

BLACK AND WHITE TRANSMISSION

The Significant aspect of monochrome television is discussed here

Camera tube :- The Video sequence at the transmitting station begins with a transducer which converts light into electric signal i.e. a camera tube. A camera tube has a mosaic screen onto which the scene is focused through the lens system of the television camera. An electron gun forms a beam which is accelerated towards this photo-electric screen. The beam scans the screen from left to right and top to bottom, covering the entire screen 30 times per second. The beam intensity is affected by the charge on the screen at that point and this in turn depends

on the brightness of the point. The current modulated beam is collected at a target electrode, located at or just beyond the screen. The output voltage from this electrode is a varying voltage, whose amplitude is proportional to the screen brightness at the point being scanned. This voltage is now applied to Video amplifiers.

Video Stages :- The output of the camera is fed to a video switcher which may also receive videotape or outside broadcast video signals at other inputs. The function of this switching system is to provide the many video controls required. It is at this point that mixing or switching of the various inputs, such as fading in of one signal and fading out of another will take place. Videotapes corresponding to advertisements or station identification pattern will be inserted here, as well as various visual effects involving brightness, contrast or hue.

The output of this mixing and switching amplifier goes to more video amplifier

whose function is to raise the signal level until it is sufficient for modulation. Along the chain of video amplifiers, certain pulses are inserted. These are the vertical and horizontal blanking and synchronizing pulses, which are required by receivers to control their scanning processes. The final video amplifier is the power amplifier which grid modulates the output RF amplifier.

RF and Sound Circuitry:- Essentially the sound transmitter is a frequency-modulated transmitter. The only difference is that maximum deviation limited to 25 KHz instead of the 75 KHz for FM broadcast transmitter.

The RF aspect of the picture transmitter are such that output stage must be broadband in view of the large bandwidth of the transmitted video modulated signals.

The output of the sound and picture transmitter is fed to the antenna via a combining network, whose function is to ensure that although both the picture and sound transmitter are connected to the antenna with a minimum loss, neither is connected to the other.

BLACK - AND - WHITE RECEPTION

A television receiver is a combination of an AM receiver for the picture signal and an FM receiver for the associated sound. In addition, the receiver also provides suitable scanning and synchronizing circuitry for reproduction of image on the screen of picture tube.

Antenna System

Strongest signal is induced in the antenna if it has same polarization as the transmitting antenna. All TV antennas are mounted in horizontal position for better reception and favourable signal to noise ratio. The need for good signal strength has led to the use of tuned antennas. For channels located in the VHF band, a halfwave-length antenna is most widely used. Various antennas in use are of dipole type with reflectors and directors. A folded dipole with a reflectors is used because its response is more uniform over a band of frequencies.

Since it is not possible for one dipole antenna to cover both upper and lower VHF band channels effectively high and low band dipoles are mounted

together and connected to a common transmission line.

A transmission line connects antenna to the receiver input terminals for the RF tuner. A twin-lead is generally used. This type is an unshielded balanced line with characteristic impedance equal to $300\ \Omega$. When there is a problem of interference, a shielded coaxial cable is used. This cable has high attenuation, especially at UHF channel frequencies. It has a characteristic impedance of $75\ \Omega$.

RF Section

This section consists of RF amplifier, mixer, and local oscillator and is normally mounted on a separate sub-chassis, called the 'Front End' or 'RF tuner'. The purpose of the tuner unit is to amplify ~~combined in one stage~~ both sound and picture signals picked up by the antenna and to convert the carrier frequencies and their associated bands into the intermediate frequencies and their side bands. The receiver uses superhetrodyne principle as used in radio receivers.

IF amplifier Section

A short length of coaxial cable feeds tuner output to the First IF amplifier. This section is also called video IF amplifier since composite video signal is the envelope of the modulated picture IF signal. Practically all the gain and selectivity of the receiver is provided by the IF section.

The main function of this section is to amplify modulated IF signal over its entire bandwidth with an input of about 0.5 mV signal from the mixer to deliver about 4 V into the Video detector. This needs an overall gain of 8000. To achieve desired gain, at least three stages of tuned amplifiers are cascaded and to obtain desired bandwidth the resonant frequencies of these stages are staggered.

Video Detector

Modulated IF signals after due amplification in the IF section are fed to the video detector. The detector is designed to recover composite video signal and to transform the sound signal to another lower carrier frequency. This is done by rectifying the input signal and filtering out unwanted frequency components.

Video Amplifier

The picture tube needs video signal with peak-to-peak amplitude of 80 to 100 volts for producing picture with good contrast. With an input of about 2 volts from the detector the video amplifier is designed to have a gain that varies between 40 to 60.

The video amplifier is DC coupled from the video detector to the picture tube, in order to preserve the DC component for correct brightness. In the video amplifiers that employ tubes, one stage is enough to provide the desired gain. Besides gain, response of the amplifier should ideally be flat from DC (zero) to 5 MHz to include all essential video components. This needs rigorous design consideration because the band of frequencies to be covered extends from DC through audio range to radio frequencies.

Picture tube circuitry and Control

The output from the video amplifier may be fed either at the cathode or control grid of the picture tube. In either case a particular polarity of the video signal is essential for correct reproduction of picture details. In

most cases cathode drive is preferred. The grid is thus left free to receive retrace blanking pulses to ensure that no retrace lines are seen on the screen for any setting of the brightness control.

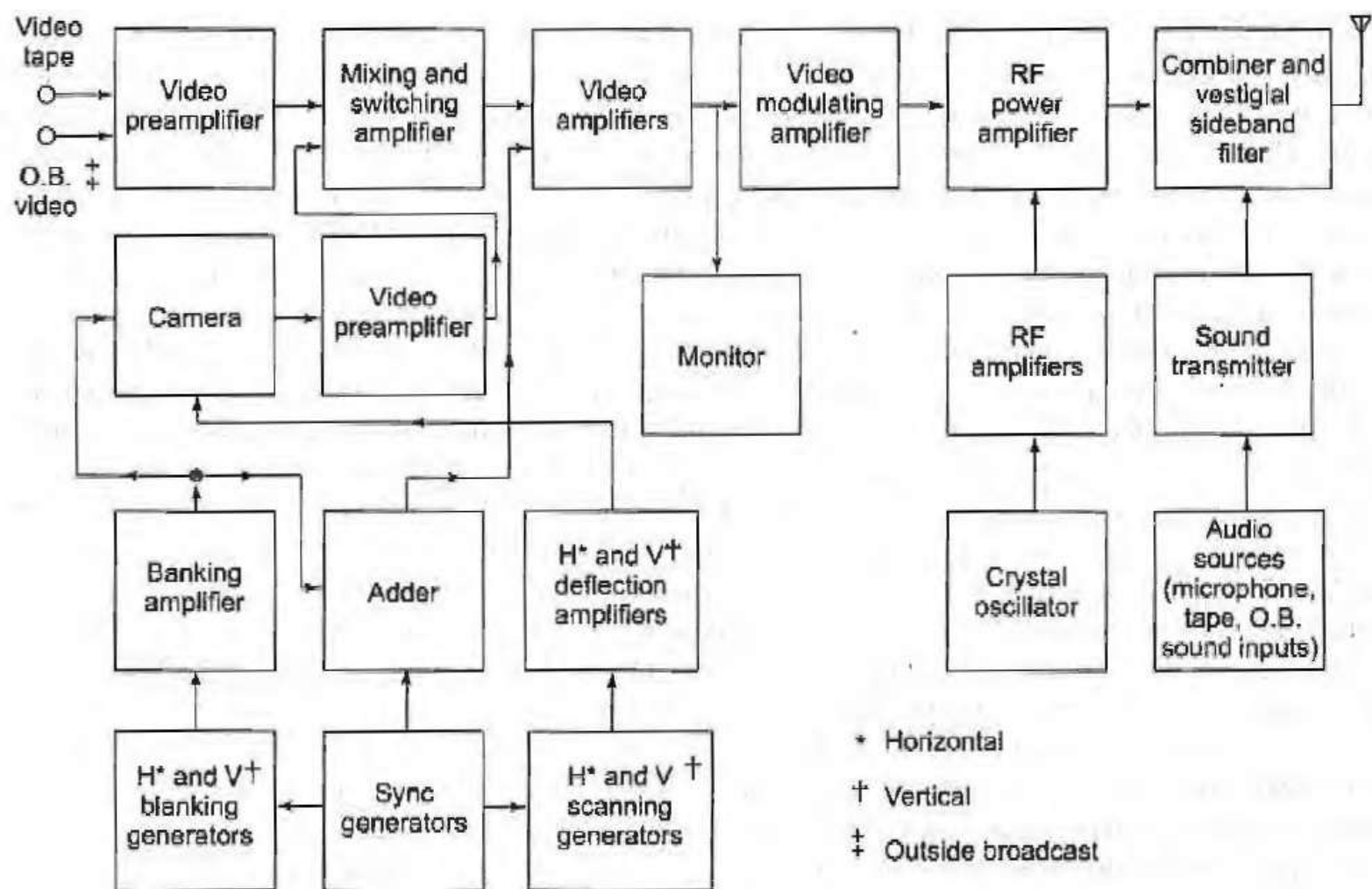
Sound ~~Signal~~ ~~Separation~~ Section

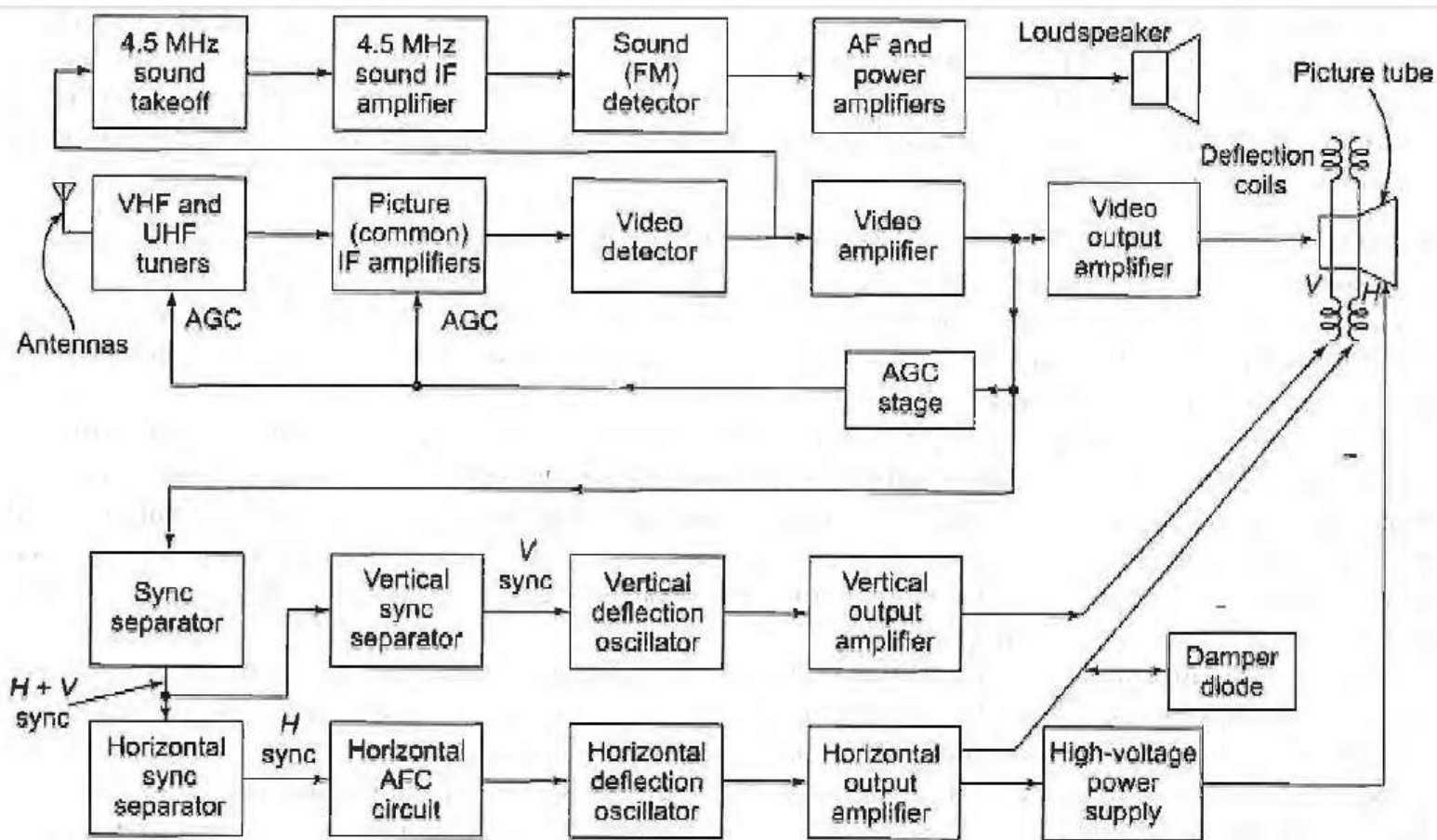
The picture and sound on their reception carriers are amplified together in the IF section.

On application of the two signals to the video detector, the picture IF (38.9 MHz) acts as the carrier and beats with the sound carrier (33.4 MHz) and its associated FM side-band frequencies, to produce difference i.e. 5.5 MHz component. This is called inter carrier beat signal.

The relatively weak FM sound signal, on a carrier frequency of 5.5 MHz is given at least one stage of amplification before feeding it to the FM detector. This stage is a tuned amplifier with enough bandwidth to pass the FM sound signal. This tuned amplifier is known as sound IF amplifier. The FM detector is normally a ratio detector or a discriminator preceded by a limiter.

The frequency of audio signal depends on the rate of frequency deviation. At the output of FM detector, a de-emphasis circuit is provided that has the same time constant as that of the pre-emphasis circuit employed at the sound transmitter. This restores the amplitude of higher audio frequencies to their correct level. The audio signal receives atleast one stage of amplification before it is passed on to the audio output (power) amplifier. The power amplifier is either a single ended or push-pull configuration employing tubes or transistors. The audio amplifier feeds into one or two loudspeakers provided at a convenient location along front panel of the receiver.





Block diagram of typical monochrome television receiver.