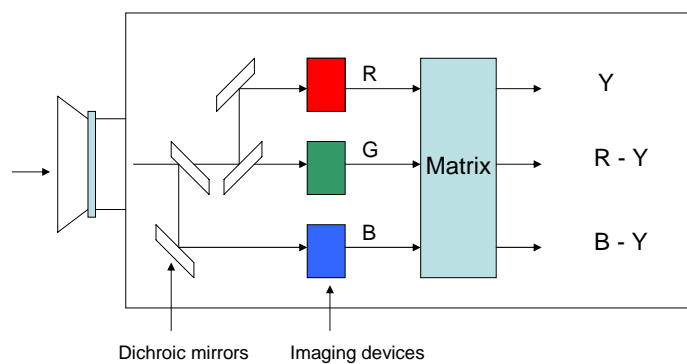


Analog and Digital Video

- Produce Television signal



Component signal Y,R-Y,B-Y

$$Y = 0.299R + 0.587G + 0.114B$$



PAL (Phase alternation line)

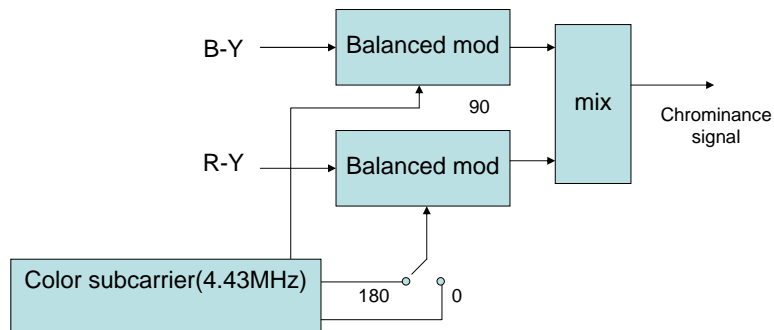
625 horizontal scan lines

Interlace scanning

2 field = 1 frame

25 frame/second

PAL (Phase Alternation Line)



$$\text{Burst (4.43MHz)} = 284f_h - f_h/4 + 25$$

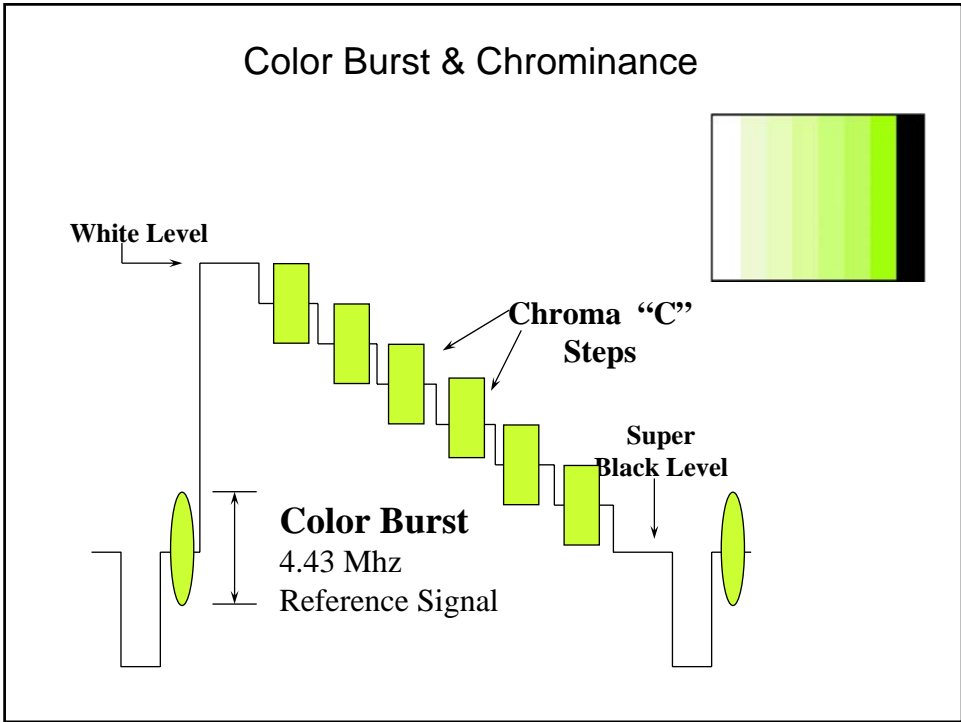
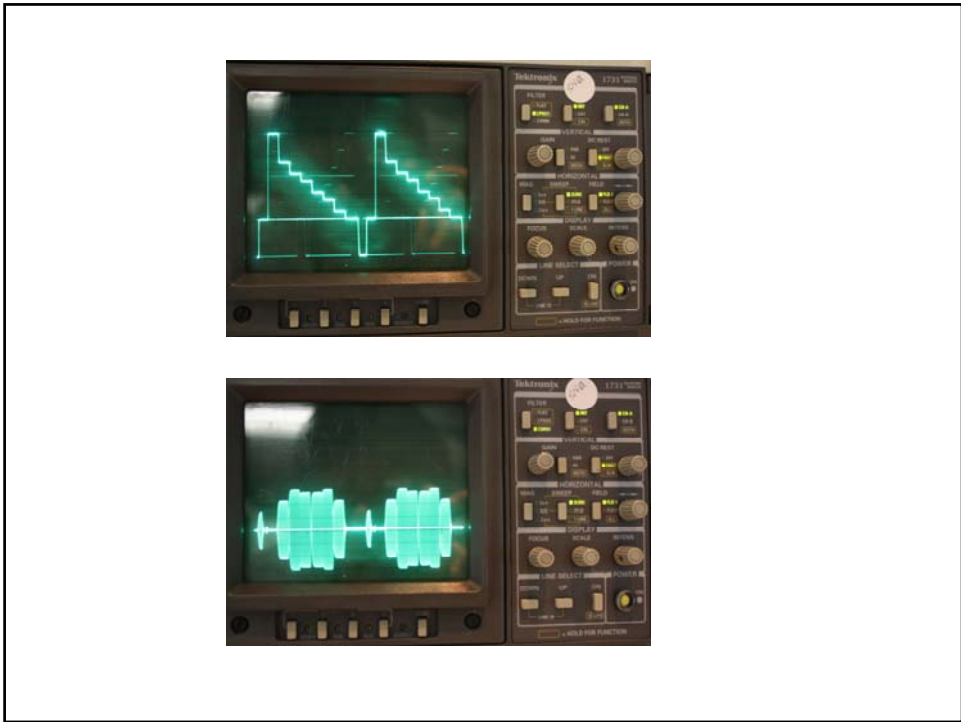
$$f_h \text{ (Horizontal frequency)} = 15,625 \text{ Hz}$$

เรียกวิธีนี้ว่า quarter line offset system

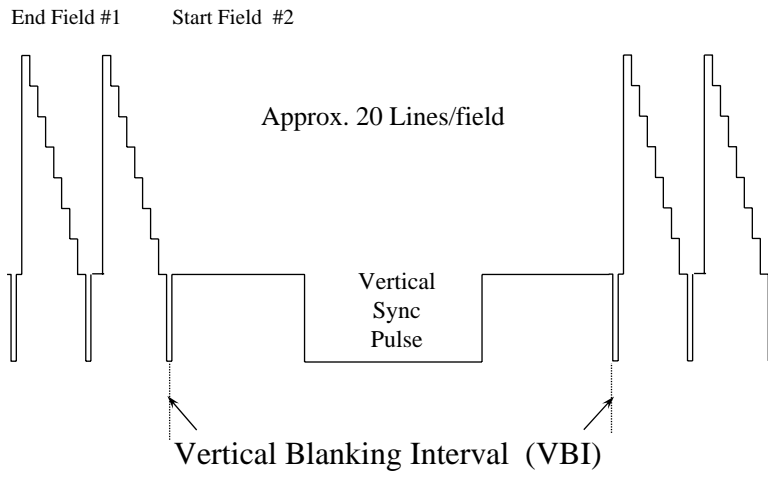
Composite video (CVBS)

- Color
- Video
- Blanking (v. blank, h. blank)
- Sync (v. sync, h. sync)

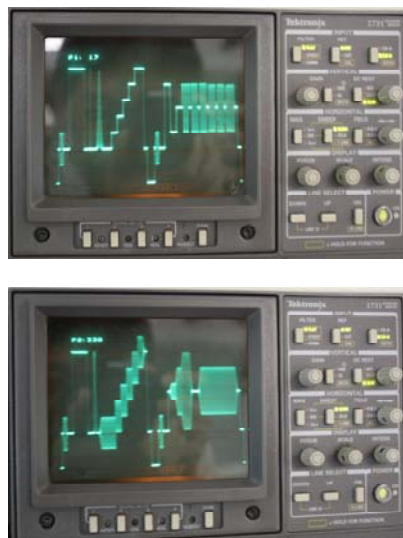




Vertical Interval

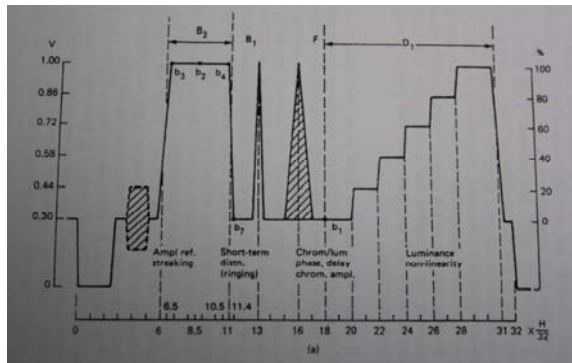


Insertion test signals (ITS)



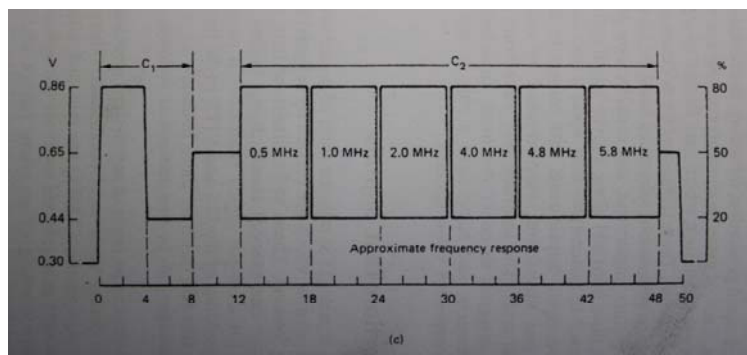
Line 17

- Amplitude ref.
- Chroma/lum phase, delay
- Luminance non-linearity



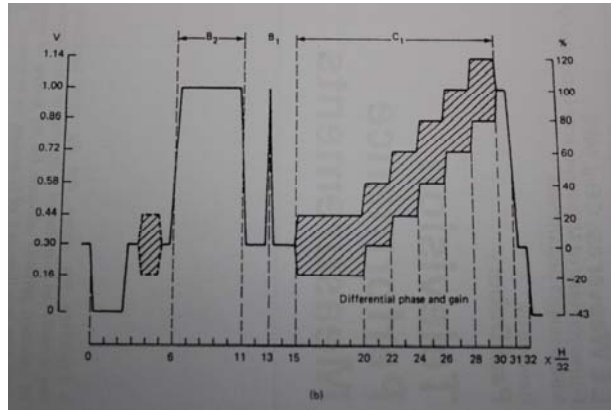
Line 18

- Frequency response



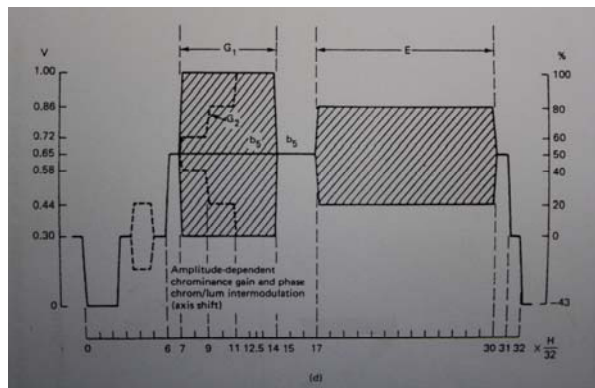
Line 330

- Differential phase and gain



Line 331

- Chrominance gain and phase
- Chrom/lum intermodulation



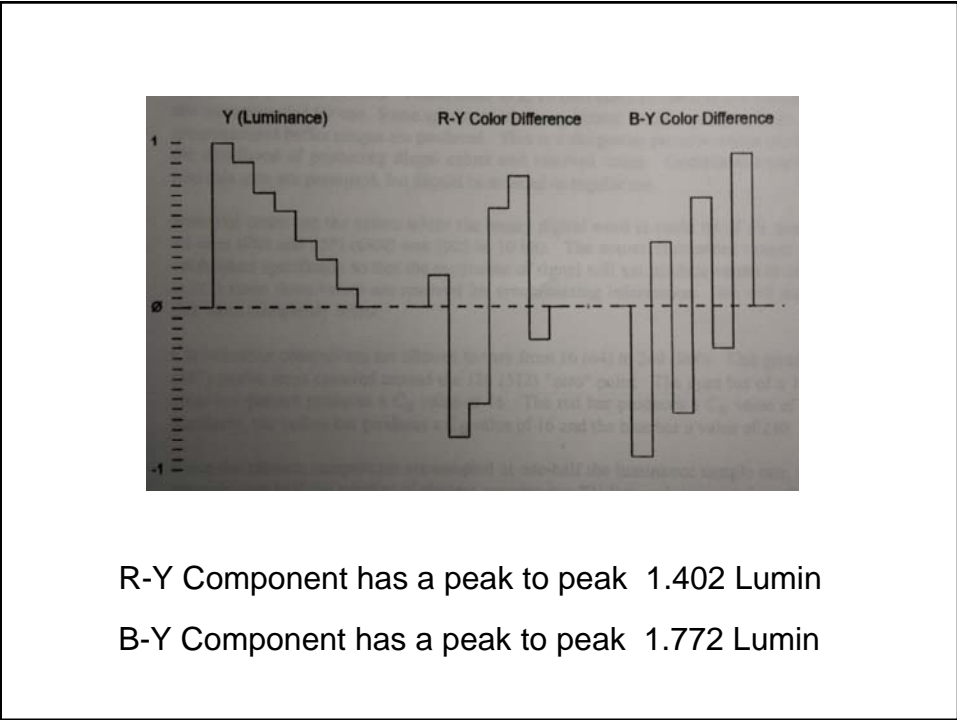
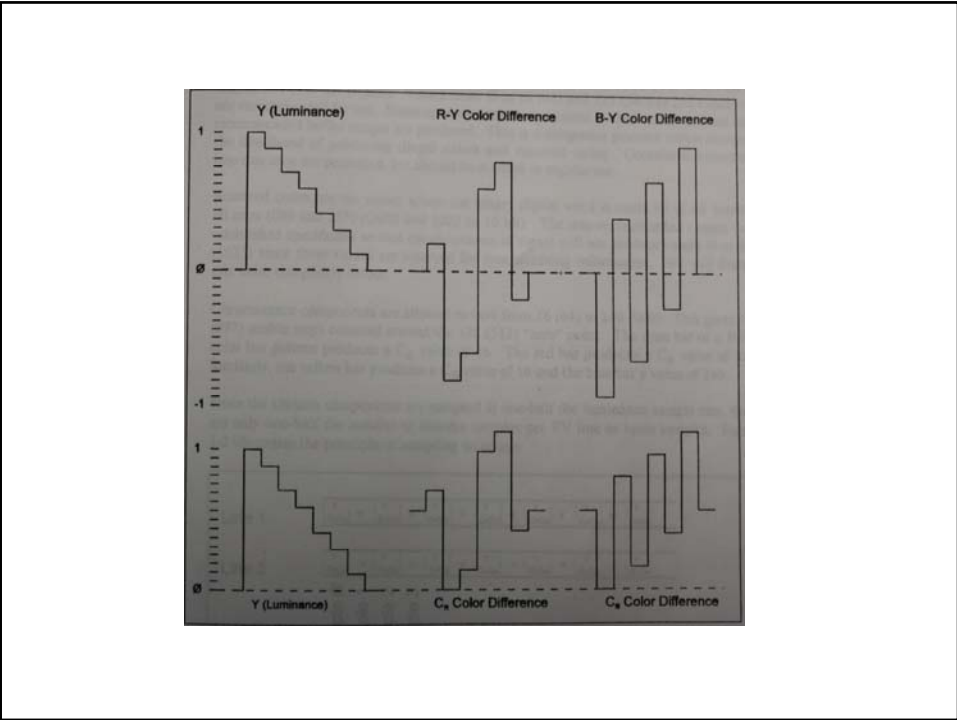
Component Digital Video

4:2:2, 270 Megabits/second (CCIR 601)

50 field, or 25 frames/second	25 f/s
625 lines/frame (576 active+49 V blank)	625 l/f
864 pixels/line (720 active+144 H blank)	864 p/f
2 components/pixel (luminance, chrominance)	2 c/p
10 bit/component	10 b/c
270 million bits per second (270 Mbs)	270,000,000 b/s

Sample Rate

Y (Luminance)	13.5 MHz
Cr (Color Difference)	6.75 MHz
Cb (Color Difference)	6.75 MHz
Quantized 10 bits (1024 levels)	



R-Y Component has a peak to peak 1.402 Lumin

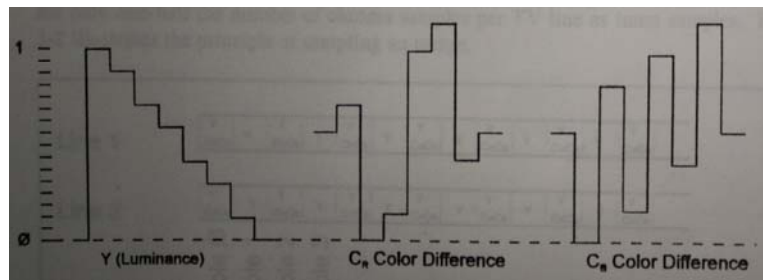
B-Y Component has a peak to peak 1.772 Lumin

Modified R-Y,B-Y Signals before digitization

R-Y multiply by 0.713

B-Y multiply by 0.564

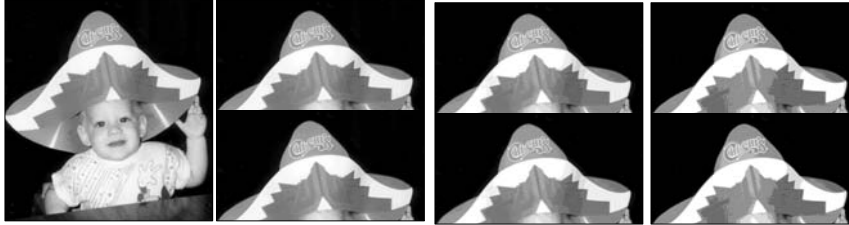
DC offset is zero level



Grayscale Resolution

- B/W line drawing = 1 Bit = 2^1
- 16 levels of gray = 4 Bit = 2^4
- 64 levels of gray = 6 Bit = 2^6
- 128 levels of gray = 7 Bit = 2^7
- 256 levels of gray = 8 Bit = 2^8
- 1024 levels of gray = 10 Bit = 2^{10}
- 4096 levels of gray = 12 Bit = 2^{12}

Effect of Quantizing on Grey Scale



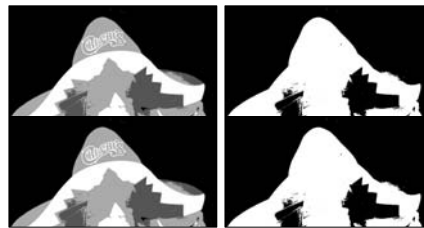
256 Levels of
Grey (8 Bit)

32 Levels of
Grey (5 Bit)

16 Levels of
Grey (4 Bit)

8 Levels of
Grey (3 Bit)

4 Levels of
Grey or B/W
(2 Bit)

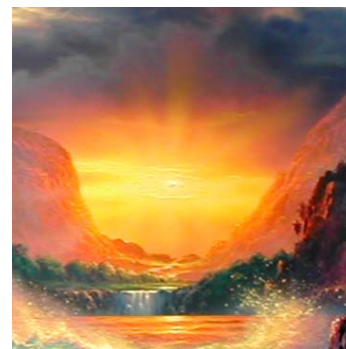


2 Levels of
Grey or B/W
(1 Bit)

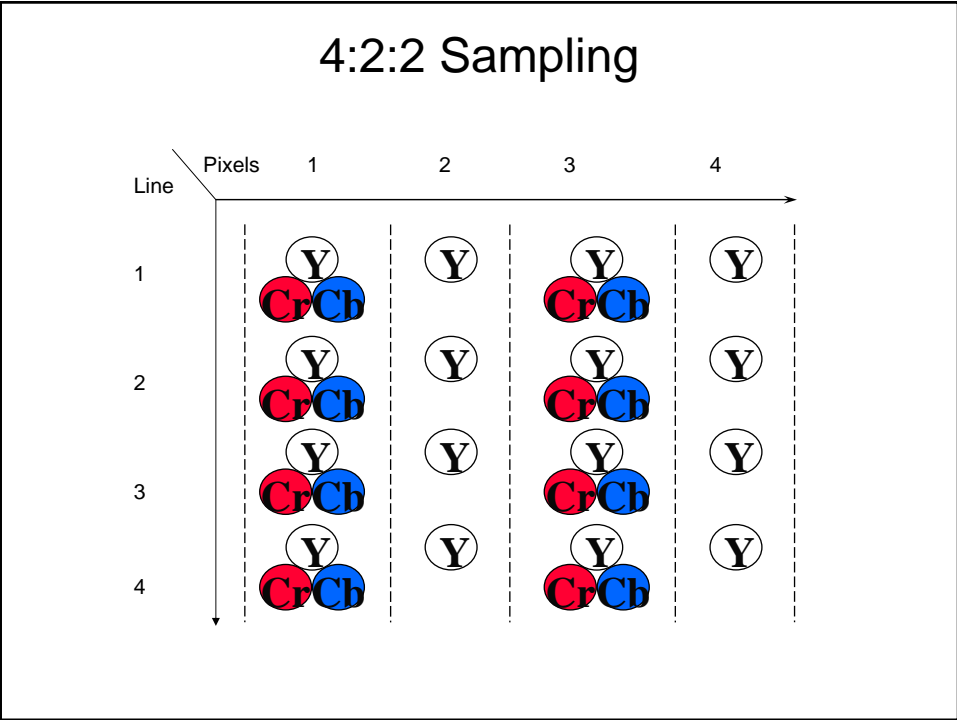
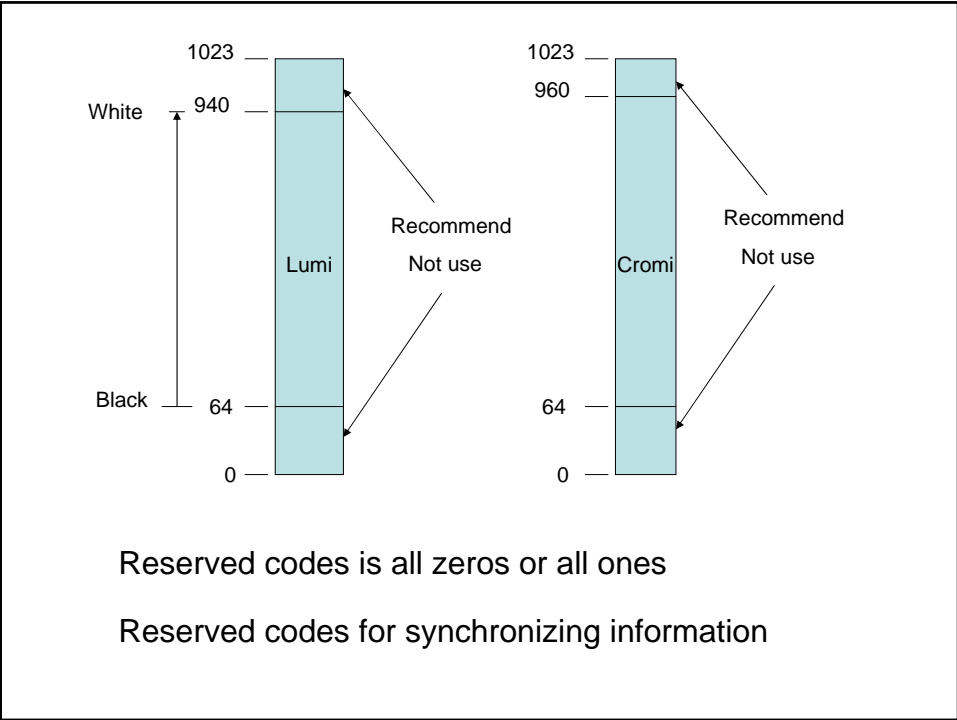
Effect of Quantizing on Color

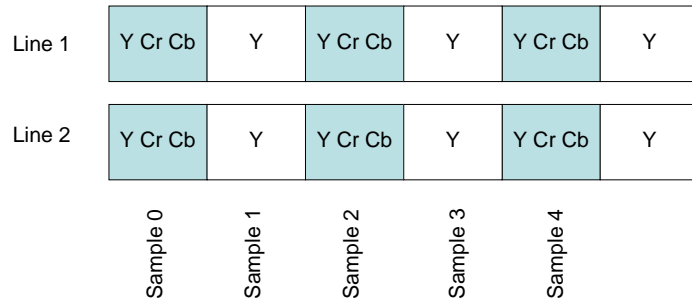


16 Colors (4 bit)



256 Colors (8 bit)





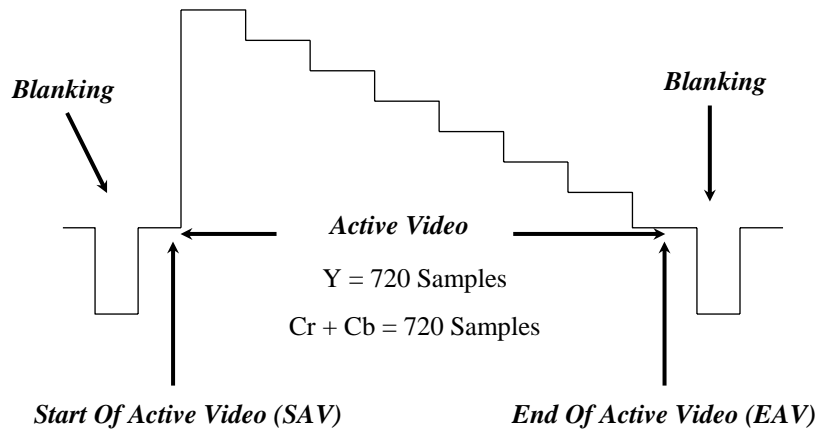
Luminance samples per horizontal line = 864

Active picture contains 720 samples

Chroma samples Cr = 360 , Cb = 360

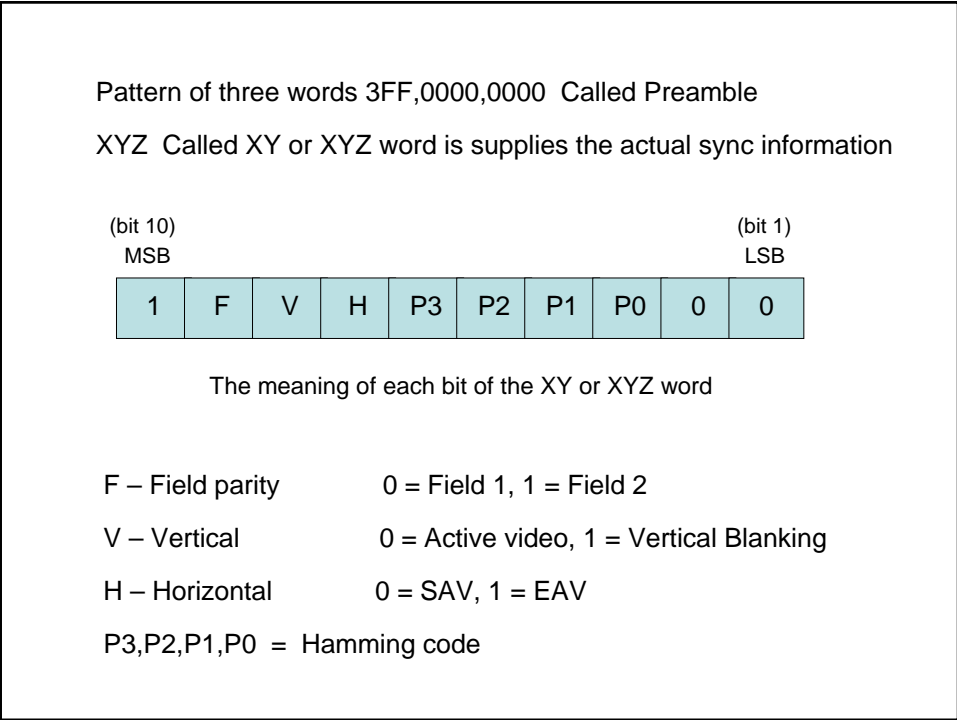
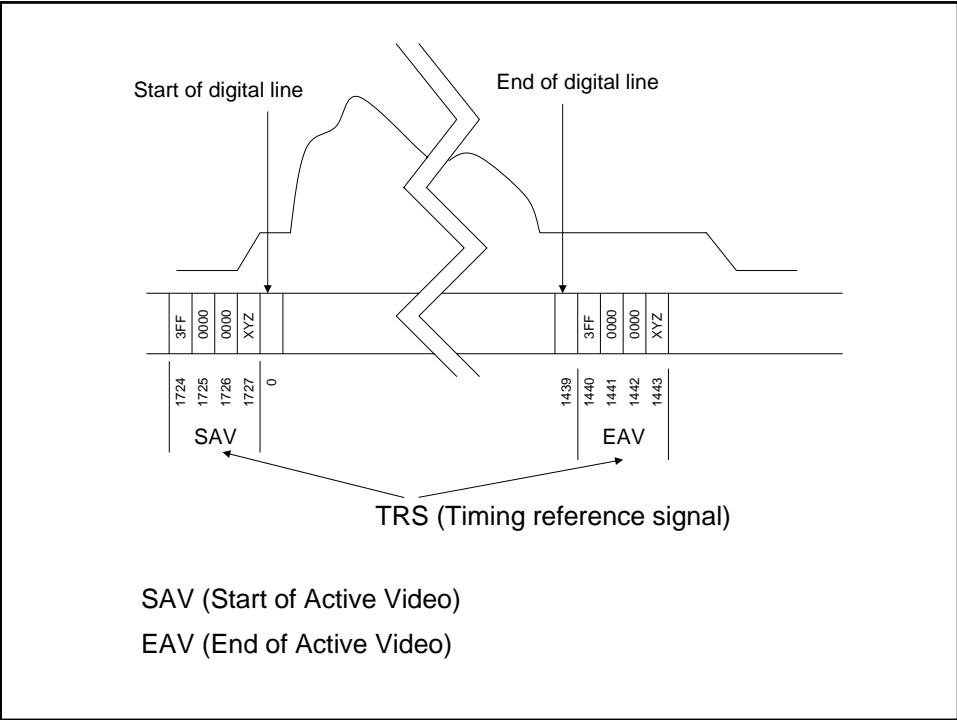
Total = 1440 samples (720 + 360 + 360)

Remainder are taken during the horizontal blanking interval



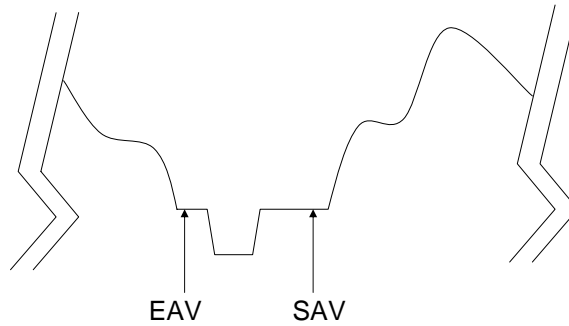
Active Video = 1440 Y/C Samples

Blanking = 288 Y/C Samples



Space between EAV and SAV. Any type of data can be inserted

Into this space and is called ancillary data



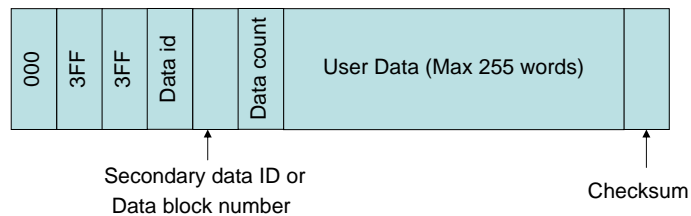
The most common type of ancillary data to be inserted is AES/EBU digital audio

AES – The audio Engineering Society, EBU – European Broadcasting Union

HANC (Horizontal ANCillary data) 176,250 word

VANC (Vertical ANCillary data) 70,560 word

The structure of ancillary data



Data ID – digital audio (one or several channels), timecode

Data block number – sequence of data block

Checksum – protect the integrity of the data

