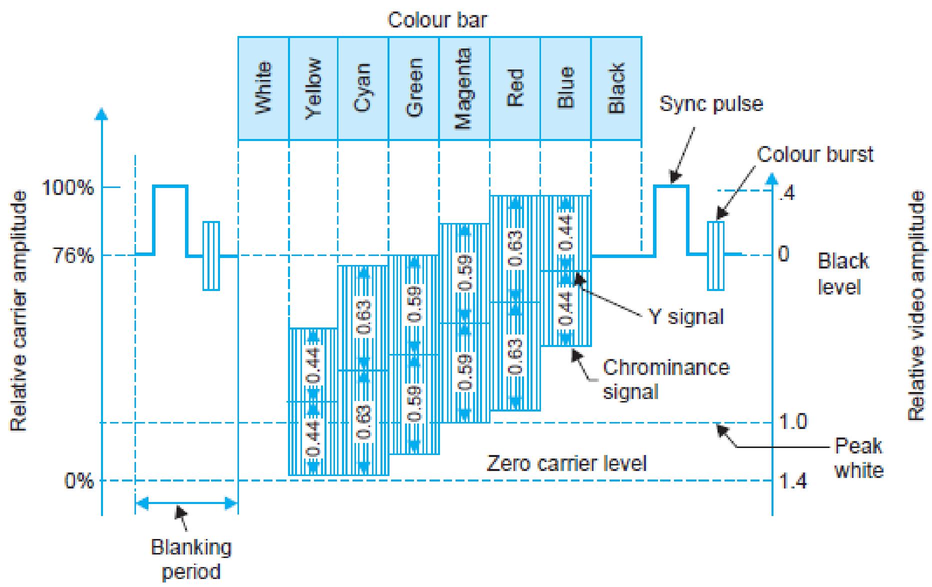

Figure 2 100% saturated, 100% amplitude colour-bar signal in which the colour difference signals are reduced by weighting factors to restrict the chrominance signal excursions to 33% beyond black and peak white levels.

Colour	Luminance signal (λ)	B − Y	R − Y	G − Y	C_{SC}	B − Y	R − Y	C_{SC}
		Unweighted				Weighted		
White	1	0	0	0	0	0	0	0
Yellow	0.89	–.89	+.11	+.11	.9	–.4385	+.096	0.44
Cyan	0.7	+.3	–.7	+.3	.76	+.148	–.614	0.63
Green	0.59	–.59	–.59	+.41	.83	–.29	–.517	0.59
Magenta	0.41	+.59	+.59	–.41	.83	+.29	+.517	0.59
Red	0.3	–.3	+.7	–.3	.76	–.148	+.614	0.63
Blue	0.11	+.89	–.11	–.11	.9	+.4388	–.096	0.44
Black	0	0	0	0	0	0	0	0

$$C_{SC} = \sqrt{(B - Y)^2 + (R - Y)^2}$$

$(B - Y)$ weighted = 0.493 $(B - Y)$ unweighted

$(R - Y)$ weighted = 0.877 $(R - Y)$ unweighted

Figure 3 The unweighted and weighted values of colour difference signals

Observations:-

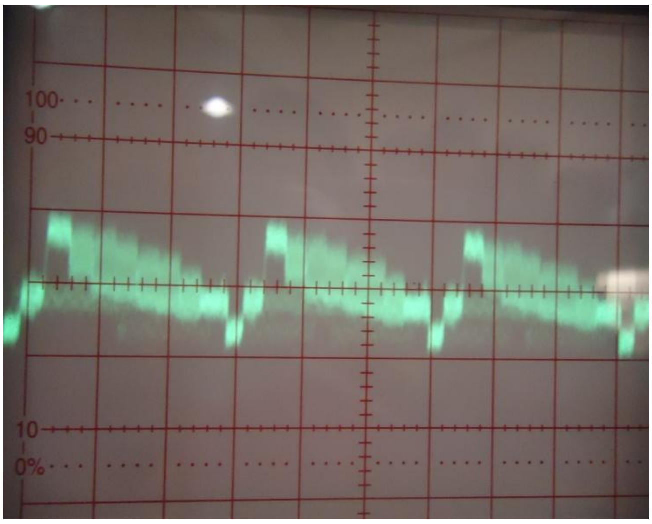

Figure 4 Composite Video Signal for Colour bar pattern

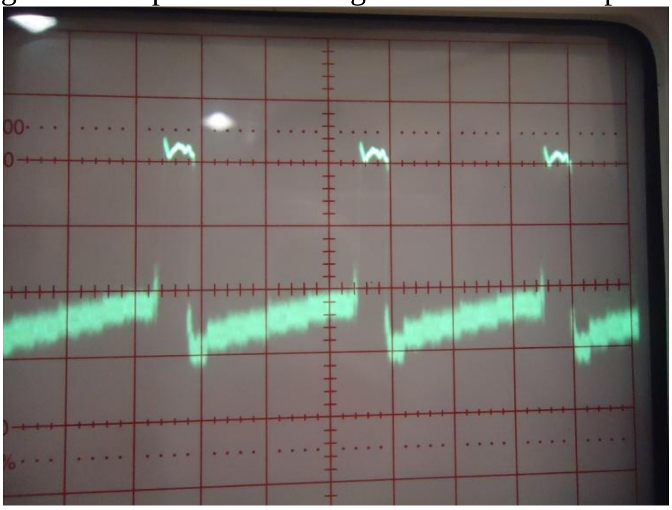

Figure 5 Output of Luminance Signal Processor

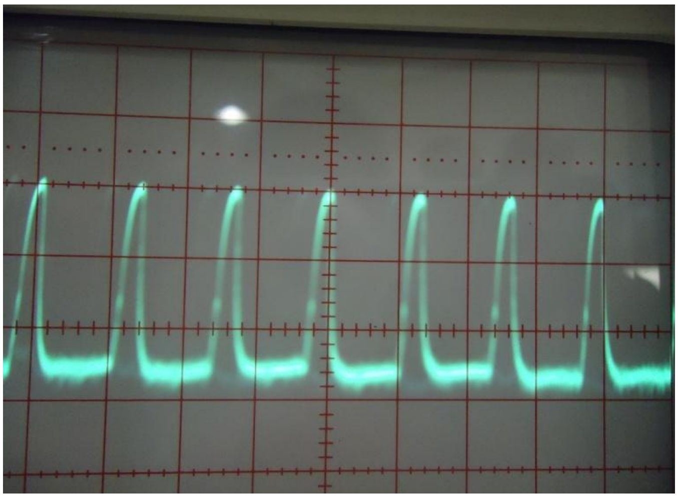

Figure 6 Red colour Voltage for red colour pattern (V_R)

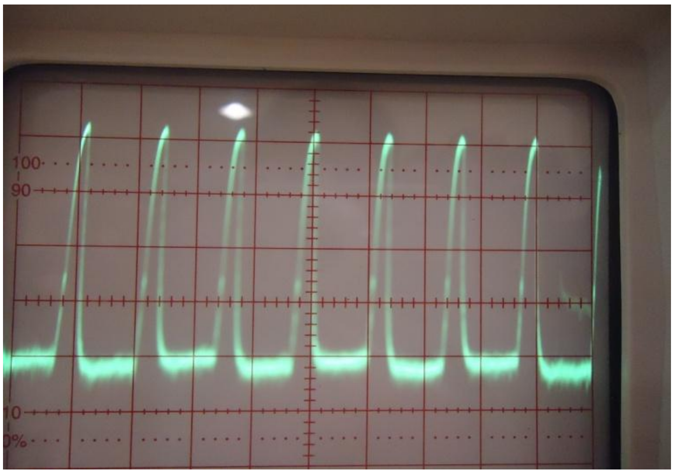

Figure 7 Green colour Voltage for Green colour pattern (V_G)

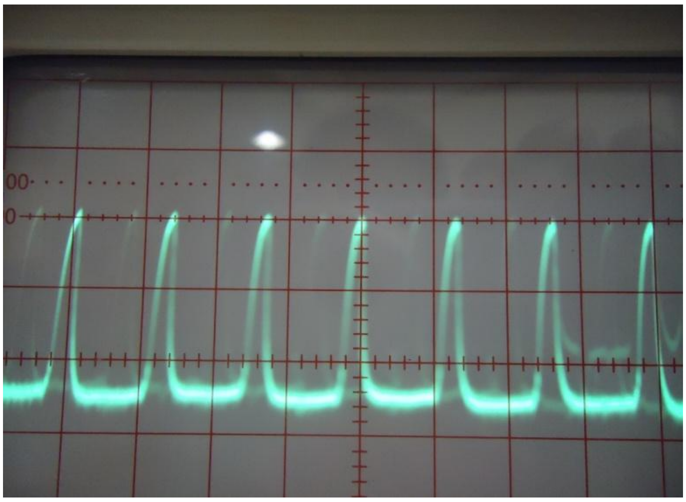

Figure 8 Blue colour voltage for Blue colour pattern (V_B)

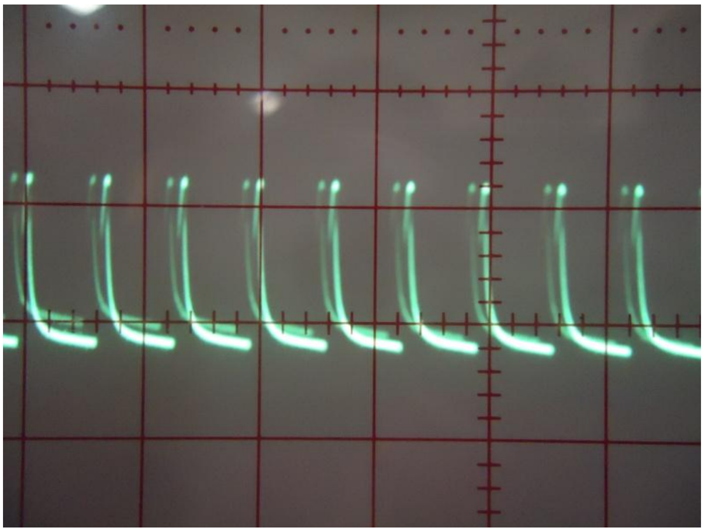

Figure 9 Sync Separator circuit output

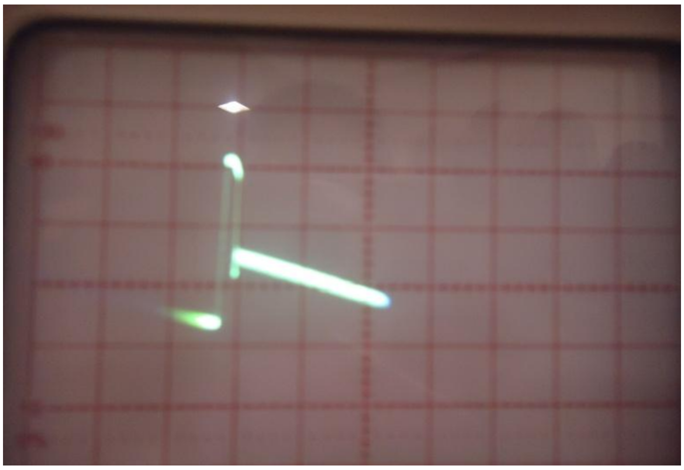

Figure 10 Vertical Deflection coil current (50Hz)

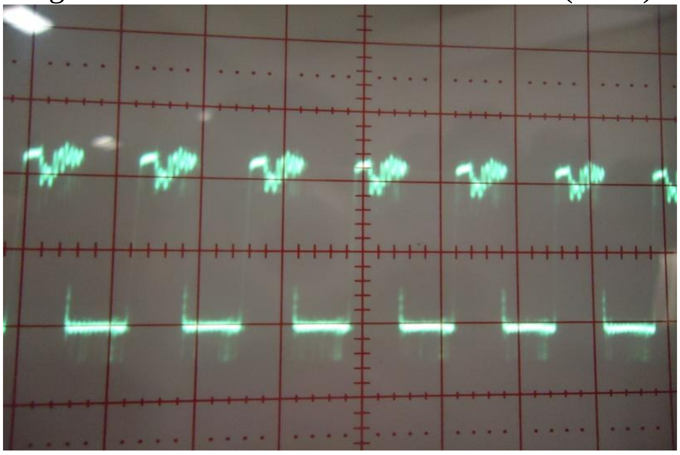

Figure 11 Horizontal Deflection coil current (15625 Hz)

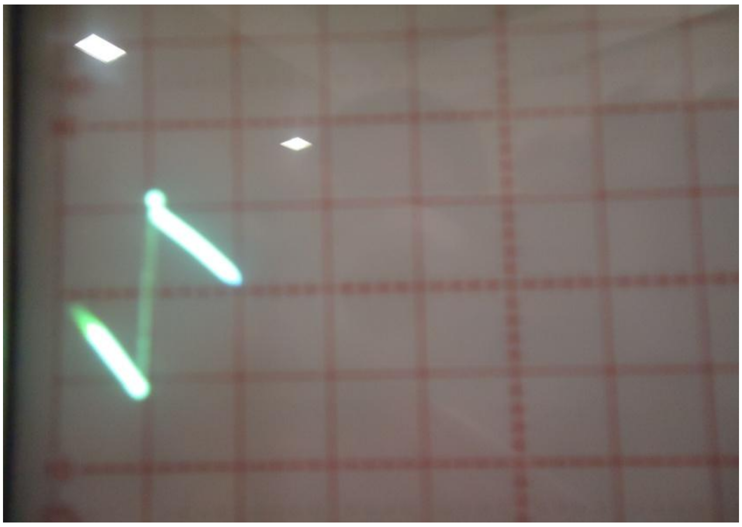

Figure 12 Vertical Oscillator output (50 Hz)

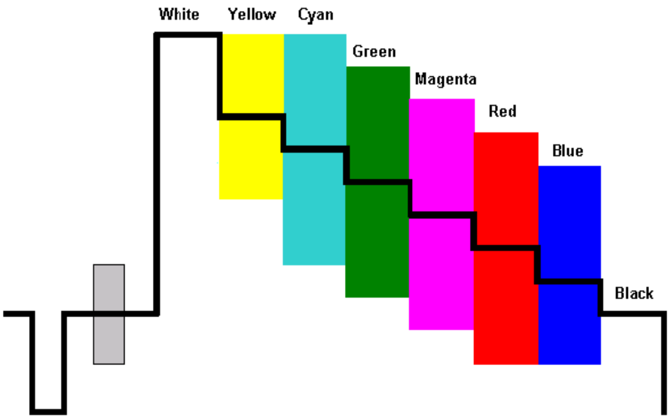

Figure 13 Composite video Signal for colour bar pattern

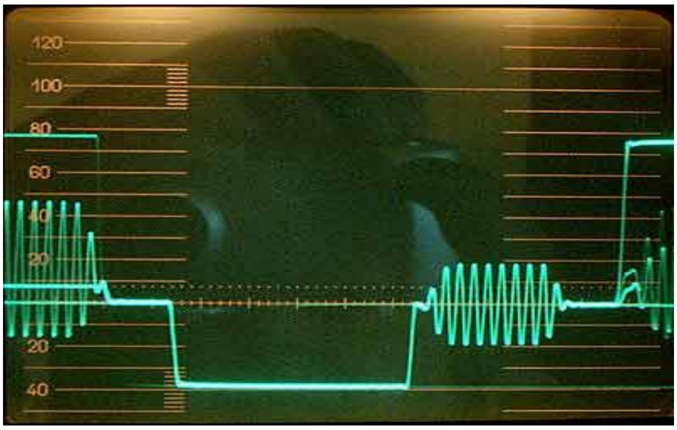

Figure 14 Colour Burst at back porch of Horizontal Sync pulse (4.43 MHz)

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EXPERIMENT NO. 6

Colour Television Receiver Fault Finding

Aim:- To find out various faults and trace circuits in PAL Colour TV receiver.

Apparatus:- PAL colour TV receiver, CRO, CRO probe, digital Multimeter.

Theory:-

The first step towards finding the cause of failure of a receiver is visual inspection of the components, tubes, transistors and ICs mounted on various printed circuit boards, modules and chassis of the receiver. Such an inspection sometimes leads quickly to the defective device or part in the receiver. For example, burnt or charred resistors can often be spotted by visual observation. Similarly overheated transformers, oil or wax filled capacitors and coils can be located by a peculiar small caused by overheating and shorting. In addition a disoldered wire of a coil or component, broken load of a transistor or other similar faults can be found out by a preliminary visual inspection.

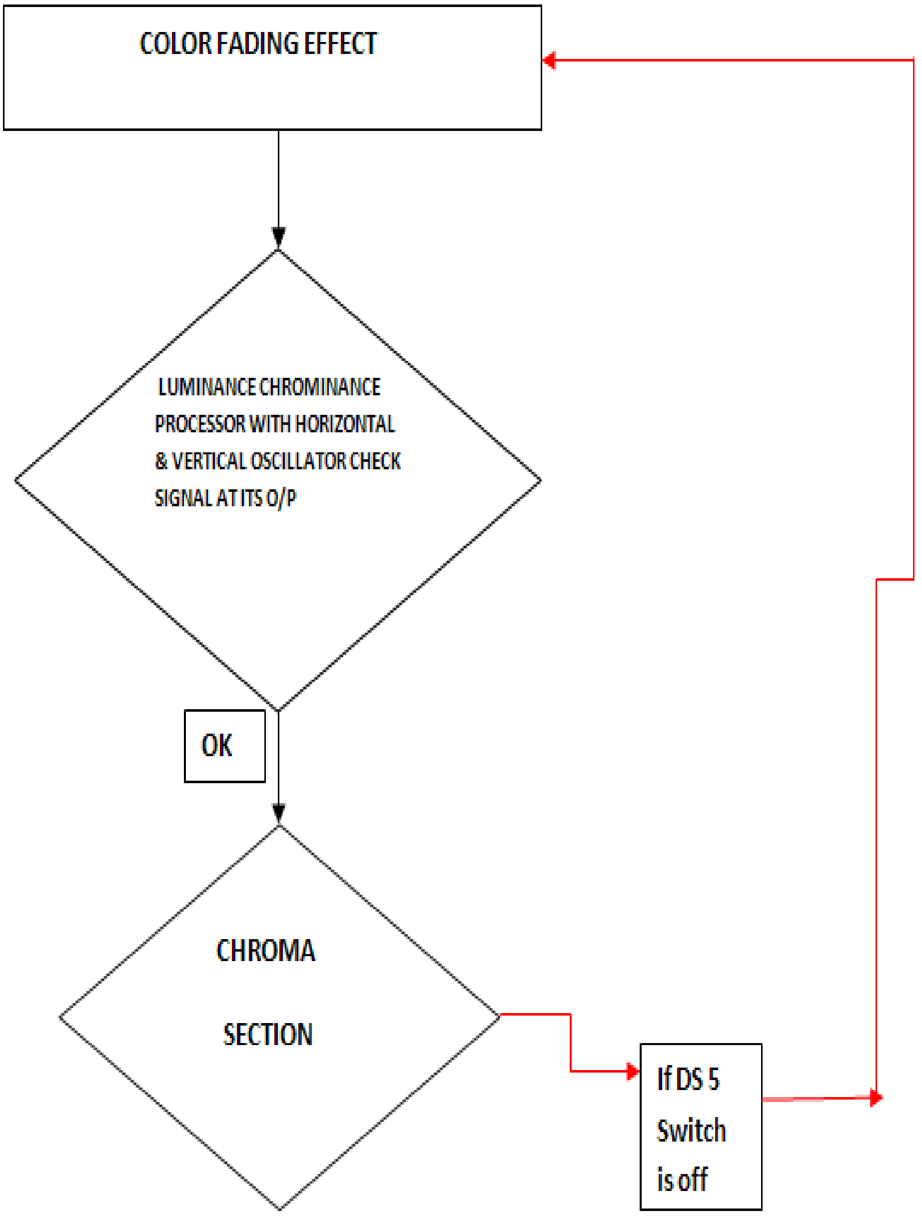
In this experiment we have localized five faults in Colour TV system illustrated in flow chart related with various circuits as listed below in Table 1.

Table 1 Faults in Colour TV system

Sr. No	Name of Faults in Colour TV receiver	Related Circuits in Colour TV system
1	Colour Fading effect	Luminance chrominance processor with horizontal & vertical oscillator, Chroma section, DS 5 switch
2	Video Amplifier supply open (No color signal only Luminance signal)	Chroma Section to video amplifier, DS 8 Switch
3	No Raster & No picture	Luminance Chrominance Processor with horizontal and Vertical oscillator stage, Horizontal output stage, Link L 17
4	Only Raster No picture & Sound	Electronic Tuner, VIF & SIF section, Luminance Chrominance Processor with horizontal and Vertical oscillator stage, Link L6
5	Luminance information disappears on screen	Luminance Chrominance Processor with horizontal and Vertical oscillator stage, Horizontal output stage, Link L10

Fault 1: Colour Fading Effect
Stages: Luminance chrominance processor with horizontal & vertical oscillator, Chroma section

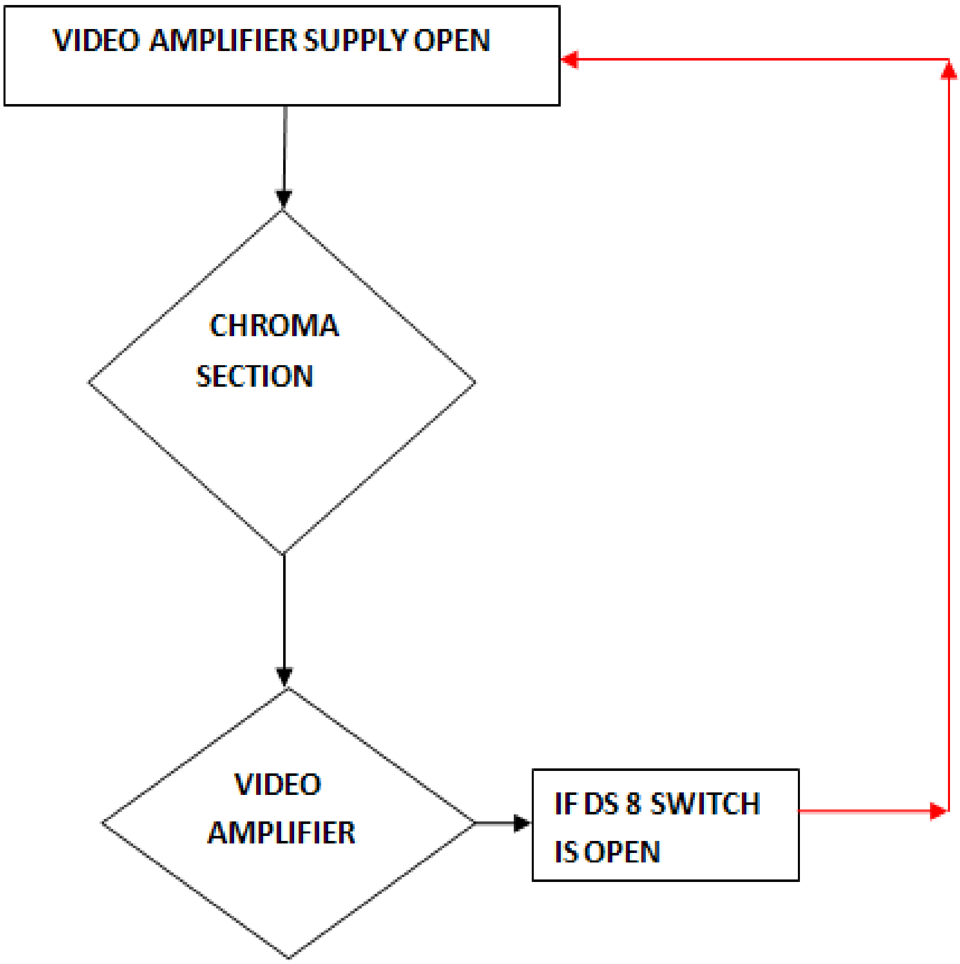
Flow Chart (1) Colour Fading Effect



Fault 2 : Video Amplifier supply open (No color signal only Luminance signal)

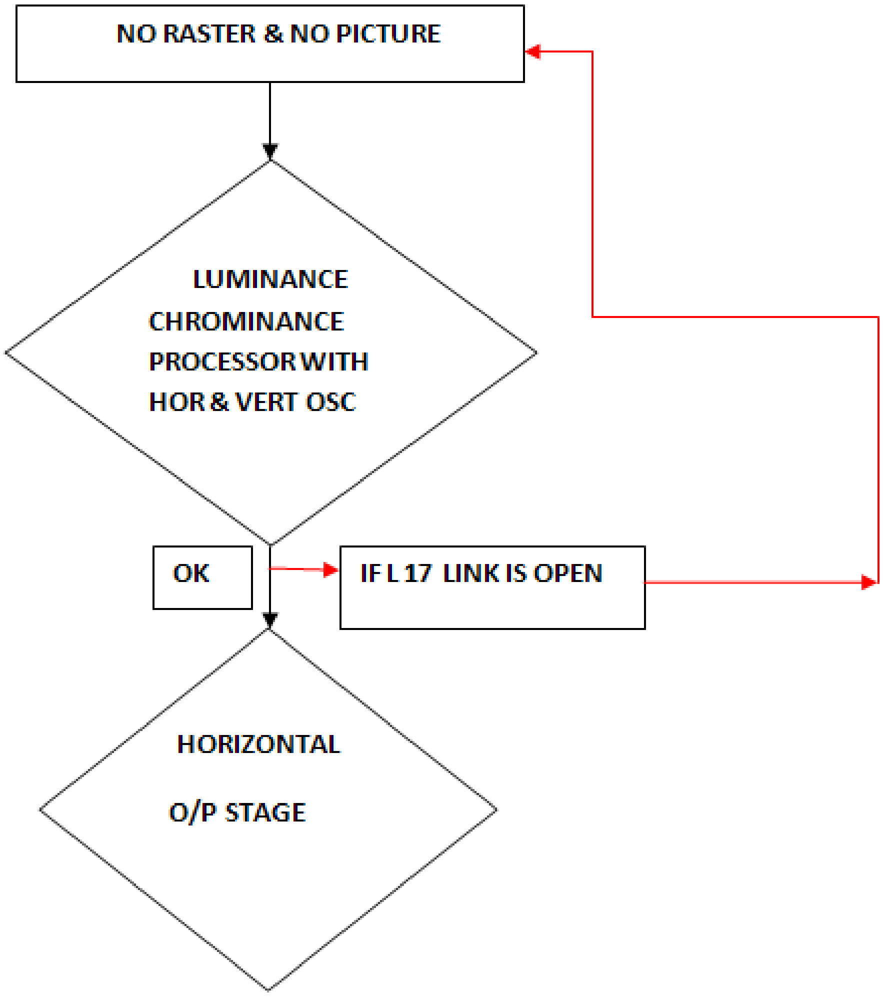
Stages: Chroma section and video amplifier

Flow Chart (2) No Color signal only Luminance signal



Fault 3 : No Raster & No picture
Stages: Luminance Chrominance Processor with horizontal and Vertical oscillator stage, Horizontal output stage

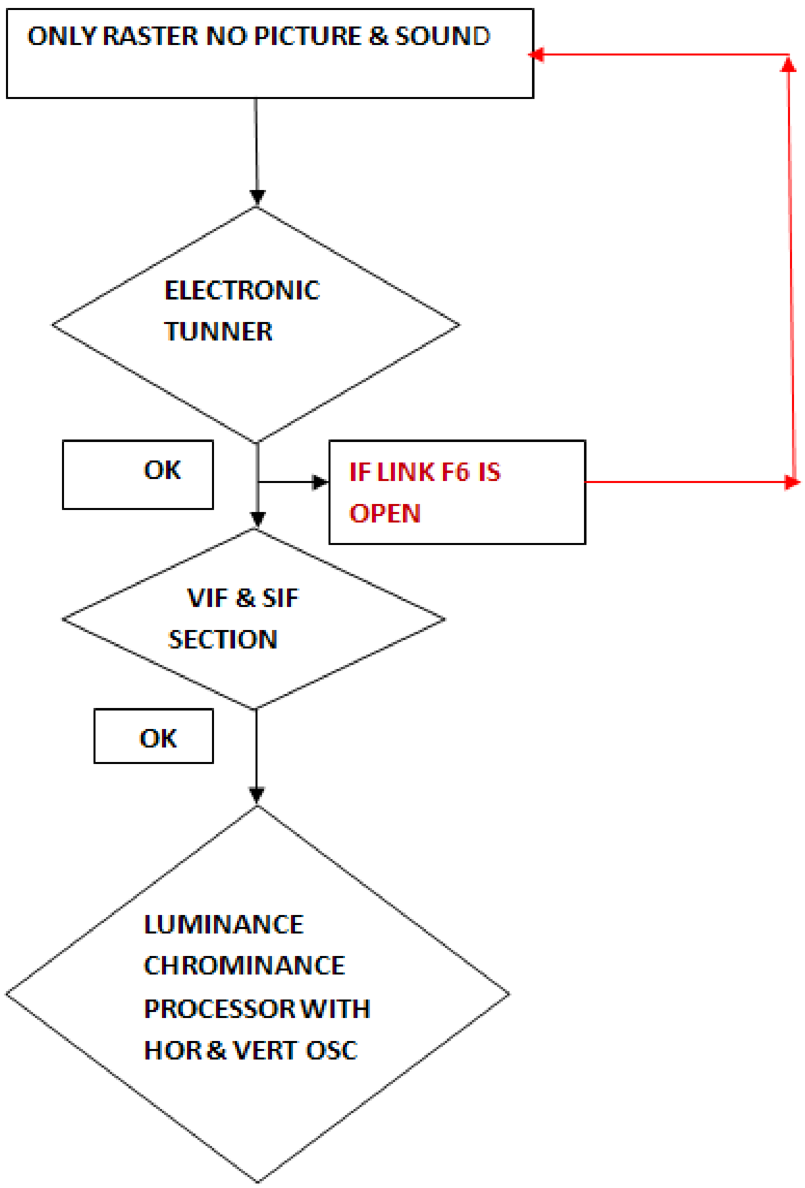
Flow Chart (3) No Raster & No picture



Fault 4 : Only Raster No picture & sound

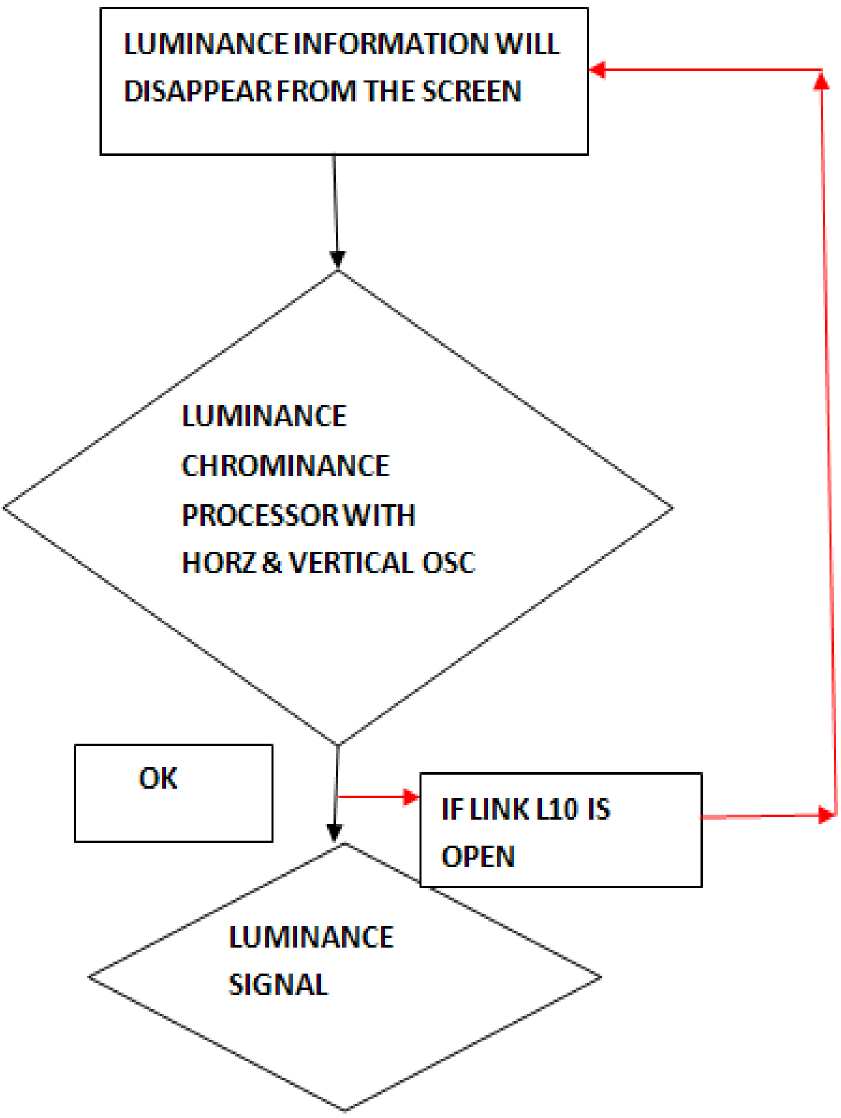
Stages: Electronic Tuner, VIF & SIF section, Luminance Chrominance Processor with horizontal and Vertical oscillator stage

Flow chart (4) Only Raster No picture & sound



Fault 5: Luminance information disappears on screen
Stages: Luminance Chrominance Processor with horizontal and Vertical oscillator stage

Flow Chart (5) Luminance information disappears



Conclusion: Thus in this experiment we have studied trouble shooting procedure for colour television receiver and localized five faults in PAL colour television system.

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EXPERIMENT NO. 7

Installation of Satellite Dish antenna

Aim:- Installation of satellite dish antenna and measurement of LNB frequency, RF power with DTH system for reception of TV channels.

Apparatus:- Dish antenna, DTH system, LCD monitor, Coaxial cables, Nut Driver, Screw Driver, Adjustable Wrench, Electric Drill, Coaxial Cables, Mast Hardware, satellite finder, RF power meter.

Theory:-

Procedure of installing satellite dish antenna for reception of Television channels:-

The installation of home DTH systems has become easier as dish size has shrunk and as technology has improved. With the introduction of small-dish systems installation has evolved to the point where a technically oriented consumer should be able to manage the entire process.

Dish antenna Installation:-

The first step in any installation is the site survey, a critical yet often occasionally neglected step. This involves making a number of decisions that include:

1. **Where the dish will be located**. This involves finding a position with a clear view of the satellite. A dish must have a clear line-of sight view because any obstruction absorbs or reflects microwaves and subsequently lowers the amount of signal received. Moisture in trees is a particularly strong absorber of microwaves, especially in the higher Ku band frequency range.

2. **How the dish will be grounded.** A well electrically grounded system reduces the potential for damage resulting from power surges or nearby lightning during a storm. In extreme cases, severe injury or even death could result, including damage to television sets or receiving equipment. A ground point must be connected to the home electrical ground connection or a grounding rod.

3. **How the dish will be mounted**. The small DTH dishes can be supported on poles, roofs, terraces, on external walls, or on grills outside windows and in balconies. The mounting chosen should be rigid and structurally sound as well as safe. High winds can topple even the smallest receive dish. You may need permission from your building society to install a dish on the external wall of the building or on the terrace.

4. **Cable routes from the dish to the indoors satellite receiver**. Coaxial cable can be run in underground conduits, down the side of buildings or through false ceilings. The goal should be to keep cable runs as short as possible and out of sight.

Where will the satellite receiver will be placed relative to other audio/video home entertainment components. More than one television set as well as an audio system that consists of a DVD player, or your cable set-top box might be hooked up. All DTH signals are in stereo sound, especially the music channels. You may want to hook-up the audio to your stereo system for great sound.

STEP-BY-STEP INSTALLATION PROCEDURE

1. INSTALL THE DISH SUPPORT

Satellite dishes are usually mounted on poles that are set in concrete. However, other types of supporting structures can be used. The critical element of this step is to be sure that the pole is mounted in a perfectly vertical (plumb) orientation. Any tilting in the east/west direction can result in poor tracking.

2. TRENCHING AND CABLE RUNS

The route from the dish to the indoor equipment is then prepared. Conduit of 1" diameter or larger is recommended when cable is to be installed underground. This ensures that extra cable can be pulled in or the old cable can be repaired at some future date. Use solvent to connect joints so the conduit is leak proof. Install a separate large diameter grounding conductor, if it is not part of the cable. Lay the conduit and cable in the trench but do not cover it up until the entire installation has been completed and everything is working properly.

3. ASSEMBLE THE MOUNT

Whenever possible, the mount should be assembled independently of the dish and then lifted onto the pole. Bolting the dish and the heavy mount together and then lifting them onto the pole together can easily warp the reflective surface. This mistake should be avoided.

4. ASSEMBLE THE DISH

After assembly, the dish can either be lifted onto the mount so it sits horizontally like a bird bath or it can be rolled into alignment with a vertically oriented mount. Secure the reflector to the mount. Then attach the feed support struts or buttonhook to the dish. While most large reflectors must be assembled, some smaller dishes of 8 feet or less in diameter are pre-assembled. Assemble reflectors on a flat surface and do not tighten the bolts until all pieces are in place and the accuracy of the panel alignment can be ensured.

5. LNB SUPPORT

The next step is to secure the dish onto the LNB support arm by attaching four pan head bolts, to mount the LNB and then to attach the coaxial cable to the LNB. It is easiest to complete this step on the ground and then lift the lightweight assembly to its final location and attach it to the mounting bracket. Before fixing the LNB to the support arm, route the coax through the centre of this arm and back down the supporting pipe.

Use only RG-6 coax with at least a 60% woven braid. Install an F-connector on the cable end, screw it onto the LNB, waterproof this connection and finally bolt the LNB to the support arm with the supplied hardware. Take the coax from the dish and run it into the home to the satellite
receiver.

After bolting the LNB and feed together lower the dish by adjusting the elevation angle and possibly by loosening the bolt in the clamp so the LNB/feed assembly can be attached to its supports. It is crucial to always install a weather cover to protect the LNB. Attach the dish to the mount. Then after bolting the LNB and feed together, also bolt these components onto the mount.

6. ELECTRICAL CONNECTIONS

Complete the necessary connection to the LNB, and to the indoor receiver. Be sure both the dish and receiver are properly grounded. Always attach a copper or aluminum grounding wire to the pole and run it to a grounding rod or to a point where it can be electrically secured to the home ground. The BIS defines codes regarding installing and wiring grounding attachments for electronic equipment. Proper grounding is essential to protecting life and property.

7. POWER ON AND ALIGN ANTENNA

Carefully set the elevation and declination angles. Then check that all wires are connected correctly, turn on the power and align the dish to the arc of satellites. Set the azimuth and elevations angles and turn the power on. Fine tune the alignment of the dish to optimize signal reception. The azimuth and Elevation angle is relative to your location on the map, and the location of the satellite which you are trying to receive. See section at the end of this article which deals with Determining Aiming Angles.

Two basic instruments are required to both conduct a site survey and aim a dish: An angle finder or inclinometer and a compass.

When a polar mount is installed, these instruments are used to aim the mount towards true south and then to set the polar axis and declination angles. When installing a fixed dish an az-el mount, adjusting the azimuth and elevation angle can target each satellite. The azimuth is measured in degrees of rotation from true north and the elevation in degrees up from the horizon.

The azimuth (AZ) heading as well as Elevation (El) angle towards any chosen satellite can be found by calculation or from computer programs. For example, NSS 6 has different azimuth and elevation angles in the various parts of the country. Some of these are in the table alongside. In Mumbai, the NSS satellite has an elevation angle of 56.37° and a compass heading of 128.56° East.

It would therefore be found by rotating 128.56° from the north compass heading and then by aiming up to an elevation of 56.37°.

If a tree or any other obstruction blocks the view, the proposed installation site would have to be changed. The AZ & El settings are the same for installation anywhere in the same town / city.

Elevation angles are measured with an angle finder (also known as an inclinometer or protractor). The protractor (also referred to as the 'D') from a school geometry box serves the purpose quite well. Placing it on a long ruler or any other straight edge increases sighting ease and accuracy when it is used in a fashion similar to sighting a rifle. The ruler can then be raised until the desired elevation is reached. If a protractor is used, its base must be kept level before checking elevation angles. When the correct elevation and azimuth angle is found, check to ensure that no objects are blocking a clear view to any satellite.

There is an important difference in the process of aiming an analog C-band TVRO and a DTH digital dish. With C-band analog, even with a faint signal received, a hint of a television picture appears. Then fine adjustments can be made to improve reception. In contrast, digital receivers usually either lock onto the signal, if it is strong enough, or give no indication of a signal, if it is weak and below "threshold." Therefore the aiming angles should be set as accurately as possible before powering on. Once the signal has been acquired, then the signal strength can be monitored for fine tuning. One saving grace with small dish systems is that the beam width is so wide that aiming errors of even a degree or more will not have a major impact.

The next step is to adjust the elevation and azimuth (compass heading). The DTH system has fortunately been designed to make this process quite easy.

The dish can be rotated to the correct elevation by loosening one bolt and then reading the angle as marked on the side of the LNB support arm. This is accurate to within at least a half a degree when the pole is vertically aligned. The compass heading is set by sighting with a compass and then by rotating the dish about its support arm by loosening the bolts behind the dish.

A database of channels is mostly pre-programmed into the satellite receiver. Simply turn the powers on, select the main menu from the remote control or front panel buttons, select "Options," then "Setup" from the next menu, and finally tune channels from the menu.

Once the aiming angles have been manually set the receiver can be used to peak the signal. Again select the main menu via the remote control or front panel buttons, select "Options," then "Setup" and "Dish Pointing" from the two subsequent menus and finally "Signal Strength Meter" from the last menu.

Most digital satellite receivers provide an on-screen signal strength meter, which show up as a progressive vertical or horizontal bar on the TV screen. This can also be used for fine tuning the alignment. The process involves adjusting the elevation and then the azimuth to peak this meter.

The system requires a three second wait between each read-out on the meter to allow it to complete its cycle. Both a graphic display and a number that varies between 0 and 99 are provided to facilitate this process.

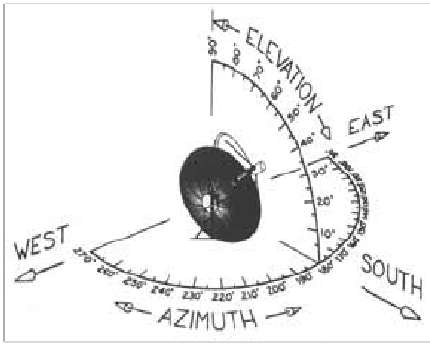
Once the setup has been done, sit back and auto-tune the receiver using the remote. Most receivers will automatically tune the downlink frequencies and the other parameters, and store these in memory.

Table1. is indicating Look up table giving details of Location in terms Latitude, Longitude, Azimuth angle and Elevation angle for installation of dish antenna towards satellites which are launched in orbits. For Mumbai region dish antennas are focused in South-East direction.

Table1 Look up table giving details of Location

Look Angle Table: NSS 6 at 95 Degrees East
All angles in Degrees

Location	Lat	Long	AZ	EL	Location	Lat	Long	AZ	EL
Ahmadabad	23.05N	72.67E	133.62	53.13	Jodhpur	26.30N	73.13E	137.83	50.82
Allahabad	25.47N	81.90E	151.58	56.81	Jullundur	31.30N	75.67E	145.97	47.91
Amritsar	31.58N	74.93E	145.11	47.25	Junagadh	21.53N	70.53E	128.89	52.57
Andaman	12.00N	92.67E	168.91	75.63	Lucknow	26.92N	80.98E	151.13	54.90
Bangalore	12.97N	77.58E	125.58	64.70	Ludhiana	30.92N	75.90E	146.02	48.40
Bhopal	23.27N	77.60E	141.57	56.44	Madras	13.08N	80.30E	130.79	67.03
Bhubaneswar	20.25N	85.87E	155.09	64.07	Maldives	5.50N	73.00E	103.35	63.48
Bombay	18.93N	72.85E	128.56	56.37	Panaji	15.50N	73.92E	124.73	59.66
Calcutta	22.57N	88.40E	163.22	62.53	Patna	25.62N	85.20E	158.22	58.11
Chandigarh	30.70N	76.90E	147.37	49.13	Pune	18.52N	73.92E	129.48	57.57
Delhi	28.67N	77.23E	146.26	51.24	Salem	11.63N	78.13E	123.63	66.09
Dibrugarh	27.48N	94.97E	179.93	57.90	Sholapur	17.72N	75.93E	131.36	59.84
Hyderabad	17.33N	78.50E	135.17	62.20	Srinagar	34.10N	74.85E	146.80	44.86
Imphal	24.73N	93.97E	177.53	61.05	Trivandrum	8.68N	76.95E	114.86	66.59
Indore	22.73N	75.83E	138.03	55.71	Vishakhapatnam	17.70N	83.40E	145.97	65.32
Jabalpur	23.17N	79.98E	145.71	58.02					
Jagdalpur	19.07N	82.08E	144.93	63.19					
Jaipur	26.88N	75.83E	142.45	52.07					
Jalgaon	21.02N	75.65E	135.60	57.01					
Jalna	19.83N	75.97E	134.52	58.21					
Jalpaiguri	26.50N	88.83E	166.39	58.28					
Jamnagar	22.47N	70.10E	129.46	51.55					
Jamshedpur	22.78N	86.20E	158.21	61.52					
Jaunpur	25.73N	82.68E	153.30	56.91					
Jeypore	18.85N	82.68E	145.95	63.77					
Jhelum	31.07N	72.17E	140.79	46.11					



Azimuth & Elevation

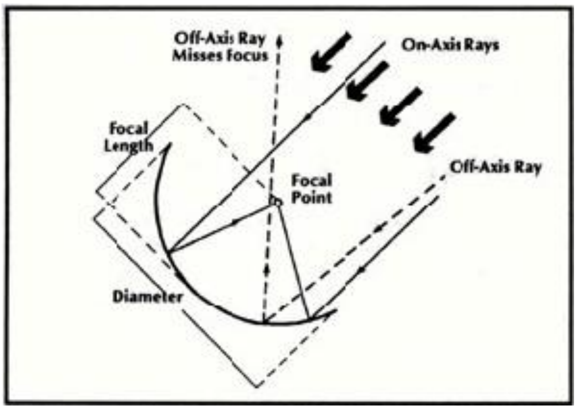


Figure 2 Parabolic dish antenna.

PARABOLIC DISH ANTENNA

The input source to dish antenna is from various satellites. However collection of signals coming from satellite is quite complex, because the arriving signal is extremely weak and its frequency is very high, being in the super UHF i.e. microwave spectrum. Therefore, a high gain antenna becomes necessary. Figure 2 is demonstrating construction of Parabolic dish antenna.

A horn type parabolic dish antenna of large diameter meets this requirement. This when correctly oriented towards the satellite, collects signals arriving from it and reflects them to a common point called "Focal Point" which is located in front and above the centre of antenna dish as shown in fig.

A feed horn which is actually a small wave-guide section is mounted at the focal point and its function is to receive signals reflected towards it by the dish and deliver these to the close by located low noise block converter (LNBC) as shown in fig. 3. The down link signals from most communication satellites are in C – band of the frequency spectrum in the range of 3.7 to 4.2 GHz i.e. 3700 to 4200 MHz. In order to minimize losses in coaxial cables that carry dish antenna signals to control room, the collected signals are first translated to a lower frequency range.

This is done by a low – noise block converter (LNBC), the building blocks of which are shown in fig.4.

The composite signal collected by the feed horn is fed to a low noise amplifier (LNA) which is specially designed to provide enough gain while maintaining maximum possible signal – to noise ratio.

The LNA output is fed to a converter (mixer) which translates the incoming microwave signals to a lower frequency range of 950 – 1450 MHz. This is achieved by fixing local oscillator (LO) frequency of the converter at 5150 MHz and selecting only the difference products from its output.

The difference products will thus have the desired range of 950 MHz (5150 MHz-4200 MHz) to 1450 MHz (5150 MHz – 3700 MHz).

A band pass filter (BPF) at the output of mixer separates the wanted IF signals from other signals. It is amplified by a multistage IF amplifier and then sent through a high grade coaxial cable to the cable station.

If necessary, by a low noise amplifier (LNA) is provided in the middle of coaxial cable run to make-up for any losses in it. This LNA if often called "Bullet Amplifier".

The feed horn and LNBC unit is called Front-end-Converter (FEC) and also referred to as "outdoor Equipment" because it is located in the open and close to where the dish antenna is mounted. It is often necessary to install 2, 4, 6 or even 8 dish antenna units with associated feed horn and LNBC's to collect signals from different satellites.

The signal reception from VHF and UHF terrestrial broadcasts is done by installing conventional TV antennas mounted usually close to dish antenna on a high rise building. If these transmissions are also available via satellites, it is advisable to use signals picked up from dish antenna to obtain noise free quality reception.

A DISH ANTENNA

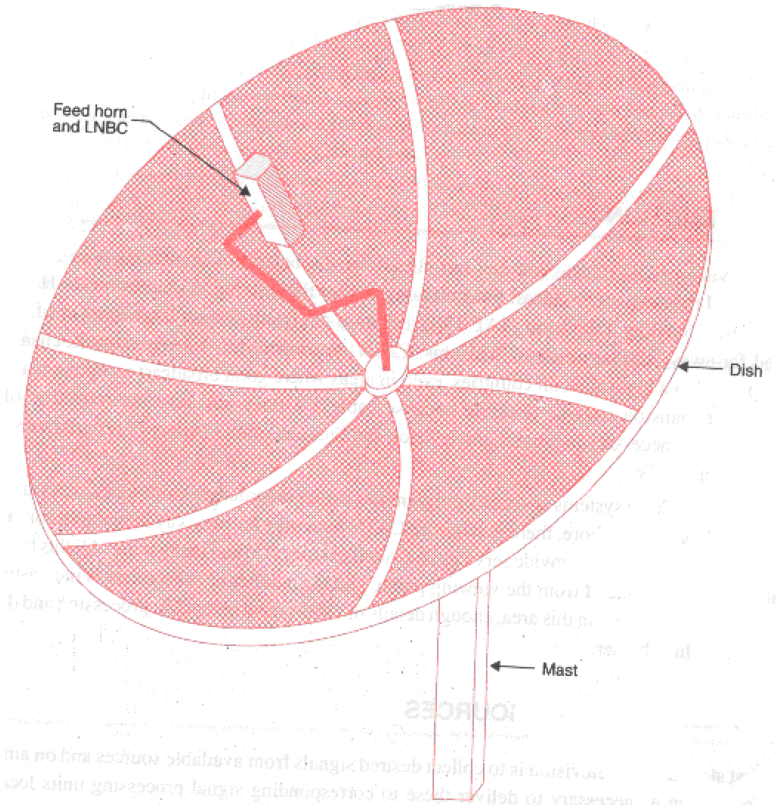


Figure 3 A typical dish antenna with feed horn and LNBC mounted side by side at its focal point.

LOW NOISE BLOCK CONVERTER (LNBC)

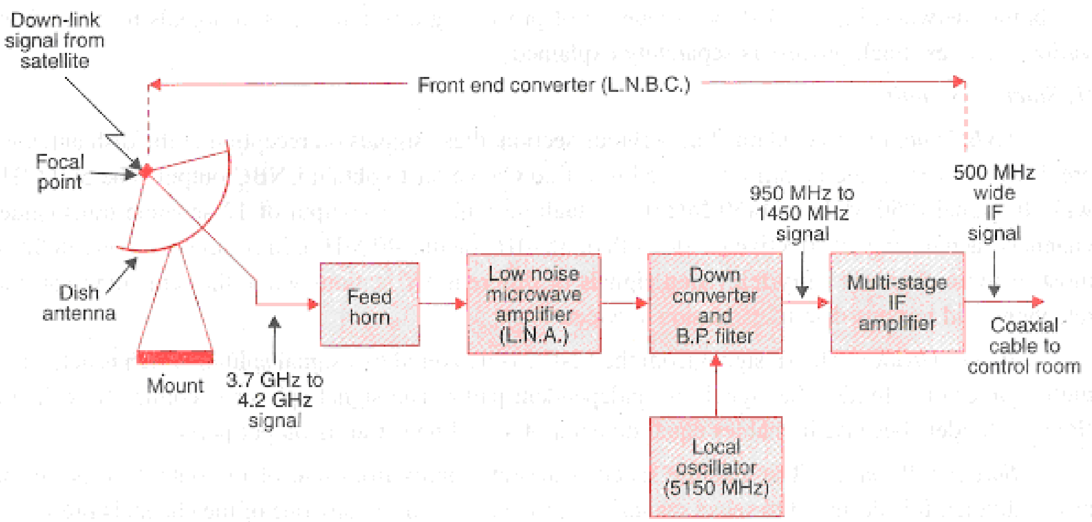


Figure 4 Block Schematic of an LNBC also called Front End Converter (FEC)

Conclusion:-

Thus we have installed satellite dish antenna for receiving television signals from satellite. And we have taken following observations:

1. Installation of mast and dish antenna.
2. Understood working of low noise block converter circuit used for down frequency conversion from (3.7 to 4.2 GHz) to (950-1450MHz) and amplifying incoming weak signals.
3. Use of Radio frequency (RF) power meter for measuring RF power of incoming signals in decibels.
4. Use of magnetic compass or Digital satellite finder for determining direction for installing satellite dish antenna.
5. Measuring LNB frequency on LCD screen in program set up and edit LNB mode.
6. Observed Signal intensity (81% and more), signal status (locked or unlocked) and received signal quality.
7. Crimping of Coaxial cable connector with crimping tool.
8. Observation of direction of inclinometer (Fig. 5), LNB frequency, in-coming signal strength in decibels, signal quality and Signal status is as shown below (figure 6 & 7).

Observations:-

Figure 5 Inclinometer

Figure 6 LNB frequency, Signal Intensity, Signal Quality and Signal Status

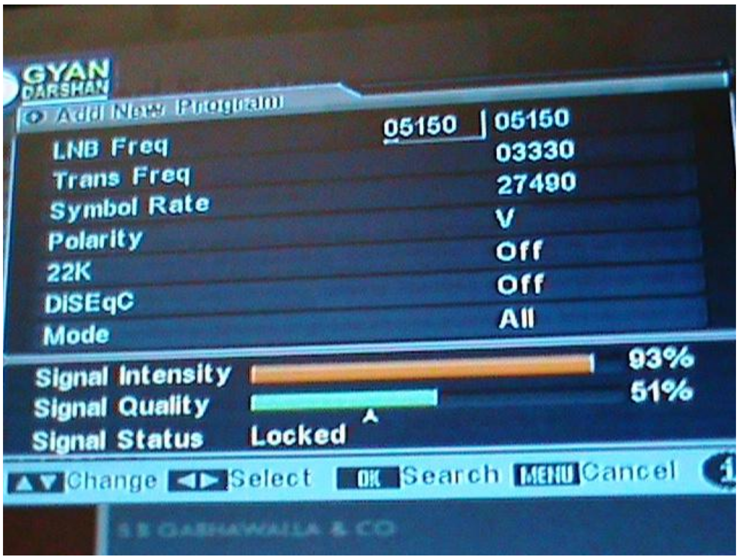


Figure 7 LNB frequency, Signal intensity, and signal quality of received RF signals.

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Subject- Television and Video Engineering
EXPERIMENT NO. 8

Analog CRT and LCD TV

Aim:- Comparison of Analog (CRT) TV and Liquid Crystal Display (LCD) TV technology.

Apparatus:- LCD TV and CRT television.

Theory:-
LCD Overview
LCD displays consists primarily of two sheets of polarized glass plates with a thin layer of liquid crystal solution sandwiched between them. The type of liquid crystals used in LCD panels have very specific properties that enable them to serve as effective shutters that open and close to block or let light through in response to an electric current.

The current through the liquid crystals is controlled by a voltage applied between the glass plates via transparent electrodes that form a grid, with rows on one side of the panel and columns on the other. As the electric current passes through these liquid crystals, they untwist to varying degrees, depending on the voltage applied. This untwisting effect will change the polarization of the light passing through the LCD panel. As the polarization changes in response to the applied voltage across the glass plates, more or less light is able to pass through the polarized filter on the face of the LCD. Intersecting grid points represent picture elements (pixels).

Figure 1 is illustrating various layers of LCD display and how image is created on the screen with the Glass polarizer's, liquid crystal layer, Thin film transistor array and Red, Green and Blue filters.

Figure 2 is representing LCD colour pixels each for three primary colours used in colour television.

Figure 3 illustrates the major difference between CRT picture tube and Liquid Crystal Display construction for reproducing image on television screen.

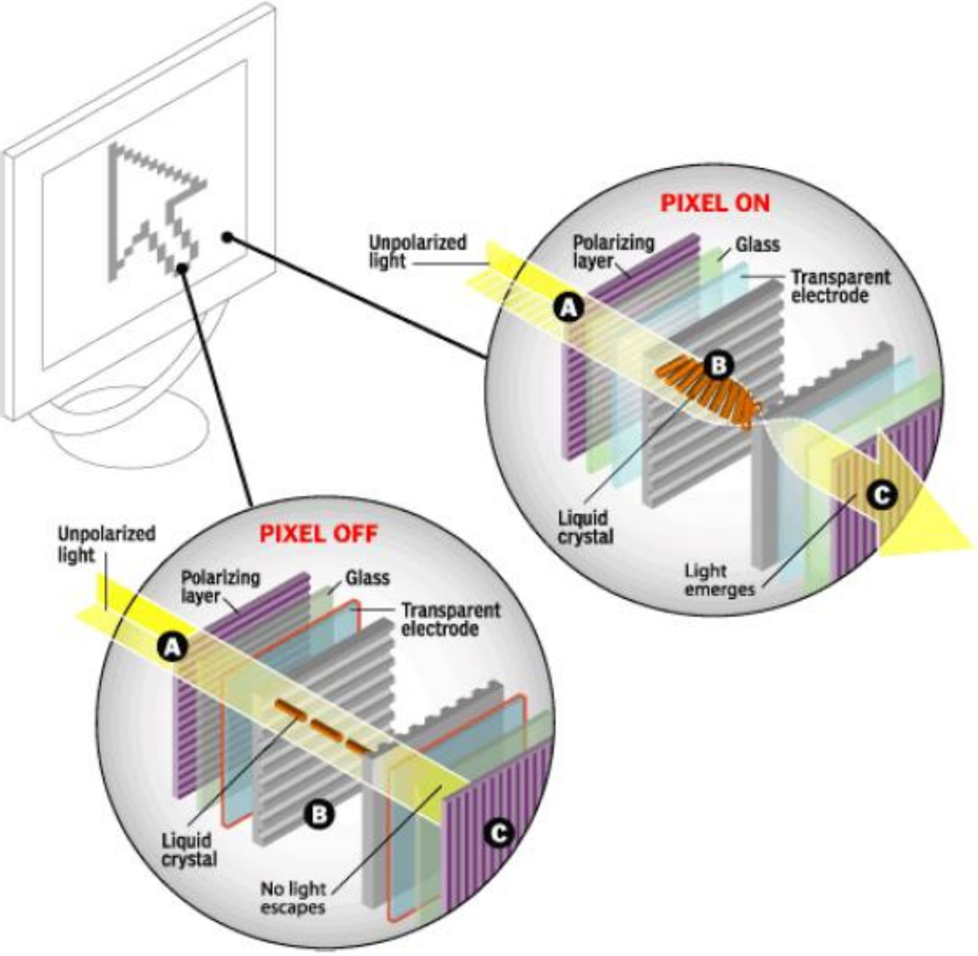


Figure 1 Inside a LCD Display

In a color LCD panel, each pixel is made up of three liquid crystal cells. Each of those three cells contains a red, green, or blue filter. Light passing through the filtered cells creates the colors seen on the LCD.

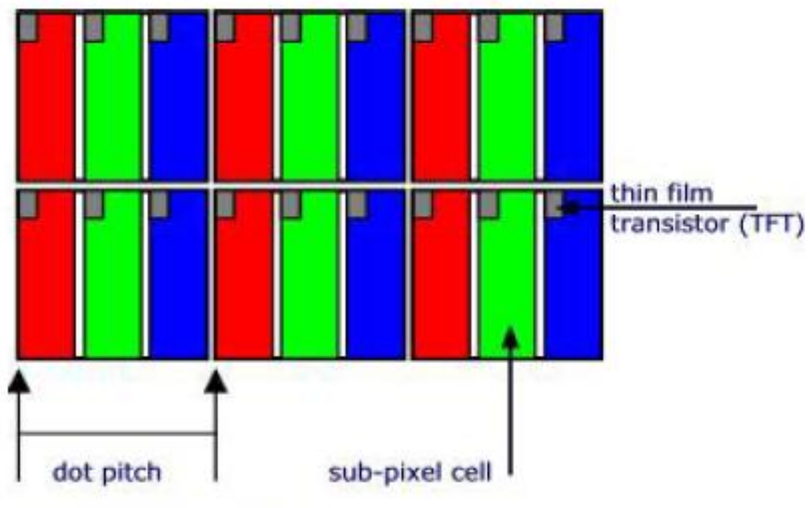


Figure 2 LCD Colour Pixels

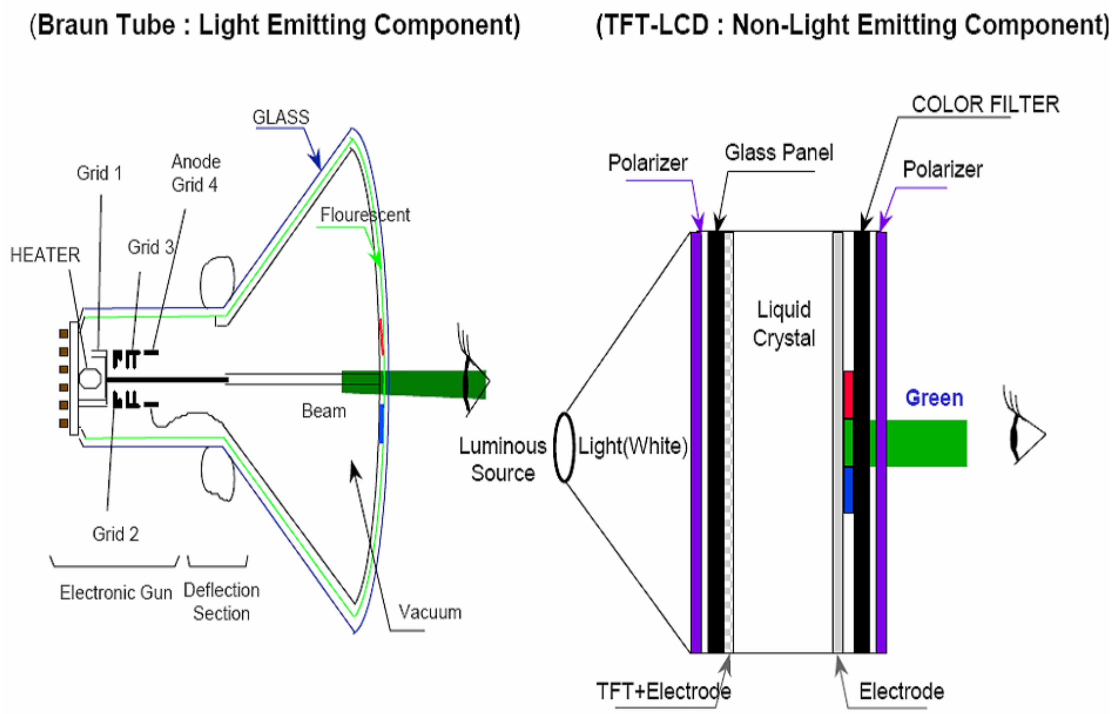


Figure 3 CRT picture tube and LCD layer construction.

Table 1 is comparing various parameters in Thin-film transistor Liquid crystal display technology and Cathode ray tube for analog television.

Table 1 Comparison between TFT LCD Monitor and CRT of Analog TV

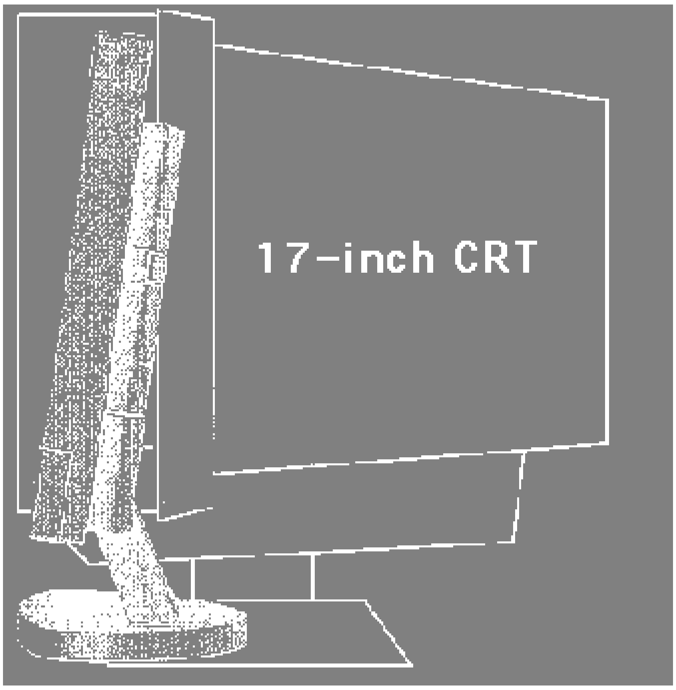
Sr. No.	Parameter	TFT LCD Monitor of Digital TV	Cathode Ray tube (CRT) of Analog TV
1	**Working principle based on**	Digital system. Colour LCD TV uses Thin film transistor or active matrix. For displaying picture on LCD screen scaling method is used.	Analog System. CRT screen consists of Phosphors dots. Scanning principle is used for displaying picture on CRT screen .CRT screen is divided in no. of lines and they are scanned by using electron beam.
2	**Size and shape**	Small in shape and lighter in weight	Bigger in size and heavy in weight
3	**Viewing Angle**	Problem regarding view angle (~) (90° to 170°	Picture can be viewed from all angles(+)more than 150°
4	**View Size**	17” TFT LCD Monitor’s view size is 17”. 17” TFT monitor is having 19” CRT monitor	17” CRT Monitor’s view size is 16.1”

		view size.	
5	**Picture Quality**	Very sharp	If there is too much sharpness, due to the errors of picture focus spots are formed.
6	**Power consumption**	Low (+) 25 to 40 Watts (1/3 times Less than CRT)	Much higher -60 to 160 Watts
7	**Light emitting components**	Non light emitting components are used	Used
8	**Brightness**	Much more ((+) 170 to 300 cd/m^2)	Less (~ 80 to120 cd/m^2)
9	**Pixel response time**	(-) 20 to 50 ms	(+) not visible
10	**Affected by magnetic fields**	(+) not affected	(-) depending on cladding, can be very sensitive
11	**Flickering and corner distortion**	(+) none	(~) not visible above 85 Hz . This type of distortion occurs.
12	**Colour purity/ Colour quality**	(~) bad to mediocre	(+) very good
13	**Uniformity**	(~) often brighter at the edges	(~) often brighter in the middle
14	**Gamma (col. tuning for the human eye)**	(~) Satisfactory	(+) photo quality
15	**Possible resolutions**	(~) Set resolution or interpolation. It is designed to work on single resolution because	(+) many It works good on high resolution
16	**Input signal**	(+) analog or digital	(~) only analog
17	**Defective pixels**	(~) up to 8	(+) none
18	**Geometry**	(+) perfect	(~) possible errors
19	**Focus**	(+) Very good	(~) satisfactory to very good
20	**Convergence errors**	(+) none	(~) 0.0079 to 0.0118 ” (0.20 to 0.30 mm)
21	**Contrast**	(-) 150:1 to 450:1	(+) 350:1 to 700:1
22	**Dimensions**	TFT monitor is thin and occupies less space. TFT monitor is more comfortable for eyes of viewer. It can be hanged on wall easily.	CRT monitor is bulky and occupies more space.
23	**Response time**	In TFT monitor refresh rate for getting maximum brightness of one pixel is measured in terms of response time. If TFT monitor’s	No Response time problems.

		response time is 125 ms then graphics display running on monitor will be very bad and appears as ghost as we move cursor with mouse on the monitor screen. TFT monitor having 8 ms – 25 ms response time has good graphics display. Response time problems are associated with TFT Monitor.	
24	**Life**	TFT monitor screen life is around 45000-60000 hours. If we use TFT Monitor for four hours daily then life will be 30 – 35 years.	CRT monitor screen life is around 15000-20000 hours. If we use CRT TV for four hours daily then life will be 10 to 15 years.

(+) Best
(-) Netative
(~) Decent

Conclusion: Thus in this experiment we have compared principle, advantages and drawbacks of both the Analog Cathode ray tube and Liquid Crystal display technology as listed in Table 1.



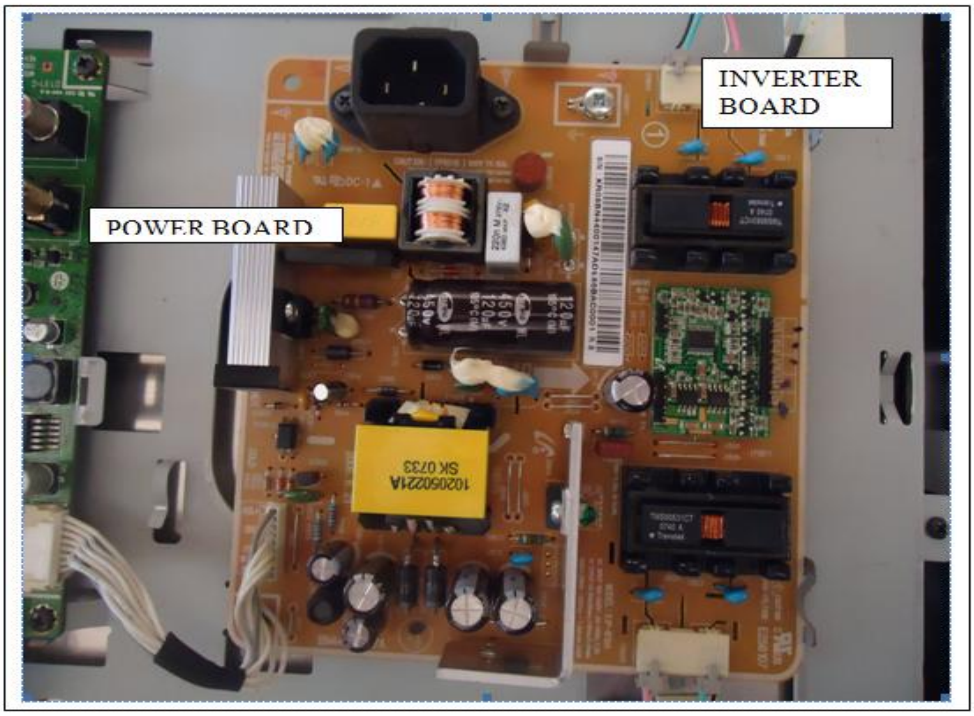


Figure 2 LCD TV panel indicating Inverter circuit and Power supply section

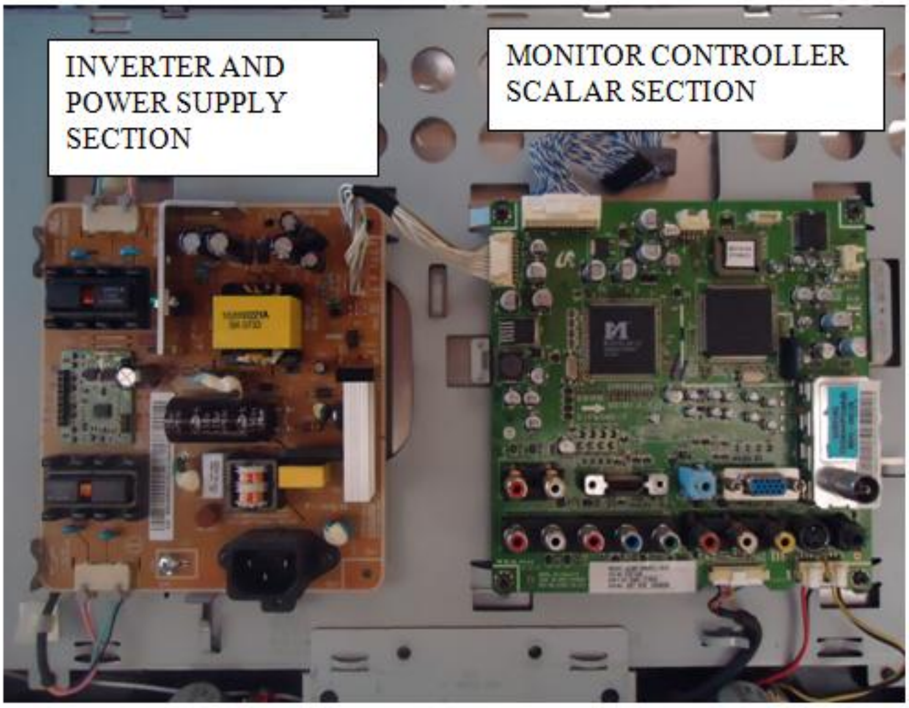


Figure 3 LCD panel indicating monitor controller Scalar section

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Subject- Television and Video Engineering
EXPERIMENT NO. 9

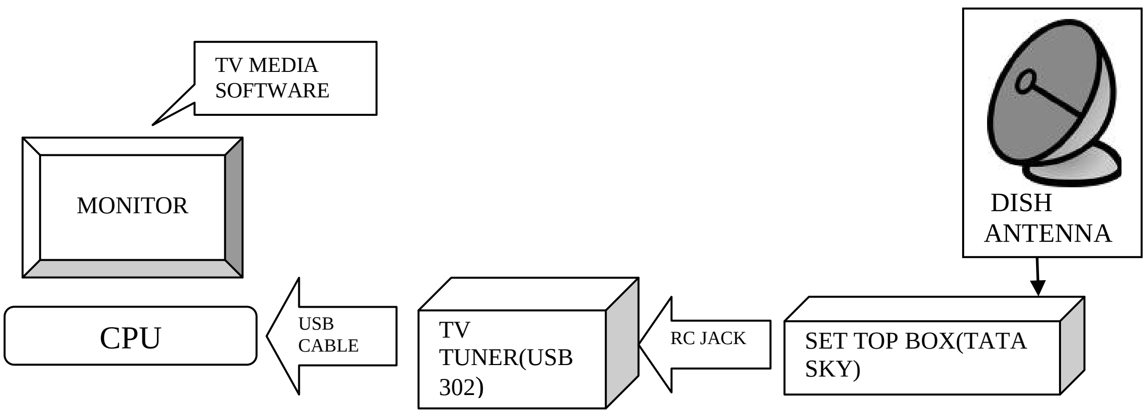
Use of Combo Box and USB TV Box

Aim:- Using LCD screen to receive the satellite TV station and use of combo box to get satellite TV reception on PC monitor. (Input given from Camera or Indoor antenna).

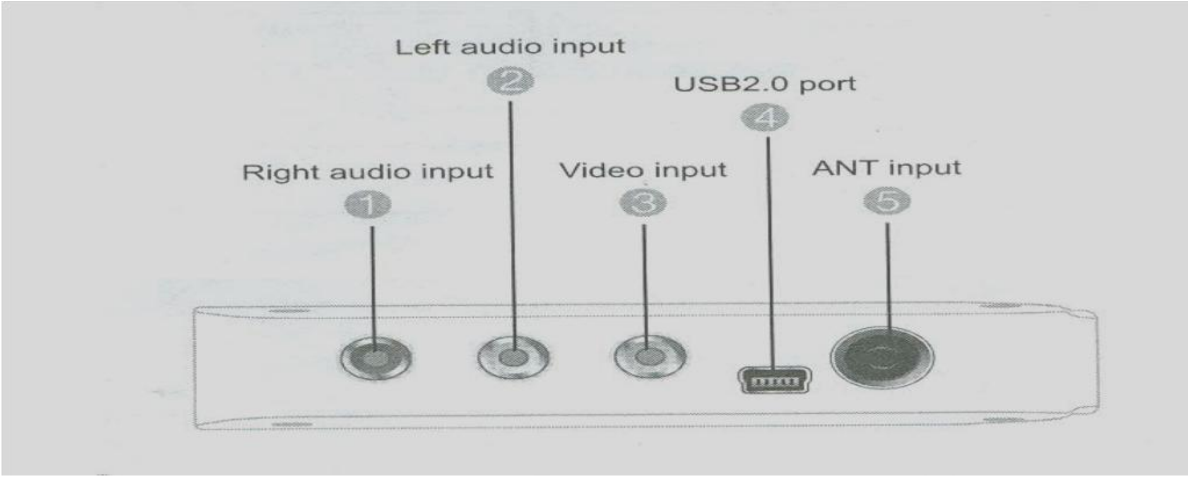
Apparatus:- PC , CRT, Combo TV box , TV tuner (USB 302),Set Top box (TATA SKY), composite video cables, s-video cables, speakers, ALTO box (3803).

Theory:-

A) Use of Set-Top box with PC through TV tuner (TV Media software)



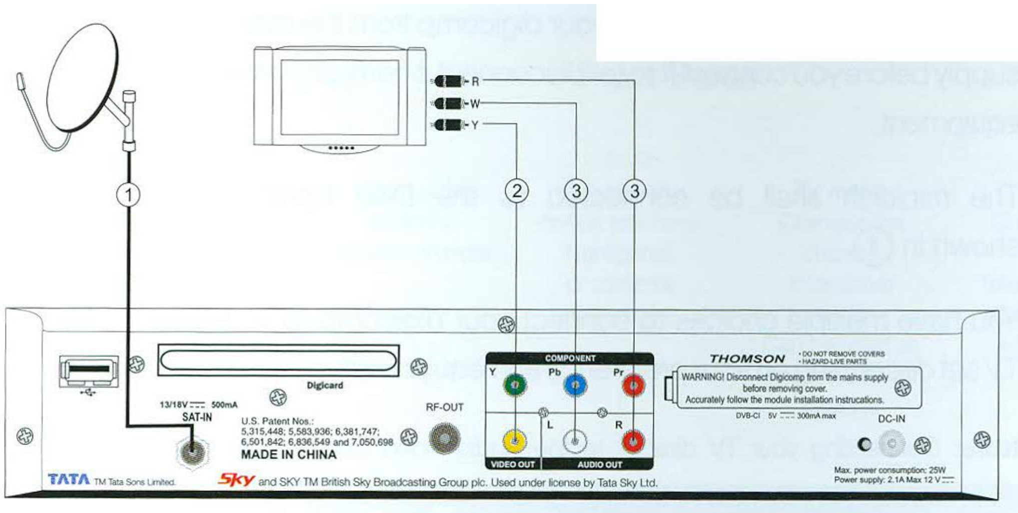
SET UP DIAGRAM



CONNECTIONS AT REAR PANEL OF TV TUNER

FEATURES OF TV TUNER BOX (USB302 GADMEI):-

1) Palm size, sleek &portable
2) Embedded 10-bit video decoder to achieve stable picture & vivid color
3) Receive full-channel TV programs & favorite channels group & rename functions.
4) Full system AV input port, connect to DVD player, STB, game player etc.
5) Record video in MPEG ½, VCD or DVD format.
6) Schedule record &still image capture.
7) Multi-channel preview
8) Easy-installed powerful & user friendly software included.
9) Full function IR remote control & keyboard shortcuts supported.



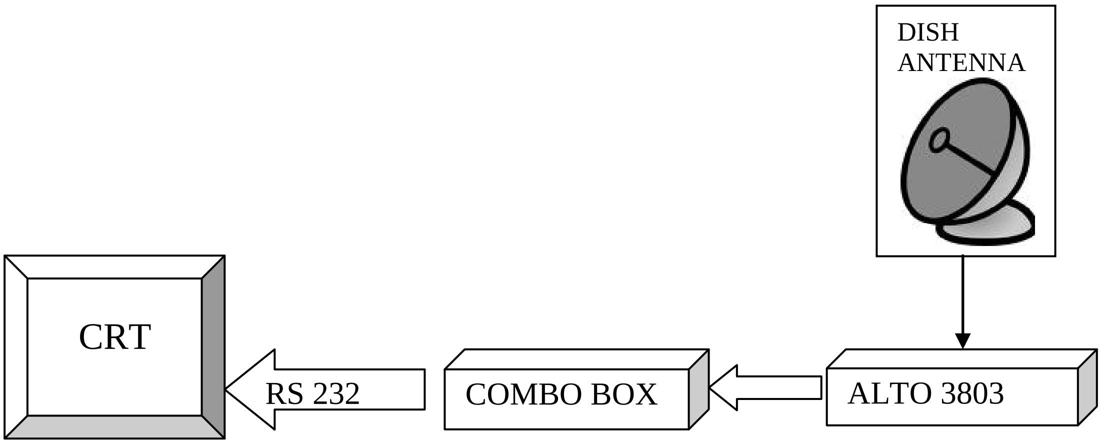
REAR PANEL OF SETTOP BOX

CONNECTION PROCEDURE:

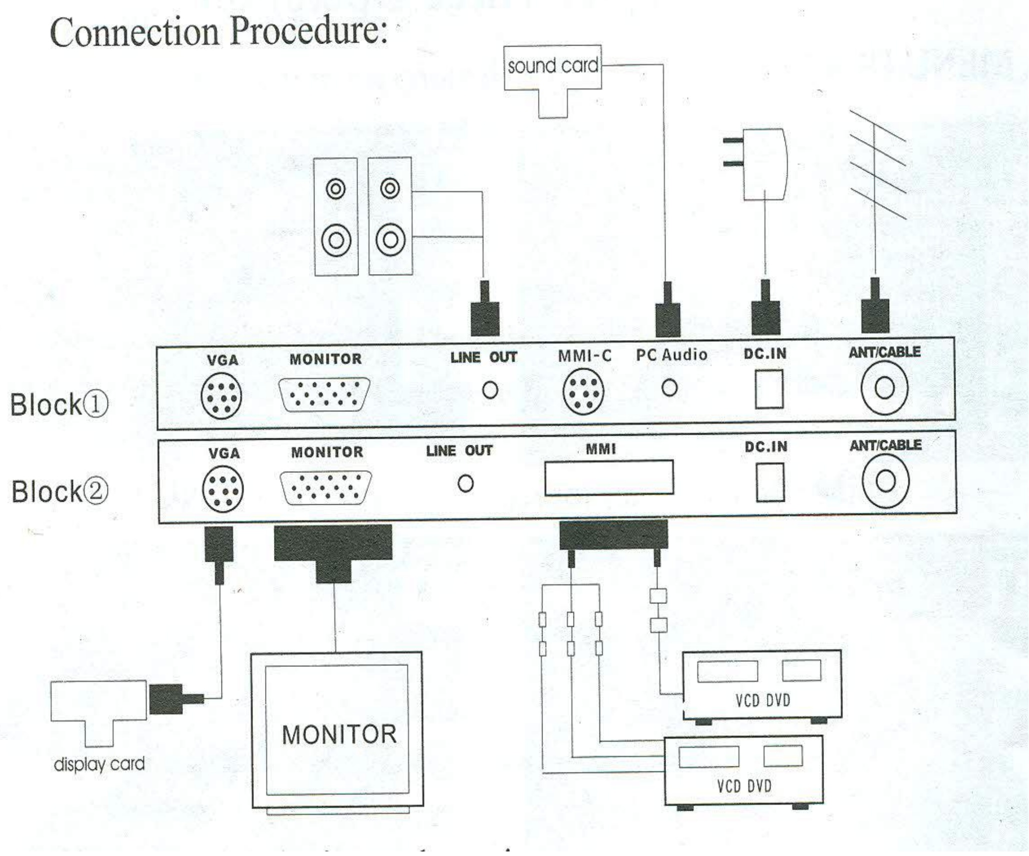
1) TV tuner box is the intermediate block which is used to connect PC Monitor and Set-Top box.
2) Firstly, connect the Set-Top (TATA SKY) box to the cable or antenna.

3) Now output of Set-Top box (which is Composite Video Signal) connect to the TV tuner at Pin no.1,2 and 3.
4) The RF in directly from the antenna or from the Set-Top box can also be given to the TV tuner at Pin no.5
5) Output of TV TUNER(Pin no.4) is now connected to CPU using USB cable.
6) Composite video signals i.e; audio and video signals can be analysed and seen on the CRO by connecting pin no.1,2 and 3 of the TV tuner to the CRO.
7) The software TV Media ,which is normally available with TV TUNER is installed in PC.
8) This Software can be now used to watch the SAT antenna signals on PC through TV tuner.

B) Use of Combo box with only CRT monitor



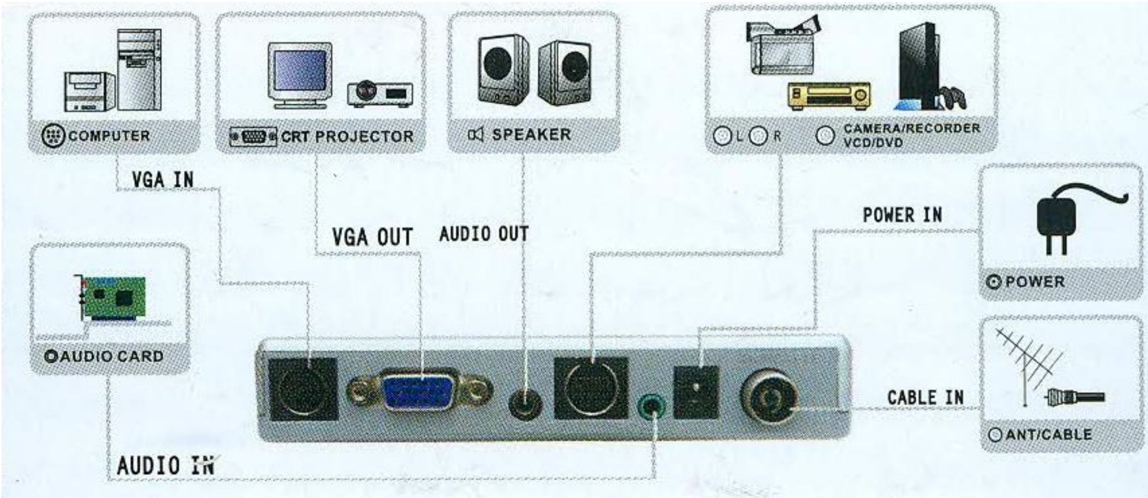
SET UP DIAGRAM



COMBO BOX REAR PANEL

FEATURES: COMBO TUNER BOX (3830 E)

1) Store up to 1000 channels
2) Adopt advanced digital video dealing chip to achieve refined picture.
3) Large storage for channels.
4) OSD & full-function remote control make it easy operate.
5) With MMI interface to extend AV input & external multi-media functions.
6) OSD operation on PC volume.
7) Calendar, timing turn on/off the PC.
8) Secure external power switch.



ALTO 3803 REAR PANEL WITH CONNECTION DIAGRAM:

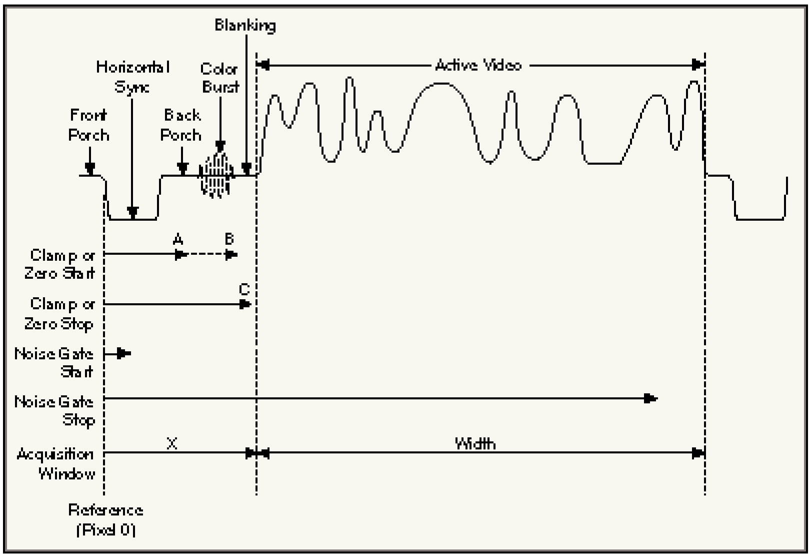
FEATURES: ALTO (3803)

1) Up to 2500 TV channel & Radio storage location.
2) Interactive TV functions.
   S/PDF –AC3 Dolby Digital coax output
3) Timer with 12 programmable weekly or daily events input signal: UHF/VHF
4) Software can easily be updated(via antenna)
5) Picture formats 4:3,16:9
6) Letter box 4:3 full screen
7) OSD (on screen Display) in English & German
8) Loop through function

CONNECTION PROCEDURE:

1) Combo TV box is the intermediate block which is used to connect CRT and Antenna (RF in).
2) Firstly, connect the Combo box to the cable or antenna through ALTO box.
3) Now output of Combo box (which is Composite Video Signal) can also be given to the CRO directly to view the audio and video signals.
4) The RF in directly from the antenna or from the set top box can also be given to the Combo box .
5) Output of Combo box can now be connected to CRT,LCD or Projector using RS 232 cable.

OBSERVATION (ON CRO):



Parts of the Video Signal

CONCLUSION:

ALTO helps in receiving 65 free channels from satellite which is not possible if only combo box is used.

With these kinds of desktop box and TV tuner system we get audio and video signals to see through 1) PC Monitor.

2) LCD Monitor.

3) Projector

The system is found to be saving the cost of other alternative available using colour TV system.

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EXPERIMENT NO. 10

Switch Mode Power Supply

Aim:- Measuring different voltages using Switch mode power supply (SMPS).

Apparatus:- Switch Mode Power Supply circuit, Multimeter.

Theory:-

The power supply which converts 300V dc to 110V dc is known as switch mode power supply. Simply it is denoted as SMPS. A SMPS power supply is used to get 110V, 20V dc power. In a switched mode power supply the regulating elements consist of series connected transistors that act as rapidly opening and closing switches. The input ac is first converted to unregulated dc, which in turn is chopped by the switching elements operating at a rapid rate, typically 20 KHz. The resultant 20 KHz pulsed train is transformer coupled to a output network which provides final rectification and smoothing of the dc output. Regulation is accomplished by control circuits which vary the duty cycle (on –off periods) of the switching elements if the output voltage tends to vary. Figure 1 illustrates block schematic of SMPS and fig. 2 shows basic circuit of SMPS.

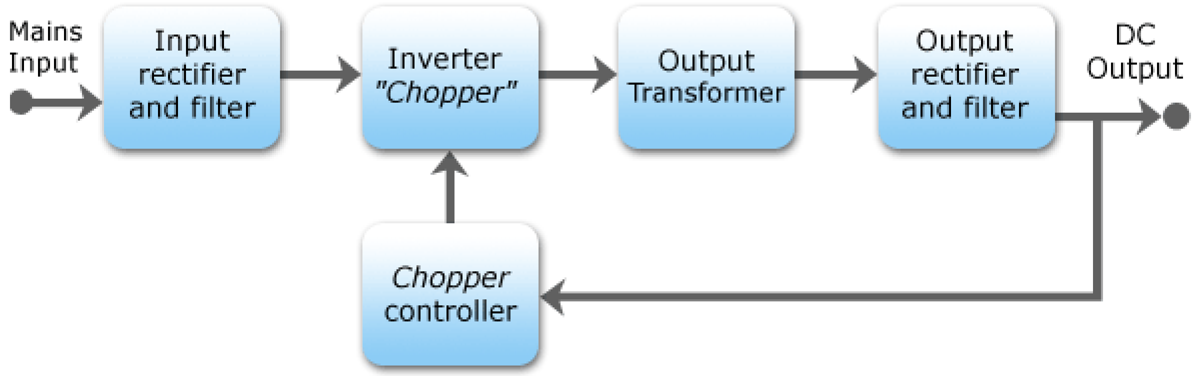

Figure 1 Block Schematic of Switch mode power supply

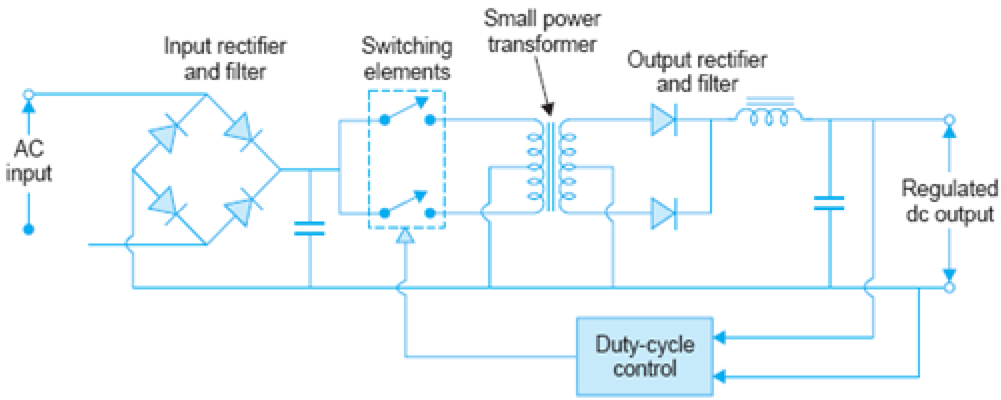

Figure 2 Basic circuit of Switch mode reulated power supply

The advantages of a SMPS over a conventional regulated supply are:

1. The switching transistors are basically on-off devices and hence dissipate very little power when either on (saturated) or off (non-conducting). Efficiencies ranging from 65 to 85 percent are typical of such supplies as compared to 30 to 45 percent efficiencies for linear supplies.

2. On account of higher switching rate (20 KHz), the power transformer, inductor and filter capacitors are much smaller and lighter than those required for operation at power line frequencies. Typically a switching power supply is less than one third in size and weight of a comparable series regulated supply.

3. A switched –mode supply can operate under low ac input voltage. It is relatively long hold –up period if input power is lost momentarily. This is so because more energy can be stored in its input filter capacitors.

Disadvantages: Although the advantages are impressive a SMPS has the following inherent disadvantages:

1. Electromagnetic interference (EMI) is a natural by product of the on-off switching within these supplies. This interference can get coupled to various sections of the receiver and hinder their normal operation. For this reason, switching supplies have build in shields and filter networks which substantially reduce EMI and also control output ripple and noise. In addition, special shields are provided around those sections of the receiver circuitry which are highly susceptible to electromagnetic interference.

2. The control circuit is expensive, quite complex and somewhat less reliable.

<u>OBSERVATION</u>: Figure 3. Represents measurement of voltages in switch mode power supply.

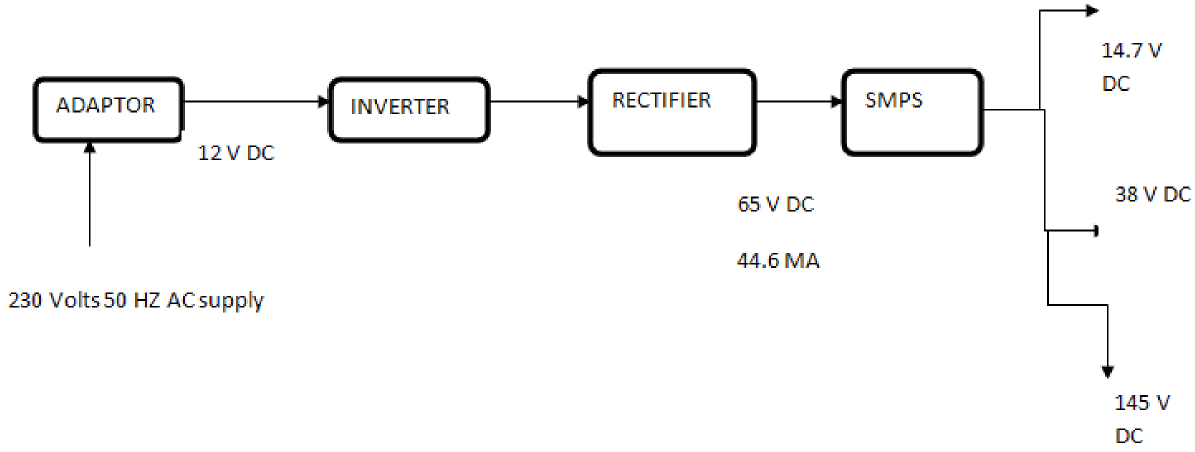

Figure 3 Voltage measurements in SMPS.

CONCLUSION:

Thus we have measured following voltages using switched mode power supply.
Adaptor output voltage: 12 V DC
Rectifier output voltage: 65 V DC, 44.6 mA.
SMPS output: 14.7 V DC, 38 V DC, 145 V DC.

SVKM'S NMIMS
Mukesh Patel School of Technology Management & Engineering

Department of Electronics &Telecommunication Engineering

Basic Communication Lab

Subject- Television and Video Engineering
EXPERIMENT NO. 11

LED TV and LCD TV

Aim:- : Understanding principle of Light emitting Diode (LED) TV and comparing LED TV and LCD TV technology.

Apparatus:- LED Monitor and LCD monitor.

Theory:-

LED Overview
LEDs differ from traditional light sources in the way they produce light. In an incandescent lamp, a tungsten filament is heated by electric current until it glows or emits light. In a fluorescent lamp, an electric arc excites mercury atoms, which emit ultraviolet (UV) radiation. After striking the phosphor coating on the inside of glass tubes, the UV radiation is converted and emitted as visible light.

A light emitting diode, in contrast, is made from a chip of semiconducting material in a way that
when connected to a power source, current flows in one direction but not the other. When current
flows through the diode, energy is released in the form of a photon (light). The specific wavelength or color emitted by the LED depends on the materials used to make the diode. Red LEDs are based on aluminum gallium arsenide (AlGaAs). Blue LEDs are made from indium gallium nitride (InGaN) and green from aluminum gallium phosphide (AlGaP). White light is created by combining the light from red, green, and blue (RGB) LEDs or by coating a blue LED with yellow phosphor. OCS displays in use today utilize red LEDs.

To make a readable display from LEDs, they are arranged in a matrix as shown below in figure 2. The matrix is configured with sufficient number of LEDs to allow alpha-numeric characters to be formed by illuminating specific patterns. Figure 1 is illustrating inside view of LED structure and figure 2 is indicating LED matrix panel.

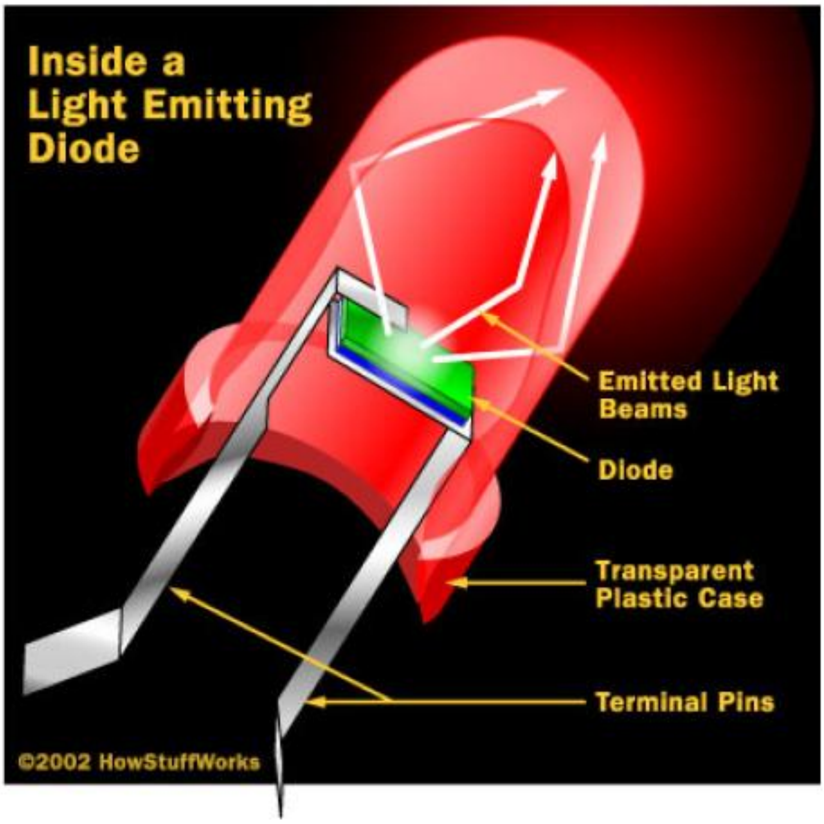

Figure 1 Inside a L.E.D

Figure 2 LED Matrix

The matrices are typically arranged end-to-end to form rows that can be used to display lines of text as shown below in figure 3.

Figure 3 Typical LED display

Comparison of LCD vs. LED Technology
Both LCD and LED technology have their own strengths and weaknesses as outlined in the table 1 below.

Table 1 Comparison of LCD Vs LED Technology

	LED	LCD (high bright)
Reliability	20,000 hours typical	50,000 hours typical
Wide Temperature Operation	Good	Good
Sunlight Readability	Moderate	Good
Pixel pitch (pixels / inch)	0.20″ (5) typical	0.011″ (85) – 15″ LCD
Number of Colors	1 Color – Red typical	16 Million Colors
Graphic Display Capability	None	Full Color Graphic Capable
International Characters	No	Yes
Flexibility of Display Layout	None. Fixed at a limited number of rows and columns of characters.	Total Flexibility. Fonts are configurable and can be scaled in real time.
Cost	Low	Moderate

Reliability – LCD reliability is limited primarily by the backlight technology utilized. Delphi's LCDs utilize high-bright cold cathode fluorescent (CCLF) bulbs, which have an expected life time of over 50,000 hours. This is measured as the average (mean) time to half-brightness or MTTH. LEDs can have a MTTH of up to 100,000 hours if operated in room temperature (25°C) conditions. However, in applications where the display is subject to heat from direct sun exposure, the internal temperatures within the display can reach 60°C. This elevated temperature dramatically reduces the longevity of LEDs to approximately 20,000 hours.

Wide Temperature Operation – Earlier limitation was due to the temperature at which the LCD fluid would reach its isotropic or "clearing point" (point where the crystals in the fluid no longer respond to electrical current) -- typically about 70°C.

When LCD fluid reaches its clearing point, a black spot appears on the display typically when exposed to direct sunlight. This condition is further exacerbated when heat-producing high-bright backlights are employed. Over the past decade, several advances have been made in industrial grade LCD technology resulting in clearing points of over 100°C. By utilizing industrial grade LCDs in combination with heat blocking filters, the operating temperature of the LCD can be significantly extended. LEDs in contrast have wider temperature operating limits; however their brightness and expected lifetime falls off significantly with heat.

Pixel Pitch – Due to the relatively large size of individual LEDs, they inherently have far fewer pixels per inch than LCDs (17:1 ratio of LCD pixels to LED pixels for the same size display area). Accordingly, they are not optimal for displaying pictures, international language characters or complex figures when viewed at close range as with OCS applications.

Number of Colors –A single color limits the amount of information that can be conveyed to the customer. Additionally, red is not the optimum color for high contrast readability in direct sunlight. In contrast, color LCDs can display over 16 million colors and achieve brightness and contrast ratios to be easily viewed in direct sunlight.

Graphic Display Capability – By their very nature, LCDs are graphical display devices. However, LEDs (as used in OCS equipment today) are limited to displaying simple alpha numeric characters and have no graphic display capability.

International Characters – LCD can display multi-byte characters to support all international language fonts. On the other hand, LEDs today cannot support complex multi-byte international language character fonts due to their inherent limitation in resolution.

Flexibility of Display Layout – LED displays are arranged as a fixed number of rows and columns of fixed size characters, allowing no flexibility in the layout of the display. LCDs, being graphical devices by their very nature, have total flexibility of display layout limited only by the software that drives them.

Cost – Due to the simplicity of the design of LED based displays, they are typically lower cost than LCD based displays. However, recent advances in technology have reduced the cost gap significantly.

Following is a list of semiconductor materials and the corresponding colors:

• Aluminium gallium arsenide (AlGaAs) — red and infrared
• Aluminium gallium phosphide (AlGaP) — green
• Aluminium gallium indium phosphide (AlGaInP) — high-brightness orange-red, orange, yellow, and green
• Gallium arsenide phosphide (GaAsP) — red, orange-red, orange, and yellow
• Gallium phosphide (GaP) — red, yellow and green
• Gallium nitride (GaN) — green, pure green (or emerald green), and blue also white (if it has an AlGaN Quantum Barrier)
• Indium gallium nitride (InGaN) — 450 nm - 470 nm — near ultraviolet, bluish green and blue
• Silicon carbide (SiC) as substrate — blue
• Silicon (Si) as substrate — blue (under development)

• Sapphire (Al_2O_3) as substrate — blue
• Zinc selenide (ZnSe) — blue
• Diamond (C) — ultraviolet
• Aluminium nitride (AlN), aluminium gallium nitride (AlGaN), aluminium gallium indium nitride (AlGaInN) — near to far ultraviolet (down to 210 nm)

Conclusion:
Thus we have understood principle of LED TV technology and compared various parameters related with LED and LCD TV technology.

Figure 4 LED TV

DIMENSION(W*D*H)(MM)

Set (with Stand)	44.1(W)*16.8(D)*34.9(H)
Set (without Stand)	44.1 (W)*3.5 (D)*27.5(H)
Box	50.5X33.9X11.5
Wall Mount	7.5*7.5

FEATURES

Aspect Ratio	16:9
Brightness (Typical)	200 cd/m2
Color Depth	16.7M
Color Gamut (CIE1976)	72%
Contrast Ratio(Original)	700:1 (Typ)
Inverter(with/Without)	Without
Lamp Q'ty	4ch
Pixel Pitch(mm)	0.3(mm) x 0.3(mm)
Response Time_Typ.(on/off)	3.5ms/1.5ms
Panel Type	TN
Resolution	1366x768
Size (Inch)	18.5"
Surface Treatment(Glare/Non Glare)	Haze 25%, 3H
Contrast Ratio (DFC)	5M : 1
Viewing Angle (CR≥5)	100/75
Viewing Angle (CR≥10)	90/65

FREQUENCY

H-Frequency	30~61kHz
V-Frequency	56Hz ~ 75Hz

RESOLUTION

Analog	1366*768

SPECIAL FEATURES

Picture Mode	Yes
PC	Yes
Others1	Super Energy Saving
Others2	Dual Smart Solution
Plug & Play	Yes
DDC/CI	Yes
Intelligent Auto (Auto Resolution)	Yes