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AMENDMENT 2
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**Information technology — Generic coding
of moving pictures and associated audio
information: Video**

AMENDMENT 2: Support for colour spaces

*Technologies de l'information — Codage générique des images
animées et du son associé: Données vidéo*
AMENDEMENT 2: Prise en charge des espaces chromatiques

[ISO/IEC 13818-2:2000/Amd 2:2007](https://standards.iso.org/iso-iec-13818-2-2000-amd-2-2007)

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Reference number
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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATIONInformation technology – Generic coding of moving pictures and
associated audio information: Video

Amendment 2

Support for colour spaces

1) Subclause 4.1

Add the following definitions at the end of subclause 4.1:

Floor() the largest integer less than or equal to the argument.

Round() $\text{Sign}(x) * \text{Floor}(\text{Abs}(x) + 0.5)$, for an argument x

2) Table 6-7

Replace Table 6-7 with:

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Table 6-7 – Colour primaries

Value	Primaries	Informative remarks															
0	Forbidden																
1	<table border="1"> <tr> <td>primary</td> <td>x</td> <td>y</td> </tr> <tr> <td>green</td> <td>0.300</td> <td>0.600</td> </tr> <tr> <td>blue</td> <td>0.150</td> <td>0.060</td> </tr> <tr> <td>red</td> <td>0.640</td> <td>0.330</td> </tr> <tr> <td>white D65</td> <td>0.3127</td> <td>0.3290</td> </tr> </table>	primary	x	y	green	0.300	0.600	blue	0.150	0.060	red	0.640	0.330	white D65	0.3127	0.3290	<p>ITU-R Rec. BT.709-5</p> <p>ITU-R Rec. BT.1361 conventional colour gamut system or extended colour gamut system</p> <p>IEC 61966-2-4</p> <p>Society of Motion Picture and Television Engineers</p> <p>RP 177 Annex B</p>
primary	x	y															
green	0.300	0.600															
blue	0.150	0.060															
red	0.640	0.330															
white D65	0.3127	0.3290															
2	Unspecified	Image characteristics are unknown or are determined by the application															
3	Reserved	For future use by ITU-T ISO/IEC															
4	<table border="1"> <tr> <td>primary</td> <td>x</td> <td>y</td> </tr> <tr> <td>green</td> <td>0.21</td> <td>0.71</td> </tr> <tr> <td>blue</td> <td>0.14</td> <td>0.08</td> </tr> <tr> <td>red</td> <td>0.67</td> <td>0.33</td> </tr> <tr> <td>white C</td> <td>0.310</td> <td>0.316</td> </tr> </table>	primary	x	y	green	0.21	0.71	blue	0.14	0.08	red	0.67	0.33	white C	0.310	0.316	<p>ITU-R Rec. BT.470-6 System M (historical)</p> <p>United States National Television System Committee 1953 Recommendation for transmission standards for colour television</p> <p>United States Federal Communications Commission Title 47 Code of Federal Regulations (2004) 73.682 (a) (20)</p>
primary	x	y															
green	0.21	0.71															
blue	0.14	0.08															
red	0.67	0.33															
white C	0.310	0.316															
5	<table border="1"> <tr> <td>primary</td> <td>x</td> <td>y</td> </tr> <tr> <td>green</td> <td>0.29</td> <td>0.60</td> </tr> <tr> <td>blue</td> <td>0.15</td> <td>0.06</td> </tr> <tr> <td>red</td> <td>0.64</td> <td>0.33</td> </tr> <tr> <td>white D65</td> <td>0.3127</td> <td>0.3290</td> </tr> </table>	primary	x	y	green	0.29	0.60	blue	0.15	0.06	red	0.64	0.33	white D65	0.3127	0.3290	<p>ITU-R Rec. BT.1700 625 PAL or 625 SECAM</p> <p>ITU-R Rec. BT.1358 625</p> <p>ITU-R Rec. BT.470-6 System B, G (historical)</p> <p>ITU-R Rec. BT.601-6 625</p>
primary	x	y															
green	0.29	0.60															
blue	0.15	0.06															
red	0.64	0.33															
white D65	0.3127	0.3290															
6	<table border="1"> <tr> <td>primary</td> <td>x</td> <td>y</td> </tr> <tr> <td>green</td> <td>0.310</td> <td>0.595</td> </tr> <tr> <td>blue</td> <td>0.155</td> <td>0.070</td> </tr> <tr> <td>red</td> <td>0.630</td> <td>0.340</td> </tr> <tr> <td>white D65</td> <td>0.3127</td> <td>0.3290</td> </tr> </table>	primary	x	y	green	0.310	0.595	blue	0.155	0.070	red	0.630	0.340	white D65	0.3127	0.3290	<p>ITU-R Rec. BT.1700 NTSC</p> <p>ITU-R Rec. BT.1358 525</p> <p>Society of Motion Picture and Television Engineers 170M (functionally the same as the value 7)</p> <p>ITU-R Rec. BT.601-6 525</p>
primary	x	y															
green	0.310	0.595															
blue	0.155	0.070															
red	0.630	0.340															
white D65	0.3127	0.3290															

Table 6-7 – Colour primaries

Value	Primaries	Informative remarks
7	primary x y green 0.310 0.595 blue 0.155 0.070 red 0.630 0.340 white D65 0.3127 0.3290	Society of Motion Picture and Television Engineers 240M (functionally the same as the value 6)
8-255	Reserved	For future use by ITU-T ISO/IEC

3) Table 6-8

Replace Table 6-8 with:

Table 6-8 – Transfer characteristics

Value	Transfer characteristic	Informative remarks
0	Forbidden	
1	$V = 1.099 L_c^{0.45} - 0.099$ for $1 \geq L_c \geq 0.018$ $V = 4.500 L_c$ for $0.018 > L_c \geq 0$	ITU-R Rec. BT.709-5 ITU-R Rec. BT.1361 conventional colour gamut system (functionally the same as the value 6)
2	Unspecified	Image characteristics are unknown or are determined by the application.
3	Reserved	For future use by ITU-T ISO/IEC
4	Assumed display gamma 2.2	ITU-R Rec. BT.470-6 System M (historical) United States National Television System Committee 1953 Recommendation for transmission standards for colour television United States Federal Communications Commission Title 47 Code of Federal Regulations (2004) 73.682 (a) (20)
5	Assumed display gamma 2.8	ITU-R Rec. BT.1700 (2007 Revision) 625 PAL or 625 SECAM ITU-R Rec. BT.470-6 System B, G (historical)
6	$V = 1.099 L_c^{0.45} - 0.099$ for $1 \geq L_c \geq 0.018$ $V = 4.500 L_c$ for $0.018 > L_c \geq 0$	ITU-R Rec. BT.1700 NTSC ITU-R Rec. BT.1358 525 or 625 Society of Motion Picture and Television Engineers 170M (functionally the same as the value 1) ITU-R Rec. BT.601-6 525 or 625
7	$V = 1.1115 L_c^{0.45} - 0.1115$ for $L_c \geq 0.0228$ $V = 4.0 L_c$ for $0.0228 > L_c$	Society of Motion Picture and Television Engineers 240M
8	$V = L_c$	Linear transfer characteristics
9	$V = 1.0 - \log_{10}(L_c) + 2$ for $1 \geq L_c \geq 0.01$ $V = 0.0$ for $0.01 > L_c \geq 0$	Logarithmic transfer characteristic (100:1 range)
10	$V = 1.0 - \log_{10}(L_c) + 2.5$ for $1 \geq L_c \geq 0.0031622777$ $V = 0.0$ for $0.0031622777 > L_c \geq 0$	Logarithmic transfer characteristic (316.22777:1 range)

Table 6-8 – Transfer characteristics

Value	Transfer characteristic	Informative remarks
11	$V = 1.099 L_c^{0.45} - 0.099$ for $L_c \geq 0.018$ $V = 4.500 L_c$ for $0.018 > L_c > -0.018$ $V = -(1.099 (-L_c)^{0.45} - 0.099)$ for $-0.018 \geq L_c$	IEC 61966-2-4
12	$V = 1.099 L_c^{0.45} - 0.099$ for $1.33 > L_c \geq 0.018$ $V = 4.500 L_c$ for $0.018 > L_c \geq -0.0045$ $V = -(1.099 (-4 * L_c)^{0.45} - 0.099) \div 4$ for $-0.0045 > L_c \geq -0.25$	ITU-R Rec. BT.1361 extended colour gamut system
13-255	Reserved	For future use by ITU-T ISO/IEC

4) Subclause 6.3.6 semantics of matrix_coefficients and Table 6-9

Replace semantics of matrix_coefficients and Table 6-9 with:

matrix_coefficients – This 8-bit integer describes the matrix coefficients used in deriving luminance and chrominance signals from the green, blue, and red primaries, and is defined in Table 6-9

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Table 6-9 – Matrix coefficients

Value	Matrix	Informative remarks
0	Forbidden	
1	$E'_Y = 0.7152 E'_G + 0.0722 E'_B + 0.2126 E'_R$ $E'_{PB} = -0.3854 E'_G + 0.5000 E'_B - 0.1146 E'_R$ $E'_{PR} = -0.4542 E'_G - 0.0458 E'_B + 0.5000 E'_R$	ITU-R Rec. BT.709-5 ITU-R Rec. BT.1361 conventional colour gamut system and extended colour gamut system IEC 61966-2-4 xvYCC ₇₀₉ Society of Motion Picture and Television Engineers RP 177 Annex B
2	Unspecified	Image characteristics are unknown or are determined by the application
3	Reserved	For future use by ITU-T ISO/IEC
4	$E'_Y = 0.59 E'_G + 0.11 E'_B + 0.30 E'_R$ $E'_{PB} = -0.331 E'_G + 0.500 E'_B - 0.169 E'_R$ $E'_{PR} = -0.421 E'_G - 0.079 E'_B + 0.500 E'_R$	United States National Television System Committee 1953 Recommendation for transmission standards for colour television United States Federal Communications Commission Title 47 Code of Federal Regulations (2004) 73.682 (a) (20)
5	$E'_Y = 0.5870 E'_G + 0.1140 E'_B + 0.2990 E'_R$ $E'_{PB} = -0.3313 E'_G + 0.5000 E'_B - 0.1687 E'_R$ $E'_{PR} = -0.4187 E'_G - 0.0813 E'_B + 0.5000 E'_R$	ITU-R Rec. BT.1700 625 PAL or 625 SECAM ITU-R Rec. BT.1358 625 IEC 61966-2-4 xvYCC ₆₀₁ ITU-R Rec. BT.470-6 System B, G (historical) (functionally the same as the value 6) ITU-R Rec. BT.601-6 625
6	$E'_Y = 0.5870 E'_G + 0.1140 E'_B + 0.2990 E'_R$ $E'_{PB} = -0.3313 E'_G + 0.5000 E'_B - 0.1687 E'_R$ $E'_{PR} = -0.4187 E'_G - 0.0813 E'_B + 0.5000 E'_R$	ITU-R Rec. BT.1700 NTSC ITU-R Rec. BT.1358 525 Society of Motion Picture and Television Engineers 170M IEC 61966-2-4 xvYCC ₆₀₁ (functionally the same as the value 5) ITU-R Rec. BT.601-6 525

Table 6-9 – Matrix coefficients

Value	Matrix	Informative remarks
7	$E'_Y = 0.701 E'_G + 0.087 E'_B + 0.212 E'_R$ $E'_{PB} = -0.384 E'_G + 0.500 E'_B - 0.116 E'_R$ $E'_{PR} = -0.445 E'_G - 0.055 E'_B + 0.500 E'_R$	Society of Motion Picture and Television Engineers 240M
8	YCgCo	Defined as specified below
9-255	Reserved	For future use by ITU-T ISO/IEC

In Table 6-9:

- When transfer_characteristics is not equal to 11 or 12, E'_R , E'_G and E'_B are analog with values between 0 and 1;
- When transfer_characteristics is equal to 11 (IEC 61966-2-4) or 12 (ITU-R Rec. BT.1361 extended colour gamut system), E'_R , E'_G and E'_B are analog with a larger range not specified in this Recommendation | International Standard;
- Nominal black is considered to have the property $E'_R = 0$, $E'_G = 0$ and $E'_B = 0$;
- Nominal white is considered to have the property $E'_R = 1$, $E'_G = 1$ and $E'_B = 1$;
- If matrix_coefficients is not equal to 8, the following applies:
 - E'_Y is analog with the value 0 associated with nominal black and the value 1 associated with nominal white;
 - E'_{PB} and E'_{PR} are analog with the value 0 associated with both nominal black and nominal white;
 - When transfer_characteristics is not equal to 11 or 12, E'_Y has values between 0 and 1;
 - When transfer_characteristics is not equal to 11 or 12, E'_{PB} and E'_{PR} have values between -0.5 and 0.5;
 - When transfer_characteristics is equal to 11 (IEC 61966-2-4), or 12 (ITU-R Rec. BT.1361 extended colour gamut system), E'_Y , E'_{PB} and E'_{PR} are analog with a larger range not specified in this Recommendation | International Standard.
 - Y, Cb and Cr are related to E'_Y , E'_{PB} and E'_{PR} by the following formulae:

$$Y = \max[0, \min[255, \text{Round}((219 * E'_Y)) + 16]]$$

$$Cb = \max[0, \min[255, \text{Round}((224 * E'_{PB})) + 128]]$$

$$Cr = \max[0, \min[255, \text{Round}((224 * E'_{PR})) + 128]]$$

- Otherwise (matrix_coefficients is equal to 8 (YCgCo)), the following applies:

$$R = 219 * E'_R + 16$$

$$G = 219 * E'_G + 16$$

$$B = 219 * E'_B + 16$$

$$Y = \max[0, \min[255, \text{Round}(0.5 * G + 0.25 * (R + B))]]$$

$$Cb = \max[0, \min[255, \text{Round}(0.5 * G - 0.25 * (R + B)) + 128]]$$

$$Cr = \max[0, \min[255, \text{Round}(0.5 * (R - B)) + 128]]$$

NOTE 1 – For purposes of the YCgCo nomenclature used in Table 6-9, Cb and Cr of the above equations may be referred to as Cg and Co, respectively. The inverse conversion for the above three equations should be computed as:

$$t = Y - (Cb - 128)$$

$$G = Y + (Cb - 128)$$

$$B = t - (Cr - 128)$$

$$R = t + (Cr - 128)$$

NOTE 2 – The decoding process given by this Recommendation | International Standard limits output sample values for Y, Cr and Cb to the range [0:255]. Thus, sample values outside the range implied by the above equations may occasionally occur at the output of the decoding process. In particular the sample values 0 and 255 may occur.

In the case that `sequence_display_extension()` is not present in the bitstream or `colour_description` is zero the matrix coefficients are assumed to be implicitly defined by the application.

NOTE 3 – In applications which may have signals with more than one set of colour primaries, transfer characteristics, and/or matrix coefficients, it is recommended to transmit a `sequence_display_extension` with `colour_description` set to one, and to specify the appropriate values for the colorimetry parameters.

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