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AMENDMENT 2
1997-12-15

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

AMENDMENT 2: 4:2:2 Profile

*Technologies de l'information — Codage générique des images animées et
des informations sonores associées: Vidéo*

AMENDEMENT 2: Profil 4:2:2



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Foreword

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – GENERIC CODING OF MOVING PICTURES
AND ASSOCIATED AUDIO INFORMATION: VIDEOAMENDMENT 2
4:2:2 Profile

1) Clause 8

Replace Table 8-4 by:

Table 8-4 – Escape profile_and_level_indication identification

profile_and_level_indication	Name
10000110 to 11111111	(Reserved)
10000101	4:2:2 profile @ Main level
10000000 to 10000100	(Reserved)

Add the following text as a Note after Table 8-4:

NOTE – On 4:2:2 Profile: The ITU-T Rec. H.262 | ISO/IEC 13818-2 compression algorithm exploits temporal redundancy, spatial redundancy, and human psycho-visual properties and is not a lossless algorithm. For sequences with substantial spatial and temporal redundancies, or without many sharp lines/edges, the quality of the sequences obtained after decompression will be higher than that obtained for sequences with lower redundancy, or with a large number of sharp lines/edges.

The 4:2:2 profile can provide higher video quality, better chroma resolution and allows a higher bit rate (at Main level, up to 50 Mbit/s) than MP@ML. It also provides the capability to encode all active lines of video.

Although it is not part of the hierarchy of profiles and levels, the 4:2:2 profile @ Main level decoder is required to decode all the bit streams decodable by MP@ML decoders.

The 4:2:2 profile does not support scalability. This allows implementation architectures to be similar to those of MP@ML.

This profile can be used for applications requiring multiple generations of encoding and decoding. In the case of multiple generations without picture manipulation or change in picture coding type between generations, the quality remains nearly constant after the first generation. Use of picture manipulation or change in picture coding type between generations causes some degradation in quality. Nevertheless, the resulting quality is acceptable for a broad range of applications.

The 4:2:2 profile permits all I-picture encoding. This enables fast recovery from transmission errors and can simplify editing applications. This profile allows the high bit rates required to maintain high quality while using only I-picture coding. The 4:2:2 profile also allows the use of P- and B-picture coding types which can further improve quality or reduce bit rate for the same quality.

See Annex J for more information on the picture quality of the 4:2:2 profile.

2) Subclause 8.2

Replace Table 8-5 by:

Table 8-5 – Syntactic constraints of profiles

Syntactic Element	Profile					
	Simple	Main	SNR	Spatial	High	4:2:2
chroma_format	4:2:0	4:2:0	4:2:0	4:2:0	4:2:2 or 4:2:0	4:2:2 or 4:2:0
frame_rate_extension_n	0	0	0	0	0	0
frame_rate_extension_d	0	0	0	0	0	0
aspect_ratio_information	0001, 0010, 0011	0001, 0010, 0011	0001, 0010, 0011	0001, 0010, 0011	0001, 0010, 0011	0001, 0010, 0011
picture_coding_type	I, P	I, P, B	I, P, B	I, P, B	I, P, B	I, P, B
repeat_first_field	Constrained		Unconstrained			Constrained
sequence_scalable_extension()	No	No	Yes	Yes	Yes	No
scalable_mode	–	–	SNR	SNR or Spatial	SNR or Spatial	–
picture_spatial_scalable_extension()	No	No	No	Yes	Yes	No
intra_dc_precision	8, 9, 10	8, 9, 10	8, 9, 10	8, 9, 10	8, 9, 10, 11	8, 9, 10, 11
Slice structure	Restricted 6.1.2.2					

Replace Table 8-6 by:

Table 8-6 – Maximum number of bits in a macroblock

chroma_format	Maximum number of bits
4:2:0	4608
4:2:2	6144
4:2:2 (in 4:2:2 Profile)	Unconstrained
4:4:4	9216

3) Subclause 8.2.1

After the following bullet in 8.2.1:

- if vertical_size > 480 lines frame_rate shall be “25Hz”

add the following text:

Additionally, the following constraints exist for 4:2:2 profile @ Main level only:

- if vertical_size > 512 lines,
then if picture_coding_type=011 (i.e. B-picture), repeat_first_field shall be 0;
- if vertical_size > 512 lines frame_rate shall be “25Hz”.

4) Subclause 8.5

Replace Table 8-11 by:

Table 8-11 – Upper bounds for sampling density

Level	Spatial resolution layer		Profile					
			Simple	Main	SNR	Spatial	High	4:2:2
High	Enhancement	Samples/line		1920			1920	
		Lines/frame		1152			1152	
		Frames/sec		60			60	
	Lower	Samples/line		–			960	
		Lines/frame		–			576	
		Frames/sec		–			30	
High-1440	Enhancement	Samples/line		1440		1440	1440	
		Lines/frame		1152		1152	1152	
		Frames/sec		60		60	60	
	Lower	Samples/line		–		720	720	
		Lines/frame		–		576	576	
		Frames/sec		–		30	30	
Main	Enhancement	Samples/line	720	720	720		720	720
		Lines/frame	576	576	576		576	608 ^{a)}
		Frames/sec	30	30	30		30	30
	Lower	Samples/line	–	–	–		352	–
		Lines/frame	–	–	–		288	–
		Frames/sec	–	–	–		30	–
Low	Enhancement	Samples/line		352	352			
		Lines/frame		288	288			
		Frames/sec		30	30			
	Lower	Samples/line		–	–			
		Lines/frame		–	–			
		Frames/sec		–	–			

^{a)} 512 lines/frame for 525/60, 608 lines/frame for 625/50

NOTE – In the case of single layer or SNR scaled coding, the limits specified by “Enhancement layer” apply.

Replace Table 8-12 by:

Table 8-12 – Upper bounds for luminance sample rate (samples/sec)

Level	Spatial resolution layer	Profile					
		Simple	Main	SNR	Spatial	High	4:2:2
High	Enhancement		62 668 800			62 668 800 (4:2:2) 83 558 400 (4:2:0)	
	Lower		–			14 745 600 (4:2:2) 19 660 800 (4:2:0)	
High-1440	Enhancement		47 001 600		47 001 600	47 001 600 (4:2:2) 62 668 800 (4:2:0)	
	Lower		–		10 368 000	11 059 200 (4:2:2) 14 745 600 (4:2:0)	
Main	Enhancement	10 368 000	10 368 000	10 368 000		11 059 200 (4:2:2) 14 745 600 (4:2:0)	11 059 200
	Lower	–	–	–		– 3 041 280 (4:2:0)	–
Low	Enhancement		3 041 280	3 041 280			
	Lower		–	–			

NOTE – In the case of single layer or SNR scaled coding, the limits specified by “Enhancement layer” apply.

Replace Table 8-13 by:

Table 8-13 – Upper bounds for bit rates (Mbit/s)

Level	Profile					
	Simple	Main	SNR	Spatial	High	4:2:2
High		80			100 all layers 80 middle + base layer 25 base layer	
High-1440		60		60 all layers 40 middle + base layers 15 base layer	80 all layers 60 middle + base layers 20 base layer	
Main	15	15	– 15 both layers 10 base layer		20 all layers 15 middle + base layer 4 base layer	50
Low		4	– 4 both layers 3 base layer			

Replace Table 8-14 by:

Table 8-14 – VBV buffer size requirements (bits)

Level	Layer	Profile					
		Simple	Main	SNR	Spatial	High	4:2:2
High	Enhancement 2 Enhancement 1 Base		9 781 248			12 222 464 9 781 248 3 047 424	
High-1440	Enhancement 2 Enhancement 1 Base		7 340 032		7 340 032 4 882 432 1 835 008	9 781 248 7 340 032 2 441 216	
Main	Enhancement 2 Enhancement 1 Base	1 835 008	1 835 008	— 1 835 008 1 212 416		2 441 216 1 835 008 475 136	9 437 184
Low	Enhancement 2 Enhancement 1 Base		475 136	— 475 136 360 448			

Replace Table 8-15 by:

Table 8-15 – Forward compatibility between different profiles and levels

Profile and Level indication in bitstream	Decoder											
	HP @ HL	HP @ H-14	HP @ ML	Spatial @ H-14	SNR @ ML	SNR @ LL	MP @ HL	MP @ H-14	MP @ ML	MP @ LL	SP @ ML	4:2:2 @ ML
HP@HL	X											
HP@H-14	X	X										
HP@ML	X	X	X									
Spatial@H-14	X	X		X								
SNR@ML	X	X	X	X	X							
SNR@LL	X	X	X	X	X	X						
MP@HL	X						X					
MP@H-14	X	X		X			X	X				
MP@ML	X	X	X	X	X		X	X	X			X ^{b)}
MP@LL	X	X	X	X	X	X	X	X	X	X	X ^{a)}	X ^{b)}
SP@ML	X	X	X	X	X		X	X	X		X	X ^{b)}
ISO/IEC 11172	X	X	X	X	X	X	X	X	X	X	X	X ^{b)}
4:2:2@ML												X

X Indicates that the decoder shall be able to decode the bit stream including all relevant lower layers.

a) SP@ML decoders are required to decode MP@LL bitstreams.

b) A 4:2:2 profile@Main level decoder shall be able to decode Main profile@Main level, Main profile@Low level and Simple profile@Main level bit streams, as well as ISO/IEC 11172-2 constrained system parameter bit streams.

5) Annex E

Replace Table E.2 by:

Table E.2 – Sequence header

#	Status							Type	
	4:2:2								Comments
	HIGH								
	SPATIAL								
	SNR								
	MAIN								
	SIMPLE								
	Syntactic elements								
01	horizontal_size_value	x	x	x	x	x	x	D	Table 8-11
02	vertical_size_value	x	x	x	x	x	x	D	Table 8-11
03	aspect_ratio_information	x	x	x	x	x	x	P	
04	frame_rate_code	x	x	x	x	x	x	D	Table 8-11
05	(pel rate) NOTE – This is not a syntactic element.							D	Table 8-12; pel rate is a product of pels/line, lines/frame and frames/sec
06	bit_rate_value	x	x	x	x	x	x	D	Table 8-13
07	vbv_buffer_size_value	x	x	x	x	x	x	D	Table 8-14
08	constrained_parameters_flag	x	x	x	x	x	x	I	Set to “1” if ISO/IEC 11172-2 constrained, Set to “0” if ITU-T Rec. H.262 ISO/IEC 13818-2
09	load_intra_quantiser_matrix	x	x	x	x	x	x	I	
10	intra_quantiser_matrix[64]	x	x	x	x	x	x	I	
11	load_non_intra_quantiser_matrix	x	x	x	x	x	x	I	
12	non_intra_quantiser_matrix[64]	x	x	x	x	x	x	I	
13	sequence_extension()	x	x	x	x	x	x	I	Always present if ITU-T Rec. H.262 ISO/IEC 13818-2
14	sequence_display_extension()	x	x	x	x	x	x	P	
15	sequence_scalable_extension()	o	o	x	x	x	o	I	Table 8-9 for maximum number of scalable layers
16	user_data()	x	x	x	x	x	x	I	Decoder may skip this data

Replace Table E.3 by:

Table E.3 – Sequence extension

#	Status							Type	
	4:2:2								
	HIGH								
	SPATIAL								
	SNR								
	MAIN								
	SIMPLE								
	Syntactic elements								
								Comments	
01	profile_and_level_indication	x	x	x	x	x	x	D	Profile: one of 8 values Level: one of 16 values Escape bits: one of 2 values
02	progressive_sequence	x	x	x	x	x	x	I	
03	chroma_format	x	x	x	x	x	x	I	Table 8-5
04	horizontal_size_extension	x	x	x	x	x	x	D	Input picture size related
05	vertical_size_extension	x	x	x	x	x	x	D	Input picture size related
06	bit_rate_extension	x	x	x	x	x	x	D	Input picture size related
07	vbv_buffer_size_extension	x	x	x	x	x	x	D	Input picture size related
08	low_delay	x	x	x	x	x	x	I	
09	frame_rate_extension_n	x	x	x	x	x	x	I	Set to "0" for all defined profiles
10	frame_rate_extension_d	x	x	x	x	x	x	I	Set to "0" for all defined profiles

Replace Table E.4 by:

Table E.4 – Sequence display extension elements

#	Status							Type	Comments
	4:2:2								
	HIGH								
	SPATIAL								
	SNR								
	MAIN								
	SIMPLE								
	Syntactic elements								
01	video_format	x	x	x	x	x	x	P	
02	colour_description	x	x	x	x	x	x	P	Input format related
03	colour_primaries	x	x	x	x	x	x	P	
04	transfer_characteristics	x	x	x	x	x	x	P	
05	matrix_coefficients	x	x	x	x	x	x	P	
06	display_horizontal_size	x	x	x	x	x	x	P	Input format related
07	display_vertical_size	x	x	x	x	x	x	P	Input format related