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

AMENDMENT 5: Transport of JPEG 2000 Part 1 (ITU-T Rec T.800 | ISO/IEC 15444-1) video over ITU-T Rec H.222.0 | ISO/IEC 13818-1

Technologies de l'information — Codage générique des images animées et du son associé: Systèmes

AMENDEMENT 5: Transport de video de la partie 1 de JPEG 2000 (ITU-T Rec T.800 | ISO/CEI 15444-1) sur ITU-T Rec H.222.0 | ISO/CEI 13818-1

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Foreword

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INTERNATIONAL STANDARD
RECOMMENDATION ITU-T

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

Amendment 5

Transport of JPEG 2000 Part 1 (ITU-T T.800 | ISO/IEC 15444-1) video over ITU-T H.222.0 | ISO/IEC 13818-1

1) Clause 1.2.3

In 1.2.3, Additional References, add the following reference:

– Recommendation ITU-T T.800 (2002) | ISO/IEC 15444-1:2004, *Information technology – JPEG 2000 image coding system: Core coding system*.

2) New clauses 2.1.89 to 2.1.92

After 2.1.88, add 2.1.89 to 2.1.92:

2.1.89 JPEG 2000 (J2K) video access unit: An access unit defined in Rec. ITU-T T.800 (2002)/Amd.3 (2010) | ISO/IEC 15444-1:2004/Amd.3:2010 which includes all the parameters required to decode the access unit and display the decoded data.

2.1.90 J2K video elementary stream: Video elementary stream consisting of a succession of J2K video access units.

2.1.91 J2K video sequence: J2K video elementary stream where all the access units have the same profile/level, J2K video access unit coding parameters and video parameters.

2.1.92 J2K still picture (system): J2K video access unit as defined in 2.1.89 with constraints as specified in S.2.

3) New clause 2.4.2.10

After 2.4.2.9, add 2.4.2.10:

2.4.2.10 T-STD extensions for carriage of J2K video elementary streams

The interpretation, extensions, use and constraints for syntax elements in the adaptation header (2.4.3.4 and 2.4.3.5) for JPEG 2000 part 1 video are defined in S.5.

The interpretation, extensions, use and constraints for syntax elements in the PES header (2.4.3.6 and 2.4.3.7) for JPEG 2000 Part 1 video are defined in S.5.

To define the decoding of J2K video elementary streams carried in a Transport Stream, the T-STD model needs to be extended. The T-STD extensions and T-STD parameters for decoding of J2K video elementary streams conforming to one or more profiles defined in Rec. ITU-T T.800 (2002) | ISO/IEC 15444-1:2004 are defined in S.6.

NOTE – No extensions are specified for P-STD model, as carriage of J2K video elementary streams in program streams is not supported.

4) Clause 2.4.3.7

In 2.4.3.7, replace Table 2-22 with the following:

Table 2-22 – Stream_id assignments

stream_id	Notes	Stream coding
1011 1100	1	program_stream_map
1011 1101	2 and 9	private_stream_1
1011 1110		padding_stream
1011 1111	3	private_stream_2
110x xxxx		ISO/IEC 13818-3 or ISO/IEC 11172-3 or ISO/IEC 13818-7 or ISO/IEC 14496-3 audio stream number x xxxx
1110 xxxx		Rec. ITU-T H.262 | ISO/IEC 13818-2 or ISO/IEC 11172-2 or ISO/IEC 14496-2 or Rec. ITU-T H.264 | ISO/IEC 14496-10 video stream number xxxx
1111 0000	3	ECM_stream
1111 0001	3	EMM_stream
1111 0010	5	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 Annex A or ISO/IEC 13818-6_DSMCC_stream
1111 0011	2	ISO/IEC_13522_stream
1111 0100	6	Rec. ITU-T H.222.1 type A
1111 0101	6	Rec. ITU-T H.222.1 type B
1111 0110	6	Rec. ITU-T H.222.1 type C
1111 0111	6	Rec. ITU-T H.222.1 type D
1111 1000	6	Rec. ITU-T H.222.1 type E
1111 1001	7	ancillary_stream
1111 1010		ISO/IEC14496-1_SL-packetized_stream
1111 1011		ISO/IEC14496-1_FlexMux_stream
1111 1100		metadata stream
1111 1101	8	extended_stream_id
1111 1110		reserved data stream
1111 1111	4	program_stream_directory

The notation x means that the values '0' or '1' are both permitted and results in the same stream type. The stream number is given by the values taken by the x's.

NOTE 1 – PES packets of type program_stream_map have unique syntax specified in 2.5.4.1.

NOTE 2 – PES packets of type private_stream_1 and ISO/IEC_13552_stream follow the same PES packet syntax as those for Rec. ITU-T H.262 | ISO/IEC 13818-2 video and ISO/IEC 13818-3 audio streams.

NOTE 3 – PES packets of type private_stream_2, ECM_stream and EMM_stream are similar to private_stream_1 except no syntax is specified after PES_packet_length field.

NOTE 4 – PES packets of type program_stream_directory have a unique syntax specified in 2.5.5.

NOTE 5 – PES packets of type DSM-CC_stream have a unique syntax specified in ISO/IEC 13818-6.

NOTE 6 – This stream_id is associated with stream_type 0x09 in Table 2-29.

NOTE 7 – This stream_id is only used in PES packets, which carry data from a Program Stream or an ISO/IEC 11172-1 System Stream, in a Transport Stream (refer to 2.4.3.8).

NOTE 8 – The use of stream_id 0xFD (extended_stream_id) identifies that this PES packet employs an extended syntax to permit additional stream types to be identified.

NOTE 9 – JPEG 200 video streams (stream_type = 0x21) are carried using the same PES packet syntax as private_stream_1.

5) Clause 2.4.4.9

In 2.4.4.9, Semantic definition of fields in Transport Stream program map section, replace Table 2-34 with the following:

Table 2-34 – Stream type assignments

Value	Description
0x00	ITU-T | ISO/IEC Reserved
0x01	ISO/IEC 11172-2 Video
0x02	Rec. ITU-T H.262 | ISO/IEC 13818-2 Video or ISO/IEC 11172-2 constrained parameter video stream
0x03	ISO/IEC 11172-3 Audio
0x04	ISO/IEC 13818-3 Audio
0x05	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 private_sections
0x06	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 PES packets containing private data
0x07	ISO/IEC 13522 MHEG
0x08	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 Annex A DSM-CC
0x09	Rec. ITU-T H.222.1
0x0A	ISO/IEC 13818-6 type A
0x0B	ISO/IEC 13818-6 type B
0x0C	ISO/IEC 13818-6 type C
0x0D	ISO/IEC 13818-6 type D
0x0E	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 auxiliary
0x0F	ISO/IEC 13818-7 Audio with ADTS transport syntax
0x10	ISO/IEC 14496-2 Visual
0x11	ISO/IEC 14496-3 Audio with the LATM transport syntax as defined in ISO/IEC 14496-3
0x12	ISO/IEC 14496-1 SL-packetized stream or FlexMux stream carried in PES packets
0x13	ISO/IEC 14496-1 SL-packetized stream or FlexMux stream carried in ISO/IEC 14496_sections
0x14	ISO/IEC 13818-6 Synchronized Download Protocol
0x15	Metadata carried in PES packets
0x16	Metadata carried in metadata_sections
0x17	Metadata carried in ISO/IEC 13818-6 Data Carousel
0x18	Metadata carried in ISO/IEC 13818-6 Object Carousel
0x19	Metadata carried in ISO/IEC 13818-6 Synchronized Download Protocol
0x1A	IPMP stream (defined in ISO/IEC 13818-11, MPEG-2 IPMP)
0x1B	AVC video stream conforming to one or more profiles defined in Annex A of Rec. ITU-T H.264 | ISO/IEC 14496-10 or AVC video sub-bitstream, as defined in 2.1.78, or MVC base view sub-bitstream, as defined in 2.1.85, or AVC video sub-bitstream of MVC, as defined in 2.1.88
0x1C	ISO/IEC 14496-3 Audio, without using any additional transport syntax, such as DST, ALS and SLS
0x1D	ISO/IEC 14496-17 Text
0x1E	Auxiliary video stream as defined in ISO/IEC 23002-3
0x1F	SVC video sub-bitstream of an AVC video stream conforming to one or more profiles defined in Annex G of Rec. ITU-T H.264 | ISO/IEC 14496-10
0x20	MVC video sub-bitstream of an AVC video stream conforming to one or more profiles defined in Annex H of Rec. ITU-T H.264 | ISO/IEC 14496-10
0x21	Video stream conforming to one or more profiles as defined in Rec. ITU-T T.800 | ISO/IEC 15444-1
0x22-0x7E	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 Reserved
0x7F	IPMP stream
0x80-0xFF	User Private

6) Clause 2.6.1

In 2.6.1, Semantic definition of fields in program and program element descriptors, replace Table 2-45 with:

Table 2-45 – Program and program element descriptors

descriptor_tag	TS	PS	Identification
0	N/A	N/A	Reserved
1	N/A	X	Forbidden
2	X	X	video_stream_descriptor
3	X	X	audio_stream_descriptor
4	X	X	hierarchy_descriptor
5	X	X	registration_descriptor
6	X	X	data_stream_alignment_descriptor
7	X	X	target_background_grid_descriptor
8	X	X	video_window_descriptor
9	X	X	CA_descriptor
10	X	X	ISO_639_language_descriptor
11	X	X	system_clock_descriptor
12	X	X	multiplex_buffer_utilization_descriptor
13	X	X	copyright_descriptor
14	X		maximum_bitrate_descriptor
15	X	X	private_data_indicator_descriptor
16	X	X	smoothing_buffer_descriptor
17	X		STD_descriptor
18	X	X	IBP_descriptor
19-26	X		Defined in ISO/IEC 13818-6
27	X	X	MPEG-4_video_descriptor
28	X	X	MPEG-4_audio_descriptor
29	X	X	IOD_descriptor
30	X		SL_descriptor
31	X	X	FMC_descriptor
32	X	X	external_ES_ID_descriptor
33	X	X	MuxCode_descriptor
34	X	X	FmxBufferSize_descriptor
35	X		multiplexBuffer_descriptor
36	X	X	content_labeling_descriptor
37	X	X	metadata_pointer_descriptor
38	X	X	metadata_descriptor
39	X	X	metadata_STD_descriptor
40	X	X	AVC video descriptor
41	X	X	IPMP_descriptor (defined in ISO/IEC 13818-11, MPEG-2 IPMP)
42	X	X	AVC timing and HRD descriptor
43	X	X	MPEG-2_AAC_audio_descriptor
44	X	X	FlexMuxTiming_descriptor
45	X	X	MPEG-4_text_descriptor
46	X	X	MPEG-4_audio_extension_descriptor
47	X	X	Auxiliary_video_stream_descriptor
48	X	X	SVC extension descriptor
49	X	X	MVC extension descriptor

Table 2-45 – Program and program element descriptors

descriptor_tag	TS	PS	Identification
50	X	n/a	J2K video descriptor
51-63	n/a	n/a	Rec. ITU-T H.222.0 | ISO/IEC 13818-1 Reserved
64-255	n/a	n/a	User Private

7) New clauses 2.6.80 and 2.6.81

After 2.6.79, add 2.6.80 and 2.6.81:

2.6.80 J2K video descriptor

For J2K video elementary streams conforming to one or more profiles defined in Rec. ITU-T T.800 | ISO/IEC 15444-1, the J2K video descriptor provides information that may be present in each J2K access unit as well as for the J2K video sequence. In addition, it provides information to signal J2K still pictures. This descriptor shall be included for each J2K video elementary stream component in the PMT with stream_type equal to 0x21.

Table AMD5-1 – J2K video descriptor

Syntax	No. of bits	Mnemonic
J2K_video_descriptor() {		
descriptor_tag	**8**	**uimsbf**
descriptor_length	**8**	**uimsbf**
profile_and_level	**16**	**uimsbf**
horizontal_size	**32**	**uimsbf**
vertical_size	**32**	**uimsbf**
max_bit_rate	**32**	**uimsbf**
max_buffer_size	**32**	**uimsbf**
DEN_frame_rate	**16**	**uimsbf**
NUM_frame_rate	**16**	**uimsbf**
color_specification	**8**	**bslbf**
still_mode	**1**	**bslbf**
interlaced_video	**1**	**bslbf**
reserved	**6**	**bslbf**
for (i=0; i<N; i++) {		
private_data_byte	**8**	**bslbf**
}		
}		

2.6.81 Semantics of fields in J2K video descriptor

profile_and_level – This field shall be in the range 0x0101-0x04ff and coded as defined in Table A.10 of Rec. ITU-T T.800 | ISO/IEC 15444-1 and indicates broadcast profile and level values.

horizontal_size – This field shall be coded the same as Xsiz parameter found in the J2K codestream main header, as defined in Annex A of Rec. ITU-T T.800 | ISO/IEC 15444-1.

vertical_size – This field shall be coded the same as Ysiz parameter found in the J2K codestream main header, as defined in Annex A of Rec. ITU-T T.800 | ISO/IEC 15444-1.

max_bit_rate – This field may be coded the same as the Maxbr value in the j2k_brat field box specified in Table S.1 and shall not exceed the maximum compressed bit rate value for the profile and level specified in Table S.2. This field shall be set appropriately and signalled when profile_and_level = 0x0307, where no maximum bit rate is specified.

max_buffer_size – This field shall not exceed the Maximum buffer size value for the profile and level specified in the j2k_brat box in Table S.2. When profile_and_level = 0x0307, the max_buffer_size shall be set appropriately and shall not exceed (max_bit_rate/1.60E5), where max_bit_rate is expressed in bit/s.

DEN_frame_rate – This field shall be coded the same as frat_denominator field in the j2k_frat box specified in Table S.1 (see Annex S).

NUM_frame_rate – This field shall be coded the same as frat_numerator field in the frat box specified in Table S.1 (see Annex S).

NOTE – J2K frame rate is derived from the DEN_frame_rate and NUM_frame_rate values. Table AMD5-2 lists examples of typical broadcast frame rates with associated values of DEN_frame_rate and NUM_frame_rate.

Table AMD5-2 – Example frame rates based on DEN_frame_rate and NUM_frame_rate values

DEN_frame_rate	NUM_frame_rate	Frame rate ratio (decimal representation)	Frame rate
0000 0000 0000 0000			Forbidden
0000 0011 1110 1001	0101 1101 1100 0000	24 000 / 1001	23.976
0000 0000 0000 0001	0000 0000 0001 1000	24 / 1	24.0
0000 0000 0000 0001	0000 0000 0001 1001	25 / 1	25.0
0000 0011 1110 1001	0111 0101 0011 0000	30 000 / 1001	29.97
0000 0000 0000 0001	0000 0000 0001 1110	30 / 1	30.0
0000 0000 0000 0001	0000 0000 0011 0010	50 / 1	50.0
0000 0011 1110 1001	1110 1010 0110 0000	60 000 / 1001	59.94
0000 0000 0000 0001	0000 0000 0011 1100	60 / 1	60.00

color_specification – This field shall be coded the same as the bcol_colrc 8-bit field of the j2k_bcol box as specified in Table S.1 (see Annex S).

still_mode – This 1-bit field, when set to '1', indicates that the J2K video stream may include J2K still pictures. When set to '0', then the associated J2K video stream shall not contain J2K still pictures.

interlaced_video – This 1-bit field indicates whether the J2K video stream contains interlaced video. When this flag is set to '1' the J2K access unit elementary stream header (see Table S.1) shall include the syntax elements Auf2, fiel_box_code, fic and fio. When this flag is set to '0', these syntax elements shall not be present in the J2K access unit elementary stream header.

8) Annex S

After Annex R, add the following annex:

Annex S

Carriage of JPEG 2000 part 1 video over MPEG-2 Transport Streams

(This annex forms an integral part of this Recommendation | International Standard.)

S.1 Introduction

This annex specifies normative constraints for the carriage of JPEG 2000 video in an MPEG-2 transport stream. The parameters specified include mapping of J2K video streams into MPEG-2 transport packets, signalling of J2K video streams as well as T-STD parameters for various profiles. Transport of J2K video shall be limited to transport stream only. Program stream support may be added in the future based on application requirements.

S.2 J2K video access unit, J2K video elementary stream, J2K video sequence and J2K still picture

The J2K video access unit contains the elementary stream (elsm) header created in a manner following Annex M of Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3 concatenated with self-contained Rec. ITU-T T.800 | ISO/IEC 15444-1 codestream(s). The (elsm) header contains all video-related parameters necessary to display the decoded codestream(s). Multiple codestreams may comprise an access unit when, for instance, the access unit is an interlaced frame. The J2K video elementary stream is a progression of J2K access units and the J2K video sequence is a subset of J2K video elementary stream where all the J2K access units have the same parameters in the (elsm) header.

The J2K still picture (system) consists of a J2K video sequence which contains exactly one J2K access unit. This still picture has an associated PTS and the presentation time of succeeding pictures, if any, is later than that of the still picture by at least two picture periods. The J2K still picture (system) mode is used to support transmission of J2K video access units at a rate much lower than the display frame rate (determined by the difference in PTS values between successive J2K access units). J2K still picture can be used in applications such as 'slide show' and 'stills with Music'.

S.3 Elementary stream header (elsm) and mapping to PES packets

Table S.1 shows each portion of the elsm header as defined in Annex M of Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3 and the concatenation of detailed metadata boxes within the elsm header.

Table S.1 – J2K Access unit elementary stream header

Syntax	No. of bits	Mnemonic
j2k_es() {		
j2k_elsm '0x656c 736d'	32	bslbf
// j2k_frat		
frat_box_code '0x6672 6174'	32	bslbf
frat_denominator	16	uimsbf
frat_numerator	16	uimsbf
// j2k_brat		
brat_box_code = '0x6272 6174'	32	bslbf
Maxbr	32	uimsbf
Aufl	32	uimsbf
// If (interlaced_video == 1) {		
Auf2	32	uimsbf
}		
// j2k_fiel		
// If (interlaced_video == 1) {		
fiel_box_code = 0x6669 656c	32	bslbf
fic	8	uimsbf
fio	8	uimsbf
}		
// j2k_tcod		
tocd_code = 0x7463 6f64	32	bslbf
HH (0-23)	8	uimsbf
MM (0-59)	8	uimsbf
SS (0-59)	8	uimsbf
FF (1-60)	8	uimsbf
// j2k_bcol		
bcol_code = 0x6263 686c	32	bslbf
bcol_colcr	8	uimsbf
reserved	8	bsfbf
}		

j2k_frat – A field box defined in Annex M of Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3 corresponding to the required frat box containing frame rate coding.

j2k_brat – A field box defined in Annex M of Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3 corresponding to the required brat box containing the maximum instantaneous bit rate of the elementary stream.

j2k_fiel – A field box defined in Annex M of Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3 corresponding to the optional fiel box containing interleaved field coding. If the j2k_fiel is present, there shall be two contiguous codestreams present.

j2k_tcod – A field box defined in Annex M of Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3 corresponding to the required tcod box containing time code and frame count information of the J2K video access unit.

j2k_bcol – A field box defined in Annex M of Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3 corresponding to the required bcol box containing broadcast color specification coding.

Figure S.1 shows the structure and mapping of J2K video access unit into PES packets. JPEG 2000 represents each frame as one or two Part 1 (Rec. ITU-T T.800 | ISO/IEC 15444-1) contiguous codestreams. The codestream main header, included within each contiguous condestream contains all information to decode its image, including the image

size and the profile indicator, called a SIZ marker in Rec. ITU-T T.800 | ISO/IEC 15444-1. In addition to each codestream's main header, Annex M of Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3 adds an elementary stream (elsm) header containing video-related information, as shown in Table S.1 and the j2k_video_descriptor in 2.6.80.

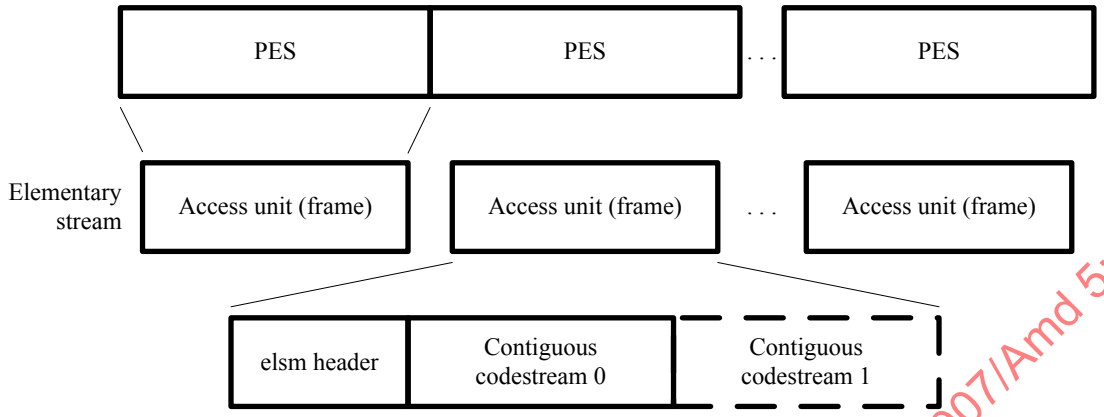

Figure S.1 – Structure and order of JPEG 2000 access units

S.4 J2K transport constraints

When a J2K video elementary stream conforming to one or more profiles as defined in Rec. ITU-T T.800 | ISO/IEC 15444-1 is transported using MPEG-2 systems, the following constraints apply:

1) Each J2K access unit shall contain an elementary stream header (elsm) defined in Table S.1 (as specified in Rec. ITU-T T.800 (2002)/Amd.3 | ISO/IEC 15444-1:2004/Amd.3) followed by one or two codestream(s).
2) Each J2K codestream main header contains a SIZ marker segment that includes a RSIZ capability parameter. Both the SIZ marker segment and RSIZ capability parameter are defined in Annex A of Rec. ITU-T T.800 | ISO/IEC 15444-1 equating to the profile_and_level parameter (see 2.6.81).
3) The J2K video access units shall be ordered in the J2K video elementary stream in a monotonic display order.
4) Each J2K video access unit shall include a PES header with PTS and each PES packet shall contain exactly one J2K video access unit.
5) For successive J2K video access units, the increments to PTS shall be consistent with increments to corresponding J2K_tcod parameters in the elsm header.
6) The following constraints apply to the coding of syntax elements in the adaptation header for transport of J2K video elementary stream:
   a) Both random_access_indicator and elementary_stream_priority_indicator flags can be set to '1' for each J2K video access unit contained in the transport packet. Applications may limit the signalling of random access based on their use cases. Any J2K video access unit is also a J2K video 'access point' required for random access.
   b) All other flags should be set appropriately.
7) The following constraints apply to the coding of syntax elements in the PES header for transport of J2K video elementary stream:
   a) stream_id shall be set to 0xBD (same as Private_stream_1).
   b) PES_packet_length shall be set to 0x0000.
   c) data_alignment_indicator shall be set to '1'. Also see S.5 for alignment constraints.
   d) PTS_DTS_flags shall be set to '10'. This precludes display re-ordering for J2K video access units.
   e) All other flags should be set appropriately.