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Information technology — Coded representation of immersive media —

Part 20:
Conformance testing for visual volumetric video-based coding (V3C) with video-based point cloud compression (V-PCC)

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts in the ISO 23090 series can be found on the ISO and IEC websites.

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Introduction

This document outlines the conformance testing specification for ISO/IEC 23090-5.

Information technology — Coded representation of immersive media —

Part 20:
Conformance testing for visual volumetric video-based coding (V3C) with video-based point cloud compression (V-PCC)

1 Scope

This document specifies a set of tests and procedures designed to indicate whether encoders or decoders meet the requirements specified in ISO/IEC 23090-5.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 23090-5:2023, *Information technology — Coded representation of immersive media — Part 5: Visual volumetric video-based coding (V3C) and video-based point cloud compression (V-PCC)*

ISO/IEC 23090-19, *Information technology — Coded representation of immersive media — Part 19: Reference Software for V-PCC*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 23090-5 apply, and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
bitstream
sequence of bits that conforms to specified syntax requirements or sequence of bits to be tested for conformance to such syntax requirements

3.2
decoder
embodiment of the decoding process to be tested for conformance to such a decoding process specification

Note 1 to entry: The decoder does not include the rendering and display process, which are outside the scope of this document.

3.3
encoder
embodiment of a process, not specified in this document (except in respect to identification of the reference software encoder), that produces a *bitstream* (3.1)

3.4
reference software decoder
particular *decoder* (3.2) provided as a software package for use as an example available for study, as a potential starting basis for the development of other decoders, as a way of testing *bitstreams* (3.1) for conformance to a decoding process specification, or as a reference for comparison with the behaviour of other decoders

3.5
reference software encoder
particular *encoder* (3.3) provided as a software package for use as an example available for study, as a potential starting basis for the development of other encoders, or as a reference for comparison with the behaviour of other encoders

3.6
V3C output unit
particular structure containing decoded and normalized V3C components that correspond to a specific composition time

3.7
V-PCC reconstruction
particular recommendation of the reconstruction process to be tested for conformance to such a reconstruction process specification

4   Abbreviated terms and acronyms

The relevant abbreviated terms and acronyms are specified in Clause 4 of ISO/IEC 23090-5:2023.

5   Conventions

The relevant conventions are specified in Clause 5 of ISO/IEC 23090-5:2023.

6   Conformance for ISO/IEC 23090-5

6.1   General

The following clauses specify normative tests for verifying the conformance of V3C bitstreams as well as decoders. Those normative tests make use of test data (bitstream test suites) provided at https://standards.iso.org/iso-iec/23090/-20/ed-1/en/ and the reference software decoder specified in ISO/IEC 23090-5.

6.2   Bitstream conformance

The bitstream conformance is specified by Clause E.4 of ISO/IEC 23090-5:2023.

6.3   Decoder conformance

The decoder conformance is specified by Clause E.5 of ISO/IEC 23090-5:2023.

6.4   Reconstruction conformance

The reconstruction conformance of ISO/IEC 23090-5 is specified by Annex B and H.10, H.11, and H.12 according to the chosen reconstruction profile indicated in ISO/IEC 23090-5:2023, H.15. The voxelized representation of the decoded point cloud shall be used for conformance testing. Therefore, the adaptation process specified in the ISO/IEC 23090-5:2023, H.13 shall be ignored.

Decoders conforming to a V-PCC profile with a reconstruction profile component shall perform reconstruction operations required by this reconstruction profile component. Conformance is assessed at conformance point A, as shown in Figure 1, examining the decoded attribute, geometry, and occupancy bitstreams together with the decoded atlas and appropriate information that can associate the decoded patch metadata with the decoded video signal (e.g., patch to block map information). For conformance point A, conformance is exact.

Conformance is assessed at conformance point B, as shown in Figure 1, when the decoder selects to operate in a particular reconstruction profile. Associated reconstruction information to a specific reconstruction profile is provided as reference only. A conformant V-PCC decoder to a particular reconstruction profile may implement alternative processes that produce similar or better visual quality. The definition of similar or better visual quality is outside the scope of this document.

For conformance testing, post-decoding conversion of the decoded V3C video components to a nominal video format is performed.

The process specified in Annex B of ISO/IEC 23090-5 is recommended to be used for the decoded to the nominal video format conversion. The reconstruction process follows a specified order of operations for reconstruction conformance. It is suggested to follow the implementation in ISO/IEC 23090-19.

The process of synchronizing the V3C components is specified in Annex B of ISO/IEC 23090-5. An example containing a detailed description of the V3C component synchronization process can be found in Reference [1].

It is a recommendation of this document that the decoded V3C output units are stored in an intermediate buffer for reconstruction purposes. The decoded V3C output units may be placed into the intermediate buffer at the output time of the corresponding V3C output unit processing. The reconstruction process can start when all required V3C units are available for processing.
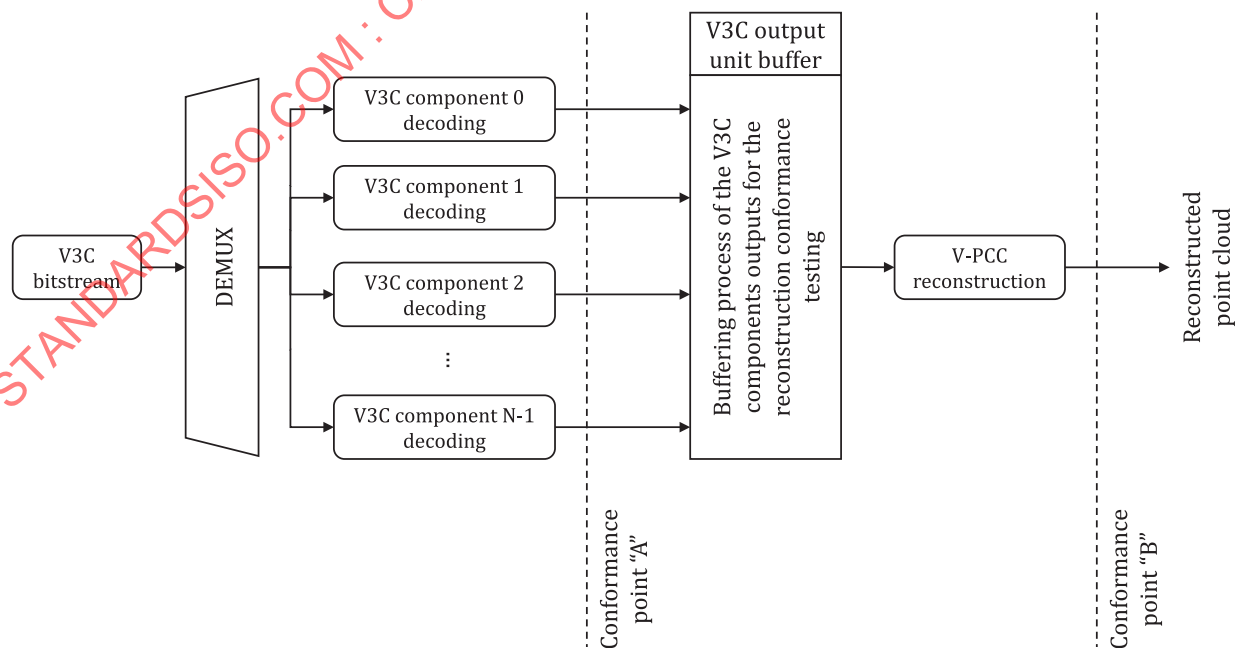

Figure 1 — V3C bitstream conformance evaluation for V-PCC content

6.5 Procedure to test bitstreams

A bitstream that claims conformance with ISO/IEC 23090-5 shall pass the following normative tests:

The bitstream shall be decoded by processing it with the reference software decoder. When processed by the reference software decoder, the bitstream shall not cause any error or non-conformance messages to be reported by the reference software decoder. This test should not be applied to bitstreams that are known to contain errors introduced by transmission, as such errors are likely to result in bitstreams that lack conformance to ISO/IEC 23090-5. The decoding process is performed at best effort to decode atlas, occupancy, geometry, and attribute components of the V3C bitstream. It is a minimum requirement that the atlas component of the V3C bitstream is present for conformance testing.

Additional tests may be required to thoroughly check that the bitstream appropriately meets all the requirements specified in ISO/IEC 23090-5, including the hypothetical reference decoder (HRD) conformance (based on Annexes E, F, and G). These complementary tests may be performed using other point cloud bitstream verification solutions or decoders that perform additional tests compared to checks implemented by the reference software decoder.

ISO/IEC 23090-5 contains several informative recommendations that are not an integral part of that document. When testing a bitstream for conformance, it may also be helpful to test whether the bitstream follows those recommendations.

To check the correctness of a bitstream, it is necessary to parse the entire bitstream and extract all the syntax elements and other values derived from those syntax elements and used by the decoding process specified in ISO/IEC 23090-5.

The verification process shall not necessarily perform all stages of the decoding process specified in ISO/IEC 23090-5 to verify bitstream correctness. Some tests can be performed on syntax elements in a state before their use in corresponding processing stages.

6.6 Procedure to test decoder conformance

6.6.1 Conformance bitstreams

A bitstream has values of ptl_profile_codec_group_idc, ptl_profile_toolset_idc, ptl_profile_reconstruction_idc, and ptl_level_idc corresponding to a set of specified constraints on a bitstream for which a decoder conforming to a specified profile and level is required in Annex A of ISO/IEC 23090-5 to perform the decoding process properly.

6.6.2 Contents of the bitstream file

The conformance bitstreams are available at https://standards.iso.org/iso-iec/23090/-20/ed-1/en/. The information indicated in Table 1 is included in a single zipped file for each such bitstream.

In cases where the decoded pictures or hashes of decoded pictures are not available, the reference software decoder shall be used to generate the necessary reference decoded pictures from the bitstream.

Table 1 — List of the files for conformance testing

Item	Extension	Description	Requirement
1	*.bin	coded bitstream	mandatory
2	*_dscr_bitstr.txt	a short description of the bitstream	mandatory
3	*.cfg	the configuration files used to generate bitstream with a software encoder provided in ISO/IEC 23090-20.	optional, if reference software is used.
4	*_bitstream_md5.txt	the MD5 checksum of the entire coded V3C bitstream file	mandatory
5	*_hls_md5.txt	the MD5 checksum of the HLS and SEI units, if present, of the coded V3C bitstream file	mandatory for HLS optional for SEI
6	*_picture_log.txt	Contains the logs for occupancy, geometry, and attribute components	optional
7	*_atlas_log.txt	output atlas log	optional*
8	*_tile_log.txt	output tile log	optional*
9	*_pcframe_log.txt	output point cloud frame log before post-reconstruction	optional
10	*_rec_pcframe_log.txt	the output of post-reconstruction point cloud frame log	optional
11	*_dec_[frm_no].ply	A collection of decoded point cloud frames per indicated reconstruction profile containing the unordered reconstructed decoded point cloud frames.	optional

6.6.3 Requirements on the output of the decoding process, reconstruction process, and timing

The output of the decoding process is specified in Clauses 8, 9, and Annexes E, F, G, and H of ISO/IEC 23090-5:2023. The output of the decoding process is used as the input of the reconstruction process and timing, as defined in Annex B of ISO/IEC 23090-5:2023.

For output order conformance, it is a requirement that all the decoded V3C component frames (point cloud frames) specified for output in Annex E of ISO/IEC 23090-5:2023 shall be output by a conforming decoder in the specified order and that the values of the decoded samples in all the V3C component frames that are output shall be equal to the values specified in Clause 8 of ISO/IEC 23090-5:2023.

For output timing conformance, it is a requirement that a conforming decoder shall also output the decoded samples at the rates and times specified in Annex E of ISO/IEC 23090-5:2023.

For the reconstruction conformance, it is a requirement that all the decoded components are normalized to the nominal frame rate. An example is provided in Annex B of ISO/IEC 23090-5:2023.

The visualization and display processes, which ordinarily follow the output of the reconstruction process, are outside the scope of this document.

6.6.4 Bitstream validation

The uploaded bitstreams should be validated, and the following aspects should be verified.

— Confirm that the decoded V3C components are identical at conformance point A,

— Confirm that all intended features are included in the bitstream.

The outputs for conformance point A, comprised of the V3C components representing a point cloud frame at a given time instance, are used as an input for the decoder reconstruction process that specifies soft conformance check for conformance point B.

6.6.5 Recommendations (informative)

This clause does not form an integral part of this document.

In addition to the requirements, conforming decoders should implement various informative recommendations specified in ISO/IEC 23090-5 that are not an integral part of that document. This clause lists some of these recommendations.

It is recommended that a conforming decoder can resume the decoding process as soon as possible after the loss or corruption of part of a bitstream. In most cases, it is possible to continue decoding at the following V3C tile unit header. It is recommended that a conforming decoder can perform concealment for the patches or V3C packets for which all the coded data of the V3C components has not been received.

6.7 Test bitstreams

6.7.1 General

The test bitstreams[1] are part of the mechanism to verify decoder conformance according to ISO/IEC 23090-5.

The zipped log files are stored at https://standards.iso.org/iso-iec/23090/-20/ed-1/en/ for the V3C conformance bitstreams test.

Subclause 6.7.2 lists test bitstreams coded with basic toolset and reconstructed with Rec0 profiles, as indicated in Table 2.

Table 2 — Basic toolset bitstreams list

No	Bitstream name	MD5 Sum for decoded bitstream (BITSTRMD5)
1	HEVCMain10_Basic_Rec0_STLINTRA_SONY	5fb-5d5e2434168c07330527f23e14095
2	HEVCMain10_Basic_Rec0_STLINTRA_MC1_INTERDIGITAL	0937d8615746da43ac-c0dee5fb927520
3	HEVCMain10_Basic_Rec0_STLINTRA_MC2_INTERDIGITAL	b16a41e5b11160b9a20efed-860a6253b
4	HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M2P21MC1_INTER-DIGITAL	9989f3757815dab0459a 2c3464275327
5	HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M2P21MC2_INTER-DIGITAL	4d16e79e58750329e3a6462d-49d39df5
6	HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M3P11MC1_INTER-DIGITAL	0e6e2f2742d49b-b1462976024a442b7b
7	HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M3P11MC2_INTER-DIGITAL	b7ecfb5bd-c78476968331661918d1d42
8	HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M3P21MC1_INTER-DIGITAL	9989f3757815dab0459a 2c3464275327
9	HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M3P21MC2_INTER-DIGITAL	4d16e79e58750329e3a6462d-49d39df5
10	HEVCMain10_Basic_Rec0_STLLRA_MC1_INTERDIGITAL	9955e89a55b-35832785f9630ed1655f5
11	HEVCMain10_Basic_Rec0_STLLRA_MC2_INTERDIGITAL	511e459e5797fb179285a79f04293fb6
12	HEVCMain10_Basic_Rec0_MTLLRA_tileT2M2P21MC1_INTERDIG-ITAL	5c91cd236b5ed9c-99d542a78c0691fdf

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1) Sony®, Interdigital™, Samsung in the bitstream names are given for the convenience of users of this document and do not constitute an endorsement by ISO or IEC.

Table 2 *(continued)*

No	Bitstream name	MD5 Sum for decoded bitstream (BITSTRMD5)
13	HEVCMain10_Basic_Rec0_MTLLRA_tileT2M2P21MC2_INTERDIG-ITAL	a17fbe41da9412a87174b0ae3f7ecfb5
14	HEVCMain10_Basic_Rec0_MTLLRA_tileT2M3P21MC1_INTERDIG-ITAL	5c91cd236b5ed9c-99d542a78c0691fdf
15	HEVCMain10_Basic_Rec0_MTLLRA_tileT2M3P21MC2_INTERDIG-ITAL	a17fbe41da9412a87174b0ae3f7ecfb5
16	MP4RA_Basic_Rec0_SEICCM_MC1_INTERDIGITAL	acf33444354598a11e2f-59c08e99e549
17	MP4RA_Basic_Rec0_SEICCM_MC2_INTERDIGITAL	49db25179023cab3c1d3802e75e-a24ed
18	HEVCMain10_Basic_Rec0_LOSSYOM_SAMSUNG_v1	39941d7b2c920f-86309305661b388aa5
19	HEVCMAIN10BASIC_MTL_1MAP_SS_basketball_player	ad92fdd94cb15e-b585099e1c3b280832
20	HEVCMAIN10BASIC_MTL_1MAP_SS_longdress	8b7b97448e18556b5fdce217a0f-9d80a
21	HEVCMAIN10BASIC_MTL_2MAP_MS_basketball_player	1cfddc7fa93a1f43535c7e99819feb11
22	HEVCMAIN10BASIC_MTL_2MAP_MS_longdress	37409b9ef2002febe941d-820c1a0681d
23	HEVCMAIN10BASIC_MTLNONUNI_1MAP_SS_basketball_player	71296ea0e77cb5f0d0b2ca9ad-5b444f5
24	HEVCMAIN10BASIC_MTLNONUNI_1MAP_SS_longdress	8235b0f5a5a6d-72098233c53be895527
25	HEVCMAIN10BASIC_MTLNONUNI_2MAP_MS_basketball_player	54ecbb384241483f5cc12adeffdd5185
26	HEVCMAIN10BASIC_MTLNONUNI_2MAP_MS_longdress	c3130f-b1741a1a432f9b26d189797362
27	HEVCMAIN10BASIC_STL_1MAP_SS_basketball_player	a8129a79da1af42e13cbd54005bf-cbd3
28	HEVCMAIN10BASIC_STL_1MAP_SS_longdress	051bd5b55ff3a0d76ad1d-7a7206d1d11
29	HEVCMAIN10BASIC_STL_2MAP_MS_basketball_player	3e2e4bb8c66ccf78620709d-e43cd80d7
30	HEVCMAIN10BASIC_STL_2MAP_MS_longdress	68559cb8d38735336ca934d-302c2ff57

Subclause 6.7.2 lists test bitstreams coded with basic toolset still and reconstructed with Rec0 profiles, as indicated in Table 3.

Table 3 — Basic toolset still bitstreams list

No	Bitstream name	MD5 Sum for decoded bitstream (BITSTRMD5)
1	HEVCMAIN10_BASIC_STILL_MTL_2MAP_MS_basketball_player	a64b90433ac6fdba1c126d0b64bfa8ef
2	HEVCMAIN10_BASIC_STILL_MTL_2MAP_MS_longdress	a7258d5d6f1ac601aa4bcb0854a497f8
3	HEVCMAIN10_BASIC_STILL_STL_1MAP_SS_basketball_player	df4be9bd01ad7dcb9f94d071fbe20a51
4	HEVCMAIN10_BASIC_STILL_STL_1MAP_SS_longdress	2bb57067a0891209f0b122ced437c77e

Subclause 6.7.4 lists test bitstreams coded with extended toolset and reconstructed with Rec0 profiles, as indicated in Table 4.

Table 4 — Extended toolset bitstreams list

No	Bitstream name	MD5 Sum for decoded bitstream (BITSTRMD5)
1	HEVCMain10_Extended_Rec0_PEXT_SONY	daa83e77634c7b01b371ffe74a895bed
2	HEVCMain10_Extended_Rec0_POEIGHT_SONY_v1	8e8925a83f6ac99978ecce0c76deef98

Subclause 6.7.5 lists test bitstreams with soft conformance reconstructed with Rec 1 profiles, as indicted in Table 5.

Table 5 — Soft conformance REC1 bitstreams list

No	Bitstream name	MD5 Sum for decoded bitstream (BITSTRMD5)
1	HEVCMain10_Basic_Rec1_GEOSM_SONY	ac94dbcf4f48457af3ee72b1a0b7cffe
2	HEVCMain10_Basic_Rec1_ATTRSM_SAMSUNG_v1	eadd2d534fb3e40f5d3416a552e54ad7
3	HEVCMain10_Basic_Rec1_PDI_INTERDIGITAL	011c280fae20ad2412d9790861499326
4	HEVCMain10_Extended_Rec1_PLR_MC1PLR1_INTERDIGITAL	efec2b6b09168f4f68060ca1aa18aa21
5	HEVC444_Extended_Rec1_PTEOM_LOSGEO_INTERDIGITAL	27e230ed30f2ba00f9818ce9f453a41b
6	HEVC444_Extended_Rec1_PTRAX_LOSGEO_INTERDIGITAL	67d97cf5fa42313d13393e9ff7892966

Subclause 6.7.6 lists test bitstreams with soft conformance reconstructed with Rec 2 profiles, as indicated in Table 6.

Table 6 — Soft conformance REC2 bitstreams list

No	Bitstream name	MD5 Sum for decoded bitstream (BITSTRMD5)
1	HEVCMain10_Basic_Rec2_OCCSY_PBF_INTERDIGITAL	49e6ac465e1689dc0da4b-2712641cd77
2	HEVCMain10_Extended_Rec2_PLR_MC1PLR1_OCCSY_PBF_INTER-DIGITAL	2388e9534b9c2be8f-8389cdead804877
3	HEVC444_Basic_Rec2_PTRAW_INTERDIGITAL	04a7a4d4982bb9aa5c8b840c3f-fa42b7
4	HEVCMain10_Basic_Rec2_ATTRSM_SAMSUNG_v1	bdf8da8707220dab41585953b-dd2f2f7

6.7.2   Bitstreams coded with basic toolset coding profile and reconstructed with Rec 0 profiles

6.7.2.1   General

This subclause contains bitstreams coded with basic toolset and reconstructed with Rec 0 profiles.

6.7.2.2   HEVCMain10_Basic_Rec0_STLINTRA_SONY

Specification: V3C coded bitstream is a single bitstream composed of 32 coded atlas frames together with the corresponding occupancy, geometry, and attribute V3C components coded using HEVC main 10 profile. Each atlas frame contains a single tile, coded as intra tile (I_TILE). Two maps are used to code each of the geometry and texture attribute V3C video components. Texture attribute consists of 3 channels: r, g, and b. The V3C profile for coding the V3C bitstream is HEVC Main10 Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of a single atlas tile, with one or two maps. The patches are coded in intra mode only.

6.7.2.3   HEVCMain10_Basic_Rec0_STLINTRA_MC1_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple map streams configuration, 32 frames are coded.

— The bitstream contains one map.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of a single atlas tile with one map. The patches are coded in intra mode only.

6.7.2.4   HEVCMain10_Basic_Rec0_STLINTRA_MC2_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple map streams configuration, 32 frames are coded.

— The bitstream contains two maps.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of a single atlas tile with two maps. The patches are coded in intra mode only.

6.7.2.5   HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M2P21MC1_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 2.

— The bitstream contains one map.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 2.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with one map. The patches are coded in intra mode only.

6.7.2.6   HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M2P21MC2_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 2.

— The bitstream contains two maps.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 2.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with two maps. The patches are coded in intra mode only.

6.7.2.7   HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M3P11MC1_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 3.

— The bitstream contains one map.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 1.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with one map. The patches are coded in intra mode only.

6.7.2.8   HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M3P11MC2_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 3.

— The bitstream contains two maps.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 1.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with two maps. The patches are coded in intra mode only.

6.7.2.9 HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M3P21MC1_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 3.

— The bitstream contains one map.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 2.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with one map. The patches are coded in intra mode only.

6.7.2.10 HEVCMain10_Basic_Rec0_MTLINTRA_tileT2M3P21MC2_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 3.

— The bitstream contains two maps.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 2.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with two maps. The patches are coded in intra mode only.

6.7.2.11 HEVCMain10_Basic_Rec0_STLLRA_MC1_INTERDIGITAL

Specification: V3C coded bitstream is processed with Inter Random Access, Merge, Skip, and multiple map streams configuration, 32 frames are coded.

— The bitstream contains one map.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with one map. The patches are coded in inter, skip, and merge modes.

6.7.2.12 HEVCMain10_Basic_Rec0_STLLRA_MC2_INTERDIGITAL

Specification: V3C coded bitstream is processed with Inter Random Access, Merge, Skip, and multiple map streams configuration, 32 frames are coded.

— The bitstream contains two maps.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with two maps. The patches are coded in inter, skip, and merge modes.

6.7.2.13 HEVCMain10_Basic_Rec0_MTLLRA_tileT2M2P21MC1_INTERDIGITAL

Specification: V3C coded bitstream is processed with Inter Random Access, Merge, Skip, and multiple map streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 2.

— The bitstream contains 1 map.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 2.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles, with two maps. The patches are coded in inter, skip, and merge modes.

6.7.2.14 HEVCMain10_Basic_Rec0_MTLLRA_tileT2M2P21MC2_INTERDIGITAL

Specification: V3C coded bitstream is processed with Inter Random Access, Merge, Skip, and multiple map streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 2.

— The bitstream contains 2 maps.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 2.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles, with two maps. The patches are coded in inter, skip, and merge modes.

6.7.2.15 HEVCMain10_Basic_Rec0_MTLLRA_tileT2M3P21MC1_INTERDIGITAL

Specification: V3C coded bitstream is processed with Inter Random Access, Merge, Skip, and multiple map streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 3.

— The bitstream contains 1 map.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 2.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles, with two maps. The patches are coded in inter, skip, and merge modes.

6.7.2.16 HEVCMain10_Basic_Rec0_MTLLRA_tileT2M3P21MC2_INTERDIGITAL

Specification: V3C coded bitstream is processed with Inter Random Access, Merge, Skip, and multiple map streams configuration, 32 frames are coded.

— It contains multiple I_TILE. The maximum number of tiles per frame is set to 3.

— The bitstream contains 2 maps.

— The tile segmentation method is 2D Patch size based.

— The uniform partition width in the unit of 64 pixels is set to 2.

— The uniform partition height in the unit of 64 pixels is set to 1.

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles, with two maps. The patches are coded in inter, skip, and merge modes.

6.7.2.17 MP4RA_Basic_Rec0_SEICCM_MC1_INTERDIGITAL

Specification: V3C coded bitstream is processed with Inter Random Access, Merge, Skip, and multiple map streams configuration, 32 frames are coded.

— The bitstream contains 1 map.

— The Component Codec Mapping SEI message is used (pointing to HEVC codec).

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Component codec mapping (CCM) SEI message.

Purpose: Check that the decoder can properly parse and decode information contained in CCM SEI message.

6.7.2.18   MP4RA_Basic_Rec0_SEICCM_MC2_INTERDIGITAL

Specification: V3C coded bitstream is processed with Inter Random Access, Merge, Skip, and multiple map streams configuration, 32 frames are coded.

— The bitstream contains 2 maps

— The Component Codec Mapping SEI message is used (pointing to HEVC codec).

— The bitstream allows testing conformance point A.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec0.

Functional stage: Component codec mapping (CCM) SEI message.

Purpose: Check that the decoder can properly parse and decode information contained in CCM SEI message.

6.7.2.19   HEVCMain10_Basic_Rec0_LOSSYOM_SAMSUNG_v1

Specification: V3C coded bitstream is a single bitstream composed of a single coded atlas frame together with the corresponding occupancy, geometry, and attribute V3C components coded using the HEVC main 10 profile. The V3C profile for coding the V3C bitstream is HEVC Main10 Basic Rec0.

Functional stage: Derivation of binary occupancy map values for point cloud reconstruction.

Purpose: Check that the reconstruction is performed correctly when the bitstream includes a positive value for oi_lossy_occupancy_compression_threshold.

6.7.2.20   HEVCMAIN10BASIC_MTL_1MAP_SS_basketball_player

Specification: HEVCMAIN10BASIC_MTL_1MAP_SS_basketball_player.bit is a V-PCC elementary bitstream of the sequence basketball_player_vox11.

The bitstream has 32 point cloud frames that consist of multiple I_TILEs. The frame has one map. One geometry video bitstream and One attribute video bitstream are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is uniform (afti_uniform_partition_spacing_flag = 1).

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has multiple intra tiles with uniformly partitioned in one map.

6.7.2.21   HEVCMAIN10BASIC_MTL_1MAP_SS_longdress

Specification: HEVCMAIN10BASIC_MTL_1MAP_SS_longdress.bit is a V-PCC elementary bitstream of the sequence longdress_vox10.

The bitstream has 32 point cloud frames that consist of multiple I_TILEs. The frame has one map. One geometry video bitstream and One attribute video bitstream are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has multiple intra tiles with uniformly partitioned in one map.

6.7.2.22 HEVCMAIN10BASIC_MTL_2MAP_MS_basketball_player

Specification: HEVCMAIN10BASIC_MTL_2MAP_MS_basketball_player.bit is a V-PCC elementary bitstream of the sequence basketball_player_vox11.

The bitstream has 32 point cloud frames that consist of multiple I_TILEs. The frame has two maps. Two geometry video bitstreams and two attribute video bitstreams are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is uniform (afti_uniform_partition_spacing_flag = 1).

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has multiple intra tiles with two maps in two bitstreams.

6.7.2.23 HEVCMAIN10BASIC_MTL_2MAP_MS_longdress

Specification: HEVCMAIN10BASIC_MTL_2MAP_MS_longdress.bit is a V-PCC elementary bitstream of the sequence longdress_vox10.

The bitstream has 32 point cloud frames that consist of multiple I_TILEs. The frame has two maps. Two geometry video bitstreams and two attribute video bitstreams are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is uniform (afti_uniform_partition_spacing_flag = 1).

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has multiple intra tiles with two maps in two bitstreams.

6.7.2.24 HEVCMAIN10BASIC_MTLNONUNI_1MAP_SS_longdress

Specification: HEVCMAIN10BASIC_MTLNONUNI_1MAP_SS_longdress.bit is a V-PCC elementary bitstream of the sequence longdress_vox10.

The bitstream has 32 point cloud frames that consist of multiple I_TILEs. The frame has one map. One geometry video bitstream and One attribute video bitstream are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is non-uniform (afti_uniform_partition_spacing_flag = 0).

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has multiple intra tiles with one map in one bitstream.

6.7.2.25 HEVCMAIN10BASIC_MTLNONUNI_1MAP_SS_basketball_player

Specification: HEVCMAIN10BASIC_MTLNONUNI_1MAP_SS_basketball_player.bit is a V-PCC elementary bitstream of the sequence basketball_player_vox11.

The bitstream has 32 point cloud frames that consist of multiple I_TILEs. The frame has one map. One geometry video bitstream and One attribute video bitstream are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is non-uniform (afti_uniform_partition_spacing_flag = 0).

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has multiple intra tiles with one map in one bitstream.

6.7.2.26 HEVCMAIN10BASIC_MTLNONUNI_2MAP_MS_basketball_player

Specification: HEVCMAIN10BASIC_MTLNONUNI_2MAP_MS_basketball_player.bit is a V-PCC elementary bitstream of the sequence basketball_player_vox11.

The bitstream has 32 point cloud frames that consist of multiple I_TILEs. The frame has two maps. Two geometry video bitstreams and two attribute video bitstreams are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is non-uniform (afti_uniform_partition_spacing_flag = 0).

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has multiple intra tiles with two maps in two bitstreams.

6.7.2.27 HEVCMAIN10BASIC_MTLNONUNI_2MAP_MS_longdress

Specification: HEVCMAIN10BASIC_MTLNONUNI_2MAP_MS_longdress.bit is a V-PCC elementary bitstream of the sequence longdress_vox10.

The bitstream has 32 point cloud frames that consist of multiple I_TILEs. The frame has two maps. Two geometry video bitstreams and two attribute video bitstreams are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is non-uniform (afti_uniform_partition_spacing_flag = 0).

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has multiple intra tiles with one map in one bitstream.

6.7.2.28 HEVCMAIN10BASIC_STL_1MAP_SS_basketball_player

Specification: HEVCMAIN10BASIC_STL_1MAP_SS_basketball_player.bit is a V-PCC elementary bitstream of the sequence basketball_player_vox11.

The bitstream has 32 point cloud frames that consist of a single I_TILE. The frame has one map. One geometry video bitstream and One attribute video bitstream are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has a single intra tile in one map.

6.7.2.29 HEVCMAIN10BASIC_STL_1MAP_SS_longdress

Specification: HEVCMAIN10BASIC_STL_1MAP_SS_longdress.bit is a V-PCC elementary bitstream of the sequence longdress_vox10.

The bitstream has 32 point cloud frames that consist of a single I_TILE. The frame has one map. One geometry video bitstream and One attribute video bitstream are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has a single intra tile in one map.

6.7.2.30   HEVCMAIN10BASIC_STL_2MAP_MS_basketball_player

Specification: HEVCMAIN10BASIC_STL_2MAP_MS_basketball_player.bit is a V-PCC elementary bitstream of the sequence basketball_player_vox11.

The bitstream has 32 point cloud frames that consist of a single I_TILE. The frame has two maps. Two geometry video bitstreams and two attribute video bitstreams are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has a single intra tile in two maps

6.7.2.31   HEVCMAIN10BASIC_STL_2MAP_MS_longdress

Specification: HEVCMAIN10BASIC_STL_2MAP_MS_longdress.bit is a V-PCC elementary bitstream of the sequence longdress_vox10.

The bitstream has 32 point cloud frames that consist of a single I_TILE. The frame has two maps. Two geometry video bitstreams and two attribute video bitstreams are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC profile, ptl_profile_toolset_idc is 0 and ptl_profile_reconstruction_idc is 0.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

Functional stage: Atlas coding in Basic Toolset profile.

Purpose: Check that the decoder can properly decode a bitstream has a single intra tile in two maps.

6.7.3 Bitstreams coded with basic toolset still coding profile and reconstructed with Rec 0 profiles

6.7.3.1 General

This subclause contains bitstreams coded with basic toolset still and reconstructed with Rec 0 profiles.

6.7.3.2 HEVCMAIN10_BASIC_STILL_MTL_2MAP_MS_basketball_player

Specification: HEVCMAIN10_BASIC_STILL_MTL_2MAP_MS_basketball_player.bit is a V-PCC elementary bitstream of the sequence, basketball_player_vox11.

The bitstream has a single point cloud frame. The frame has one map. Two geometry video bitstreams and two attribute video bitstreams are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC STILL profile, ptl_profile_toolset_idc is 0, ptl_profile_ reconstruction_idc is 0 and ptc_one_v3c_frame_only_flag =1.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is non-uniform (afti_uniform_partition_spacing_flag = 0)

Functional stage: Atlas coding in Basic Toolset Still profile.

Purpose:. Check that the decoder can properly decode a bitstream in Basic Still profile with multiple tiles. The patches are coded in intra mode only.

6.7.3.3 HEVCMAIN10_BASIC_STILL_MTL_2MAP_MS_longdress

Specification: HEVCMAIN10_BASIC_STILL_MTL_2MAP_MS_longdress.bit is a V-PCC elementary bitstream of the sequence, longdress_vox10.

The bitstream has a single point cloud frame. The frame has one map. Two geometry video bitstreams and two attribute video bitstreams are present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC STILL profile, ptl_profile_toolset_idc is 0, ptl_profile_ reconstruction_idc is 0 and ptc_one_v3c_frame_only_flag =1.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

The tile partition is non-uniform (afti_uniform_partition_spacing_flag = 0).

Functional stage: Atlas coding in Basic Toolset Still profile.

Purpose:. Check that the decoder can properly decode a bitstream in Basic Still profile with multiple tiles. The patches are coded in intra mode only.

6.7.3.4 HEVCMAIN10_BASIC_STILL_STL_1MAP_SS_basketball_player

Specification: HEVCMAIN10_BASIC_STILL_STL_1MAP_SS_basketball_player.bit is a V-PCC elementary bitstream of the sequence, basketball_player_vox11.

The bitstream has a single point cloud frame. The frame has one map. An attribute video bitstream is present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC STILL profile, ptl_profile_toolset_idc is 0, ptl_profile_reconstruction_idc is 0 and ptc_one_v3c_frame_only_flag =1.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

Functional stage: Atlas coding in Basic Toolset Still profile.

Purpose: Check that the decoder can properly decode a bitstream in Basic Still profile with single tile. The patches are coded in intra mode only.

6.7.3.5   HEVCMAIN10_BASIC_STILL_STL_1MAP_SS_longdress

Specification: HEVCMAIN10_BASIC_STILL_STL_1MAP_SS_longdress.bit is a V-PCC elementary bitstream of the sequence, longdress_vox10.

The bitstream has a single point cloud frame. The frame has one map. An attribute video bitstream is present in the bitstream. Auxiliary video is not present in the bitstream.

Occupancy, geometry, and attribute videos are compressed only with intra prediction.

It conforms HEVCMAIN10 and BASIC STILL profile, ptl_profile_toolset_idc is 0, ptl_profile_reconstruction_idc is 0 and ptc_one_v3c_frame_only_flag =1.

None of the post-processing, such as geometry smoothing, attribute transfer or color smoothing is applied.

Functional stage: Atlas coding in Basic Toolset Still profile.

Purpose: Check that the decoder can properly decode a bitstream in Basic Still profile with single tile. The patches are coded in intra mode only.

6.7.4   Bitstreams coded with extended toolset coding profile and reconstructed with Rec 0 profiles

6.7.4.1   General

This subclause contains bitstreams coded with extended toolset and reconstructed with Rec 0 profiles.

6.7.4.2   HEVCMain10_Extended_Rec0_PEXT_SONY

Specification: V3C coded bitstream is a single bitstream composed of 32 coded atlas frames together with the corresponding occupancy, geometry, and attribute V3C components coded using HEVC main 10 profile. Each atlas frame contains a single tile, coded as intra tile (I_TILE). Two maps are used to code each of the geometry and texture attribute V3C video components. Texture attribute consists of 3 channels: r, g, and b. The V3C profile for coding the V3C bitstream is HEVC Main10 extended Rec0.

Functional stage: Atlas coding in Extended Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with one or two maps. The patches are projected using a 45-degree extended projection.

6.7.4.3   HEVCMain10_Extended_Rec0_POEIGHT_SONY_v1

Specification: V3C coded bitstream is a single bitstream composed of 32 coded atlas frames together with the corresponding occupancy, geometry, and attribute V3C components coded using HEVC main

10 profile. Each atlas frame contains a single tile, coded as intra tile (I_TILE). Two maps are used to code each of the geometry and texture attribute V3C video components. Texture attribute consists of 3 channels: r, g, and b. The V3C profile for coding the V3C bitstream is HEVC Main10 extended Rec0.

Functional stage: Atlas coding in Extended Toolset profile.

Purpose: Check that the decoder can properly decode atlas bitstreams comprised of multiple uniform atlas tiles with one or two maps. The patches are packed using up to eight different orientations.

6.7.5   Bitstreams with soft conformance reconstructed with Rec 1 profile

6.7.5.1   General

This subclause contains bitstreams coded with basic toolset, extended toolset, and reconstructed with Rec 1 profiles

6.7.5.2   HEVCMain10_Basic_Rec1_GEOSM_SONY

Specification: V3C coded bitstream is a single bitstream composed of 32 coded atlas frames together with the corresponding occupancy, geometry, and attribute V3C components coded using HEVC main 10 profile. The V3C profile for coding the V3C bitstream is HEVC Main10 Basic Rec1.

Functional stage: Geometry Smoothing in Rec 1 profile.

Purpose: Check that the reconstruction can properly process geometry smoothing.

6.7.5.3   HEVCMain10_Basic_Rec1_ATTRSM_SAMSUNG_v1

Specification: V3C coded bitstream is a single bitstream composed of a single coded atlas frame together with the corresponding occupancy, geometry, and attribute V3C components coded using HEVC main 10 profile. The V3C profile for coding the V3C bitstream is HEVC Main10 Basic Rec1.

Functional stage: Attribute Smoothing in Rec 1 profile.

Purpose: Check that the reconstruction can properly process attribute smoothing in conjunction with geometry smoothing.

6.7.5.4   HEVCMain10_Basic_Rec1_PDI_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and single-stream configuration, 32 frames are coded.

— The bitstream contains one map.

— The pixel deinterleaving tool is enabled.

— The bitstream allows testing conformance points A and B.

— The bitstream profile is HEVC MAIN10 V-PCC Basic Rec1.

Functional stage: Pixel deinterleaving reconstruction.

Purpose: Check that the decoder can properly decode and reconstruct points carried in interleaved maps, with one map.

6.7.5.5   HEVCMain10_Extended_Rec1_PLR_MC1PLR1_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and single-stream configuration, 32 frames are coded.

— The bitstream contains one map.

— The point local reconstruction (PLR) tool is enabled.

— The bitstream allows testing conformance point A and B.

— The bitstream profile is HEVC Main10 V-PCC Extended Rec1.

Functional stage: Point local reconstruction.

Purpose: Check that the decoder can properly decode and reconstruct points carried with point local reconstruction (PLR) method, with one map.

6.7.5.6 HEVC444_Extended_Rec1_PTEOM_LOSGEO_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra lossless and single-stream configuration, 32 frames are coded.

— The Enhanced Occupancy Map tool is enabled.

— The geometry map is losslessly coded.

— The bitstream allows testing conformance points A and B.

— The bitstream profile is HEVC444 V-PCC Extended Rec1.

Functional stage: EOM patch decoding and EOM points reconstruction in Rec 1 profile.

Purpose: Check that the decoder can properly decode the EOM patch type, and reconstruction can properly process points associated with decoded EOM patch.

6.7.5.7 HEVC444_Extended_Rec1_PTRAX_LOSGEO_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra lossless and single-stream configuration, 32 frames are coded.

— The RAW points are enabled and coded in an auxiliary video.

— The EOM points are enabled and coded in an auxiliary video.

— The geometry map is coded losslessly.

— The bitstream allows testing conformance points A and B.

— The bitstream profile is HEVC444 V-PCC Extended Rec1.

Functional stage: RAW and EOM patch decoding in the auxiliary video.

Purpose: Check that the decoder can adequately decode RAW and EOM patches carried in the auxiliary video and reconstruction can properly process points associated with the decoded RAW patch and EOM patch.

6.7.6 Bitstreams with soft conformance reconstructed with Rec 2 profile

6.7.6.1 General

This subclause contains bitstreams coded with basic toolset and reconstructed with Rec 2 profiles.

6.7.6.2 HEVC444_Basic_Rec2_PTRAW_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra lossless and multiple stream configuration, 32 frames are coded.

— The Enhanced Occupancy Map tool is set to 0 (disabled).

— The RAW tool is set to 1 (enabled).

— The bitstream allows testing conformance points A and B.

The bitstream profile is HEVC444 V-PCC Basic Rec2.

Functional stage: RAW patch decoding and RAW points reconstruction in Rec 2 profile.

Purpose: Check that the decoder can properly decode RAW patch type and reconstruction can properly process points associated with the decoded RAW patch.

6.7.6.3   HEVCMain10_Basic_Rec2_OCCSY_PBF_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and multiple streams configuration, 32 frames are coded.

— The occupancy synthesis method 1: Patch Border Filtering (PBF) is enabled.

— The bitstream allows testing conformance points A and B.

— The bitstream profile is HEVC Main10 V-PCC Basic Rec2.

Functional stage: Patch Border Filtering in Rec 2 profile.

Purpose: Check that the reconstruction can properly process occupancy map filtering using patch border filtering, with two maps.

6.7.6.4   HEVCMain10_Extended_Rec2_PLR_MC1PLR1_OCCSY_PBF_INTERDIGITAL

Specification: V3C coded bitstream is processed with All Intra and single-stream configuration, 32 frames are coded.

— The bitstream contains one map.

— The occupancy synthesis method 1: Patch Border Filtering (PBF) is enabled.

— The point local reconstruction (PLR) tool is enabled.

— The bitstream allows testing conformance points A and B.

— The bitstream profile is HEVC Main10 V-PCC Extended Rec2.

Functional stage: Point local reconstruction and Patch Border Filtering.

Purpose: Check that the decoder can properly decode and reconstruct points carried with point local reconstruction (PLR) method and process occupancy map filtering using patch border filtering, with one map.

6.7.6.5   HEVCMain10_Basic_Rec2_ATTRSM_SAMSUNG_v1

Specification: V3C coded bitstream is a single bitstream composed of a single coded atlas frame together with the corresponding occupancy, geometry, and attribute V3C components coded using HEVC main 10 profile. The V3C profile for coding the V3C bitstream is HEVC Main10 Basic Rec2.

Functional stage: Attribute Smoothing in Rec 2 profile.

Purpose: Check that the reconstruction can properly process attribute smoothing in conjunction with occupancy synthesis.

6.8 Conformance test suites ISO/IEC 23090-5

6.8.1 Bitstreams for basic toolset

In Table 7 , the bitstreams use the following naming convention to describe the coding tools for basic toolset profile.

Table 7 — Coding tool bitstreams for basic toolset profile

Categories	Tool description	Feature Name	Bitstream features
Atlas coding	Patch packing in single tile	STL	Test single atlas tile
Atlas coding	Patch packing in multiple tiles	MTL	Test multiple atlas tiles
Atlas coding	Patch packing in multiple tiles	MTLNONUNI	Test non-uniform tile partitions
Atlas coding	Patch packing in multiple tiles	SS	Test atlas map carriage in single sub-bitstream
Atlas coding	Patch packing in multiple tiles	MS	Test atlas map carriage in multiple individual sub-bitstreams
SEI	Video coding component mapping	CCM	Test reconstruction with different component codec mapping
Occupancy map coding	Reconstruction of lossy coded map	LOSSYOM	Test lossy occupancy map

6.8.2 Bitstreams for basic toolset still profile

In Table 8 , the bitstreams use the following naming convention to describe the coding tools for extended toolset profile.

Table 8 — Coding tools for extended toolset profile

Categories	Tool description	Feature Name	Bitstream features
Atlas coding	Patch packing in multiple tiles	MTL	Test still profile with multiple tiles
Atlas coding	Patch packing in single tile	STL	Test still profile with single tile

6.8.3 Bitstreams for extended toolset profile

In Table 9 , the bitstreams use the following naming convention to describe the coding tools for extended toolset profile.

Table 9 — Coding tools for extended toolset profile

Categories	Tool description	Feature Name	Bitstream features
Patch projection	Patch projection to additional projection plane and point cloud reconstruction from additional plane	PEXT	Test additional 45 degree patch projection planes
Patch projection	Flexible patch orientation in projection map	POEIGHT	Test eight patch orientation modes