

## RECOMMENDATION ITU-R BT.814-2

**Specifications and alignment procedures for setting  
of brightness and contrast of displays**

(Question ITU-R 211/11)

(1992-1994-2007)

**Scope**

This Recommendation defines a test signal for the adjustment of Cathode Ray Tubes (CRTs) and Flat Panel Display (FPD) devices. The signal may be used to set displayed image values for both standard definition television and high definition television.

The ITU Radiocommunication Assembly,

*considering*

- a) that precision CRT picture monitors or FPDs are used in a variety of applications including subjective laboratory testing and control room monitoring of operational systems;
- b) variations in the set-up and adjustment of displays may lead to variations in displayed pictures;
- c) that special waveforms that assist with the set-up and adjustment of monitors have been developed and have been in operational use for many years,

*recommends*

**1** that the PLUGE test signal (see Note 1) described in Annex 1 should be used for setting of displays used for subjective assessments, and for operational monitoring of systems described in Recommendations ITU-R BT.1700<sup>1</sup>, ITU-R BT.601<sup>2</sup>, ITU-R BT.709<sup>3</sup>, and ITU-R BT.1358<sup>4</sup>. The procedure for the use of the test signal is described in Annex 2.

NOTE 1 – The acronym, PLUGE, was originally derived from “Picture Line Up Generating Equipment”.

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<sup>1</sup> Recommendation ITU-R BT.1700 – Characteristics of composite video signals for conventional analogue television systems.

<sup>2</sup> Recommendation ITU-R BT.601 – Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios.

<sup>3</sup> Recommendation ITU-R BT.709 – Parameter values for the HDTV standards for production and international programme exchange.

<sup>4</sup> Recommendation ITU-R BT.1358 – Studio parameters of 625- and 525-line progressive scan television systems.

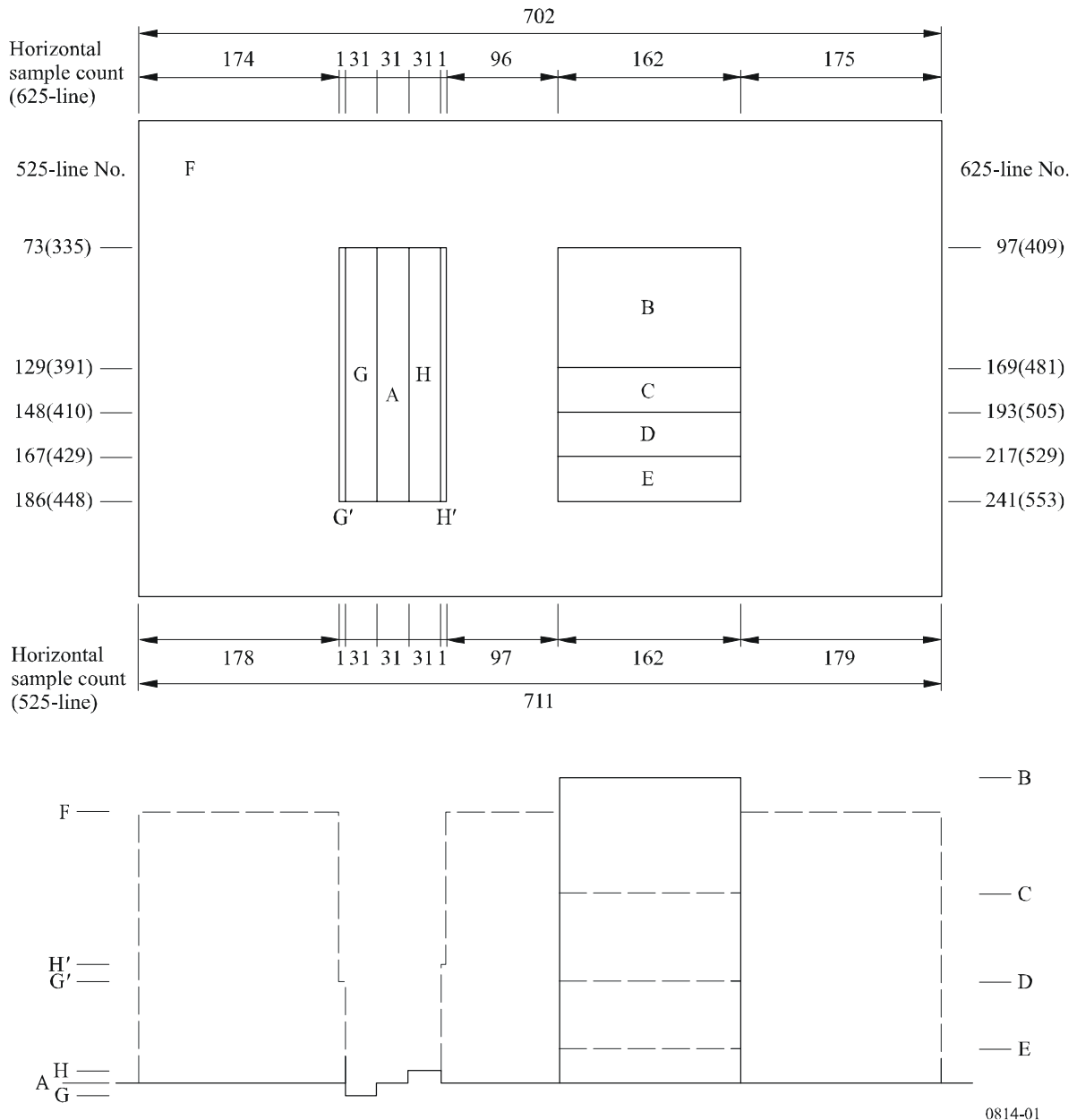
## Annex 1

### Specifications of PLUGE waveforms

The PLUGE waveform (see Fig. 1) is composed of:

- a) three closely spaced narrow vertical stripes on the left-hand side of the picture. The central vertical stripe is at waveform black level. The left-hand stripe is slightly darker, and the right-hand stripe is slightly lighter than the central stripe;
- b) a broad bar signal located on the right-hand side of the picture. It is divided into four areas, one at white level and the other three at descending grey levels. This grey scale is in approximately equal steps, as seen by eye, over a contrast range of 30:1. The peak white area is sufficiently large to enable the peak luminance to be set by a measuring instrument;
- c) a uniform background surrounding the vertical stripes and the broad bar described above. Two different levels for this background are specified according to the application:
  - for operational monitoring the background level is set to waveform black level;
  - for subjective assessments the background level is set to the grey level shown in Table 1. This background level has been optimized to give a picture display of subjective quality similar to that used in sequences used in subjective assessment.

FIGURE 1  
PLUGE active field and waveform



To take account of the characteristics of the human eye, the luminance specified for the vertical stripes described in c) is slightly different for the two applications (see Table 1).

To ensure that in analogue composite systems the colour decoder of a display is working in its colour mode, it is recommended that a standard colour burst is included in the analogue waveform.

The horizontal sample count is less than the 720 horizontal samples defined in Recommendation ITU-R BT.601. The PLUGE signal should be centred within the active line of digital and analogue systems  $\pm 2$  samples.

TABLE 1  
Levels of waveform

	Operational monitoring			Subjective assessment monitoring		
	Level		% mV digital	Level		% mV digital
	625-line	525-line		625-line	525-line	
A black level	0% 0 mV (16)64	0% 0 mV (16)64	7.5% 54 mV (16)64	0% 0 mV (16)64	0% 0 mV (16)64	7.5% 54 mV (16)64
B white level	100% 700 mV (235)940	100% 714 mV (235)940	100% 714 mV (235)940	100% 700 mV (235)940	100% 714 mV (235)940	100% 714 mV (235)940
C grey level 3	63.0% 441 mV (154)616	63.0% 450 mV (154)616	65.8% 470 mV (154)616	63.0% 441 mV (154)616	63.0% 450 mV (154)616	65.8% 470 mV (154)616
D grey level 2	35.2% 246 mV (93)372	35.2% 251 mV (93)372	40.0% 286 mV (93)372	35.2% 246 mV (93)372	35.2% 251 mV (93)372	40.0% 286 mV (93)372
E grey level 1	15.1% 105 mV (49)196	15.1% 108 mV (49)196	21.4% 153 mV (49)196	15.1% 105 mV (49)196	15.1% 108 mV (49)196	21.4% 153 mV (49)196
F background level	0% 0 mV (16)64	0% 0 mV (16)64	7.5% 54 mV (16)64	70.3% 492 mV (170)680	70.3% 502 mV (170)680	72.5% 518 mV (170)680
G black stripe level	-1.8% -13 mV (12)48	-1.8% -13 mV (12)48	5.8% 42 mV (12)48	-2.7% -19 mV (10)40	-2.7% -20 mV (10)40	5.0% 35 mV (10)40
G' mid-level between black stripe and background levels	NA	NA	NA	33.8% 237 mV (90)360	33.8% 237 mV (90)360	38.8% 277 mV (90)360
H grey stripe level	1.8% 13 mV (20)80	1.8% 13 mV (20)80	9.2% 66 mV (20)80	2.7% 19 mV (22)88	2.7% 20 mV (22)88	10.0% 72 mV (22)88
H' mid-level between grey stripe and background levels	NA	NA	NA	36.5% 256 mV (96)384	36.5% 256 mV (96)384	41.3% 295 mV (96)384

*Note 1* – The 10 bit digital levels are defined as the primary values, and the rest are derived. The 8 bit digital levels are in parentheses.

*Note 2* – Digital levels are expressed in the same way as described in Recommendation ITU-R BT.601.

*Note 3* – For the subjective assessment monitoring waveform, mid-levels between stripes and background are introduced to avoid ringing due to the sharp transition of the waveform.

*Note 4* – NA: the mid-level is not applied, and the level for this area is the same as the background.

## Annex 2

### Procedure for use of PLUGE test signals

These adjustments are very dependent on the viewing conditions and it is preferable to conform to the conditions for viewing distance and ambient illumination contained in Recommendation ITU-R BT.500:

- the brightness control is reduced until the blackest stripe disappears, whilst the brighter stripe remains visible. This setting shall correspond to the pre-set brightness condition;
- using a photometer, the contrast is adjusted until the centre of the white area (100% video level) has a luminance value of 70 cd/m<sup>2</sup>. This setting shall correspond to the pre-set contrast control condition;
- before a result that is entirely satisfactory is obtained, the procedure described above will usually be repeated, so as to reduce the effects of interactions between these two controls.

## Annex 3

### PLUGE for HDTV systems

A PLUGE signal for HDTV displays is shown in Figs. 2 and 3. The peak white patch is used to set the peak luminance by means of the contrast control.

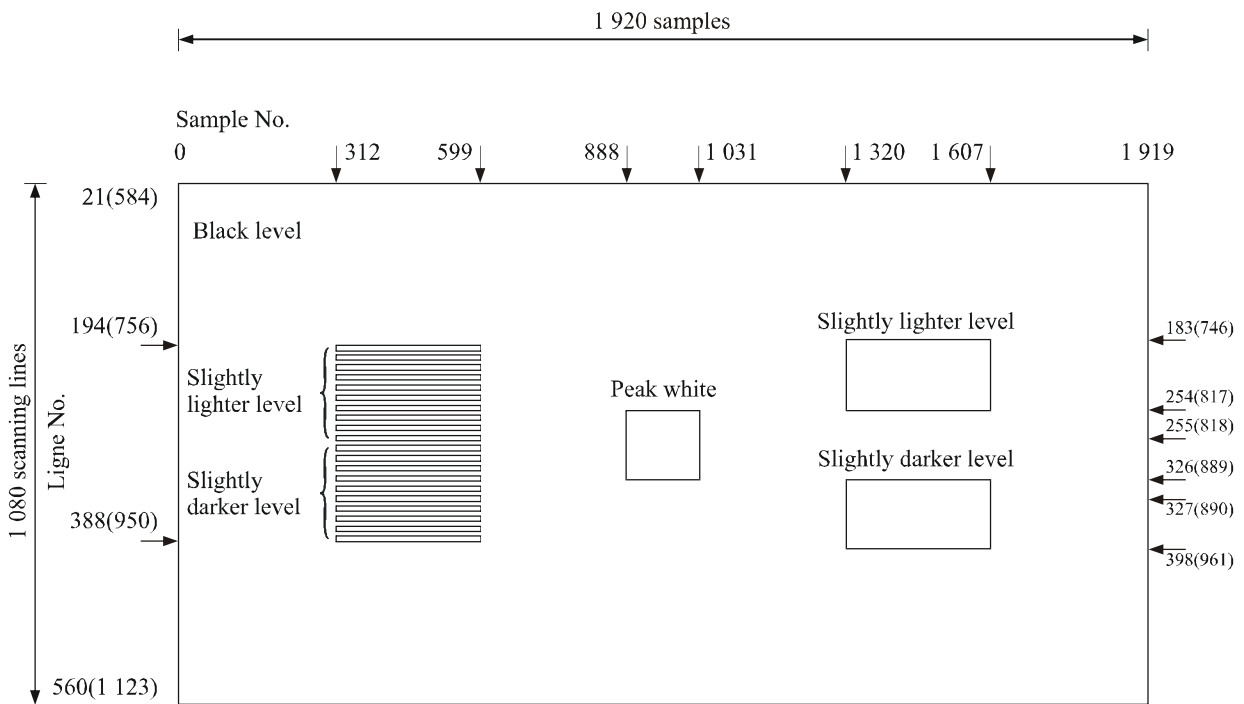
Two types of signal can be used to set the brightness of the black level of the display by means of the brightness control.

The signal on the left-hand side of the picture consists of narrow horizontal stripes (a width of 10 scanning lines). The stripes extend from approximately 2% above the black level of the waveform to approximately 2% below the black level. The signal on the right-hand side of the picture consists of two coarse stripes (a width of 138 lines) one stripe is approximately 2% above black level the other is approximately 2% below black level. This signal is suitable for setting display values for both CRT and FPD type displays.

As in Annex 2, the black level of the display is adjusted by the display brightness control such that the negative horizontal stripes disappear, whilst the positive horizontal stripes remain visible.

Parameter values, Figs. 2 and 3	8 bit digital value	10 bit digital value
Peak white	235	940
Black level	16	64
Slightly lighter level	20	80
Slightly darker level	12	48

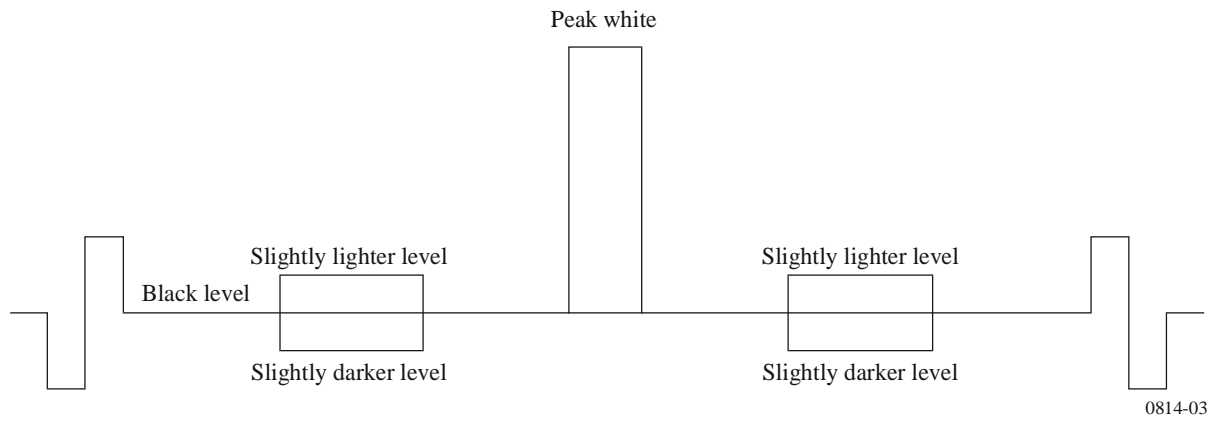
FIGURE 2  
PLUGE signal for adjusting black level



Sample and line numbers are inclusive,  
e.g. for the peak white box 888 is the first white sample  
and 1 031 is the last white sample.  
( ) Indicates in 2nd field

FIGURE 3

Analogue waveform of the signal for adjusting black level



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