Course: Multimedia Processing

Sem: VII

By

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UNIT - I
FUNDAMENTALS OF DIGITAL TELEVISION

- Topics:
- Aspect Ratio
- Image Continuity
- Scanning
- Colour Television
- TV Transmitter & Receiver

Aspect Ratio

- Standard aspect ratio: 4:3
- Horizontal motion preferred
- Comfortable for human eyes
- Same ratio needed at transmitter and receiver

Image Continuity

- Based on persistence of vision
- Human eye retains image for ~1/16 sec
- TV frame rate: 25 frames/sec
- Creates illusion of motion

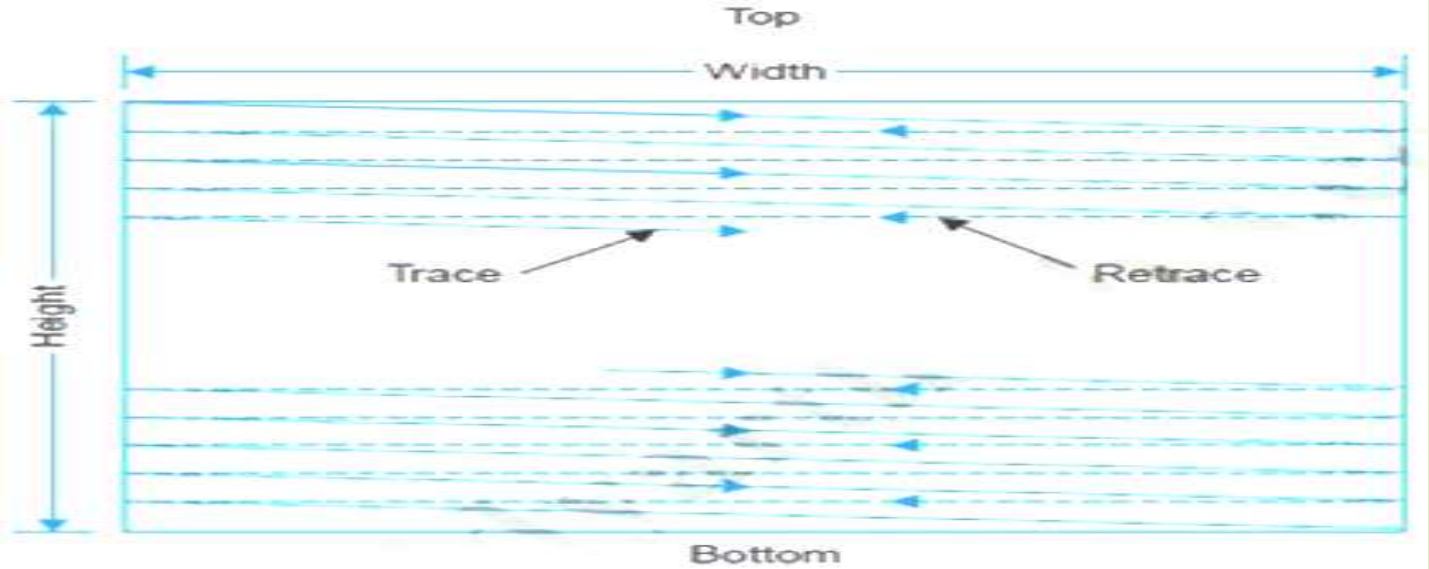
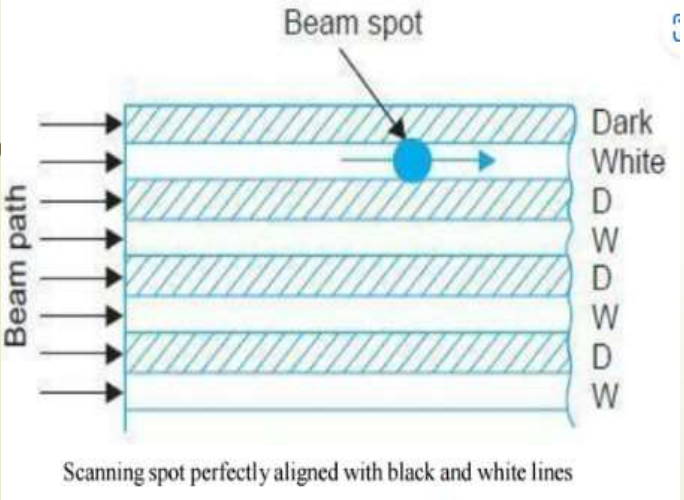


Figure. Path of scanning beam in covering picture area

Scanning in Television

- Converts optical image to electrical signal
- Image divided into pixels
- Scanning from left to right and top to bottom
- 25 frames per second



Scanning spot perfectly aligned with black and white lines

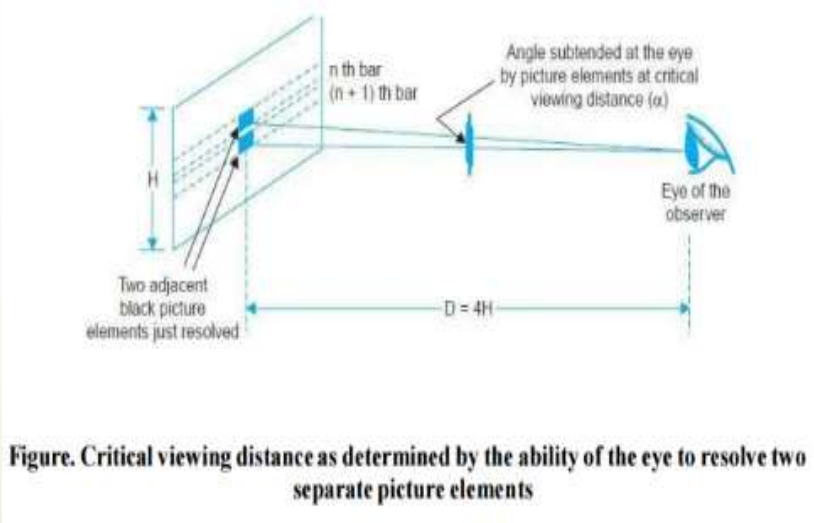


Figure. Critical viewing distance as determined by the ability of the eye to resolve two separate picture elements

Types of Scanning

- Horizontal Scanning
- Vertical Scanning
- Flicker
- Interlaced Scanning

Horizontal Scanning

- Electron beam moves left to right
- Controlled by horizontal deflection coils
- Sawtooth waveform used
- Frequency: 15,625 Hz (625 line system)

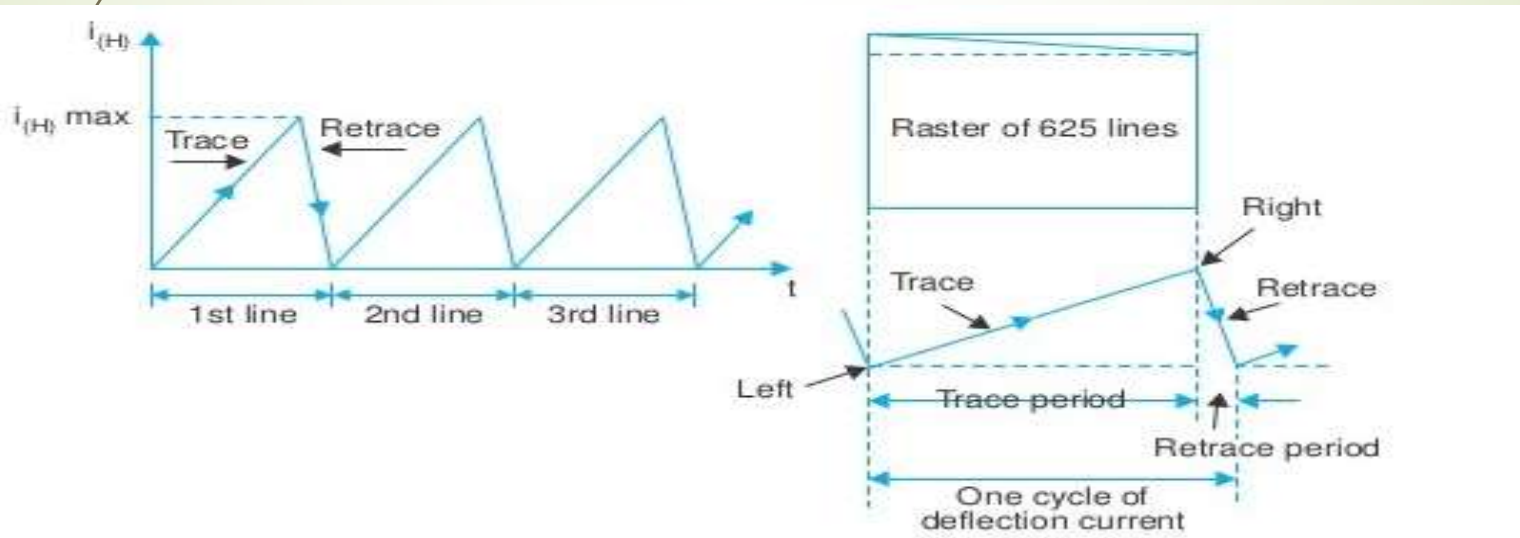


Figure1: Waveform of Horizontal Deflection

Vertical Scanning

- Beam moves from top to bottom
- Produces horizontal lines
- Controlled by vertical deflection coils
- Frequency: 25 Hz

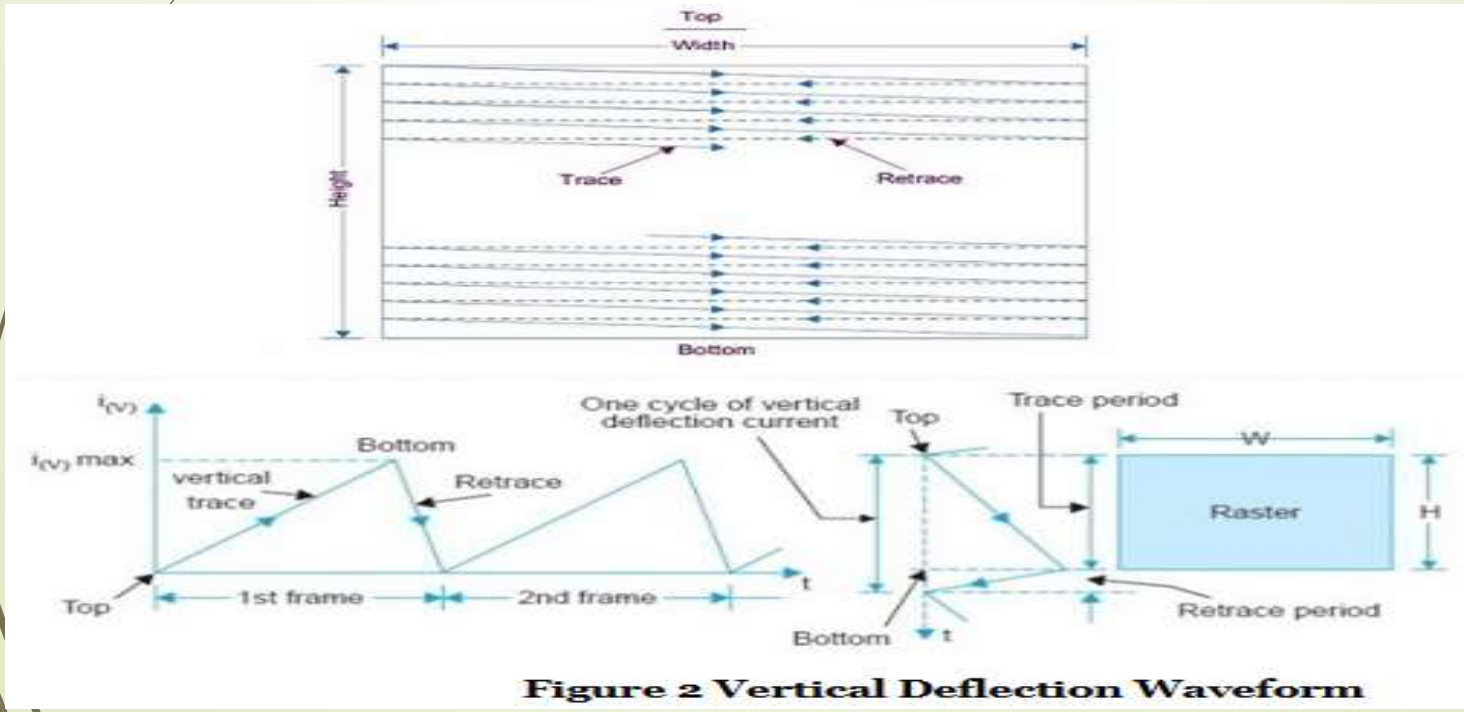


Figure 2 Vertical Deflection Waveform

Flicker

- Occurs due to low frame rate
- Brightness fluctuates
- Visible flickering effect
- Solved using interlaced scanning

Interlaced Scanning

- Frame divided into odd and even fields
- Each field scans alternate lines
- 312.5 lines per field (625 system)
- 50 fields/sec, 25 frames/sec

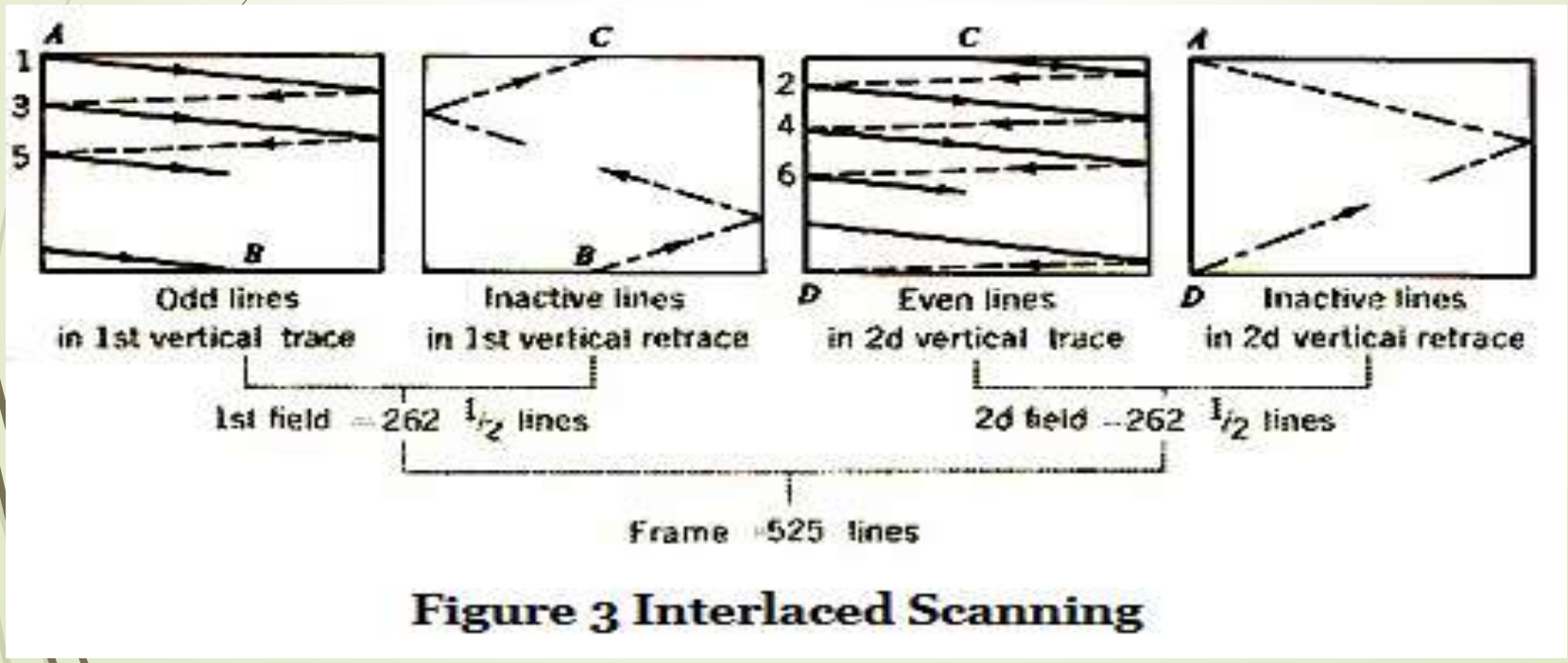


Figure 3 Interlaced Scanning

Colour Television

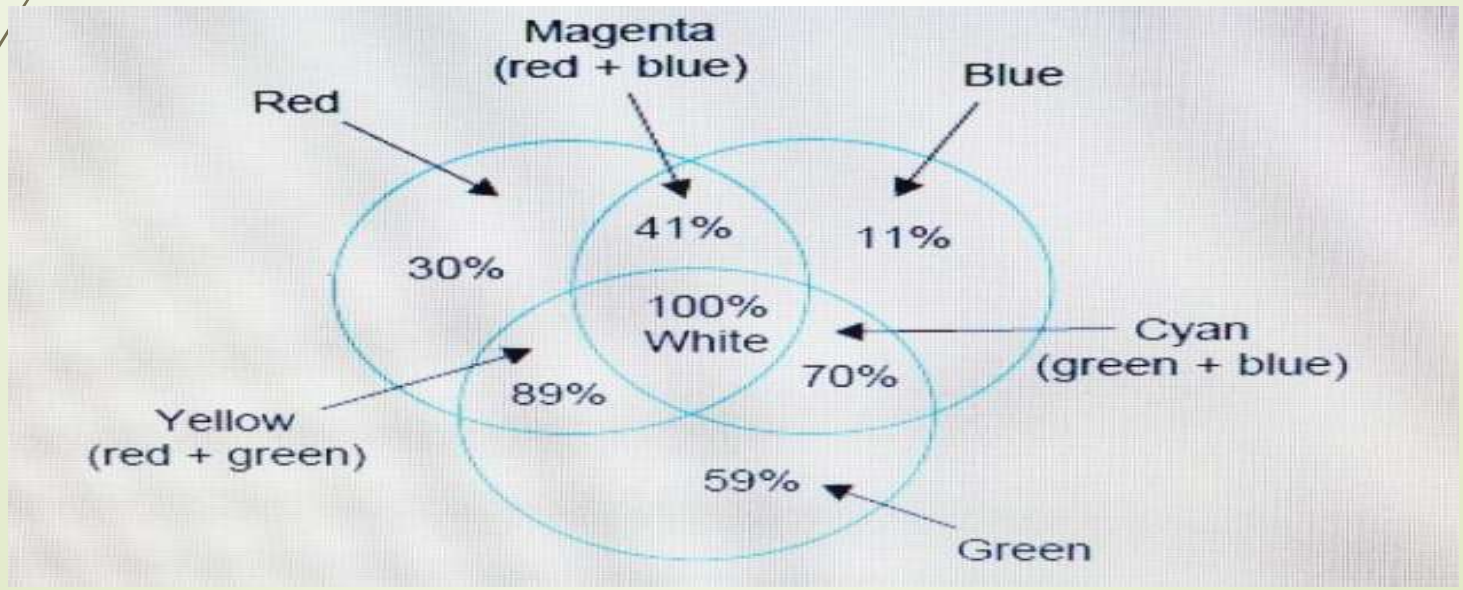
- Monochrome TV shows brightness only
- Colour TV adds colour information
- Must remain compatible with monochrome TV

Colour Perception

- Human retina has rods and cones
- Rods detect brightness
- Cones detect colour: Red, Green, Blue
- Maximum eye sensitivity at ~550 nm

Three Colour Theory

- Primary colours: Red, Green, Blue
- Additive colour mixing
- R+G=Yellow, R+B=Magenta, B+G=Cyan
- R+G+B=White



Colour Specifications

- Hue: Actual colour
- Luminance: Brightness
- Saturation: Purity of colour

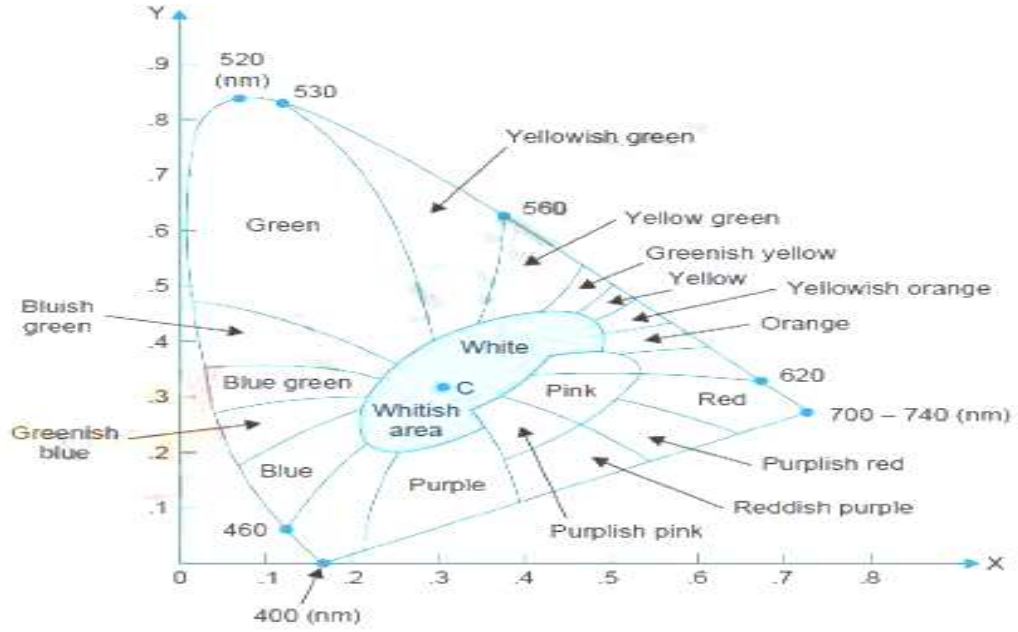


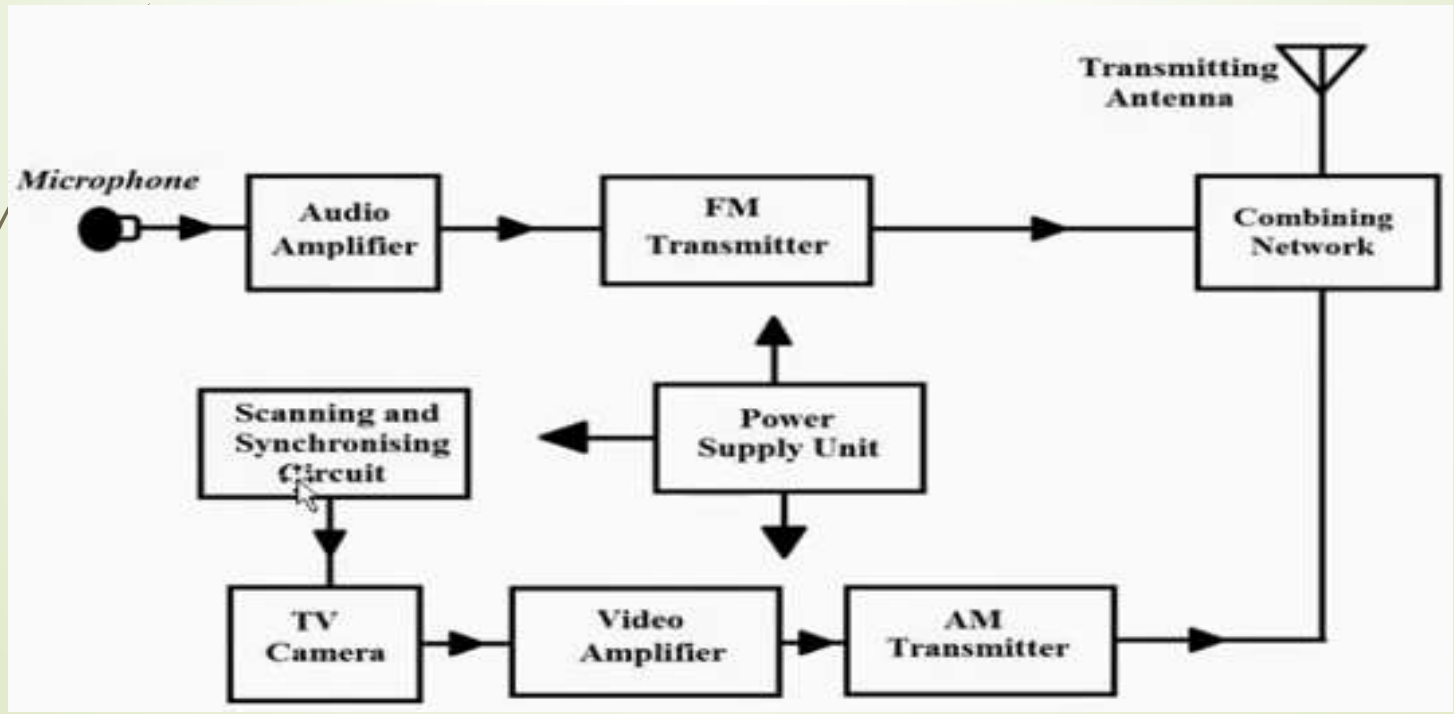
Figure. Chromaticity diagram. Note that red, green and blue have been standardized at wavelengths of 700, 646.1 and 438.8 nanometers respectively. X and Y denote color coordinates. For example white lies at X = 0.31 and Y = 0.32.

Colour Signals

- Luminance signal Y = 0.3R + 0.59G + 0.11B
- Chrominance carries colour info
- Colour difference signals: R-Y and B-Y

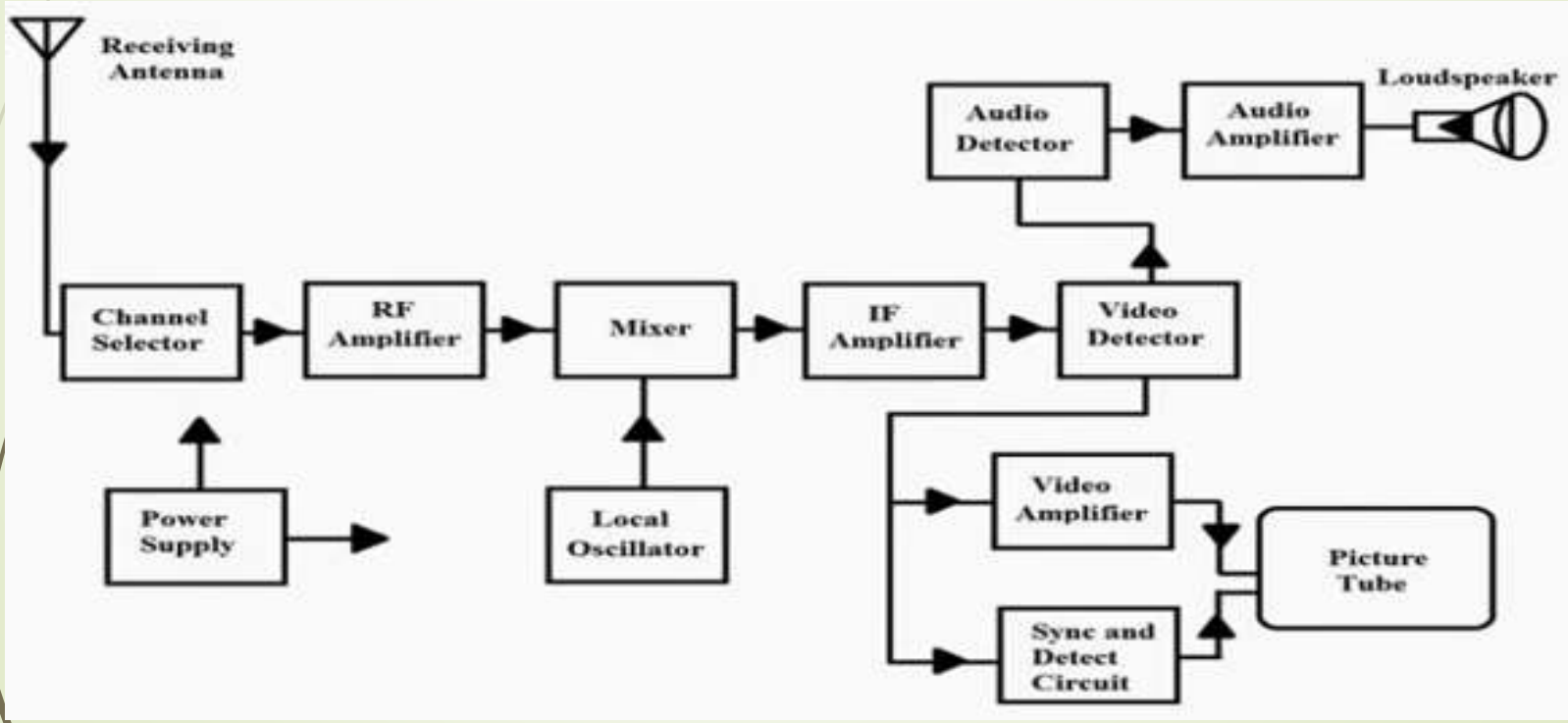
TV Transmitter

- Video section: Camera, Video amplifier, AM modulator
- Audio section: Microphone, Audio amplifier, FM modulator
- Video uses AM, Audio uses FM



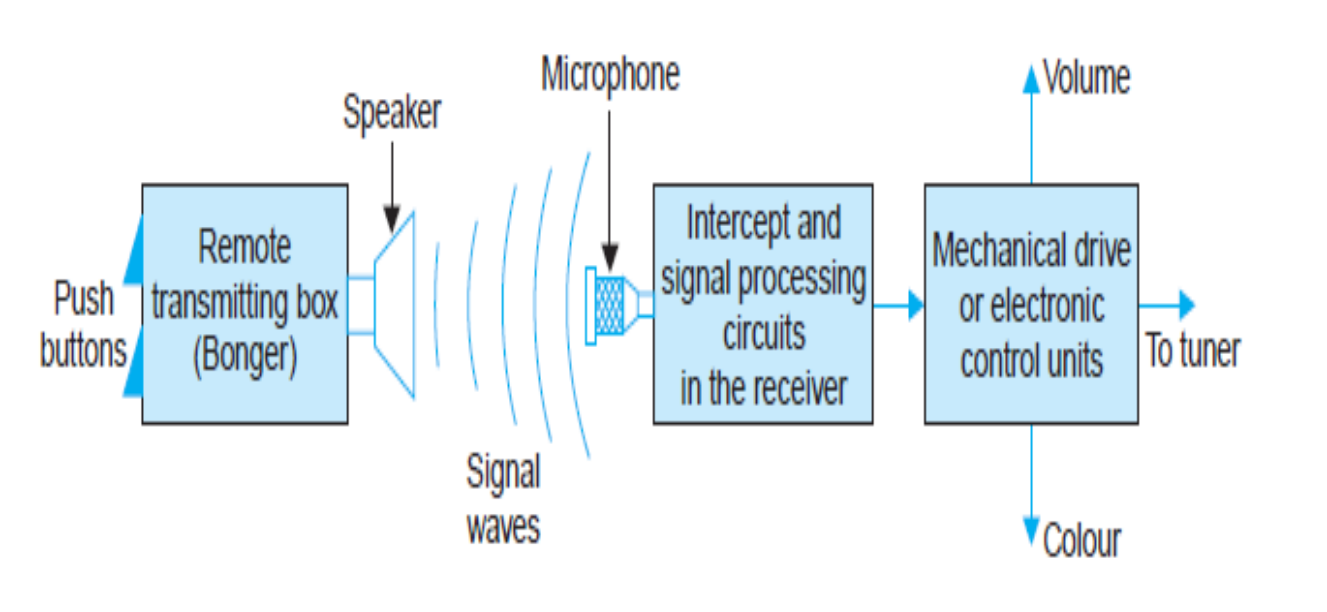
TV Receiver

- RF Section: Antenna, Channel selector, RF amplifier, Mixer, IF amplifier
- Audio Section: Audio detector, Audio amplifier, Loudspeaker



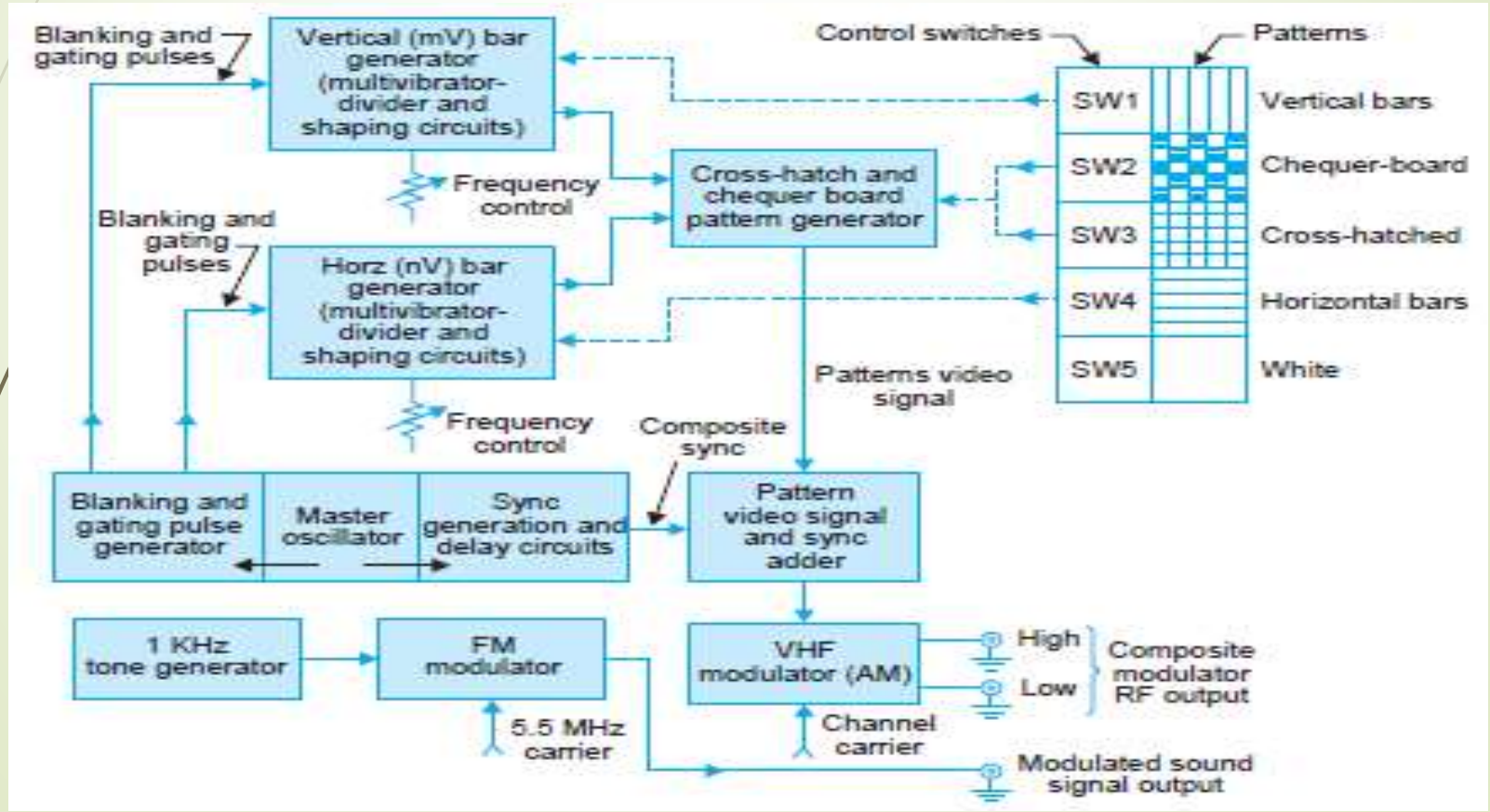
Remote Control System

- Uses ultrasonic frequencies
- Typical range: 37–44 kHz
- Functions: Channel selection, volume control, power



Pattern Generator

- Used for testing TV receivers
- Generates patterns: bars, chessboard, cross-hatch, dots, white screen



Wobbluscope

- Combines sweep generator, marker generator and oscilloscope
- Used for alignment of RF, IF and video circuits

