

ISO/IEC 13818-1:2025-08 (E)

Information technology - Generic coding of moving pictures and associated audio information - Part 1: Systems

Contents	Page
SECTION 1 – GENERAL.....	1
1.1 Scope.....	1
1.2 Normative references	1
SECTION 2 – TECHNICAL ELEMENTS	4
2.1 Definitions.....	4
2.2 Symbols and abbreviations	12
2.3 Method of describing bit stream syntax	14
2.4 Transport stream bitstream requirements.....	15
2.5 Program stream bitstream requirements.....	63
2.6 Program and program element descriptors.....	76
2.7 Restrictions on the multiplexed stream semantics.....	164
2.8 Compatibility with ISO/IEC 11172.....	169
2.9 Registration of copyright identifiers	169
2.10 Registration of private data format.....	169
2.11 Carriage of ISO/IEC 14496 data	170
2.12 Carriage of metadata	181
2.13 Carriage of ISO 15938 data.....	190
2.14 Carriage of Rec. ITU-T H.264 ISO/IEC 14496-10 video	190
2.15 Carriage of ISO/IEC 14496-17 text streams	206
2.16 Carriage of auxiliary video streams	208
2.17 Carriage of HEVC.....	208
2.18 Carriage of green access units.....	222
2.19 Carriage of ISO/IEC 23008-3 MPEG-H 3D audio data.....	224
2.20 Carriage of Quality Access Units in MPEG-2 sections.....	226
2.21 Carriage of sample variants.....	227
2.22 Carriage of Media Orchestration Access Units.....	228
2.23 Carriage of VVC	228
2.24 Carriage of EVC.....	233
2.25 Carriage of LCEVC	236
Annex A CRC decoder model	238
A.1 CRC decoder model	238
Annex B Digital storage medium command and control (DSM-CC).....	239
B.1 Introduction.....	239
B.2 General elements.....	240
B.3 Technical elements.....	242
Annex C Program-specific information.....	248
C.1 Explanation of program-specific information in transport streams.....	248
C.2 Introduction.....	248
C.3 Functional mechanism	248
C.4 The mapping of sections into transport stream packets.....	249
C.5 Repetition rates and random access	249
C.6 What is a program?	250
C.7 Allocation of program_number.....	250
C.8 Usage of PSI in a typical system.....	250
C.9 The relationships of PSI structures.....	251
C.10 Bandwidth utilization and signal acquisition time	253

Annex D Systems timing model and application implications of this Recommendation International Standard.....	256
D.1 Introduction.....	256
Annex E Data transmission applications	265
E.1 General considerations	265
E.2 Suggestion.....	265
Annex F Graphics of syntax for this Recommendation International Standard.....	266
F.1 Introduction.....	266
Annex G General information	270
G.1 General information	270
Annex H Private data.....	271
H.1 Private data.....	271
Annex I Systems conformance and real-time interface	272
I.1 Systems conformance and real-time interface.....	272
Annex J Interfacing jitter-inducing networks to MPEG-2 decoders.....	273
J.1 Introduction.....	273
J.2 Network compliance models.....	273
J.3 Network specification for jitter smoothing	274
J.4 Example decoder implementations	275
Annex K Splicing transport streams	276
K.1 Introduction.....	276
K.2 The different types of splicing point	276
K.3 Decoder behaviour on splices	277
Annex L Registration procedure (see 2.9).....	279
L.1 Procedure for the request of a Registered Identifier (RID)	279
L.2 Responsibilities of the Registration Authority	279
L.3 Responsibilities of parties requesting an RID	279
L.4 Appeal procedure for denied applications.....	279
Annex M Registration application form (see 2.9)	281
M.1 Contact information of organization requesting a Registered Identifier (RID).....	281
M.2 Statement of an intention to apply the assigned RID	281
M.3 Date of intended implementation of the RID	281
M.4 Authorized representative	281
M.5 For official use only of the Registration Authority	281
Annex N Registration Authority Diagram of administration structure (see 2.9).....	282
Annex O Registration procedure (see 2.10).....	283
O.1 Procedure for the request of an RID.....	283
O.2 Responsibilities of the Registration Authority	283
O.3 Contact information for the Registration Authority	283
O.4 Responsibilities of parties requesting an RID	283
O.5 Appeal procedure for denied applications.....	283
Annex P Registration application form	285
P.1 Contact information of organization requesting an RID	285
P.2 Request for a specific RID	285
P.3 Short description of RID that is in use and date system that was implemented	285
P.4 Statement of an intention to apply the assigned RID	285
P.5 Date of intended implementation of the RID	285
P.6 Authorized representative	285
P.7 For official use of the Registration Authority	285
Annex Q T-STD and P-STD buffer models for ISO/IEC 13818-7 ADTS	286
Q.1 Introduction.....	286
Q.2 Leak rate from transport buffer	286
Q.3 Buffer size.....	286
Q.4 Conclusion	287

Annex R	Carriage of ISO/IEC 14496 scenes in Rec. ITU-T H.222.0 ISO/IEC 13818-1	289
R.1	Content access procedure for ISO/IEC 14496 program components within a program stream	289
R.2	Content access procedure for ISO/IEC 14496 program components within a transport stream	290
Annex S	Carriage of JPEG 2000 part 1 video over MPEG-2 transport streams.....	294
S.1	Introduction.....	294
S.2	J2K video access unit, J2K video elementary stream, J2K video sequence and J2K still picture.....	294
S.3	Optional J2K block mode for high resolution support	294
S.4	Optional J2K stripe mode for Ultra-Low Latency	295
S.5	Elementary stream header (elsm) and mapping to PES packets	295
S.6	J2K transport constraints.....	298
S.7	Interpretation of flags in adaptation and PES headers for J2K video elementary streams.....	299
S.8	T-STD extension for J2K video elementary streams	299
Annex T	MIME type for MPEG-2 transport streams	302
T.1	Introduction.....	302
T.2	MIME type and subtype.....	302
T.3	Security considerations	303
T.4	Parameters.....	303
Annex U	Carriage of timeline and external media information over MPEG-2 transport streams	305
U.1	Introduction.....	305
U.2	TEMI access unit and TEMI elementary stream.....	306
U.3	AF descriptors	307
Annex V	Transport of HEVC tiles	316
V.1	Introduction.....	316
V.2	HEVC tile substream identification example.....	317
V.3	Subregion layout example.....	317
Annex W	Carriage of JPEG XS part 1 video over MPEG-2 Transport Streams.....	319
W.1	Introduction.....	319
W.2	JPEG XS video access unit, JPEG XS video elementary stream, JPEG XS video sequence and JPEG XS still picture	319
W.3	Elementary stream header (jxes) and mapping to PES packets.....	319
W.4	JPEG XS transport constraints	320
W.5	Interpretation of flags in adaptation field and PES packet for JPEG XS video elementary streams.....	321
W.6	T-STD extension for JPEG XS video elementary streams.....	321
Bibliography	324

List of Tables

Table 2-1	– Transport stream.....	26
Table 2-2	– Transport packet of this Recommendation International Standard.....	26
Table 2-3	– PID table.....	27
Table 2-4	– Scrambling control values.....	27
Table 2-5	– Adaptation field control values	28
Table 2-6	– Transport stream adaptation field.....	28
Table 2-7	– Splice parameters Table 1 Simple Profile Main Level, Main Profile Main Level, SNR Profile Main Level (both layers), Spatial Profile High-1440 Level (base layer), High Profile Main Level (middle + base layers), Multi-view Profile Main Level (base layer) Video	35
Table 2-8	– Splice parameters Table 2 Main Profile Low Level, SNR Profile Low Level (both layers), High Profile Main Level (base layer), Multi-view Profile Low Level (base layer) Video.....	35
Table 2-9	– Splice parameters Table 3 Main Profile High-1440 Level, Spatial Profile High-1440 Level (all layers), High Profile High-1440 Level (middle + base layers), Multi-view Profile High-1440 Level (base layer) Video	36
Table 2-10	– Splice parameters Table 4 Main Profile High Level, High Profile High-1440 Level (all layers), High Profile High Level (middle + base layers), Multi-view Profile High Level (base layer) Video.....	36
Table 2-11	– Splice parameters Table 5 SNR Profile Low Level (base layer) Video	36
Table 2-12	– Splice parameters Table 6 SNR Profile Main Level (base layer) Video	36
Table 2-13	– Splice parameters Table 7 Spatial Profile High-1440 Level (middle + base layers) Video	37

Table 2-14 – Splice parameters Table 8 High Profile Main Level (all layers), High Profile High-1440 Level (base layer) Video	37
Table 2-15 – Splice parameters Table 9 High Profile High Level (base layer), Multi-view Profile Main Level (both layers) Video	37
Table 2-16 – Splice parameters Table 10 High Profile High Level (all layers), Multi-view Profile High-1440 Level (both layers) Video	37
Table 2-17 – Splice parameters Table 11 4:2:2 Profile Main Level Video	38
Table 2-18 – Splice parameters Table 12 Multi-view Profile Low Level (both layers) Video.....	38
Table 2-19 – Splice parameters Table 13 Multi-view Profile High Level (both layers) Video.....	38
Table 2-20 – Splice parameters Table 14 4:2:2 Profile High Level Video.....	38
Table 2-21 – PES packet	39
Table 2-22 – Stream_id assignments.....	42
Table 2-23 – PES scrambling control values.....	43
Table 2-24 – Trick mode control values.....	48
Table 2-25 – Field_id field control values.....	49
Table 2-26 – Coefficient selection values.....	49
Table 2-27 – Stream_id extension assignments.....	51
Table 2-28 – Program-specific information.....	52
Table 2-29 – Program-specific information pointer	54
Table 2-30 – Program association section	54
Table 2-31 – table_id assignment values.....	55
Table 2-32 – Conditional access section.....	56
Table 2-33 – Transport stream program map section	57
Table 2-34 – Stream type assignments	58
Table 2-35 – Private section	61
Table 2-36 – The transport stream description table	62
Table 2-37 – Program stream	68
Table 2-38 – Program stream pack.....	68
Table 2-39 – Program stream pack header	68
Table 2-40 – Program stream system header.....	69
Table 2-41 – Program stream map.....	72
Table 2-42 – Program stream directory packet.....	74
Table 2-43 – Intra_coded indicator.....	76
Table 2-44 – Coding_parameters indicator	76
Table 2-45 – Program and program element descriptors.....	77
Table 2-46 – Video stream descriptor	78
Table 2-47 – Frame rate code	78
Table 2-48 – Audio stream descriptor	79
Table 2-49 – Hierarchy descriptor.....	80
Table 2-50 – Hierarchy_type field values.....	81
Table 2-51 – Registration descriptor	81
Table 2-52 – Data stream alignment descriptor.....	82
Table 2-53 – Video stream alignment values	82
Table 2-54 – AVC video stream alignment values.....	83
Table 2-55 – HEVC video stream alignment values	83
Table 2-56 – Audio stream alignment values	83
Table 2-57 – VVC video stream alignment values.....	84
Table 2-58 – EVC video stream alignment values	84
Table 2-59 – Target background grid descriptor	85
Table 2-60 – Video window descriptor	85
Table 2-61 – Conditional access descriptor.....	86
Table 2-62 – ISO 639 language descriptor	86
Table 2-63 – Audio type values.....	87
Table 2-64 – System clock descriptor	88
Table 2-65 – Multiplex buffer utilization descriptor	88

Table 2-66 – Copyright descriptor.....	89
Table 2-67 – Maximum bitrate descriptor	89
Table 2-68 – Private data indicator descriptor.....	90
Table 2-69 – Smoothing buffer descriptor.....	90
Table 2-70 – STD descriptor	91
Table 2-71 – IBP descriptor.....	91
Table 2-72 – MPEG-4 video descriptor.....	92
Table 2-73 – MPEG-4 audio descriptor.....	92
Table 2-75 – IOD descriptor.....	95
Table 2-76 – SL descriptor	95
Table 2-77 – FMC descriptor	96
Table 2-78 – External_ES_ID descriptor.....	96
Table 2-79 – Muxcode descriptor.....	97
Table 2-80 – M4MuxBufferSize descriptor.....	97
Table 2-81 – MultiplexBuffer descriptor.....	98
Table 2-82 – M4MuxTiming descriptor.....	98
Table 2-83 – Content labelling descriptor	99
Table 2-84 – Metadata_application_format.....	99
Table 2-85 – Content_time_base_indicator values.....	100
Table 2-86 – Metadata pointer descriptor.....	101
Table 2-87 – Metadata format values	101
Table 2-88 – MPEG_carriage_flags.....	102
Table 2-89 – Metadata descriptor	103
Table 2-90 – decoder_config_flags	104
Table 2-91 – Metadata STD descriptor.....	105
Table 2-92 – AVC video descriptor.....	105
Table 2-93 – AVC timing and HRD descriptor.....	107
Table 2-94 – MPEG-2 AAC_audio_descriptor	108
Table 2-95 – MPEG-2_AAC_additional_information field values.....	109
Table 2-96 – MPEG-4 text descriptor	109
Table 2-97 – MPEG-4 audio extension descriptor	109
Table 2-98 – Auxiliary video stream descriptor	110
Table 2-99 – SVC extension descriptor.....	111
Table 2-100 – MVC extension descriptor.....	112
Table 2-101 – J2K video descriptor.....	113
Table 2-102 – Example frame rates based on DEN_frame_rate and NUM_frame_rate values	115
Table 2-103 – MVC operation point descriptor.....	117
Table 2-104 – MPEG2_stereoscopic_video_format_descriptor syntax	118
Table 2-105 – Stereoscopic_program_info_descriptor syntax	118
Table 2-106 – Stereoscopic_service_type values	119
Table 2-107 – Stereoscopic_video_info_descriptor syntax.....	119
Table 2-108 – Upsampling factor values.....	120
Table 2-109 – Extension descriptor.....	120
Table 2-110 – Extension descriptor tag values.....	123
Table 2-111 – Transport_profile_descriptor syntax	124
Table 2-112 – Transport_profile values.....	124
Table 2-113 – HEVC video descriptor	125
Table 2-114 – Semantics of HDR_WCG_idc.....	127
Table 2-115 – HEVC timing and HRD descriptor.....	127
Table 2-116 – Adaptation field extension descriptor.....	128
Table 2-117 – HEVC operation point descriptor.....	129
Table 2-118 – HEVC hierarchy extension descriptor.....	131
Table 2-119 – Semantics of extension dimension bits.....	131
Table 2-120 – Green extension descriptor.....	132
Table 2-121 – MPEG-H 3D audio descriptor.....	133

Table 2-122 – MPEG-H 3D audio config descriptor.....	133
Table 2-123 – MPEG-H 3D audio scene descriptor	134
Table 2-124 – MPEG-H 3D audio text label descriptor	137
Table 2-125 – MPEG-H 3D audio multi-stream descriptor.....	139
Table 2-126 – MPEG-H 3D audio DRC and Loudness descriptor()	140
Table 2-127 – MPEG-H 3D audio command descriptor	142
Table 2-128 – Quality extension descriptor.....	143
Table 2-129 – Virtual segmentation descriptor	144
Table 2-130 – HEVC tile substream descriptor.....	145
Table 2-131 — HEVC subregion descriptor	146
Table 2-132 – JPEG XS video descriptor.....	148
Table 2-133 – VVC video descriptor.....	150
Table 2-134 – Semantics of HDR_WCG_id.....	151
Table 2-135 – SDR widely used video property combinations	152
Table 2-136 – WCG widely used video property combinations.....	152
Table 2-137 – HDR/WCG widely used video property combinations	152
Table 2-138 – No Indication.....	153
Table 2-139 – VVC timing and HRD descriptor.....	153
Table 2-140 – EVC video descriptor.....	154
Table 2-141 – EVC timing and HRD descriptor	156
Table 2-142 – LCEVC video descriptor.....	157
Table 2-143 – LCEVC linkage descriptor	157
Table 2-144 – Media service kind descriptor	158
Table 2-145 – media_description_flag	159
Table 2-146 – Media type indicator.....	159
Table 2-147 – ID_length_code.....	159
Table 2-148 – ID_type.....	159
Table 2-149 – configuration type values	160
Table 2-150 – lang_len_indicator.....	160
Table 2-151 – Media service type values	160
Table 2-152 – Carriage of individual ISO/IEC 14496 streams in Rec. ITU-T H.222.0 ISO/IEC 13818-1	170
Table 2-153 – Section syntax for transport of ISO/IEC 14496 stream.....	175
Table 2-154 – ISO/IEC defined options for carriage of an ISO/IEC 14496 scene and associated streams in Rec. ITU-T H.222.0 ISO/IEC 13818-1	179
Table 2-155 – Metadata Access Unit Wrapper.....	185
Table 2-156 – Metadata AU cell	185
Table 2-157 – Cell fragment indication.....	185
Table 2-158 – Section syntax for transport of metadata	186
Table 2-159 – Section fragment indication.....	187
Table 2-160 – View and dependency representation delimiter NAL unit	196
Table 2-161 – Implied hierarchy_layer_index if no hierarchy descriptors are used.....	216
Table 2-162 – Green access unit section syntax	223
Table 2-163 – Green access unit.....	223
Table 2-164 – Quality Access Unit	226
Table B.1 – DSM-CC syntax.....	243
Table B.2 – Command_id assigned values	243
Table B.3 – DSM-CC control.....	244
Table B.4 – Select mode assigned values	245
Table B.5 – DSM-CC Acknowledgement	246
Table B.6 – Time code	247
Table C.1 – Composite_descriptor	253
Table C.2 – Sub-descriptor.....	253
Table C.3 – Program association table bandwidth usage (bit/s) Number of programs per transport stream	254
Table C.4 – Program map table bandwidth usage (bit/s) Number of programs per transport stream.....	254

Table D.1 – Re-multiplexing strategy.....	261
Table E.1 – PES packet header example	265
Table S.1 – J2K Access unit elementary stream header	296
Table S.2 – Operating levels and maximum buffer size for JPEG 2000 broadcast profiles (from Table A.49 in Rec. ITU-T T.800 (2015) ISO/IEC 15444-1:2016)	301
Table T.1 – 'codecs' parameter values for some specific stream_type values	303
Table U.1 – Variable field length notation example.....	305
Table U.1 <i>bis</i> – Table U.1 in equivalent full notation	306
Table U.2 – TEMI access unit.....	306
Table U.3 – AF descriptor tags.....	307
Table U.4 – TEMI location descriptor.....	308
Table U.5 – TEMI URL scheme types	308
Table U.6 – TEMI service types.....	309
Table U.7 – TEMI base URL descriptor.....	309
Table U.8 – TEMI timeline descriptor	310
Table U.9 – TEMI MPEG-H_3dAudio_extStreamID descriptor	312
Table U.10 – Boundary descriptor.....	313
Table U.11 – sequence_number_length_code interpretation.....	313
Table U.12 – Labelling Descriptor	314
Table U.13 – label_length_code interpretation.....	314
Table U.14 – label_type values	314
Table U.15 – HEVC tile substream af_descriptor	315
Table W.1 – JPEG XS Access unit elementary stream header (jxes header)	319

List of Figures

Figure Intro. 1 – Simplified overview of the scope of this Recommendation International Standard	xviii
Figure Intro. 2 – Prototypical transport demultiplexing and decoding example.....	xx
Figure Intro. 3 – Prototypical transport multiplexing example.....	xx
Figure Intro. 4 – Prototypical transport stream to program stream conversion	xx
Figure Intro. 5 – Prototypical decoder for program streams.....	xxi
Figure 2-1 – Transport stream system target decoder notation.....	16
Figure 2-2 – Program stream system target decoder notation	63
Figure 2-3 – Target background grid descriptor display area.....	84
Figure 2-4 – Media Service Kind Descriptor semantics at program level.....	163
Figure 2-5 – Media Program Kind Descriptor semantics at elementary stream level	164
Figure 2-6 – T-STD model extensions for individual ISO/IEC 14496 elementary streams	171
Figure 2-7 – T-STD model for ISO/IEC 14496 content.....	176
Figure 2-8 – P-STD model for ISO/IEC 14496 Systems stream	179
Figure 2-9 – Timing model for delivery of content and metadata	182
Figure 2-10 – Delivery of metadata in PES packets	183
Figure 2-11 – Metadata signalling and referencing.....	189
Figure 2-12 – Metadata decoding in the STD.....	189
Figure 2-13 – T-STD model extensions for Rec. ITU-T H.264 ISO/IEC 14496-10 video.....	193
Figure 2-14 – P-STD model extensions for Rec. ITU-T H.264 ISO/IEC 14496-10 video	195
Figure 2-15 – T-STD model extensions for Rec. ITU-T H.264 ISO/IEC 14496-10 video with scalable video sub-bitstreams.....	196
Figure 2-16 – P-STD model extensions for Rec. ITU-T H.264 ISO/IEC 14496-10 Video with scalable video sub-bitstreams.....	199
Figure 2-17 – T-STD model extensions for Rec. ITU-T H.264 ISO/IEC 14496-10 Video with MVC video sub-bitstreams.....	201
Figure 2-18 – P-STD model extensions for Rec. ITU-T H.264 ISO/IEC 14496-10 Video with MVC video sub-bitstreams.....	205
Figure 2-19 – T-STD model extensions for ISO/IEC 14496-17 text streams.....	207
Figure 2-20 – T-STD model extensions for single layer HEVC.....	210

Figure 2-21 – T-STD model extensions for layered transport of HEVC temporal video subsets.....	212
Figure 2-22 – T-STD model extensions for bitstream-partition-specific CPB operation	214
Figure 2-23 – T-STD model extensions for transport of HEVC tiles through individual ESs	218
Figure 2-24 – T-STD model extensions for transport of HEVC tiles in a common ES using AF descriptors.....	220
Figure 2-25 – T-STD model extension for transport of HEVC tiles in a common ES ignoring AF descriptors	222
Figure 2-26 – T-STD model extension for green access units.....	224
Figure 2-27 – Transport stream system target decoder for multiple audio elementary streams	226
Figure 2-28 – Quality Access Unit decoder processing model.....	227
Figure 2-29 – T-STD model extensions for single layer VVC	229
Figure 2-30 – T-STD model extensions for layered transport of VVC temporal video subsets.....	231
Figure 2-31 – T-STD model extensions for single layer EVC	234
Figure A.1 – 32-bit CRC decoder model.....	238
Figure B.1 – Configuration of DSM-CC application.....	241
Figure B.2 – BSM-CC bitstream decoded as a stand-alone bitstream.....	241
Figure B.3 – DSM-CC bitstream decoded as part of the system bitstream	242
Figure C.1 – Program and network mapping relationships	251
Figure D.1 – Constant delay model	256
Figure D.2 – STC recovery using PLL	260
Figure F.1 – Transport stream syntax diagram	266
Figure F.2 – PES packet syntax diagram	267
Figure F.3 – Program association section diagram	267
Figure F.4 – Conditional access section diagram	267
Figure F.5 – TS program map section diagram	268
Figure F.6 – Private section diagram.....	268
Figure F.7 – Program stream diagram	269
Figure F.8 – Program stream map diagram	269
Figure J.1 – Sending system streams over a jitter-inducing network	274
Figure J.2 – Jitter-smoothing using network-layer timestamps	274
Figure J.3 – Integrated dejittering and MPEG-2 decoding	275
Figure R.1 – Example of ISO/IEC 14496 content in a program stream	290
Figure R.2 – Example of ISO/IEC 14496 content in a transport stream.....	291
Figure R.3 – Usage of MPEG-4 in a transport stream with BIFS scene referring to native PES	292
Figure R.4 – Usage of MPEG-4 in a transport stream with an ODUupdate_descriptor carrying an image ObjectDescriptor in the PMT.....	293
Figure S.1 – Structure and order of JPEG 2000 access units.....	298
Figure S.2 – T-STD model extensions for J2K Video.....	299
Figure U.1 – Stream partitioning into 2 and 5 second segments	313
Figure V.1 – Illustration of HEVC tiled encoding of panoramic content beyond UHD.....	316
Figure V.2 – Example of HEVC tile substream identification	317
Figure V.3 – Example of subregion layout for a 3 x 3 RoI.....	317
Figure W.1 – Structure and order of JPEG XS access units	320
Figure W.2 – T-STD model extensions for JPEG XS Video.....	322