Government Girls' Polytechnic, Bilaspur

Name of the Lab: **Communication Lab**

Practical: **Television Engineering Lab**

Class : **6th Semester (ET&T)**

Teachers Assessment: 10 End Semester Examination: 40

Experiment no - 1

Objective:-Familiarization with consumer and technician control & safety precautions

Theory:-

Control Measures

Control measures are implemented to eliminate or reduce the possibility of eye or skin exposure to hazardous levels of laser radiation and to other ancillary hazards associated with the use of laser systems. The potential for injury from a laser is determined by its classification and therefore the control measures are also determined by the laser classification. Consideration of the environment where the laser will be used and application of the laser are also factors to consider when determining appropriate control measures to be applied. The control measures reviewed in this section are adapted from ANSI Z136.1-1993 (Safe Use of Lasers) and can be found in section 4 of this standard.

Laser safety control measures include administrative controls such as (procedures, training, warning signs, personal protection), and engineering controls which may include (protective housing, interlocks, beam stops, barriers and curtains). The combined use of both engineering and administrative control methods is effective in controlling the hazards of laser radiation.

1. Protective Housing, Interlocks

A protective housing is a physical barrier sufficient to contain the beam and laser radiation from exiting the laser system so that the maximum permissible exposure MPE is not exceeded on the outside surface. Protective housings must be interlocked so that the laser cannot operate when the housing is opened or removed. When the requirements of a protective housing are fulfilled then the laser system is considered a Class 1 laser and no further control measures are required.

2. Laser Use in TV without Protective Housing

In the research environment lasers are often used without a protective housing in place. Typically the use of optical tables and optical devices are employed in order to manipulate the laser beam. In this environment the Radiation Protection Office (617 495-2060) will evaluate the hazards and see that controls measures are in place to ensure safe operation. These control measures may include but are not limited to:

Access Restriction
Area Controls
Barriers, Curtains, Bearn Stops
Eye Protection
Procedural Controls
Training

3. Access Restriction

For Class 3b and 4 laser laboratories, access controls are required to prevent unauthorized personnel from entering the area when the laser is in use. Doors need to be kept closed when the laser is in operation and locked when the laser is left unattended. A door interlocked with the laser shutter may be required.

4. Area Controls

For Class 3b and 4 lasers area control measures are used to minimize laser radiation hazards. The area must be posted with the appropriate signage and include a lighted sign at the doorways indicating the "on" status of a laser system. Only authorized personnel who have been appropriately trained will be allowed to operate the laser. For open beam installations a nominal hazard zone (NHZ) analysis will be performed.

5. Barriers, Beam Stops, Enclosures

Beam barriers, stops and enclosures are used to prevent beam propagation outside of the controlled access area in excess of the MPE. It is always desirable to enclose as much of the beam path as possible. As with a protective housing, the proper enclosure of the entire beam path may change the laser system to a Class 1 laser. When the beam needs to be directed to another area such as between optical tables, enclosure of the beam is recommended. Physical barriers are used to prevent laser radiation from exiting the controlled area. Laser curtains and partitions are routinely used as laser containment systems. Rail curtains can be used to completely enclose an optical table or part of the laser system. Due to the power density of Class 4 lasers, consideration of barrier material regarding combustion must be given. Use beam stops to prevent the beam from leaving the optical table and to terminate the beam path. Beam stops are use behind optical devices in the event that the beam becomes misalign.

Administrative Controls

Administrative controls are methods and instructions that promote tv safety in the laboratory.

1. Standard Operating Procedures (SOP's)

A written SOP must be established for normal, maintenance, and alignment operations. The SOP's will be maintained with the tv equipment for reference by operators or service personnel and can be used for instructional material to train new laser users in the facility. All SOP's will be updated to reflect any changes in laboratory protocol and equipment usage.

2. Warning Signs and Labels

All signs and labels must comply with ANSI Z 136.1 (1993) and the FDA/CDRH standards. For all entranceways into laboratories, equal to or less than the MPE, will be posted with signs indicating "Caution". For class 3a lasers exceeding the MPE for irradiance must be posted with "Danger" signs. In accordance with ANSI Z 136.1, the signs will include the laser class, wavelength, and laser output. Lasers are marked with the manufacturers' label according to FDA/CDRH regulations. For laser systems developed in house call the Radiation Protection Office to evaluate the laser for proper labeling.

3. Eye Protection

Eye protection is required for tv when engineering and administrative controls are inadequate to eliminate potential exposure in excess of the applicable MPE. The use of laser protective eyewear is especially important during alignment procedures since most laser accidents occur during this process. Protective eyewear must be labeled with the absorption wavelength and optical density (OD) rating at that wavelength. In addition to selecting the appropriate OD for safe viewing, one should considered the percent of visible light transmitted to the eye while wearing eye protection so that the beam can be adequately seen without the need to remove the protective eyewear. Comfort and fit are important factors when selecting protective eyewear.

Result- consumer are Familiarize with tv safely control it.

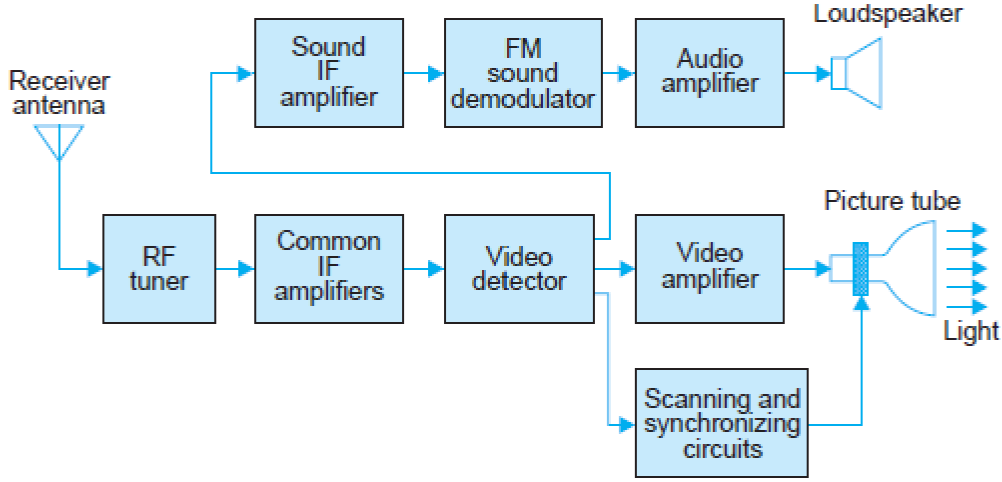
Experiment no –2

Objective- Identify different components and section in TV receiver (B/W & Color)

Material required- Picture tube, loudspeaker Video detector, Camera, Tuner, Color T.V. Trainer Kit, Digital Voltmeter, Cathode Ray oscilloscope

Theory-

A simplified block diagram of a black and white TV receiver is shown in Fig. 1.5. The receiving Antenna intercepts radiated RF signals and the tuner selects desired channel's frequency band and



Converts it to the common IF band of frequencies. The receiver employs two or three stages of Intermediate frequency (IF) amplifiers. The output from the last IF stage is demodulated to recover the video signal. This signal that carries picture information is amplified and coupled to the picture tube which converts the electrical signal back into picture elements of the same degree of black and white. The picture tube shown in Fig. 1.6 is very similar to the cathode-ray tube used in an oscilloscope. The glass envelope contains an electron-gun structure that produces a beam of electrons aimed at the fluorescent screen. When the electron beam strikes the screen, light is emitted. The beam is deflected by a pair of deflecting coils mounted on the neck of picture tube in the same way as the beam of camera tube scans the target plate. The amplitudes of currents in the horizontal and vertical deflecting coils are so adjusted that the entire screen, called raster, gets illuminated because of the fast rate of scanning.

The video signal is fed to the grid or cathode of picture tube. When the varying signal voltage Makes the control grid less negative, the beam current is increased, making the spot of light on the screen brighter. More negative grid voltage reduces brightness. If the grid voltage is negative enough to cut-off the electron beam current at the picture tube, there will be no light. This state corresponds to black. Thus the video signal illuminates the fluorescent screen from white to black through various shades of grey depending on its amplitude at any instant. This corresponds to brightness changes encountered by the electron beam of the camera tube while scanning picture details element by element. The rate at which the spot of light moves is so fast that the eye is unable to follow it and so a complete picture is seen because of storage capability of the human eye.

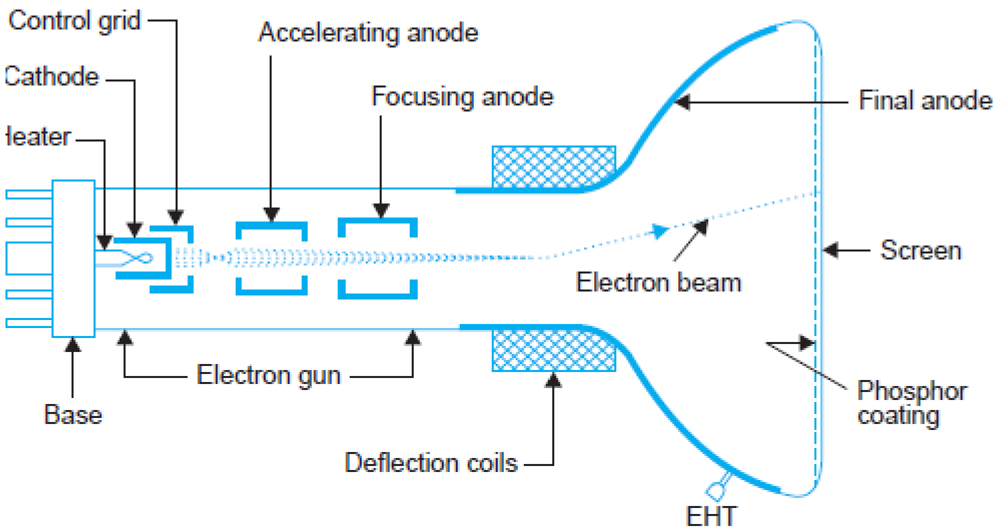


Fig. 1.6. Elements of a picture tube.

Sound Reception

The path of sound signal is common with the picture signal from antenna to video detector section of the receiver. Here the two signals are separated and fed to their respective channels. The frequency modulated audio signal is demodulated after at least one stage of amplification. The audio output from the FM detector is given due amplification before feeding it to the loudspeaker

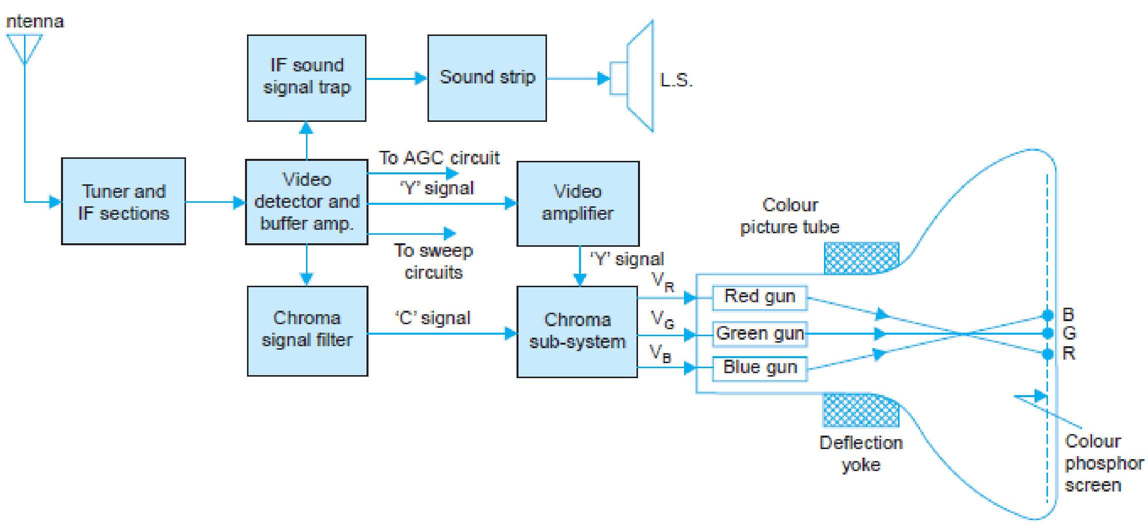


Fig. 1.7. An oversimplified block diagram of a colour receiver.

As shown in Fig. 1.7, the color picture tube has three guns corresponding to the three pick-ups Tubes in the color camera. The screen of this tube has red, green and blue phosphors arranged in alternate stripes. Each gun produces an electron beam to illuminate corresponding color phosphor separately on the fluorescent screen. The eye then integrates the red, green and blue color information sand their luminance to perceive actual color and brightness of the picture being televised. The sound signal is decoded in the same way as in a monochrome receiver.

SYNCHRONIZATION

It is essential that the same co-ordinates be scanned at any instant both at the camera tube target plate and at the raster of picture tube; otherwise, the picture details would split and get distorted. To ensure perfect synchronization between the scenes being televised and the picture produced on the raster, synchronizing pulses are transmitted during the retrace, i.e., fly-back intervals of horizontal and vertical motions of the camera scanning beam. Thus, in addition to carrying picture details, the radiated signal at the transmitter also contains synchronizing pulses. These pulses which are distinct for horizontal and vertical motion control are processed at the receiver and fed to the picture tube sweep circuitry thus ensuring that the receiver picture tube beam is in step with the transmitter camera tube beam.

As stated earlier, in a color TV system additional sync pulses called color burst are transmitted Along with horizontal sync pulses. These are separated at the input of chroma section and used to synchronize the color demodulator carrier generator. This ensures correct reproduction of colors in the otherwise black and white picture.

RECEIVER CONTROLS

Most black and white receivers have on their front panel (i) channel selector, (ii) fine tuning, (iii) brightness, (iv) contrast, (v) horizontal hold and (vi) volume controls besides an ON-OFF switch.

Some receivers also provide a tone control. The channel selector switch is used for selecting the desired channel. The fine tuning control is provided for obtaining best picture details in the selected channel.The hold control is used to get a steady picture in case it rolls up or down. The brightness control varies beam intensity of the picture tube and is set for optimum average brightness of the picture. The contrast control is actually gain control of the video amplifier. This can be varied to obtain desired contrast between white and black contents of the reproduced picture. The volume and tone controls form part of the audio amplifier in sound section, and are used for setting volume and tonal quality of the sound output from the loudspeaker.
In colour receivers there is an additional control called 'colour' or 'saturation' control. It is used to vary intensity or amount of colours in the reproduced picture. In modern colour receivers that employ integrated circuits in most sections of the receiver, the hold control is not necessary and hence usually not provided.

different components and section in TV receiver

Antenna :

The main function of an antenna is to accept the electro magnetic waves coming from the T.V. transmitter. Antenna receives these waves and converts them into RF signals. Which are given to the T.V. Transmitter. For better reception of RF signal, Yaagi Uda antenna is most commonly used to in all T.V. receivers in VHF/UHF range for its simple construction and low air resistance.

Balun :
It is used for matching the impedance balanced 300W to unbalanced 75W tuner input impedance. R.F. signal from antenna is given to the RF tuner through the balun transformer.

RF Tuner :
It is used for better picture and sound reception. The main functions of tuner are
1. Selection of desired channel frequencies and rejects others.
2. It matches antenna with T.V. receiver, because of the ghost image can be removed.
3. It converts the R.F. signal into IF signal by heterodyne with local oscillator frequency.
4. It isolates the local oscillator signals from the antenna for preventing radiation of it through the antenna.
5. It rejects the image frequency which causes the ghost image along with the picture. The RF tuner selects RF signals of desired channel amplifiers then is to IF signals. The tuner consists of an RF amplifier, an oscillator and a mixer stage. Local oscillator generates a constant frequency for desired channel, RF amplifier amplifies the
RF signal achieved from antenna and mixer stage converts them into IF signal by heterodyne RF signal from the local oscillator frequency. The IF carrier frequency present in IF signals for picture and sound are 38.9 MHz 33.4 MHz respectively. Thus IF signal achieved from the tuner is fed to the IF amplifier.

IF Pre-Amplifier :
It amplifies the IF signal. This stage of amplification is necessary because by the used of saw filter the gain of the receiver becomes less.24

SAW - FILTER :
The saw filter used in place of wave trap circuits. It passes only required frequencies and grounds unwanted adjacent channel frequencies.

VIDEO IF STAGE :
By using an IC this stage is desired. This stage consists of video amplifier, AFC and AGC circuits etc.,

VIDEO IF AMPLIFIER :
This stage amplifies IF signal and provides sufficient gain. AGC voltage is applied to all the separate IF amplifier except the last IF amplifier. From video amplifier the signal is applied to the video detector.

VIDEO DETECTOR :
Signal obtained from video IF amplifier is injected to the vedio detector. In video detector the signal is demodulated giving back the Y-signal and the colour side band along with various synchronizing pulses and the colour burst signal. AFC signal is also given to tuner section for automatic frequency control. The video detector is to mix both VIF, SIF to produce a new IF sound IF signal at 5.5 MHz and fed to the sound section.
5.5 MHz tank (LC) circuit is also used with video detector to remove the 5.5 MHz inter carrier sound signal from the vedio signal. From video detector video signal is obtained given to video amplifier input. This stage is coupled to video preamplifier and AGC sections.

Sound Section :

SOUDN IF AMPLIFIER :
The 5.5 MHz inter carrier signal from video detector stage is fed to the sound IF amplifier for amplification.

FM Detector :

5.5 MHz sound signal is amplified by SIF stage given to detector stage. The original sound signal is detected from the carrier.

Audio Amplifier :
In this stage voltage amplification is given to the audio signal and finally fed to the speaker. T.V. Servicing Lab - II 25

Video Pre-Amplifier :
The output of Video amplifier the video signal is given to video pre amplifier. This signal consists of the 1) Luminance / Y Signal 2) The colour sub carrier containing red, blue colour difference signals 3) The horizontal and vertical sync pulses 4) The colour burst signal. The video pre amplifier amplifies the signal strength from 2V to 6V, so that it is able to drive video output stages. In this stage the division of chrominance and luminance takes place. From video pre amplifier video signal coupled to chroma band pass amplifiers through chroma filter circuit, sync separation and delay time circuit.

Delay time :
From video pre amplifier, Y signal passes through a delay time to amplifier stage. The delay line delays the Y signal by 0.8 milliseconds. The delay speed of the signal through the delay time is a special coil with very high value of inductance and distributed capacitance so that the delay speed of the signal through the delay line is greatly reduced.

Chroma section :
The output of video pre amplifier the composite colour video signal is coupled to the chroma band pass filter at 4.43 MHz and two stages of chroma amplifier.
The chroma filter separates the modulated chroma sub carrier signal and the colour burst from incoming composite video signals. The separated chroma signals are amplified by the first chroma amplifier which is gain controlled by the voltage developed by the automatic colour control amplifier.

Colour Burst Circuit :
The colour burst circuit consists of the burst pre amplifier, pre amplifier pulse shaper and the gated burst amplifier.

Burst pre amplifier :
The chroma input signal from the chroma amplifier gets amplified in this stage.

Gated Burst Amplifier :
In this stage the gated horizontal flyback pulses are applied to this stage through a pulse shaping circuit.

Pulse Shaper :
The pulse shaper receives a positive pulse from horizontal output section. The conduction of gated burst amplifier depends on the gating pulses derived from pulse shapes. Burst signals are applied to Automatic Chroma Colour control circuit and phase discriminator.

Reference Oscillator:
The U and V signals are separately produced at the transmitting and by double balanced suppressed carrier modulator. Automatic Colour Control (ACC) Circuit: In this stage colour is controlled automatically.

Burst Phase Discriminator :
This stage works by comparing the phase of wave from produced by the reference oscillator with the burst pulses obtained from the burst amplifier.

Colour Killer Circuit :

In this stage the colour killer is to be cut off the second chroma band pass amplifier when black and white program is obtained by a colour T.V. Circuit.

Sync Separator :
From the emitter of video pre amplifier, composite colour video signal is fed to the sync separator, horizontal, vertical sync signals are separated by the use of suitable low, high pass filter circuits. This stage also amplifies the signals. Automatic Frequency Control/AFC Circuit : In this stage horizontal flyback pulses and horizontal sync signals are separated.

Horizontal Oscillator :
This stage generates 15, 625Hz saw tooth horizontal line frequency for horizontal deflection of electron beam inside the picture tube.

Horizontal Driver :
The signal coming from horizontal oscillator is amplified.

Horizontal Driver Transformer :
In this provides impedance matching. T.V. Servicing Lab - II 27

Horizontal Output Stage :
This stage consists of a Transistor and an EHT Transformer amplification is provided in this stage.

Vertical Stage :
This is an IC version consists of vertical oscillator, vertical driver, vertical output.

Vertical oscillator :
Vertical line frequency 50Hz coming from low pass filter and deflected electron beem vertically in the picture tube.

Vertical Driver :
It provides voltage amplification to vertical signal.**Vertical output :**
The vertical output is given to vertical deflection coil.

Power Supply :
A SMPS power supply is used to get 110V,20V dc power

Observation table-

S.No.	Type of stage	Transistors	IC's
1.	Tuner	BC 147, BC 157	CW 2225
2.	VIF (Video)	BC 959, BC 147	TDA 3541
3.	SIF (Sound)	-	IC TDA 1190/CA 1190z TDA 613
4.	Horizontal Output, Horizontal Oscillator sync separator	BD115, BC 157 BC 147	TDA 613, IC 3 TDA 1940F
5.	Vertical	BC 147(2)	IC4 TDA 2653A
6.	CD/VDA	BC 147	TDA 3560 / TDA 3561
7.	EHT	BU208 D	-
8.	SMPS	BU 536	IC 6 TA 4600A/4601

Typical Voltages

S.No.	Test Point	Voltages VPP (Volts)	Section on T.V.

Result -IC's, transistors observed at various stages, voltages are observed at various points.

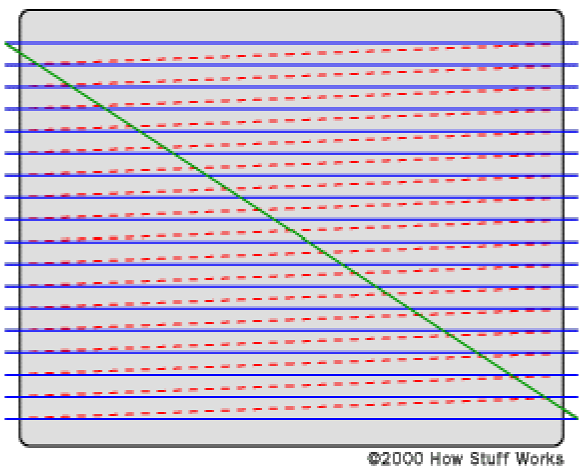
Experiment no –3

Objective- Signal injection and signal tracing in black & white & Color TV

Apparatus required- T.V. Trainer Kit, Digital Voltmeter, Cathode Ray Oscilloscope

Theory - The Black-and-White TV Signal

In a black-and-white TV, the screen is coated with white phosphor and the electron beam "paints" an image onto the screen by moving the electron beam across the phosphor a line at a time. To "paint" the entire screen, electronic circuits inside the TV use the magnetic coils to move the electron beam in a "raster scan" pattern across and down the screen. The beam paints one line across the screen from left to right. It then quickly flies back to the left side, moves down slightly and paints another horizontal line, and so on down the screen, like this:



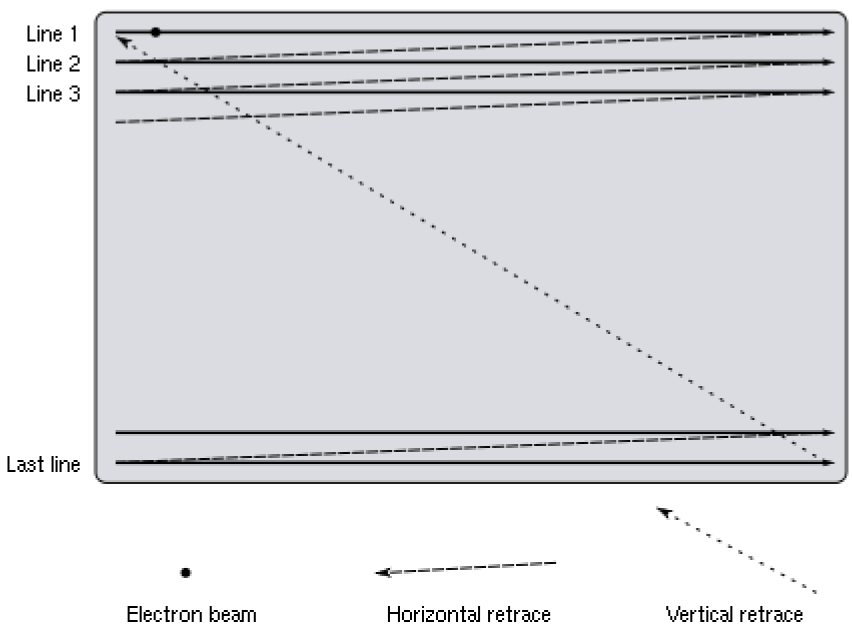
In this figure, the blue lines represent lines that the electron beam is "painting" on the screen from left to right, while the red dashed lines represent the beam flying back to the left. When the beam reaches the right side of the bottom line, it has to move back to the upper left corner of the screen, as represented by the green line in the figure. When the beam is "painting," it is on, and when it is flying back, it is off so that it does not leave a trail on the screen. The term horizontal retrace is used to refer to the beam moving back to the left at the end of each line, while the term vertical retrace refers to its movement from bottom to top.

As the beam paints each line from left to right, the intensity of the beam is changed to create different shades of black, gray and white across the screen. Because the lines are spaced very closely together, your brain integrates them into a single image. A TV screen normally has about 480 lines visible from top to bottom. In the next section, you'll find out how the TV "paints" these lines on the screen.

Displaying an image

A CRT television displays an image by scanning a beam of electrons across the screen in a pattern of horizontal lines known as a raster. At the end of each line the beam returns to the start of the next line; at the end of the last line it returns to the top of the screen. As it passes each point the intensity of the beam is varied, varying the luminance of that point. A color television system is identical except that an additional signal known as chrominance controls the color of the spot.

Raster scanning is shown in a slightly simplified form below.



When analog television was developed, no affordable technology for storing any video signals existed; the luminance signal has to be generated and transmitted at the same time at which it is displayed on the CRT. It is therefore essential to keep the raster scanning in the camera (or other device for producing the signal) in exact synchronization with the scanning in the television.The physics of the CRT require that a finite time interval is allowed for the spot to move back to the start of the next line (horizontal retrace) or the start of the screen (vertical retrace). The timing of the luminance signal must allow for this.The human eye has a characteristic called Persistence of vision. Quickly displaying successive scan images will allow the apparent illusionof smooth motion. Flickering of the image can be partially solved using a long persistence phosphor coating on the CRT, so that successive images fade slowly. However, slow phosphor has the negative side-effect of causing image smearing and blurring when there is a large amount of rapid on-screen motion occurring.The maximum frame rate depends on the bandwidth of the electronics and the transmission system, and the number of horizontal scan lines in the image. A frame rate of 25 or 30 hertz is a satisfactory compromise, while the process of interlacing two fields of the picture per frame is used to build the image. This process doubles the apparent number of fields per second and further reduces flicker and other defects in transmission.

Receiving signal

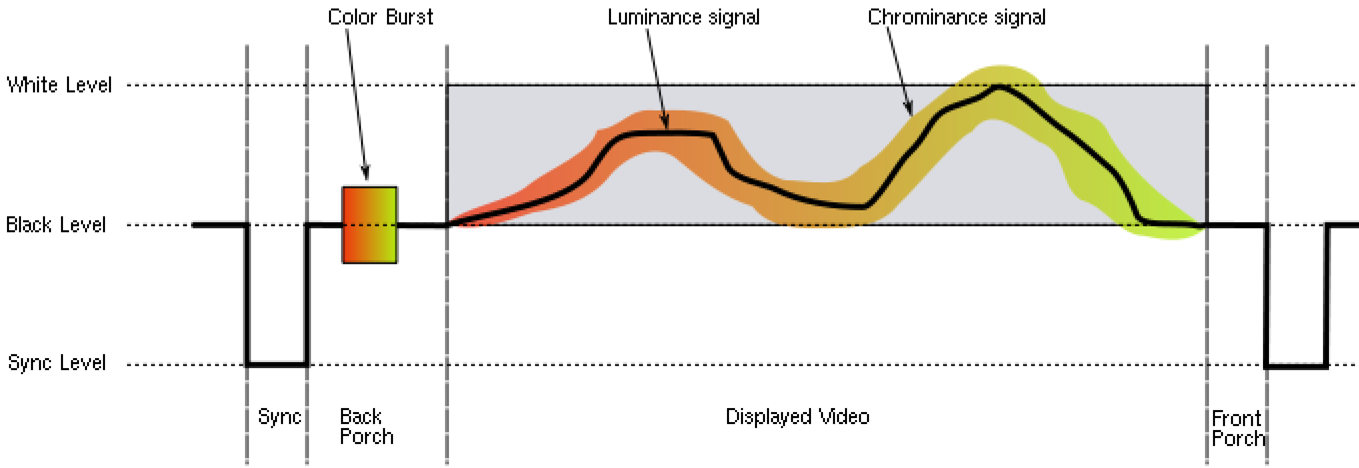
The television system for each country will specify a number of channels within the UHF or VHFfrequency ranges. A channel actually consists of two signals: the picture information is transmitted using amplitude modulation on one frequency, and the sound is transmitted withfrequency modulation at a frequency at a fixed offset (typically 4.5 to 6 MHz) from the picture signal.The channel frequencies chosen represent a compromise between allowing enough bandwidth for video (and hence satisfactory picture resolution), and allowing enough channels to be packed into the available frequency band. In practice a technique called vestigial sideband is used to reduce the channel spacing, which would be at least twice the video bandwidth if purely AM was used.Signal reception is invariably done via a superheterodyne receiver: the first stage is a tuner which selects a channel and frequency-shifts it to a fixed intermediate frequency (IF). Signal amplification (from the microvolt range to fractions of a volt) is then performed largely by the IF stages.

Extracting the sound

At this point the IF signal consists of a video carrier at one frequency and the sound carrier at a fixed offset. A demodulator recovers the video signal and sound as an FM signal at the offset frequency (this is known as intercarrier sound).The FM sound carrier is then demodulated, amplified, and used to drive a loudspeaker. Until the advent of NICAM, and MTS, sound transmission was invariably monophonic.

Structure of a video signal

The video carrier is demodulated to give a composite video signal; this contains luminance (brightness), chrominance (color) and synchronization signals;[5] this is identical to the video signal format used by analog video devices such as VCRs or CCTV cameras. Note that the RF signal modulation is inverted compared to the conventional AM: the minimum video signal level corresponds to maximum carrier amplitude, and vice versa. The carrier is never shut off altogether; this is to ensure that intercarrier sound demodulation can still occur.



Each line of the displayed image is transmitted using a signal as shown below. The same basic format (with minor differences mainly related to timing and the encoding of color) is used for PAL, NTSC and SECAM television systems. A monochrome signal is identical to a color one, with the exception that the elements shown in color in the diagram (the color burst, and the chrominance signal) are not present.

Monochrome video signal extraction

The luminance component of a composite video signal varies between 0 V and approximately 0.7 V above the 'black' level. In the NTSC system, there is a blanking signal level used during the front porch and back porch, and a black signal level 75 mV above it; in PAL and SECAM these are identical.In a monochrome receiver the luminance signal is amplified to drive the control grid in the electron gun of the CRT. This changes the intensity of the electron beam and therefore the brightness of the spot being scanned. Brightness and contrast controls determine the DC shift and amplification, respectively.

Color video signal extraction

Colour bar generator test signal

A color signal conveys picture information for each of the red, green, and blue components of an image (see the article on Color space for more information). However, these are not simply transmitted as three separate signals, because:

- such a signal would not be compatible with monochrome receivers (an important consideration when color broadcasting was first introduced)
- it would occupy three times the bandwidth of existing television, requiring a decrease in the number of channels available
- typical problems with signal transmission (such as differing received signal levels between different colors) would produce unpleasant side-effects.

Instead, the RGB signals are converted into YUV form, where the Y signal represents the overall brightness, and can be transmitted as the luminance signal. This ensures a monochrome receiver will display a correct picture. The U and V signals are the difference between the Y signal and the B and R signals respectively. The U signal then represents how 'blue' the color is, and the V signal how 'red' it is. The advantage of this scheme is that the U and V signals are zero when the picture has no color content. As the eye is more sensitive to errors in luminance than in color, the U and V signals can be transmitted in a relatively lossy (specifically: bandwidth-limited) way with acceptable results. The G signal is not transmitted in the YUV system but is recovered algebraically at the receiving end.

Colour signals mixed with video signal

In the NTSC and PAL color systems, U and V are transmitted by adding a color subcarrier to the composite video signal, and using quadrature amplitude modulation on it. In NTSC, the subcarrier is at approximately 3.58 MHz, in the PAL system it is roughly 4.43 MHz these frequencies are within the luminance signal band, but the exact frequency is chosen so that it is midway between two harmonics of the line repetition rate, thus ensuring that the majority of the energy of the luminance signal does not overlap with the energy of the chroma signal.In the U.K. PAL (D) system the actual frequency is 4.433618.75 Hz, a direct multiple of the scan rate frequency. This frequency was chosen to minimise the chroma beat interference pattern which is visible in areas of high color saturation in the transmitted picture.The two signals (U and V) modulate both the amplitude and phase of the color carrier, so to demodulate them it is necessary to have a reference signal against which to compare it. For this reason a short burst of reference signal known as the color burst is transmitted during the back porch (re-trace period) of each scan line. A reference oscillator in the receiver locks onto this signal (see phase-locked loop) to achieve a phase reference, and uses its amplitude to set an AGC system to achieve an amplitude reference.The U and V signals are then demodulated by band-pass filtering to retrieve the color subcarrier, mixing it with the in-phase and quadraturesignals from the reference oscillator, and low-pass filtering the results.

Test card showing "Hanover Bars" (colour banding phase effect) in Pal S (simple) signal mode of transmission.

NTSC uses this process unmodified; unfortunately this often results in poor color reproduction due to phase errors in the received signal. The PAL D (delay) system corrects this by reversing the phase of the signal on each successive line and averaging the result over pairs of lines. This process is achieved by the use of a 1H (where H = horizontal scan frequency) duration delay line. (A typical circuit used with this device converts the low frequency color signal to ultrasonic sound and back again). Phase shift errors between successive lines are therefore cancelled out and the wanted signal amplitude is increased when the two in-phase (coincident) signals are re-combined.In the SECAM television system, U and V are transmitted on alternate lines, using simplefrequency modulation of the color subcarrier.In analog color CRT displays the

brightness control signal (luminance) is fed to the cathodeconnections of the electron guns, and the color difference signals (chrominance) are fed to the control grids connections. This simple matrix mixing technique was replaced in later solid statedesigns of signal processing.

Signal tracking

The practical value of signal tracing as a means of rapidly locating trouble in radio circuits is too well known to require any special pleading. Even when used by an inexperienced radio student, this method gives his tentative efforts a quality directness and continuity In the hands of an expert, the technique identifies and isolates trouble with incredible speed.In radio servicing, no man can attempt to clear trouble intelligently unless he knows the function of each part ind it relation to every other part. Aside from its practical utility, signal tracing has great educational value. Even on paper, without instruments, a student may be taught to trace the signal from point to point, to describe its character, and to account for any deviation from normal operation. A most helpful exercise, both for practical work and for an underanding of principles, is to follw the signal along its entire trip through the receiver. A detailed and lettered diagram may be used to indicate the points at witch the signal will be examined. Other points will be tested to make sure that the signal has not wandered off onto forbidden paths.

Fig. shows a conventional superheterodyne receiver with one untuned r.f. stage, diode detector, a.v.c., and pentoded output. If the student will master this fundamental circuit, if he will learn "the funciton of each part and its relation to every other part," he will find that hew knows something about radio. A standard radio receiver can be converted easily into a simple dynamic tester. Such an instrument was covered in an article entitled "Clearing That Intermittent," which appeared in the September, 1944, issue of Radio News. It traces the signal audibly from antenna post to voice coil. The use of an analyzer of this type (or any professionally manufactured unit) gives rise to the detailed analysis that follows.

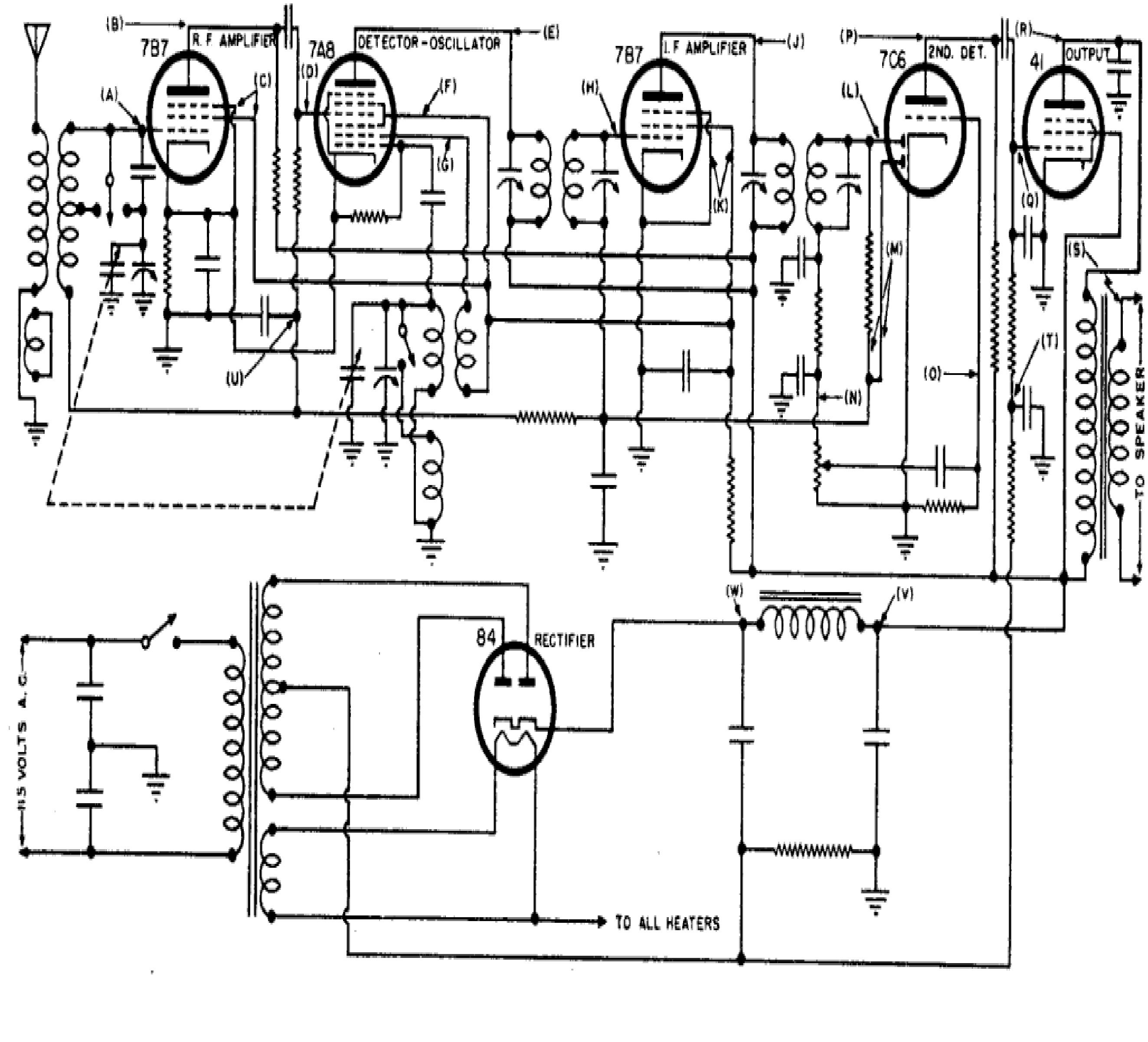

(B)
7B7
R.F AMPLIFIER
7A8
DETECTOR-OSCILLATOR
(E)
7B7
I.F AMPLIFIER
(J)
(P)
7C6
2ND. DET.
(R)
41
OUTPUT
(A)
(C)
(D)
(F)
(G)
(H)
(K)
(L)
(M)
(N)
(O)
(Q)
(S)
(T)
(U)
TO SPEAKER
115 VOLTS A.C.
84
RECTIFIER
(W)
(V)
TO ALL HEATERS

Fig The function of each stage of a super heterodyne receiver should be known before attempting to use signal-tracing methods.

Result - It has been amply demonstrated that signal tracing/injection can follow a signal from its first feeble flutter on the antenna to its final full force at the speaker. Signal tracing/injection can determine whether the signal remains within the prescribed channels as a well-behaved signal should or whether it goes out of bounds. Signal tracing/injection can track down unwanted signal voltages and aid in their elimination. Rather, it is the radioman that does all this. The hand that moves the probe must be guided by an intelligence that knows the function of each part and its relation to every other part. Signal tracing/injection is a happy union of ingenious instrumentation with high intelligence.

Experiment no – 4

Objective- Voltage and waveform measurements of signal

Apparatus required- CRO, Microphone

Theory

Many oscilloscope users take advantage of only a small fraction of the powerful features available to them. In addition, selecting the right measurement from a catalog of possibilities and accurately interpreting the results can lead to confusion and mistakes. This series of articles is intended to help users understand oscilloscope measurements more completely in order to avoid common pitfalls.

Digital storage oscilloscopes vary greatly among vendors in terms of form factor (stand-alone, PXI, VXI, PCI, etc), resolution (8-bit, 12-bit, 16-bit, etc), acquisition rates (1 MS/sec, 1 GS/sec, 40 GS/sec, etc), functionality (advanced triggering, deep memory, self-calibration, etc.), and more. One aspect that separates true oscilloscopes from most PC-based, modular digitizers is the ability to make measurements in hardware on an onboard processor. The available measurements also differ from one oscilloscope to another, although this paper will cover a large segment of them. In addition, the algorithms used to complete the measurements may differ slightly among vendors. This paper will focus on the measurements and algorithms used in ZTEC modular oscilloscopes, but most of these concepts are universal.

Oscilloscope measurements can be sorted into the following three categories:

- Vertical-Axis
- Horizontal-Axis
- Frequency Domain

Vertical-Axis Measurements

Vertical-axis measurements analyze the vertical component of the applied signal. These measurements most often describe a signal in terms of a voltage level. However, they can also correspond to current, power, or any other physical phenomena converted to voltage via a probe or transducer. Some common vertical-axis measurements include Amplitude, Peak-To-Peak, Average, and RMS measurements.

Vertical Resolution and Accuracy

The resolution and accuracy of an oscilloscope can affect measurements greatly, so its important to understand these limitations. An oscilloscope with an 8-bit analog-to-digital converter (ADC) has 28 (256) levels available while a 16-bit ADC has 216 (65536) levels. Thus, a 16-bit oscilloscope has 256 times more resolution than an 8-bit oscilloscope. Since only finite levels are available to represent the signal, there is a quantization error of 1 least significant bit (LSB). To

find the minimum detectable voltage change (code width), divide the input range by the number of levels. Figure 1 depicts a 16-bit oscilloscope digitizing an 8 Vpp square wave with a 100 mV ripple voltage. In this case, the oscilloscopes code
width is (10/65536) 150 uV which allows it to produce a good representation of both the large and small signals. An 8-bit
oscilloscopes code width would be only (10/256) 39 mV, so it could not show the 100 mV component adequately. Changing the input range setting to 250 mVpp would improve the performance, reducing the code width to (0.25/256) 1 mV.

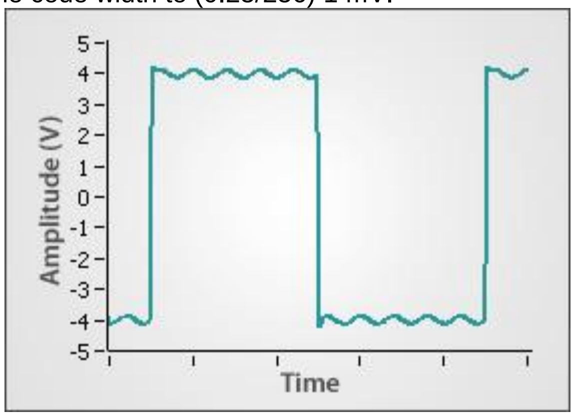


Figure 1: Signal with Large & Small Components

The dynamic range of an oscilloscope refers to how well the instrument can detect small signals in the presence of large signals and is expressed in decibels (dB). It is limited by the quantization error and all other noise sources such as background noise, distortion, spurious signals, etc. The equation for computing the dynamic range is:
Vmax is the maximum voltage that must be acquired and Vres is the minimum resolution that can be seen. A good rule of thumb is that every bit of resolution equals 6 dB of dynamic range. An 8-bit instruments theoretical maximum dynamic range is 48 dB, but it is significantly less once all limitations are considered.Accuracy refers to the oscilloscopes ability to represent the true value of a signal. An oscilloscope with high resolution, does not necessarily translate into giving an accurate result. Accuracy and resolution are related though, because the achievable accuracy of an instrument is limited by the resolution of the ADC.The factors that reduce the accuracy of an oscilloscope can be mostly lumped into high- and low-frequency errors. Noise is generally the cause of high-frequency errors, while low-frequency errors are caused by drift stemming from temperature, aging, bias currents, etc. High-frequency errors can usually be removed by oversampling and averaging. Low-frequency errors often require the calibration of the instrument, either internally or through a factory calibration.

Relative vs. Absolute Measurements

An oscilloscopes accuracy is often specified in terms of gain accuracy and offset accuracy. Gain accuracy is related to how well it handles high-frequency noise and can be called its relative accuracy. Offset accuracy is related to how well it handles the low-frequency issues and can be referred to as absolute accuracy. Figure 2 shows a real and measured 1 Vpp sine wave. Notice that the measured Amplitude is 0.99 V which equates to a gain error of 0.01 V or 1%. The measured signal is also offset 0.02 V for a 2% offset error.

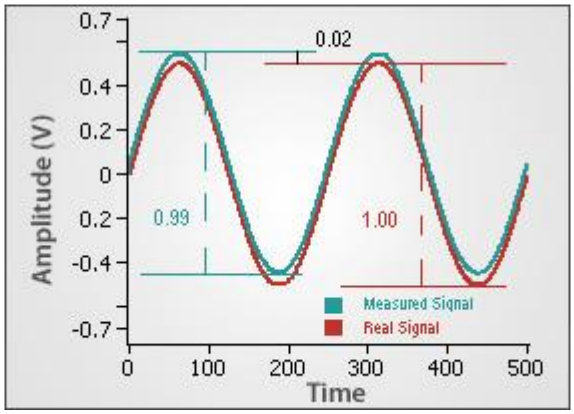


Figure 2: Gain & Offset Errors

Vertical-axis measurements can either be relative or absolute in nature. Relative measurements compare two voltages within the same signal. Amplitude is an example of a relative measurement because it returns the difference between the high and low voltage. The Amplitude of a 1 Vpp sine wave will be the same when it is centered at zero or has an offset of 5 V. Therefore, relative measurements are unaffected by the offset error. Absolute measurements are a representation of their real-world value and are affected by gain and offset errors. The Average measurement is an example of an absolute measurement.

Amplitude vs. Peak-To-Peak

Two vertical-axis measurements that are often confused are Amplitude and Peak-To-Peak. This is understandable because they are identical for all types of signals, except a pulse signal. Figure 3 shows the difference between the Amplitude and Peak-To-Peak (PTPeak) for a pulse signal. Peak-To-Peak returns the difference between the extreme Maximum and Minimum values, while the Amplitude returns the difference between where the pulse settles at the top (High) and bottom (Low) of the signal. The other measurements shown--Rise Overshoot (ROV), Rise Preshoot (RPR), Fall Overshoot (FOV), and Fall Preshoot (FPR)--are only valid when measuring pulses.

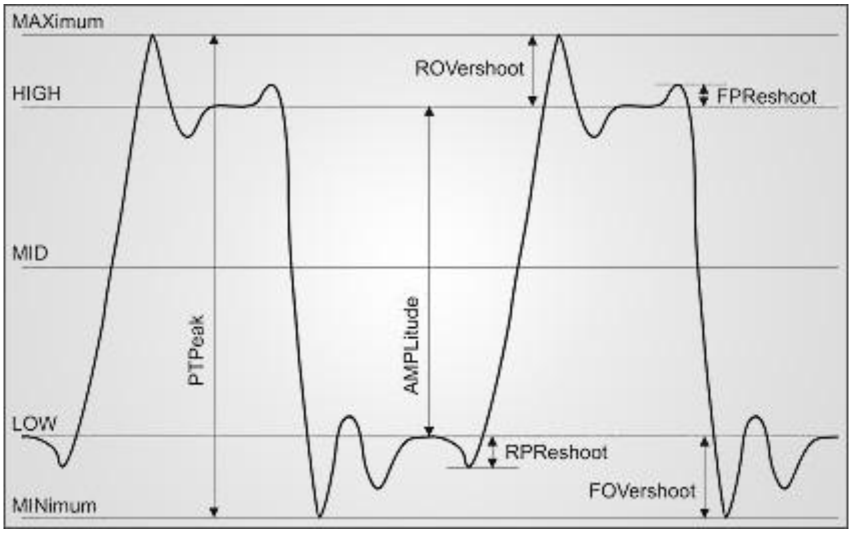


Figure 3: Vertical Axis Measurements [1]

The measurements shown in Figure 3 are computed on the oscilloscope processor using a histogram. Figure 4 shows how the pulse signal in Figure 3 is represented in an 8-bit oscilloscope histogram. The samples are sorted into one of 256 bins, each corresponding to a voltage range. The algorithms simply look for the bit value with the most points for the Low and High measurements and the absolute largest and smallest bit values for the Maximum and Minimum. This allows for an extremely fast computation, but the measurements resolution is limited by the quantization error (1 LSB) of the ADC. The accuracy also suffers due to a single samples susceptibility to noise.

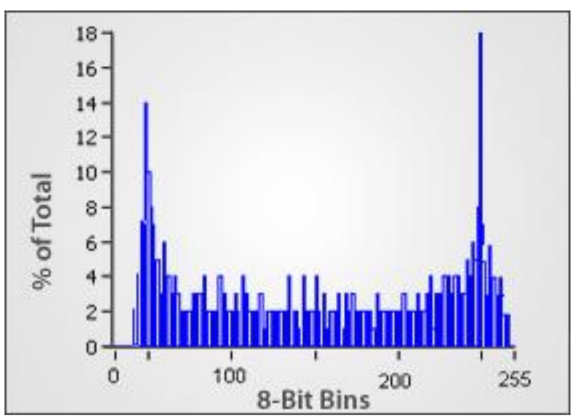


Figure 4: Histogram Processing of a Sine Wave

Root Mean Squared (RMS) & Average

The Direct Current (DC) RMS, Alternating Current (AC) RMS, and Average measurements are methods of characterizing the vertical level and power using the entire waveform.The Average function is the mean vertical level of the entire captured waveform. It can be calculated by taking the sum of all of the voltage levels and dividing that by the number of points as shown:

$$V_{avg} = \frac{\sum V}{\text{Number of Samples}}$$

The DC RMS and AC RMS measurements return the average power of the signal. The DC RMS returns the entire power contained within a signal including AC and DC components. This can also be described as the heating power when applied to a resistor. The AC RMS is used to characterize AC signals by subtracting out the DC power, leaving only the AC power component. The equations for the RMS measurements are as follows:

$$\text{DC RMS} = \sqrt{\frac{\sum V^2}{\text{Number of Samples}}}$$

$$\text{AC RMS} = \sqrt{\frac{\sum (V-V_{avg})^2}{\text{Number of Samples}}}$$

Figure 5 shows these results on a 4 Vpp square wave with 0.5 V of offset.

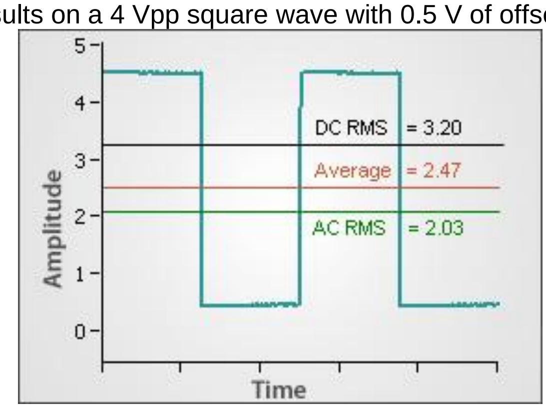


Figure 5: Average & RMS

All three of these measurements are capable of more accuracy than the Amplitude and Peak-To-Peak measurements described in the previous section. The reason for this is that every single point in the waveform is included in the calculation of the Average and RMS measurements. This naturally cancels out noise that may be present in the signal. Additionally, when measuring the Average or RMS values, the more points that are acquired in the waveform, the better the accuracy of the measurements become. The upper bound of the accuracy is determined by the number of bits in the

On board processor. Some oscilloscopes use a 16-bit processor, so these measurements are limited to 16 bits of resolution because the largest number that can be stored on the chip is 16-

bits. However, the 64-bit processor on the ZT4611 modular oscilloscope allows users to attain up to 64 bits of resolution. The tradeoff for the higher accuracy is longer computations since more points must be analyzed.When only a few cycles of a waveform is acquired, it becomes critical to acquire only the full cycles or otherwise the results contain an asymmetric error. Figure 6 shows the same signal as Figure 5 except that an additional (high) half cycle was acquired. The Average and RMS values are offset because of this.

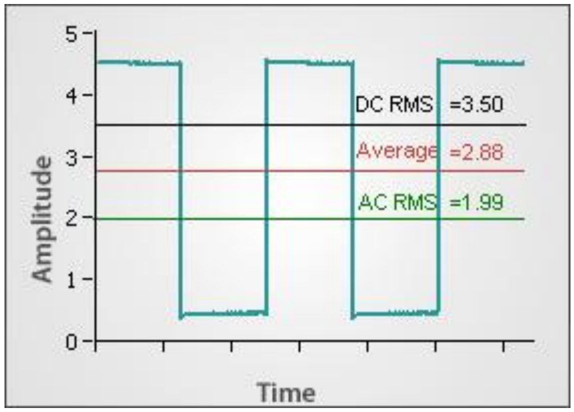


Figure 6: Average & RMS with Partial Cycle

There are a few ways to avoid this circumstance. The best way is to acquire a longer waveform that includes many cycles so that the offset is effectively minimized. This method requires more time and more onboard memory to store the waveform. Another way to solve the problem is to make use of the Cycle RMS or Cycle Average measurements. These calculate the RMS and Average including only the points from the first cycle of the waveform. The third way to solve the problem would be to use a gated measurement. Gated measurements allow the user to choose the points that are included. This can be done by selecting a start and stop time or a start and stop point. Both the Gated By Time and Gated By Points methods require the user to know the period of the waveform to solve the problem shown in Figure 6.

Horizontal-Axis Measurements

Horizontal-axis measurements involve analyzing the horizontal time axis of the applied signal, and include measurements such as Period, Frequency, and Rise Time. The value returned is usually in time, but can also be expressed as a ratio, radians, or in Hertz.

Horizontal Resolution and Accuracy

The horizontal-axis resolution is limited by the sample rate of the onboard clock. A board with a 1 GS/sec acquisition rate can only achieve a time resolution of 1 / (1 GS/sec) = 1 nsec. Much like the vertical axis, the horizontal-axis accuracy can be reduced by high- and low-frequency errors.

High-frequency errors consist of clock jitter or phase-noise, but these are usually minute when considering that clocks used on most oscilloscopes have errors of 100 parts per million (ppm) or less. An error this small is insignificant when compared to the accuracy of the vertical axis. Occasionally, when completing horizontal-axis measurements, it may appear that clock jitter or phase-noise is causing incorrect readings. However, it is usually the lack of vertical-axis accuracy or noise that causes the incorrect time measurement. This will be further discussed later in the Edge **Measurement section.**

Low-frequency errors can be a problem and consist of drift associated with temperature, aging, etc. Annual factory calibrations must be completed to guarantee the accuracy of the clock over a long period of time.

Horizontal Waveform Measurements

The majority of the horizontal-axis measurements are fairly straight forward. They are shown in Figure 1. The Period measures the average time for a cycle to complete using the entire waveform in the capture window. The Frequency is the inverse of the period and is measured in Hertz. The Positive Pulse Width measures the time from the first rising edge to the first falling edge, while the Negative Pulse Width does the opposite. The Positive and Negative Duty Cycles are then calculated by taking the ratio of their corresponding Pulse Widths to the Period. All of these measurements are calculated based on the Middle voltage level which is simply halfway between the High and Low values. The time of the first maximum and minimum levels can also be retrieved using the Time of Maximum and Time of Minimum measurements.

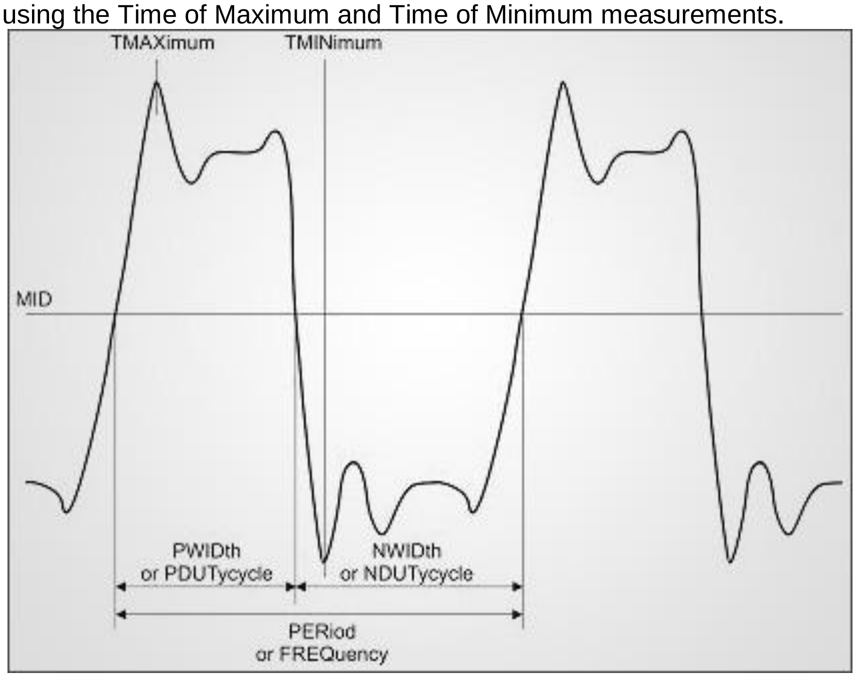


Figure 1: Horizontal-Axis Measurements

When acquiring Period and Frequency measurements their accuracy can be very much affected by the sample rate. Both of these measurements are calculated by counting the number of samples that occur between Middle crossings. If a 10 MHz signal is being sampled at 100 MHz, this will result in exactly ten samples per period. The samples at the zero crossings may be very near the borders. If one is missed, this results in only nine samples being detected which returns a Period of 9 * (10nsec) = 90 nsec and a resulting Frequency of 11.1 MHz. This resolution is obviously not very good. It could be improved by acquiring long waveforms to capture many cycles and average out the resolution error. Another solution would be to sample the signal at 1 GHz or greater. Overall, for more accurate Frequency and Period measurements, it is best to sample at a far greater rate than the signal and capture many cycles. Cycle Average and Cycle Frequency measurements can be used to measure only the first cycle if desired. Also, the gated methods described in the vertical-axis section can also be employed. All of these methods are still susceptible to the resolution errors described above.Phase measurements make most sense when acquiring two or more waveforms to determine how many radians or degrees a waveform is shifted in relation to another. However, the phase can be measured on a single periodic signal. This can be confusing, but it is simply calculated by comparing the starting point of the waveform to the rising edge Middle crossing. Figure 2 shows one signal with a positive 90 degree (1.57 rad) phase shift and another with a 270 degree (4.72 rad) phase shift.

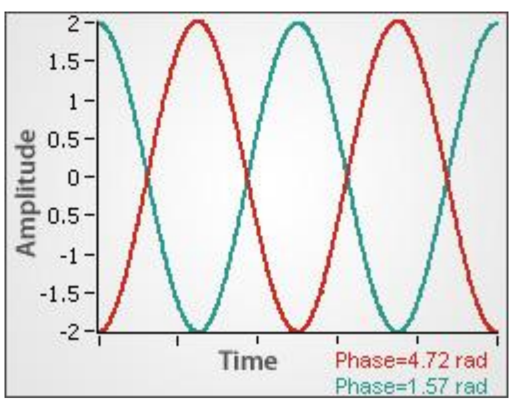


Figure 2: Phase Measurement

Edge Measurements

A subset of Horizontal-Axis measurements is Edge Measurements. All of these measurements are made in relation to the Reference High (REF HIGH), Reference Middle (REF MID), and Reference Low (REF LOW). These references are user-selectable and are different than the

High, Middle, and Low levels discussed in the previous sections, which are not user-selectable. By default, the REF HIGH, REF MID, and REF LOW are set to 90%, 50%, and 10% of the Amplitude (High

Low). However, all of these percentages can be adjusted to suit the applications needs, or input in terms of absolute voltages.

With a firm understanding of the references, the meaning of the edge measurements becomes clear. They are shown in Figure 3. The Rise Time (RTIMe) measures the relative time for the leading edge of a pulse to rise from the REF LOW to the REF HIGH. The Fall Time (FTIMe) measures the same thing on the falling edge. The Rise Crossing Time (RTCRoss) is the absolute time when the waveform rises above the REF MID, measured from the start of the waveform. The Fall Crossing Time (FTCRoss) measures the same thing on the falling edge. All four of these measurements are edge selectable, meaning that the user can choose which number edge to characterize within the capture window.

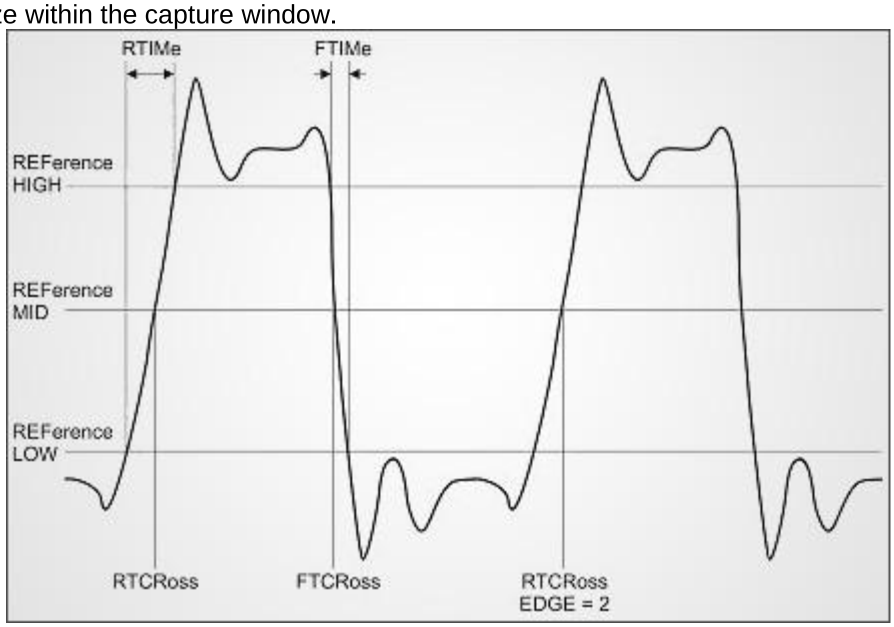


Figure 3: Edge Measurements

One possible problem when taking edge measurements are inaccurate crossings due to noise on the vertical axis. Figure 4 shows a signal with and without vertical noise and how that could affect a horizontal measurement. The noisy signal crosses the voltage thresholds at slightly different points than the smooth signal, causing a shorter Rise Time Measurement. Another problem with a noisy signal is the potential for false crossings. This occurs when noise causes a signal to dither near the crossing points in several recorded crossings. Both of these problems can be avoided by either oversampling and averaging or by using the Smooth function before taking the measurement to reduce the noise. The algorithms used on ZTEC oscilloscopes incorporate hysteresis at the crossings which helps avoid detecting false crossings. This does result in a minimal detectable edge, however.

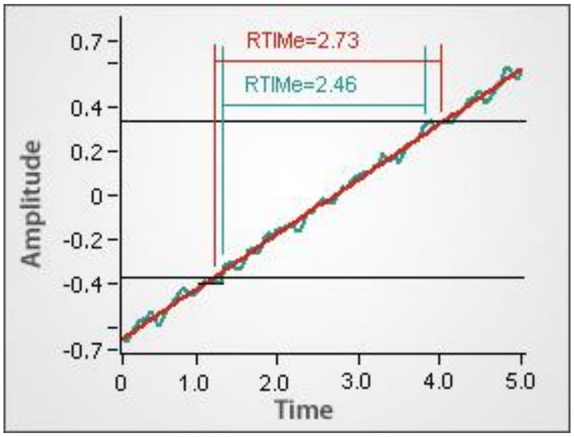


Figure 4: Noisy & Smooth Rise Times

Relative vs. Absolute Measurements

Much like the distinction made between absolute and relative voltage measurements made in the vertical-axis section, there are absolute and relative time measurements as well. For example, the Period of a waveform compares two points on the same waveform, so its often unnecessary to relate this to a real-world or absolute time. Therefore, this is considered a relative time measurement. An example where the absolute time would be important is measuring the Time of Maximum (TMAX), which returns the timestamp of the first maximum voltage level in relation to the start of the acquisition.

Frequency Domain Measurements

Frequency domain measurements involve translating a time-domain waveform with a fast Fourier transform (FFT), and then measuring the noise and distortion characteristics in the frequency domain. Frequency domain measurements provide magnitude and phase characteristics versus frequency.

Frequency Resolution and Accuracy

Using the FFT to quickly transform a signal into its frequency components is powerful, because it reveals signal characteristics that cant be seen in the time-domain. The FFT used within ZTEC oscilloscopes returns complex IQ data which is then converted to magnitude and phase data. Figure 1 shows the result of calculating the FFT of a signal and a few of the measurements.

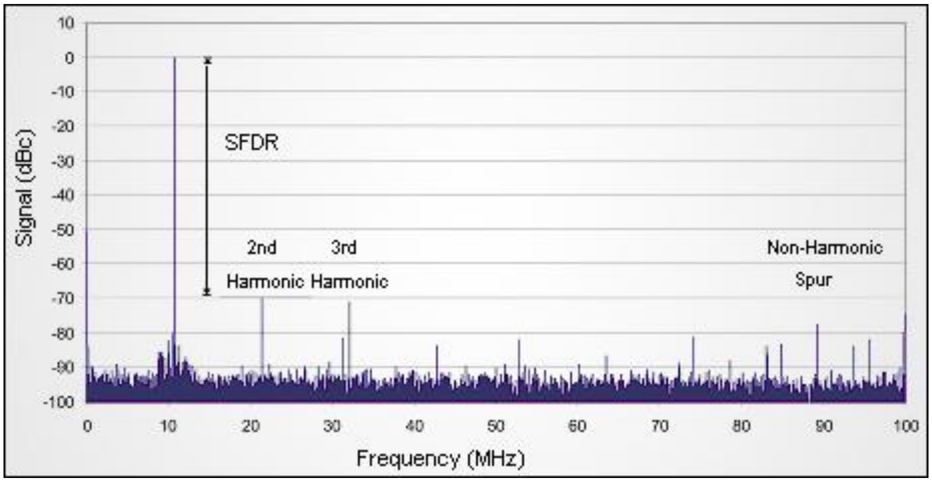


Figure 1: Frequency Domain Measurements

ZTEC oscilloscopes provide four FFT windows that can be applied as well. Windows are used to increase the spectral resolution in the frequency domain. The Rectangular Window provides the best frequency and worst magnitude resolution. It is almost the same as no window. The Blackman-Harris Window provides the best magnitude and worst frequency resolution. The Hamming Window provides better frequency and worse magnitude resolution than the Rectangular Window. It provides slightly better frequency resolution than the Hanning Window. The Hanning Window provides better frequency and worse magnitude resolution than the Rectangular Window.Like some of the vertical- and horizontal-axis measurements discussed previously, the accuracy of the FFT can be improved by analyzing longer waveforms. Due to the nature of the calculations, the resolution is limited to half of the resolution of the onboard processor. In the case of the ZTEC ZT4611 oscilloscope, which uses a 64-bit processor, the accuracy would be limited to 32 bits of resolution. The FFT algorithm is binary in nature, so for the best performance it is wise to select a waveform size that is equal to 2N.

Frequency Domain Measurements

Once a signal has been converted to the frequency-domain, five valuable measurements can be performed as explained in the following paragraphs. All of these measurements assume that the input signal is a perfect single-frequency sine wave and that all other frequency components are assumed to be harmonics or noise. All except the ENOB (bits) are expressed in decibels relative to carrier (dBc). THD is the only negative value.

The Signal-to-Noise Ratio (SNR) is the ratio of the RMS amplitude of the fundamental frequency to the RMS amplitude of all non-harmonic noise sources. SNR does not include the first nine harmonics as noise. In Figure 1, the SNR would be computed by dividing the magnitude of the fundamental by the sum of the magnitudes of all of the other frequency components, excluding the 2nd through the 10th harmonics. SNR is commonly used when only the narrow-band around the fundamental frequency is of concern and the harmonics will not have an effect on the system under test.

The Total Harmonic Distortion (THD) is the ratio of the RMS amplitude of the sum of the first nine harmonics to the RMS amplitude of the fundamental. In Figure 1, this would be calculated by summing the magnitudes of the 2nd through the 10th harmonics and then dividing that by the fundamental magnitude. THD is a concern when using active components such as amplifiers and mixers where the harmonics need to be minimized to reduce distortion.

The Spurious-Free Dynamic Range (SFDR) is the ratio of the RMS amplitude of the fundamental to the RMS amplitude of the largest spurious signal. This spurious signal can be a harmonic or noise frequency component. In Figure 1, the SFDR would be computed by dividing the magnitude of the fundamental by the magnitude of the 2nd harmonic, since it is the largest spurious signal. SFDR is used when there is a dominant spurious signal in relation to the other noise and distortion components.The Signal-to-Noise and Distortion (SINAD) is the ratio of the RMS amplitude of the fundamental to the RMS amplitude of the sum of all noise and distortion sources. This is equivalent to the sum of the SNR and THD. In Figure 1, this would be calculated by dividing the magnitude of the fundamental by the sum of the magnitudes of all of the other frequency components, including harmonics and noise. SINAD is used in broad-band applications where all harmonics and noise will affect the signal.The Effective Number of Bits (ENOB) is another way of expressing SINAD. It provides a measure of the input signal dynamic range as if the signal were converted using an ideal ADC. For instance, the ENOB of an 8-bit oscilloscope is often somewhere in the 6-7 bit range due to the noise and distortion affecting the instrument. The ENOB is calculated using the following equation:

$$\text{ENOB} = \frac{\text{SINAD} - 1.763}{6.02}$$

High-Speed ADC Test Example

The specifications and test procedures of a high-speed Analog to Digital Converters (ADCs) are generally expressed in the frequency domain. The frequency measurements on a ZTEC oscilloscope can be used to mimic a more expensive spectrum analyzer to complete these tests. One test that is often used is a two-tone or multi-tone distortion test. This is completed because intermodulation distortion can occur when the ADC samples a signal composed of more than one sine wave. Figure 2 shows the FFT of an acquired ADC data record undergoing a two-tone test. Once the FFT is created, measurements such as THD and SINAD can be used to characterize the performance of the ADC.

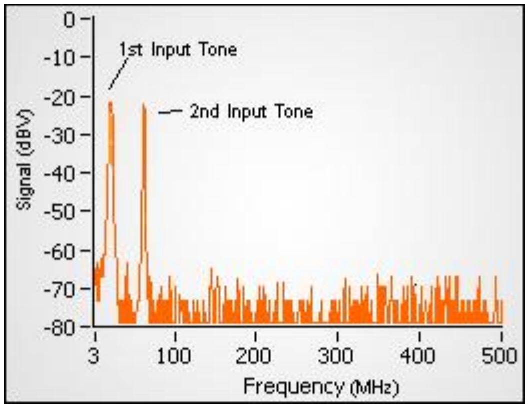


Figure 2: FFT of Two-Tone Distortion Test

This concludes "The Fundamentals of Oscilloscope Measurements". Hopefully, these articles have provided our readers with a little deeper understanding of the waveform measurements available from an oscilloscope. This understanding can help users leverage the power of oscilloscopes more effectively and avoid potential pitfalls.

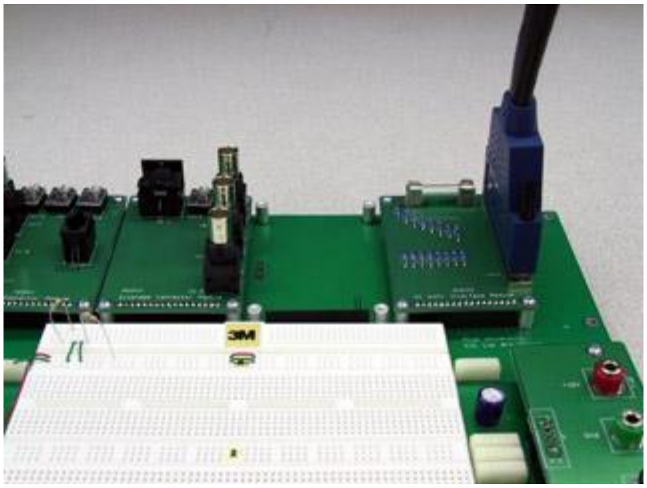
$$V_{avg} = \frac{\sum V}{\text{Number of Samples}}$$

Observation table-

Pin No.	Function	Typical Voltage
1 and 8	Heater connected across 1 and 8	6.3 V a.c.
7	Cathode	75 V dc
2 and 6 (Internally shorted)	Control grid	-Ve to 40V dc
3	Screen grid	160V. dc
4	Focusing grid	0V
5	Ground	0V
6	No connections	0V

Procedure-

Step 1: Connect the cable from the DAQ card to J3-1 on the rightmost interface module. It should look like this:

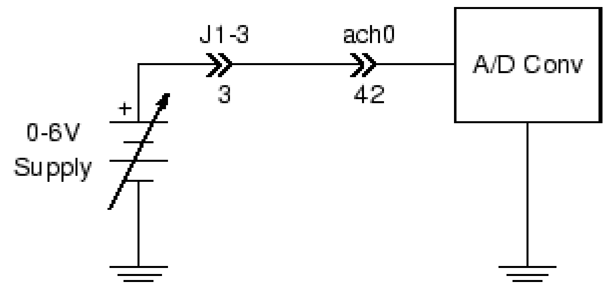


Step 2: Plug your BNC-banana adapter into the 6V supply terminals.

Note
There is a bump on one side of the adapter to denote which prong is connected to ground. Be sure to plug this prong into the black terminal of the power supply.

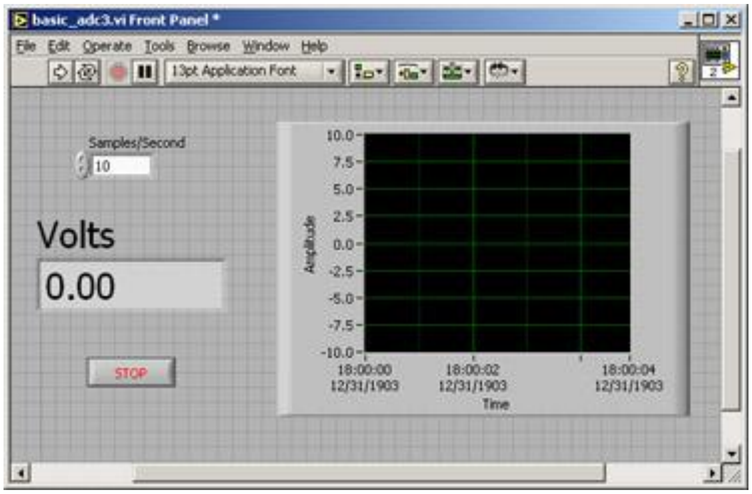
Step 3: Using a BNC patch cable, connect the 6 V supply output to J1-3.

Step 4: Strip both ends of a 16 cm length of wire and connect J1-3 to A/D channel 0 as shown in the following diagram. The numbers below the connector symbols (→≫—) are the pin numbers on the interface connector socket strip.



Note that, as with the function generator and oscilloscope, the ground connection to the DAQ card is made automatically. We will not show the DAQ card ground in subsequent drawings.

Step 5: Load the "Basic ADC" program from the Start menu by following the path: Programs -> ELEC 243 -> Basic ADC. It should look like this:



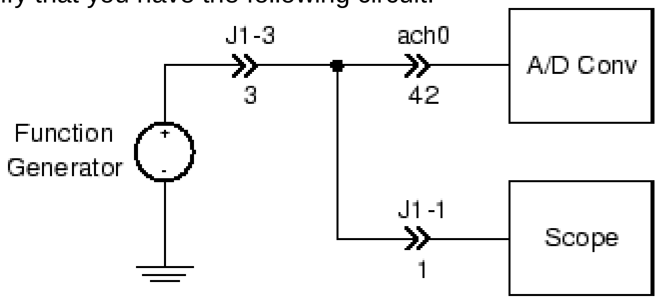
Labview programs are called Virtual Instruments (or VIs for short).

Step 6: Start the instrument by selecting Run from the Operate menu, or by pressing the run button (the small arrow just below the menu bar), or by pressing CTRL-R on the keyboard with the cursor over the panel.

Vary the power supply voltage and verify that the displayed value changes. Measure the voltage with your Fluke DMM and see how the values compare.

Step 7: Move the BNC patch cable from the 6 V supply to the function generator 50Ω Output. With a second BNC patch cable, connect CH 1 of the oscilloscope to J1-1. Strip a short piece of wire and connect the function generator output (on J1-3) to the oscilloscope input (on J1-1).

Step 8: Verify that you have the following circuit:



Step 9: Using the oscilloscope, adjust the function generator to produce a 5 V p-p, 0.5 Hz sine wave. An easy way to do this is to first select the 1 kHz range, set the amplitude to 5 V p-p and the frequency to 500 Hz, then switch to the 1 Hz range. Observe the signal on the Basic ADC display.

Step 10:	Increase the frequency to 1 Hz. Note that due to the reduced number of samples per cycle, the sinusoidal shape of the waveform is less smoothly defined.
Step 11:	Increase the freqency to 10.00 Hz. Observe the resulting display.
Question 1:	Explain why a 10 Hz sine wave, when sampled 10 times per second, appears as a nearly constant (DC) value on the A/D display. What would an 11 Hz sine wave look like under the same conditions?
Step 12:	Increase the sample rate to 100 samples per second by entering "100" into the Samples/Second field and pressing the Enter key. Observe the resulting display.
Step 13:	Stop the Basic ADC program by pressing the red STOPbutton.

Note
Strange things can happen if two VIs are running simultaneously. Always make sure that all other VIs have been stopped before starting a new one.

Result - Voltage and waveform measurements of signal is taken from CRO.

Precautions-

1. all connection should be made properly.
2. apparatus should be handle with care.

Experiment no –5

Objective – Alignment of RF, VIDIF and SIF sections.

Apparatus required- trap circuits, oscillator circuits, tuner, AGC, CRO, balun

Theory -

Monochrome Receiver Alignment –The exact procedure for aligning the tuner and IF stage is based on their design and is perfected after a great deal of experimentation by the manufacturers of television Receivers therefore, the alignment should be carried out strictly in accordance with the procedure recommended in the literature of the receiver.

Alignment Sequence-It is a good practice to carry out receiver alignment in the following sequence:

1. Setting up of trap circuits at proper frequencies,
2. Alignment of IF stages,
3. Sound section alignment,
4. Tracking of RF and mixer stages,
5. Tracking of oscillator circuits to obtain best picture and sound output.

RF Tuner Alignment- the main requirements of tuner alignment are:

(1) Adjustment of tuned circuit at the antenna input terminals, RF amplifier output and mixer output, to obtain a bandwidth of 7MHz.

(2) Setting of the local oscillator to correct frequency for each channel.The initial precaution are the same as detailed for IF section alignment. In addition the receiver, sweep and marker generators should placed on a metal plate acting as a ground plane. The equipment and receiver should be properly bonded and grounded to the metal plate.The circuit connections are shown in fig. The tuner should be left to have its normal AGC bias and the total oscillators should not be disabled. However, the horizontal sweep oscillator may be cut-off to avoid any undesired pick up. The shield cover of the tuner must be left 'on' because its capacitance has an effect an all tuner adjustment. The alignment procedure is as under:

- Connect the sweep and marker generator combination of the receiver input terminals through a
- balun or any matching termination.
- Set the sweep and marker generator frequencies in accordance with the channel setting on the tuner.
- Adjust width control to obtain a sweep of about 10MHz.
- Adjust sluge of the tuned circuit to obtain maximum gain and a symmetrical response curve. The marker on either side will indicate the channel bandwidth.
- Proceed as above for the remaining channels and ensure that practically same bandwidth and response curve is obtained on all the channels. Note that for each channel it would be necessary to reset the sweep generator and marker frequencies to new values.

DIAGRAM-

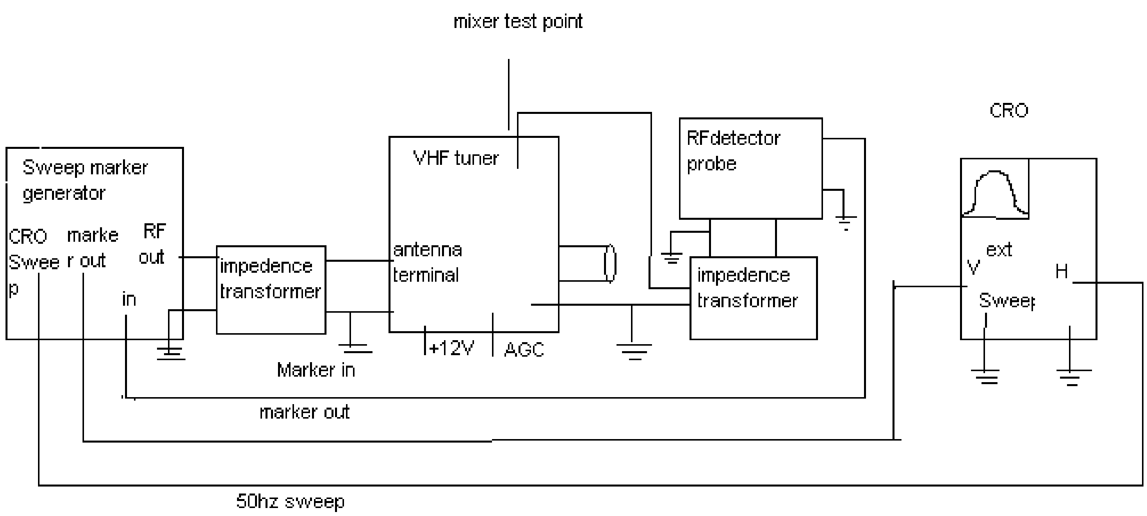


fig A typical set up for the alignment of a VHF tuner

IF Section Alignment-

The primary purpose of IF amplifier is to obtain a response curve of proper shape, frequency coverage and gain. Correct alignment of the combined picture and sound IF stages is necessary for a good picture and distortion free sound. There are two method of alignment IF stage:

(a) Marker generator and voltmeter method. For staggered-tuned IF stage of the receiver, the individual stage are tuned at predetermined frequencies using a CW marker generator and VTVM. The electronic voltmeter is connected at the output of video detector. After adjusting all the trap circuit for minimum output and tuned band-pass circuit for maximum output, a sweep generator, a marker generator and a scope is used to check the overall response curve.

(b) Sweep cum marker generator and scope method. One such method to inject the output of the sweep cum marker generator into the input circuit of the last IF amplifier and observe the response on a scope connected to the video detector output. The tuned circuit of the IF stage is adjusted for proper and amplitude following the curve given in the service manual of the receiver.

Overall IF Response-

The overall IF response includes if all the tuned circuit from the mixer output in the tuner to the video detector.

Initial adjustment before proceeding to adjust double-tuned circuit of the IF sections make the following connection and adjustment:

(1) Disable the horizontal scanning oscillator to prevent the appearance of any spikes on the response curve. In the absence of any specific service instruction connect a dummy load across the horizontal sweep amplifier B voltage from going too high.

(2) Disable AGC bias and instead connect the recommended fixed bias from a bias box or from the sweep generator if available.

(3) Connect sweep cum marker generator output to the mixer input through an impedance matching transformer.

(4) In case of the sensitivity of the vertical amplifier is low, take after one stage of video amplifier through an isolating resister.
(5) Calibrate the graticule of the CRO screen by feeding a low frequency ac voltage of known amplitude.
(6) Set the sweep-mode switch of the scope on ‘external’ and connected 50volt sweep voltage from the generator to the horizontal input of the terminal of the scope.

(7) Set the dial of the sweep generator at about 36 MHz and adjust sweep width control to get an overall variation from 28 to 43 MHz.
(8) Disable tuner oscillator to prevent any interference with sweep and marker signal.
(9) Set the marker generator to deliver simultaneous at all the important frequencies along the response curve.
(10) Switch on all equipment and receiver. Allow a small warm up time before proceeding to adjust various tuned circuits

IF Alignment Procedure-

(1) Observe the pattern which appears on the scope screen and make horizontal gain control adjustments if necessary to obtain a suitable spread of the pattern.
(2) To make sure that the IF stages are not being overloaded; vary step attenuator or the sweep generator to see that the height of the curve varies with changes in the RF output voltage.
(3) Adjust phase control and polarity switch if necessary to obtain a single trace of desired polarity.
(4) Use the blanking control to get a reference line during retrace interval of the sweep.
(5) Adjust slugs of the various tuned circuits to obtain an overall response as given in the service manual. In general the response should be almost flat between 34 to 38 MHz. use variable markers to locate these frequencies. Retune trap circuit to get almost 50% amplitude at the picture carrier marker of 38.9MHz with reference to the maximum on the response curve.

While adjusting tuned transformers, their slugs may produce to resonant point. The adjustment which is obtained with the core farther away from center of the coil is normally the correct position for optimum band-width.

Result- study has completed.

Alignment Precaution-While the detailed alignment procedure may differ from receiver to receiver, it is worthwhile to observe the following precaution before commencing alignment of any section of the receiver:

(1) Shielded wire should be used for interconnecting sweep generator, receiver under alignment and scope to avoid stray field pickup effect.
(2) All connecting leads and cable must be kept as small as possible to minimize high frequency signal losses.
(3) It should be ensured that the load resistance across which the scope is connected has one end at ground potential and is also strapped to the ground terminal of the scope

Experiment no –6

OBJECT: - Study of composite video signal.

THEORY : - Video signal vary between constant amplitude. That level of video signal when picture detail is transmitted according to maximum whiteness is called as peak white level. This level signal is fixed at maximum value of 10 to 12.5% whereas black level is fixed at 72%. Synchronous pulses are added at 75% which is called as blanking level. The difference between black level & blanking level is called as pedestal. In original these two levels are very close to each other. Like this picture information at special time the relative brightness of picture get vary according to composite video signal from 10 to 75%.Lowest 10% voltage range is not used for noise reduction it is also known as white than whiter range. In this modulator without distortion enough margin is provided for excessive bright spot.

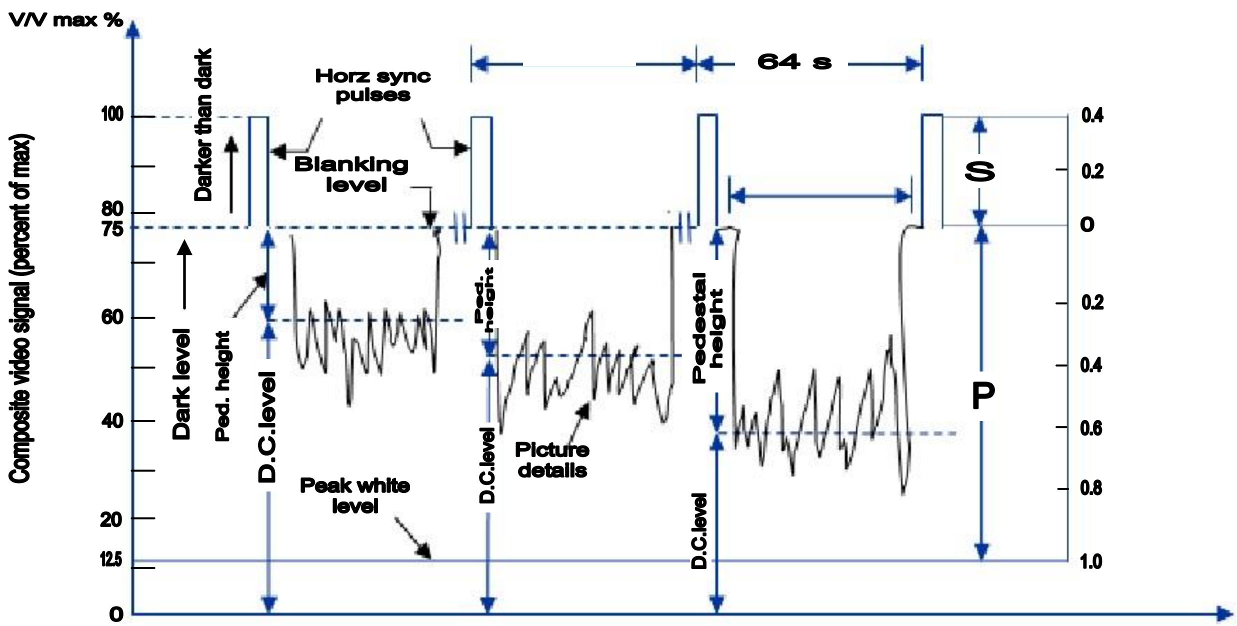
DC COMPONENT LEVEL OF THE VIDEO SIGNAL:-The scene of video signal according.To the average brightness there is one average value or dc component. In the absence of dc component receiver does not follow the change in brightness. Like in black background the gray signal of gray picture element have white area in which there is no change in signal.

PEDESTAL HEIGHT:- Pedestal height is the distance between the video signal of pedestal level & dc level. It indicate the average brightness because average brightness measure the average value of black level.

THE BLANKING PULSES:- The composite video signal contains blanking pulses to make (75 percent) the retrace lines invisible by raising the signal amplitude slightly above the black level during the time the scanning circuits produce retraces. The composite video signal contains horizontal and vertical blanking pulses to blank the corresponding retrace intervals. The repetition rate of horizontal blanking pulses is therefore equal to the line scanning frequency of 15625 Hz. Similarly the frequency of the vertical blanking pulses in equal to the field-scanning frequency of 50 Hz. It may be noted that through the level of the blanking pulses is distinctly above the picture signal information, these are not used as sync pulses. The reason is that any occasional signal corresponding to any extreme black portion in the picture may rise above the blanking level and might conceivably interface with the synchronization of the scanning generators. Therefore, the sync pulses, specially designed for triggering the sweep oscillators are placed in the upper 25 percent (75 percent to 100 percent of the carrier amplitude) of the video signal, and are transmitted along with the picture signal.

SYNC PULSE AND VIDEO SIGNAL AMPLITUDE RATIO:- The overall arrangement of combining the picture signal and sync pulses may be thought of as a kind of voltage division multiplexing were above 65 per cent of the carrier amplitude is occupied by the video signal and the upper 25 per cent by the sync pulses. The final radiated signal has a picture to sync signal ratio (P/S) equal to 10/4. This ratio has been found most satisfactory because if the picture signal amplitude is increase at the expense of sync pulses, then when the signal to noise ratio of the received signal falls, a point is reached when the sync pulse amplitude becomes insufficient to keep the picture locked even though the picture voltage is still of adequate amplitude to yield an acceptable picture. On the other hand if sync pulse height is increased at the expense of the picture detail, then under similar conditions the raster remains locked but the picture content is too low an amplitude to setup a worthwhile picture. A ratio of P/S = 10/4, or thereabout, results in a situation such that when the signal to noise ratio reaches a certain low level, the sync amplitude becomes insufficient, i.e., the sync fails at the same time as the picture ceases to be of entertainment value. This represents the most efficient use of the television system.

DIAGRAM OF COMPOSITE VIDEO SIGNAL :-



RESULT:- Study of composite video signal is completed.

Experiment - 7

Objective - Colour TV adjustments, gray scale tracking, Colour killer, focus, chroma traps, sound traps,saturation control, black level

Theory- Colour TV adjustments

Room lighting
Since most people turn down the lights to watch a movie, our recommendations are designed to deliver a better DVD picture in rooms with controlled lighting. Unless you have a big-screen projector or you're sitting at the minimum viewing distance, you shouldn't watch movies in complete darkness--it can cause eyestrain. For bright plasmas and smaller direct-view sets, the ideal setup is to place a dim light directly behind the TV and leave the rest of the room dark. Look for special "daylight" bulbs that glow at 6,500 degrees Kelvin. You should also prevent any light in the room from reflecting off the TV, as glare will hamper image fidelity. Watching at night is best, but if you watch during the day, thick curtains will really improve the picture. Before you make any of the adjustments detailed below, set room lighting as if you were about to watch a movie. For viewing in brighter environments, we recommend you use one of the picture presets, such as Standard, Sports, or Vivid, and reserve your custom settings for dark rooms.

Brightness
What it is: Also called black level, brightness actually adjusts how dark the black sections of the picture appear.

What it does: Excessive brightness can result in a two-dimensional, washed-out look with reduced color saturation. Images with brightness set too low lose detail in shadows, and distinctions between dark areas disappear in pools of black.

How to set it: After connecting your DVD player using the highest-quality input available, insert a DVD that has letterbox bars above and below the image, and find a scene that has a roughly equal amount of light and dark material. Turn up the control all the way, then decrease until the letterbox bars begin to appear black, as opposed to dark gray. If you notice a loss of shadow detail--for example, when people's eyes disappear into the depths under their brows--then you've set brightness too low. Some plasma, LCD, DLP, and LCoS TVs won't ever look black, so you'll need a setup disc to properly configure their brightness

Contrast
What it is: Also called picture or white level, contrast controls the intensity of the white parts of the image and determines the overall light output of the display.

What it does: Contrast is usually set extremely high by default because it makes images look brighter in the store. High contrast can obscure details and distort lines in the image, cause eyestrain in dim rooms, and shorten the lifespan of tubes and plasma elements. Setting contrast too low robs the image of impact.

How to set it: Display a still image from DVD of a white object with some visible details--such as someone wearing a white button-up shirt or a shot of a glacier from the Ice Age DVD. Adjust the control up all the way, then reduce it until you can make out all the details in the white (such as buttons on a shirt or cracks in the ice). In general, TVs look best when contrast is set between 30 percent and 50 percent

Color
What it is: Also called saturation, this control adjusts how intense the colors look.

What it does: When there's too much color, the set looks garish and unrealistic. It's most noticeable with reds, which are often accentuated (pushed) by the TV's color decoder. On the other hand, too little color diminishes the impact of the picture, making it look drab. Setting color to zero results in a black-and-white image.

How to set it: If available, first set the color-temperature control to the warmest option as described below. Then find an image of someone with light, delicate skin tones, preferably a close-up of a face, on a DVD. Turn up the color control until it looks like the person has sunburn, then reduce it until the skin looks natural, without too much red. If the rest of the colors look too drab, you can increase color slightly at the expense of accurate skin tones.

Other controls

Tint: Unless you're using one of the DVDs mentioned in the Intermediate section to set it properly, this control is best left at the midway point.

Sharpness: This adds artificial edges to objects, which sometimes helps with soft cable signals but almost always mars the already sharp image from a DVD. Reduce it to zero unless you detect visible softening along the edges of text; if you do, increase it until the edges appear sharp again.

Edge enhancement: Also called VSM or SVM for scan-velocity modulation, set this control to Off if possible.

Color temperature: This important control affects the entire palette of colors. Select the Warm or Low option, which should come closest to the NTSC standard of 6,500 degrees Kelvin.

Generally, the image looks best for DVD with picture "enhancements" such as autocolor, autoflesh tone, autocontrast, noise reduction, and other proprietary processing modes turned off. DVD image quality is good enough that these modes usually do more harm than good

gray scale tracking

Conventional image display apparatus, such as color televison receivers employing multibeam cathode ray display devices, are provided with potentiometers for adjusting the biases and the gains of video amplifiers driving electron gun cathodesproducing the electron beams. These potentiometers are factory adjusted to present neutral gray images when a video signal representing a gray image of any intensity is applied to the video amplifiers. The bias adjustments, made while a video signalrepresenting a low intensity gray image is applied, establish the output voltages of the video amplifiers at magnitudes which cause the production of low magnitude electron beam currents having predefined ratios resulting in a low intensity gray image. At other image intensities, the ratios of these beam currents must be maintained to achieve gray scale tracking. The gain adjustments, made while a video signal representing a higher intensity gray image is applied, set the gains of the amplifiers tocompensate for differences in the transconductances of the respective cathodes driven thereby and establish individual transfer functions such that the predefined ratios of the beam currents are maintained at all intensities.Adjusting the biases and gains of the video amplifiers, as described above, accomplishes more than the production of neutral gray images. It also causes the beam currents to be maintained at predefined magnitudes for any given hue, saturationlevel and intensity represented by a video signal applied to the video amplifiers. Maintaining gray scale tracking is essential for the accurate representation of color images.Although control of the biases and gains of the video amplifiers is an effective manner of achieving and maintaining gray scale tracking, control by manual adjustment of potentiometers suffers a major disadvantage--lack of permanency. Theelectrical characteristics of the cathode ray devices drift with age, change with cathode temperature and are susceptible to changes caused by mechanical shock. Also, the output voltages of the video amplifiers vary with temperature and the supplyvoltage. Thus, continual bias and gain readjustment is necessary if degradation of color quality is to be avoided.Continual bias and gain readjustment is also necessary in single beam image display apparatus such as monochromatic television receivers. Here readjustment is necessary to maintain initially established relationships between video signalmagnitude and image intensity.Circuitry is known for automatically adjusting beam current in a CRT and thus eliminating the need for manual adjustments. The known circuitry works upon the premise that the beam current produced by each cathode in the CRT is equal to thecathode current itself. This is not realistic because it fails to account for leakage current which often exists in CRTs. The magnitude of this leakage current, which varies with the temperatures and voltages of the CRT device elements between which itflows (typically, the cathode, the heater filament and a control electrode adjacent to the cathode), can be substantial with respect to the beam current, even for high magnitude beam currents. The error in ignoring leakage current becomes most apparentat low beam currents, however, because the leakage component of the cathode current increases as the beam current is decreased. At the lowest beam currents the leakage current component can become orders of magnitude larger than the beam current component. This large error at low beam currents is particularly objectionable in the display of color images because the eye is most sensitive to color abnormalities at low image intensities. It is also objectionable in the display of monochromaticimages because the eye is most sensitive to intensity abnormalities at the dark level. Thus, beam current control circuitry which does not take such leakage current into account cannot adequately maintain gray scale tracking.

Colour killer

The color killer is a stage in color TV receiver sets which acts like a mute circuit to cut off the color amplifiers when the signal received is in black and white (i.e., monochrome) the color tv signal In color TV waveform a reference pulse, named burst is transmitted in the back porch of the line. (Burst is actually a 10 period color carrier signal.) If the transmitted signal is monochromatic, then the burst is not transmitted. The color killer is actually a muting circuit in the chroma section which supervises the signal and turns off the color amplifiers when the signal is received in monochrome.

Focus

In geometrical optics, a focus, also called an image point, is the point where light raysoriginating from a point on the object converge.[1] Although the focus is conceptually a point, physically the focus has a spatial extent, called the blur circle. This non-ideal focusing may be caused by aberrations of the imaging optics. In the absence of significant aberrations, the smallest possible blur circle is the Airy disc, which is caused by diffraction from the optical system'saperture. Aberrations tend to get worse as the aperture diameter increases, while the Airy circle is smallest for large apertures.

An image, or image point or region, is in focus if light from object points is converged almost as much as possible in the image, and out of focus if light is not well converged. The border between these is sometimes defined using a circle of confusion criterion.

A principal focus or focal point is a special focus:

- For a lens, or a spherical or parabolic mirror, it is a point onto which collimated light parallel to the axis is focused. Since light can pass through a lens in either direction, a lens has two focal points—one on each side. The distance in air from the lens or mirror's principal plane to the focus is called the focal length.
- Elliptical mirrors have two focal points: light that passes through one of these before striking the mirror is reflected such that it passes through the other.
- The focus of a hyperbolic mirror is either of two points which have the property that light from one is reflected as if it came from the other

chroma traps

In a NTSC or PAL video signal, the luma (black and white) and the chroma (color) information are combined together. If you want to decode the video signal, the luma and chroma must be separated. The chroma trap is one method for separating the chroma from the luma, leaving the luma relatively intact. How does it work? The NTSC or PAL signal is fed to a trap filter. For all practical purposes, a trap filter allows certain frequencies to pass through, but not others. The trap filter is designed with a response to remove the chroma so that the output of the filter only contains the luma. Since this trap stops chroma, it's called a chroma trap. The sad part about all of this is that not only does the filter remove chroma, it removes luma as well if it exists within the frequencies where the trap exists. The filter only knows ranges and, depending on the image, the luma information may overlap the chroma information. The filter can't tell the difference between the luma and chroma, so it traps both when they are in the same range. What's the big deal? Well, you lose luma and this means that the picture is degraded somewhat. Using a comb filter for a Y/C separator is better than a chroma trap or chroma bandpass

sound trap

A sound trap is a special acoustical treatment of Heating Ventilating and Air-Conditioning (HVAC) ductwork designed to reduce transmission ofnoise through the ductwork, either from equipment into occupied spaces in a building, or between occupied spaces.In its simplest form, a sound trap consists of an offset in the ductwork to reflect the sound back to its source. This configuration is often combined with the use of sound-absorbing material inside the trap. The physical dimensions of the sound trap may be selected to tune the trap to specific frequencies of sound. As such, it is then essentially a Helmholtz resonator used as a passive noise-control device.

saturation control

the reproduced image; and (8) a saturation (or “colour”) control, which adjusts the magnitudes of the colour-difference signals applied to the electron guns of the picture tube. If the saturation control is turned to the “off” position, no colour difference action will occur and the reproduction will appear in black and white.

Black level

black level is defined as the level of brightness at the darkest (black) part of a visual image or the level of brightness at which no light is emitted from a screen, resulting in a pure black screen.

Video displays generally need to be calibrated so that the displayed black is true to the black information in the video signal. If the black level is not correctly adjusted, visual information in a video signal could be displayed as black, or black information could be displayed as above black information (gray).The voltage of the black level varies across different television standards. PAL sets the black level the same as the blanking level, whilstNTSC sets the black level approximately 54 mv above the blanking level.User misadjustment of black level on monitors is common. It results in darker colours having their hue changed, it affects contrast, and in many cases causes some of the image detail to be lost.Black level is set by displaying a testcard image and adjusting display controls. With CRT displays:

- 'brightness' adjusts black level
- 'contrast' adjusts white level
- CRTs tend to have some interdependence of controls, so a control sometimes need adjustment more than once.

In Digital video black level usually means the range of RGB values in video signal, which can be either [0..255] (typical of a computer output) or [16..235] (standard for video)

Result- study of all terms in the objective are completed.

Experiment no –8

Aim : Familiarization with specification, operation and use of TV set equipment, DVM, TVM Monochrome & Colour pattern generators, sweep generator, X-Y display wobbuloscope etc

Operettas Required :Pattern generator, T.V. Receiver, connecting wires. Wobbuloscope, Balun,

Theory :
A pattern generator produces audio / video signals, direct and with the RF modulation, on theallocated T.V. Channel frequencies for alignment, testing and servicing of T.V. receivers. The outputsignals is designed to simple patterns.

1. Chess board pattern
2. Horizontal bars
3. Vertical bars
4. Chess board patter at one corner
5. Cross hatched
6. Dot pattern
7. Pure white pattern

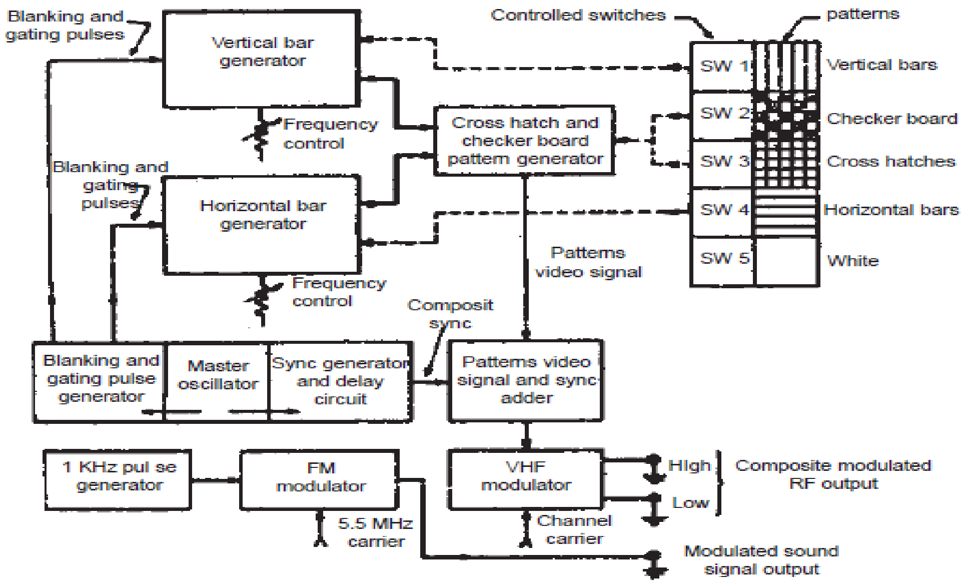
Block Diagram :
The block diagram of the pattern generator given below.The pattern generator contains two stable chains of multi vibrators, dividers and pulse shaping circuits, one below the line frequency to produce a series of horizontal bars and the other above 15,625 Hz to produce vertical bars. The signals are modified into short duration pulses which fed to
the video section of the receiver along with the sync pulses train to produce fine lines on the screen. Output from the multi vibrator produces square wave video signal at "m" times the horizontal frequency to provide vertical block and white bars. After every "m" cycles the horizontal blanking pulse triggers the multi vibrator for synchronizing the bar signal on each line. We can vary the number of bars by the front panels of pattern generator by changing its frequency. In the same way, square wave pulses derived either from 50Hz mains or from the master oscillator are used to trigger another set of multi vibrators to generate square wave video signal that is "n" times the vertical frequency. When these are fed to the video amplifier they produce horizontal black and white bars. The switching rate of the multi vibrator can be controlled by a potentio meter i.e., onthe front panel. It control the number of black and white horizontal bars. The sync and blanking pulses are added to these signals prior to modulation. A master oscillator is used to generate blanking and gating pulses and generation. The composite sync. Signal is given to the pattern vedio signal and sync adder. The output of the vertical andhorizontal bar generators goes to cross hatch and chequer board pattern generator. The pattern vedio signal is given to the adder. From this adder the signal goes to the VHF modulator.

STUDY OF PATTERN GENERATOR AND ITS USE

Amplitude modulation takes place over the carrier frequency output is available in high or low level from the output sockets. The master oscillator, sync, generator and blanking generator supply the blanking pulses getting pulses to the multi vibrators that generator the vertical and horizontal bar signals. A. 1 KHz audio oscillator generate a signal which is frequency modulated over a carrier of 5.5 MHz. This serves the purpose of the frequency modulated audio signal for the testing of the audio sections. Its output is available over a separate socket marked as audio / sound signal. The combination of switches mH and nV, the multi vibrator generate different pattern.

Switch mH Switch nV Output pattern
OFF OFF Pure white raster

OFF ON Horizontal bars
ON OFF Vertical bars
ON ON Cross hatch
The horizontal bar pattern is used for checking vertical linearity. The vertical bar pattern is used for check horizontal linearity.

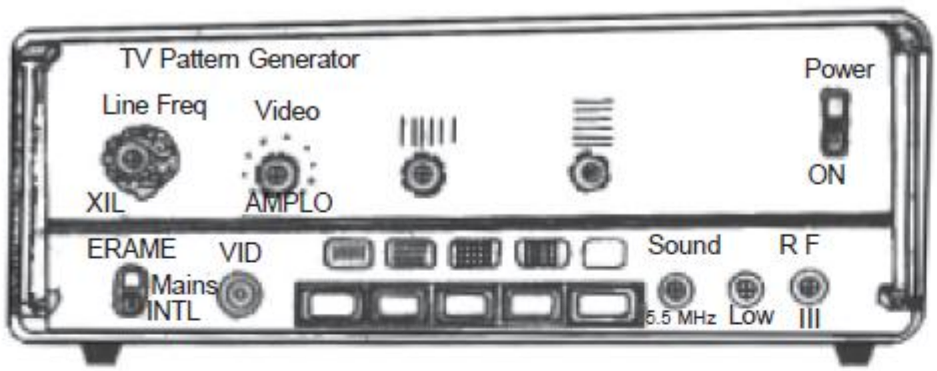


PATTERN GENERATOR

The cross hatch pattern is used for both linearity picture centering and aspect ratio. The dotpattern is suitable for checking and adjusting the static convergence of the picture in the centre of thescreen with a low ambient brightness. The white pattern, with no information is suitable for checking uniformity of brightness over the entire screen in the absence of hum. Colour picture patterns are suitable for checking colour purity, proper colour reproduction and over all performance of the receiver. The test signals available with patterns generator are (1) RF signals (2) IF signals (3) Vedio signals.

Controls and specifications of pattern generator :
Controls :
1. Line frequency
2. Video (amplitude) output
3. Power ON/OFF switch
4. FM socket
5. RF socket
6. Controls to change vertical and horizontal bars.
7. Pattern selector switch.

FRONT PANEL CONTROLS OF PATTERN GENERATOR



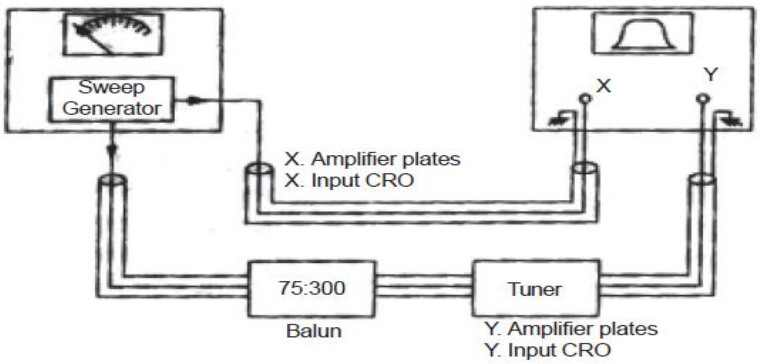
FRONT PANEL CONTROLS OF PATTERN GENERATOR
Fig 1.2

Specifications:
Power: 230V/50Hz- 6W
FM Carrier: 5.5 MHz
Internal signal: 1KHz sine wave
Test signals: Vertical bars
Horizontal bars
Cross hatch
Chequer board
Circle - white
Circle on black back - ground
RF output: 100mV peak to peak
Applications:
1. Checking line and frame time bar linearity
2. Checking picture height and width
3. Video IF checking
4. Adjustments of sound IF stage and checking
5. AGC section checking
6. Trouble shooting video amplifier and using variable video output.
Procedure:
Connect the pattern generator to the T.V. receiver. Switch on the pattern generator. Set the T.V. Receiver to the desired channel using band selector switches and channel selector switch\
Band I - 2 to 4 channels
Band III - 5 to 12 channels
Observe the seven patterns on T.V. receiver and make necessary adjustments in T.V. receiver.
Result:
The pattern generator is studied 7 patterns; video/audio patterns are observed and drawn.

WOBBULOSCOPE
.**Theory:**
A wobbuloscope consists of a sweep generator, CRO and a marker generator, which can be tuned to frequencies corresponding to the vision carrier, associate of sound signal as well as the IF of the T.V. receiver

Alignment of a T.V. Receiver using wobbuloscope :

Using Wobbuloscope can test the tuner response, vedio I-F response, vedio response, sound IFresponse and over all frequency response using the following block diagram. The response of a amplifieror particular section visible on the screen of the CRO.



WOBBULOSCOPE
Fig 2.1

Two frequencies are generated from the sweep generator. One is at low frequency generally below 100 Hz called wobbulator frequency and another is corresponding to produce centre frequency is produce to IF frequency of the T.V. receiver 33.4 MHz, 38.9 MHz respectively. The output signal from wobbuloscope given to the x-input of the CRO directly and another signal is given to balun (75:300) for impedance matching to the sections of the tuner of the receiver Y plates input to the CRO. The response curve is displayed on the CRO. The connections are made as per the block diagram.

Sweep Generator
75:300 Tuner
X. Amplifier plates
X. Input CRO
Y. Amplifier plates
Y. Input CRO
Balun
X
Y
6

Controls :

1. Sweep frequency fine control
2. Sweep frequency course range control
3. ON/OFF switch
4. Marker frequency course range control
5. Marker frequency fine control
6. Sweep width control
7. Sweep width attenuator control
8. Rotating dial for marker frequency.

9. Y shift, X shift, Focus, Illumination, Time/Division Amplitude / Division of CRO controls.
10. RF output socket
11. Marker output terminals

Specifications :
1. Power supply : 230V/50Hz
2. Sweep width : 5MHz - 40 MHz
3. Sweep frequency : 5MHz - 400 MHz
4. Band width of oscilloscope : 20Hz - 1MHz
5. Frequency of the time base
generator of CRO : 20Hz to 50 KHz
6. RF output voltages : 0.25V - 0.5V (rms).

Results :
Marker frequency
(i) AM - IF marker for Radio 455KHz
(ii) FM - IF - 10.7 MHz
(iii) Inter carrier frequency between SIF to VIF is 5.5 MHz
(iv) VIF - 38.9 MHz
SIF - 33.4 MHz and various controls of wobbuloscope is studied

Experiment no –9

Objective - Test TV antenna and booster.

Apparatus required- Booster amplifier, antenna

Theory -

Television antenna

HD- 68 element VHF/UHF aerial antenna

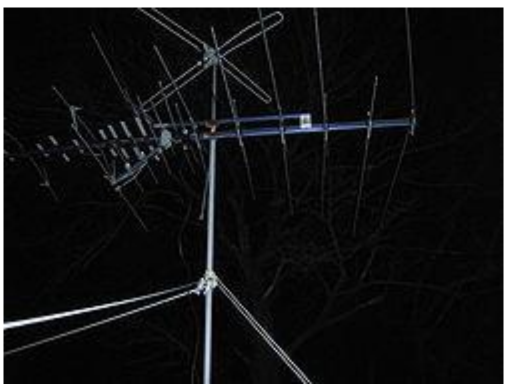
A television antenna, or TV aerial, is an antenna specifically designed for the reception of over the air broadcast television signals, which are transmitted at frequencies from about 41 to 250 MHz in the VHF band, and 470 to 960 MHz in the UHF band in different countries. To cover this range antennas generally consist of multiple conductors of different lengths which correspond to the wavelength range the antenna is intended to receive. The length of the elements of a TV antenna are usually half the wavelength of the signal they are intended to receive. The wavelength of a signal equals the speed of light (c) divided by the frequency. The design of a television broadcast receiving antenna is the same for the older analog transmissions and the digital television transmissions which are replacing them Sellers often claim to supply a special "digital" or "high definition" antenna advised as a replacement for an existing analog antenna, even if satisfactory: this is misinformation to generate sales of unneeded equipment.[1][2]

Simple/indoor

"rabbit ears" set-top antenna of older model

Simple half-wave dipole VHF antennas or UHF loop antennas that are made to be placed indoors are often used for television (and VHF radio); these are often called "rabbit ears" or "bunny aerials". because of their appearance. The length of the telescopic "ears" can be adjusted by the user, and should be about one half of the wavelength of the signal for the desired channel. These are not as efficient as an aerial rooftop antenna since they are less directional and not always adjusted to the proper length for the desired channel. Dipole antennas are bi-directional, that is, they receive evenly forward and backwards, and also cover a broader band than antennas with more elements. This makes them less efficient than antennas designed to maximise the signal from a narrower angle in one direction. Coupled with the poor placing, indoors and closer to the ground, they are much worse than multi-element rooftop antennas at receiving signals which are not very strong, although often adequate for nearby transmitters, in which case they may be adequate and cheap. These simple antennas are called set-top antennas because they are often placed on top of the television set or receiver.The actual length of the ears is optimally about 91% of half the wavelength of the desired channel in free space.[3] Quarter-wave television antennas are also used. These use a single element, and use the earth as a ground plane; therefore, no ground is required in the feed line. See also: Dipole antenna#Quarter-wave antenna

Outdoor



Yagi antenna

An aerial or rooftop antenna generally consists of multiple conductive elements that are arranged such that it is a directional antenna. The length of the elements is about one half of the signal wavelength. Therefore, the length of each element corresponds to a certain frequency.In a combined VHF/UHF antenna the longer elements (for picking up VHF frequencies) are at the "back" of the antenna, relative to the device's directionality, and the much shorter UHF elements are in the "front"[citation needed], and the antenna works best when "pointing" to the source of the signal to be received. The smallest elements in this design, located in the "front", are UHF director elements, which are usually identical and give the antenna its directionality, as well as improving gain. The longest elements, located in the "back" of the antenna form a VHF phased array. Other long elements may be UHF reflectors Another common aerial antenna element is the corner reflector, a type of UHF reflector which increases gain and directionality for UHF frequencies.

An antenna can have a smaller or larger number of directors; the more directors it has (requiring a longer boom), and the more accurate their tuning, the higher its gain will be. For the commonly used Yagi antenna this is not a linear relationship. Antenna gain is the ratio of the signal received from the preferred direction to the signal from an ideal omnidirectional antenna. Gain is inversely proportional to the antenna's acceptance angle. The thickness of the rods on a Yagi antenna and its bandwidth are inversely proportional; thicker rods provide a wider band. Thinner rods are preferable to provide a narrower band, hence higher gain in the preferred direction; however, they must be thick enough to withstand wind.Two or more directional rooftop antennas can be set up and connected to one receiver. Antennas designed for rooftop use are sometimes located in attics.Sometimes television transmitters are organised such that all receivers in a given location need receive transmissions in only a relatively narrow band of the full UHF television spectrum and from the same direction, so that a single antenna provides reception from all stations.

Types of outdoor antenna

A UHF television antenna

An antenna pole setup in a chimney, reaching 35 feet (10.7 meters) off the ground Small multi-directional: The smallest of all outdoor television antennas. They are designed to receive equal amounts of signal from all directions. These generally receive signals up to a maximum of thirty miles away from the transmitting station, greatly depending on the type. But, things such as large buildings or thick woods may greatly affect signal. They come in many different styles, ranging from small dishes to small metal bars, some can even mount on existing satellite dishes.Medium multi-directional: A step up from the small multi-directional, these also receive signals from all directions. These usually require an amplifier in situations when long cable lengths are between the television receiver and the antenna. Styles are generally similar to small multi-directionals, but slightly larger.Large multi-directional: These are the largest of all multi-directional outdoor television antennas. Styles include large "nets" or dishes, but can also greatly vary. Depending on the type, signal reception usually ranges from 30 to up to 70 miles.Small directional: The smallest of all directional antennas, these antennas are multi-element antennas, typically placed on rooftops. This style of antenna receives signals generally equal to that of large multi-directionals. One advantage that small directionals hold, however, is that they can significantly reduce "ghosting" effects of television picture.Medium directional: These antennas are the ones most often seen on suburban rooftops. Usually consisting of many elements, and slightly larger than the small directionals, these antennas are ideal for receiving television signals in suburban areas. Signal usually ranges from 30 to 60 miles away from the broadcasting station.Large directional: The largest of all common outdoor television antennas, these antennas are designed to receive the weakest available stations in an area. Largerthan the medium directional, this type of antenna consists of many elements and is usually used in rural areas, where reception is difficult. When used in conjunction with an amplifier, these antennas can usually pick up stations from 60 up to and over 100 miles, depending on the type.The use of outdoor antennas with an amplifier can improve signal on low signal strength channels. If the signal quality is low repositioning the antenna onto a high mast will improve signal**Installation**

A short antenna pole next to a house; this setup would only work well for receiving signals on that side of the house as they would not go through stone, especially

Multiple Yagi TV aerials

Antennas are commonly placed on rooftops, and sometimes in attics. Placing an antenna indoors significantly attenuates the signal available to it. [7] [8] Directional antennas must be pointed at the transmitter they are receiving; in most cases great accuracy is not needed. In a given region it is sometimes arranged that all television transmitters are located in roughly the same direction and use frequencies space closely enough that a single antenna suffices for all. A single transmitter location may transmit signals for several channelsAnalog television signals are susceptible to ghosting in the image, multiple closely-spaced images giving the impression of blurred and repeated images of edges in the picture. This was due to the signal being reflected from nearby objects (buildings, tree, and mountains); several copies of the signal, of different strengths and subject to different delays, are picked up. This was different for different transmissions. Careful positioning of the antenna could produce a compromise position which minimized the ghosts on different channels. Ghosting is also possible if multiple antennas connected to the same receiver pick up the same station, especially if the lengths of the cables connecting them to the splitter/merger were different lengths or the antennas were too close together. Analog television is being replaced by digital, which is not subject to ghosting.

Rooftop and other outdoor antennas

Aerials are attached to roofs in various ways, usually on a pole to elevate it above the roof. This is generally sufficient in most areas. In some places; however, such as a deep valley or near taller structures, the antenna may need to be placed significantly higher, using a lattice tower or mast.The higher the antenna is placed, the better it will perform. An antenna of higher gain will be able to receive weaker signals from its preferred direction. Intervening buildings, topographical features (mountains), and dense forest will weaken the signal; in many cases the signal will be reflected such that a usable signal is still available. There are physical dangers inherent to high or complex antennas, such as the structure falling or being destroyed by the weather. There are also varying local ordinances which restrict and limit such things as the height of a structure without obtaining permits. For example, in the USA, the Telecommunications Act of 1996 allows any homeowner to install "An antenna that is designed to receive local television broadcast signals", but that "masts higher than 12 feet above the roof-line may be subject to local permitting requirements." [11]

Indoor antennas

As discussed previously, antennas may be placed indoors where signals are strong enough to overcome antenna shortcomings. The antenna is simply plugged into the television receiver and placed conveniently, often on the top of the receiver ("set-top"). Sometimes the position needs to be experimented with to get the best picture. Indoor antennas can also benefit from RF amplification, commonly called a TV booster. Indoor antennas will never be an option in weak signal areas.

Attic installation

Sometimes it is desired not to put an antenna on the roof; in these cases, antennas designed for outdoor use are often mounted in the attic or loft, although antennas designed for attic use are also available. Putting an antenna indoors significantly decreases its performance due to lower elevation above ground level and intervening walls; however, in strong signal areas reception may be satisfactory. One layer of asphalt shingles, roof felt, and a plywood roof deck are considered to attenuate the signal to about half.

Multiple antennas, rotators

Two aerials setup on a roof. Spaced horizontally and vertically

It is sometimes desired to receive signals from transmitters which are not in the same direction. This can be achieved, for one station at a time, by using a rotator operated by an electric motor to turn the antenna as desired. Alternatively, two or more antennas, each pointing at a desired transmitter and coupled by appropriate circuitry, can be used. To prevent the antennas interfering with each other, the vertical spacing between the booms must be at least half the wavelength of the lowest frequency to be received (Distance=λ/2). The wavelength of 54 MHz (Channel 2) is 5.5 meters (λ x f = c) so the antennas must be a minimum of 2.25 meters, or ~89 inches apart. It is also important that the cables connecting the antennas to the signal splitter/merger be exactly the same length, to prevent phasing issues,which cause ghosting with analog reception. That is, the antennas might both pick up the same station; the signal from the one with the shorter cable will reach the receiver slightly sooner, supplying the receiver with two pictures slightly offset. There may be phasing issues even with the same length of down-lead cable. Bandpass filters or "signal traps" may help to reduce this problemFor side-by-side placement of multiple antennas, as is common in a space of limited height such as an attic, they should beseparated by at least one full wavelength of the lowest frequency to be received at their closest point.Often when multiple antennas are used, one is for a range of co-located stations and the other is for a single transmitter in a different direction.

How Television Broadcasting Works

While millions of people watch television each day, many of us aren't quite sure how the technology works. Television has been around for many decades and although some of the technology components have changed over the years, the way in which television broadcasts work is still pretty much the same.

Elements of Broadcast Television

There are a several major parts that are required in order to receive television broadcasts at home. They include an image source, a sound source, a transmitter, a receiver, a display device and a sound device.

Image Source

The image source can be defined as the program. It can be a movie, TV show, news program, etc. The image source is just the video of the source and does not include the sound. Usually the image source has been recorded on camera or flying spot scanner

Sound Source

We already have the image source, let's say the video of a movie, now to complete the media, we also need the sound. The sound source is the audio signal of the TV programming whether coming from a movie, TV show, news program, etc. It can come in the form of mono, stereo or even digitally processed surround sound.

Transmitter

A transmitter is what sends both audio and video signals over the air waves. Transmitters usually transmit more than one signal (TV channel) at a time. A transmitter modulates both picture and sound into one signal and then send this transmission over a wide range to be received by a receiver (TV set).

Receiver

A receiver (TV set) is able to receive the transmitted signals (TV programs) and turn radio waves which include audio and video signals into useful signals that can be processed back into an image and sound.

Display Device

This is either a TV set or monitor. A display device has the technology to turn the electrical signals received into visible light. On a standard TV set this includes the technology CRT (Cathode Ray Tube).

Sound Device

The sound device are usually speakers either built into the TV set or that accompany the TV set that turns electrical signals into sound waves to play audio along with the video images that the person is viewing.

Broadcast Television Signals - Broadcast Television Signals are video and sound signals that are transmitted over the air. They are usually free to be picked up by anyone using a television set that has a receiver and an antenna. Antennas are used to grab as much signal as possible and to sometimes amplify the signal.All TV sets include the ability to switch the receiver's tuner to pick up specific channels of programming. Each channel is transmitted on its own frequency which can be tuned in and received by your TV set.

Broadcast TV vs. Satellite TV and Cable TV

There are three main ways to receive TV programming, one is through broadcast television, and the other two are through satellite TV and cable TV.

Broadcast TV

Broadcast TV are audio and video signals transmitted over the air waves from a ground based transmitter. These signals are usually free to pick up and are on specific frequency spectrums.

Satellite TV

Satellite TV is usually a digital TV signal broadcasted from a satellite flying in space, orbiting the earth. They are usually pay services that require special equipment to receive programming and operate on special frequencies.

Cable TV

Cable TV are pay TV services that send out signals not over the air, but through cable that runs from the cable company to the viewers home. There are many types of cables used from copper cable to fiber optic cable. The signal can be analog or digital.

Television Transmission Bands

Television is transmitted on various bands or frequencies. Transmission bands vary by country. In America, the bands III to V are used, they include VHF and UHF signals.

Band I

It is important to note that lower band signals such as bands I do not have enough bandwidth which means they can't carry lots of information or data..

Band II

Band II in America is what carries FM radio. While this band is able to carry an audio signal, adding video to the signal would overcrowd it and it would be inferior to the signal that you receive today.

Bands III , IV and V

A Normal TV signal is located on either Band III, IV or V. Usually these bands require bandwidth to carry both audio and video signals. Most TV signals have about 4MHz of bandwidth for the video portion, when you add on the sound portion of the signal the signal will have a total of about 6 MHz. The FCC has allocated each TV channel to a bandwidth of 6 MHz. Channels are as followed

- Band III – Channels 2 to 6 (54 to 88 MHz)
- Band IV – Channels 7 to 13 (174-216 MHz)
- Band V – Channels 14 to 83 (470 to 890 MHz)

VHF and UHF

VHF (very high frequencies) are usually channels that include channels 2 to 13. UHF (ultra high frequencies) are channels that usually include channels 14 to 83.Both VHF and UHF are great frequencies for carrying TV signals (both audio and video signals). They have a long range and can penetrate structures such as walls.

Higher Bands

These bands are much higher in frequency and behave like light waves instead of radio waves. They are usually obstructed by structures and need a clear line of sight. Many satellite signals can use these frequencies, but do require special equipment.

NTSC

All standard television signals that are transmitted in the United States follow NTSC regulations. NTSC (National Television Standards Committee) states that the video signal must have a video line resolution of 525 lines with a 3.58 MHz chroma carrier (color TV signal) and must cycle at 60 cycles per second. It also states that frames are to be displayed at 30 frames per second. NTSC standard makes it easy for all TV sets to pick up the same signals transmitted by broadcast companies. It is important to note that this standard is for analog television only.

Testing of TV antenna and booster

Procedure to testing of anteena

1 Locate the dipole away from the television and as close as you can to a window. In all likelihood, the cable will be too short and you will need to extend it. The extension is needed to reduce any electrical interference from the television, which would ruin this test.

2 Ensure the television antenna selector is set to "Off-air", which should be an option in the setup menu.

3 Position the dipole in a "V" shape and initially extend the telescopes fully. The "V" shape is best for channels 7 to 13. Run the channel scan on the television.

4 Allow the scan to complete and verify the results by surfing the channels. See what you captured. If your preference is for channels 2 to 6, the optimum position is to have the dipoles horizontal and shortened. In both positions, some channels you like may not be receivable with this solution.

Procedure to make TV antenna booster

1 Draw a circle on a piece of cardboard, then draw a pair of semi-circular projections on either side of the circle, just above and below the midpoint of the circle. These should not be very large in relation to the circle.

2 Cut another piece of cardboard into a rectangle that's a little longer than the diameter of the circle. The width of this piece will be a bit less than that of the circle, but should extend noticeably beyond the projections at either end of the circle. You're essentially making a reflector, so think of that when you consider the size in relation to your wireless TV antenna.

3 Cover one side of each piece of cardboard with aluminum foil.

4 Fold the long piece of cardboard around the circular piece, and fold the circle in half. Use the projections on the circular piece like tabs so that they fit through slots that you cut in the rectangular piece. The whole thing should look sort of like a semicircle when you are finished.

5 Fold the outside edge of the circle up to form a lip that runs the length of the piece. The foil-covered circle will be suspended in the other piece.

6 Cut a small hole for the antenna in the middle of what used to be the circle--which now looks like a semicircle.

7 Attach your TV antenna booster over the existing antenna on your wireless TV antenna.

Precautions (Safety)

TV antennas are large conductors of electricity and attract lightning, acting as a lightning rod. The use of a lightning arrestor is usual to protect against this. A large grounding rod connected to both the antenna and the mast or pole is required. Properly installed masts, especially tall ones, are guyed with galvanized cable; no insulators are needed. They are designed to withstand worst-case weather conditions in the area, and positioned so that they do not interfere with power lines if they fall.

Experiment-10

Objective- Troubleshoot VCRs for simple faults

Equipment required : A B/W T.V receiver, Multimeter tool kit box, soldering iron, paste and lead , Colour T.V. Trainer Kit, Multi meter tool Kits.

Theory :
There are no thumb rules or cut and dry methods for the repairing of T.V. receivers except a through knowledge of the functions of the various stages and a careful observations of the indications provided by the picture tube screen and the loud speaker. However certain trouble shooting charts or tables based on major fault indications provided by the raster, picture and sound together with suspected stages and the likely defects sometimes prove helpful in quick location of the faulty stage or component as follows-

Trouble symptoms	Suspected Stage	Likely defect
1. No. raster no sound no picture	Power supply	(i) Mains voltage not being applied either due to a blown off fuse or some defective lead (ii) Heater circuit open (iii) Defective dc rectifier circuit.
2. No raster, no picture but sound ok.	EHT circuit, line output stage picture tube, its bias and socket connections, video output circuit.	Defective EHT transformer (LOT) or line output transistor, EHT rectify or booster condenser, line oscillator, defective picture tube or improper voltages on its pins, defective brightness control picture tube socket, video amplifier transistor or IC
3. Raster and picture normal but no sound	Video amplifier	Sound IF, FM detector AF stage, loud speaker, sound IC.
4. Raster and sound normal but no	Video amplifier	Video amplifier transistor, Contrast control, or coupling capacitor, between video amplifier and picture tube cathode.

5. Raster normal but no picture, no sound	Antenna, feeder wire line, tuner, video, IF amplifier video detector, AGC.	Broken antenna or feeder line, tuner voltage defective video IF amplifier stage, defective detector diode, AGC adjustment.
6. No raster no picture only a bright horizontal line on the screen sound normal	Vertical sweep, vertical deflection coil	Defective vertical stage, open vertical deflection coil.
7. No raster, no picture but only a bright vertical line on screen sound	Horizontal deflection coil	Line deflection coils or circuit components between LOT and horizontal deflection coils, weak line output stage normal.
8. Raster and sound normal but picture height is less even with maximum position of height control	Vertical oscillator, vertical output or vertical deflection coil	Defective oscillator transistor reduced voltage, to vertical oscillator or output stage, defective vertical output transformer defective vertical deflection coil, effective VDRs.
9. Raster and sound normal but picture width is less.	Horizontal deflection stage, horizontal deflection coil.	Line oscillator stage, line output amplifier, defective booster diode, reduced HT voltage, defective horizontal deflection coil.
10. Picture rolling vertically, raster and sound normal	Vertical oscillator	Vertical oscillator stage, defective vertical hold vertical sync separator.
11. Picture torn, diagonal bars and slanting streaks	Horizontal oscillator, Horizontal sync., AFC	Horizontal oscillator stage oscillator coil adjustments, coil core defective, discriminator circuit power supply filter circuit
12. Picture unstable both in horizontal and vertical direction	Sync separator, AGC, signal section.	Sync separator IC, defective AGC stage, tuner or video amplifier gain adjustment.
13 (a) Vertical non-linearity	(a) Vertical oscillator or vertical output	(a) Vertical output transistor vertical linearity control.
(b) Horizontal non-linearity	(b) Horizontal deflection drive	(b) Line oscillator or line output stage, booster diode or booster capacitor, horizontal linearity coil.

14. Blooming in picture	EHT rectifier stage	Defective EHT rectifier.
15. Ghosts	Antenna	Antenna direction, not correct director or reflector missing.

Faults in receiver-

S.No.	Fault Symptoms	Possible Cause	Remedial Measures
1.	No Colour	1. Chroma amplifier 2. Sub-carrier oscillator 3. Colour Killer	Check chroma amplifier circuit and operation of colour killer and associated circuits
2.	Colour show on monochrome picture	1. RF stages 2. Colour killer stage	Check alignment of RF stage and also check colour killer and associated circuits.
3.	Weak colour	Chroma band pass amplifier	Adjust tuning of band pass amplifier transformer
4.	Drifting colours or colour bars.	No colour sync.	Adjust colour phase discriminator or burst amplifier
5.	One colour missing	1. Defective electron gun 2. Defective chroma demodulator	Test individual electron guns and also check the relevant chroma channel.
6.	In correct relative hues	Phase error in sub carrier oscillator	Adjust tint control and check sub carrier oscillator for a leacky capacitor.
7.	Abnormally intense colours	Automatic colour control (ACC) or defective colour control.	Check ACC circuit and replace defective colour control.

Result :

In all stages various problems are studied with rectification measures

Experiment - 11

Objective- Study of multimedia and animation

Theory -

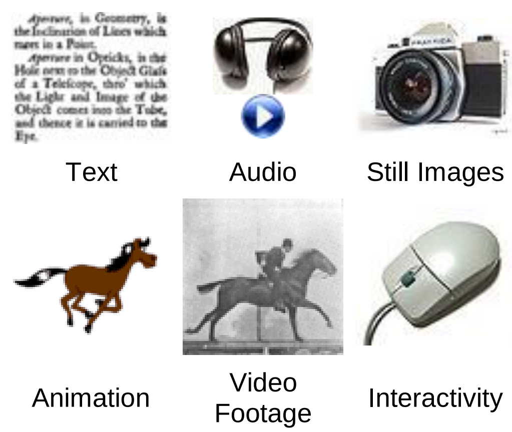
Multimedia is media and content that uses a combination of different content forms. The term can be used as a noun (a medium with multiple content forms) or as an adjective describing a medium as having multiple content forms. The term is used in contrast to media which only use traditional forms of printed or hand-produced material. Multimedia includes a combination of text, audio, still images,animation, video, and interactivity content forms.

Multimedia is usually recorded and played, displayed or accessed by information content processing devices, such as computerized and electronic devices, but can also be part of a live performance. Multimedia (as an adjective) also describes electronic media devices used to store and experience multimedia content. Multimedia is distinguished from mixed media in fine art; by including audio, for example, it has a broader scope. The term "rich media" is synonymous for interactive multimedia. Hypermedia can be considered one particular multimedia application.

Categorization of multimedia

Multimedia may be broadly divided into linear and non-linear categories. Linear active content progresses without any navigational control for the viewer such as a cinema presentation. Non-linear content offers user interactivity to control progress as used with a computer game or used in self-paced computer based training. Hypermedia is an example of non-linear content.Multimedia presentations can be live or recorded. A recorded presentation may allow interactivity via a navigation system. A live multimedia presentation may allow interactivity via an interaction with the presenter or performer.

Examples of individual content forms combined in multimedia:



Major characteristics of multimedia

Multimedia presentations may be viewed by person on stage, projected, transmitted, or played locally with a media player. A broadcastmay be a live or recorded multimedia presentation. Broadcasts and recordings can be either analog or digital electronic media technology.

Digital online multimedia may be downloaded or streamed. Streaming multimedia may be live or on-demand.

Multimedia games and simulations may be used in a physical environment with special effects, with multiple users in an onlinenetwork, or locally with an offline computer, game system, or simulator.

The various formats of technological or digital multimedia may be intended to enhance the users' experience, for example to make it easier and faster to convey information. Or in entertainment or art, to transcend everyday experience.

A laser show is a live multimedia performance.

Enhanced levels of interactivity are made possible by combining multiple forms of media content. Online multimedia is increasingly becoming object-oriented and data-driven, enabling applications with collaborative end-user innovation and personalization on multiple forms of content over time. Examples of these range from multiple forms of content on Web sites like photo galleries with both images (pictures) and title (text) user-updated, to simulations whose co-efficients, events, illustrations, animations or videos are modifiable, allowing the multimedia "experience" to be altered without reprogramming. In addition to seeing and hearing, Haptic technology enables virtual objects to be felt. Emerging technology involving illusions of taste and smell may also enhance the multimedia experience.

Usage

A presentation using Powerpoint. Corporate presentations may combine all forms of media content.

Virtual reality uses multimedia content. Applications and delivery platforms of multimedia are virtually limitless.

VVO Multimedia-Terminal in Dresden WTC (Germany)

Multimedia finds its application in various areas including, but not limited to, advertisements,art, education, entertainment, engineering, medicine, mathematics, business, scientific research and spatial temporal applications. Several examples are as follows:

Creative industries

Creative industries use multimedia for a variety of purposes ranging from fine arts, to entertainment, to commercial art, to journalism, to media and software services provided for any of the industries listed below. An individual multimedia designer may cover the spectrum throughout their career. Request for their skills range from technical, to analytical, to creative.

Commercial

Much of the electronic old and new media used by commercial artists is multimedia. Exciting presentations are used to grab and keep attention in advertising. Business to business, and interoffice communications are often developed by creative services firms for advanced multimedia presentations beyond simple slide shows to sell ideas or liven-up training. Commercial multimedia developers may be hired to design for governmental services andnonprofit services applications as well.

Entertainment and fine arts

In addition, multimedia is heavily used in the entertainment industry, especially to developspecial effects in movies and animations. Multimedia games are a popular pastime and are software programs available either as CD-ROMs or online. Some video games also use multimedia features. Multimedia applications that allow users to actively participate instead of just sitting by as passive recipients of information are called Interactive Multimedia. In the Artsthere are multimedia artists,

whose minds are able to blend techniques using different media that in some way incorporates interaction with the viewer. One of the most relevant could bePeter Greenaway who is melding Cinema with Opera and all sorts of digital media. Another approach entails the creation of multimedia that can be displayed in a traditional fine arts arena, such as an art gallery. Although multimedia display material may be volatile, the survivability of the content is as strong as any traditional media. Digital recording material may be just as durable and infinitely reproducible with perfect copies every time.

Education

In Education, multimedia is used to produce computer-based training courses (popularly called CBTs) and reference books like encyclopedia and almanacs. A CBT lets the user go through a series of presentations, text about a particular topic, and associated illustrations in various information formats. Edutainment is an informal term used to describe combining education with entertainment, especially multimedia entertainment.

Learning theory in the past decade has expanded dramatically because of the introduction of multimedia. Several lines of research have evolved (e.g. Cognitive load, Multimedia learning, and the list goes on). The possibilities for learning and instruction are nearly endless.The idea of media convergence is also becoming a major factor in education, particularly higher education. Defined as separate technologies such as voice (and telephony features), data (and productivity applications) and video that now share resources and interact with each other, synergistically creating new efficiencies, media convergence is rapidly changing the curriculum in universities all over the world. Likewise, it is changing the availability, or lack thereof, of jobs requiring this savvy technological skill.

Journalism

Newspaper companies all over are also trying to embrace the new phenomenon by implementing its practices in their work. While some have been slow to come around, other major newspapers like The New York Times, USA Today and The Washington Post are setting the precedent for the positioning of the newspaper industry in a globalized world.News reporting is not limited to traditional media outlets. Freelance journalists can make use of different new media to produce multimedia pieces for their news stories. It engages global audiences and tells stories with technology, which develops new communication techniques for both media producers and consumers. Common Language Project is an example of this type of multimedia journalism production.

Engineering

Software engineers may use multimedia in Computer Simulations for anything from entertainment to training such as military or industrial training. Multimedia for software interfaces are often done as a collaboration between creative professionals and software engineers.

Industry

In the Industrial sector, multimedia is used as a way to help present information to shareholders, superiors and coworkers. Multimedia is also helpful for providing employee training, advertising and selling products all over the world via virtually

unlimited web-based technology

Mathematical and scientific research

In mathematical and scientific research, multimedia is mainly used for modeling and simulation. For example, a scientist can look at amolecular model of a particular substance and manipulate it to arrive at a new substance. Representative research can be found in journals such as the Journal of Multimedia.

Medicine

In Medicine, doctors can get trained by looking at a virtual surgery or they can simulate how the human body is affected by diseasesspread by viruses and bacteria and then develop techniques to prevent it.

Document imaging

Document imaging is a technique that takes hard copy of an image/document and converts it into a digital format (for example, scanners).

Disabilities

Ability Media allows those with disabilities to gain qualifications in the multimedia field so they can pursue careers that give them access to a wide array of powerful communication forms.

Structuring information in a multimedia form

Multimedia represents the convergence of text, pictures, video and sound into a single form. The power of multimedia and the Internet lies in the way in which information is linked.Multimedia and the Internet require a completely new approach to writing. The style of writing that is appropriate for the 'on-line world' is highly optimized and designed to be able to be quickly scanned by readers.[6]A good site must be made with a specific purpose in mind and a site with good interactivity and new technology can also be useful for attracting visitors. The site must be attractive and innovative in its design, function in terms of its purpose, easy to navigate, frequently updated and fast to download.[7]When users view a page, they can only view one page at a time. As a result, multimedia users must create a ‘mental model of information structure’.

Animation is the rapid display of a sequence of images of 2-D or 3-D artwork or model positions in order to create an illusion of movement. The effect is an optical illusion ofmotion due to the phenomenon of persistence of vision, and can be created and demonstrated in several ways. The most common method of presenting animation is as a motion picture or video program, although there are other methods.

Origin of the name

"Animation" derivated from the Latin anima, the "animating principle", the vital force inside every living creature. It is often used as a translation for the Greek word psyche, and related to the Christian concept of soul. "Animation" would be the technique of giving "soul" to inanimate objects, drawings, etc.

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Techniques

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Traditional animation (also called cel animation or hand-drawn animation) was the process used for most animated films of the 20th century. The individual frames of a traditionally animated film are photographs of drawings, which are first drawn on paper. To create the illusion of movement, each drawing differs slightly from the one before it. The animators' drawings are traced or photocopied onto transparent acetate sheets called cels, which are filled in with paints in assigned colors or tones on the side opposite the line drawings. The completed character cels are photographed one-by-one onto motion picture film against a painted background by a rostrum camera.

The traditional cel animation process became obsolete by the beginning of the 21st century. Today, animators' drawings and the backgrounds are either scanned into or drawn directly into a computer system. Various software programs are used to color the drawings and simulate camera movement and effects. The final animated piece is output to one of several delivery media, including traditional 35 mm film and newer media such asdigital video. The "look" of traditional cel animation is still preserved, and the character animators' work has remained essentially the same over the past 70 years. Some animation producers have used the term "tradigital" to describe cel animation which makes extensive use of computer technology.

- **Full animation** refers to the process of producing high-quality traditionally animated films, which regularly use detailed drawings and plausible movement. Fully animated films can be done in a variety of styles, from more realistically animated works such as those produced by the Walt Disney studio (Beauty and the Beast, Aladdin, Lion King) to the more 'cartoony' styles of those produced by theWarner Bros. animation studio. Many of the Disney animated features are examples of full animation, as are non-Disney works such asThe Secret of NIMH (US, 1982) and The Iron Giant (US, 1999), Nocturna (Spain, 2007)
- **Limited animation** involves the use of less detailed and/or more stylized drawings and methods of movement. Pioneered by the artists at the American studio United Productions of America, limited animation can be used as a method of stylized artistic expression, as

in Gerald McBoing Boing (US, 1951), Yellow Submarine (UK, 1968), and much of the anime produced in Japan. Its primary use, however, has been in producing cost-effective animated content for media such as television (the work of Hanna-Barbera,Filmation, and other TV animation studios) and later the Internet (web cartoons). Some examples are; Spongebob Squarepants (USA, 1999–present), The Fairly OddParents (USA, 2001–present) and Invader Zim (USA, 2001–2002, 2006).

- **Rotoscoping** is a technique, patented by Max Fleischer in 1917, where animators trace live-action movement, frame by frame. The source film can be directly copied from actors' outlines into animated drawings, as in The Lord of the Rings (US, 1978), used as a basis and inspiration for character animation, as in most Disney films, or used in a stylized and expressive manner, as in Waking Life(US, 2001) and A Scanner Darkly (US, 2006). Some other examples are: Fire and Ice (USA, 1983) and Heavy Metal (1981).

- **Live-action/animation** is a technique, when combining hand-drawn characters into live action shots. One of the earlier uses of it wasKoko the Clown when Koko was drawn over live action footage. Other examples would include Who Framed Roger Rabbit? (USA, 1988), Space Jam (USA, 1996) and Osmosis Jones (USA, 2002).

2D animation

2D animation figures are created and/or edited on the computer using 2D bitmap graphics or created and edited using 2D vector graphics. This includes automated computerized versions of traditional animation techniques such as of tweening,morphing, onion skinning and interpolated rotoscoping.

3D animation

3D animation are digitally modeled and manipulated by an animator. In order to manipulate a mesh, it is given a digital skeletal structure that can be used to control the mesh. This process is called rigging. Various other techniques can be applied, such as mathematical functions (ex. gravity, particle simulations), simulated fur or hair, effects such as fire and water and the use of motion capture to name but a few, these techniques fall under the category of 3D dynamics. Well-made 3D animations can be difficult to distinguish from live action and are commonly used as visual effects for recent movies

Experiment -12

Objective- Use of various video cameras and its controls

Theory -

A **video camera** is a camera used for electronic motion picture acquisition, initially developed by the television industry but now common in other applications as well.

A Sony high definition video camera

The earliest video cameras were those of John Logie Baird, based on the electromechanical Nipkow disk and used by theBBC in experimental broadcasts through the 1930s. All-electronic designs based on the cathode ray tube, such as Vladimir Zworykin's Iconoscope and Philo T. Farnsworth's Image dissector, supplanted the Baird system by the 1940s and remained in wide use until the 1980s, when cameras based on solid-state image sensors such as CCDs (and later CMOS active pixel sensors) eliminated common problems with tube technologies such as burn-in and made digital video workflow practical.Video cameras are used primarily in two modes. The first, characteristic of much early television, is what might be called a live broadcast, where the camera feeds real time images directly to a screen for immediate observation. A few cameras still serve live television production, but most live connections are for security, military/tactical, and industrial operations where surreptitious or remote viewing is required. The second is to have the images recorded to a storage device for archiving or further processing; for many years, videotape was the primary format used for this purpose, but optical discmedia, hard disk, and flash memory are all increasingly used. Recorded video is used in television and film production, and more oftensurveillance and monitoring tasks where unattended recording of a situation is required for later analysis.

Using a pocket video camera

Modern video cameras have numerous designs and uses, not all of which resemble the early television cameras.

Types of video camera-

1. Professional video cameras, such as those used in television and sometimes film production; these may be studio-based or mobile. Such cameras generally offer extremely fine-grained manual control for the camera operator, often to the exclusion of automated operation.
2. Camcorders, which combine a camera and a VCR or other recording device in one unit; these are mobile, and are widely used for television production, home movies, electronic news gathering (including citizen journalism), and similar applications. Some digital ones are
3. Pocket video cameras.
4. Closed-circuit television (CCTV) cameras, generally used for security, surveillance, and/or monitoring purposes. Such cameras are designed to be small, easily hidden, and able to operate unattended; those used in industrial or scientific settings are often meant for use in environments that are normally inaccessible or uncomfortable for humans, and are therefore hardened for such hostile environments (e.g. radiation, high heat, or toxic chemical exposure).

5. Webcams are video cameras which stream a live video feed to a computer. Larger video cameras (especially camcorders and CCTV cameras) can be similarly used, though they may need an analog-to-digital converter in order to store the output on a computer ordigital video recorder or send it to a wider network.
6. Digital cameras which convert the signal directly to a digital output; such cameras are often small, even smaller than CCTV security cameras, and are often used as webcams or optimized for still-camera use. The majority are incorporated directly into computer or communications hardware, particularly mobile phones.
7. Special systems, like those used for scientific research, e.g. on board a satellite or a spaceprobe, or in artificial intelligence and roboticsresearch. Such cameras are often tuned for non-visible radiation for Infrared photography (for night vision and heat sensing) or X-ray (for medical and video astronomy use).

Result – study of video camera is completed.