INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.262

Amendment 3
(02/98)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Coding of moving video

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

Amendment 3

ITU-T Recommendation H.262 – Amendment 3

(Previously CCITT Recommendation)

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INTERNATIONAL STANDARD 13818-2

ITU-T RECOMMENDATION H.262

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

AMENDMENT 3

Source

The ITU-T Recommendation H.262, Amendment 3 was approved on the 6th of February 1998. The identical text is also published as ISO/IEC International Standard 13818-2.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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

AMENDMENT 3

1) Subclause 6.2.2.2.1

Replace 6.2.2.2.1 by the following:

6.2.2.2.1 Extension data

extension_data(i) {	No. of bits	Mnemonic
while (nextbits()== extension_start_code) {		
extension_start_code	32	bslbf
if (i == 0) { /* follows sequence_extension() */		
if (nextbits()== "Sequence Display Extension ID")		
sequence_display_extension()		
else if (nextbits()		
== "Sequence Scalable Extension ID")		
sequence_scalable_extension()		
}		
/* NOTE – i never takes the value 1 because extension_data()		
never follows a group_of_pictures_header() */		
if (i == 2) { /* follows picture_coding_extension() */		
if (nextbits() == "Quant Matrix Extension ID")		
quant_matrix_extension()		
else if (nextbits() == "Copyright Extension ID")		
copyright_extension()		
else if (nextbits() == "Picture Display Extension ID")		
picture_display_extension()		
else if (nextbits()		
== "Picture Spatial Scalable Extension ID")		
picture_spatial_scalable_extension()		
else if (nextbits()		
== "Picture Temporal Scalable Extension ID")		
picture_temporal_scalable_extension()		
else if (nextbits()		
== "Camera Parameters Extension ID")		
camera_parameters_extension()		
}		
}		
}		

2) Subclause 6.3.1

Replace Table 6-2 by:

Table 6-2 – extension_start_code_identifier codes

extension_start_code_identifier	Name
0000	Reserved
0001	Sequence Extension ID
0010	Sequence Display Extension ID
0011	Quant Matrix Extension ID
0100	Copyright Extension ID
0101	Sequence Scalable Extension ID
0110	Reserved
0111	Picture Display Extension ID
1000	Picture Coding Extension ID
1001	Picture Spatial Scalable Extension ID
1010	Picture Temporal Scalable Extension ID
1011	Camera Parameters Extension ID
1100	Reserved
…	…
1111	Reserved

3) New subclause 6.2.3.7.1

Insert new subclause 6.2.3.7.1:

6.2.3.7.1 Camera parameters extension

camera_parameters_extension() {	No. of bits	Mnemonic
extension_start_code_identifier	4	uimsbf
reserved	1	uimsbf
camera_id	7	simsbf
marker_bit	1	bslbf
height_of_image_device	22	uimsbf
marker_bit	1	bslbf
focal_length	22	uimsbf
marker_bit	1	bslbf
f_number	22	uimsbf
marker_bit	1	bslbf
vertical_angle_of_view	22	uimsbf
marker_bit	1	bslbf
camera_position_x_upper	16	simsbf
marker_bit	1	bslbf
camera_position_x_lower	16	
marker_bit	1	bslbf
camera_position_y_upper	16	simsbf
marker_bit	1	bslbf
camera_position_y_lower	16	
marker_bit	1	bslbf
camera_position_z_upper	16	simsbf
marker_bit	1	bslbf
camera_position_z_lower	16	
marker_bit	1	bslbf
camera_direction_x	22	simsbf
marker_bit	1	bslbf
camera_direction_y	22	simsbf
marker_bit	1	bslbf
camera_direction_z	22	simsbf
marker_bit	1	bslbf
image_plane_vertical_x	22	simsbf
marker_bit	1	bslbf
image_plane_vertical_y	22	simsbf
marker_bit	1	bslbf
image_plane_vertical_z	22	simsbf
marker_bit	1	bslbf
reserved	32	bslbf
next_start_code()		
}		

4) New subclause 6.3.19

Insert new subclause 6.3.19:

6.3.19 Camera parameters extension

camera_id – The number in camera_id identifies a camera.

height_of_image_device – This is a 22-bit unsigned integer which specifies the height of image device. Its value shall be measured to a resolution of 0.001 millimeter and having a range of zero to 4,194.303 mm.

focal_length – This is a 22-bit unsigned integer which specifies the focal length. Its value shall be measured to a resolution of 0.001 millimeter and having a range of zero to 4,194.303 mm.

f_number – This is a 22-bit unsigned integer which specifies the F-number. F-number is defined by (focal_length)/(effective aperture of lens). Its value shall be measured to a resolution of 0.001 and having a range of zero to 4,194.303.

vertical_angle_of_view – This is a 22-bit unsigned integer which specifies the vertical angle of the field of view as determined between the top and bottom edges of the image device. Its value shall be measured to a resolution of 0.0001 degree and having a range of zero to 180 degrees.

camera_position_x_upper, camera_position_y_upper, camera_position_z_upper – These words constitute the 16 most significant bits of camera_position_x, camera_position_y and camera_position_z respectively.

camera_position_x_lower, camera_position_y_lower, camera_position_z_lower – These words constitute the 16 least significant bits of camera_position_x, camera_position_y and camera_position_z respectively.

camera_position_x, camera_position_y, camera_position_z – A set of these values specifies the position of the optical principal point of the camera in a user-specified world coordinate system. Each of these values shall be measured to a resolution of 0.001 millimeter and having a range of +2,147,483.647 mm to –2,147,483.648 mm. The camera_position_x is a 32-bit signed (two's complement) integer, the 16 least significant bits are defined in camera_position_x_lower, the 16 most significant bits are defined in camera_position_x_upper. The camera_position_y is a 32-bit signed (two's complement) integer, the 16 least significant bits are defined in camera_position_y_lower, the 16 most significant bits are defined in camera_position_y_upper. The camera_position_z is a 32-bit signed (two's complement) integer, the 16 least significant bits are defined in camera_position_z_lower, the 16 most significant bits are defined in camera_position_z_upper.

camera_direction_x, camera_direction_y, camera_direction_z – A set of these values specifies the direction of the camera. The direction of the camera is defined by using the vector from optical principal point to a point which is in front of the camera and is on the optical axis of the camera. Each of these values is a 22-bit signed (two's complement) integer and having a range of +2,097,151 to –2,097,152.

image_plane_vertical_x, image_plane_vertical_y, image_plane_vertical_z – A set of these values specifies the upper direction of the camera. The upper direction of the camera is defined by using the vector which is parallel to the side edge of the image device and is from bottom edge to top edge. Each of these values is a 22-bit signed (two's complement) integer and is having a range of +2,097,151 to –2,097,152.

Figures in Appendix I explain these terms pictorially.

5) Clause 8

a) Replace Table 8-4 by:

Table 8-4 – Escape profile_and_level_indication identification

profile_and_level_indication	Name
10001111 to 11111111	(Reserved)
10001110	Multi-view profile @ Low level
10001101	Multi-view profile @ Main level
10001100	(Reserved)
10001011	Multi-view profile @ High1440 level
10001010	Multi-view profile @ High level
10000110 to 10001001	(Reserved)
10000101	4:2:2 profile @ Main level
10000000 to 10000100	(Reserved)

b) Add the following text as a Note after the Note on 4:2:2 Profile (as indicated in Amendment 2); accordingly, the Note on 4:2:2 Profile shall be renamed "NOTE 1 – On 4:2:2 Profile ":

NOTE 2 – On Multi-view Profile: The Multi-view Profile (MVP) is envisioned to be a profile appropriate for applications that require multiple viewpoints within the context of ITU-T Rec. H.262 | ISO/IEC 13818-2. MVP supports stereoscopic pictures as its source images for a wide range of picture resolution and quality as requested by the applications to be used. A base layer of MVP is assigned to a left view and an enhancement layer is assigned to a right view.

A monoscopic coding with the same tools as Main Profile (MP), including ISO/IEC IS 11172-2, is applied to the base layer. An enhancement layer is coded using Temporal Scalability tools and a hybrid prediction of motions and disparity can be utilized in the enhanced layer.

MVP, viewed as one of the scalable profiles in terms of multiple viewpoint layers, is expected to have the same type of compatibility features other scalable profiles have, such as compatibility with MP. For example:

1) decoders compliant to MVP at a certain Level are capable of decoding the bitstreams compliant to MP at the corresponding Level (i.e. forward compatibility);

2) decoders compliant to MP at a certain Level are capable of decoding the bitstream in the base layer of MVP (i.e. backward compatibility).

6) 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	Multi-view
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	4:2:0
frame_rate_extension_n	0	0	0	0	0	0	0
frame_rate_extension_d	0	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	0001, 0010, 0011
picture_coding_type	I, P	I, P, B	I, P, B	I, P, B	I, P, B	I, P, B	I, P, B
repeat_first_field	Constrained		Unconstrained			Constrained	Unconstrained
sequence_scalable_ extension()	No	No	Yes	Yes	Yes	No	Yes
scalable_mode	–	–	SNR	SNR or Spatial	SNR or Spatial	–	Temporal
picture_spatial_scalable_ extension()	No	No	No	Yes	Yes	No	No
picture_temporal_scalable_ extension()	No	No	No	No	No	No	Yes
intra_dc_precision	8, 9, 10	8, 9, 10	8, 9, 10	8, 9, 10	8, 9, 10, 11	8, 9, 10, 11	8, 9, 10
Slice structure	Restricted 6.1.2.2						

7) Subclause 8.4

Replace the text and Table 8-9 by:

The SNR Scalable, Spatial Scalable, High and Multi-view profiles may use more than one bitstream to code the image. These different bitstreams represent layers of coding, which when combined create a higher quality image than that obtainable from one layer alone (see Annex D). The maximum number of layers for a given profile is specified in Table 8-9. The scalable layers are named according to Table 7-31. The syntactic and parameter constraints for these profile/level combinations when coded using the maximum permitted number of layers are given in Tables 8-11, 8-12, 8-13 and 8-14. When the number of layers is less than the maximum permitted, reference should also be made to Tables E-21 to E-46 as appropriate.

It should be noted that a bitstream of the base layer of SNR Scalable and Multi-view profiles can always be decoded by a Main profile decoder of equivalent level. Conversely, a Main profile bitstream shall be decodable by either SNR Scalable or Multi-view profile decoder of equivalent level.

Table 8-9 – Upper bounds for scalable layers in SNR Scalable, Spatial Scalable, High and Multi-view profiles

Level	Maximum Number of	Profile			
		SNR	Spatial	High	Multi-view
High	All layers (base + enhancement) Spatial enhancement layers SNR enhancement layers Temporal auxiliary layers			3 1 1 0	2 0 0 1
High-1440	All layers (base + enhancement) Spatial enhancement layers SNR enhancement layers Temporal auxiliary layers		3 1 1 0	3 1 1 0	2 0 0 1
Main	All layers (base + enhancement) Spatial enhancement layers SNR enhancement layers Temporal auxiliary layers	2 0 1 0		3 1 1 0	2 0 0 1
Low	All layers (base + enhancement) Spatial enhancement layers SNR enhancement layers Temporal auxiliary layers	2 0 1 0			2 0 0 1

8) Subclause 8.4.1

Replace the text and Table 8-10 by:

Table 8-10 is a summary of the permitted combinations, and is subject to the following rules:

- SNR Scalable and Multi-view profile: maximum of 2 layers; Spatial Scalable and High profile: maximum of 3 layers. (See Table 8-9.)
- Only one SNR and one Spatial scale allowed in 3-layer combinations, either SNR/Spatial or Spatial/SNR order is permitted. (See Table 8-9.)
- Adding 4:2:2 chroma format to a 4:2:0 lower layer is considered an SNR enhancement permitted for either SNR or Spatial scale.
- A 4:2:0 layer is not permitted if the lower layer is 4:2:2. (See 7.7.3.3.)

Table 8-10 – Permissible layer combinations

	Scalable mode			Profile/level of simplest base layer decoder (level reference top layer) [a]
Profile	Base layer	Enhancement layer 1	Enhancement layer 2	
SNR	4:2:0	SNR, 4:2:0	–	MP@same level
Spatial	4:2:0	SNR, 4:2:0	–	MP@same level
Spatial	4:2:0	Spatial, 4:2:0	–	MP@(level – 1)
Spatial	4:2:0	SNR, 4:2:0	Spatial, 4:2:0	MP@(level – 1)
Spatial	4:2:0	Spatial, 4:2:0	SNR, 4:2:0	MP@(level – 1)
High	4:2:0	–	–	HP@same level
High	4:2:2	–	–	HP@same level
High	4:2:0	SNR, 4:2:0	–	HP@same level
High	4:2:0	SNR, 4:2:2	–	HP@same level
High	4:2:2	SNR, 4:2:2	–	HP@same level
High	4:2:0	Spatial, 4:2:0	–	HP@(level – 1)
High	4:2:0	Spatial, 4:2:2	–	HP@(level – 1)
High	4:2:2	Spatial, 4:2:2	–	HP@(level – 1) [b]
High	4:2:0	SNR, 4:2:0	Spatial, 4:2:0	HP@(level – 1)
High	4:2:0	SNR, 4:2:0	Spatial, 4:2:2	HP@(level – 1)
High	4:2:0	SNR, 4:2:2	Spatial, 4:2:2	HP@(level – 1) [b]
High	4:2:2	SNR, 4:2:2	Spatial, 4:2:2	HP@(level – 1) [b]
High	4:2:0	Spatial, 4:2:0	SNR, 4:2:0	HP@(level – 1)
High	4:2:0	Spatial, 4:2:0	SNR, 4:2:2	HP@(level – 1)
High	4:2:0	Spatial, 4:2:2	SNR, 4:2:2	HP@(level – 1)
High	4:2:2	Spatial, 4:2:2	SNR, 4:2:2	HP@(level – 1) [b]
Multi-view	4:2:0	Temporal, 4:2:0	–	MP@same level

[a] The simplest compliant decoder to decode the base layer is specified, assuming that bitstream may contain any syntax and parameter value permitted for the stated profile @ level, except scalability. Note that for High profile @ Main level spatially scaled bitstreams, 'HP @ (level – 1)' becomes 'MP @ (level – 1)'. In the event that a base layer bitstream uses fewer syntactic elements or a reduced parameter range than permitted, profile_and_level_indication may indicate a 'simpler' profile @ level.

[b] Note that 4:2:2 chroma format is not supported as a lower spatial layer of High profile @ Main level (see Table 8-12).

9) New subclause 8.4.2

Add the following new subclause:

8.4.2 Multi-view Profile specific constraints

Both the enhancement and base layers have the same frame rate.

The picture_mux_enable, picture_mux_order and picture_mux_factor are not used in this profile and shall be ignored.

The reference_select_code should be "00" or "01" for the P-frames in the enhancement layer. The reference_select_code should be "01" for B-frames in the enhancement layer.

If the base layer coded frame is the first frame of the Group Of Pictures then the corresponding frame in the enhancement layer should be either I-frame or P-frame with the reference_select_code value of “01”.

In a P-field picture with reference_select_code = "01" and which is the first field of a frame, the following restriction applies:

- Dual prime prediction shall not be used.
- Field prediction in which motion_vertical_field_select indicates the second field of the base layer frame shall not be used.
- If base and enhancement layers do not have the same value for top_field_first, there shall be no macroblocks that are coded with macroblock_motion_forward zero and macroblock_intra zero.
- If base and enhancement layer do not have the same value for top_field_first, there shall be no skipped macroblocks.

In a B-field picture which is the first field of a frame, the prediction shall not make reference to the second field of the corresponding base layer frame.

It is inherent in the Multi-view Profile that the two layers are tightly coupled to one another. It is a requirement that the pictures in enhancement layer shall be decoded immediately after their corresponding required reference pictures are decoded unless this requirement makes one to decode the enhancement layer pictures out of display order. In that case, the pictures in the enhancement layer should be decoded in the display order.

10) Subclause 8.5

a) 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	Multi-view
High	Enhancement	Samples/line Lines/frame Frames/sec		1920 1152 60			1920 1152 60		1920 1152 60
	Lower	Samples/line Lines/frame Frames/sec		–			960 576 30		1920 1152 60
High-1440	Enhancement	Samples/line Lines/frame Frames/sec		1440 1152 60		1440 1152 60	1440 1152 60		1440 1152 60
	Lower	Samples/line Lines/frame Frames/sec		–		720 576 30	720 576 30		1440 1152 60
Main	Enhancement	Samples/line Lines/frame Frames/sec	720 576 30	720 576 30	720 576 30		720 576 30	720 608 [a] 30	720 576 30
	Lower	Samples/line Lines/frame Frames/sec	–	–	–		352 288 30	–	720 576 30
Low	Enhancement	Samples/line Lines/frame Frames/sec		352 288 30	352 288 30				352 288 30
	Lower	Samples/line Lines/frame Frames/sec		–	–				352 288 30

[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.

b) 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	Multi-view
High	Enhancement		62 668 800			62 668 800 (4:2:2) 83 558 400 (4:2:0)		62 668 800
	Lower		–			14 745 600 (4:2:2) 19 660 800 (4:2:0)		62 668 800
High-1440	Enhancement		47 001 600		47 001 600	47 001 600 (4:2:2) 62 668 800 (4:2:0)		47 001 600
	Lower		–		10 368 000	11 059 200 (4:2:2) 14 745 600 (4:2:0)		47 001 600
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	10 368 000
	Lower	–	–	–		– 3 041 280 (4:2:0)	–	10 368 000
Low	Enhancement		3 041 280	3 041 280				3 041 280
	Lower		–	–				3 041 280
NOTE – In the case of single layer or SNR scaled coding, the limits specified by 'Enhancement layer' apply.								

c) 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	Multi-view
High		80			100 all layers 80 middle + base layer 25 base layer		– 130 both layers 80 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		– 100 both layers 60 base layer
Main	15	15	– 15 both layers 10 base layer		20 all layers 15 middle + base layer 4 base layer	50	– 25 both layers 15 base layer
Low		4	– 4 both layers 3 base layer				– 8 both layers 4 base layer

d) Replace Table 8-14 by:

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

Level	Layer	Profile						
		Simple	Main	SNR	Spatial	High	4:2:2	Multi-view
High	Enhancement 2 Enhancement 1 Base		 9 781 248			12 222 464 9 781 248 3 047 424		– 15 898 480 9 787 248
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		– 12 222 464 7 340 032
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	– 3 047 424 1 835 008
Low	Enhancement 2 Enhancement 1 Base		 475 136	– 475 136 360 448				– 950 272 475 136

e) 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	MVP @ HL	MVP @ H-14	MVP @ ML	MVP @ LL
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						X			
MP@H-14	X	X		X			X	X					X	X		
MP@ML	X	X	X	X	X		X	X	X			X[b]	X	X	X	
MP@LL	X	X	X	X	X	X	X	X	X	X	X[a]	X[b]	X	X	X	X
SP@ML	X	X	X	X	X		X	X	X		X	X[b]	X	X	X	
ISO/IEC 11172-2	X	X	X	X	X	X	X	X	X	X	X	X[b]	X	X	X	X
4:2:2@ML												X				
MVP@HL													X			
MVP@H-14													X	X		
MVP@ML													X	X	X	
MVP@LL													X	X	X	X

X indicates that the decoder shall be able to decode the bitstream including all relevant lower layers.

a) Note that 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 bitstreams, as well as ISO/IEC 11172-2 constrained system parameter bitstreams.

11) Annex E

a) Replace Table E.2 by:

Table E.2 – Sequence header

#	Syntactic elements	Status							Type	Comments
		SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view		
01	**horizontal_size_value**	x	x	x	x	x	x	x	D	Table 8-11
02	**vertical_size_value**	x	x	x	x	x	x	x	D	Table 8-11
03	**aspect_ratio_information**	x	x	x	x	x	x	x	P	
04	**frame_rate_code**	x	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	x	D	Table 8-13
07	**vbv_buffer_size_value**	x	x	x	x	x	x	x	D	Table 8-14
08	**constrained_parameters_flag**	x	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	x	I	
10	**intra_quantiser_matrix[64]**	x	x	x	x	x	x	x	I	
11	**load_non_intra_quantiser_matrix**	x	x	x	x	x	x	x	I	
12	**non_intra_quantiser_matrix[64]**	x	x	x	x	x	x	x	I	
13	sequence_extension()	x	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	x	P	
15	sequence_scalable_extension()	o	o	x	x	x	o	x	I	Table 8-9 for maximum number of scalable layers
16	user_data()	x	x	x	x	x	x	x	I	Decoder may skip this data

b) Replace Table E.3 by:

Table E.3 – Sequence extension

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**profile_and_level_indication**	x	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	x	I	
03	**chroma_format**	x	x	x	x	x	x	x	I	Table 8-5
04	**horizontal_size_extension**	x	x	x	x	x	x	x	D	Input picture size related
05	**vertical_size_extension**	x	x	x	x	x	x	x	D	Input picture size related
06	**bit_rate_extension**	x	x	x	x	x	x	x	D	Input picture size related
07	**vbv_buffer_size_extension**	x	x	x	x	x	x	x	D	Input picture size related
08	**low_delay**	x	x	x	x	x	x	x	I	
09	**frame_rate_extension_n**	x	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	x	I	Set to "0" for all defined profiles

c) Replace Table E.4 by:

Table E.4 – Sequence display extension elements

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

d) Replace Table E.5 by:

Table E.5 – Sequence scalable extension

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

e) *Replace Table E.6 by:*

Table E.6 – Group of pictures header

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

f) *Replace Table E.7 by:*

Table E.7 – Picture header

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**temporal_reference**	x	x	x	x	x	x	x	I	
02	**picture_coding_type**	x	x	x	x	x	x	x	I	Simple Profile: I, P at Main level, I, P, B at Low level Main, SNR, Spatial, High and Multi-view Profile: I, P, B
03	**vbv_delay**	x	x	x	x	x	x	x	I	
04	**full_pel_forward_vector**	x	x	x	x	x	x	x	I	Set to "0" for ITU-T Rec. H.262 | ISO/IEC 13818-2
05	**forward_f_code**	x	x	x	x	x	x	x	I	Set to "111" for ITU-T Rec. H.262 | ISO/IEC 13818-2
06	**full_pel_backward_vector**	x	x	x	x	x	x	x	I	Set to "0" for ITU-T Rec. H.262 | ISO/IEC 13818-2
07	**backward_f_code**	x	x	x	x	x	x	x	I	Set to "111" for ITU-T Rec. H.262 | ISO/IEC 13818-2
08	**extra_information_picture**	x	x	x	x	x	x	x	I	
09	picture_coding_extension()	x	x	x	x	x	x	x	I	
10	quant_matrix_extension()	x	x	x	x	x	x	x	I	
11	picture_display_extension()	x	x	x	x	x	x	x	P	
12	picture_spatial_scalable_extension()	o	o	o	x	x	o	o	I	
13	picture_temporal_scalable_extension()	o	o	o	o	o	o	x	I	
14	camera_parameters_extension()	o	o	o	o	o	o	x	P	

g) Replace Table E.8 by:

Table E.8 – Picture coding extension

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**f_code[0][0] (forward horizontal)**	x	x	x	x	x	x	x	D	Low Level [1:7] Main Level [1:8] High-1440 and High Level [1:9]
02	**f_code[0][1] (forward vertical)**	x	x	x	x	x	x	x	D	Low Level [1:4] Main, High-1440 and High Level [1:5]
03	**f_code[1][0](backward horizontal)**	x	x	x	x	x	x	x	D	Low Level [1:7] Main Level [1:8] High-1440 and High Level [1:9]
04	**f_code[1][1] (backward vertical)**	x	x	x	x	x	x	x	D	Low level [1:4] Main, H-14 and High Level [1:5]
05	**intra_dc_precision**	x	x	x	x	x	x	x	I	Simple, Main, SNR, Spatial and Multi-view Profile: [8:10] High Profile: [8:11] 4:2:2 Profile: [8:11]
06	**picture_structure**	x	x	x	x	x	x	x	I	
07	**top_field_first**	x	x	x	x	x	x	x	I	
08	**frame_pred_frame_dct**	x	x	x	x	x	x	x	I	
09	**concealment_motion_vectors**	x	x	x	x	x	x	x	I	
10	**q_scale_type**	x	x	x	x	x	x	x	I	
11	**intra_vlc_format**	x	x	x	x	x	x	x	I	
12	**alternate_scan**	x	x	x	x	x	x	x	I	
13	**repeat_first_field**	x	x	x	x	x	x	x	I	
14	**chroma_420_type**	x	x	x	x	x	x	x	P	
15	**progressive_frame**	x	x	x	x	x	x	x	P	
16	**composite_display_flag**	x	x	x	x	x	x	x	P	
17	**v_axis**	x	x	x	x	x	x	x	P	
18	**field_sequence**	x	x	x	x	x	x	x	P	
19	**sub_carrier**	x	x	x	x	x	x	x	P	
20	**burst_amplitude**	x	x	x	x	x	x	x	P	
21	**sub_carrier_phase**	x	x	x	x	x	x	x	P	

h) Replace Table E.9 by:

Table E.9 – Quant matrix extension

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**load_intra_quantiser_matrix**	x	x	x	x	x	x	x	I	
02	**intra_quantiser_matrix[64]**	x	x	x	x	x	x	x	I	
03	**load_non_intra_quantiser_matrix**	x	x	x	x	x	x	x	I	
04	**non_intra_quantiser_ matrix[64]**	x	x	x	x	x	x	x	I	
05	**load_chroma_intra_quantiser_ matrix**	o	o	o	o	x	x	o	I	
06	**chroma_intra_quantiser_ matrix[64]**	o	o	o	o	x	x	o	I	
07	**load_chroma_non_intra_ quantiser_matrix**	o	o	o	o	x	x	o	I	
08	**chroma_non_intra_quantiser_ matrix[64]**	o	o	o	o	x	x	o	I	

i) Replace Table E.10 by:

Table E.10 – Picture display extension

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**frame_centre_horizontal_offset**	x	x	x	x	x	x	x	P	Input format related
02	**frame_centre_vertical_offset**	x	x	x	x	x	x	x	P	Input format related

j) *Replace Table E.11 by:*

Table E.11 – Picture temporal scalable extension

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**reference_select_code**	o	o	o	o	o	o	x	I	
02	**forward_temporal_reference**	o	o	o	o	o	o	x	I	
03	**backward_temporal_reference**	o	o	o	o	o	o	x	I	

k) *Replace Table E.12 by:*

Table E.12 – Picture spatial scalable extension

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**lower_layer_temporal_reference**	o	o	o	x	x	o	o	I	
02	**lower_layer_horizontal_offset**	o	o	o	x	x	o	o	D	Input format related
03	**lower_layer_vertical_offset**	o	o	o	x	x	o	o	D	Input format related
04	**spatial_temporal_weight_code_ table_index**	o	o	o	x	x	o	o	I	
05	**lower_layer_progressive_frame**	o	o	o	x	x	o	o	I	
06	**lower_layer_deinterlaced_field_ select**	o	o	o	x	x	o	o	I	

l) *Insert new Table E.12-1:*

Table E.12-1 – Camera parameters extension

#	Syntactic elements	Status							Type	Comments
		SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view		
01	**reserved**	o	o	o	o	o	o	x	P	
02	**camera_id**	o	o	o	o	o	o	x	P	
03	**marker_bit**	o	o	o	o	o	o	x	P	
04	**height_of_image_device**	o	o	o	o	o	o	x	P	
05	**marker_bit**	o	o	o	o	o	o	x	P	
06	**focal_length**	o	o	o	o	o	o	x	P	
07	**marker_bit**	o	o	o	o	o	o	x	P	
08	**f_number**	o	o	o	o	o	o	x	P	
09	**marker_bit**	o	o	o	o	o	o	x	P	
10	**vertical_angle_of_view**	o	o	o	o	o	o	x	P	
11	**marker_bit**	o	o	o	o	o	o	x	P	
12	**camera_position_x_upper**	o	o	o	o	o	o	x	P	
13	**marker_bit**	o	o	o	o	o	o	x	P	
14	**camera_position_x_lower**	o	o	o	o	o	o	x	P	
15	**marker_bit**	o	o	o	o	o	o	x	P	
16	**camera_position_y_upper**	o	o	o	o	o	o	x	P	
17	**marker_bit**	o	o	o	o	o	o	x	P	
18	**camera_position_y_lower**	o	o	o	o	o	o	x	P	
19	**marker_bit**	o	o	o	o	o	o	x	P	
20	**camera_position_z_upper**	o	o	o	o	o	o	x	P	
21	**marker_bit**	o	o	o	o	o	o	x	P	
22	**camera_position_z_lower**	o	o	o	o	o	o	x	P	
23	**marker_bit**	o	o	o	o	o	o	x	P	
24	**camera_direction_x**	o	o	o	o	o	o	x	P	
25	**marker_bit**	o	o	o	o	o	o	x	P	
26	**camera_direction_y**	o	o	o	o	o	o	x	P	
27	**marker_bit**	o	o	o	o	o	o	x	P	
28	**camera_direction_z**	o	o	o	o	o	o	x	P	
29	**marker_bit**	o	o	o	o	o	o	x	P	
30	**image_plane_vertical_x**	o	o	o	o	o	o	x	P	
31	**marker_bit**	o	o	o	o	o	o	x	P	
32	**image_plane_vertical_y**	o	o	o	o	o	o	x	P	
33	**marker_bit**	o	o	o	o	o	o	x	P	
34	**image_plane_vertical_z**	o	o	o	o	o	o	x	P	
35	**reserved**	o	o	o	o	o	o	x	P	

m) Replace Table E.13 by:

Table E.13 – Slice layer

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**slice_vertical_position_extension**	x	x	x	x	x	x	x	D	Input format related
02	**priority_breakpoint**	o	o	o	o	o	o	o	I	Only required for data partitioning
03	**quantiser_scale_code**	x	x	x	x	x	x	x	I	
04	**slice_extension_flag**	x	x	x	x	x	x	x	I	
05	**intra_slice**	x	x	x	x	x	x	x	I	Decoder may skip this data
06	**slice_picture_id_enable**	x	x	x	x	x	x	x	I	Decoder may skip this data
07	**slice_picture_id**	x	x	x	x	x	x	x	I	Decoder may skip this data
08	**extra_bit_slice**	x	x	x	x	x	x	x	I	Decoder may skip this data
09	macroblock()	x	x	x	x	x	x	x	I	

n) Replace Table E.14 by:

Table E.14 – Macroblock layer

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**macroblock_escape**	x	x	x	x	x	x	x	I	
02	**macroblock_address_increment**	x	x	x	x	x	x	x	I	
03	macroblock_modes()	x	x	x	x	x	x	x	I	
04	**quantiser_scale_code**	x	x	x	x	x	x	x	I	
05	motion_vectors(0)	x	x	x	x	x	x	x	I	Forward motion vector
06	motion_vectors(1)	o	x	x	x	x	x	x	I	Backward motion vector
07	coded_block_pattern()	x	x	x	x	x	x	x	I	
08	block(i)	x	x	x	x	x	x	x	I	

o) Replace Table E.15 by:

Table E.15 – Macroblock modes

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**macroblock_type**	x	x	x	x	x	x	x	I	
02	**spatial_temporal_weight_code**	o	o	o	x	x	o	o	I	
03	**frame_motion_type**	x	x	x	x	x	x	x	I	01: Field-based prediction 10: Frame-based prediction 11: Dual-prime
04	**field_motion_type**	x	x	x	x	x	x	x	I	01: Field-based prediction 10: 16 × 8 MC 11: Dual-prime
05	**dct_type**	x	x	x	x	x	x	x	I	

p) Replace Table E.16 by:

Table E.16 – Motion vectors

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**motion_vertical_field_select**	x	x	x	x	x	x	x	I	
02	motion_vector()	x	x	x	x	x	x	x	I	

q) *Replace Table E.17 by:*

Table E.17 – Motion vector

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**motion_horizontal_code**	x	x	x	x	x	x	x	I	
02	**motion_horizontal_r**	x	x	x	x	x	x	x	I	
03	**dmv_horizontal**	x	x	x	x	x	x	x	I	
04	**motion_vertical_code**	x	x	x	x	x	x	x	I	
05	**motion_vertical_r**	x	x	x	x	x	x	x	I	
06	**dmv_vertical**	x	x	x	x	x	x	x	I	

r) *Replace Table E.18 by:*

Table E.18 – Coded block pattern

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	**coded_block_pattern_420**	x	x	x	x	x	x	x	I	
02	**coded_block_pattern_1**	o	o	o	o	x	x	o	I	4:2:2
03	**coded_block_pattern_2**	o	o	o	o	o	o	o	I	4:4:4

s) *Replace Table E.19 by:*

Table E.19 – Block layer

#	Syntactic elements	Status: SIMPLE	MAIN	SNR	SPATIAL	HIGH	4:2:2	Multi-view	Type	Comments
01	DCT coefficients	x	x	x	x	x	x	x	I	
02	End of block	x	x	x	x	x	x	x	I	

t) *Replace Table E.20 by:*

Table E.20 – Abbreviations for profile and level names

Profile	<profile abbreviation>	Level	<level abbreviation>
Simple	SP	Low	LL
Main	MP	Main	ML
SNR Scalable	SNR	High-1440	H-14
Spatially Scalable	Spt	High	HL
High	HP		
Multi-view	MVP		
ISO/IEC 11172-2 constrained parameters			ISO 11172-2

u) *Add new Tables E.47 to E.50:*

Table E.47 – Multi-view profile @ Low level

No. of layers	layer id	Scalable mode	Maximum sample density (H/V/F)	Maximum sample rate	Maximum total bit rate /1000000	Maximum total VBV buffer	Profile and level indication
2	0	Base	352/288/30	3 041 280	4	475 136	MP@LL
	1	Temporal	352/288/30	3 041 280	8	950 272	MVP@LL

Table E.48 – Multi-view profile @ Main level

No. of layers	layer id	Scalable mode	Maximum sample density (H/V/F)	Maximum sample rate	Maximum total bit rate /1000000	Maximum total VBV buffer	Profile and level indication
2	0	Base	720/576/30	10 368 000	15	1 835 008	SP@ML
	1	Temporal	720/576/30	10 368 000	25	3 047 424	MVP@ML
2	0	Base	720/576/30	10 368 000	15	1 835 008	MP@ML
	1	Temporal	720/576/30	10 368 000	25	3 047 424	MVP@ML

Table E.49 – Multi-view profile @ High-1440 level

No. of layers	layer id	Scalable mode	Maximum sample density (H/V/F)	Maximum sample rate	Maximum total bit rate /1000000	Maximum total VBV buffer	Profile and level indication
2	0	Base	1440/1152/60	47 001 600	60	7 340 032	MP@H-14
	1	Temporal	1440/1152/60	47 001 600	100	12 222 464	MVP@H-14

Table E.50 – Multi-view profile @ High level

No. of layers	layer id	Scalable mode	Maximum sample density (H/V/F)	Maximum sample rate	Maximum total bit rate /1000000	Maximum total VBV buffer	Profile and level indication
2	0	Base	1920/1152/60	62 668 800	80	9 781 248	MP@HL
	1	Temporal	1920/1152/60	62 668 800	130	15 898 480	MVP@HL

Appendix I

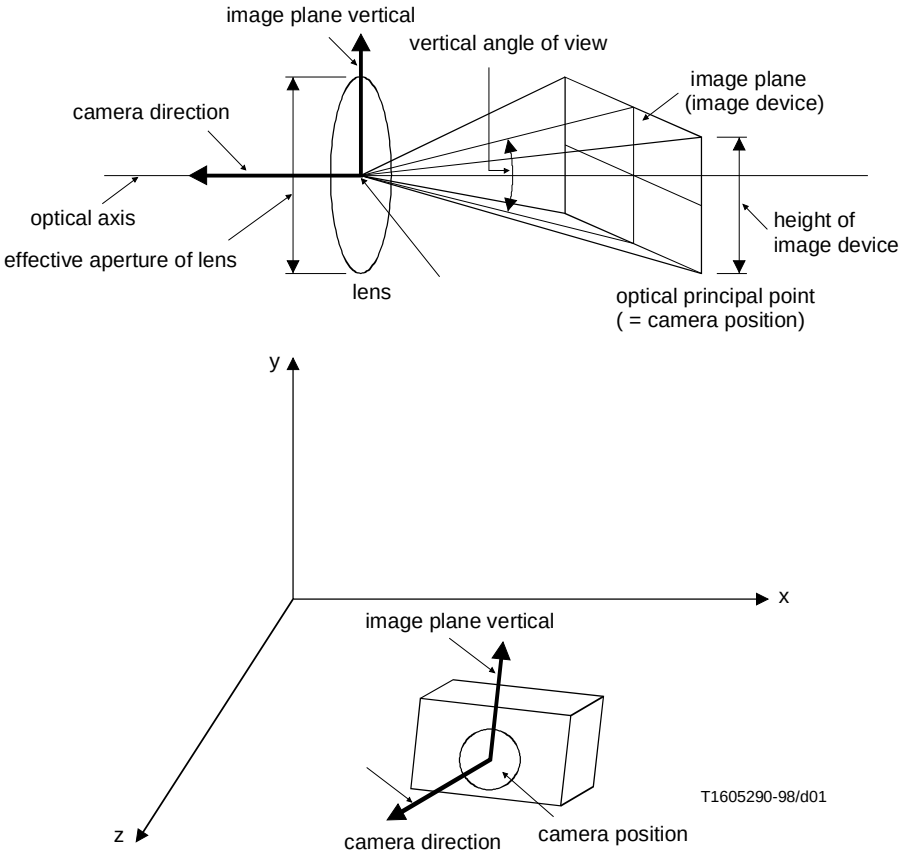
image plane vertical
vertical angle of view
image plane
(image device)
camera direction
optical axis
effective aperture of lens
lens
height of
image device
optical principal point
(= camera position)
y
x
z
image plane vertical
camera direction
camera position
T1605290-98/d01

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