

ISO/IEC 23090-3:2021-02 (E)

Information technology - Coded representation of immersive media - Part 3: Versatile video coding

Contents

Page

Foreword	vi
Introduction	vii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviated terms	13
5 Conventions	16
5.1 General	16
5.2 Arithmetic operators	16
5.3 Logical operators	16
5.4 Relational operators	17
5.5 Bit-wise operators	17
5.6 Assignment operators	17
5.7 Range notation	17
5.8 Mathematical functions	17
5.9 Order of operation precedence	18
5.10 Variables, syntax elements and tables	19
5.11 Text description of logical operations	20
5.12 Processes	21
6 Bitstream and picture formats, partitionings, scanning processes and neighbouring relationships	21
6.1 Bitstream formats	21
6.2 Source, decoded and output picture formats	21
6.3 Partitioning of pictures, subpictures, slices, tiles, and CTUs	23
6.3.1 Partitioning of pictures into subpictures, slices, and tiles	23
6.3.2 Block, quadtree and multi-type tree structures	25
6.3.3 Spatial or component-wise partitionings	26
6.4 Availability processes	27
6.4.1 Allowed quad split process	27
6.4.2 Allowed binary split process	27
6.4.3 Allowed ternary split process	29
6.4.4 Derivation process for neighbouring block availability	30
6.5 Scanning processes	30
6.5.1 CTB raster scanning, tile scanning, and subpicture scanning processes	30
6.5.2 Up-right diagonal scan order array initialization process	34
6.5.3 Horizontal and vertical traverse scan order array initialization process	35
7 Syntax and semantics	35
7.1 Method of specifying syntax in tabular form	35
7.2 Specification of syntax functions and descriptors	36
7.3 Syntax in tabular form	38
7.3.1 NAL unit syntax	38
7.3.2 Raw byte sequence payloads, trailing bits and byte alignment syntax	38
7.3.3 Profile, tier, and level syntax	57
7.3.4 DPB parameters syntax	60
7.3.5 Timing and HRD parameters syntax	60
7.3.6 Supplemental enhancement information message syntax	61
7.3.7 Slice header syntax	62
7.3.8 Weighted prediction parameters syntax	64
7.3.9 Reference picture lists syntax	65

7.3.10	Reference picture list structure syntax.....	66
7.3.11	Slice data syntax.....	66
7.4	Semantics.....	88
7.4.1	General.....	88
7.4.2	NAL unit semantics.....	88
7.4.3	Raw byte sequence payloads, trailing bits and byte alignment semantics.....	95
7.4.4	Profile, tier, and level semantics.....	141
7.4.5	DPB parameters semantics.....	146
7.4.6	Timing and HRD parameters semantics.....	146
7.4.7	Supplemental enhancement information message semantics.....	150
7.4.8	Slice header semantics.....	150
7.4.9	Weighted prediction parameters semantics.....	158
7.4.10	Reference picture lists semantics.....	159
7.4.11	Reference picture list structure semantics.....	160
7.4.12	Slice data semantics.....	161
8	Decoding process.....	183
8.1	General decoding process.....	183
8.1.1	General.....	183
8.1.2	Decoding process for a coded picture.....	184
8.2	NAL unit decoding process.....	185
8.3	Slice decoding process.....	185
8.3.1	Decoding process for picture order count.....	185
8.3.2	Decoding process for reference picture lists construction.....	187
8.3.3	Decoding process for reference picture marking.....	191
8.3.4	Decoding process for generating unavailable reference pictures.....	192
8.3.5	Decoding process for symmetric motion vector difference reference indices.....	192
8.3.6	Decoding process for collocated picture and no backward prediction.....	193
8.4	Decoding process for coding units coded in intra prediction mode.....	194
8.4.1	General decoding process for coding units coded in intra prediction mode.....	194
8.4.2	Derivation process for luma intra prediction mode.....	195
8.4.3	Derivation process for chroma intra prediction mode.....	198
8.4.4	Cross-component chroma intra prediction mode checking process.....	199
8.4.5	Decoding process for intra blocks.....	200
8.5	Decoding process for coding units coded in inter prediction mode.....	231
8.5.1	General decoding process for coding units coded in inter prediction mode.....	231
8.5.2	Derivation process for motion vector components and reference indices.....	235
8.5.3	Decoder-side motion vector refinement process.....	254
8.5.4	Derivation process for geometric partitioning mode motion vector components and reference indices.....	259
8.5.5	Derivation process for subblock motion vector components and reference indices.....	260
8.5.6	Decoding process for inter blocks.....	285
8.5.7	Decoding process for geometric partitioning mode inter blocks.....	307
8.5.8	Decoding process for the residual signal of coding blocks coded in inter prediction mode.....	313
8.5.9	Decoding process for the reconstructed signal of chroma coding blocks coded in inter prediction mode.....	314
8.6	Decoding process for coding units coded in IBC prediction mode.....	316
8.6.1	General decoding process for coding units coded in IBC prediction mode.....	316
8.6.2	Derivation process for block vector components for IBC blocks.....	317
8.6.3	Decoding process for IBC blocks.....	321
8.7	Scaling, transformation and array construction process.....	322
8.7.1	Derivation process for quantization parameters.....	322
8.7.2	Scaling and transformation process.....	324
8.7.3	Scaling process for transform coefficients.....	325
8.7.4	Transformation process for scaled transform coefficients.....	327
8.7.5	Picture reconstruction process.....	347
8.8	In-loop filter process.....	350
8.8.1	General.....	350
8.8.2	Picture inverse mapping process for luma samples.....	350
8.8.3	Deblocking filter process.....	351
8.8.4	Sample adaptive offset process.....	377
8.8.5	Adaptive loop filter process.....	379
9	Parsing process.....	391
9.1	General.....	391
9.2	Parsing process for k-th order Exp-Golomb codes.....	391
9.2.1	General.....	391
9.2.2	Mapping process for signed Exp-Golomb codes.....	392

9.3	CABAC parsing process for slice data	393
9.3.1	General	393
9.3.2	Initialization process.....	394
9.3.3	Binarization process	418
9.3.4	Decoding process flow	427
Annex A (normative)	Profiles, tiers and levels.....	444
Annex B (normative)	Byte stream format	456
Annex C (normative)	Hypothetical reference decoder	458
Annex D (normative)	Supplemental enhancement information and use of SEI and VUI	480
Bibliography	504