INTERNATIONAL STANDARD

ISO/IEC 13818-2

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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

Reference number
ISO/IEC 13818-2:1996/Amd.2:1997(E)

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. 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.

Amendment 2 to International Standard ISO/IEC 13818-2:1996 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*, in collaboration with ITU-T. The identical text is published as ITU-T Rec. H.262/Amd.2.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – GENERIC CODING OF MOVING PICTURES AND ASSOCIATED AUDIO INFORMATION: VIDEO

AMENDMENT 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

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Type	Comments
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

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Type	Comments
01	**profile_and_level_indication**	x	x	x	x	x	x	D	Profile: one of 8 values Level: one of 16 values Escape bit: 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

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Type	Comments
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

Replace Table E.5 by:

Table E.5 – Sequence scalable extension

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Type	Comments
01	**scalable_mode**	o	o	x	x	x	o	I	SNR Profile: SNR Scalability Spatial and High Profile: SNR or Spatial Scalability
02	**layer_id**	o	o	x	x	x	o	I	
	if (spatial scalable)								
03	**lower_layer_prediction_ horizontal_size**	o	o	o	x	x	o	D	Table 8-12 for luminance sampling density
04	**lower_layer_prediction_ vertical_size**	o	o	o	x	x	o	D	Table 8-12 for luminance sampling density
05	**horizontal_subsampling_ factor_m**	o	o	o	x	x	o	I	
06	**horizontal_subsampling_ factor_n**	o	o	o	x	x	o	I	
07	**vertical_subsampling_ factor_m**	o	o	o	x	x	o	I	
08	**vertical_subsampling_ factor_n**	o	o	o	x	x	o	I	
	if (temporal scalable)								
09	**picture_mux_enable**	o	o	o	o	o	o	I	
10	**mux_to_progressive_ sequence**	o	o	o	o	o	o	I	
11	**picture_mux_order**	o	o	o	o	o	o	I	
12	**picture_mux_factor**	o	o	o	o	o	o	I	

Replace Table E.6 by:

Table E.6 – Group of pictures header

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Type	Comments
01	**time_code**	x	x	x	x	x	x	I	Decoder may skip this data
02	**closed_gop**	x	x	x	x	x	x	I	
03	**broken_link**	x	x	x	x	x	x	I	