# INTERNATIONAL STANDARD

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**AMENDMENT 1** 2007-07-01

Information technology — Coding of audio-visual objects —

Part 10: Advanced Video Coding

AMENDMENT 1 Support for colour spaces and aspect ratio definitions

Technologies de l'information — Codage des objets audiovisuels — Partie 10: Codage visuel avancé

AMENDEMENT 1: Support pour espaces couleurs et définitions du tormat de l'image

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## **Foreword**

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Amendment 1 to ISO/IEC 14496-10:2005 was prepared by Joint Technical Committee ISO/IEC JTC 1, Information technology, Subcommittee SC 29, Coding of audio, picture, multimedia and hypermedia information.

Amendment 1 to ISO/IEC 14496-10:2005, together with ISO/IEC 14496-10:2005/Cor.2:2006, is technically aligned with ITU-T Rec. H.264 (2005)/Amd.1 (2006) but is not published as identical text.

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# Information technology — Coding of audio-visual objects —

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Part 10: Advanced Video Coding								
		E-1 with the following:	or colour spaces and aspect rations. The spect rations are colour spaces and aspect rations. The spect rations are colour spaces and aspect rations.					
	aspect_ratio_idc	Sample aspect ratio	(informative) Examples of use					
	0	Unspecified	Control of the second of the s					
	1	1:1 ("square")	1280x720 16.9 frame without overscan 1920x1080 16:9 frame without overscan (cropped from 1920x1088) 640x480 4:3 frame without overscan					
	2	12:11	720x576 4:3 frame with horizontal overscan 352x288 4:3 frame without overscan					
3 10:1:		10:11	720x480 4:3 frame with horizontal overscan 352x240 4:3 frame without overscan					
	4	16:11	720x576 16:9 frame with horizontal overscan 528x576 4:3 frame without overscan					
	5	40:33	720x480 16:9 frame with horizontal overscan 528x480 4:3 frame without overscan					
	6	<b>1</b> 24:11	352x576 4:3 frame without overscan 480x576 16:9 frame with horizontal overscan					
	7	20:11	352x480 4:3 frame without overscan 480x480 16:9 frame with horizontal overscan					
	85	32:11	352x576 16:9 frame without overscan					
	3	80:33	352x480 16:9 frame without overscan					
	10	18:11	480x576 4:3 frame with horizontal overscan					
1	11	15:11	480x480 4:3 frame with horizontal overscan					
M	12	64:33	528x576 16:9 frame without overscan					
	13	160:99	528x480 16:9 frame without overscan					
	14	4:3	1440x1080 16:9 frame without overscan					
	15	3:2	1280x1080 16:9 frame without overscan					
	16	2:1	960x1080 16:9 frame without overscan					
	17254	Reserved						
	255	Extended_SAR						

In E.2, replace Table E-3 with the following:

Table E-3 – Colour primaries

Value	Primaries			Informative Remarks
0	Reserved			For future use by ITU-T / ISO/IEC
1	primary	X	у	ITU-R Recommendation BT.709-5
	green	0.300	0.600	ITU-R Recommendation BT.1361
	blue	0.150	0.060	conventional colour gamut system and
	red	0.640	0.330	extended colour gamut system
	white D65	0.3127	0.3290	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 ITU-T / ISO/IEC
4	primary	X	у	ITU-R Recommendation BT.470-6
	green	0.21	0.71	System M (historical)
	blue	0.14	0.08	ITU-R Recommendation BT.1700
	red	0.67	0.33	(2007 revision) 625 PAL or 625 SECAM
	white C	0.310	0.316	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	In mino o mar		\X	
3	primary	x 0.29	y 0.60 0.06 He	ITU-R Recommendation BT.1358 625
	green blue	0.29	0.06	ITU-R Recommendation BT.470-6 System B, G (historical)
	red	0.13	0.33	B, G (mstorical)
	white D65	0.3127	0.3290	
6	primary	X X	· (V	ITU-R Recommendation BT.1700 NTSC
Ü	green	0.310	0.595	ITU-R Recommendation BT.1358 525
	blue	0.155	0.070	Society of Motion Picture and Television
	red	0.630	0.340	Engineers 170M
	white D65	0.3127	0.3290	(functionally the same as the value 7)
7	primary C	X	y	Society of Motion Picture and Television
	green	0.310	0.595	Engineers 240M
	blue	0.155	0.070	(functionally the same as the value 6)
	red	0.630	0.340	
	white D65	0.3127	0.3290	
8	primary	X	y	Generic film (colour filters using
70,	green	0.243	0.692 (Wratten 58)	Illuminant C)
M	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 ITU-T / ISO/IEC

# In E.2, replace Table E-4 with the following:

**Table E-4 – Transfer characteristics** 

Value	Transfer Characteristic		Informative Remarks
0	Reserved		For future use by ITU-T / ISO/IEC
1	$V = 1.099 * L_c^{0.45} - 0.099$ $V = 4.500 * L_c$	for $1 >= L_c >= 0.018$ for $0.018 > L_c >= 0$	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 PU-T / 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
		SOILE	United States Federal Communications Commission Title 47 Code of Federal Regulations (2004) 73.682 (a) (20)
5	Assumed display gamma 2.8	opk of the	ITU-R Recommendation BT.1700 625 PAL or 625 SECAM
		, PO,	ITU-R Recommendation BT.470-6 System B, G (historical)
6	$V = 1.099 * L_c^{0.45} - 0.099$	for $1 > = L_c > = 0.018$	ITU-R Recommendation BT.1700 NTSC
	$V = 4.500 * L_c$	for $0.018 > L_c >= 0$	ITU-R Recommendation BT.1358 525 or 625
	4.300 L <sub>c</sub>		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 $1 >= L_c >= 0.0228$	Society of Motion Picture and Television Engineers 240M
	$V = 4.0 * L_c$	for $0.0228 > L_c >= 0$	
8	$V = L_c$	for $1 > L_c >= 0$	Linear transfer characteristics
9	$V = 1.0 - \text{Log}_{10}(L_c) \div 2$ V = 0.0	for $1 \ge L_c \ge 0.01$ for $0.01 \ge L_c \ge 0$	Logarithmic transfer characteristic (100:1 range)
10	$V = 1.0 - \text{Log}_{10}(L_c) \div 2.5$	for $1 >= L_c >= 0.0031622777$	Logarithmic transfer characteristic
AP	V = 0.0	for $0.0031622777 > L_c >= 0$	(316.22777:1 range)
W,	$V = 1.099 * L_c^{0.45} - 0.099$	for $L_c >= 0.018$	IEC 61966-2-4
	$V = 4.500 * L_c$	for $0.018 > L_c > -0.018$	
	$V = -(1.099 * (-L_c)^{0.45} - 0.099)$	for $-0.018 >= L_c$	
12	$V = 1.099 * L_c^{0.45} - 0.099$	for $1.33 > L_c >= 0.018$	ITU-R Recommendation BT.1361
	$V = 4.500 * L_c$	for $0.018 > L_c > = -0.0045$	extended colour gamut system
	$V = -(1.099 * (-4 * L_c)^{0.45} - 0.099$	·	
		for $-0.0045 > L_c > = -0.25$	
13255	Reserved		For future use by ITU-T / ISO/IEC

# ISO/IEC 14496-10:2005/Amd.1:2007(E)

In E.2, replace the semantics of matrix\_coefficients and Table E-5 with the following:

matrix coefficients describes the matrix coefficients used in deriving luma and chroma signals from the green, blue, and red primaries, as specified in Table E-5.

matrix\_coefficients shall not be equal to 0 unless both of the following conditions are true

- BitDepth<sub>C</sub> is equal to BitDepth<sub>Y</sub>
- chroma format idc is equal to 3 (4:4:4)

The specification of the use of matrix\_coefficients equal to 0 under all other conditions is reserved for future use b ITU-T | ISO/IEC.

matrix\_coefficients shall not be equal to 8 unless one of the following conditions are true

— BitDepth<sub>C</sub> is equal to BitDepth<sub>Y</sub>

— BitDepth<sub>C</sub> is equal to BitDepth<sub>Y</sub> + 1 and chroma\_format\_idc is equal to 3 (4:4:4)

The specification of the use of matrix coefficients equal to 8 under all other conditions is reserved for future use by ITU-T | ISO/IEC.

When the matrix\_coefficients syntax element is not present, the value of matrix coefficients shall be inferred to be equal to 2 (unspecified).

The interpretation of matrix coefficients is defined as follows.

- If transfer\_characteristics is not equal to 11 or 12, E'<sub>R</sub>, E'<sub>G</sub>, and E'<sub>B</sub> are analog with values in the range of 0 to 1.
- Otherwise (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 Specification.
- Nominal white is specified as having  $E'_R$  equal to 1,  $E'_G$  equal to 1, and  $E'_B$  equal to 1.
- Nominal black is specified as having E'<sub>R</sub> equal to 0, E'<sub>G</sub> equal to 0, and E'<sub>B</sub> equal to 0.
- If video full range flag is equal to 0, the following equations apply.
  - If matrix\_coefficients is equal to 1, 4, 5, 6, or 7, the following equations apply.

$$Y = Clip1_{Y}(Round((1 << BitDepth_{Y} - 8)) * (219 * E'_{Y} + 16)))$$
(E-1)

$$Cr = Clip T_C (Round((1 << (BitDepth_C - 8)) * (224 * E'_{PR} + 128)))$$
 (E-3)

Otherwise, if matrix coefficients is equal to 0 or 8, the following equations apply.

$$R = \text{Clip1}_{Y}((1 << (\text{BitDepth}_{Y} - 8)) * (219 * E'_{R} + 16))$$
(E-4)

$$G = Clip1_{y}((1 \le (BitDepth_{y} - 8)) * (219 * E'_{G} + 16))$$
 (E-5)

$$B = Clip1_{Y}((1 << (BitDepth_{Y} - 8)) * (219 * E'_{B} + 16))$$
(E-6)

Otherwise, if matrix coefficients is equal to 2, the interpretation of the matrix coefficients syntax element is unknown or is determined by the application.

- Otherwise (matrix coefficients is not equal to 0, 1, 2, 4, 5, 6, 7, or 8), the interpretation of the matrix coefficients syntax element is reserved for future definition by ITU-T | ISO/IEC.
- Otherwise (video full range flag is equal to 1), the following equations apply.
  - If matrix coefficients is equal to 1, 4, 5, 6, or 7, the following equations apply.

$$Y = Clip1_{Y}(Round(((1 \le BitDepth_{Y}) - 1) * E'_{Y}))$$
(E-7)

$$Cb = Clip1_{C}(Round(((1 \le BitDepth_{C}) - 1) * E'_{PB} + (1 \le (BitDepth_{C} - 1))))$$

$$Cr = Clip1_{C}(Round(((1 \le BitDepth_{C}) - 1) * E'_{PR} + (1 \le (BitDepth_{C} - 1))))$$

$$Otherwise, if matrix\_coefficients is equal to 0 or 8, the following equations apply.$$

$$R = Clip1_{Y}(((1 \le BitDepth_{Y}) - 1) * E'_{R})$$

$$G = Clip1_{Y}(((1 \le BitDepth_{Y}) - 1) * E'_{G})$$

$$E-10$$

$$Otherwise, if matrix\_coefficients is equal to 2, the interpretation of the matrix\_coefficients syntax element is equal to 2.$$

$$Cr = Clip1_C(Round(((1 << BitDepth_C) - 1) * E'_{PR} + (1 << (BitDepth_C - 1))))$$
 (E-9)

Otherwise, if matrix coefficients is equal to 0 or 8, the following equations apply.

$$R = Clip1_{Y}(((1 \le BitDepth_{Y}) - 1) * E'_{R})$$
(E-10)

$$G = Clip1_{Y}(((1 \le BitDepth_{Y}) - 1) * E'_{G})$$
(E-11)

$$B = Clip1_{Y}(((1 \le BitDepth_{Y}) - 1) * E'_{B})$$
(E-12)

- Otherwise, if matrix coefficients is equal to 2, the interpretation of the matrix coefficients syntax element is unknown or is determined by the application.
- Otherwise (matrix coefficients is not equal to 0; 12, 4, 5, 6, 7, or 8), the interpretation of the matrix coefficients syntax element is reserved for future definition by ITU-T | ISO/IEC.
- If matrix coefficients is not equal to 0 or 8, the following equations apply.

$$E'_{Y} = K_{R} * E'_{R} + (1 - K_{R} - K_{B}) * E'_{G} + K_{B} * E'_{B}$$
 (E-13)

$$E'_{PB} = 0.5 * (E'_{B} - E'_{Y}) \div (1 - K_{B})$$
(E-14)

$$E'_{PR} = 0.5 * (E'_{R} - E'_{Y}) \div (1 - K_{R})$$
 (E-15)

NOTE - 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'<sub>Y</sub> is analog with values in the range of 0 to 1. When transfer characteristics is not equal to 11 or 12, E'<sub>PB</sub> and E'<sub>PB</sub> are analog with values in the range of -0.5 to 0.5. When transfer\_characteristics is equal to 11 (IEC 61966-2-4), or 12 (ITU-R BT.1361 extended colour gamut system), E'<sub>Y</sub>, E'<sub>PB</sub> and E'<sub>PR</sub> are analog with a larger range not specified in this Specification.

Otherwise if matrix coefficients is equal to 0, the following equations apply.

$$Y = Round(G)$$
 (E-16)

$$Cb = Round(B)$$
 (E-17)

$$Cr = Round(R)$$
 (E-18)

- Otherwise (matrix coefficients is equal to 8), the following applies.
  - If BitDepth<sub>C</sub> is equal to BitDepth<sub>Y</sub>, the following equations apply.

$$Y = Round(0.5 * G + 0.25 * (R + B))$$
 (E-19)

Cb = Round(
$$0.5 * G - 0.25 * (R + B)$$
) + ( $1 << (BitDepth_C - 1)$ ) (E-20)