Laboratory Manual for

AUDIO VIDEO ENGINEERING

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PART – 1 LABORATORY MANUAL

EXPERIMENT – 1

MONOCHROME AND COLOR TELEVISION RECEIVER

AIM: To study television transmitter & receiver and compare monochrome and color television receiver.

THEORY:

TELEVISION TRANSMISSION

PICTURE TRANSMISSION

The picture information is optical in nature and may be thought of as an assemblage of a large number of bright and dark areas representing picture details. These elementary areas into which the picture details may be broken up are known as 'picture elements' or 'pixels', which when viewed together, represent the visual information of the scene. Thus the problem of picture transmission is fundamentally much more complex. Presently the practical difficulties of transmitting all the information simultaneously and decoding it at the receiving end seem impossible and so a method known as scanning is used instead. Scanning of the elements is done at a very fast rate and this process is repeated a large number of times per second to create an illusion of simultaneous pick-up and transmission of picture details.

SOUND TRANSMISSION

The microphone converts the sound associated with the picture being televised into proportionate electrical signal, which is normally a voltage. This electrical output, regardless of the complexity of its waveform, is a single valued function of time and so needs a single channel for its transmission. The audio signal from the microphone after amplification is frequency modulated, employing the assigned carrier frequency. In FM, the amplitude of the carrier signal is held constant, whereas its frequency is varied in accordance with amplitude variations of the modulating signal. As shown in Fig. 1, output of the sound FM transmitter is finally combined with the AM picture transmitter output, through a combining network, and fed to a common antenna for radiation of energy in the form of electromagnetic waves.
Main requirement of T.V. transmitter is to collect data from camera and microphone and to convert it in to electrical signal and send it through transmitting antenna as electromagnetic waves.

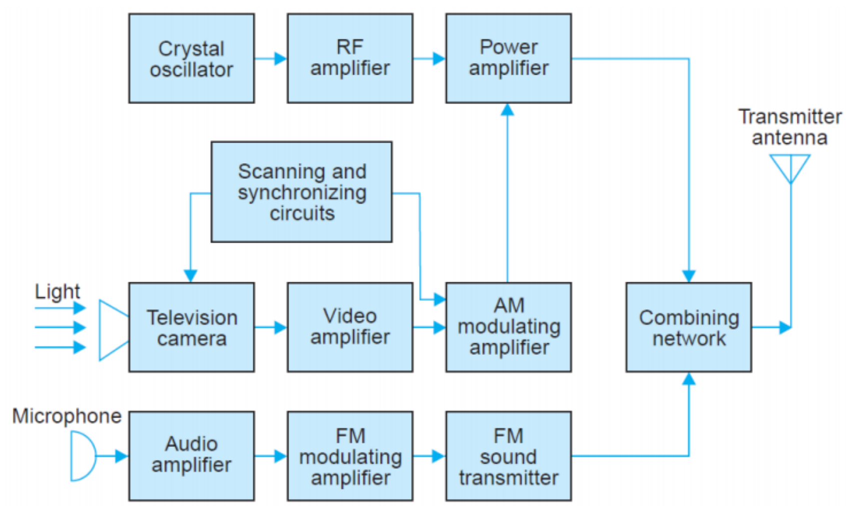

Fig. 1.1 Basic Monochrome Television Transmitter

Fig. 1.1 shows the block diagram of television transmitter. The television camera is the heart of system which is used to convert optical information into electrical signal, whose amplitude varies in accordance with variations of brightness. The low output of camera is amplified by video amplifier. Then synch information is added and AM scheme is followed.

Modulated video and audio signals are combined at combining network and transmitted through tower antenna. The transmission capacity depends on transmission power of the station. Approximately 70 km. radius covered by 10 KW transmitters, now a day for satellite communication, the signal is fed to parabolic reflector and transmitted through it.

TELEVISION RECEIVER

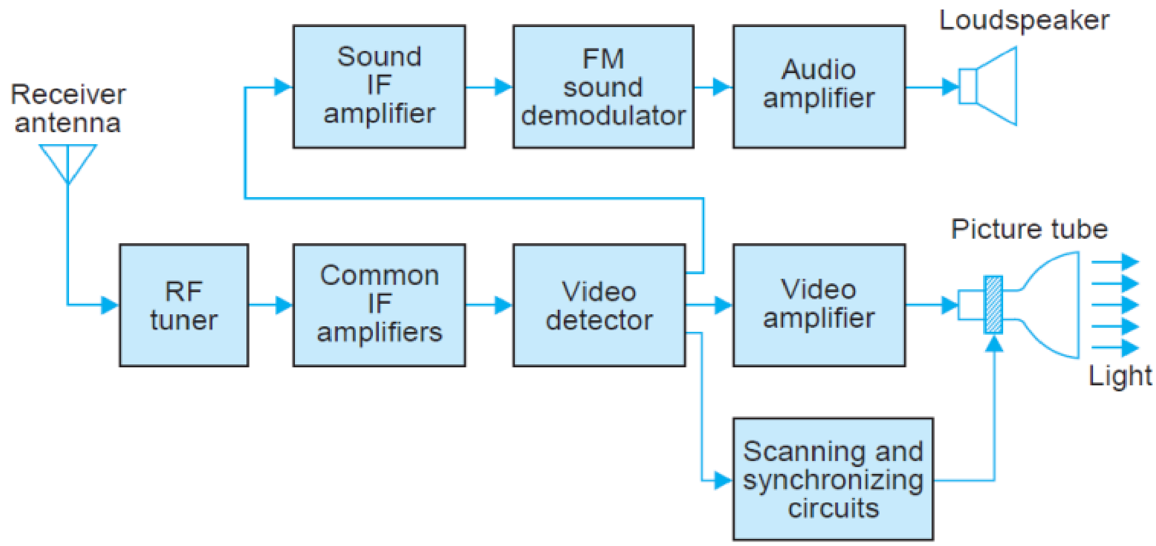

Fig. 1.2 Basic Block Diagram Of Television Receiver

Fig. 1.2 shows the over simplified block diagram of television receiver. Antenna used for reception of high frequency signals is known as Yagi antenna. At the input, the strength of signals are weak so it is required to amplification that is done by RF amplifier. It is also used to convert radio frequency signals into intermediate frequency signals that is known as heterodyne process. Now a days hyper band tuners are used to select more number of channels. The output of tuner is given to common If amplifiers for desired wave shaping. Video detector is used to separate sound, picture carrier and scanning synchronization information. Video amplifier output is used to operate the cathode of picture tube. Scanning and synchronization circuits are giving the output to the deflection plates. They are also used for the quick serene form left to right and top to bottom with the help of scanning currents. The picture tube is used to convert electrical signal to optical signals. At the sound side, the 5.5 MHz is amplified by sound IF amplifier and is given to FM demodulator which is ratio detector or peak detectors type for demodulation of sound, original sound signal is received after this block. It has less amplitude, so amplified again by audio amplifier which is class B push pull type and that gives output to loud speaker to get original sound. Now a days addition of equalizer and woofer circuits gives Hi-Fi sound output and surrounds sound. The television receiver has external controls like volume, color, brightness, bass, on-off switch for personal changes.

COLOR TELEVISION

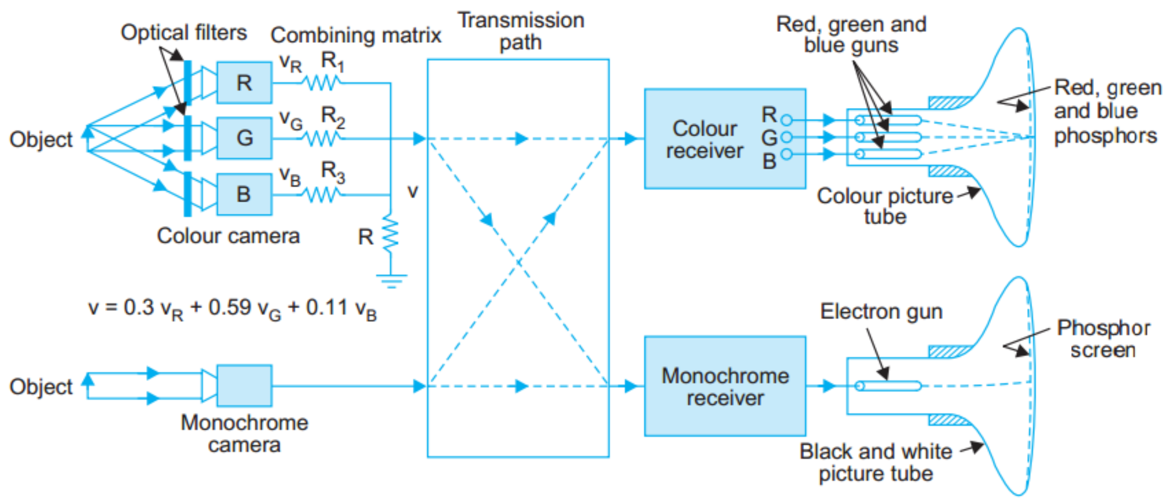

Fig. 1.3 Color and Monochrome TV System

Color television is based on the theory of additive color mixing, where all colors including white can be created by mixing red, green, and blue lights. The color camera provides video signals for the red, green, and blue information. These are combined and transmitted along with the brightness (monochrome) signal.

Each color TV system is compatible with the corresponding monochrome system. Compatibility means that color broadcasts can be received as black and white on monochrome receivers. 7Conversely color receivers are able to receive black and white TV broadcasts. This is illustrated in Fig. 1.3 where the transmission paths from the color and monochrome cameras are shown to both color and monochrome receivers.

At the receiver, the three color signals are separated and fed to the three electron guns of color picture tube. The screen of the picture tube has red, green, and blue phosphors arranged in alternate dots. Each gun produces an electron beam to illuminate the three color phosphors

separately on the fluorescent screen. The eye then integrates the red, green and blue color information and their luminance to perceive the actual color and brightness of the picture being televised.
Fig. 1.4 shows a block diagram of a typical monochrome TV receiver.

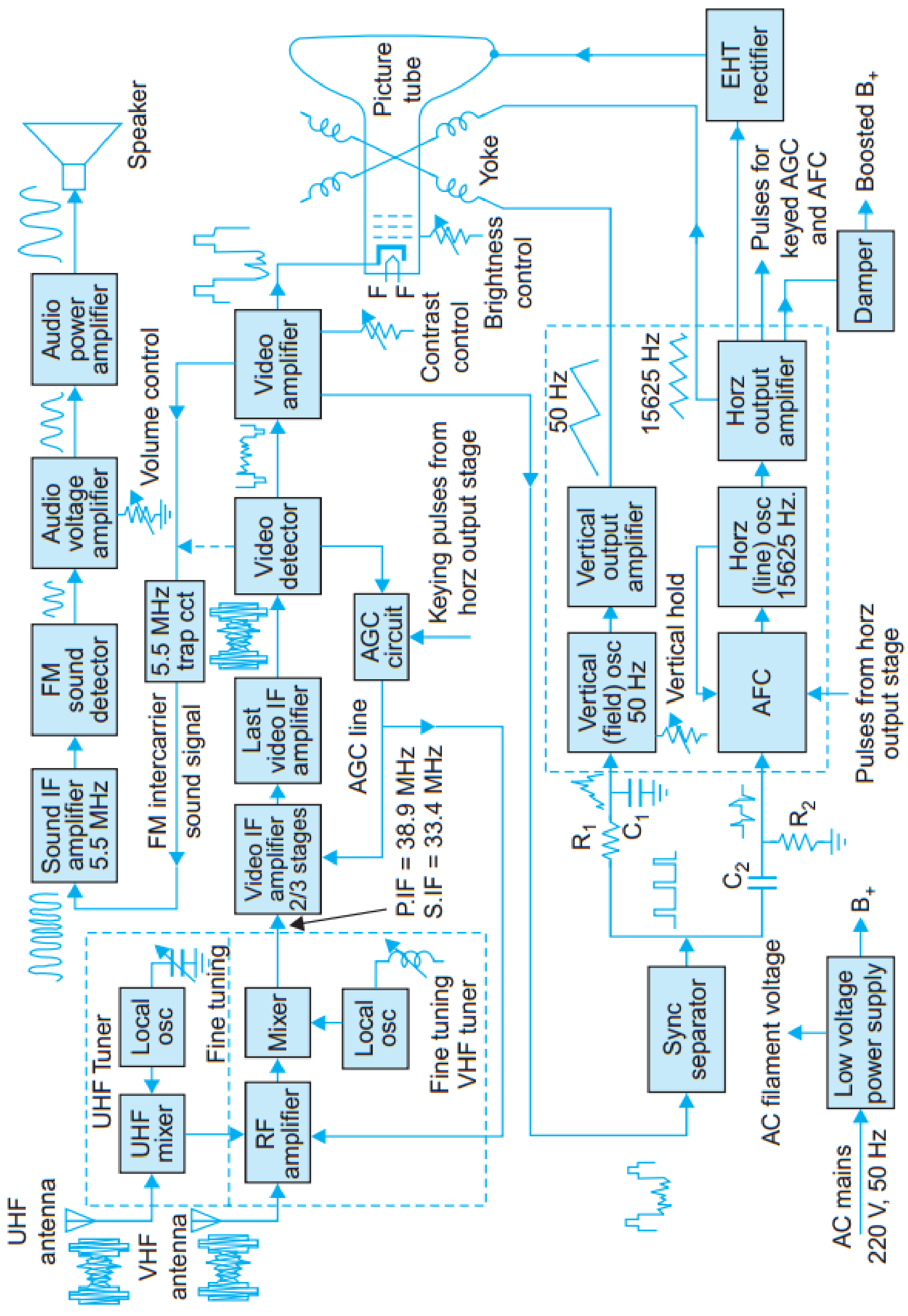

Fig. 1.4 TV Receiver Block Diagram

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) Why is scanning necessary in TV transmission? Why is it carried out at a fast rate?
(2) What is the basic principle of operation of a television camera tube?
(3) Why is FM preferred to AM for sound signal transmission?

EXPERIMENT –2

COMPOSITE VIDEO SIGNAL

AIM: (i) To study composite video signal
(ii) To study LCG-399A pattern generator.

THEORY:

In monochrome TV system composite video signal consists of a camera signal corresponding to intensity variation, blanking pulses to make the retrace invisible, and synchronizing pulses to synchronize the transmitter and receiver scanning. A horizontal synchronizing (sync) pulse is needed at the end of each active line period whereas a vertical sync pulse is required after each field is scanned. Since sync pulses are needed consecutively and not simultaneously with the picture signal, these are sent on a time division basis and thus form a part of the composite video signal. Color TV CVS contains additional information about color.

VIDEO SIGNAL DIMENSIONS

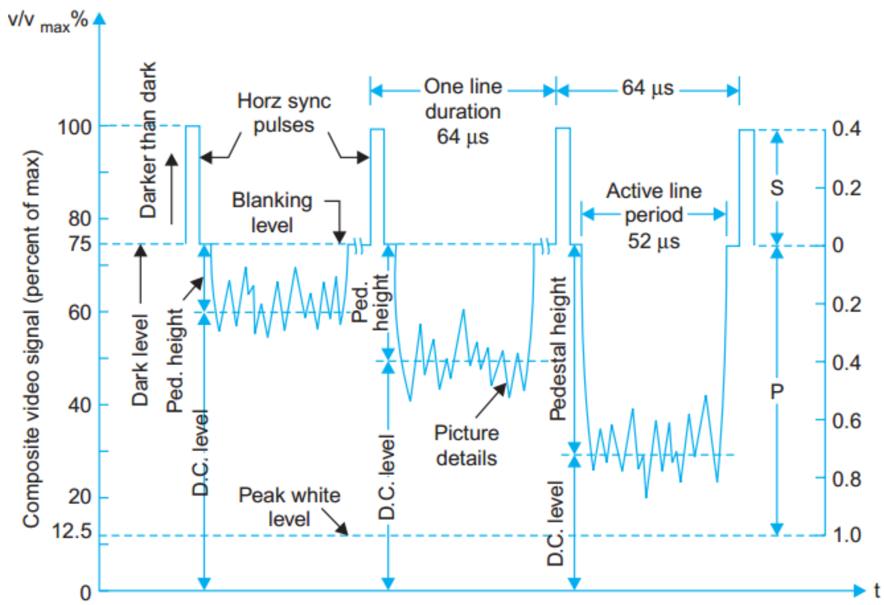

Fig. 2.1 Arbitrary picture signal details of three scanning lines with different average brightness levels

Composite video signal details of three different lines each corresponding to a different brightness level of the scene is shown in Fig. 3.1.

PEAK-WHITE LEVEL

It is the level of the video signal when the picture detail being transmitted corresponds to the maximum whiteness to be handled. It is fixed at 10 to 12.5 percent of the maximum value of the signal.

BLACK LEVEL

It corresponds to approximately 72 percent of the maximum value of the signal.

BLANKING LEVEL

It corresponds to approximately 75 percent of the maximum value of the signal. Sync pulses are added here.

PEDESTAL

It is the difference between the black level and blanking level. However, in actual practice, these two levels, being very close, tend to merge with each other as shown in the Fig. 3.1.

PEDESTAL HEIGHT

Picture information varies between 10 percent to about 75 percent of the composite video signal depending on the relative brightness of the picture at any instant. For 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. In Fig. 3.1, dc components of the signal for three lines have been identified, each representing a different level of average brightness in the scene. As noted in Fig. 3.1 the pedestal height is the distance between the pedestal level and the average value (dc level) axis of the video signal. It determines the average brightness of the scene. Setting the pedestal level of the scene is known as *DC insertion*. Smaller height of pedestal will make the scene darker while a larger pedestal height will result in higher average brightness of the scene.

BLANKING PULSES

This pulses are used to make the retrace lines invisible by raising the signal amplitude of video signal slightly above the black level (75 %) during the time the scanning circuits produce retraces. As shown in Fig. 3.1 composite video signal contains horizontal and vertical blanking pulses to blank the corresponding retrace intervals. The repetition rate of horizontal blanking pulses is equal to the line scanning frequency of 15625 Hz and repetition rate of the vertical blanking pulses is equal to the field-scanning frequency of 50 Hz.

SYNC PULSES

This pulses are specially designed for triggering the sweep oscillators and are placed in the upper 25 per cent (75 per cent to 100 per cent of the carrier amplitude) of the video signal. It is transmitted along with the picture signal.

Horizontal sync information is extracted from the sync pulse train by differentiation (high-pass filtering). Pulses corresponding to the differentiated leading edges of sync pulses are used to synchronize the horizontal scanning oscillator. Same way vertical sync information is extracted by integration (low-pass filtering). The process of deriving these pulses is illustrated in Fig. 3.2. Receivers often use monostable multivibrators to generate a scan, so a pulse is required to initiate each and every cycle of the horizontal and vertical oscillator.

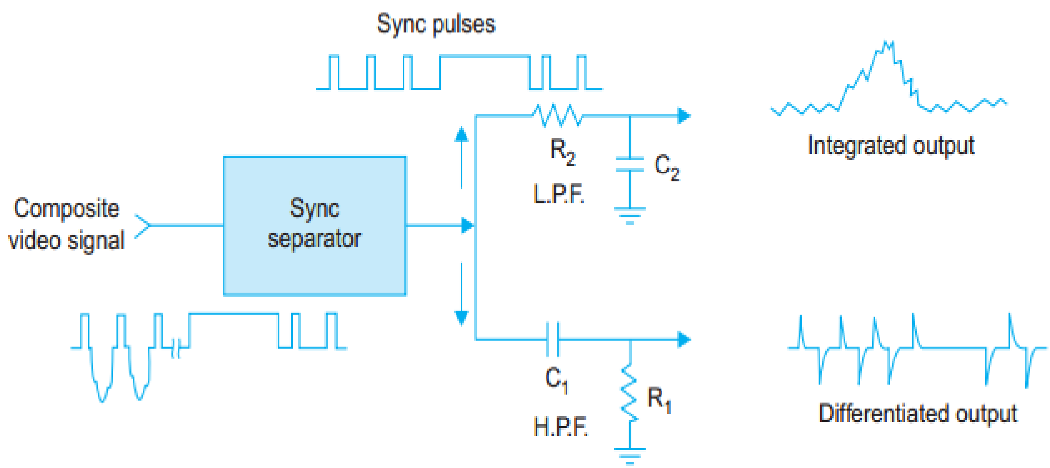

Fig. 2.2 Sync pulse separation and generation of vertical and horizontal sync pulses

HORIZONTAL SYNC DETAILS

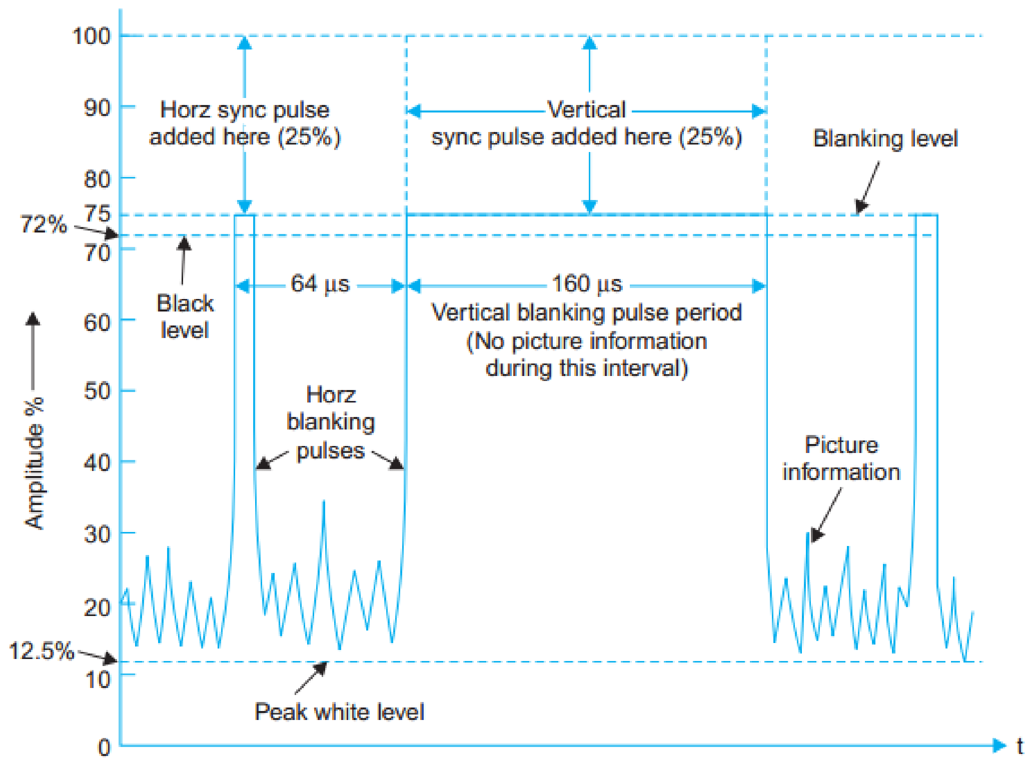

Fig. 2.3 Horizontal and vertical blanking pulses in video signal

Horizontal scanning requires 64 µSec to complete one cycle, out of which 12 µSec is blanking period. During this interval a line synchronizing pulse is inserted. The pulses corresponding to the differentiated leading edges of the sync pulses are actually used to synchronize the horizontal scanning oscillator. The line blanking period is divided into three sections. These are the 'front porch', the 'line sync' pulse and the 'back porch'. The time intervals allowed to each part are summarized below and their location is illustrated in Fig. 3.3.

Table 2.1 Horizontal line details

Period	Time (μ Sec)
Total line (H)	64
Horizontal blanking	12 ± .3
Horizontal sync pulse	4.7 ± 0.2
Front porch	1.5 ± .3
Back porch	5.8 ± .3
Visible line time	52

FRONT PORCH

This is a brief cushioning period of 1.5 μs inserted between the end of the picture detail for that line and the leading edge of the line sync pulse. This interval allows the receiver video circuit to settle down from whatever picture voltage level exists at the end of the picture line to the blanking level before the sync pulse occurs.

LINE SYNC PULSE

After the front porch, horizontal retrace is produced when the sync pulse starts. The flyback is definitely blanked out because the sync level is blacker than black. Line sync pulses are separated at the receiver and utilized to keep the receiver line time base in precise synchronism with the distant transmitter. The nominal time duration for the line sync pulses is 4.7 μs. During this period the beam on the raster almost completes its back stroke (retrace) and arrives at the extreme left end of the raster.

BACK PORCH

This period of 5.8 μs at the blanking level allows plenty of time for line flyback to be completed. It also permits time for the horizontal time-base circuit to reverse direction of current for the initiation of the scanning of next line. In color TV transmission a short sample (8 to 10 cycles) of the color subcarrier is sent to the receiver for proper detection of color signal sidebands and is located at the back porch.

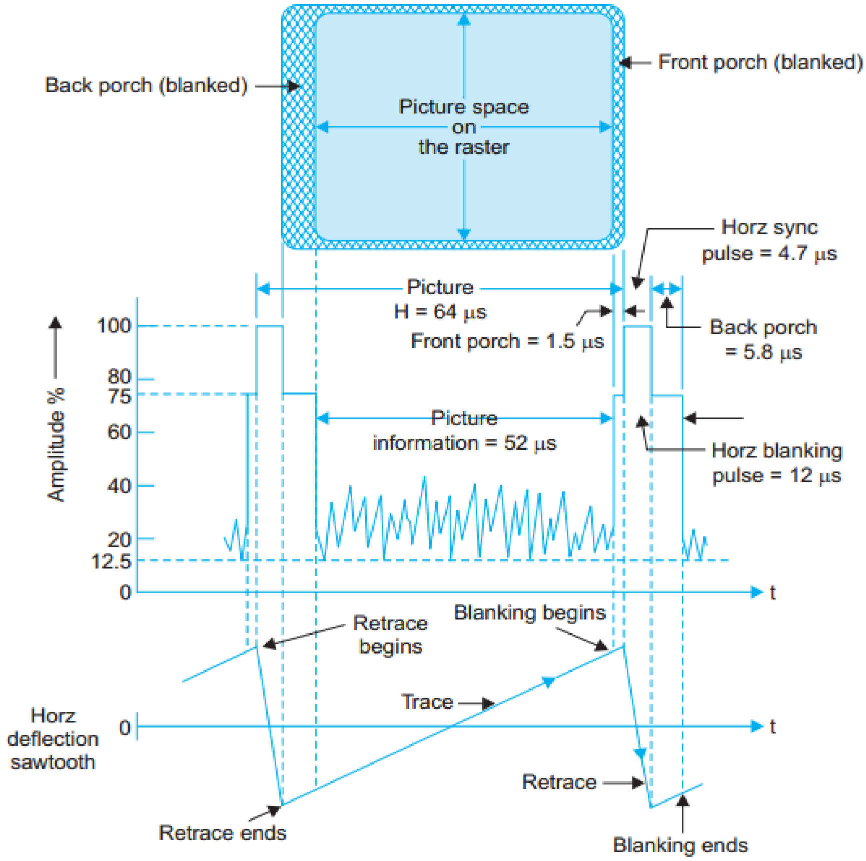

Fig. 2.4 Horizontal line and sync details

VERTICAL SYNC DETAILS

The vertical sync pulse train added at the end of both even add odd fields. Its width is kept much larger than the horizontal sync pulse. The standards specify that the vertical sync period is equal to 2.5 times the horizontal line period (64 μ Sec x 2.5 = 160 μ Sec). Position of vertical sync pulses is indicated in Fig. 4. Repetition rate of vertical sync pulse is 50Hz.

To keep horizontal oscillator in sync during vertical sync period, it becomes necessary to cut slots in the vertical sync pulse at half-line-intervals to provide horizontal sync pulses during the period of vertical sync pulse. Thus five narrow slots of 4.7µs width are formed in each vertical sync pulse at intervals of 32 µs.

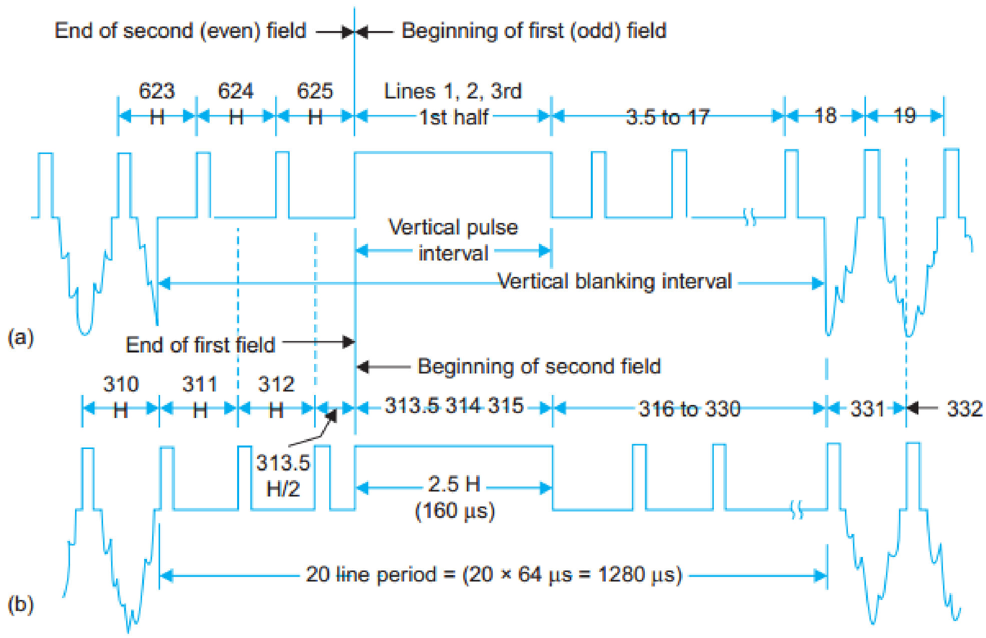

Fig. 2.5 CVS showing horizontal and vertical sync pulses at the end of (a) even field, (b) first (odd) field

As shown in Fig. 3.5, from the beginning of the first field (odd field) the last horizontal sync pulse is separated from the vertical pulse by full one line and from the beginning of the second field (even field) the last horizontal sync pulse is separated from the vertical pulse by a half line. This half line discrepancy will produce time error for triggering vertical oscillators.

To take care of this drawback which occurs on account of the half line discrepancy five narrow pulses are added on either side of the vertical sync pulses. These are known as pre-equalizing and post-equalizing pulses. Each set consists of five narrow pulses occupying 2.5 lines period on either side of the vertical sync pulses and corresponding position is illustrated in Fig. 3.6.

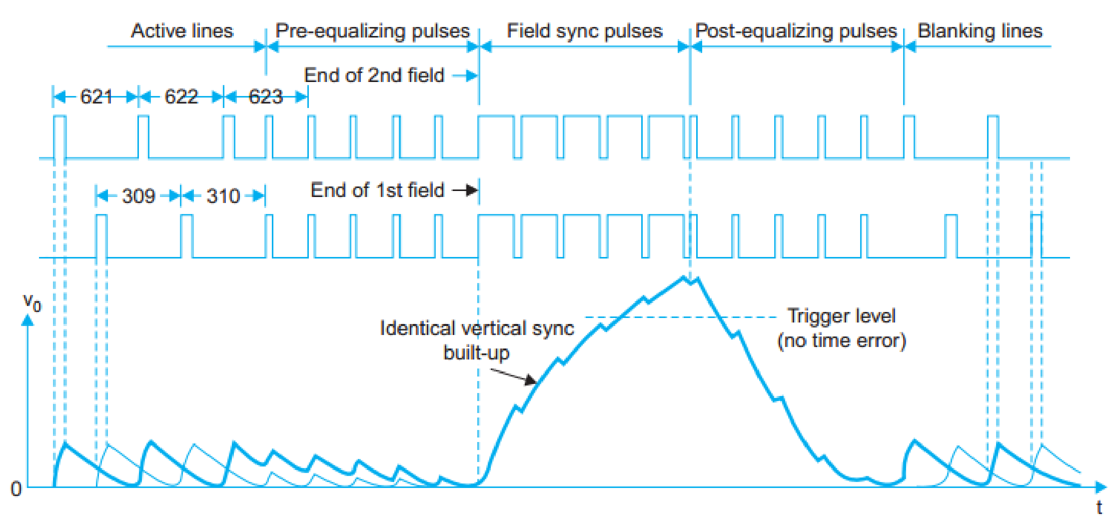

Fig. 2.6 Pre and Post equalizing pulses

CONCLUSION:

ASSIGNMENT QUESTIONS:

1. Why number of active lines is 585? Describe the scanning sequence for 625 line TV system.
2. Why slots are required in vertical sync pulse?
3. Justify the need of pre and post equalizing pulses.

(ii) To study LCG-399A pattern generator.

APPARATUS: Pattern generator, Television, CRO probe

THEORY:

Pattern generator is a device that can be used to display various patterns on the television screen. This can be used to adjust the television picture tube. From the various pattern we can judge the problem in the television circuitry.
The LCG-399A generates the following 13 kinds of basic pattern. And the output signals are two kinds as composite video and RF signal.

PATTERNS
Alignment
Convergence
Luminance
Chrominance
Color bars
8 kinds of raster
The characteristics and applications of respective pattern will be described in the following paragraphs.

SELECTION OF PATTERNS
There are 6 blue push buttons to select patterns corresponding to alignment, convergence, luminance, chrominance, color and raster, select a pattern required by pressing selectors; only one selector must be turned ON. The pattern which is generated when all the selectors are OFF or more than two selectors are simultaneously turned on is not correct.
In case the raster selector is turned on, the color can be made in 8 kinds by means of the raster selectors.

ALIGNMENT PATTERN
The alignment pattern is white pattern on black background that is composed of 5*5 crosshatch circle and polarity marker. This pattern is mainly used for raster alignment of color and black & white TV receivers.

The 3rd vertical line and 3rd horizontal line of the crosshatch conform to the electrical center line of the raster. Raster centering is performed by adjusting the horizontal and vertical position of the raster so as to have these two cross lines come to the center of the picture.

When the effective width of the raster presumed to be 100%, the 1st and 5th vertical lines indicate the boundary of width of 80% of raster with a margin of 10% left at the left and right respectively. Similarly, the 1st and the 5th horizontal line show the boundary of a height of 80% if raster surrounded by these 42 pairs of lines is called as the safety zone of the raster and these boundary lines are called safety zone lines.

Generally, TV receivers are adjusted to make the horizontal and vertical amplitude of the raster over scanning by about 10 to 18%.

The safety zone lines (1st and 5th vertical and horizontal lines) of alignment pattern display the limit over-scanning of TV receiver. If the right on the screen of a TV receiver can be seen when then alignment pattern is received, the TV receiver is properly adjusted for raster over-scanning. The 16 rectangles in the safety zone formed by 5*5 crosshatches are all in equal size and the ratio of height is ¾ which is equal to width of raster aspect ratio. These rough 5*5 crosshatched are used in testing and adjusting of the linearity, pincushion effect, etc. checking if these 5*5 crosshatches are equal in size at any place the picture if there is any bent line performs testing and adjusting.

Dots of 3 columns×4 rows located at the bottom right corner of the alignment pattern are polarity markers. These marks indicate whether or not a deflection yoke connected at a correct polarity.
If this marker is located at the top right corner, it indicates that the vertical coil of a deflection yoke is connected in reverse, and if it is located at the bottom corner, a horizontal coil is reversibly connected. And it indicates that both horizontal and vertical coils are reversely connected if the marker is located at the upper left corner.

The CIRCLE SELECT jumper is the short pin type jumper located on the circle generator pc (printed circuit) board assigned T-2498. This is placed near the rear panel on the bottom side of the two stays.

CHROMINANCE PATTERN
The chrominance pattern is signals of chrominance component of the color signal. In which luminance component is removed. This pattern is used for testing and adjusting color circuits of the TV receivers and VTRs.

Since the chrominance pattern has no luminance component, the color of color bar appearing in the picture will be dark color for which a proper name is hard to be given.

COLOR PATTERN

The color pattern is full field color bars which is PAL standard type of 75% amplitude and 100% saturated. Color bar signals are used for testing and adjusting color TV receivers, VTRs and other color circuits.
The LCG-399A shipped from a factory is set to standard color bars of 75% amplitude and 100% saturated. Additional functions can be made to color bars by the internal color bar program switches.

ADJUSTMENTS OF CIRCUIT FROM PATTERNS

(i) If we have applied the circular pattern to TV and if it gets stretched in any direction then we can say that the deflection coil current is not properly adjusted for the focusing.
If the circle gets stretched in the vertical direction then horizontal coil (vertical deflection) current is more compared to that of the vertical coil (horizontal deflection).
According to the right hand rule, the force on the electron is in the direction perpendicular to both electron velocity and magnetic field. So the horizontal coil deflects electron beam in the vertical direction. And this current should be adjusted.
(ii) Same is the case for square pattern if all the squares are not identical or looks like a rectangle then current in the coil should be adjusted.
(iii) If we are not getting luminance signal or chrominance signal then there might be a problem with R-G-B electron guns circuit.
(iv) If we display color raster on the screen and if it doesn't appear on the screen then the color section of TV must be checked for this kind of problem
Since the chrominance pattern has no luminance component, the color of color bar appearing in the picture will be dark color for which a proper name is hard to be given. In case of this pattern the result of a test is not judged by the color of picture but generally it is judged by the waveforms of signals to be seen on the oscilloscope. The Fig.3.7 below shows the front panel of the Pattern Generator. The buttons when pressed one by one from TOP to BOTTOM gives the corresponding patterns on the TV screen.

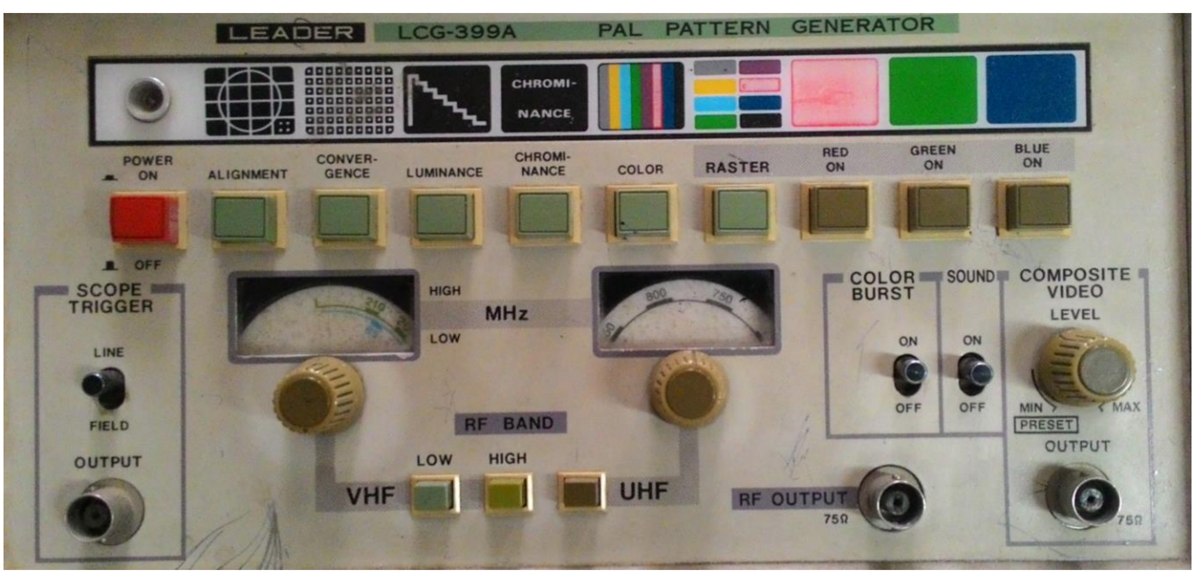

Fig. 2.7 Pattern generator

CONVERGENCE SIGNAL

No. of equally sized squares are represented on the raster with white dot in the center of each. Which may give the idea related to deflection coil current problems.

BRIGHTNESS SIGNAL

The Fig. 2.8 shows luminance signal which represents only brightness.

Fig.2.8 Brightness Signal

COLOR SIGNAL WITHOUT BRIGHTNESS

The Fig. 2.9 shows the chrominance signal without luminance. This is just a color signal without brightness.

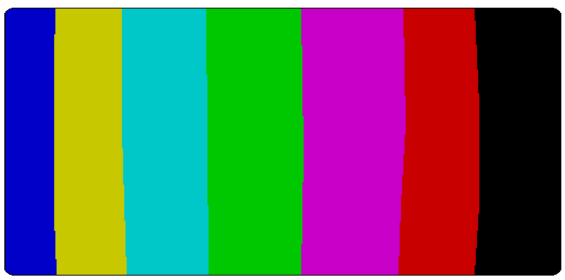

Fig. 2.9 Brightness Signal Without Brightness

COLOR SIGNAL WITH BRIGHTNESS

The Fig. 2.10 shows the color signal which means it includes both luminance and chrominance signal.

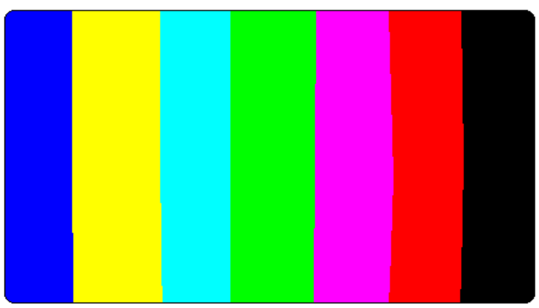

Fig. 2.10 Brightness Signal With Brightness

The figures below display the raster of primary color signal given from Pattern Generator.

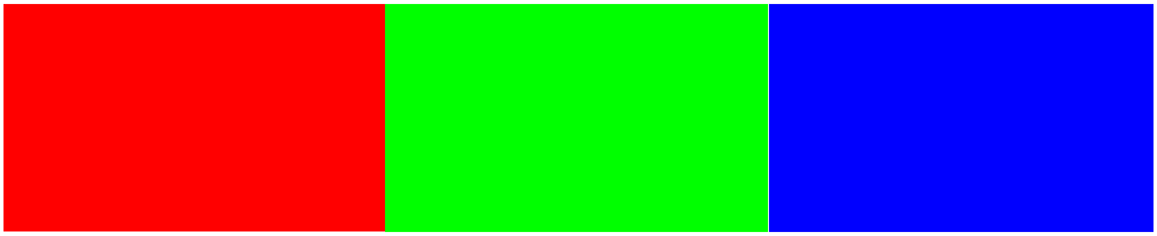

Fig. 2.11 Red **Green** **Blue**

Similarly, we can get the rest of the colors from the different combinations of primary colors.

Fig. 2.12 Yellow **Cyan** **Magenta**

RASTER PATTERN

The raster is a pattern which causes the whole picture to become raster of the same color. The color raster can be had in one 8 kinds of color. Shown in the table below by the combination of on/off of red, green and blue raster selectors. Although the color of raster is basically the same as that of color bars of 75% amplitude and 100% saturated, it is designed to produce 100% peak white instead of 75% white.The raster pattern is used for testing and adjusting purity and white balance of color TV receivers and color circuits of VTR.

Table 2.2 Switch Selection for Raster Color

RASTER SELECTORS			RASTER COLOR
RED	GREEN	BLUE	
ON	ON	ON	WHITE
ON	ON	OFF	YELLOW
OFF	ON	ON	CYAN
OFF	ON	OFF	GREEN
ON	OFF	ON	MAGENTA
ON	OFF	OFF	RED
OFF	OFF	ON	BLUE
OFF	OFF	OFF	BLACK

EFFECT OF RASTER OVER SCANNING OF TV RECEIVER

Generally, a TV receiver is adjusted in such a manner that, the width and height of its raster can be over scanned. Therefore some receivers may fail to produce the whole pattern shown, whose part of top, bottom, left or right corner is forced to go out the picture when they display a pattern of the LGC-399A on the screen.

PROCEDURE:

(1) Connect RF output of pattern generator to the receiver module of TV with the help of CRO probe.
(2) Turn on TV, tune the TV receiver to the frequency given from the Pattern Generator according to the frequency band.
(3) Observe patterns for alignment, convergence.
(4) See different pattern of selected color like blue, red and green on TV screen.

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) If in an alignment pattern ellipse is being displayed in the horizontal direction then what adjustments are required to be made in the TV?
(2) If any electron gun fails then how will you identify the faulty gun?
(3) What is the frequency range of VHF-1 band?

EXPERIMENT –3

Color Picture Signal

AIM: (i) To study the color picture signal.
(ii) To study vectroscope.

THEORY:

Since any color is an additive mix of red, green and blue, the picture information is considered in terms of these primary colors. When the image of any picture is scanned by a color camera, separate video signals are developed for these colors. In order to maintain compatibility between B&W and Color TV the camera outputs i.e. R, G and B are combined in a suitable way to form two signals; one for brightness (or luminance – Y signal) and the other for color (or chrominance-C signal).It is formed by rearranging and modulating camera outputs.
In order to generate any color signal it is necessary to know definite ratio in which R, G and B are mixed to form new color. This is known as additive mixing. By pairwise additive mixing of the primary colors the following complementary are produced.

Red + Green = Yellow
Red + Blue = Magenta
Blue + Green = Cyan

Any color has three characteristics to specify its visual information.

1) LUMINANCE
This is the amount of light intensity as perceived by the eye regardless of the color. In black and white pictures, better lighted parts have more luminance than the dark areas.

2) HUE
This is the predominant spectral color of the received light. Color of any object is distinguished by its hue. Different hues result from different wavelengths of spectral radiation.

3) SATURATION
This is the spectral purity of the color light. Since single hue colors occur rarely alone, this indicates the amounts of other colors present. Thus saturation may be taken as an indication of how little the color is diluted by white. A fully saturated color has no white. As an example. Vivid green is fully saturated and when diluted by white it becomes light green. The hue and saturation of a color put together is known as chrominance.
At any instant during the scanning process camera output V_R, V_G, and V_B indicate the proportions of red, green and blue lights which are present in the element being scanned. Besides this, the luminance signal which represents the brightness of the elements being scanned must be transmitted along with the color signals.

To compensate for the non-linearity of the system including TV camera and picture tubes, a Gamma correction is applied to these voltages to remove any nonlinearity present and are normalized. For maximum white it is usually 1Vp-p as shown in Fig. 4.1.

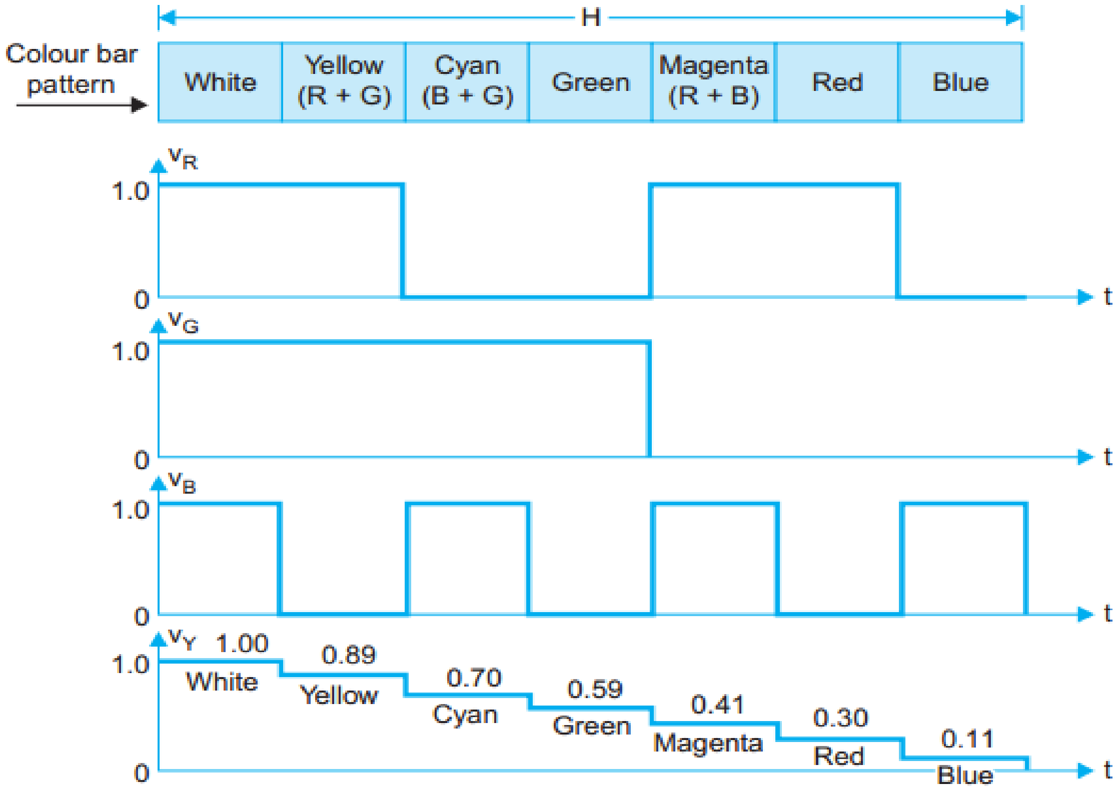

Fig. 3.1 Formation of Y signal from V_R, V_G, and V_B signal

LUMINANCE SIGNAL

To generate the monochrome or brightness signal that represents the luminance of the scene, the three camera outputs are added through a resistance matrix in the proportion of 0.3, 0.59 and 0.11 of R, G, and B respectively. The resulting signal voltage represents the brightness of the scene and is referred to as 'Y' signal. Therefore,

$$Y = 0.30V_R + 0.59V_G + 0.11V_B \text{ Volt}$$

For bright white all camera outputs are 1V therefore Y = 1V, and for black Y = 0V. Next consider a color object, say a bar that is painted red, is fully illuminated. On scanning, it develops

$$Y = 0.30(1) + 0.59(0) + 0.11(0) = 0.30V$$

This is so because for red color there is no output from V_G and V_B. A monochrome camera on scanning the bar will also produce the same result because the red appears 30% bright compared to white. As illumination on the bar is varied from maximum white to completely dark the magnitude of V_R varies from 1V to 0V, thus changing Y from 0.3V to 0V. Such a behavior is true for all color and hence Y represent brightness of various color as perceived by our eye. This is illustrated in Fig. 4.1.

COLOR DIFFERENCE SIGNAL

For color TV system the 'Y' signal is transmitted as in a monochrome system. However, color difference signals are generated to avoid the transmission of V_R, V_G, and V_B separately. Color difference voltages are derived by subtracting the luminance voltage from the color voltages. Only $(V_R - Y)$ and $(V_B - Y)$ are transmitted while $(V_G - Y)$ is obtained at the receiver by suitable matricing circuit. The difference signals bear information about both hue and saturation of different colors.

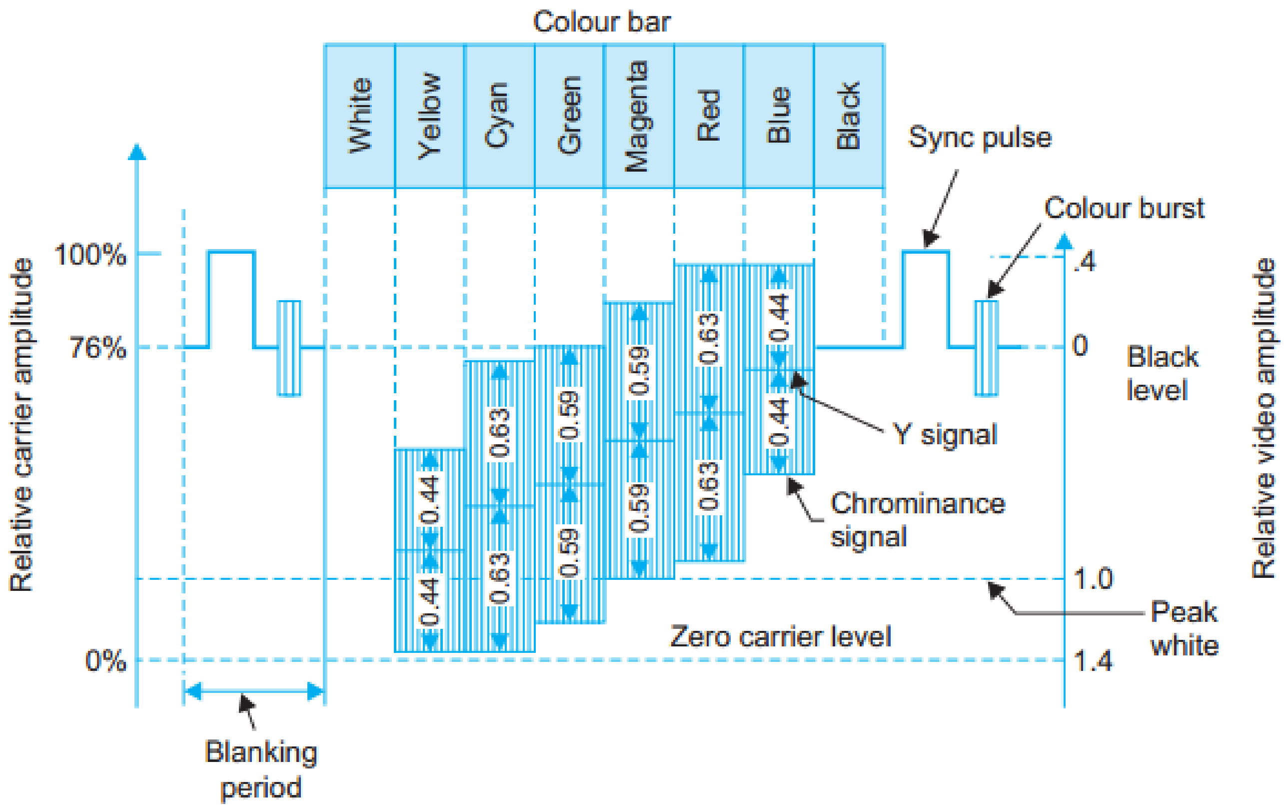

Fig. 3.2 Composite color signal

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) Why $(V_R$-Y) and $(V_B$-Y) signals are transmitted and not the $(V_G$-Y) signal?
(2) Why weighting factors are applied to the color difference signal?
(3) Why color burst is transmitted along with other sync pulses?

(ii) To study vectroscope.

APPRATUS: PAL pattern generator, television, vectroscope, probes.

THEORY:

The LVS 585A Vectroscope provides a television probe plot of Pal chrominance signal. Its major use includes the measurement, matching, evaluation of composite video signal.
The vectroscope deals with the color aspects of the composite video signal only and ignores luminance (black and white, sync). It is designed to evaluate color using the standard color bar signal (75% amplitude, fully-saturated colors as per EIA RS-189A or SMPTE ECRI-1978 standards). Color bars form the basic color test signal. In addition to providing the means for monitoring the quality or the NTSC encoded color signal, the vectroscope is also a powerful tool for phase-matching video sources when setting up multiple-source systems.

WHAT THE VECTROSCOPE SHOWS

The subject of previous issues, the waveform monitor, is basically an oscilloscope. It draws a graph of voltage (up and down) versus time (from left to right). The vectroscope is quite different. It too draws a graph but this time the amplitude of the 3.58 MHz chroma signal is plotted as a radius whose amplitude is plotted outward from center screen and whose phase angle is measured around the circle much as time is marked off on a clock face. Engineers call this graph a polar plot. To get an idea of how a vectroscope works you need a gist of the concept of vectors. Vectors are also used to solve problem of two AC voltages that have the same frequency but differ in phase. In the NTSC .system, two-phase modulation is used to carry two color signals on the same 3.58 MHz subcarrier signal. Two modulators operating with subcarrier signals that are 90º apart in phase are fed with the color difference signals R-Y and B-Y. (Hold off on I and Q for a wee dab.) The outputs of the two modulators are simply added together and to find the resultant, a vector plot is made. Fig. 4.3 shows the basic vector diagram. It happens to be the same diagram that is plotted on the screen of the vectroscope. In the diagram, B-Y (blue subtracted from the luminance or Y signal) is plotted horizontally. The modulators are balanced and the carrier itself is suppressed so that positive values of the B-Y signal are plotted to the right (3 o'clock) and negative values, -(B-Y), to the left (9 o'clock). Subcarrier for R-Y signal is at 90º from the B-Y signal and is plotted at 90º as shown. Positive R-Y is up at 12 o'clock and negative R-Y is down at 6 o'clock. Okay, let's plot a color. For a simple illustration, we'll plot red and we'll ignore the complications that are applied for purely practical reasons. For fully saturated, 100% red R=1, B=0 and G=0. The Y and color difference signals then work out to Y=0.3*, R-Y=0.7 and B-Y=-0.3. If we lay out the amplitudes for R-Y and B-Y on the vector plot of Fig. 4.4:

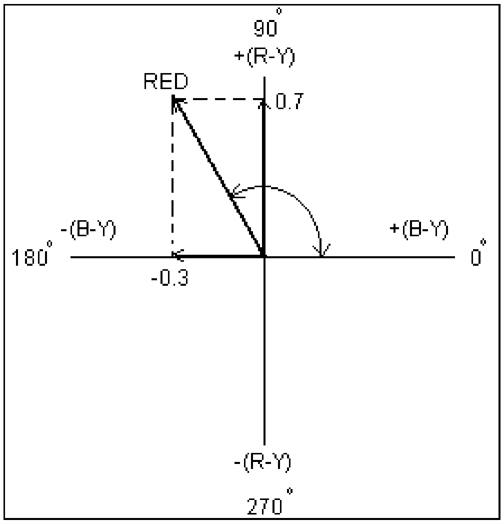

Fig 3.3 **RED plotted as a vector using B-Y and R-Y**

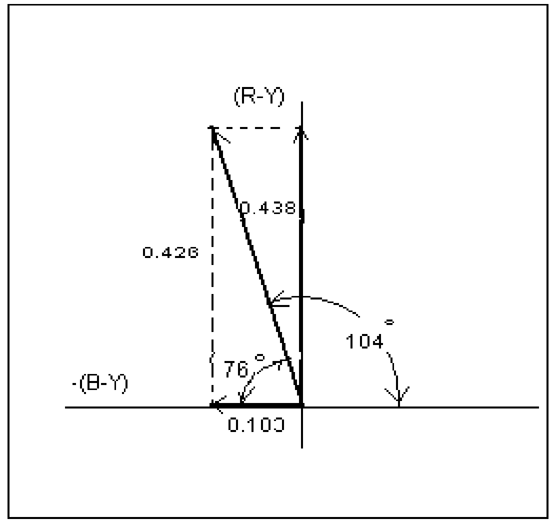

Fig 3.4 RED plotted using corrected simplified value for B-Y and R-Y

The complications alluded to earlier include attenuation factors for B-Y and R-Y to squash down the subcarrier signal and keep it within 100 IRE for most signals and to take care of the effects of setup which subtracts from the total available signal swing. When these corrections are applied, R-Y and B-Y for fully saturated 75% (amplitude) red turn out to be about 0.426 and 0.103 respectively. These are plotted in Fig. 4.4. Simple trigonometry allows the solution for the angles as shown. All angles are measured counter clockwise from zero, which by engineering convention starts at 3 o'clock, and this puts the red vector at 104º. So much for pencil drawings let the vectroscope do it. Fig. 4.4 shows how fully saturated 75% red appears on the screen of the vectroscope. The arrow tips of the pencil vector diagram shows up as a bright dot on the vectroscope. The dots are bright because they represent the signal dwelling at one value for a period of time. The signal for Fig. 4.4 is a full red raster so the vector remains at the same location for the entire active period of the raster. Somewhat dimmer dots show up at each of the colors for the color bar signal because the vectors stay at one location for the duration of each bar and repeat for ¾ th of each field for split-field bars.

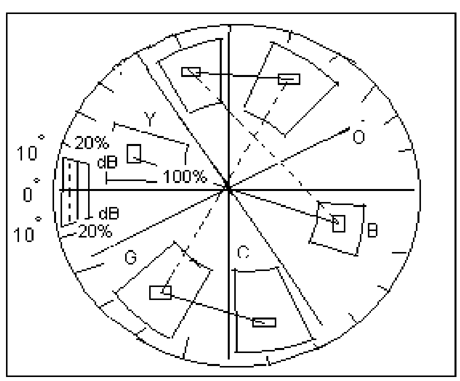

Fig 3.5 Red plots as a bright spot on the vectroscope

BURST

Burst also shows up as a vector (dot) on the vectroscope. It is the phase reference and subcarrier sample that the color decoder in the receiver or monitor uses to regenerate the carrier needed for the demodulation process. By convention, burst phase is at 180º, that is on the –(B-Y) axis at 9o'clock. Fig. 4.5 shows the burst vector at the indicated position. When viewing any NTSC signal, the front panel PHASE control is adjusted to put the burst vector at the position in Fig. 4.5. The graticule is also marked for proper burst amplitude (distance from the origin). The burst dot is somewhat dimmer because the vector stays at the value for a short time (the duration of the burst

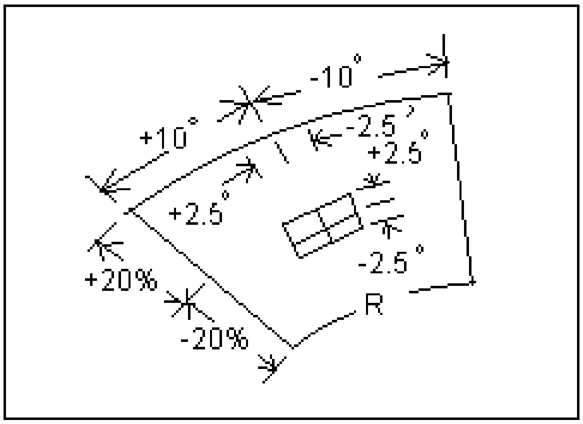

Fig 3.6 Detail of tolerances for the vectroscope targets

The standard color bar signal provides 8 colors if we include white and black. These are in order from left to right column white, yellow, cyan, green, magnets, red, blue, and black. White and black are balanced colors. That is, the color difference signals go to zero for neutral white, gray or black. There is no o/p from the encoder modulators in these cases. The 3.58 MHz sub carrier also goes to zero. The semi neutral gray, white or black has no effect on the vectroscope display. But the remaining colors the primaries, red, green and blue and the complements cyan, magenta and yellow all product vectors that can be plotted as was shown for red. The vectroscope plots these vectors and is basically a very simple device. It simply decodes the input composite signal into R-Y and B-Y components and applies them to X-Y display so that R-Y deflects the electron beam up and down, B-Y left and right. Its doing this job accurately that causes vectroscopes to be somewhat expensive. They require dedicated cathode ray tubes and precision decoders. Show tight and loose tolerances respectively. See fig. 4.6.The smaller boxes outline a spread of +/- 2.5° in phase and +/- 2.5 IRE units in amplitude. The larger boxes outline a spread of +/- 10° in phase and +/- 20% in amplitude. You can accept a camera's encoder as being accurate if its color bar signal puts each of vector dots in the smaller boxes.

FRONT PANEL CONTROLS

Fig. 3.7 Front Panel of vectroscope

(1) **Power switch:** Press to turn on power. The pilot lamp will light.

(2) **Horizontal centering:** Turn CW to move display center to the right. CCW to move to the left. Place display origin at Horizontal center of the graticule.

(3) **Vertical Centering:** turn CW to move display center upwards, CCW to move display downwards. Place display origin at the vertical center of the graticule.

(4) **Focus:** Adjust to maximum resolution in the display.

(5) **Astigmatism:** Connects astigmatism in the display. Adjust to correct spot shape at the display and at the ends of the vectors adjust simultaneously with FOCUS control for the best resolution at all points on the display.

(6) **INTEN:** Controls the brightness of the display.

(7) **UNCAL:** _LED lights when the GAIN control is not at the CAL'D setting.

(8) **GAIN control:** Adjust the amplitude of the selected (A or B) composite video signal applied to the decoder. When set fully CCW to the detented CAL'D setting and a 75 ohm terminator is used on the input connector, the vectroscope is adjusted correctly to display signals at the standard 1 V p-p level.

(9) **INPUT selectors (A,B, A CW):** Push-button selector selects the signals applied to the A or B rear panel inputs for vector display. The A CW button selects the A input but inserts an attenuator to permit standard level subcarrier signals to be displayed vector ally.

(10) **PHASE A,B, EXT CW:** push button selectors selects the input signal to be used as the phase reference for the output display. The choices are subcarrier burst separated from the signals applied to the signals applied to the A or B rear panel jacks, or CW subcarrier sample applied to the EXT CW jacks on the rear panel.

(11) **SATURATION:** push button sets internal gain to process 75% standard color bars (button out) or 100% color bars (button in).

(12) Note: Vector length is proportional to saturation in the Chroma signal. However it should be noted that the percentages identified with standard color bar signals rear to the amplitude of RGB signals at the input to the encoder. Both 75% and 100% color bars are fully saturated

(13) **TEST CIRCLE ON-OFF:** push in(ON) to unlock the internal sub carrier regenerator. Provides a test circle to check B-Y and R-Y gain balance as well as decoder quadrature-phase setting. Push again to release (button out) for normal operation.

(14) **PHASE:** Goniometer provides 360 continuous phase rotation for regenerated subcarrier or EXT CW subcarrier whichever has been selected as the phase reference for the vector display.

(15) **FUSE:** line fuse, 0.8A.

INITIAL SETUP: Set the LVS-5851a controls as follows:

(1) Vertical & Horizontal Position: Midrange
(2) Focus: Midrange
(3) Intensity: Fully Ccw
(4) Input: B (In)
(5) Phase: B (In)
(6) Amplitude: 75 %(Out)
(7) Scale: On (In)
(8) Test Circle: Off (Out)
(9) Power: On (In)

PROCEDURE:

(1) ON' all the instruments.
(2) Adjust centering control carefully to place the origin of the vector display.
(3) Check to see that the brightness spot that represents the size colors a centered in small
(4) Target boxes of the display, with phase lock from another channel.
(5) Press the OA push button. This signal fed to channel A into subcarrier generator in decoder circuit.
(6) Reset phase after seeing that.
(7) Turn gain control clockwise just out deflect poison. There is minimum gain setting.
(8) Check, rotate phase lock on the display.

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) What is the application of vectroscope?
(2) Why we get two phases for one color?
(3) Briefly explain the use of vectroscope for video camera.

EXPERIMENT –4

BLOCK DIAGRAM & FUNCTIONING OF LED TV REVEIVER

AIM: To study block diagram and functioning of LED TV receiver.

APPARTUS: LED television receiver kit.

THEORY:

Now a days, LCD (Liquid Crystal Display), TFT (Thin Film Transistor), CRT (Cathode Ray Tube), and Plasma displays are being used as screens to obtain the picture. All this displays are flat from the front side. The TV made from these types of displays are called Flat TVs. According to the transmission technology. The TV can be broadly divided into 2 categories; Analog TVs and Digital TVs.

The LED TV is Digital TV as shown in Fig. 4.1. The LED TV is a more advanced version of the LCD TV. While both types of TV rely on LCD technology and have flat-panel designs, the online review resource, "LED TVs are slimmer, brighter, and more detailed than your traditional LCD TV." LED TVs function by illuminating LCD panels with LED backlighting. However, not all LED TVs utilize the same type of LED backlighting.

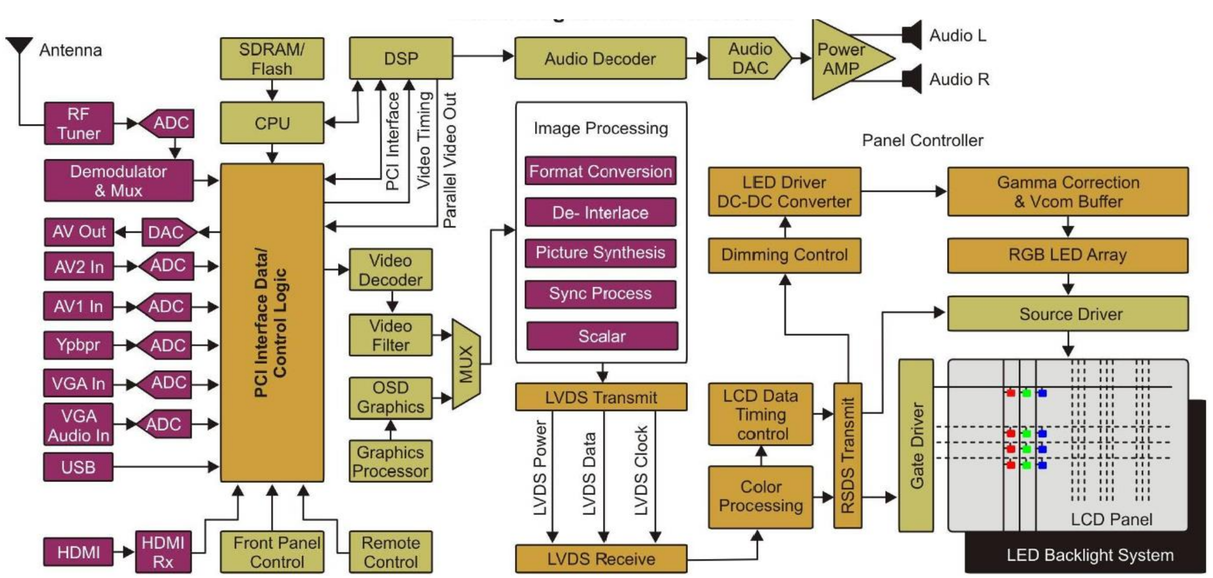

Fig. 4.1 Block diagram of LED TV receiver

The LED Television has two main boards:

1. SMPS Power supply board
2. Drive board

When the television is switched on, then the trigger voltage is out from the SMPS power supply board and given to 1st controller section. It switches on the coupler and supply is given to 2nd controller section. This section sent the supply to various sections.

The Drive board is consists of following sections:

1. PCI Interface Data / Control Logic Section:
    a. RF Tuner Section
    b. Audio Video Input Port
    c. YPbPr input port
    d. Audio Video Output Port
    e. VGA In Port
    f. VGA Audio In Port
    g. HDMI Port
    h. USB Port
2. Main Micro-Processor Section (SOC):
    A. Video Processing Section:
        a. Video Decoder (Analog TV Demodulator /TV Controller)
        b. Video Filter (Combo Filter)
        c. OSD Graphics
        d. Graphic Processor
    B. Image Processing Section:
        a. Format Conversion
        b. De-Interlacing
        c. Picture Synthesis
        d. Sync Process
        e. Scalar
3. Sub Micro-Processor Section:
    a. CPU
    b. SDRAM/ Flash Memory
    c. DSP
4. Audio Processor:
    a. Audio Decoder
    b. Audio DAC
    c. Audio Power Amplifier
5. Front Panel Control/ Remote control Section
6. LVDS Data Process/ Control Section:
    a. LVDS Transmit
    b. LVDS Receive
    c. Colour Processing
    d. LCD Data timing Control
    e. RSDS Transmit

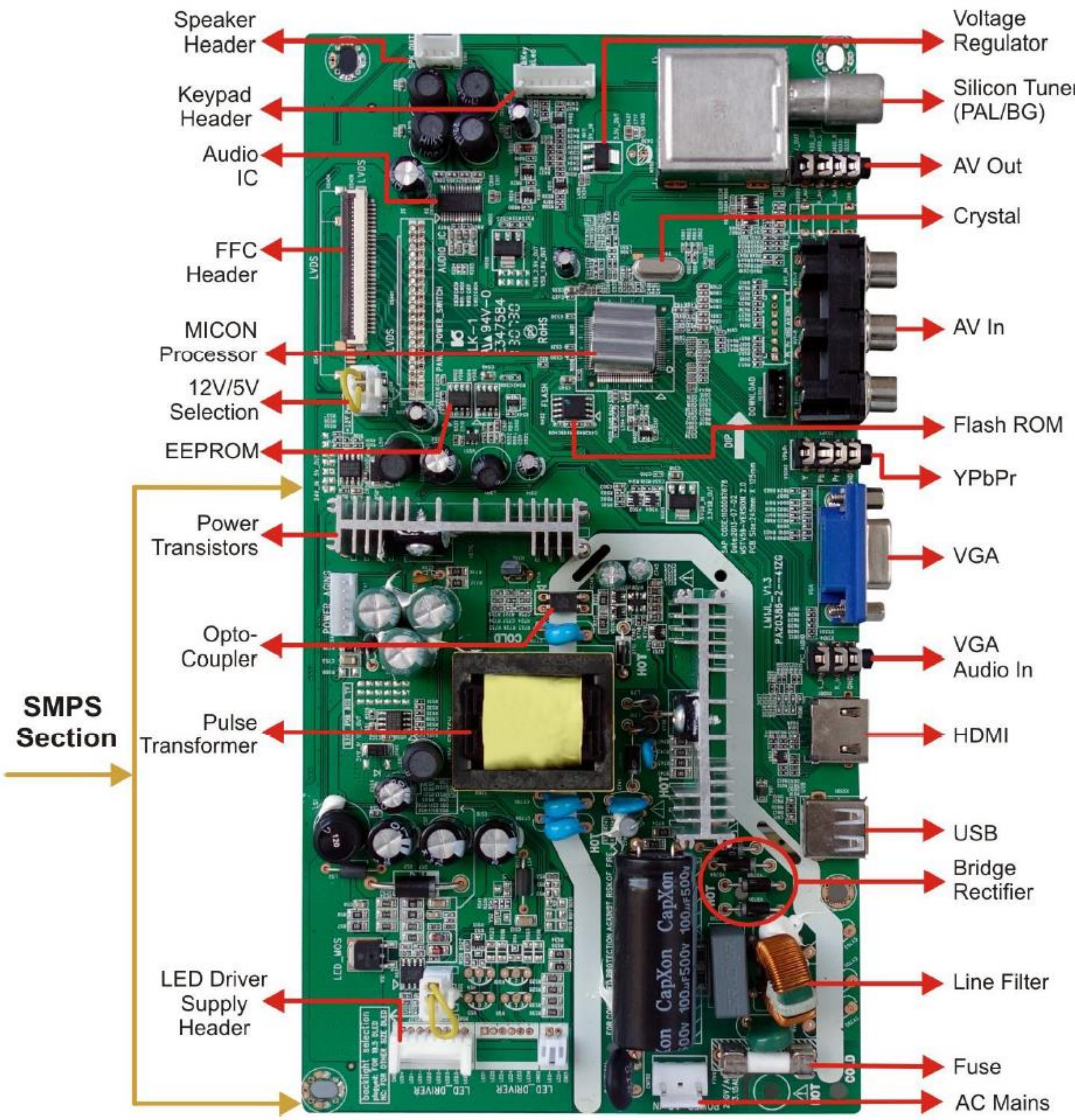

Fig. 4.2 SMPS and Driver board

7. LCD Panel Controller:
    a. LED Driver
    b. DC-DC Converter
    c. Dimming Control
    d. LED Backlight Driver
    e. Gamma Correction & Vcom Buffer
8. LCD Panel:
    a. RGB LED Array
    b. Gate Driver (Rows)
    c. Source Driver (Columns)
    d. LED Backlight system

1. **PCI Interface Data / Control Logic section:**
    a. **Tuner section (Antenna port):** The RF signals from antenna are received by RF Tuner. RF tuner process the RF signals to give SIF (Sound Intermediate Frequency) and CVS (Composite Video Signals) outputs. SIF signals are sent to Audio processor section and CVS signals are sent to Video processor/Peripheral controller section.
    b. **Audio/Video port:** Left and right signals coming from this port are sent to audio switching section and video signals from video port are sent to Video processor /Peripheral section.
    c. **Component (Y/Pb/Pr) video/audio port:** This port is used in NTSC and SECAM transmission system. Y/Pb/Pr signals coming in the form of components signals are separately given to the Video processor/Peripheral section.
    d. **PC Audio/Video Port (VGA):** The Red/Blue/Green signals coming in the form of PC video signals and the horizontal and vertical sync signals are sent to Video processor/Peripheral section. The left/right audio signals from PC are sent to audio switching section.
    e. **HDMI Port:** These signals are also sent to Video processor/Peripheral section and the left/right audio signals are sent to audio switching section.

2. Main Micro-Processor Section (SOC):

Video Processor/Peripheral section is the important part of the main logic card. With the help of this section the signals coming from all types of Input/output ports as mentioned above are interfaced with the next processing sections of the main logic card. These signals are sent to 3D Combo De-interlace scalar for scaling of the signals. The LVDS (Low Voltage Differential Signals) signals output from scalar is sent to LVDS drive board. During the scaling, Data bus signals, Address bus signals, and Control bus signals from DDR RAM section are shared for reading and writing of data. Video processor section gets the stored data from flash memory through main microcomputer and after scaling it is sent to drive board by display section. LVDS drive board amplifies the LVDS signals and sent them to LCD panel. Control signals from key boards are sent to key-bard controller section and then to video processor section and video processor section controls the attached peripheral devices according to the control signals.

The MediaTek MT8227 family is a Rich Multimedia TV product. It consists of an ATV frontend demodulator, a backend decoder and a TV controller and offers high integration for advanced applications. It combines a transport de-multiplexer, a high definition video decoder, an audio decoder, a dual-link LVDS transmitter, and an NTSC/PAL/SECAM TV decoder with a 3D comb filter (NTSC/PAL). The MT8227 enables consumer electronics manufactures to build high quality, low cost and feature-rich ATV products. The MT8227 supports Full-HD MPEG1/2/4/H.264/DivX/VC1/RM [option] video decoder standards and JPEG. The MT8227 also supports MediaTek MDDiTM de-interlace solution can reach very smooth picture quality for motions. A 3D comb filter added to the TV decoder recovers great details for still pictures. The special color processing technology provides natural, deep colors and true studio quality video.
Also, the MT8227 family has built-in high resolution and high-quality audio codec. The MT8227 family enables true single chip experience. It integrates high-quality HDMI1.4a, high speed VGA ADC, LVDS, and USB2.0 receiver.

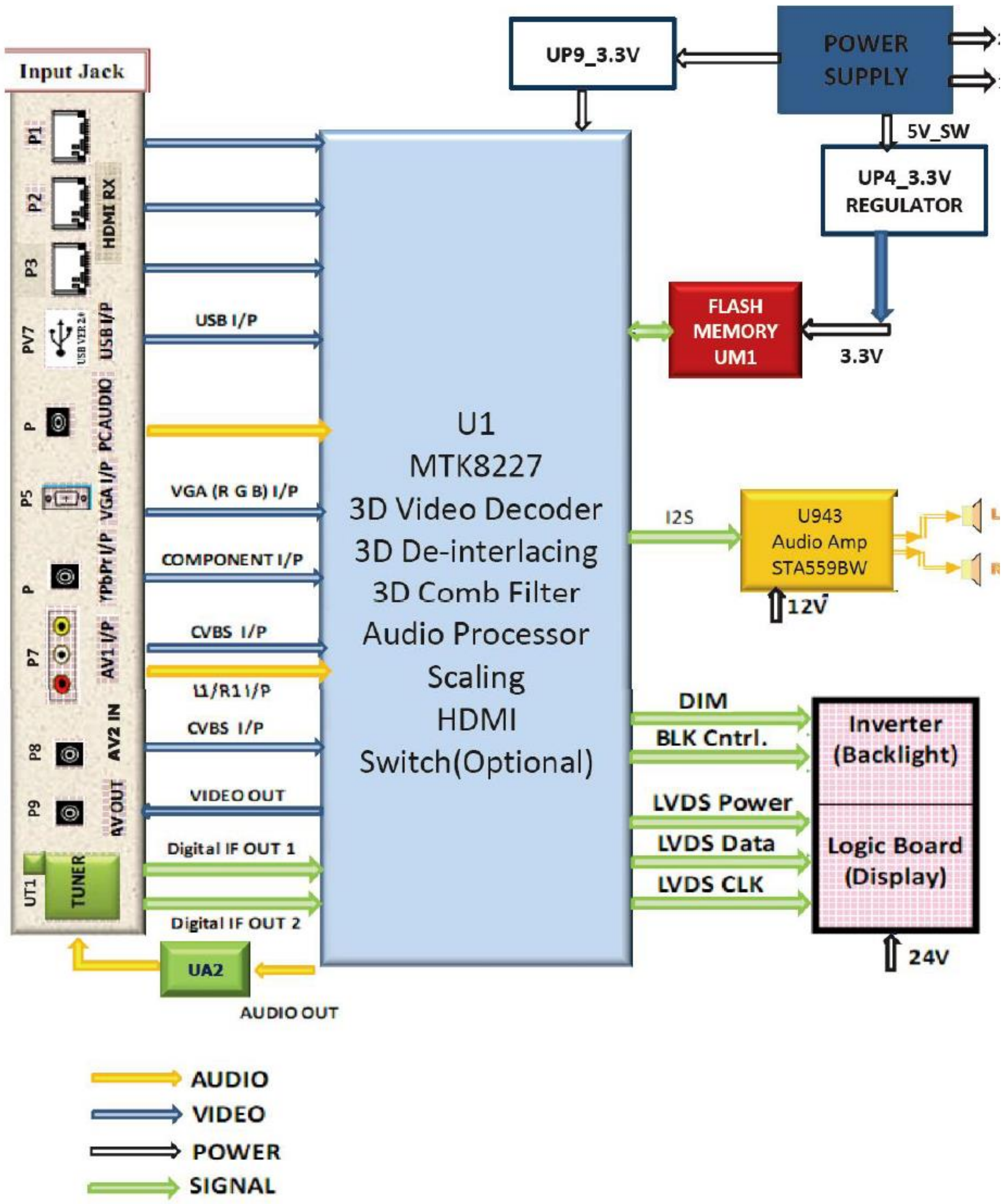

Fig. 4.3 Main Micro-Processor Section

3. Sub Micro-Processor Section:

In the internal structure of the microcomputer, it also has a Flash and a RAM memory. This section reads the data stored in the flash memory and sent it to video processor/peripheral section. This section also controls the transformation of RX and TX signals for RS232 Controller section. Main microcomputer section reads the data stored in EEPROM and sent to video processor. It also reads the changes in the TV function done by keyboard with the help of video processor and then writes it in EEPROM. The information of the peripherals connected to the input/output port of video processor is received by the main computer section and is sent to sub-microcomputer section

a. Flash memory section: The manufacturer company stores the name of the product, and its features in the flash memory. Main microcomputer section reads the information stored in it and sent it to video processor/peripheral section.
b. EEPROM section: this section stores the information related to the changes in the functions done by main microcomputer. Whenever the TV set is switched on, it reads the stored information in and set the functions as previous.

4. Audio Processor:

a. Audio Switching section: This section selects the audio signals from the multi audio input port and sent it to Audio processor.
b. Audio Processor section: This section converts the audio signals in to digital signals and controls the bits of the signal. It also converts the digital audio bit signals in to analog audio signals and sent it to audio amplifier section and left / right audio output port.
c. Audio Amplifier section: This section amplifies the audio signals received form audio processor and sent the left/right audio signals to speakers.

5. Front Panel Control / Remote control Section & Logic Board Driver Section:

Key Board Controller section: the signals coming from key board are converted in to serial data and sent to video processor section.

6. LVDS Data Process/ Control Section:

Microcontroller / LVDS Processor receive the Reset signals from Reset section and Control Bus signals from control bus section. LVDS signal scaling is done in Scaling section and RAM is used to read and write the data in it during scaling of signals. Chip select signals, Bank address signals. Write enable signals, Column address strobe signals, Row address enable signals, Clock signals and Clock enable signals are sent to write the data in RAM and Data and Address signals are also sent in the form of control signals. In the same way control signals are sent to read the data from RAM. Microcontroller / LVDS Processor perform the function of Scaling of the input LVDS signals and sent to LCD panel which in turn form the image according to the coming signals.

7. LCD Panel Controller:

There are large arrays of LEDs located behind the LCD panel in a typical LCD TV LED backlighting system as shown in Figure 1.In this array are a large number of parallel channels of LEDs connected in series depending on the size of the TV and the type of backlighting, for example edge backlighting (less LEDs but more in series) or direct backlighting (more LEDs in parallel).The LED voltage (VLED) is provided by the White LED Backlight Driver Board to each LED channel and is regulated to a level needed by the highest voltage required to maximize the light output of each LED string.

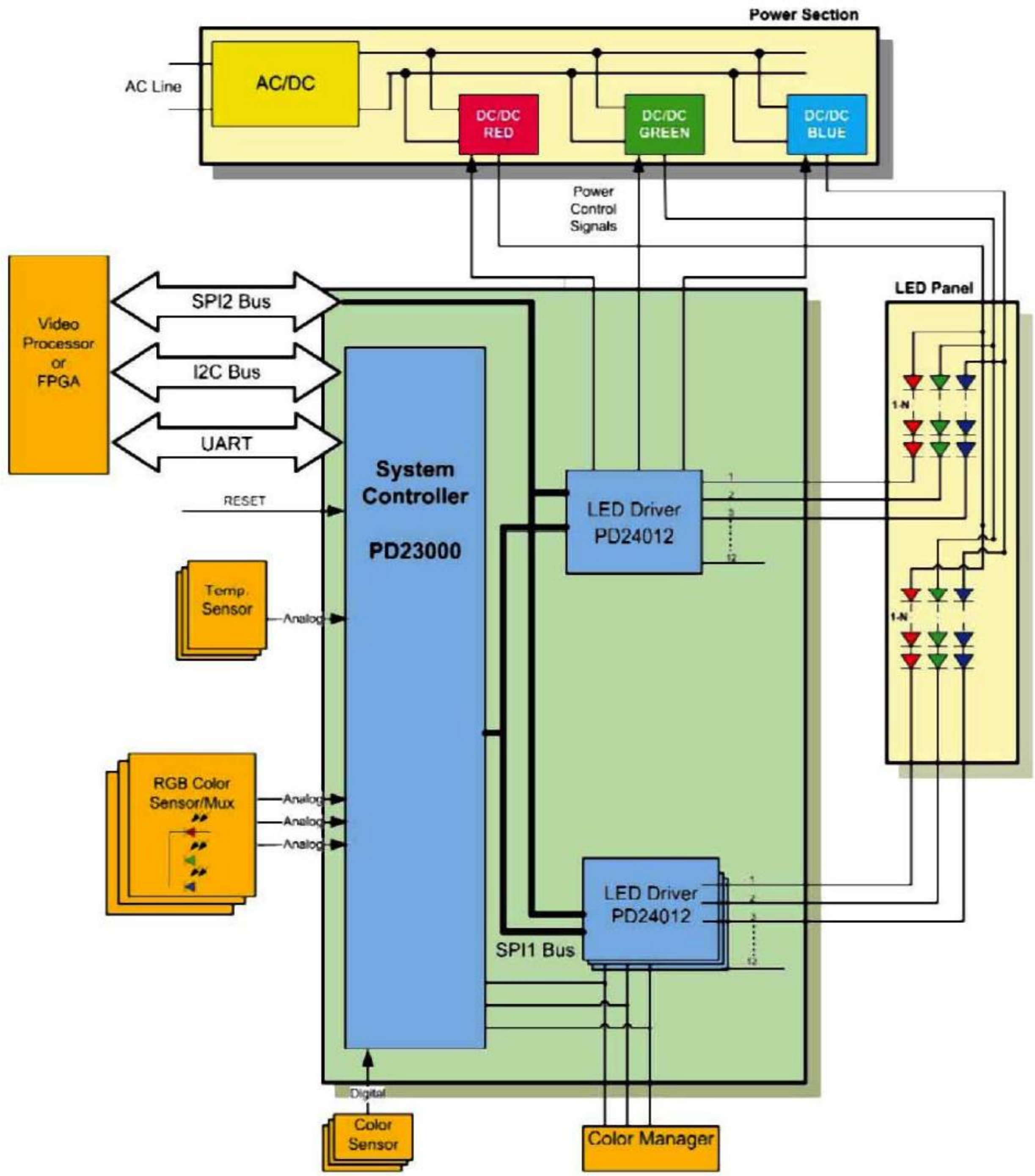

Fig. 4.4 LED driver for LCD TV Backlighting

Depending upon the power supply requirements determined by the number of LEDs in the string or grouping of parallel LED strings, the up-stream power source for the LED backlight driver board may be a DC/DC step-up boost converter, a DC/DC stepdown converter or more commonly an AC/DC converter. In the case where supply voltage is lower than the required VLED, a step-up boost converter will be used. In some systems it is desirable to maintain the operating LED voltage when the LED current sinks are OFF. When the LEDs are OFF, the voltage across the LED string decreases. When the LED string turns off, the current sink voltage will rise. Without a sample and hold technique, the LED voltage will regulate down in order to drive the current sink voltage to the regulation point even though the LED string is OFF. Since there is no power consumed when the LED string is off, regulating the current sink voltage during the OFF time of the LED string is unnecessary. A potentially unwanted effect of regulating the LED voltage during the OFF time is that additional time is necessary to establish the proper LED voltage when the current sink is turned back on as the LED voltage slews to the required voltage level. During this time, the current in the LED string will not be regulated and will tend to be less than the final desired LED current level.

8. LCD Panel:

Video Drive section is used to drive the LCD panel. The function of this drive board is to drive or switch on and off the sub-pixels (RGB) which are arranged in the form of matrix in LCD panel.
Video Drive board has the following sections:

a. Voltage Regulator section
b. Microcontroller section
c. RAM section
d. EPROM section and Controller section
e. Boost Controller section
f. LCD Panel Controller section

Video Drive section receives LVDS (Low Voltage Differential Signals), PWM (pulse Width Modulation) Dimming signals, ANA Dimming signals and Vcc (+5V) supply from main Logic card. +5V supply is sent to regulator circuits for generating 3.3V and 2.5V supply and sent to all the section of drive board. +5V supply is also sent to Boost supply section.

Boost supply section provides the Drive signals and Boost voltage and these are sent to Boost Drive Controller Stage and LCD Panel. Boost drive Controller section perform the switching on the basis of Drive signals coming from Boost supply section. High voltages are generated due to the switching action of Boost controller section which is sent to LCD panel. SDA (Serial Data) and SCL (Serial Clock) signals are generated according to the ANA Dimming, PWM dimming signals and Enable signals revived from Main Logic Card. When it receives the Control Bus signals, the Enable signals generates the Controlled voltage which controls the brightness of LCD panel.

Boost Supply section sent the voltage to LCD panel and Gamma correction circuit sent the biasing voltage to LCD panel. Inside the LCD panel, Driver circuits are used to drive the Rows and Columns of pixels. According to the received LVDS signals from Video drive section, the driver circuits control the on and off switching of sub pixels RGB (Red, Blue, Green) and the color image is formed on the LCD screen.

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) Differentiate LED TV and CRT based TV.

(2) What is aspect ratio in PAL system?
(3) What is TFT LCD?
(4) Hod do the LCD panel works?

EXPERIMENT –5

STUDY OF POWER SYPPLY SECTION

AIM: To study and measure voltages of power supply section in LED TV.

APPARTUS: LED Television Receiver kit. Pattern Generator, RF cable, Digital Multimeter

THEORY:

The mains AC supply voltage is sent to serge voltage protector section where the serge voltage removed and the phase neutral output is given to the noise filter section As shown in Fig.5.1. Noise filter section removes the interference and the Phase neutral output is given to line filter section. Line filter removes the unwanted signals for phase and neutral supply and the output is given to bridge rectifier section. Bridge rectifier circuit converts the AC supply in to DC supply. The output of the bridge rectifier section is given to filter section for filtering and storing. The negative supply output of the bridge rectifier is known as floating negative and shown by horizontal cut section lines. The positive and negative output supply from bridge rectifier is sent to all three main section; DC controller section, Starter section and SM controller section. But first of all starter section is started.

Starter transformer gets the supply input through the fuse. Positive supply is sent through starter transformer to oscillator, switching and error amplifier sections. The signals generated from this section are switched through starter transformer and due to mutual inductance the secondary voltages are generated at the secondary windings of the starter transformer and sent to rectifier and filter section. The output supply from this section is standby supply voltage +5V. The standby supply is sent to voltage controller section. It checks the voltage for its value, if the voltage is more than the required, it switch on the coupler section and the information is given to error amplifier. Error amplifier controls the oscillator section according to error and makes the standby voltage stable. Stable Stand by voltage is sent to Main logic card.

When the television is switched on, then the trigger voltage is out from the power supply (PS_ON) pin and given to 1st controller section. It switches on the coupler and supply is given to 2nd controller section. This section sent the supply to various sections

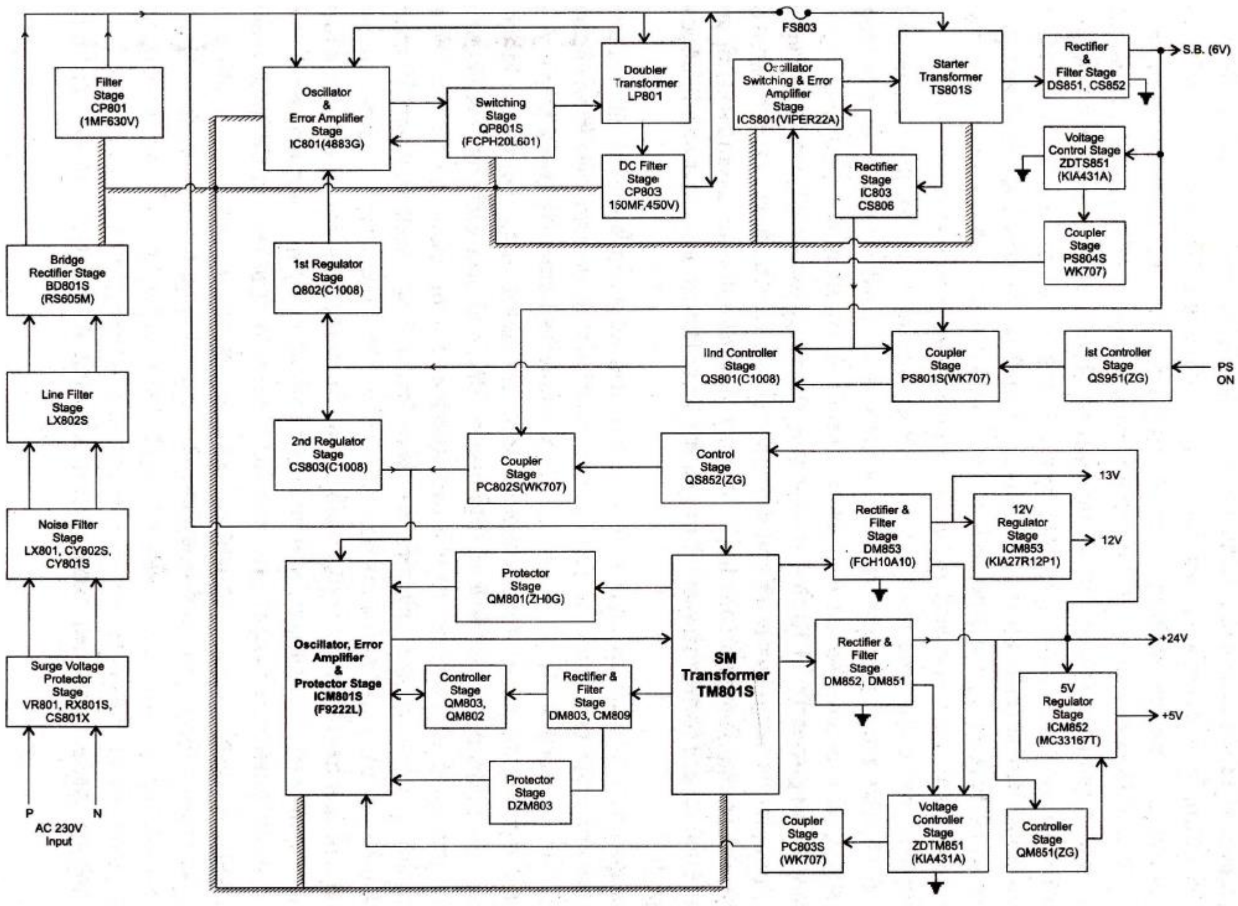

Fig. 5.1 Block Diagram of Power Supply

MEASUREMENT OF VOTAGES AT DIFFERENT TEST POINTS

Test Point	Supply	Description
1.	+25 - 32V	LED1+ : Driver Supply for LED Panel
2.	+12 - 16V	Boost Supply for Drive Controller Stage
3.	+12 - 16V	+12 - 16V Supply for Gamma Correction Stage
4.	0V	LED-: Ground for Driver Supply
5.	+12V	Power input to Sound Amplifier
6.	+18 - 20V	Power input to Bus Driver
7.	+5V	Power input for Stand By operation
8.	+3.3V	Power input to Tuner circuit
9.	+1.5 - 2V	Power input to Processor
10.	+3.3V	Power input to DRAM section

PROCEDURE:

(1) Connect the mains cord to the unit and keep the switch to ‘off’ position till all the connections are carried out correctly and properly..
(2) Check that all the switch faults on Scientech 2651A Main board unit are in ‘off’ position.
(3) Connect pattern generator to LED TV receiver using RF cable.
(4) Switch on pattern generator and select the TV mode to operate it with LED Television in the tray.
(5) Now switch on Scientech 2651A Main board unit. 6. Press ‘Stand By’ key of Front Panel Control section of Scientech 2651A to start the LED Television.
(6) Video output of pattern generator will start to display at LED Display screen.
(7) Use Remote Control functions accordingly as and when required.
(8) Measure the voltages of Power supply section at different test points

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) What is the use of power supply section in LED TV?
(2) Compare CCFL and LED backlight technologies?
(3) Enlist the advantages of LED TV.

EXPERIMENT –6

OBSERVE SIGNALS OF DIFFERENT SECTION OF LED TV

AIM: To study observe waveforms/signals of different sections of LED television

APPARTUS: LED Television Receiver kit, Pattern Generator, RF cable, DVD/CD Player, AV cable, CPU, VGA cable, USB source (pen drive), CRO probe, Oscilloscope.

THEORY:

The LED TV receives the audio and video signal simultaneously from the different sources like. AV source, RF source, VGA source, Ypbpr source, USB source and HDMI source. The different sources provides audio and video information in diffent format to TV receiver. All sections of LED TV receiver play their important roal to process the differ form of audio and video signal simultaneously. The signaling of LED receiver can be study by observing the characteristic of the signal provided from the different sources on the board. Audio/Video input section connects the AV signal to speaker. LED display interface section carries the LVDS signals (Low Voltage Differential Signals) from mother board to LED display. VGA section connects the VGA output from PC to LED Display therefore LED display can be used as a PC monitor. When LED TV is used as a PC monitor and a VGA output is connected to VGA In port of TV, along with this 'Line out' is also to be connected to VGA Audio In socket of Multimedia in/out section. This will connect the Audio signal from PC to LED Television. Audio/ Video output section provides the same signal to connect to another TV. Y, Pb and Pr components signal can be given through the Ypbpr in port. The USB source is connected to TV through USB port to transfer USB data. HDMI signal can be connected to HDMI port. The tuner section is used to connect RF signal at television.

Different section and their test points

Audio/Video input section:

- Audio L input for Left Speaker
- Audio R input for Right Speaker
- Composite Video input signal

LED Display Interface section:

Interfacing between the drive board and the LED display unit is carried out using a 30 pin FFC cable. It carries the LVDS signals (Low Voltage Differential Signals) from mother board to LED display. Following are some Signals to observe.

- VCC – LVDS Power supply input
- O3P – LVDS Data signal for Channel 3 (+ve)
- O3N – LVDS Data signal for Channel 3 (-ve)

- OCKP – LVDS Clock signal (+ve)
- OCKN – LVDS Clock signal (-ve)
- O2P – LVDS Data signal for Channel 2 (+ve)
- O2N – LVDS Data signal for Channel 2 (-ve)
- O1P – LVDS Data signal for Channel 1 (+ve)
- O1N – LVDS Data signal for Channel 1 (-ve)
- O0P – LVDS Data signal for Channel 0 (+ve)
- O0N – LVDS Data- signal for Channel 0 (-ve)

VGA in port: This section can be studied when a VGA output from PC is given to this port and the LED display is to be used as a PC monitor. Connect a VGA pin form PC to the VGA In port of Scientech 2651A unit. Press TV/AV key and use CH+/CH- to select the VGA option, press VOL+ to enter. Now observe the signals at the test points as follows:

11. Red video signal
12. Green video signal
13. Blue video signal
14. Horizontal Sync signal
15. Vertical Sync signal
16. VGA Audio (L) Input
17. VGA Audio (R) Input
18. Ground (VGA Audio)

Ypbpr In: When Ypbpr signals are connected to this port observe the following signals at the test points.

19. Y component
20. Pb component
21. Pr component

Audio/Video Output section: When Audio/Video inputs are connected form a DVD player then the same signals can be taken out form this port to connect to another TV

- Audio L output for Left Speaker
- Audio R output for Right Speaker
- Composite Video output signal

USB In: When USB flash drive is connected to this port observe the following signals at the test points.

- +5V supply to USB
- USB Data- signals
- USB Data+ signals
- Ground

PROCEDURE:

(1) Connect the mains cord to the unit and keep the switch to ‘off’ position till all the connections are carried out correctly and properly.
(2) Check that all the switch faults on Scientech 2651A Main board unit are in ‘off’ position.
(3) Connect Audio/Video input sockets of Scientech 2651A to the respective Audio and Video sockets of a DVD/CD player using the Audio/Video cable.
(4) Switch on the DVD/CD player and insert a DVD/CD of a select the AV mode to operate it with LED Television in the tray.
(5) Switch on Scientech 2651A Main board unit.
(6) Press ‘Stand By’ key of Front Panel Control section of Scientech 2651A to start the LED Television.
(7) Press TV/AV key to select the operating mode and use ‘CH+’ key to select ‘AV1’ option and ‘VOL+’ key to enter.
(8) Video output of DVD will start to display at LED Display screen. Play the video from DVD player.
(9) Use ‘VOL+’/ ‘VOL-’ keys of Front Panel Control of Scientech 2651A to set the volume.
(10) Use Remote Control functions accordingly as and when required.
(11) Observe the waveforms/signals of different sections at test.

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) Compare NTSC and PAL system in the terms of audio and video signal
(2) What is the input signal and output signal of Set-up box?
(3) To connect DVD/ CD player with TV, Which port of TV receiver is used?

EXPERIMENT –7

SWITH FAULTS AND TROUBLESHOOTING IN DIFFERENT SECTION OF LED TV

AIM: To study of switch faults and troubleshooting in different sections of LED Television

APPARTUS: LED Television Receiver kit, Pattern Generator, RF cable, DVD/CD Player, AV cable, CPU, VGA cable, USB source (pen drive), CRO probe, Oscilloscope, Multi-meter.

THEORY: Fault finding and troubleshooting is very import skill to restore system operation for audio video engineer. In order to observe the effect of fault on system, Different switches are provided in the different sections by manufacturer. The fault is created by turning on the switch in any section. By turing on and off switch, User can observed the effect of fault on the TV operation.

Creation of Switch Faults and troubleshooting:

Switch Fault – Sw1: Power Supply section

1. Switch the Fault 1.1 to ‘on’ position. Observe that the LED Television stops to show the video display but audio signals can be heard. This fault causes to disconnect the +25-32V Driver Power supply to LED1+ channel. Check the signal at Test point 1 of this section. Observe the difference in signal by switching the Fault 1.1 to ‘off’ position.

2. Switch the Fault 1.2 to ‘on’ position. Observe that the LED Television stops to show the video display but audio signals can be heard. This fault causes to disconnect the +12-16V Driver Power supply to LED2+ channel. Check the signal at Test point 2 of this section. Observe the difference in signal by switching the Fault 1.2 to ‘off’ position.

3. Switch the Fault 1.3 to ‘on’ position. Observe that the LED Television stops to show the video display but audio signals can be heard. This fault causes to disconnect the +12-16V Driver Power supply to LED3+ channel. Check the signal at Test point 3 of this section. Observe the difference in signal by switching the Fault 1.3 to ‘off’ position.

4. Switch the Fault 1.4 to ‘on’ position. Observe that the LED Television stops to show the video display but audio signals can be heard. This fault causes to disconnect the common ground of Driver Power supply (LED-). Check the signal at Test point 4 of this section. Observe the difference in signal by switching the Fault 1.4 to ‘off’ position

Switch Fault – Sw2: Audio/Video Input section

1. Switch the Fault 2.1 to ‘on’ position. Observe that the LED screen stops to show the playback video. This fault causes to disconnect the video input signal to drive board. Without any video signal LED Display stops to function. Check the video signal at ‘Video’ test point of this section. Observe the difference by switching the Fault 2.1 to ‘off’ position.

2. Switch the Fault 2.2 to ‘on’ position. Observe that the LED television stops to give the Left speaker output. This fault causes to disconnect the Audio L input signal to drive board. Check the Audio signal at ‘Audio L’ test point of this section. Observe the difference by switching the Fault 2.2 to ‘off’ position.

3. Switch the Fault 2.3 to ‘on’ position. Observe that the LED television stops to give the Right speaker output. This fault causes to disconnect the Audio R input signal to drive board. Check the Audio signal at ‘Audio R’ test point of this section. Observe the difference by switching the Fault 2.3 to ‘off’ position. 4. Switch the Fault 2.4 to ‘on’ position. This fault causes to disconnect the common ground signal of Audio/Video source to LED Display logic board. Without proper ground the picture/audio quality reduces. Observe the difference in picture by switching the Fault 2.4 to ‘off’ position. (Note: in some case the variation may not be observed if both Source and TV have common ground source.

Switch Fault – Sw4: Audio/Video Output port AV Out:

When Audio/Video inputs are connected form a DVD player then the same signals can be taken out form this port to connect to another TV.

1. Switch the Fault 4.1 to ‘on’ position. Observe that the AV Out port stops to give the audio output at Left speaker. This fault causes to disconnect the Audio L output signal from AV Out port. Check the Audio signal at ‘Audio L Out’ test point of this section. Observe the difference by switching the Fault 1 to ‘off’ position.

2. Switch the Fault 4.2 to ‘on’ position. Observe that the AV Out port stops to give the audio output at Right speaker. This fault causes to disconnect the Audio R output signal from AV Out port. Check the Audio signal at ‘Audio R Out’ test point of this section. Observe the difference by switching the Fault 2 to ‘off’ position.

3. Switch the Fault 4.3 to ‘on’ position. Observe that the AV Out port stops to give the Video output to the other television. This fault causes to disconnect the video output signal from AV Out port. Check the video signal at ‘Video Out’ test point of this section. Observe the difference by switching the Fault 4.3 to ‘off’ position.

4. Switch the Fault 4.4 to ‘on’ position. This fault causes to disconnect the common ground signal form Audio/Video source to connected device. Without proper ground the picture/audio quality reduces. Observe the difference in picture by switching the Fault 4.4 to ‘off’ position. (Note: in some case the variation may not be observed if both Source and TV have common ground source

Switch Fault – Sw5: VGA In port

This section can be studied when a VGA output from PC is given to this port and the LED display is to be used as a PC monitor. Connect a VGA pin form PC to the VGA In port of Scientech 2651A

Main board unit. Press TV/AV key and use CH+/CH- to select the VGA option, press VOL+ to enter.

1. Switch the Fault 5.1 to ‘on’ position. Observe that the color contrast of the playback video changes. This fault causes to disconnect the Red video input signal to VGA In port. Check the Red video signal at ‘11’ test point of this section. Observe the difference by switching the Fault 5.1 to ‘off’ position.

2. Switch the Fault 5.2 to ‘on’ position. Observe that the color contrast of the playback video changes. This fault causes to disconnect the Green video input signal to VGA In port. Check the Green video signal at ‘12’ test point of this section. Observe the difference by switching the Fault 5.2 to ‘off’ position.

3. Switch the Fault 5.3 to ‘on’ position. Observe that the color contrast of the playback video changes. This fault causes to disconnect the Blue video input signal to VGA In port. Check the Blue video signal at ‘13’ test point of this section. Observe the difference by switching the Fault 5.3 to ‘off’ position.

VGA Audio In:

When LED TV is used as a PC monitor and a VGA output is connected to VGA In port of TV, along with this ‘Line out’ is also to be connected to VGA Audio In socket of Multimedia in/out section. This will connect the Audio signal from PC to LED Television. Following effect of switch faults can be observed for this port.

6. Switch the Fault 5.6 to ‘on’ position. Observe that the LED Television stops to give the audio output at Left speaker. This fault causes to disconnect the Audio L input signal to VGA Audio In port. Check the Audio signal at ‘16’ test point of this section. Observe the difference by switching the Fault 5.6 to ‘off’ position.

7. Switch the Fault 5.7 to ‘on’ position. Observe that the LED Television stops to give the audio output at Right speaker. This fault causes to disconnect the Audio R input signal to VGA Audio In port. Check the Audio signal at ‘17’ test point of this section. Observe the difference by switching the Fault 5.7 to ‘off’ position.

Switch Fault – Sw6: USB In

When USB flash drive is connected to this port observe the following signals at the test points.

1. Switch the Fault 6.1 to ‘on’ position. Observe that the USB flash drive stops to function. This fault causes to disconnect the +5V signal from USB port. Check the +5V signal at ‘+5V’ test point of this section. Observe the difference by switching the Fault 6.1 to ‘off’ position.

2. Switch the Fault 6.2 to ‘on’ position. Observe that the USB flash drive stops to function. This fault causes to disconnect the USB Data- signal from USB port. Check the USB Data- signal at D-’ test point of this section. Observe the difference by switching the Fault 6.2 to ‘off’ position.

3. Switch the Fault 6.3 to ‘on’ position. Observe that the USB flash drive stops to function. This fault causes to disconnect the USB Data+ signal from USB port. Check the USB Data+ signal at D+’ test point of this section. Observe the difference by switching the Fault 6.3 to ‘off’ position.

4. Switch the Fault 6.4 to ‘on’ position. Observe that the USB flash drive stops to function. This fault causes to disconnect the ground signal from USB port. Observe the difference by switching the Fault 6.4 to ‘off’ position.

Switch Fault – Sw7: LED Display Interface section

1. Switch the Fault 7.1 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Data (+ve) for CH3 input signal (O3P) to LED Display logic board. Without proper data information the picture quality reduces. Observe the difference in the picture by switching the Fault 7.1 to ‘off’ position.

2. Switch the Fault 7.2 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Data (-ve) for CH3 input signal (O3N) to LED Display logic board. Without proper data information the picture quality reduces. Observe the difference in picture by switching the Fault 7.2 to ‘off’ position.

3. Switch the Fault 7.3 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Clock (+ve) input signal (OCKP) to LED Display logic board. Without proper clock information the picture quality reduces. Observe the difference in picture by switching the Fault 7.3 to ‘off’ position.

4. Switch the Fault 7.4 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Clock (-ve) input signal (OCKN) to LED Display logic board. Without proper clock information the picture quality reduces. Observe the difference in picture by switching the Fault 7.4 to ‘off’ position.

5. Switch the Fault 7.5 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Data (+ve) for CH2 input signal (O2P) to LED Display logic board. Without proper data information the picture quality reduces. Observe the difference in the picture by switching the Fault 7.5 to ‘off’ position.

6. Switch the Fault 7.6 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Data (-ve) for CH2 input signal (O2N) to LED Display logic board. Without proper data information the picture quality reduces. Observe the difference in picture by switching the Fault 7.6 to ‘off’ position.

7. Switch the Fault 7.7 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Data (+ve) for CH1 input signal (O1P) to LED Display logic board. Without proper data information the

picture quality reduces. Observe the difference in the picture by switching the Fault 7.7 to ‘off’ position.

8. Switch the Fault 7.8 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Data (-ve) for CH1 input signal (O1N) to LED Display logic board. Without proper data information the picture quality reduces. Observe the difference in picture by switching the Fault 7.8 to ‘off’ position.

9. Switch the Fault 7.9 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Data (+ve) for CH0 input signal (O0P) to LED Display logic board. Without proper data information the picture quality reduces. Observe the difference in the picture by switching the Fault 7.9 to ‘off’ position.

10. Switch the Fault 7.10 to ‘on’ position. Observe that the playback video quality is reduced / video display goes off at Television receiver screen. This fault causes to disconnect the LVDS Data (-ve) for CH0 input signal (O0N) to LED Display logic board. Without proper data information the picture quality reduces. Observe the difference in picture by switching the Fault 7.10 to ‘off’ position.

PROCEDURE:

(1) Connect the mains cord to the unit and keep the switch to ‘off’ position till all the connections are carried out correctly and properly.
(2) Check that all the switch faults on Scientech 2651A Main board unit are in ‘off’ position.
(3) Connect Audio/Video input sockets of Scientech 2651A to the respective Audio and Video sockets of a DVD/CD player using the Audio/Video cable.
(4) Switch on the DVD/CD player and insert a DVD/CD of a select the AV mode to operate it with LED Television in the tray.
(5) Switch on Scientech 2651A Main board unit.
(6) Press ‘Stand By’ key of Front Panel Control section of Scientech 2651A to start the LED Television.
(7) Press TV/AV key to select the operating mode and use ‘CH+’ key to select ‘AV1’ option and ‘VOL+’ key to enter.
(8) Video output of DVD will start to display at LED Display screen. Play the video from DVD player.
(9) Use ‘VOL+’/ ‘VOL-’ keys of Front Panel Control of Scientech 2651A to set the volume.
(10) Use Remote Control functions accordingly as and when required.
(11) Observe the effect on the operation of TV with faults and without faults

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) What is the output of remote control?
(2) What is LVDS signal?
(3) State True/False with justification. “Composite video signal can be display by LED TV.”

EXPERIMENT –8

MICROPHONES

AIM: To study working principle and characteristics of various microphones.

THEORY:

Microphone is the most critical element in the recording chain. Any sound that is to be recorded has to pass through the microphones. A microphone is a transducer that converts acoustic energy to electrical energy. There are many types of microphones which are available in market.

1. MOVING COIL MICROPHONES/DYNAMIC MICROPHONES

CONSTRUCTION

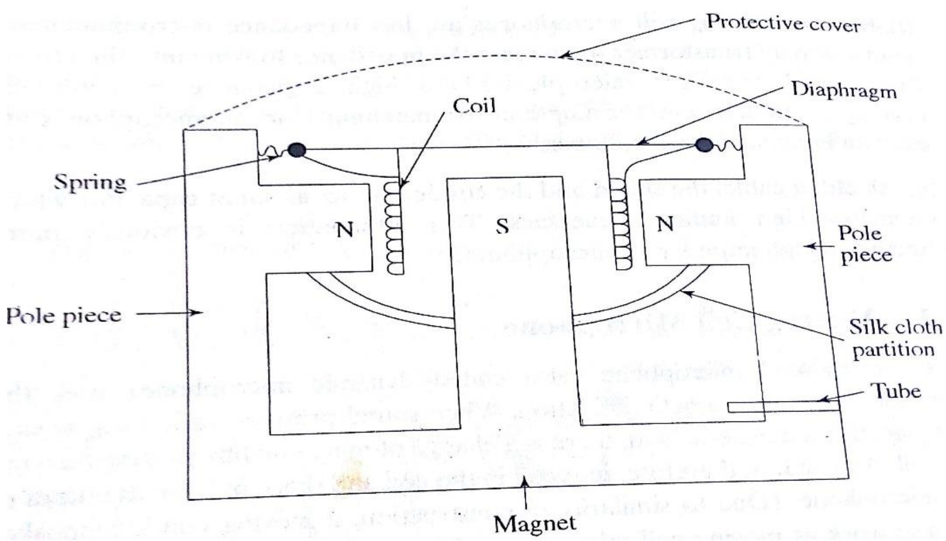

Fig. 8.1 Cross section view of dynamic microphone

As shown in fig 8.1, the main components of a moving coil microphone are magnet, diaphragm and coil. The magnet is a permanent magnet of pot type with central pole piece (South Pole) and the peripheral piece (North Pole). This type of magnet gives a uniform magnetic field in the air gap between the pole pieces.

Diaphragm is a thin circular sheet of nonmagnetic material and is of light weight .It is slightly domed for extra rigidity; It is fixed to the body of the magnet with the help of springs. The spring provides compliance to the motion of diaphragm. Mass of the diaphragm and coil assembly provides inductive effect. Coil is wound on a cardboard cylinder which is attached to the diaphragm. The coil is single layered thin enameled wire. A protective cove is used to save the delicate diaphragm and coil assembly from being mishandled. A silk cloth partition is used to separate the upper chamber from lower chamber. A small tube is used in the lower chamber to high audio frequency output.

WORKING

Moving coil microphone uses the principle of electromagnetic induction. When sound strikes the diaphragm, it moves a coil in and out, which is placed in the magnetic field. This motion changes the flux through the coil which results in emf being induced in the coil due to electromagnetic induction. The value of the emf depends on the rate of the change of flux and hence on the motion of the coil and this emf forms output of microphone.

CHARACTERISTICS

(1) **Sensitivity:** 30 μV for sound pressure level of 0.1 Pa.
(2) **Signal to noise ratio:** 30 dB
(3) **Frequency response:** 60 Hz to 8000Hz for ±1 dB. It has natural resonance 3 to 4 kHz.
(4) **Distortion:** Less than 5%
(5) **Directivity:** It is omnidirectional.
(6) **Output impedance:** It is quite low about 25Ω

APPLICATIONS

It is used in Public Address system. It is suitable for the group orchestra in cardioid form.

2. RIBBON MICROPHONE

CONSTRUCTION

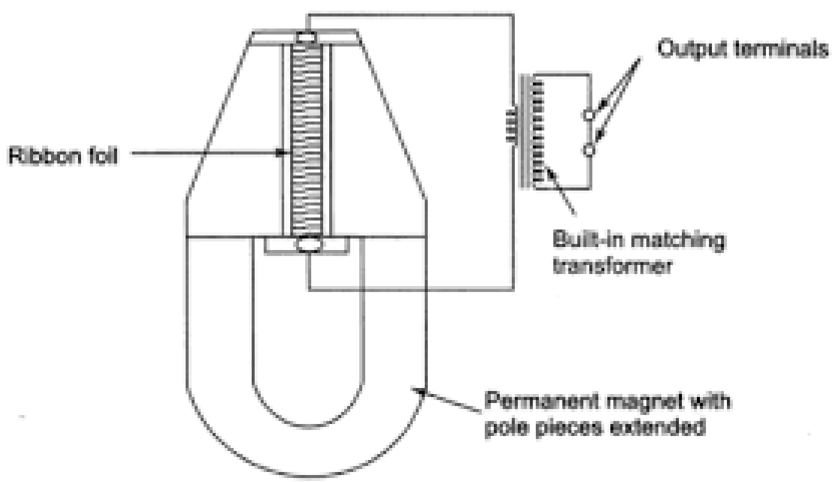

Fig. 8.2 Construction of ribbon microphone

As shown in fig 8.2, the main parts of a ribbon microphone are permanent magnet and ribbon conductor. The permanent magnet is specially designed horse shoe magnet with extended pole pieces. It provides strong magnetic field.

The ribbon is light aluminum foil. It is corrugated at the right angles to its length to provide greater surface area. The main feature is lightness of the ribbon. It is suspended in the magnetic field of the permanent magnet and the stiffness of the suspension is small. The whole unit is enclosed in a circular of rectangular baffle.

The lightness of the ribbon guarantees a flat frequency response for mid and high frequencies up to 14kHz. It resonates at very low frequencies (around 40Hz). It is very delicate and well suited for the recording of acoustic Instruments.

WORKING

In moving coil microphone, high frequency response is poor because of the mass of the diaphragm. Mechanical mass is equivalent to the electrical inductance and this attenuates the high frequencies. To increase the high frequency response for audio frequencies, very light aluminum ribbon is used in the place of diaphragm and coil assembly. The ribbon acts as conductor as well as diaphragm. Such a microphone is called ribbon microphone.

CHARACTERISTICS

(1) **Sensitivity:** It is 3 μV for sound pressure level of 0.1 Pa. It is less than moving coil microphone.
(2) **Signal to noise ratio:** 50 dB so it is suitable for high fidelity systems.
(3) **Frequency response:** 20 Hz to 12000Hz for ±1 dB. It has natural resonance below 20Hz.
(4) **Distortion:** Low about 1%
(5) **Directivity:** It is bidirectional and its polar pattern is Fig. of eight.
(6) **Output impedance:** It is quite low about 0.25Ω

APPLICATIONS

It is used in drama, music. It is suitable for the group orchestra in cardioid form.

3. CARBON MICROPHONE

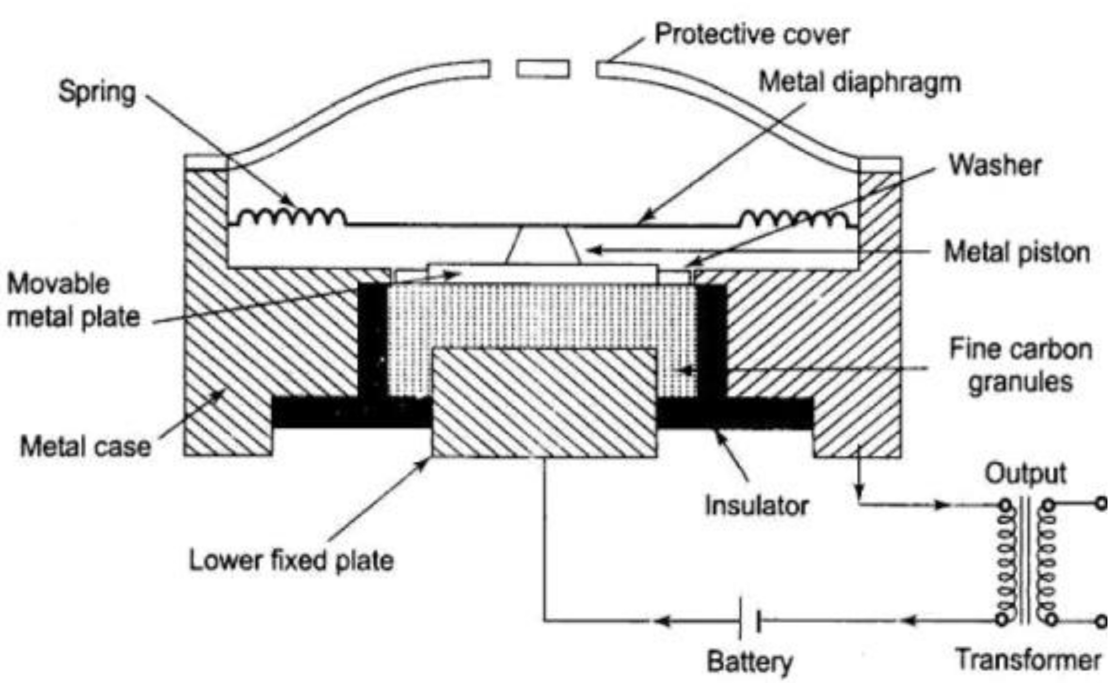

Fig. 8.3 Construction of carbon microphone

CONSTRUCTION

Fine carbon granules are enclosed between two metal plates. The upper plate is attached to movable metal diaphragm through a metal piston or plunger, the lower metal plate is fixed and is insulated from the diaphragm. A protective cover with holes is used to protect the unit.

A battery is connected between two metal plates. When load is connected, current flows through the granules and the load. Final output is obtained through a transformer to eliminate DC content of the microphone.

When sound waves strike the diaphragm, it moves to and fro. During compression condition, it presses the carbon granules and during rarefaction, it loosens them. When carbon granules are pressed, the resistance decrease and hence the current through the circuit increases. When carbon granules loosen. The resistance increases, decreasing the current through the circuit. In the absent of the sound, as steady current flows. Thus sound waves superimpose a varying current or audio current on the steady DC current.

WORKING

In carbon microphone, when carbon granules enclosed in a case are subjected to the variation of pressure, the resistance of granules changes. When such device of carbon granules is connected in series with a load through a DC supply, the current through the load will vary in accordance with pressure on the granules.

CHARACTERISTICS

(1) **Sensitivity:** Very high. The output of a carbon microphone is about 20 dB below 1 V.
(2) **Signal to noise ratio:** Poor. Random variation of resistance of carbon granules generates a continuous hiss.
(3) **Frequency response:** 200 Hz to 5000Hz. It is unsuitable for high fidelity work.
(4) **Distortion:** High. It is order of 10%.
(5) **Directivity:** It is omnidirectional.
(6) **Output impedance:** It is low 100 Ω

APPLICATIONS

Due to limited frequency range. It is used only in telephone. It is also used in portable radio communication test.

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) What is the range of audio frequency?
(2) Which microphone has best frequency response?
(3) Which microphone is used in telephones?

EXPERIMENT –9

LOUD SPEAKERS

AIM: (i) To study working principle and characteristics of various loud speakers.

THEORY:

1. MOVING COIL CONE TYPE LOUDSPEAKER

CONSTRUCTION

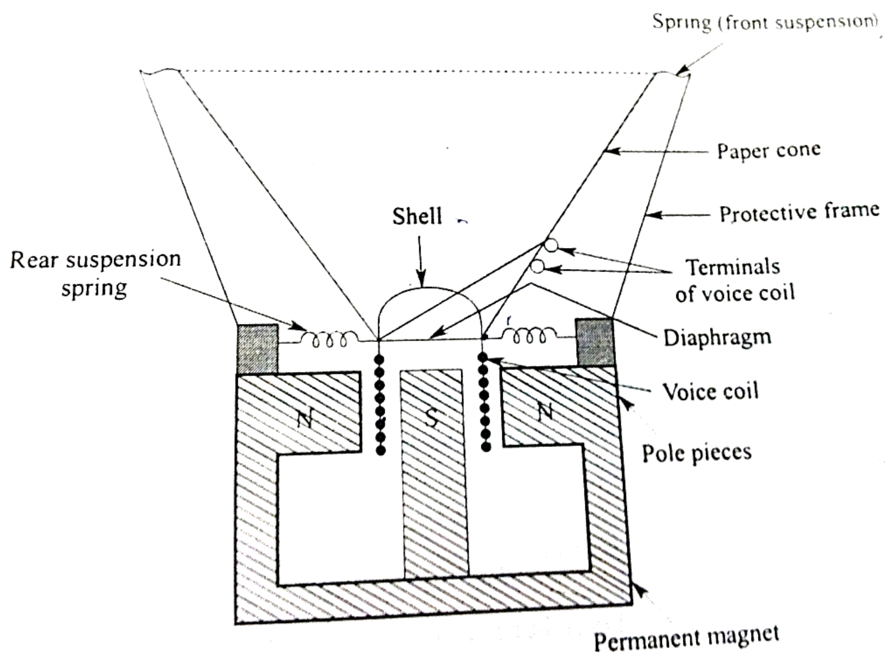

Fig 9.1 Moving Coil (cone type) Loud Speaker

Construction of a cone type moving coil loudspeaker is shown in fig. 9.1. The moving coil loudspeaker consists of a voice coil (single layer winding of fine enameled wire), wound on a cardboard or fiber cylinder. Audio current is fed to it through two terminals. The coil is placed in magnetic field.
The magnet is a pot type magnet which has a central pole (South Pole) and a per0ipheral pole (North Pole). The magnet is so shaped as to give strong radial magnetic field in the annular space between the central and peripheral poles. The voice coil is free to move in the annular space having strong and uniform magnetic field. Because of the use of the permanent magnet, it is also called 'permanent magnet type speaker'.

The coil is attached to a conical diaphragm, made paper or parchment. It is called 'Paper Cone'. The cone is corrugated having circular corrugations. The spider springs are used to support the complete diaphragm and also provide required stiffness to restrain the motion. The spiders also keep the coil centered, so that the cone moves forward and backwards only.

WORKING

The moving coil loudspeaker works on principle of interaction between magnetic field and current in the same way as an AC motor works. A coil called voice coil, is placed in a uniform magnetic field. When audio current passes through the voice coil, resulting in a force working on the movable coil. This force is proportional to the audio current and hence causes vibratory motion in the coil, which makes a conical paper diaphragm to vibrate and produce pressure variations in air, resulting in sound waves.

As shown in fig. 9.2 when audio current flows through the voice coil placed in a magnetic field, a force equal to B×I×L Newton acts on the coil and move it to and fro. The paper cone attached to the coil also moves and causes compression and rarefaction cycles in the air. Thus audio current is finally converted in to sound waves.

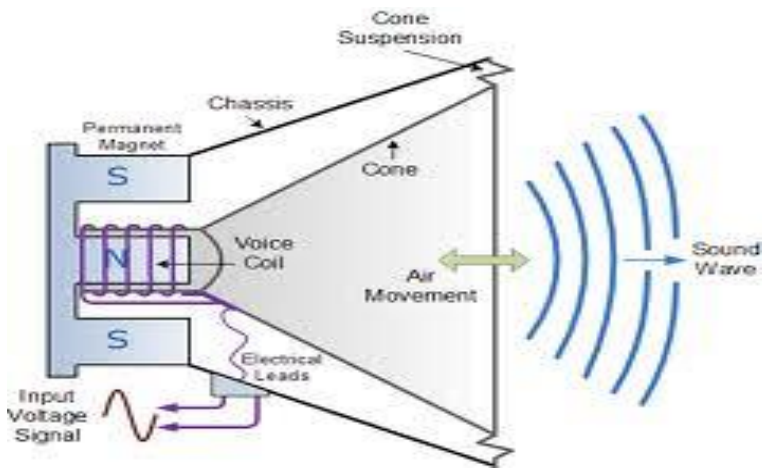

Fig.6.2 Electrical Equivalent of Moving Coil (cone type) Loud Speaker

CHARACTERISTIC

(1) **Efficiency:** The efficiency is quite low, about 5% only.
(2) **Signal to noise ratio:** It is 30 dB or better.
(3) **Frequency response:** It is restricted to mid frequencies only. Frequency response drops at low and high audio frequencies for typical loudspeaker. Frequency response of typical loudspeaker is 200 Hz to 5000 Hz. Woofers with baffles will give Frequency response up to 40 Hz and Tweeters will give Frequency response to 10 kHz or even higher.
(4) **Distortion:** Non-linear distortion due to non-uniformity in the magnetic flux density causes severe distortion up to about 10%.
(5) **Directivity:** Basically the loudspeaker is Omnidirectional. But baffles and enclosures modify the directivity so that the most of power is in the front.
(6) **Impedance:** The effective impedance taking in to account the mechanical and acoustical load varies from 2 ohm to 32 ohm. The common impedances in commercial speakers are 4, 8 or 16 ohm.

(7) **Power handling capacity:** Power range of speaker lies between a few mill watts (for 2 cm speaker) to about 25 watt for large size speakers.

1. ELECTRODYNAMICS LOUDSPEAKER

To provide very strong magnetic field for high wattage speakers, electrodynamics magnet is used instead of permanent magnet. The working principle is same as that of permanent magnet type.

CONSTRUCTION DETAIL

Its construction is shown in fig.6.3 loudspeakers of more than 25 watt and up to a few hundred watts are of electrodynamics type. The strong and steady magnetic field is produced by a large field coil wrapped around a core. The shape of the magnet is pot type with South Pole in the center and North Pole in the periphery. The voice coil is wound on fiber or aluminum. It is placed in the annular gap.

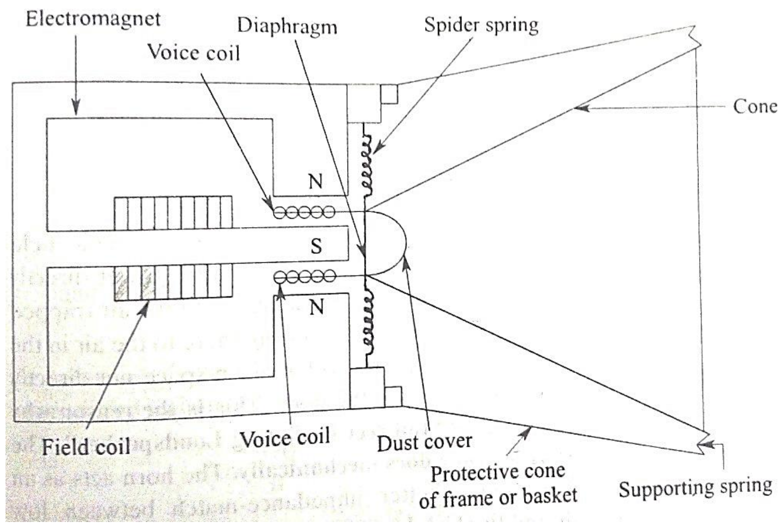

Fig.9.3 Electrodynamics Loud Speaker

WORKING

The audio signal from amplifier's output is applied to the voice coil. This signal causes varying magnetic field. The interaction between the two magnetic fields produces mechanical vibrations in the coil assembly, which corresponds to the audio signals. The vibrations of the coil are transmitted to the attached cone which create sound waves in the air in listener's area, and hence radiates sound energy directly.

ADVANTAGES

(1) Higher power can be obtained.
(2) Frequency response is better.

DISADVANTAGES

(1) Power supply is needed for field coils.
(2) Heavier in weight for the same amount of magnetic field.

(3) Costlier.

2. HORN TYPE LOUDSPEAKER

CONSTRUCTION

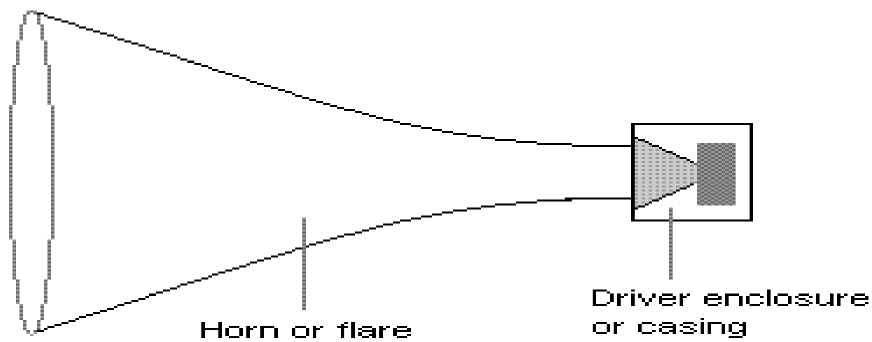

Fig 9.4 Horn Type Loud Speaker

The horn is tapered enclosure whose diameter increases from a small value at one end (called 'THROAT') to a large value at other end, (called 'MOUTH'). There is an air chamber is lined with sound absorbing material like loose felt. The driver unit is similar to direct radiating type except that the paper cone is not present. A basic horn type speaker is shown in Fig. 9.4.The exponential horn is a straight circular tube whose cross sectional area increases logarithmically along its length from the throat onwards.

WORKING

This type of loudspeaker uses a moving coil placed in a magnetic field, but instead of radiating acoustic power directly in open space of listener's area, the power is first delivered to the air trapped in fixed non-vibrating tapered or flared horn, and from there to the air in the listener's area. Thus, it radiates sound power to the air in space not directly from the diaphragm but indirectly through the horn. This is the reason why the horn type loudspeaker is called "Indirect Radiating Loudspeaker". The horn does acoustically what the cone does mechanically. The horn acts as acoustic transformer. This allows better impedance match between low impedance of free air and high impedance of the vibrating voice coil assembly. This results in increased efficiency. This efficiency is 30-50% as against only 5% efficiency of cone type speaker.
At high frequencies, distances of different points on the diaphragm from the horn will not be equal; causes phase difference and hence resultant cancellation. To overcome this difficulty, special chambers have been developed as illustrated in fig.

To improve low frequency response, we need horn of large type. The length of horn may be as big as 2 m and diameter of 1m. A low frequency horn for Hi-Fi system is shown in fig. It contains a cone loud speaker with a horn. The front of cone faces away from the audience, but the enclosure of the cone and exponential horn are so placed that the output is directed towards the listeners.

CHARACTERISTICS

(1) **Efficiency:** High, 30-50%.
(2) **Signal to noise ratio:** It is 40 dB.
(3) **Frequency response:** 30 Hz to 5000 Hz.
(4) **Distortion:** Low, less than 5%.
(5) **Directivity:** Angle between half power points around the horn axis is about 900. However, the directivity differs from low audio frequencies to high audio frequencies.
(6) **Impedance:** 16 ohms.
(7) **Power handling capacity:** About 100 watts. It can be easily accommodated in a horn type speaker for feasible size.

CONCLUSION:

(ii) To study characteristics of woofer.

THEORY:

A single loudspeaker cannot have flat response for whole audio frequency range 16 Hz to 20 KHz, and not even for the practical Hi-Fi range of40 Hz to 16 kHz. Low frequencies are weakened by the back sound waves of reverse phase in open speaker. In closed box (enclosure), the compliance (capacitive effect) of the entrapped air comes in series with the compliance of the cone system and hence increases the resonance frequency of the loudspeaker. The loss at high frequencies is due to mass of the diaphragm, thus a single speaker cannot produce both, the good solid bass and the smooth crisp treble. The best of them can only produce just acceptable bass and treble which will not satisfy the Hi-Fi requirement.

To solve the problem, the audio frequency spectrum is divided into atleast two and preferably three parts. Separate speaker has to cover only a small range of frequency. The speakers which cover low frequencies from 16 Hz to 1 kHz are called Woofers. The speakers which cover high audio frequencies called Tweeters. Many time, a third speaker called Squawker is used for mid frequency range from 500 Hz to 5 kHz, and in that case woofer works upto 500 Hz and tweeter from 5 kHz onwards. Woofer and tweeters can either be separate speaker mounted in a common enclosure or there can be a dual cone speaker.

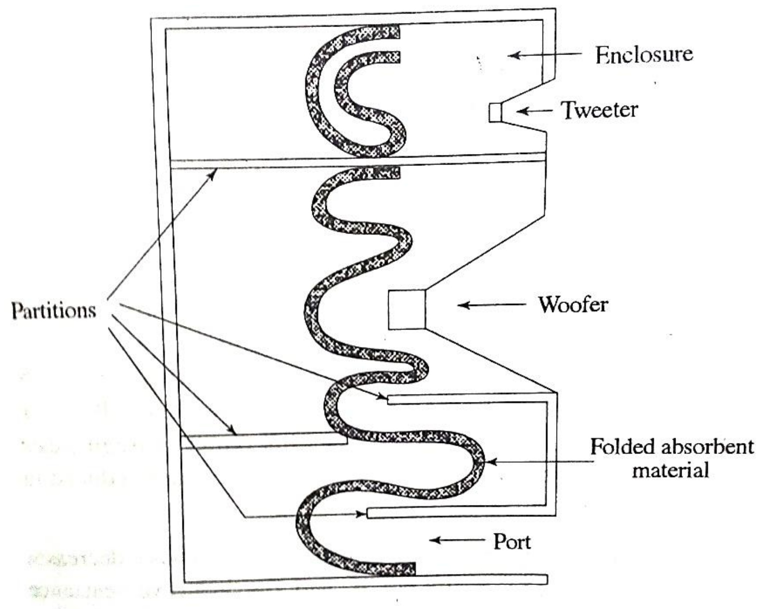

Fig 9.5 Hi-Fi Enclosure

When multi-way loudspeaker system is used to get flat frequency response for the entire range of audio frequencies. Cross-over network is used to divide the incoming signal into separate frequency ranges for the each speaker. In the absence of cross-over network, the speaker will suffer overheating and the output will be distorted when full power at frequencies outside their range is fed to them. Overall efficiency will be much reduced in the absence of cross-over network.

CONCLUSION:

ASSIGNMENT QUESTIONS:

(1) What is the working principle of loud speaker?
(2) What is the use of cross over circuits in loud speakers?
(3) Differentiate woofer, squawker, and tweeter.

EXPERIMENT –10

LCD TV AND LED TV

AIM: (i) To study LCD TV technology.
(ii) To study LED TV technology.

INTRODUCTION

Liquid-crystal-display televisions (LCD TV) are television sets that use LCD display technology to produce images. LCD televisions are thinner and lighter than cathode ray tube (CRTs) of similar display size, and are available in much larger sizes. When manufacturing costs fell, this combination of features made LCDs practical for television receivers.
LCD televisions produce a black and colored image by selectively filtering a white light. The light was provided by a series of cold cathode fluorescent lamps (CCFLs) at the back of the screen. Today, most LCD-TV displays use white or colored LEDs as backlighting instead. Millions of individual LCD shutters, arranged in a grid, open and close to allow a metered amount of the white light through. Each shutter is paired with a colored filter to remove all but the red, green or blue (RGB) portion of the light from the original white source. Each shutter–filter pair forms a single sub-pixel. The sub-pixels are so small that when the display is viewed from even a short distance, the individual colors blend together to produce a single spot of color, a pixel. The shade of color is controlled by changing the relative intensity of the light passing through the sub-pixels.

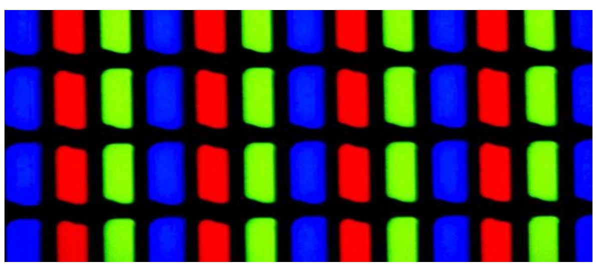

Fig.10.1 A close-up (300×) view of a typical LCD display, Clearly showing the sub-pixel structure

LCDs are relatively inefficient in terms of power use per display size, because the vast majority of light that is being produced at the back of the screen is blocked before it reaches the viewer. To start with, the rear polarizer filters out over half of the original un-polarized light. Examining the image above, you can see that a good portion of the screen area is covered by the cell structure around the shutters, which removes another portion. After that, each sub-pixel's color filter removes the majority of what is left to leave only the desired color. Finally, to control the color and luminance of a pixel as a whole, the light has to be further absorbed in the shutters.
For these reasons the backlighting system has to be *extremely* powerful. In spite of using highly efficient CCFLs, most sets use several hundred watts of power, more than would be required to light an entire house with the same technology.

(ii) To study LED TV technology.

INTRODUCTION

An LED-backlit LCD display is a flat panel display which uses LED backlighting instead of the cold cathode fluorescent(CCFL) backlighting used by most other LCDs. LED-backlit LCD TVs use the same TFT LCD (thin film transistor liquid crystal display) technologies as CCFL-backlit LCD TVs. Picture quality is primarily based on TFT LCD technology, independent of backlight type.

Three types of LED may be used:

(1) Edge-lit LEDs - in which the LEDs are formed around the rim of the screen, using a special diffusion panel to spread the light evenly behind the screen (the most common use)

(2) LED backlighting (Full array)- behind the screen, whose brightness is not controlled individually

(3) Dynamic “local dimming” backlight - LEDs controlled individually (or in clusters) to control the level of light/color intensity in a given part of the screen.

TECHNOLOGY

(1) LED-backlit LCDs are not self-illuminating (unlike pure-LED systems). There are several methods of backlighting an LCD panel using LEDs, including the use of either white or RGB (Red, Green, and Blue) LED arrays behind the panel and edge-LED lighting (which uses white LEDs around the inside frame of the TV and a light-diffusion panel to spread the light evenly behind the LCD panel). Variations in LED backlighting offer different benefits.

(2) LED backlighting using ‘white’ LEDs produces a broader spectrum source feeding the individual LCD panel filters (similar to CCFL sources), resulting in a more limited display gamut than RGB LEDs at lower cost.

(3) LED-backlit LCDs have longer life and better energy efficiency than plasma and CCFL LCD TVs.Unlike CCFL backlights, LEDs use no mercury (an environmental pollutant) in their manufacture. However, other elements (such as gallium and arsenic) are used in the manufacture of the LED emitters; there is debate over whether they are a better long-term solution to the problem of screen disposal.

(4) Because LEDs can be switched on and off faster than CCFLs and can offer a higher light output, it is theoretically possible to offer very high contrast ratios. They can produce deep blacks (LEDs off) and high brightness (LEDs on). However, measurements made from pure-black and pure-white outputs are complicated by the fact that edge-LED lighting does not allow these outputs to be reproduced simultaneously on screen.

(5) Traditional LCDs have always suffered from contrast degradation when viewed from angles of more than approximately 30 degrees from off center. Although there have been vast improvements over the last few years, LCD still falls short of Plasma TVs when it comes to viewing angle. Viewing angle is determined by the LCD Panel itself and not the backlight. Therefore, LED backlighting offer no improvement in this area.

EXPERIMENT –11

HDTV and Plasma TV

AIM: (i) To study HDTV technology.
(ii) To Study Plasma Technology.

INTRODUCTION

Two common SDTV(Standard Definition TeleVision) schemes are NTSC (suggested and named on National Television Systems Committee) and PAL(Phase Alternating Line).
High Definition Tele Vision (HDTV) provides a resolution that is substantially higher than that of SDTV.
HDTV transmission may be referred with following formats:

(1) HDTV technology is denoted by Frame size in pixels is defined as number of horizontal pixels × number of vertical pixels. Often the number of horizontal pixels are omitted in denotation.

(2) Scanning System is identified with the letter p for progressive scanning and letter I for interlaced scanning.

(3) Frame rate is identified as number of video frames per second.

Format is showing the details in a format: [frame size] [scanning system] [frame or field rate]

For example,
1080p25 identifies 1920 × 1080 horizontal and vertical pixels, progressive scanning with 25 frames per second,

1080i50 identifies 1920 × 1080 horizontal and vertical pixels, progressive scanning with 25 frames per second. These schemes require less bandwidth due to compression, like MPEG-2 data compression. Here source information data rate is 1.2Gbps with broadcast rate 20Mbps.

ADVANTAGES
(1) Noise free picture reception
(2) Higher resolution
(3) Enhanced sound services
(4) Far better cinematic experience at home
Still scope of lot of improvements to meet 70mm resolution.

(ii) To study PLASMA TV technology.

INTRODUCTION

The basic idea of a plasma display is to illuminate tiny, colored fluorescent lights to form an image. Each pixel is made up of three fluorescent lights - a red light, a green light and a blue light. Just like a CRT television, the plasma display varies the intensities of the different lights to produce a full range of colors.

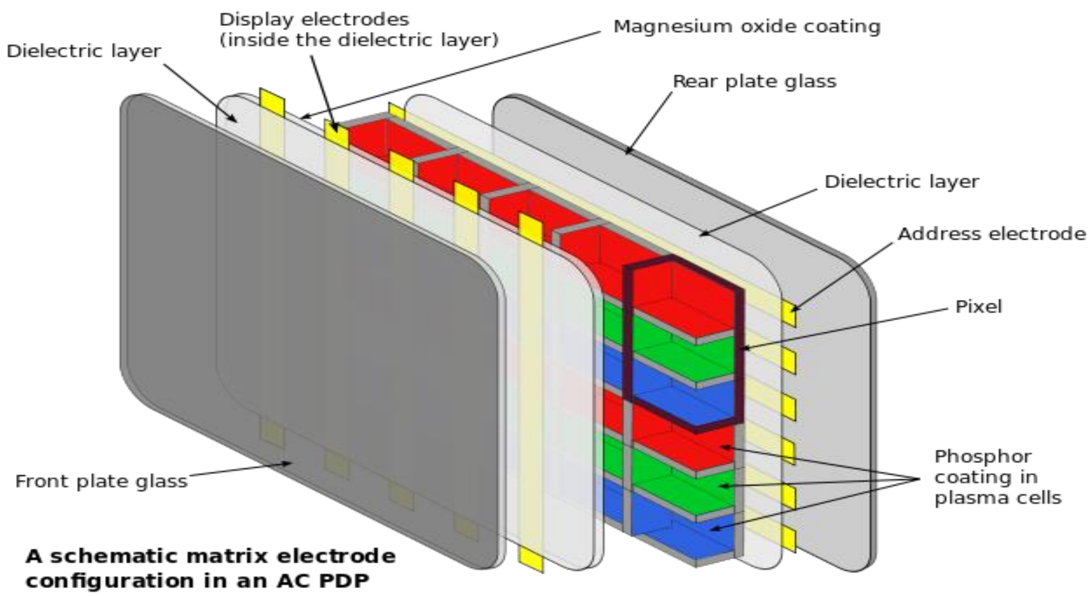

Fig.11.1 Plasma display

WORKING

As shown in fig. 9.1 two plates of glass are taken which contain millions of tiny cells filled with gases like xenon, neon. Electrodes are also placed inside the glass plates in such a way that they are positioned in front and behind each cell. The rear glass plate has with it the address electrodes in such a position that they sit behind the cells. The front glass plate has with it the transparent display electrodes, which are surrounded on all sides by a magnesium oxide layer and also a dielectric material. They are kept in front of the cell.

In between two plates of glass, there are millions of tiny cells containing gases like xenon and neon. Electrodes are also placed inside both of the glass plates in such a way that they are positioned in front and behind each cell. The front glass plate has with it the transparent display electrodes, which are surrounded on all sides by a magnesium oxide layer and also a dielectric material.

When a voltage is applied to the electrodes, they get charged and cause the ionization of the gas inside the cell, resulting in plasma. This also includes the collision between the ions and electrons resulting in the emission of photon light which is ultraviolet in nature. To obtain color, back of each cell is coated with phosphor. When the UV photon react with phosphor, it produces a colored light.

ADVANTAGES

(1) The slimmest of all displays
(2) Very high contrast ratios [1:2,000,000]
(3) Higher viewing angles compared to other displays [178 degrees].
(4) High clarity and hence better color reproduction.
(5) Very little motion blur due to high refresh rates and response time.
(6) Has a life span of about 100,000 hours. . After this period, the brightness of the TV reduces to half.

DISADVANTAGES

(1) Cost is much higher compared to other displays.
(2) Energy consumption is more.
(3) Produces glares due to reflection.
(4) These displays are not available in smaller sizes than 32 inches.
(5) Cannot be used in high altitudes. The pressure difference between the gas and the air may cause a temporary damage or a buzzing noise.

EXPERIMENT – 12

DIRECT TO HOME RECEIVER

AIM: To study DTH receiver.

THEORY

Direct to Home technology refers to the satellite television broadcasting process which is intended for home reception for television signals. The technology was developed for competing with the local cable TV distribution services by providing higher quality satellite signals with more number of channels.

DTH refers to the reception of satellite signals on a TV with a personal dish in an individual home. The satellites that are used for this purpose is geostationary satellites. The satellites compress the signals digitally, encrypt them and then are beamed from high powered geostationary satellites. They are received by dishes that are given to the DTH consumers by DTH providers.

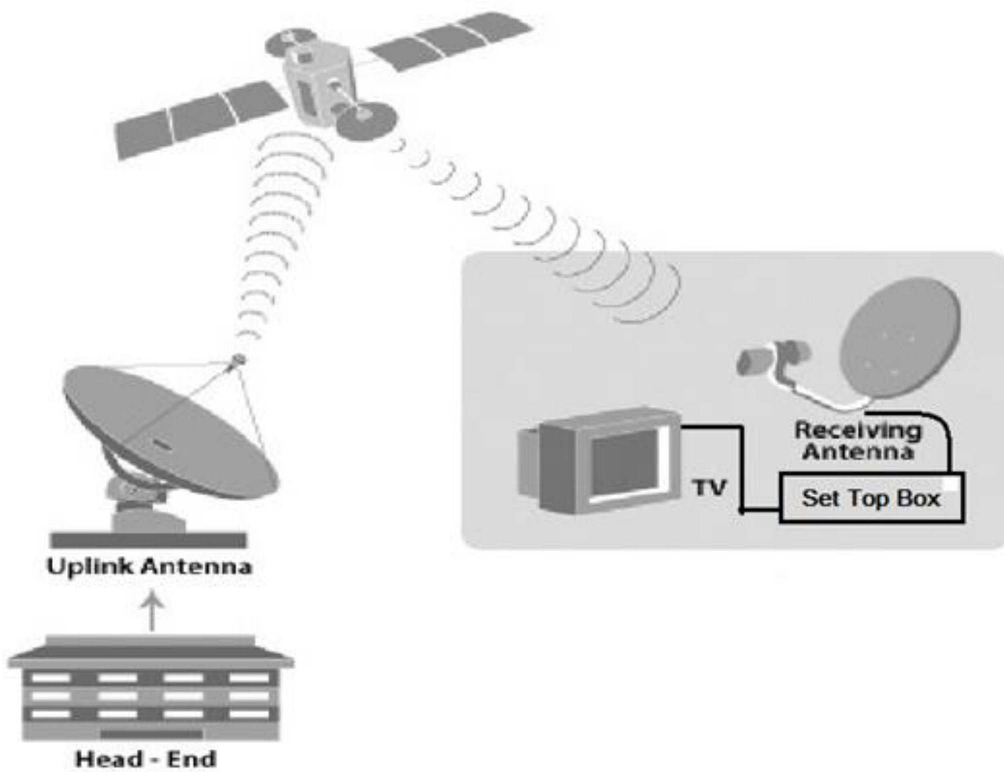

Fig. 10.1 DTH Network

The simplified diagram of Fig. 1 shows the DTH network. Live or pre-recorded programs are broadcasted by satellites all over the region. Transmitting signals over a wide range of frequencies [normal frequencies including the KU and KA band] uses satellites for the transmission of the DTH signals. DTH is more famous for its services in both the analog and digital services which includes both audio and video signals. The dishes used for this service is also very small in size. Following are the major advantages of DTH system.

(1) As the process is wireless, this system can be used in all remote or urban areas and thus it is beyond geographical.
(2) High quality audio and video which are cost effective due to absence of mediators.
(3) Almost 4000 channels can be viewed along with 2000 radio channels.
(4) With a single DTH service you will be able to use digital quality audio, video and also high speed broadband.

PART II

APPENDIX

Technical Specification of 2651A LED TV trainer kit

Display		
Display Type	:	LED, HD
Screen Size	:	20 Inch (50cm)
Display Resolution	:	1600 X 900 pixels
Contrast Ratio	:	Mega Contrast Ratio
Display Color	:	16.7 Million Display Colors
Viewing Angle	:	170(H) X 170(V)
Refresh Rate	:	50 Hz
Video Interface	**:**	Video Input/ VGA input
Audio Interface	**:**	RCA L & R
Audio Output Power	**:**	8W X 2
Receiving System	**:**	PAL BG/I/DK and NTSC (3.58/4.43)
Channel Coverage	**:**	VHF-2-12; UHF21-69; CATV (X~Z+2, S1 ~ S41)
Antenna Impedance	**:**	75Ω unbalanced
Application	**:**	Color Television/ PC Monitor
Connectivity		
USB	:	1 X USB 2.0 (MPEG, JPEG, MP3)
HDMI	:	Yes (1 X HDMI)
Other Connectivity	:	RF In, AV In. Ypbpr In, VGA In, VGA Audio In, AV Out
Composite A/V	**:**	Yes
Component Video	**:**	Yes
Analog Audio	**:**	Yes
Test Points	**:**	55 nos.
Switched Faults	**:**	50 nos.
Remote Battery	**:**	UM-4, “AAA” 1.5V (2 nos.)
Power Supply	**:**	AC 110~240V, 50/60Hz
Power Consumption	**:**	35W
Weight	**:**	11 Kg (approximately)
Dimension (mm)	**:**	W430 X D252 X H82