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AMENDMENT 3
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Information technology — Coding of audio-visual objects —

Part 2: **Visual**

AMENDMENT 3: Support for colour spaces

Technologies de l'information — Codage des objets audiovisuels —

Partie 2: Codage visuel

AMENDEMENT 3: Support pour espaces de couleur

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Foreword

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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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Amendment 3 to ISO/IEC 14496-2:2004 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

Information technology — Coding of audio-visual objects —

Part 2:
Visual

AMENDMENT 3: Support for colour spaces

At the end of subclause 4.1, add the following:

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

Round() Sign(*x*) * Floor(Abs(*x*) + 0,5), for an argument *x*

In 6.3.2, replace Table 6-8 with the following:

Table 6-8 — Colour Primaries

Value	Primaries			Informative Remarks
0	Forbidden			
1	primary green blue red white D65	x 0,300 0,150 0,640 0,3127	y 0,600 0,060 0,330 0,3290	ITU-R Recommendation BT.709-5 ITU-R Recommendation BT.1361 conventional colour gamut system or extended colour gamut system IEC 61966-2-4 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 ISO/IEC
4	primary green blue red white C	x 0,21 0,14 0,67 0,310	y 0,71 0,08 0,33 0,316	ITU-R Recommendation BT.470-6 System M (historical) United States National Television System Committee 1953 Recommendation for transmission standards for color television United States Federal Communications Commission Title 47 Code of Federal Regulations (2004) 73.682 (a) (20)
5	primary green blue red white D65	x 0,29 0,15 0,64 0,3127	y 0,60 0,06 0,33 0,3290	ITU-R Recommendation BT.1700 625 PAL or 625 SECAM ITU-R Recommendation BT.1358 625 ITU-R Recommendation BT.470-6 System B, G (historical) ITU-R Recommendation BT.601-6 625

6	primary	x	y	ITU-R Recommendation BT.1700 NTSC ITU-R Recommendation BT.1358 525 ITU-R Recommendation BT.601-6 525 Society of Motion Picture and Television Engineers 170M (functionally the same as the value 7)
	green	0,310	0,595	
	blue	0,155	0,070	
	red	0,630	0,340	
	white D65	0,3127	0,3290	
7	primary	x	y	Society of Motion Picture and Television Engineers 240M (functionally the same as the value 6)
	green	0,310	0,595	
	blue	0,155	0,070	
	red	0,630	0,340	
	white D65	0,3127	0,3290	
8	primary	x	y	Generic film (colour filters using Illuminant C)
	green	0,243	0,692 (Wratten 58)	
	blue	0,145	0,049 (Wratten 47)	
	red	0,681	0,319 (Wratten 25)	
	white C	0.310	0.316	
9-255	Reserved			For future use by ISO/IEC

In 6.3.2, replace Table 6-9 with the following:

Table 6-9 — 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 Recommendation BT.709-5 ITU-R Recommendation 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 ISO/IEC
4	Assumed display gamma 2,2	ITU-R Recommendation BT.470-6 System M (historical) United States National Television System Committee 1953 Recommendation for transmission standards for color television ITU-R Recommendation BT.1700 (2007 revision) 625 PAL or 625 SECAM United States Federal Communications Commission Title 47 Code of Federal Regulations (2004) 73.682 (a) (20)
5	Assumed display gamma 2,8	ITU-R Recommendation 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 Recommendation BT.1700 NTSC ITU-R Recommendation BT.1358 525 or 625 ITU-R Recommendation BT.601-6 525 or 625 Society of Motion Picture and Television Engineers 170M (functionally the same as the value 1)

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	$V = 1{,}0 - \text{Log}_{10}(L_C) \div 2$ for $1 \geq L_C \geq 0{,}01$ $V = 0{,}0$ for $0{,}01 > L_C$	Logarithmic transfer characteristic (100:1 range)
10	$V = 1{,}0 - \text{Log}_{10}(L_C) \div 2.5$ for $1 \geq L_C \geq 0{,}0031622777$ $V = 0{,}0$ for $0{,}0031622777 > L_C$	Logarithmic transfer characteristic (316,22777:1 range)
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 Recommendation BT.1361 extended colour gamut system
13-255	Reserved	For future use by ISO/IEC

In 6.3.2, replace the semantics of matrix_coefficients and Table 6-10 with the following:

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 6-10.

In this table, the following applies:

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 BT.1361 extended colour gamut system), E'_R, E'_G and E'_B are analog with a larger range not specified in this 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 is analog with values between 0 and 1 and E'_{PB} and E'_{PR} are analog with values between -0,5 and 0,5.

When transfer_characteristics is equal to 11 (IEC 61966-2-4) or 12 (ITU-R BT.1361 extended colour gamut system), E'_Y, E'_{PB} and E'_{PR} are analog with a larger range not specified in this International Standard.

Y, Cb and Cr are related to E'_Y, E'_{PB} and E'_{PR} by the following formulae:

if **video_range** is equal to 0:

$$Y = \max[0, \min[(2^n -1), \text{Round}(219 * 2^{n-8} * E'_Y) + 2^{n-4}]]$$
$$Cb = \max[0, \min[(2^n -1), \text{Round}(224 * 2^{n-8} * E'_{PB}) + 2^{n-1}]]$$
$$Cr = \max[0, \min[(2^n -1), \text{Round}(224 * 2^{n-8} * E'_{PR}) + 2^{n-1}]]$$

if **video_range** is equal to 1:

$$Y = \max[0, \min[(2^n -1), \text{Round}((2^n -1) * E'_Y)]]$$
$$Cb = \max[0, \min[(2^n -1), \text{Round}((2^n -1) * E'_{PB}) + 2^{n-1}]]$$
$$Cr = \max[0, \min[(2^n -1), \text{Round}((2^n -1) * E'_{PR}) + 2^{n-1}]]$$

for n bit video.

For example, for 8 bit video,

When transfer_characteristics is not equal to 11 or 12, video_range equal to 0 gives a nominal black-to-white range of Y from 16 to 235, and a nominal range of Cb and Cr from 16 to 240;

When transfer_characteristics is not equal to 11 or 12, video_range equal to 1 gives a nominal black-to-white range of Y from 0 to 255, and a nominal range of Cb and Cr from 0 to 255.

If matrix_coefficients is equal to 8 (YCgCo), the following applies.

if **video_range** is equal to 0:

$$R = \max[0, \min[(2^n - 1), 2^{n-8} * (219* E'_R + 16)]]$$
$$G = \max[0, \min[(2^n - 1), 2^{n-8} * (219* E'_G + 16)]]$$
$$B = \max[0, \min[(2^n - 1), 2^{n-8} * (219* E'_B + 16)]]$$

if **video_range** is equal to 1:

$$R = \max[0, \min[(2^n - 1), (2^n - 1)* E'_R]]$$
$$G = \max[0, \min[(2^n - 1), (2^n - 1)* E'_G]]$$
$$B = \max[0, \min[(2^n - 1), (2^n - 1)* E'_B]]$$

for n bit video.

Y, Cb and Cr are related to R, G and B by the following formulae:

$$Y = \text{Round}(0.5 * G + 0.25 * (R + B))$$
$$Cb = \text{Round}(0.5 * G - 0.25 * (R + B)) + 2^{(n-1)}$$
$$Cr = \text{Round}(0.5 * (R - B)) + 2^{(n-1)}$$

NOTE – For purposes of the YCgCo nomenclature used in Table 6-10, 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:

$$t = Y - (Cb - 2^{(n-1)})$$
$$G = \max[0, \min[(2^n - 1), Y + (Cb - 2^{(n-1)})]]$$
$$B = \max[0, \min[(2^n - 1), t - (Cr - 2^{(n-1)})]]$$
$$R = \max[0, \min[(2^n - 1), t + (Cr - 2^{(n-1)})]]$$

Table 6-10 — 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 Recommendation BT.709-5 ITU-R Recommendation 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 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 color 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 Recommendation BT.1700 625 PAL or 625 SECAM ITU-R Recommendation BT.1358 625 IEC 61966-2-4 $xvYCC_{601}$ ITU-R Recommendation BT.470-6 System B, G (historical) ITU-R Recommendation BT.601-6 625 (functionally the same as the value 6)