ElementsofaTelevisionSystem:

TV was invented by J L Baird & C F Jenkins in 1927.

TV (television) consists of two words:

Tele - distant

Vision – to see

So, term television means ‘to see from a distance’.

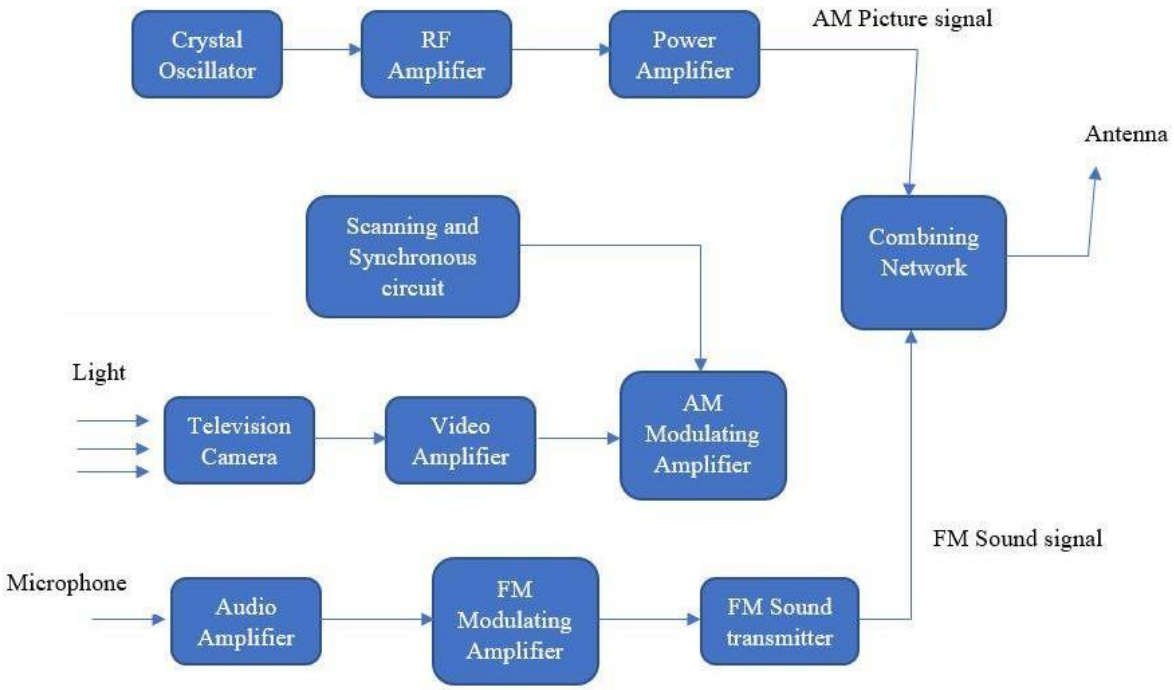
In India, we have adopted the CCIR 625 line system.

TVTransmission:

Itconsistsof2 parts:

a) PictureTransmission:

thepicturesignalisamplitudemodulatedbeforetransmission.



b) SoundTransmission:

thesoundsignalisfrequencymodulatedbeforetransmission.

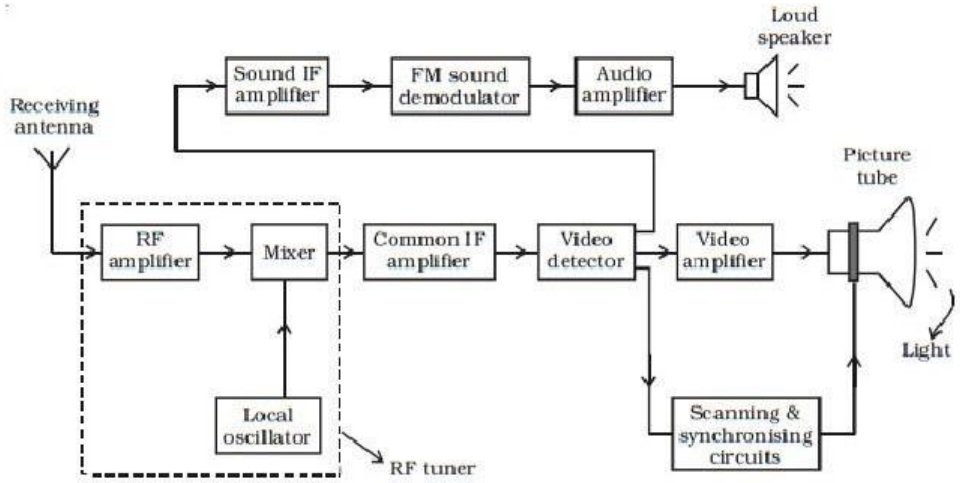


Fig Elementary block diagram of a monochrome TV receiver

Microphone:Amicrophoneisa devicethatconvertsvoicesignalintoelectricsignal.

Typesofmicrophones:

a) CarbonMicrophone

b) CondenserMicrophone

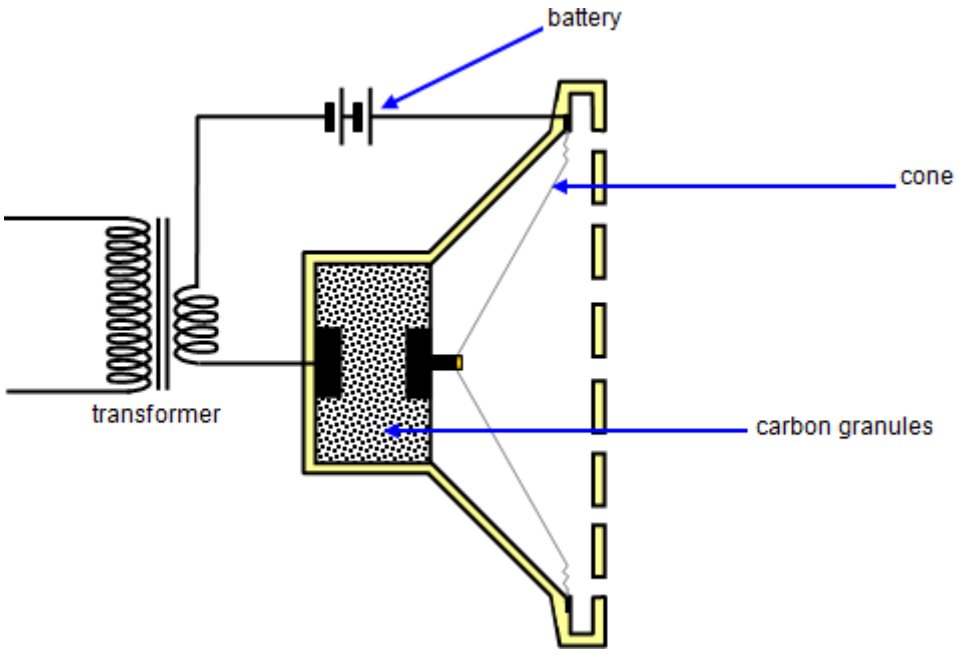
c) CordlessMicrophone

a) CarbonMicrophone:

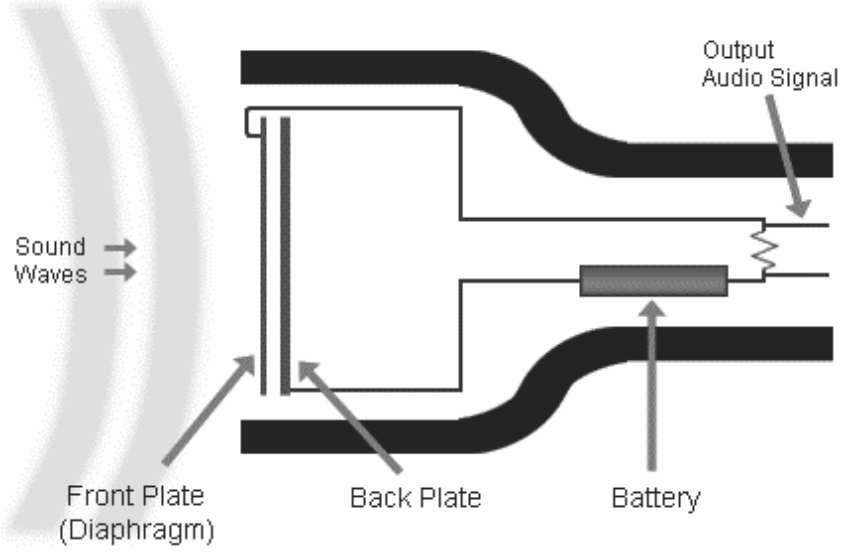
whenapersonspeaks,thevoicesignalmakesdiaphragmmoveinandout.

So,thedistancebetweencarbongranuleschangeswhichfurther changesresistanceofthecircuit. Also, the current changes according to the input voice signal.

So,thevoicesignalisconvertedintoelectricsignal(current).



b) CondenserMicrophone:



Two metal plates are set apart.

Frontplateactsasadiaphragm. Back

plate is fixed.

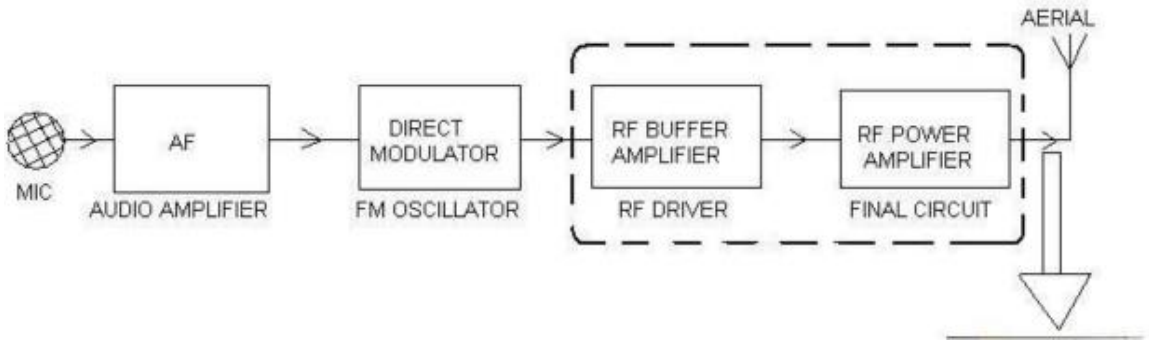
Soundwavesmakefrontplatevibrate.

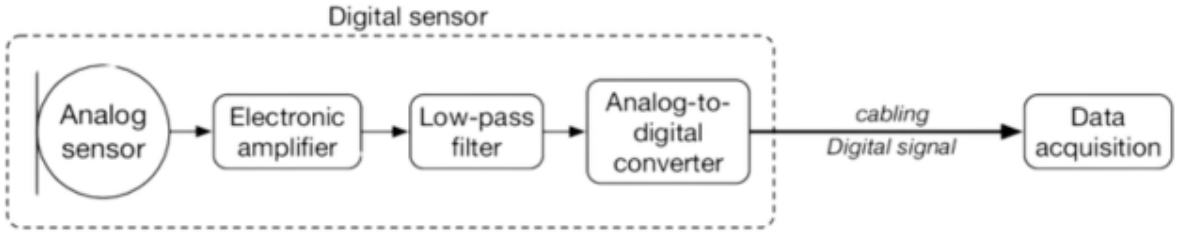
So,thecurrent variesaccordingtotheinputvoice.

C=kea/d

c) CordlessMicrophone:

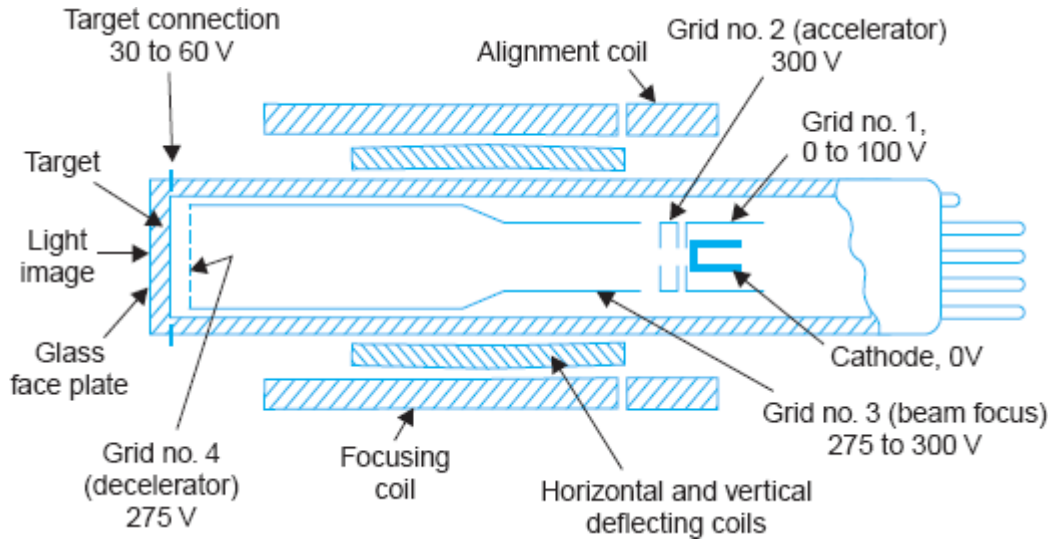
voicesignalisconvertedintoelectricalsignal.



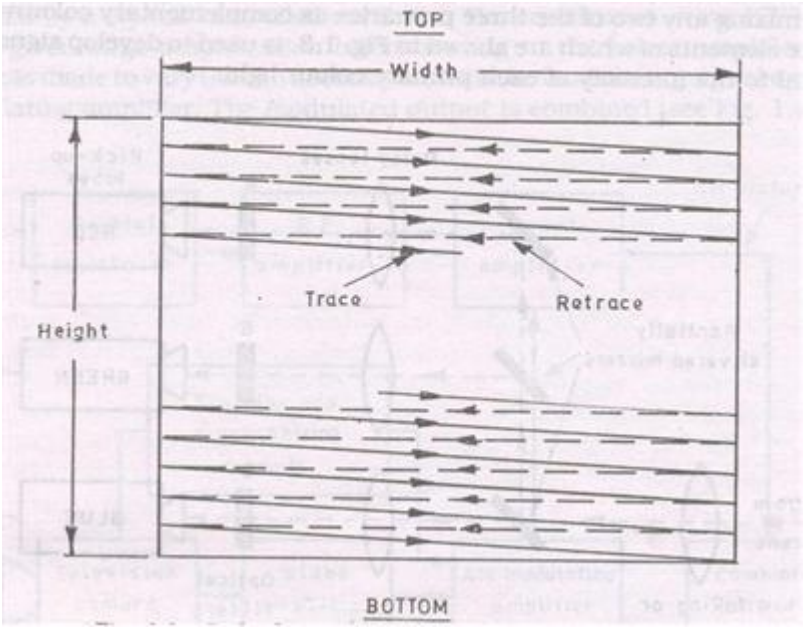

Digital sensor
Analog sensor
Electronic amplifier
Low-pass filter
Analog-to-digital converter
cabling
Digital signal
Data acquisition

MonochromeTelevision

There are two camera tubes- vidicon & plumbicon for picture transmission:

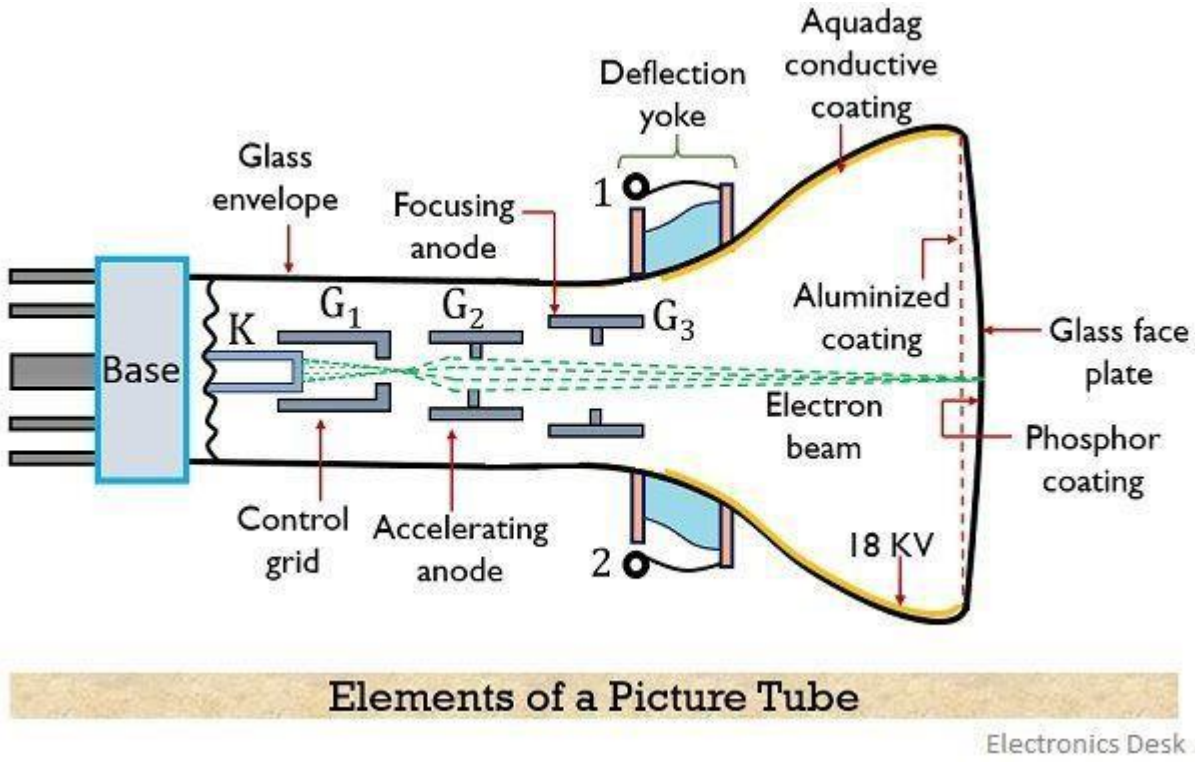


Cross-sectionalviewofVidicontvcameratube



PictureReception:

At receiving end, the TV consists of Picture Tube for picture reception.



TheoutputfromlastIFstageisdemodulatedtorecovervideosignal.

This pictureinformationsignalis amplifiedandcoupledtopicturetubewhichconverts electrical signal back into picture elements of black & white.

Thevideosignalisfedtothecathodeofthepicturetube.

SoundReception:

TheFMaudiosignalis demodulated.Theaudiooutput fromFMdetector isamplifiedbeforefeeding to the loudspeaker.

Synchronization:

It is essentialthat samecoordinates bescannedat anyinstant bothat thecamera tubetarget plate& at the raster of the picture tube.

Needforsyncpulses:

Toensureperfectsynchronization,syncpulsesaretransmitteduringretrace.

ReceiverControls:

Channel Selector

Vertical Hold

FineTuning

Contrast

Brightness

Volume&On-Off

Tone

AnalysisandSynthesisofTVPictures

a) GrossStructure:

GeometricFormandAspectRatioofthepicture

b) ImageContinuity:

ScanninganditsSequence

c) NumberofScanningLines:

Resolution of picture details

d) Flicker:

InterlacedScanning

e) FineStructure:

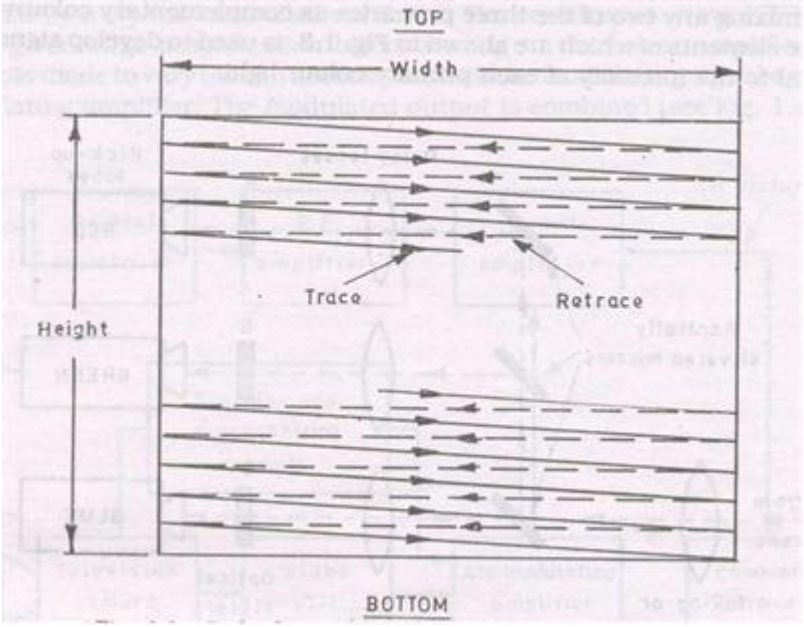
VerticalandHorizontalResolution

f) TonalGradation:

Picturebrightness characteristics

a) GrossStructure:

FrameadoptedinallTVsystemsis rectangular.



Aspect Ratio=Width/Height=4/3

b) ImageContinuity:

itisachievedby‘persistenceofvision’ofhumaneye.

Ifthepicturescanningrateisgreaterthan16,theviewappearstobecontinuoustothehuman eye.

So,scanningrateinmotionpictures=24frames/s scanning

rate in motion pictures=25 frames/s

Scanning:

a) HorizontalScanning:

The movement of electron beamspot fromleft to right and back to start a new line in the same directionistermedashorizontalscanning. Horizontalscanningfrequencyisdefinedasthenumber of lines scanned per second.

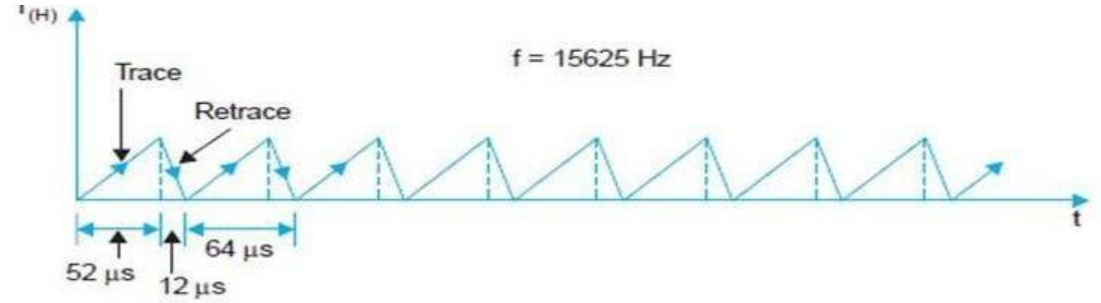
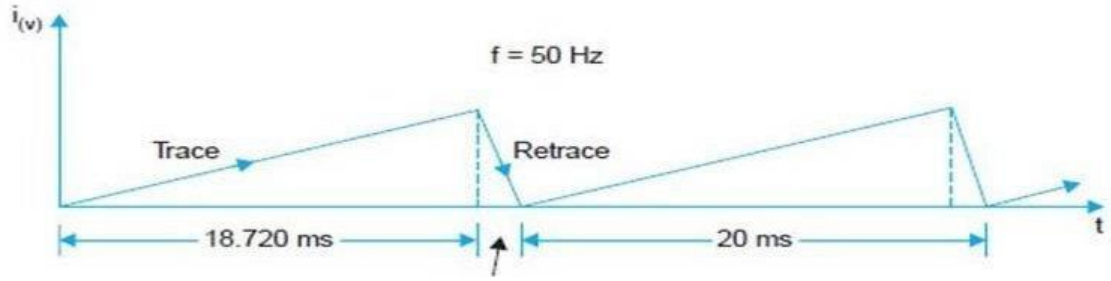


Fig. 2.5 (a) Horizontal deflection current.



b) VerticalScanning:

Verticalscanningisthemovementoftheelectronbeamspotintheverticaldirection.

Flicker:

Framerateof25framesper secondissufficientfor illusionofcontinuitybutthebrightnessof one frame does not blend into the next frame and screen is blanked for some time. This blankness is known as flicker.

Howtoremove flicker:

Toremoveflicker,interlacedscanningisused.

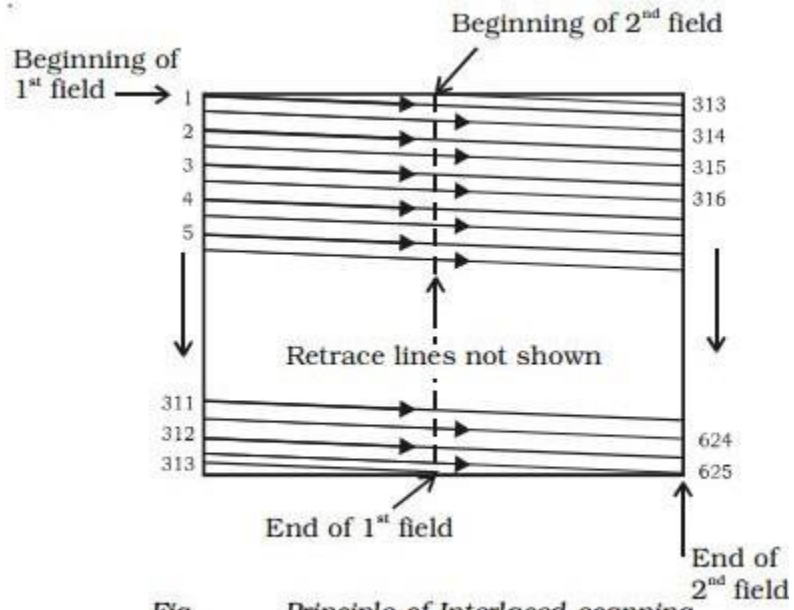


Fig *Principle of Interlaced scanning*

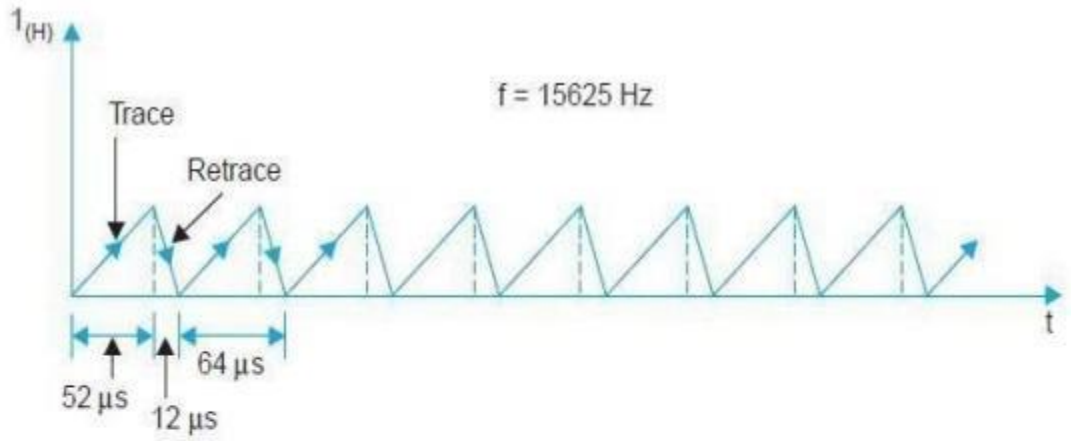


Figure. Horizontal deflection current

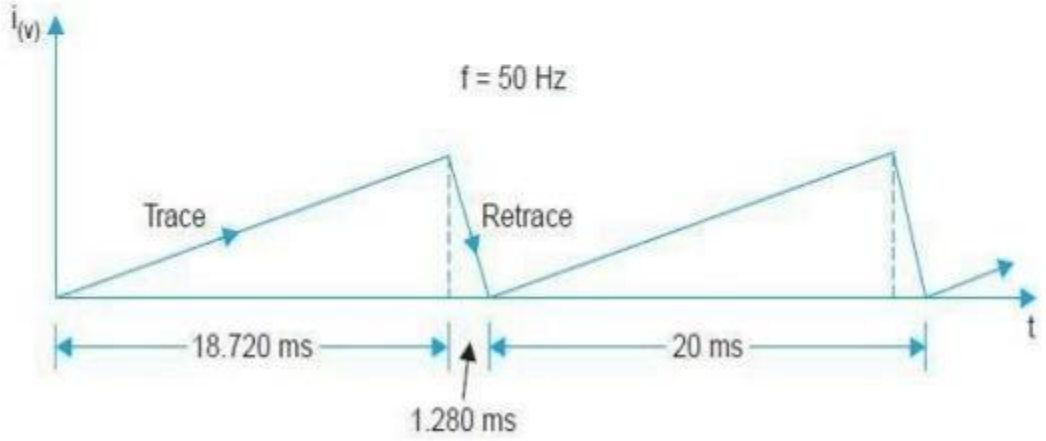


Figure. Vertical deflection current

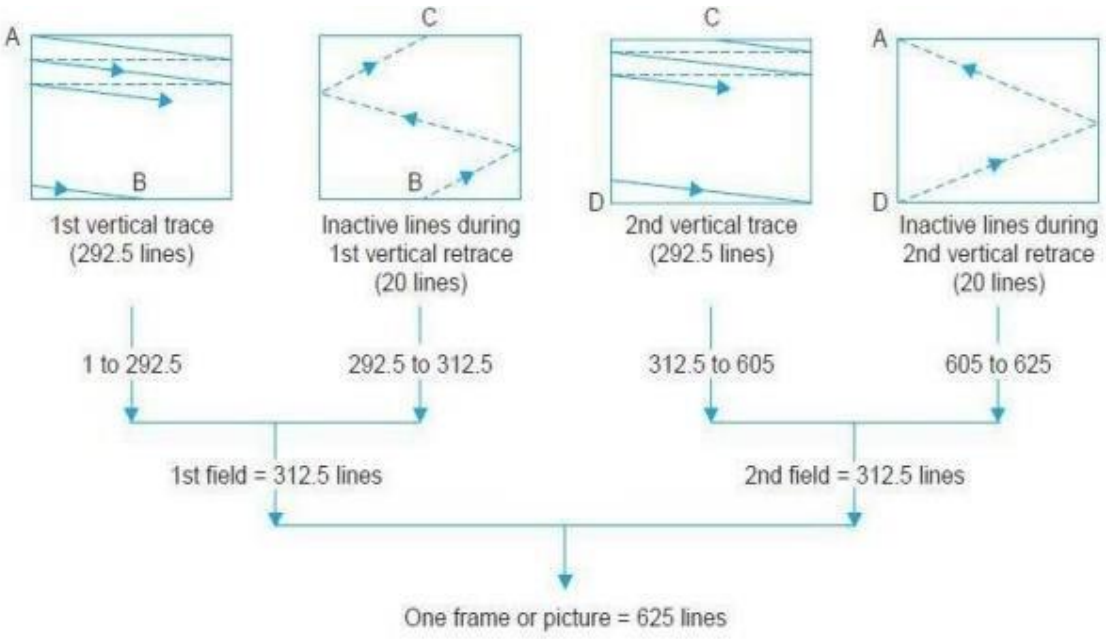
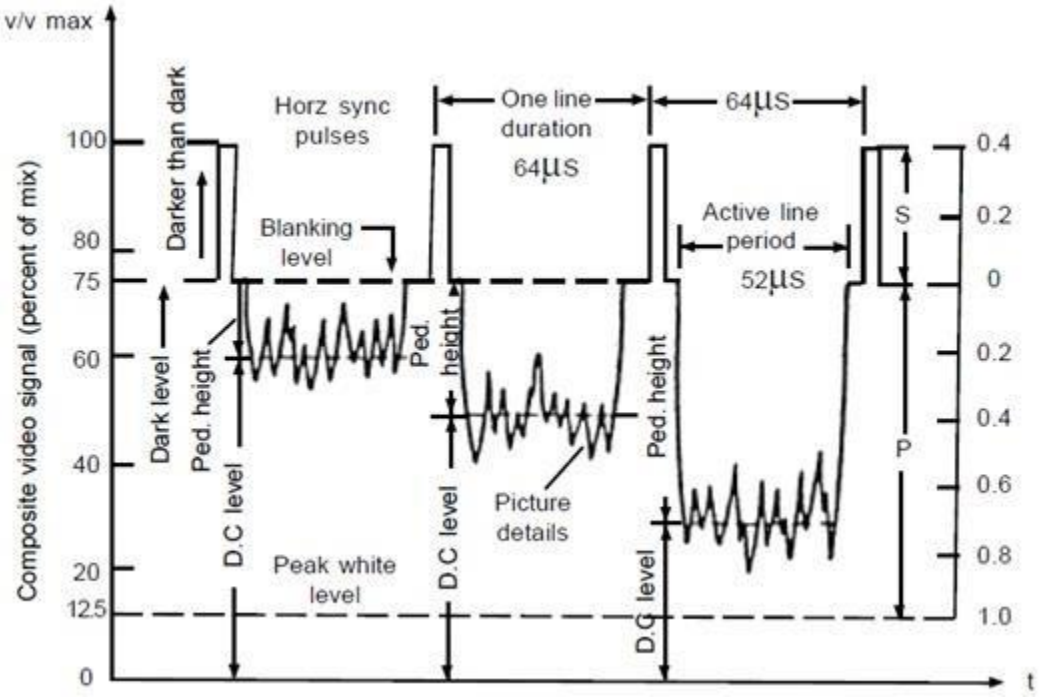
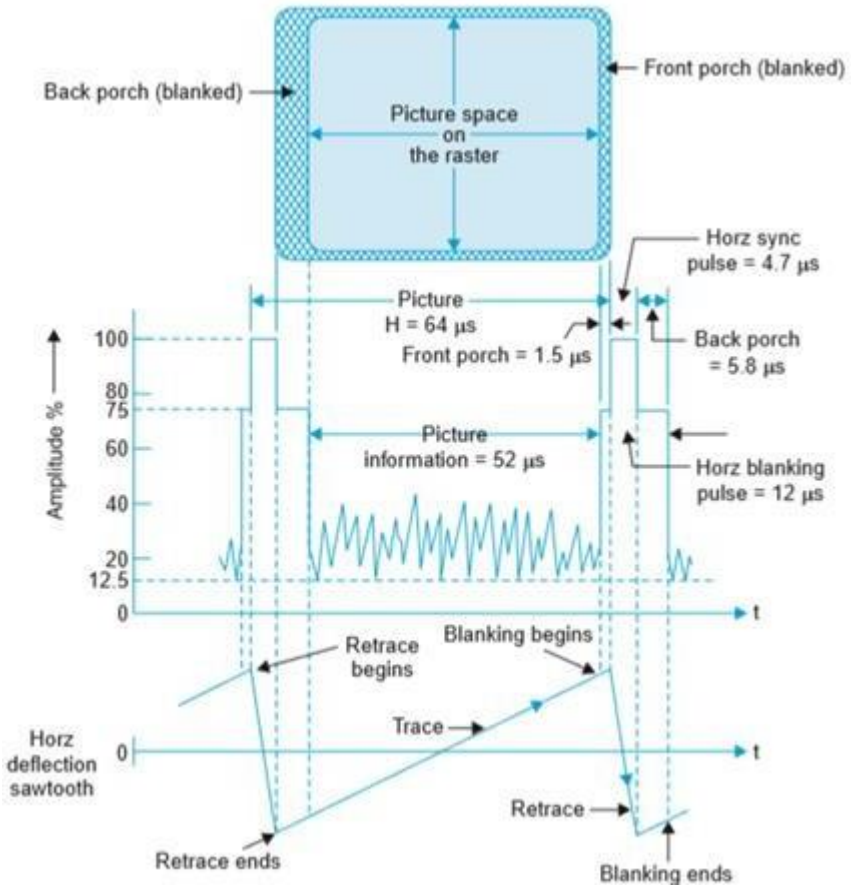


Figure. Odd line interlaced scanning procedure

CompositeVideoSignal



HorizontalSyncDetails



VerticalSyncDetails

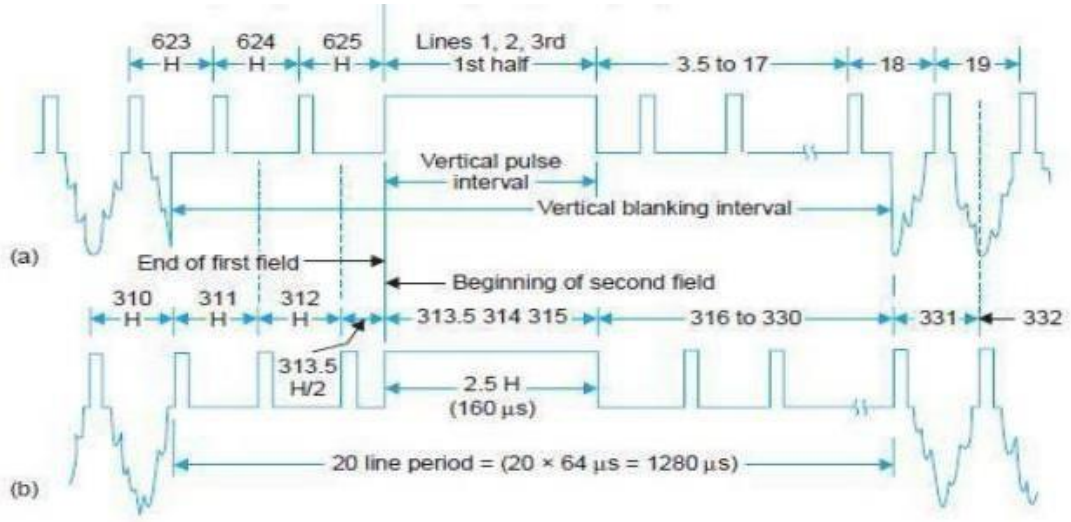
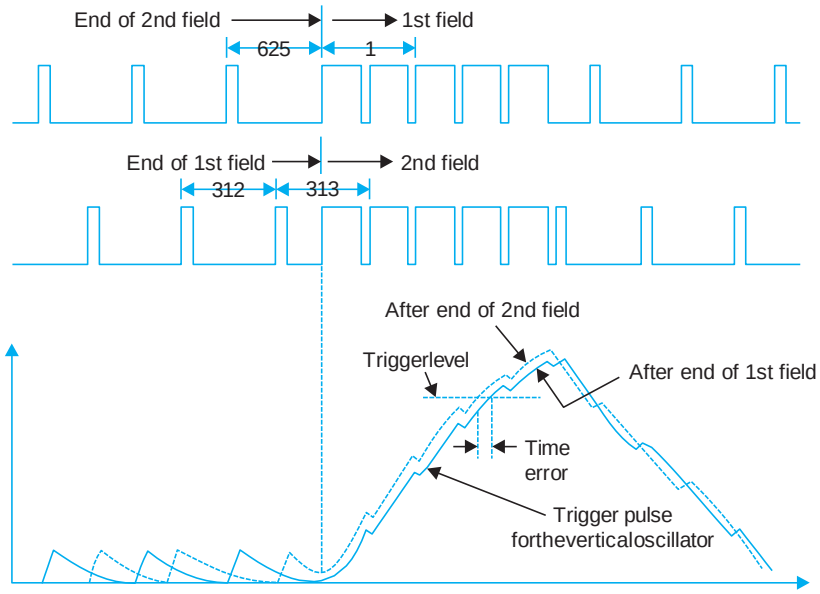


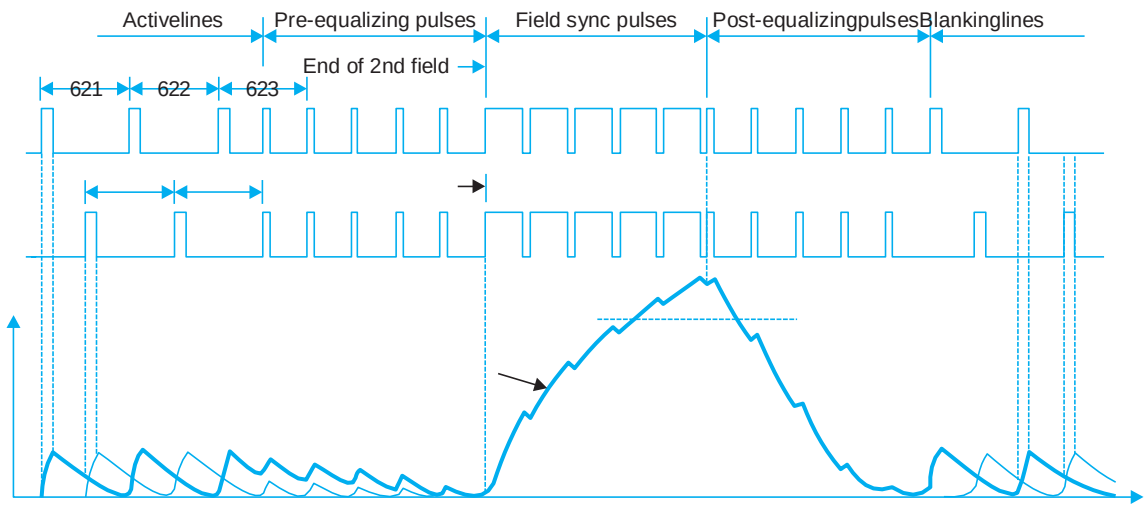
Figure. Composite video waveforms showing horizontal and basic vertical sync pulses at the end of (a) second (even) field, (b) first (odd) field. Note, the widths of horizontal blanking intervals and sync pulses are exaggerated.

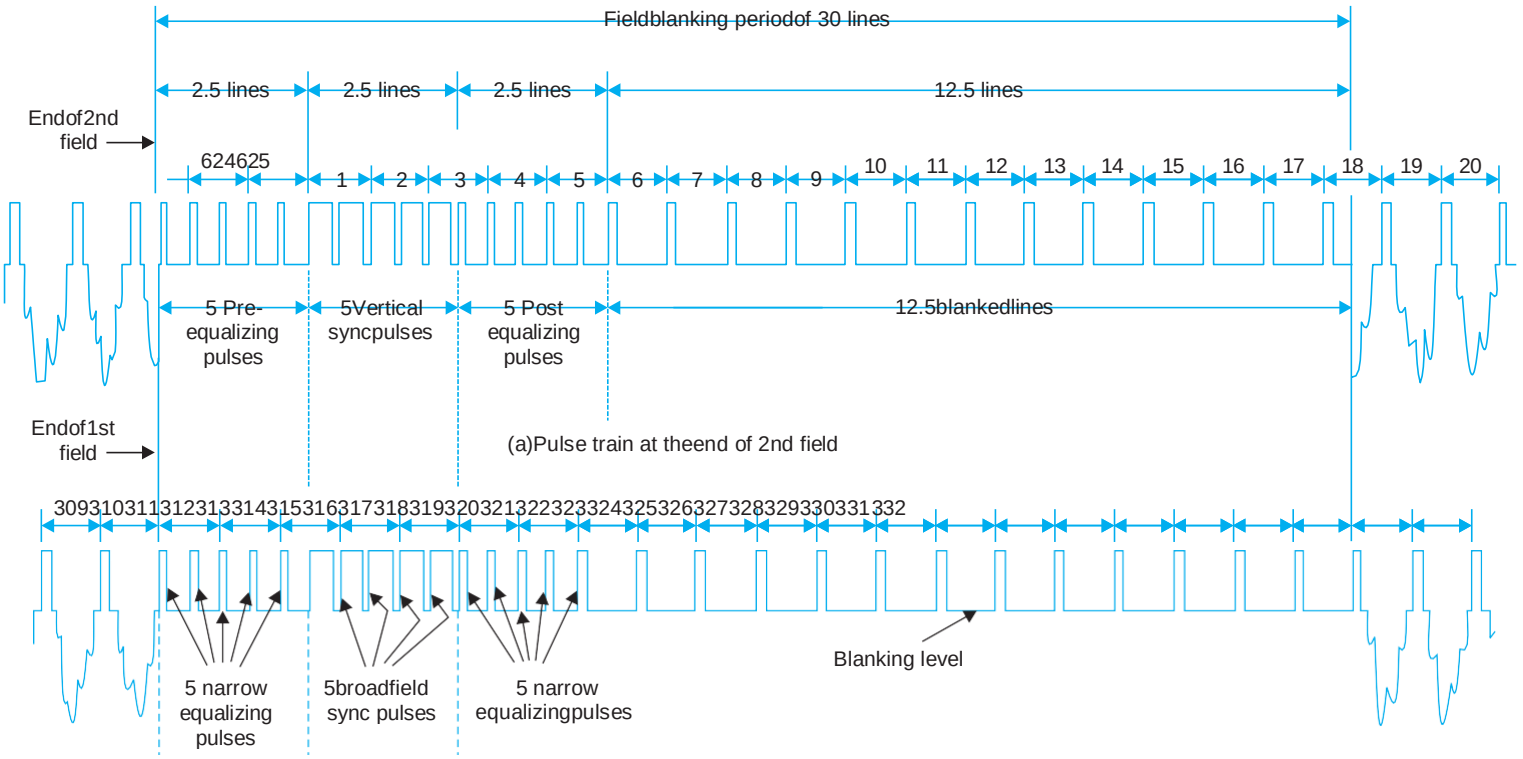


Half-line discrepancy

To remove half-line discrepancy, equalizing pulses are added.

Types of equalizing pulses:
a) Pre-equalizing pulses
b) Post-equalizing pulses


Activelines
Pre-equalizing pulses
Field sync pulses
Post-equalizingpulses
Blankinglines
End of 2nd field
621
622
623

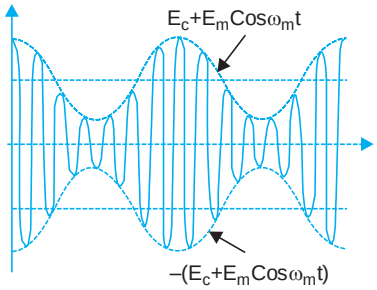

Fieldblanking periodof 30 lines
2.5 lines
2.5 lines
2.5 lines
12.5 lines
Endof2nd field
624625
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
5 Pre-equalizing pulses
5Vertical syncpulses
5 Post equalizing pulses
12.5blankedlines
Endof1st field
(a)Pulse train at theend of 2nd field
309310311312313314315316317318319320321322323324325326327328329330331332
5 narrow equalizing pulses
5broadfield sync pulses
5 narrow equalizingpulses
Blanking level

Signal Transmission and Channel Bandwidth:

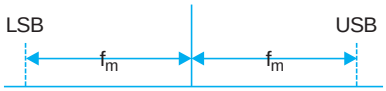
Picture Signal is Amplitude Modulated & Sound Signal is Frequency Modulated before transmission.

$e_c = E_c \cos \omega_c t$ is the carrier wave and
$e_m = E_m \cos \omega_m t$ is the modulating signal

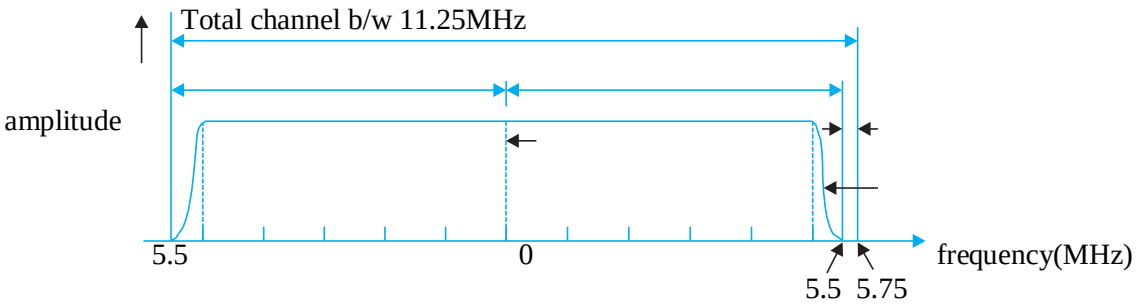
Modulated Wave:



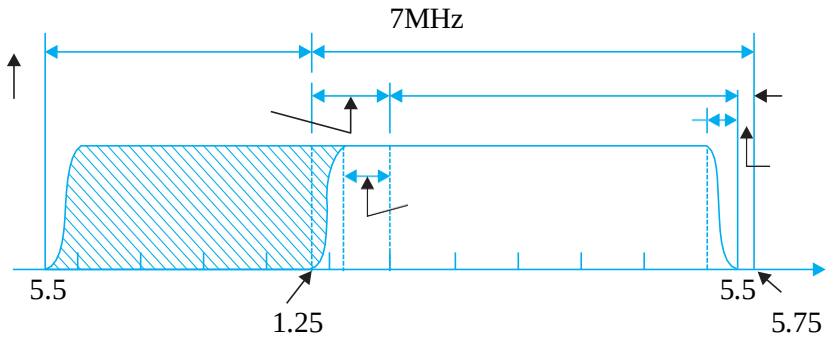
Frequency Spectrum:



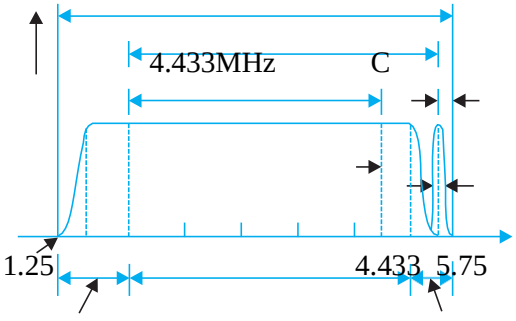
Channel Bandwidth:



Vestigial Sideband Transmission:



Total Channel Bandwidth=7 MHz

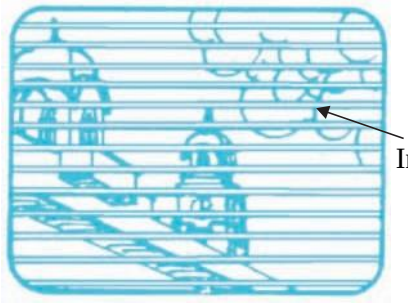


The colour subcarrier is added at 4.433 MHz.(within 7 MHz Bandwidth).

Interference suffered by Television Signal:

(a) Co-Channel Interference
(b) Adjacent Channel Interference
(c) Ghost Interference

(a) Two stations operating at same carrier frequency.



Venetian Blind Phenomenon

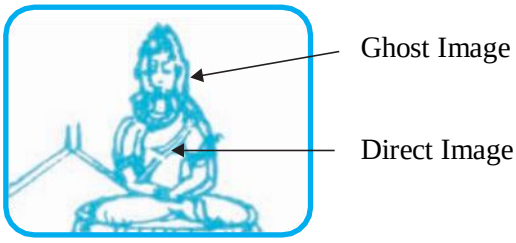
(b) Stations located close-by and occupying adjacent channels.

A Coarse Dot structure is formed on the screen.

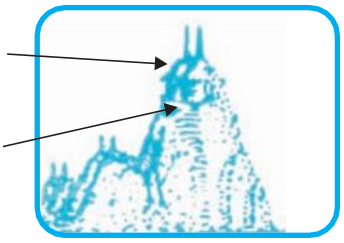
(c) Ghost Interference:

Ghost interference arises from reflection of signal from surface of buildings, bridges, hills, towers etc.

There are two types of ghost interferences:
(a) Trailing Ghost Image
(b) Leading Ghost Image



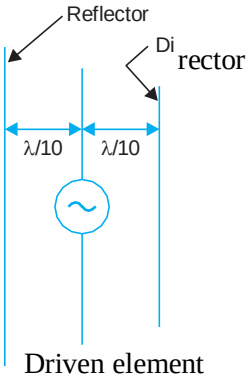
Trailing Ghost Image



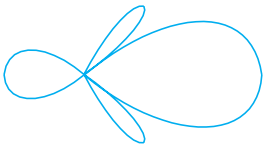
Leading Ghost Image

Televisio Antennas:

Yagi-Uda Antenna



(a)



Radiation Pattern

(b)

Sound Signal Seperation:

A television signal transmitted from a broadcast station consists of an amplitude modulated RF picture carrier and a separate frequency modulated RF sound carrier both within the 7 MHz channel bandwidth alloted to the station.

Colour Television:

Compatibility Condiderations:

(a) When a monochrome tv receiver is fed with coloured signal, monochrome display must be produced.
(b) When a colour tv receiver is fed with monochrome signal, monochrome display must be produced.

Three Colour Theory:

There are 3 primary colours:
Red (R)
Green (G)
Blue (B)

Secondary colours are produced by mixing of primary colours.

Types of mixing:
There are two types of mixing:

(a) Additive Mixing
(b) Subtractive Mixing
(a) Additive Mixing:

Red+Green=Yellow

Red+Blue=Magenta

Blue+Green=Cyan

(b) Subtractive Mixing:

White-Blue=Yellow

White-Green=Magenta

White-Red=Cyan

Grassman's Law:

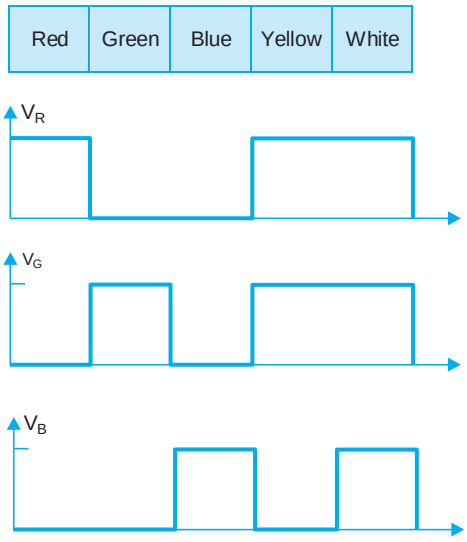
Y=0.3R+0.59G+0.11B
where, Y=Luminous Intensity

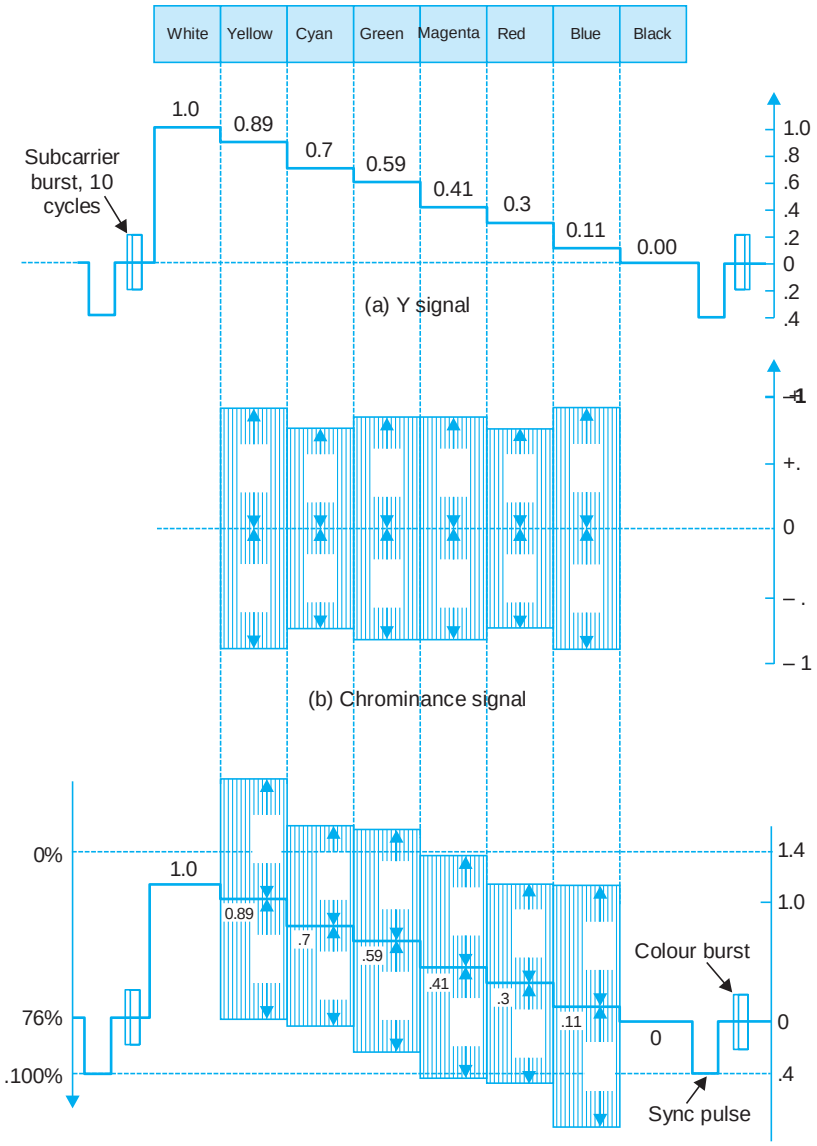
Tristimulus Value of Spectral Colours:

Tristimulus Value of Red=0.3
Tristimulus Value of Green=0.59
Tristimulus Value of Blue=0.11

Properties of Spectral Colours:

(a) Luminance: it is the amount of light intensity as perceived by the eye regardless of the colour.
(b) Hue: it is the predominant spectral colour of the received light.
(c) Saturation: it is the spectral purity of the colour light.




White
Yellow
Cyan
Green
Magenta
Red
Blue
Black
1.0
0.89
0.7
0.59
0.41
0.3
0.11
0.00
Subcarrier burst, 10 cycles
1.0
.8
.6
.4
.2
0
.2
.4
(a) Y signal
+.
0
– .
– 1
(b) Chrominance signal
0%
76%
.100%
1.0
0.89
.7
.59
.41
.3
.11
0
1.4
1.0
0
.4
Colour burst
Sync pulse