

RECOMMENDATION ITU-R BT.709-5

**Parameter values for the HDTV* standards for production
and international programme exchange**

(Question ITU-R 27/11)

(1990-1994-1995-1998-2000-2002)

The ITU Radiocommunication Assembly,

considering

- a) that for many years HDTV programmes have been produced in several countries;
- b) that parameter values for HDTV production standards should have maximum commonality;
- c) that two HDTV scanning standards, 1125/60/2:1 and 1250/50/2:1, were previously developed for that purpose, having a significant number of parameters which have been agreed on a worldwide basis, and for which some equipment remains in use;
- d) that a HDTV common image format of 1920 pixels by 1080 lines providing square pixel sampling and a number of interlace and progressive picture rates has been designed for digital television, computer imagery and other applications (in this Recommendation, the term pixel is used to describe a picture element in the digital domain);
- e) that the parameters defined for all these systems meet the quality goals set for HDTV;
- f) that film productions are an important programme source for HDTV broadcasting and, conversely, the use of HDTV production systems has significant benefits for film programme production;
- g) that high-quality conversion between the various HDTV systems, as well as down-conversion to 525/625 television systems, has been successfully implemented;
- h) that programmes produced and archived will not become obsolete using these standards,

recommends

- 1** that for HDTV programme production and international exchange, one of the systems described in Parts 1 or 2 of this Recommendation, should be used;
- 2** that for new HDTV programme production and international exchange, systems described in Part 2 are preferred.

* “A high-definition system is a system designed to allow viewing at about three times the picture height, such that the system is virtually, or nearly, transparent to the quality of portrayal that would have been perceived in the original scene or performance by a discerning viewer with normal visual acuity.” Report ITU-R BT.801.

**Signal parameter values for the 1125/60/2:1 system
and the 1250/50/2:1 system**

PART 1

HDTV systems related to conventional television

(The areas in bold characters in the Tables below denote parameter values which have been agreed to on a worldwide basis.)

1 Opto-electronic conversion

Item	Parameter	Value	
		1125/60/2:1	1250/50/2:1
1.1	Opto-electronic transfer characteristics before non-linear precorrection	Assumed linear	
1.2	Overall opto-electronic transfer characteristics at source	$V = 1.099 L^{0.45} - 0.099$ for $1 \geq L \geq 0.018$ $V = 4.500 L$ for $0.018 > L \geq 0$ where: L : luminance of the image $0 \leq L \leq 1$ V : corresponding electrical signal	
1.3	Chromaticity coordinates (CIE, 1931) Primary – Red (R) – Green (G) – Blue (B)	x	y
		0.640 0.300 0.150	0.330 0.600 0.060
1.4	Assumed chromaticity for equal primary signals (Reference white) $E_R = E_G = E_B$	D_{65}	
		x	y
		0.3127	0.3290

2 Picture characteristics

Item	Parameter	Value	
		1125/60/2:1	1250/50/2:1
2.1	Aspect ratio	16:9	
2.2	Sample per active line	1920	
2.3	Sampling lattice	Orthogonal	
2.4	Active lines per picture	1035	1152

3 Picture scanning characteristics

Item	Parameter	Value	
		1125/60/2:1	1250/50/2:1
3.1	Order of sample scanning	Left to right, top to bottom 1st line of field 1 above 1st line of field 2	
3.2	Interlace ratio	2:1	
3.3	Picture rate (Hz)	30	25
3.4	Total number of lines	1125	1250
3.5	Field frequency (Hz)	60	50
3.6	Line frequency (Hz)	$33\,750 \pm 0.001\%$	$31\,250 \pm 0.0001\%$

4 Signal format

The terms R , G , B , Y , C_B , C_R , are often used and are generally understood to refer to the signals E'_R , E'_G , E'_B , E'_Y , E'_{C_B} , E'_{C_R} respectively (i.e. they correspond to gamma pre-corrected signals).

Item	Parameter	Value	
		1125/60/2:1	1250/50/2:1
4.1	Conceptual non-linear precorrection of primary signals	$\gamma = 0.45$ (see item 1.2)	
4.2	Derivation of luminance signal E'_Y ⁽¹⁾	$E'_Y = 0.2126 E'_R +$ $0.7152 E'_G +$ $0.0722 E'_B$	$E'_Y = 0.299 E'_R +$ $0.587 E'_G +$ $0.114 E'_B$
4.3	Derivation of colour-difference signal (analogue coding) ⁽¹⁾	$E'_{C_B} = 0.5389 (E'_B - E'_Y)$ $E'_{C_R} = 0.6350 (E'_R - E'_Y)$	$E'_{C_B} = 0.564 (E'_B - E'_Y)$ $E'_{C_R} = 0.713 (E'_R - E'_Y)$
4.4	Derivation of colour-difference signal (digital coding) C_B , C_R	Digitally scaled from the values of item 4.3	

⁽¹⁾ The coefficients for the equations have been calculated following the rules laid down in SMPTE RP177-1993.