CCITT SG XV
Specialists Group on Coding for
Visual Telephony

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Title: A Block Structure for the Common Intermediate Format

1. Introduction

The defined common intermediate format (CIF) and the chosen block size of 8 x 8 pels at the Tokyo meeting on March 1986 yields a non-integer number of blocks for the two colour difference signals in the horizontal direction (Fig. 1).

Y: 360 pels/line, 45.0 blocks in horizontal direction
R-Y, B-Y: 180 pels/line, 22.5 blocks in horizontal direction

In the vertical direction the number of blocks is 36 and 18 for the luminance and the colour difference signals, resp.

To get an integer number of blocks for R-Y and B-Y, the CIF has to be modified slightly. In the following various approaches are discussed.

2. Generation of an Integer Number of Blocks

A) Use 22 blocks (176 pels), omit the last 4 pels of the colour components.
Use 45 luminance blocks (360 pels), the last 8 luminance pels are not associated with colour (Fig. 2)

B) Use 22 blocks (176 pels) for the colour components
Use 44 luminance blocks (352 pels) (Fig. 3)

As a consequence, 8 luminance pels and 4 pels of the colour components have to be omitted:

either - at the end of a line
- at the beginning of a line
- half at the beginning and half at the end of a line.

C) Use 23 blocks (184 pels) for the colour components
Use 45 luminance blocks (360 pels)
4 additional pels for the colour components have to be inserted (Fig. 4)

3. Discussion

Solution A:

Omission of colour information results in a non-coloured band at the right hand side of the screen.

Solution B:

Omission of 8 luminance pels and 4 pels for the colour components restricts the active line duration. The consequences have to be considered with respect to the different TV-standards defined in CCIR Rep. 624-2 and Rec. 472-1 for colour TV-signals (Fig. 5).

625/50-systems (PAL, SECAM):

line duration: 64 µs
line blanking interval: $(12 \pm 0.3)\mu s = a$
front porch $(1.5 \pm 0.3)\mu s = c$

Thus, the duration T of the active line becomes

$51.7\ \mu s \leq T \leq 52.3\ \mu s$

and for b in Fig. 5 we get

$9.9\ \mu s \leq b \leq 11.1\ \mu s$

525/60-systems (NTSC):

line duration: 63.5555 µs
front porch $1.27\ \mu s \leq c \leq 2.22\ \mu s$
and $9.2\ \mu s \leq b \leq 10.3\ \mu s$

Thus the duration T of active line becomes:

In Figs. 6a, b the line is divided into b, T, and c for the 625/50 and 525/60-standard, resp. Taking timing tolerances into account four cases have to be considered.

In the last rows of Figs. 6a, b the partition according to CCIR Doc. 11/1041-E (Draft Rec. 601, Mod. F Dec. 1985) is depicted.

Obviously, 360 pels per active line can handle all tolerances. If only 352 pels are used a small part of the picture, 8/360~ 2%, is discarded. The dropped pels should be shared between the start and the end of the active line.
It should be noted, that for a nominal value of the active line, 52 µs for PAL/SECAM, only 351 active pels are required. For NTSC-systems, the nominal active line duration is (63.5555-10.9) µs ~ 52.7 µs, which corresponds to 355 active pels. Thus, omitting 8 pels from 360 pels normaly has a negligible effect on the picture.

Solution C:

The additional 4 pels for the colour components have to be chosen such, that the number of effective DCT-coefficients of the 23 rd chrominance block is not enhanced. Possibly an even continuation in the pel domain can be chosen. The definition of these additional pels is not a matter of standardization.

Proposal

Solution B) is proposed. In Fig. 7, the number of pels for the luminance signal is depicted, both for 625/50 and 525/60-systems. The respective numbers of colour difference samples is half that one. Pels denoted by X are associated to black level. With this solution the number of blocks in the horizontal (and vertical) direction is even. This may have advantages if subsampling by factor 2 is used, e.g. for codecs with 64 kbit/s.

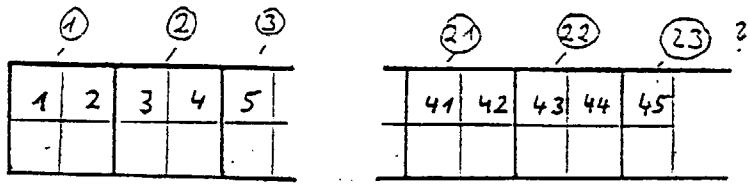


Fig. 1: luminance/chrominance blocks

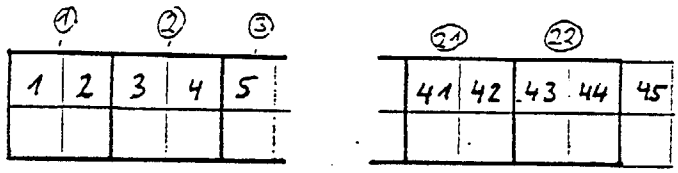


Fig.2: 22 chrm. / 44 lum. blocks

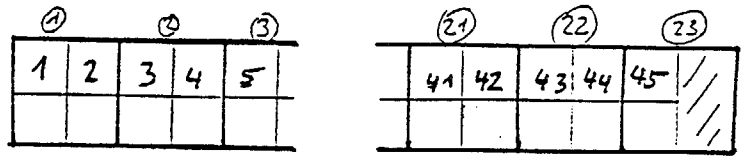


Fig.3: 22 chrom. / 45 lum. blocks

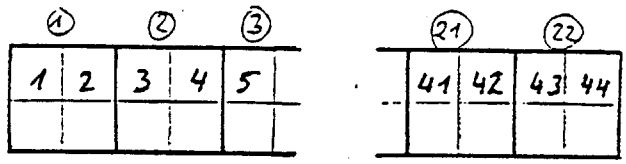
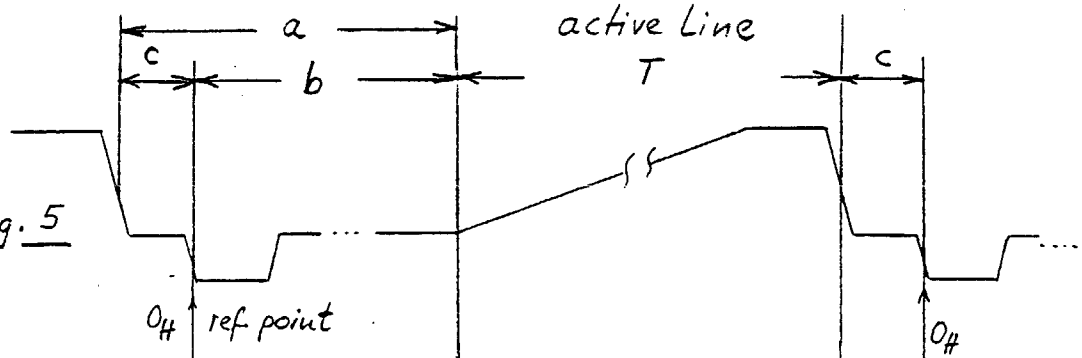


Fig.4: 23 chrom. / 45 lum. blocks

1,2,... are lum. blocks

①, ② .. chrom. blocks

Fig. 5



0_H ref. point 0_H

Fig. 6a

625/50

11.1 µs / 75	51.7 µs / 349	1.2 µs / 8	due to tolerances
10.5 µs / 71	51.7 µs / 349	1.8 µs / 12	
10.5 µs / 71	52.3 µs / 353	1.2 µs / 8	
9.9 µs / 67	52.3 µs / 353	1.8 µs / 12	
66	360	6	accord. to CCIR 601

64 µs / 432

--µs/75 means 75 pels at 6.75 MHz sampling rate

Fig. 6b

525/60

9.2 µs / 62	53.0855 µs / 358	1.27 µs / 9	due to tolerances
9.2 µs / 62	52.1355 µs / 352	2.22 µs / 15	
10.3 µs / 69	51.9855 µs / 351	1.27 µs / 9	
10.3 µs / 69	51.0355 µs / 345	2.22 µs / 15	
61	360	8	accord. to CCIR 601

63.5555 µs / 429

Fig. 7