

# COMPOSITE VIDEO SIGNAL

# COMPOSITE VIDEO SIGNAL

Consist of :

- Camera signal - corresponding to the desired picture information
- Blanking pulses – to make the retrace invisible
- Synchronizing pulses – to synchronize the transmitter and receiver scanning
  - horizontal sync pulse
  - vertical sync pulse
  - their amplitudes are kept same
  - but their duration are different
  - needed consecutively and not simultaneously with the picture signal – so sent on a time division basis

# Composite Video Signal

...contd

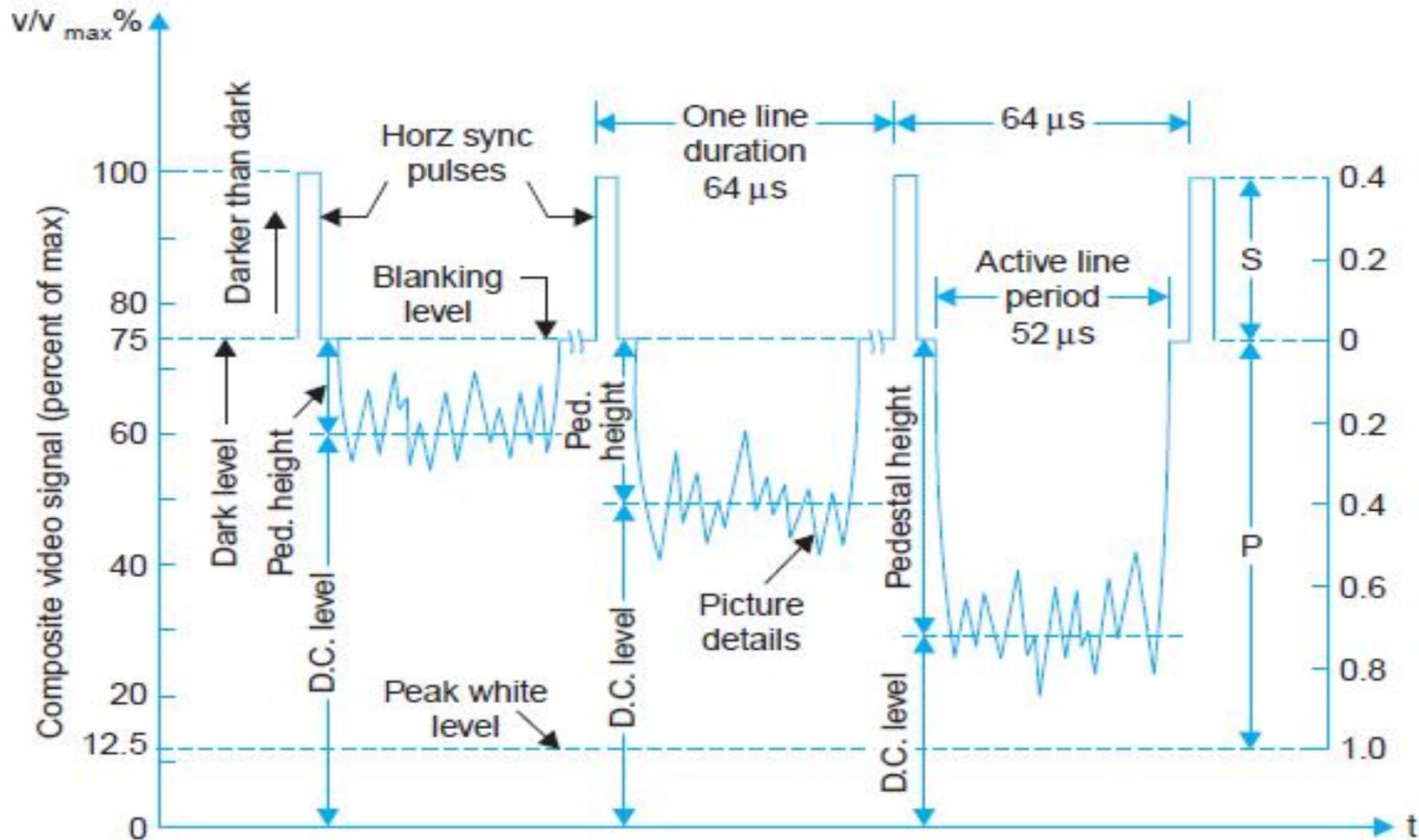


Fig. 3.1 Arbitrary picture signal details of three scanning lines with different average brightness levels. Note that picture to sync ratio  $P/S = 10/4$ .

# Composite video signal

...contd

Video signal varies between certain limits

Peak white level: 10 to 12.5%

Black level : 72%

Blanking level : Sync pulses added - 75% level

Pedestal : difference between black level and blanking level – tend to merge

Pedestal height : distance between the pedestal level and the dc level – indicates the average brightness

Picture information : 10% - 75%

Darker the picture – higher will be the voltage within those limits

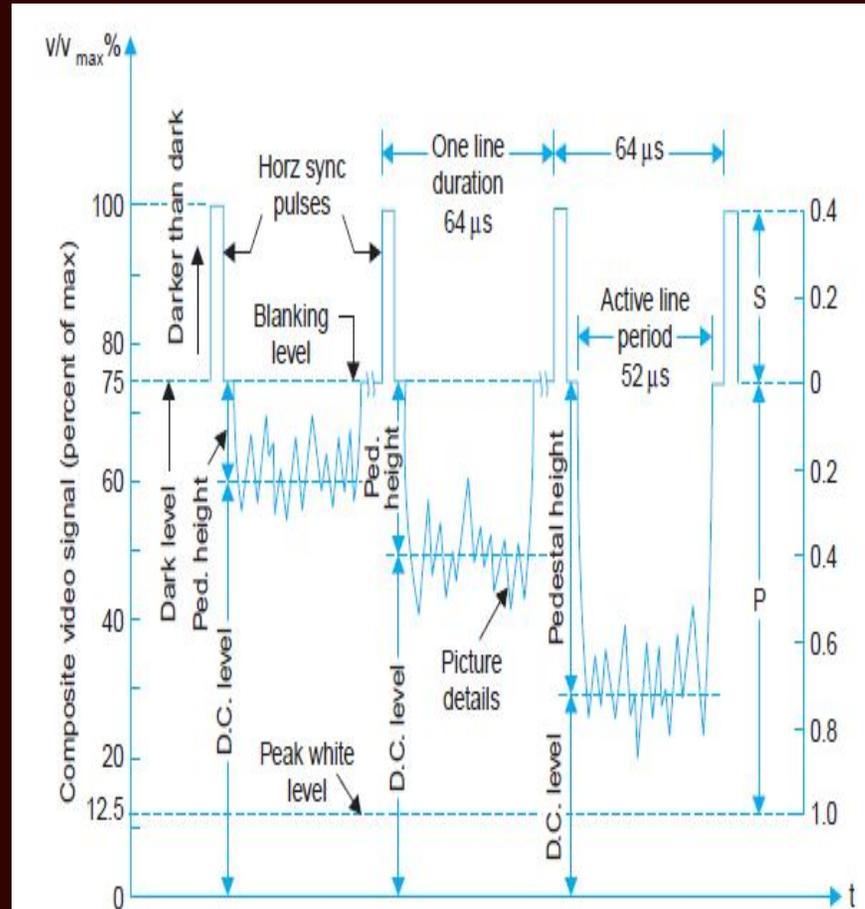


Fig. 3.1 Arbitrary picture signal details of three scanning lines with different average brightness levels. Note that picture to sync ratio  $P/S = 10/4$ .

# DC component of the video signal

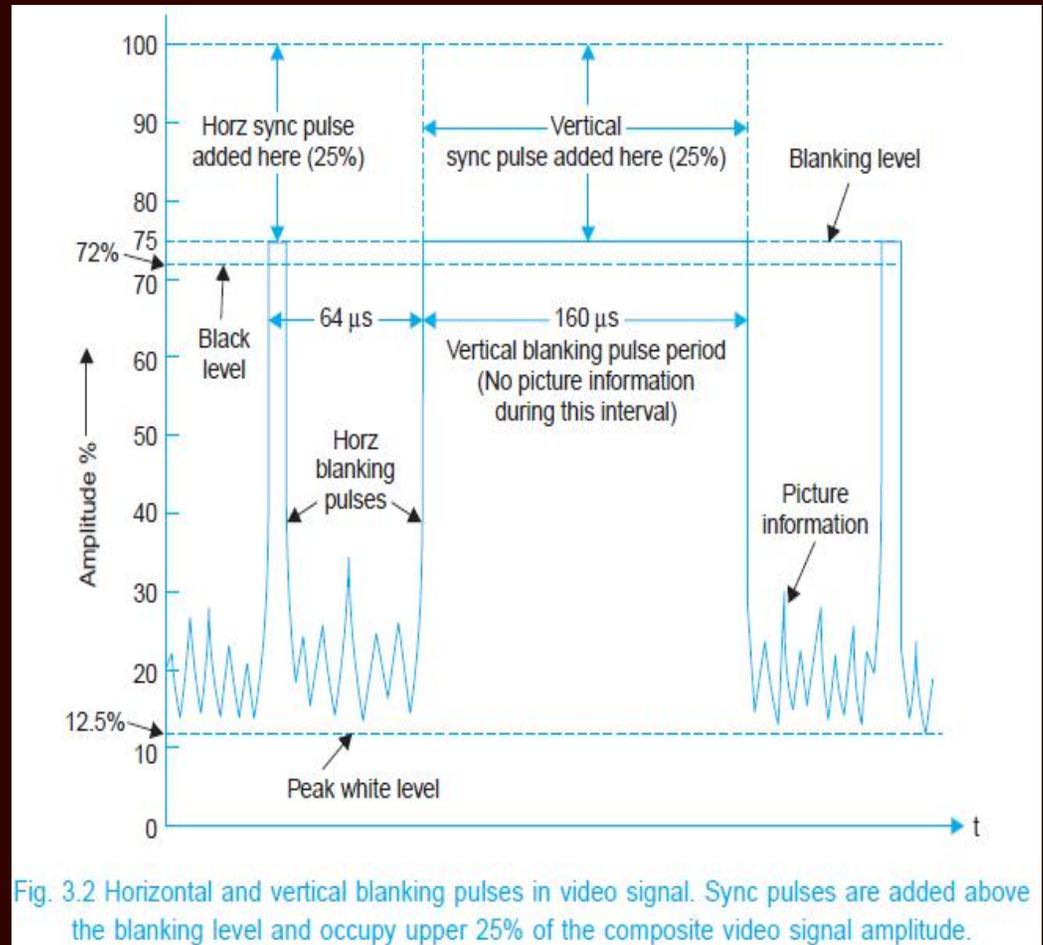
- Average value or dc component corresponding to the average brightness of the scene
- Average brightness can change only from frame to frame and not from line to line
- Low pedestal height – scene darker
- Larger pedestal height – higher average brightness

# blanking pulses . . .

Make the retrace lines invisible by raising the signal amplitude slightly above the black level (75%)

Repetition rate of horizontal blanking pulse = scanning freq. = 15625Hz

Freq of vertical blanking pulse = field scanning freq. = 50 Hz



# Sync Pulse and Video Signal Amplitude Ratio

$$\underline{P/S \text{ RATIO} = 10/4}$$

## *Justification:*

- If the picture signal amplitude is  $\uparrow$  at the expense of sync pulses – when S/N ratio at the receiver falls, sync pulse amplitude becomes insufficient to keep the picture locked
- If the sync pulse amplitude is  $\uparrow$  at the expense of the picture signal, then the raster remains locked but the amplitude of the picture content will be too low
- P/S ratio of 10/4 represents the most efficient use of TV system

# horizontal Sync details . . .

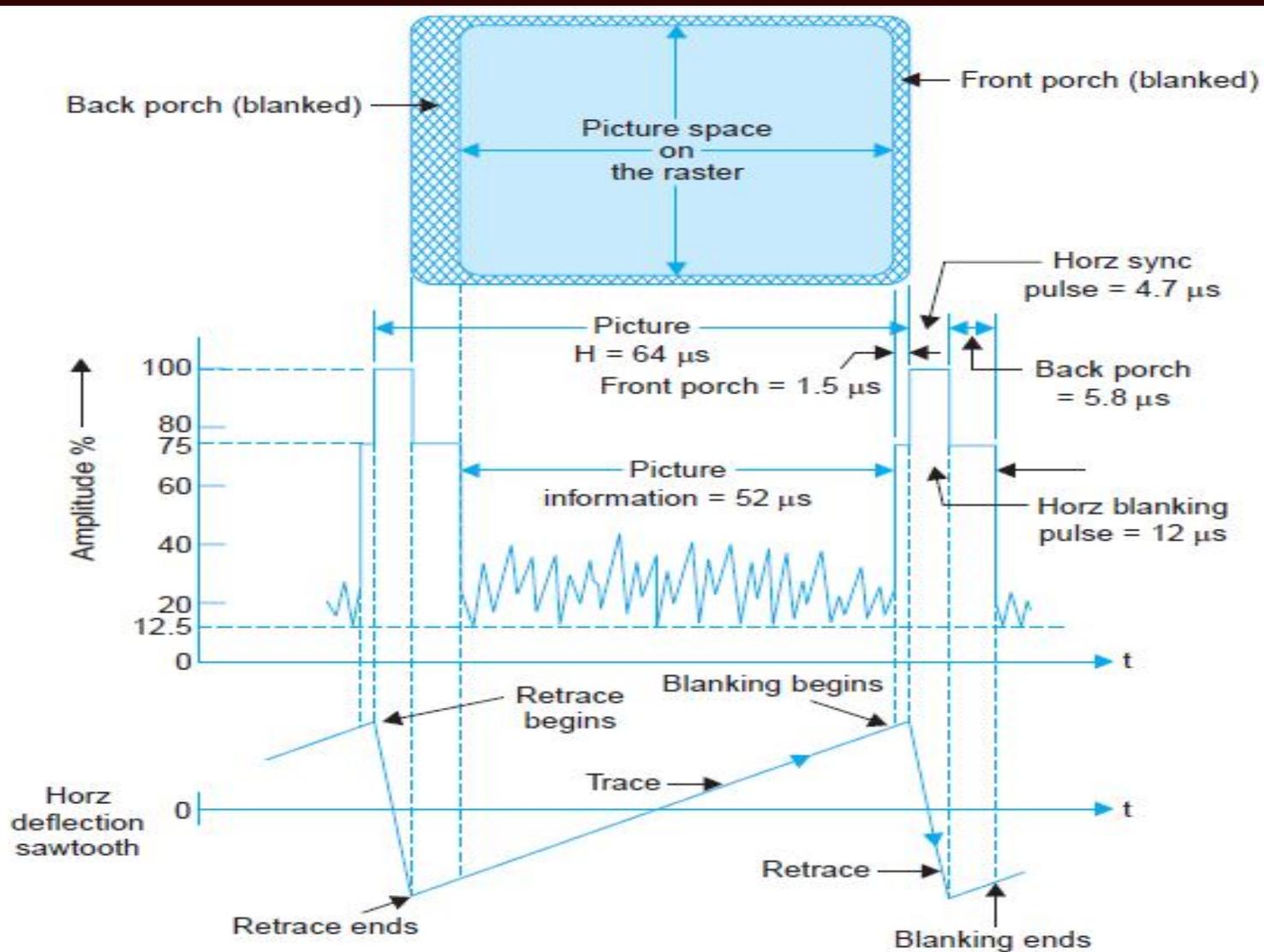


Fig. 3.3 Horz line and sync details compared to horizontal deflection sawtooth and picture space on the raster.

# horizontal sync details

...contd

- Total line period =  $64\mu\text{S}$
- Line blanking period =  $12\mu\text{S}$
- Differential leading edges are used for synchronizing horizontal scanning oscillator

- *Divided into three sections :*

*front porch*:  $1.5\mu\text{S}$  - allows the receiver video to settle down

*line sync* :  $4.7\mu\text{S}$  - for blanking the flyback/retrace  
- blacker than the black

*back porch*:  $5.8\mu\text{S}$  - time for the horizontal time base circuit to reverse the direction of current for scanning the next line  
- same amplitude as that of blanking level ; used by AGC circuits at the receiver to develop true AGC voltage

# Vertical Sync details

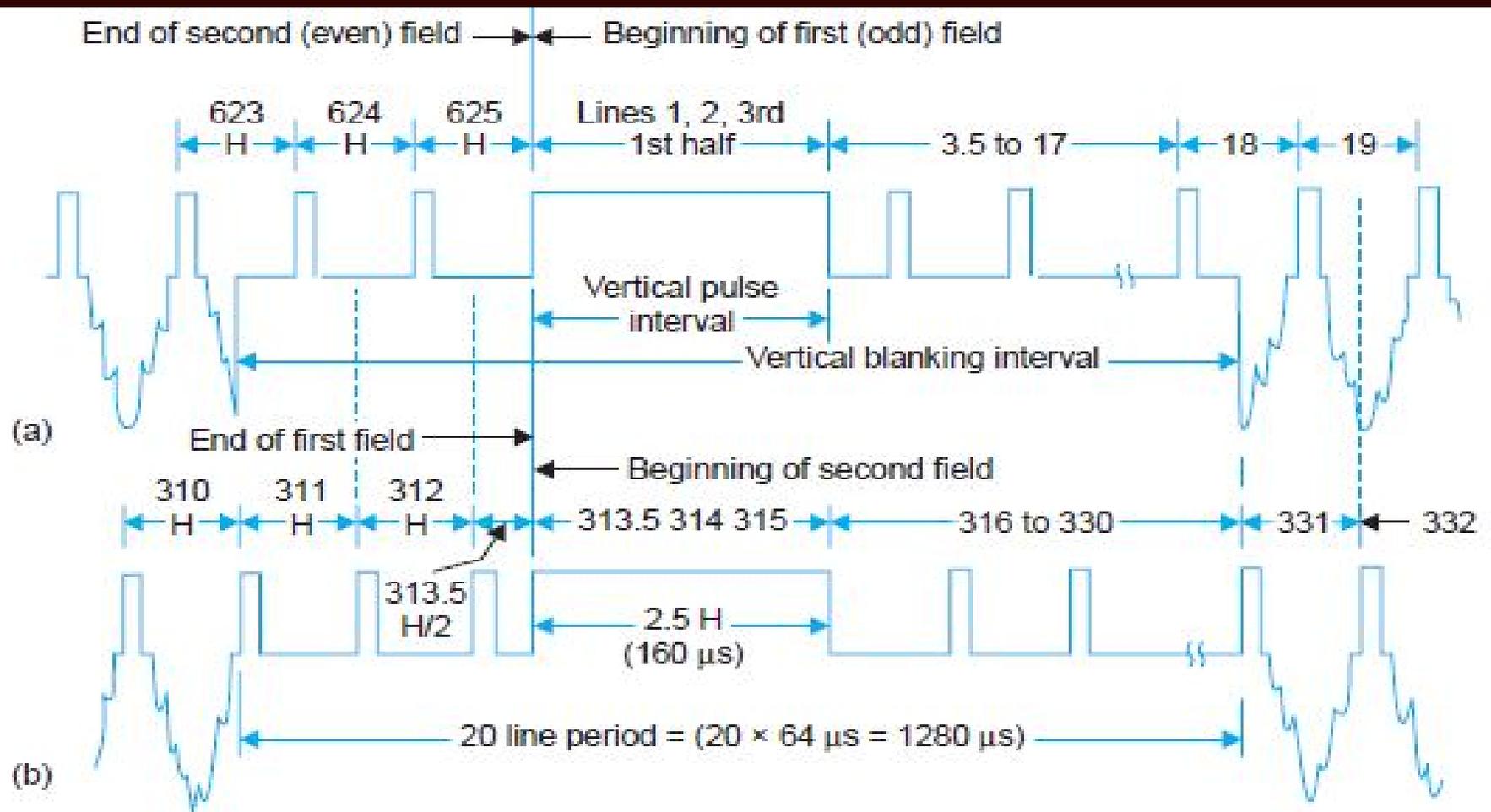


Fig. 3.4 Composite video waveforms showing horizontal and basic vertical sync pulses at the end of (a) second (even) field, (b) first (odd) field. Note, the widths of horizontal blanking intervals and sync pulses are exaggerated.

# Vertical Sync details

...contd.

- Added after each fields
- Complex in nature
- Vertical sync period = 2.5 to 3 times the horizontal line period
- In 625 line system:  $2.5 \times 64 = 160\mu\text{S}$
- Commence at the end of first half of 313<sup>th</sup> line (end of first field) and terminates at the end of 315<sup>th</sup> line
- Similarly after an exact interval of 20mS (one field period), the next sync pulse occupies the line numbers 1<sup>st</sup>, 2<sup>nd</sup> and first half of 3<sup>rd</sup> .

# Vertical sync details

...contd

- Horizontal sync information is extracted from the sync pulse train by differentiation i.e. Passing the pulse train through an HPF – leading edges are used to synchronize the horizontal scanning oscillator
- Furthermore, receivers often use monostable multivibrators to generate horizontal scan, and so a pulse is required to initiate each and every cycle of the horizontal oscillator in the receiver.

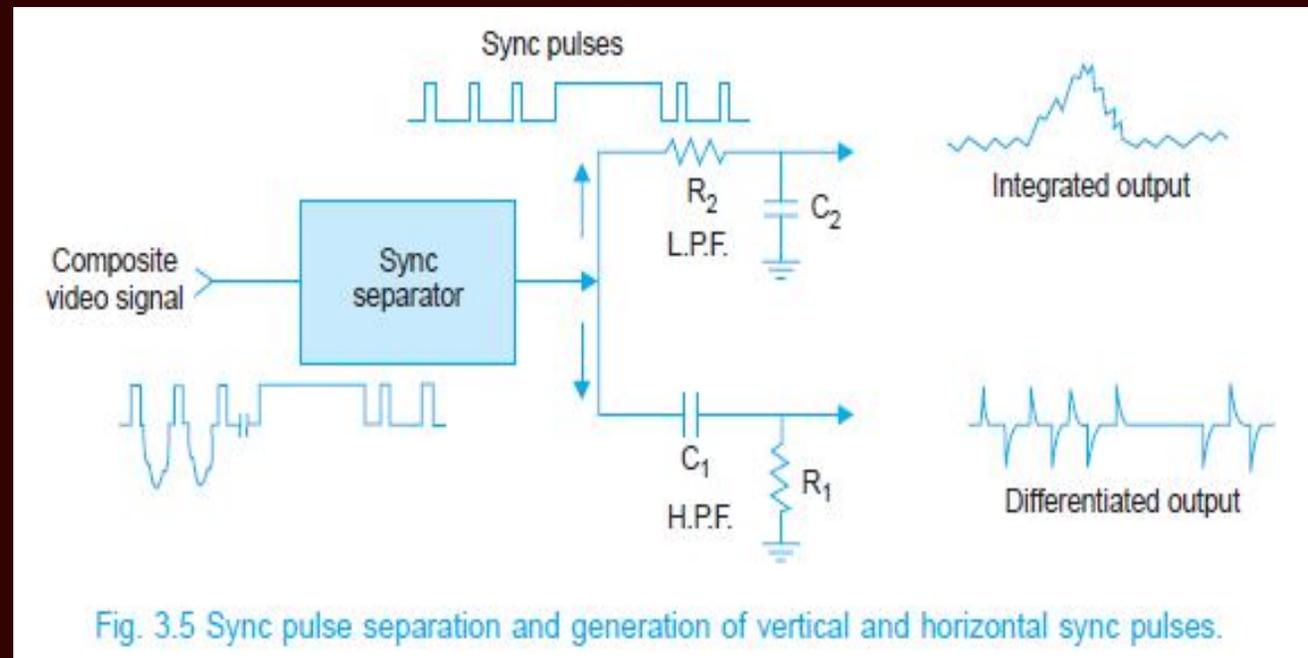


Fig. 3.5 Sync pulse separation and generation of vertical and horizontal sync pulses.

# *Shortcomings and its solution*

1. Horizontal sync pulses are available both during the active and blanked line periods but there are no sync pulses (leading edges) available during the 2.5 line vertical sync period – horizontal sweep oscillator would tend to step out of synchronism during each vertical sync period
  - The situation after an odd field is even worse
    - since it begins at midway
    - leading edge of the vertical sync pulse comes at the wrong time to provide synchronism for the horizontal oscillator
  - Therefore five narrow slots ( $4.7\mu\text{s}$  width) are cut in the vertical sync pulse at intervals of  $32\mu\text{s}$  – rising edges are used to trigger horizontal oscillator.
  - This insertion of short pulses : called notching or serration of the broad field pulses

# Shortcomings and its solution . . . . contd

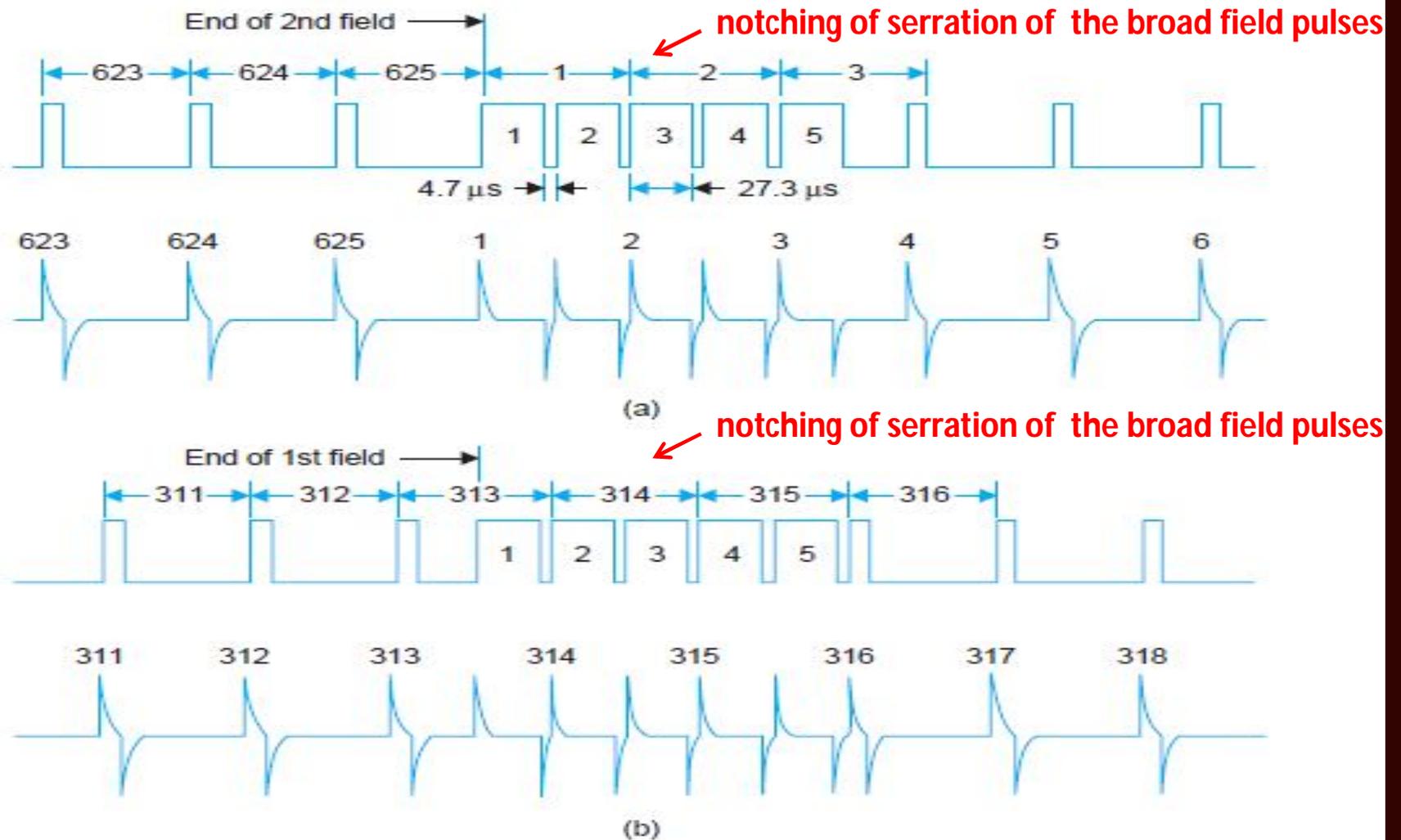


Fig. 3.6 Differentiating waveforms (a) pulses at the end of even (2nd) field and the corresponding output of the differentiator (H.P.F.) (b) pulses at the end of odd (1st) field and the corresponding output of the differentiator (H.P.F.) Note, the differentiated pulses bearing line numbers are the only ones needed at the end of each field.

# Shortcomings and its solution . . . . contd

2. It is seen that the synchronization of the vertical sweep oscillator in the receiver is obtained from vertical sync pulses by integrator (LPF)
- Voltage built across the capacitor of the LPF corresponding to the sync pulse trains of both the fields is shown in fig.

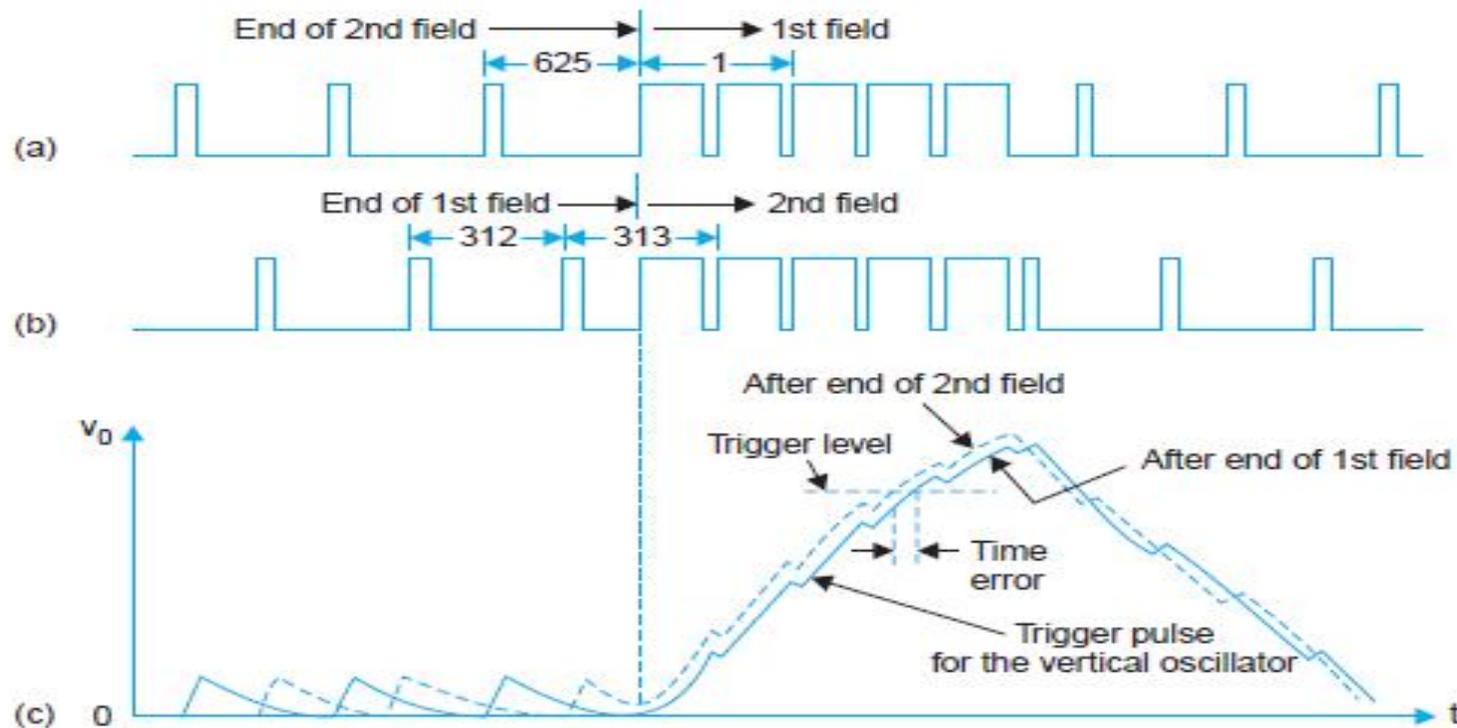


Fig. 3.7 Integrating waveforms (a) pulses at the end of 2nd (even) field (b) pulses at the end of 1st (odd) field (c) integrator output. Note the above sync pulses have purposely been drawn without equalizing pulses.

## *Shortcomings and its solution . . . . contd*

- Each horizontal pulse cause a slight rise in voltage across the capacitor, but this is reduced to zero by the time the next pulse arrives (charging period= $4.7\mu\text{S}$  and discharging period =  $59.3\mu\text{S}$ )
- But during broad serrated region, capacitor has more time to charge and only  $4.7\mu\text{S}$  to discharge
- Situation is different for the beginning of the 2<sup>nd</sup> field-here the last horizontal pulse corresponding to the beginning of the 313<sup>th</sup> line is separated from the first vertical pulse by only half-a-line.
- Therefore the voltage developed a/c the vertical filter will not have enough time to reach zero before the arrival of the 1<sup>st</sup> vertical pulse
- Hence the voltage developed a/c the o/p filter is some what higher at each instant as compared to the voltage developed at the beginning of the 1<sup>st</sup> field (shown as dotted chain)
- i.e. Oscillator get triggered a fraction of a second early as compared to the first field - upset the desired interlacing sequence
- Equalizing pulses are used to solve this problem

# Equalizing pulses

- Solves the shortcomings occurring on account of half line discrepancy
- Five narrow pulses of 2.5 line period are added on either side of the vertical sync pulses : known as pre-equalizing and post-equalizing pulses
- The effect of these pulses is to shift the half line discrepancy away from both the beginning and end of the vertical sync pulses

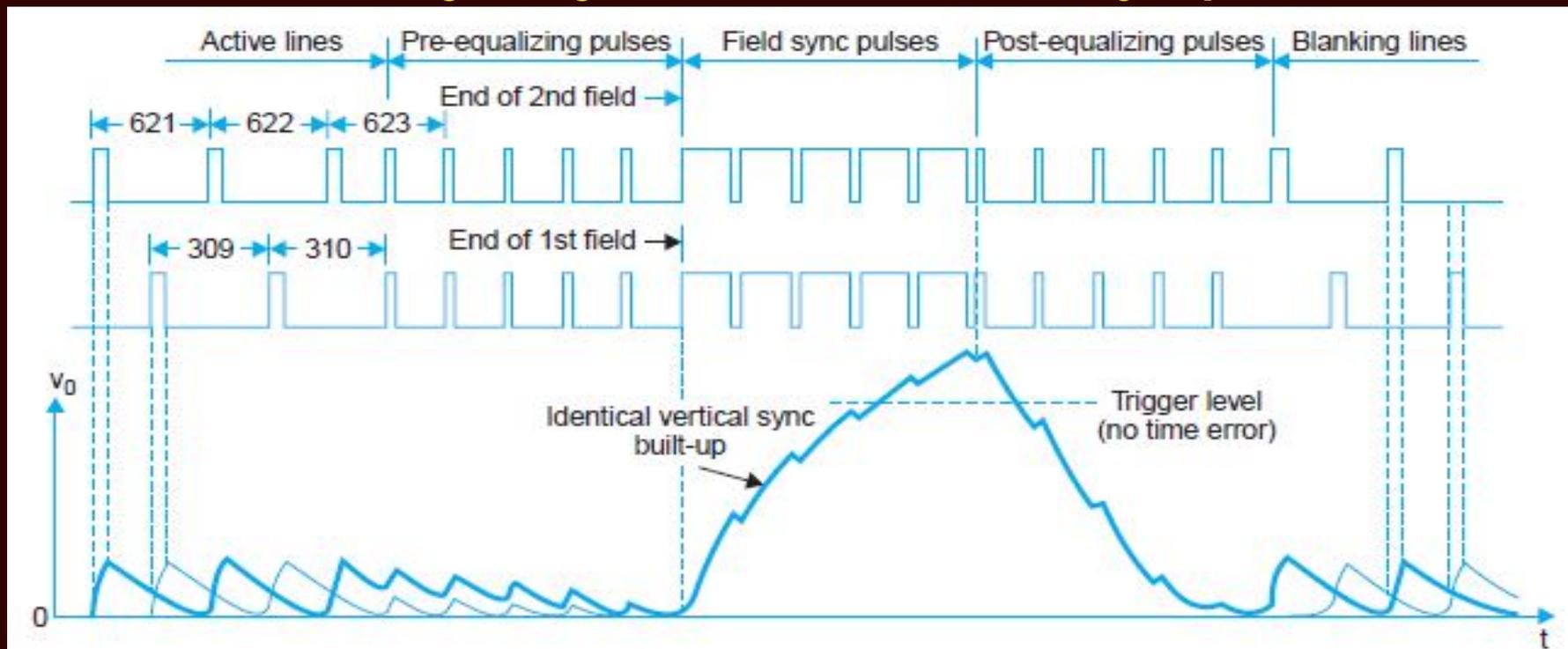


Fig. 3.9 Identical vertical sync voltage built-up across the integrating capacitor.

# Equalizing pulses

... contd

- Pre-equalizing pulses:
  - 2.3 $\mu$ S duration
  - result in the discharge of the capacitor to zero voltage in both the fields
- Post-equalizing pulses: necessary for a fast discharge of the capacitor to ensure triggering of the vertical oscillator at proper time
- With the insertion of equalizing pulses:
  - the voltage rise and fall profile is the same for both the field sequences
  - the vertical oscillator is triggered at the proper instants. i.e. exactly at an interval of 1/50<sup>th</sup> of a second.