|  |  |
| --- | --- |
| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  32nd Meeting: Ljubljana, SI, 12–18 July 2018 | Document: JCTVC-AF1004-v2 |

|  |  |  |  |
| --- | --- | --- | --- |
| *Title:* | **Conformance Testing for HEVC Screen Content Coding (SCC) Extensions and Non-Intra High Throughput Profiles (Draft 10)** | | |
| *Status:* | Output document approved by JCT-VC | | |
| *Purpose:* | Draft text | | |
| *Author(s) or Contact(s):* | Rajan Joshi Iole Moccagatta Gary Sullivan Teruhiko Suzuki Ji-Zheng Xu | Email: | [r.joshi@samsung.com](mailto:r.joshi@samsung.com) [iole.moccagata@intel.com](mailto:iole.moccagata@intel.com) [garysull@microsoft.com](mailto:garysull@microsoft.com) [teruhiko.s@sony.com](mailto:teruhiko.s@sony.com) [jzxu@microsoft.com](mailto:jzxu@microsoft.com) |
| *Source:* | Editors | | |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Abstract

This document provides the draft changes to the HEVC conformance specification for the HEVC screen content coding extensions and non-intra high-throughput profiles.

Ed. Note:

Due to the difficulty of handling a large database of bitstreams in the document archive, rather than directly attaching a copy of the associated database of conformance bitstreams, the conformance bitstreams added by this draft amendment are available (along with the prior approved bitstreams) at the following link:

<http://ftp3.itu.int/av-arch/jctvc-site/bitstream_exchange/draft_conformance/>.

# Changes relative to the base specification

*Throughout the text, replace any instances of “ITU T ” with “ITU-T ”.*

*In 6.5.7, replace the paragraph that refers to the High Throughput 4:4:4 16 Intra profile with the following:*

A decoder that conforms to the High Throughput 4:4:4 16 Intra, High Throughput 4:4:4, High Throughput 4:4:4 10 and High Throughput 4:4:4 14 profiles (as specified in subclause A.3.6 of Rec. ITU-T H.265 | ISO/IEC 23008-2), which are collectively referred to as the high throughput profiles, at specific level shall be capable of decoding the specified bitstreams in Table 4.

*At the end of 6.5.7, add the following paragraph:*

A decoder that conforms to the Screen-Extended Main, Screen-Extended Main 10, Screen-Extended Main 4:4:4, Screen-Extended Main 4:4:4 10, Screen-Extended High Throughput 4:4:4, Screen-Extended High Throughput 4:4:4 10 or Screen-Extended High Throughput 4:4:4 14 profiles (as specified in subclause A.3.7 of Rec. ITU-T H.265 | ISO/IEC 23008-2), which are collectively referred to as the screen content coding extensions profiles, shall be capable of decoding the specified bitstreams in Table 7. A decoder that conforms to some screen content coding extensions profiles is also required to be capable of decoding bitstreams that conform to particular other profiles. Thus, in addition to the specified bitstreams in Table 7, a decoder that conforms to a screen content coding extension profile shall also be capable of decoding the bitstreams specified in Table 1 or Table 4 that conform to the decoding requirements specified for the screen content coding extensions profile in subclause A.3.7 of Rec. ITU-T H.265 | ISO/IEC 23008-2.

*After 6.6.16.43, add the following additional subclauses:*

**6.6.16.44 Test bitstreams #WPP\_AND\_TILE\_10Bit422Test\_HIGH\_TP\_444\_10BIT\_RExt**

**Specification:** All slices are coded as I or P slices. The value of bit\_depth\_luma\_minus8 is set equal to 2. The value of bit\_depth\_chroma\_minus8 is set equal to 2. The value of chroma\_format\_idc is set equal to 2. There are 3 pictures in the bitstream. The cabac\_bypass\_alignment\_enabled\_flag and extended\_precision\_processing\_flag are set equal to 0.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise the combination of simultaneously using wavefronts and tiles in the specified profile (the High Throughput 4:4:4 10 profile) when cabac\_bypass\_alignment\_enabled\_flag and extended\_precision\_processing\_flag are set equal to 0.

**6.6.16.45 Test bitstreams # WPP\_AND\_TILE\_AND\_CABAC\_BYPASS\_ALIGN\_0\_HIGH\_TP\_444\_14BIT\_RExt**

**Specification:** All slices are coded as I or P slices. The value of bit\_depth\_luma\_minus8 is set equal to 0. The value of bit\_depth\_chroma\_minus8 is set equal to 0. The value of chroma\_format\_idc is set equal to 1. There are 3 pictures in the bitstream. The cabac\_bypass\_alignment\_enabled\_flag and extended\_precision\_processing\_flag are set equal to 0. The video\_full\_range\_flag is set equal to 1 in VUI.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise the combination of simultaneously using wavefronts and tiles in the specified profile (the High Throughput 4:4:4 14 profile) when cabac\_bypass\_alignment\_enabled\_flag and extended\_precision\_processing\_flag are set equal to 0.

**6.6.16.46 Test bitstreams #WPP\_AND\_TILE\_AND\_CABAC\_BYPASS\_ALIGN\_1\_HIGH\_TP\_444\_14BIT\_RExt**

**Specification:** All slices are coded as I or P slices. The value of bit\_depth\_luma\_minus8 is set equal to 0. The value of bit\_depth\_chroma\_minus8 is set equal to 0. The value of chroma\_format\_idc is set equal to 1. There are 3 pictures in the bitstream. The cabac\_bypass\_alignment\_enabled\_flag is set equal to 1. The extended\_precision\_processing\_flag is set equal to 0. The video\_full\_range\_flag is set equal to 1 in VUI.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise the combination of simultaneously using wavefronts and tiles in the specified profile (the High Throughput 4:4:4 14 profile) when cabac\_bypass\_alignment\_enabled\_flag is set equal to 1 and the extended\_precision\_processing\_flag is set equal to 0.

**6.6.16.47 Test bitstreams #WPP\_AND\_TILE\_AND\_CABAC\_EXT\_PREC\_1\_HIGH\_TP\_444\_14BIT\_RExt**

**Specification:** All slices are coded as I or P slices. The value of bit\_depth\_luma\_minus8 is set equal to 0. The value of bit\_depth\_chroma\_minus8 is set equal to 0. The value of chroma\_format\_idc is set equal to 1. There are 3 pictures in the bitstream. The cabac\_bypass\_alignment\_enabled\_flag is set equal to 0. The extended\_precision\_processing\_flag is set equal to 1. The video\_full\_range\_flag is set equal to 1 in VUI.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise the combination of simultaneously using wavefronts and tiles in the specified profile (the High Throughput 4:4:4 14 profile) when cabac\_bypass\_alignment\_enabled\_flag is set equal to 0 and the extended\_precision\_processing\_flag is set equal to 1.

**6.6.16.48 Test bitstreams #WPP\_AND\_TILE\_HIGH\_TP\_444\_8BIT\_RExt**

**Specification:** All slices are coded as I or P slices. The value of bit\_depth\_luma\_minus8 is set equal to 0. The value of bit\_depth\_chroma\_minus8 is set equal to 0. The value of chroma\_format\_idc is set equal to 1. There are 3 pictures in the bitstream. The cabac\_bypass\_alignment\_enabled\_flag and the extended\_precision\_processing\_flag are set equal to 0. The video\_full\_range\_flag is set equal to 1 in VUI.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise the combination of simultaneously using wavefronts and tiles in the specified profile (the High Throughput 4:4:4 profile) when the cabac\_bypass\_alignment\_enabled\_flag and the extended\_precision\_processing\_flag are set equal to 0.

**6.6.16.49 Test bitstreams # WPP\_HIGH\_TP\_444\_8BIT\_RExt**

**Specification:** All slices are coded as I or P slices. The value of bit\_depth\_luma\_minus8 is set equal to 0. The value of bit\_depth\_chroma\_minus8 is set equal to 0. The value of chroma\_format\_idc is set equal to 1. There are 3 pictures in the bitstream. The cabac\_bypass\_alignment\_enabled\_flag and the extended\_precision\_processing\_flag is set equal to 0. The video\_full\_range\_flag is set equal to 1 in VUI.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise use wavefronts in the specified profile (the High Throughput 4:4:4 profile) when the cabac\_bypass\_alignment\_enabled\_flag and the extended\_precision\_processing\_flag are set equal to 0.

*After 6.6.17, add the following additional subclause and subordinate subclauses:*

**6.6.18 Test bitstreams – screen content coding extensions**

**6.6.18.1 Test bitstreams #PPI\_A**

**Specification:** All slices are coded as P or B slices. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set to 3. There are a total of 33 pictures.

In the bitstream, the palette predictor initializers in both SPS and PPS are enabled. The bitstream consists of one SPS and three PPS's:

* The first part of the bitstream contains the first SPS with sps\_palette\_predictor\_initializer\_present\_flag equal to 1 and the first PPS with pps\_palette\_predictor\_initializer\_present\_flag equal to 0. Therefore, the pictures in the first part of the bitstream use the palette predictor initializer signalled in the SPS.
* The second part of the bitstream contains the second PPS with pps\_palette\_predictor\_initializer\_present\_flag set equal to 1. Therefore, the pictures in the second part of the bitsream use the palette predictor initializers as signalled in the second PPS.
* The third part of the bitstream contains the third PPS with pps\_palette\_predictor\_initializer\_present\_flag equal to 1 and pps\_num\_palette\_predictor\_initializer equal to 0. Therefore, the pictures in the third part of the bitstream use an empty palette predictor initializer.

**Coding structure:** Hierarchical B-pictures with GOP size of 16.

**Functional stage:** Test palette predictor initializer in SPS and/or PPS

**Purpose:** Test that the decoder correctly parses and decodes pictures when a palette predictor is initialized using different types of palette predictors such as from SPS or PPS or the palette predictor is initialized 0.

**6.6.18.2 Test bitstreams #PPI\_B**

**Specification:** All slices are coded as P or B slices. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set to 1. There are a total of 33 pictures.

In the bitstream, the palette predictor initializers in both SPS and PPS are enabled. The bitstream consists of one SPS and three PPS's:

* The first part of the bitstream contains the first SPS with sps\_palette\_predictor\_initializer\_present\_flag equal to 1 and the first PPS with pps\_palette\_predictor\_initializer\_present\_flag equal to 0. Therefore, the pictures in the first part of the bitstream use the palette predictor initializer signalled in the SPS.
* The second part of the bitstream contains the second PPS with pps\_palette\_predictor\_initializer\_present\_flag set equal to 1. Therefore, the pictures in the second part of the bitsream use the palette predictor initializers as signalled in the second PPS.
* The third part of the bitstream contains the third PPS with pps\_palette\_predictor\_initializer\_present\_flag equal to 1 and pps\_num\_palette\_predictor\_initializer equal to 0. Therefore, the pictures in the third part of the bitstream use an empty palette predictor initializer.

**Coding structure:** Hierarchical B-pictures with GOP size of 16.

**Functional stage:** Test palette predictor initializer in SPS and/or PPS

**Purpose:** Test that the decoder correctly parses and decodes pictures when a palette predictor is initialized using different types of palette predictors such as from SPS or PPS or the palette predictor is initialized 0.

**6.6.18.3 Test bitstreams #Zero\_and\_One\_Palette\_Size\_A**

**Specification:** The bitstream consists of a single picture that is coded as a single slice. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set to 3. Several CUs within the picture are coded using the palette mode with palette size of 0 and 1.

**Coding structure:** The single picture is coded as a P-picture with the current picture as the only reference picture.

**Functional stage:** Test the decoding and reconstruction of a palette block for palette sizes of 0 and 1.

**Purpose:** Test that the decoder correctly parses and decodes a palette block when the palette size is 0 or 1.

**6.6.18.4 Test bitstreams #Slice\_ACT\_QP\_Offsets\_A**

**Specification:** There are two pictures with each picture containing a single slice. The first slice is coded as a P slice with the current picture as the only reference picture. The second slice is coded as a B slice. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 3.

There are two PPSs. The first picture uses the first PPS and the second picture uses the second PPS. For each PPS, pps\_act\_y\_qp\_offset\_plus5, pps\_act\_cb\_qp\_offset\_plus5, and pps\_act\_cr\_qp\_offset\_plus3 are set to 2, −1, and 1, respectively. For the first PPS, pps\_slice\_act\_qp\_offsets\_present\_flag is set equal to 0. For the second PPS, pps\_slice\_act\_qp\_offsets\_present\_flag is set equal to 1 and slice\_act\_y\_qp\_offset, slice\_act\_cb\_qp\_offset, and slice\_act\_cr\_qp\_offset are set to −2, −1, and 1, respectively.

**Coding structure:** The first slice is a P slice with the current picture as the only reference picture. The second slice is a B slice.

**Functional stage:** Test the ACT QP offsets at the PPS and slice level.

**Purpose:** Check that ACT QP offsets can be specified in the PPS and modified at the slice level.

**6.6.18.5 Test bitstreams #Bipred\_8x8\_A**

**Specification:** All slices are coded as P or B slices. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 1. There are 3 pictures. In the 3rd picture, there 5 8×8 non-merge blocks for which the signalled motion vector is bi-directional. It is converted to unidirectional during the decoding process.

**Coding structure:** Low delay B configuration with hierarchical B pictures.

**Functional stage:** Test the decoding process for 8×8 blocks when a bi-directional motion vector is converted to a uni-directional motion vector.

**Purpose:** Check the decoder correctly converts a bi-directional motion vector for an 8×8 block to a uni-directional motion vector when bi-directional prediction is restricted.

**6.6.18.6 Test bitstreams #IBF\_Disabled\_A**

**Specification:** All slices are coded as P or B slices. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 3. There are 33 pictures. The intra\_boundary\_filtering\_disabled\_flag is set to 0.

**Coding structure:** Hierarchical B-pictures with GOP size of 16.

**Functional stage:** Test the reconstruction process of intra boundary filtering based on the intra\_boundary\_filtering\_disabled\_flag.

**Purpose:** Check that the decoder decodes properly when intra\_boundary\_filtering\_disabled\_flag is equal to 0.

**6.6.18.7 Test bitstreams #IBF\_Disabled\_B**

**Specification:** All slices are coded as P or B slices. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 1. There are 33 pictures. The intra\_boundary\_filtering\_disabled\_flag is set to 1.

**Coding structure:** Hierarchical B-pictures with GOP size of 16.

**Functional stage:** Test the reconstruction process of intra boundary filtering based on intra\_boundary\_filtering\_disabled\_flag.

**Purpose:** Check that the decoder properly decodes when intra\_boundary\_filtering\_disabled\_flag is equal to 1.

**6.6.18.8 Test bitstreams #DPB\_Loop\_Filters\_A**

**Specification:** All slices are coded as P or B slices. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 3. There are 10 pictures. For one picture in the middle, both SAO and deblocking filters are off and the pps\_curr\_pic\_ref\_enabled\_flag is equal to 1. For this picture, the number of reference pictures is increased by 1.

**Coding structure:** Low delay B configuration with hierarchical B pictures.

**Functional stage:** Test the maximum number of reference pictures based on whether loop filters are on or off and the value of pps\_curr\_pic\_ref\_enabled\_flag.

**Purpose:** Check that the decoder allows one more reference picture to be used when all the loop filters are off and pps\_curr\_pic\_ref\_enabled\_flag is equal to 1.

**6.6.18.9 Test bitstreams #Delta\_QP\_Chroma\_QP\_Offsets\_A**

**Specification:** Each slice is coded as a P slice with current picture as the only reference picture. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 3. There are two pictures with each picture containing a single slice.

Additionally, cu\_qp\_delta\_enabled\_flag is set to 1 and diff\_cu\_qp\_delta\_depth is also set to 1. Similarly, chroma\_qp\_offset\_list\_enabled\_flag is set to 1 and diff\_cu\_chroma\_qp\_offset\_depth is set to 1.

There are 7 instances when delta QP is signalled in a palette-coded block. There are 19 instances when chroma QP offsets are signalled in a palette-coded block.

**Coding structure:** P slices with only the current picture as reference.

**Functional stage:** Test delta QP and chroma QP offset signalling for a coding unit coded in palette mode with escape samples.

**Purpose:** Check that for a quantization or chroma offset group, delta QP and chroma QP offsets may be signalled either for a palette block with escape sample(s) or a non-palette block with non-zero residual, based on the order of occurrence of the blocks within the quantization or chroma offset group.

**6.6.18.10 Test bitstreams #MVRESIDC\_A**

**Specification:** There are 9 pictures with each picture containing a single slice. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 3.

Additionally, motion\_vector\_resolution\_control\_idc is set equal to 0. This implies that luma motion vectors have a quarter pel precision.

**Coding structure:** Low delay B configuration with hierarchical B pictures. The first picture is a P-picture with only the current picture as reference.

**Functional stage:** Test motion vector decoding process based on the value of motion\_vector\_resolution\_control\_idc.

**Purpose:** Check that the decoder can properly decode motion vectors and slices when motion\_vector\_resolution\_control\_idc is set equal to 0.

**6.6.18.11 Test bitstreams #MVRESIDC\_B**

**Specification:** There are 9 pictures with each picture containing a single slice. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 3.

Additionally, motion\_vector\_resolution\_control\_idc is set equal to 1. This implies that luma motion vectors have an integer pel precision.

**Coding structure:** Low delay configuration with hierarchical B pictures. The first picture is a P-picture with only the current picture as reference.

**Functional stage:** Test motion vector decoding process based on the value of motion\_vector\_resolution\_control\_idc.

**Purpose:** Check that the decoder can properly decode motion vectors and slices when motion\_vector\_resolution\_control\_idc is set equal to 1.

**6.6.18.12 Test bitstreams #MVRESIDC\_C**

**Specification:** There are 9 pictures with each picture containing a single slice. bit\_depth\_luma\_minus8 is set equal to 0 and bit\_depth\_chroma\_minus8 is set equal to 0. chroma\_format\_idc is set equal to 3.

Additionally, motion\_vector\_resolution\_control\_idc is set equal to 2. For pictures with even numbered POCs, the use\_integer\_mv\_flag is set equal to 1. For the remaining pictures, the use\_integer\_mv\_flag is set equal to 0.

**Coding structure:** Low delay configuration with hierarchical B pictures. The first picture is a P-picture with only the current picture as reference.

**Functional stage:** Test motion vector decoding process based on the value of motion\_vector\_resolution\_control\_idc.

**Purpose:** Check that the decoder can properly decode motion vectors and slices when motion\_vector\_resolution\_control\_idc is set equal to 2.

**6.6.18.13 Test bitstreams #HT\_A\_SCC**

**Specification:** All slices are coded as P or B slices. The value of bit\_depth\_luma\_minus8 is set equal to 2. The value of bit\_depth\_chroma\_minus8 is set equal to 2. The value of chroma\_format\_idc is set equal to 3. There are 3 pictures in the bitstream. The cabac\_bypass\_alignment\_enabled\_flag and extended\_precision\_processing\_flag are set equal to 0.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise the combination of simultaneously using wavefronts and tiles in the specified profile (the Screen-Extended High Throughput 4:4:4 10 profile) when cabac\_bypass\_alignment\_enabled\_flag and extended\_precision\_processing\_flag are set equal to 0.

**6.6.18.14 Test bitstreams #HT\_B\_SCC**

**Specification:** All slices are coded as P or B slices. The value of bit\_depth\_luma\_minus8 is set equal to 0. The value of bit\_depth\_chroma\_minus8 is set equal to 0. The value of chroma\_format\_idc is set equal to 3. There are 3 pictures in the bitstream.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise the combination of simultaneously using wavefronts and tiles in the specified profile (the Screen-Extended High Throughput 4:4:4 14 profile) when cabac\_bypass\_alignment\_enabled\_flag is set equal to 1 and extended\_precision\_processing\_flag is set equal to 0.

**6.6.18.15 Test bitstreams #HT\_C\_SCC**

**Specification:** All slices are coded as P or B slices. The value of bit\_depth\_luma\_minus8 is set equal to 0. The value of bit\_depth\_chroma\_minus8 is set equal to 0. The value of chroma\_format\_idc is set equal to 3. There are 3 pictures in the bitstream.

**Functional stage:** Test parsing and reconstruction process with various combinations of tools.

**Purpose:** The purpose of the stream is to exercise the combination of simultaneously using wavefronts and tiles in the specified profile (the Screen-Extended High Throughput 4:4:4 14 profile) when cabac\_bypass\_alignment\_enabled\_flag is set equal to 0 and extended\_precision\_processing\_flag is set equal to 1.

*Replace Table 4 with the following:*

| **Table 4 – Bitstreams for Monochrome 12, Monochrome 16, Main 12, Main 4:2:2 10, Main 4:2:2 12, Main 4:4:4, Main 4:4:4 10, Main 4:4:4 12, Main Intra, Main 10 Intra, Main 12 Intra, Main 4:2:2 10 Intra, Main 4:2:2 12 Intra, Main 4:4:4 Intra, Main 4:4:4 10 Intra, Main 4:4:4 12 Intra, Main 4:4:4 16 Intra, Main 4:4:4 Still Picture and Main 4:4:4 16 Still Picture profiles** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Categories** | **Subcategory** | **Bitstream** | **File name** | **Profile** | **Main tier** | **Level** | **Frame rate (Frames/sec)** | |
| Intra coding | Intra chroma prediction angle | ADJUST\_IPRED\_ANGLE\_A | ADJUST\_IPRED\_ANGLE\_A\_RExt\_Mitsubishi\_2 | Main 4:2:2 10 | X | 6.2 | 24 | |
| Inter coding | Cross component prediction | CCP\_8bit\_RExt | CCP\_8bit\_RExt\_QCOM\_1 | Main 4:4:4 | X | 4.1 and higher | 30 | |
|  |  | CCP\_10bit\_RExt | CCP\_10bit\_RExt\_QCOM\_1 | Main 4:4:4 10 | X | 4.1 and higher | 24 | |
|  |  | CCP\_12bit\_RExt | CCP\_12bit\_RExt\_QCOM\_1 | Main 4:4:4 12 | X | 4.1 and higher | 30 | |
| Bit depth | Different bit depth for luma and chroma | Bitdepth\_A\_RExt | Bitdepth\_A\_RExt\_Sony\_1 | Main 4:4:4 12 | X | 4.1 and higher | 60 | |
|  |  | Bitdepth\_B\_RExt | Bitdepth\_B\_RExt\_Sony\_1 | Main 4:4:4 12 | X | 4.1 and higher | 60 | |
| Quantization | Scaling list | QMATRIX\_A\_RExt | QMATRIX\_A\_RExt\_Sony\_1 | Main 4:4:4 | X | 4.0 and higher | 20 | |
| Loop filter | SAO | SAO\_A\_RExt | SAO\_A\_RExt\_MediaTek\_1 | Main 4:4:4 12 | X | 6.2 | 30 | |
| Entropy coding | Persistent Rice parameter tool | PERSIST\_RPARAM\_A\_RExt | PERSIST\_RPARAM\_A\_RExt\_Sony\_3 | Main 4:4:4 12 Intra | X | 3.0 and higher |  | |
| Precision | Extended precision | HIGH\_TP\_8BIT\_RExt | EXTPREC\_HIGHTHROUGHPUT\_444\_16\_INTRA\_8BIT\_RExt\_Sony\_1 | High Throughput 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | HIGH\_TP\_10BIT\_RExt | EXTPREC\_HIGHTHROUGHPUT\_444\_16\_INTRA\_10BIT\_RExt\_Sony\_1 | High Throughput 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | HIGH\_TP\_12BIT\_RExt | EXTPREC\_HIGHTHROUGHPUT\_444\_16\_INTRA\_12BIT\_RExt\_Sony\_1 | High Throughput 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | HIGH\_TP\_16BIT\_RExt | EXTPREC\_HIGHTHROUGHPUT\_444\_16\_INTRA\_16BIT\_RExt\_Sony\_1 | High Throughput 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | HIGH\_TP\_8BIT\_RExt | EXTPREC\_MAIN\_444\_16\_INTRA\_8BIT\_RExt\_Sony\_1 | Main 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | HIGH\_TP\_10BIT\_RExt | EXTPREC\_MAIN\_444\_16\_INTRA\_10BIT\_RExt\_Sony\_1 | Main 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | HIGH\_TP\_12BIT\_RExt | EXTPREC\_MAIN\_444\_16\_INTRA\_12BIT\_RExt\_Sony\_1 | Main 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | HIGH\_TP\_16BIT\_RExt | EXTPREC\_MAIN\_444\_16\_INTRA\_16BIT\_RExt\_Sony\_1 | Main 4:4:4 16 Intra | X | 3.0 and higher |  | |
| Others | PCM | IPCM\_A\_RExt | IPCM\_A\_RExt\_NEC\_2 | Main 4:2:2 10 | X | 6.0 and higher | 30 | |
|  |  | IPCM\_B\_RExt | IPCM\_B\_RExt\_NEC\_1 | Main 4:2:2 10 | X | 6.0 and higher | 30 | |
|  | Transform skip context | TSCTX\_8bit\_I\_RExt | TSCTX\_8bit\_I\_RExt\_SHARP\_1 | Main 4:4:4 | X | 6.2 | 30 | |
|  |  | TSCTX\_8bit\_RExt | TSCTX\_8bit\_RExt\_SHARP\_1 | Main 4:4:4 | X | 6.2 | 30 | |
|  |  | TSCTX\_10bit\_I\_RExt | TSCTX\_10bit\_I\_RExt\_SHARP\_1 | Main 4:4:4 10 | X | 6.2 | 30 | |
|  |  | TSCTX\_10bit\_RExt | TSCTX\_10bit\_RExt\_SHARP\_1 | Main 4:4:4 10 | X | 6.2 | 30 | |
|  |  | TSCTX\_12bit\_I\_RExt | TSCTX\_12bit\_I\_RExt\_SHARP\_1 | Main 4:4:4 12 | X | 6.2 | 30 | |
|  |  | TSCTX\_12bit\_RExt | TSCTX\_12bit\_RExt\_SHARP\_1 | Main 4:4:4 12 | X | 6.2 | 30 | |
|  | RDPCM | ExplicitRdpcm\_A\_RExt | ExplicitRdpcm\_A\_BBC\_1 | Main 4:4:4 12 | X | 6.2 | 60 | |
|  |  | ExplicitRdpcm\_B\_RExt | ExplicitRdpcm\_B\_BBC\_2 | Main 4:4:4 12 | X | 6.2 | 30 | |
|  | Various combination | Main\_4:2:2\_10\_A\_RExt\_Sony | Main\_422\_10\_A\_RExt\_Sony\_2 | Main 4:2:2 10 | X | 4.0 and higher | 24 | |
|  |  | Main\_4:2:2\_10\_B\_RExt\_Sony | Main\_422\_10\_B\_RExt\_Sony\_2 | Main 4:2:2 10 | X | 5.0 and higher | 30 | |
|  |  | GENERAL\_8b\_400\_RExt | GENERAL\_8b\_400\_RExt\_Sony\_1 | Monochrome | X | 3.0 and higher |  | |
|  |  | GENERAL\_8b\_420\_RExt | GENERAL\_8b\_420\_RExt\_Sony\_1 | Main Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_8b\_444\_RExt | GENERAL\_8b\_444\_RExt\_Sony\_2 | Main 4:4:4 Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_10b\_420\_RExt | GENERAL\_10b\_420\_RExt\_Sony\_1 | Main 10 Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_10b\_422\_RExt | GENERAL\_10b\_422\_RExt\_Sony\_1 | Main 4:2:2 10 Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_10b\_444\_RExt | GENERAL\_10b\_444\_RExt\_Sony\_2 | Main 4:4:4 10 Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_12b\_400\_RExt | GENERAL\_12b\_400\_RExt\_Sony\_1 | Monochrome 12 | X | 3.0 and higher |  | |
|  |  | GENERAL\_12b\_420\_RExt | GENERAL\_12b\_420\_RExt\_Sony\_1 | Main 12 Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_12b\_422\_RExt | GENERAL\_12b\_422\_RExt\_Sony\_1 | Main 4:2:2 12 Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_12b\_444\_RExt | GENERAL\_12b\_444\_RExt\_Sony\_2 | Main 4:4:4 12 Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_16b\_400\_RExt | GENERAL\_16b\_400\_RExt\_Sony\_1 | Monochrome 16 | X | 3.0 and higher |  | |
|  |  | GENERAL\_16b\_444\_RExt | GENERAL\_16b\_444\_RExt\_Sony\_2 | Main 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | GENERAL\_16b\_444\_highThroughput\_RExt | GENERAL\_16b\_444\_highThroughput\_RExt\_Sony\_2 | High Throughput 4:4:4 16 Intra | X | 3.0 and higher |  | |
|  |  | WAVETILES\_RExt | WAVETILES\_RExt\_Sony\_2 | High Throughput 4:4:4 16 Intra | X | 3.0 and higher |  | |
| High throughput |  | WPP\_AND\_TILE\_10Bit422Test\_HIGH\_TP\_444\_10BIT\_RExt | WPP\_AND\_TILE\_10Bit422Test\_HIGH\_TP\_444\_10BIT\_RExt\_Apple\_2 | High Throughput 4:4:4 10 | X | 4.0 and higher | 24 | |
|  |  | WPP\_AND\_TILE\_AND\_CABAC\_BYPASS\_ALIGN\_0\_HIGH\_TP\_444\_14BIT\_RExt | WPP\_AND\_TILE\_AND\_CABAC\_BYPASS\_ALIGN\_0\_HIGH\_TP\_444\_14BIT\_RExt\_Apple\_2 | High Throughput 4:4:4 14 | X | 3.1 and higher | 30 | |
|  |  | WPP\_AND\_TILE\_AND\_CABAC\_BYPASS\_ALIGN\_1\_HIGH\_TP\_444\_14BIT\_RExt | WPP\_AND\_TILE\_AND\_CABAC\_BYPASS\_ALIGN\_1\_HIGH\_TP\_444\_14BIT\_RExt\_Apple\_2 | High Throughput 4:4:4 14 | X | 3.1 and higher | 30 | |
|  |  | WPP\_AND\_TILE\_AND\_CABAC\_EXT\_PREC\_1\_HIGH\_TP\_444\_14BIT\_RExt | WPP\_AND\_TILE\_AND\_CABAC\_EXT\_PREC\_1\_HIGH\_TP\_444\_14BIT\_RExt\_Apple\_2 | High Throughput 4:4:4 14 | X | 3.1 and higher | 30 | |
|  |  | WPP\_AND\_TILE\_HIGH\_TP\_444\_8BIT\_RExt | WPP\_AND\_TILE\_HIGH\_TP\_444\_8BIT\_RExt\_Apple\_2 | High Throughput 4:4:4 8 | X | 3.1 and higher | 30 | |
|  |  | WPP\_HIGH\_TP\_444\_8BIT\_RExt | WPP\_HIGH\_TP\_444\_8BIT\_RExt\_Apple\_2 | High Throughput 4:4:4 8 | X | 3.1 and higher | 30 | |

*After 6.7.6, add the following subclause and table:*

**6.7.7 Bitstreams for Screen-Extended Main, Screen-Extended Main 10, Screen-Extended Main 4:4:4, Screen-Extended Main 4:4:4 10, Screen-Extended High Throughput 4:4:4, Screen-Extended High Throughput 4:4:4 10 and Screen-Extended High Throughput 14 profiles**

| **Table 7 – Bitstreams for Screen-Extended Main, Screen-Extended Main 10, Screen-Extended Main 4:4:4, Screen-Extended Main 4:4:4 10, Screen-Extended High Throughput 4:4:4, Screen-Extended High Throughput 4:4:4 10 and Screen-Extended High Throughput 14 profiles** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Categories** | **Subcategory** | **Bitstream** | **File name** | **Profile** | **Main tier** | **Level** | **Frame rate (Frames/sec)** | |
| Palette | Predictor palette initialization | PPI\_A | PPI\_A\_InterDigital\_2 | Screen-Extended Main 4:4:4 | X | 3.1 and higher | 30 | |
| PPI\_B | PPI\_B\_InterDigital\_2 | Screen-Extended Main | X | 3.1 and higher | 30 | |
| Palette size 0/1 | Zero\_and\_One\_Palette\_Size\_A | Zero\_and\_One\_Palette\_Size\_A\_Canon\_2 | Screen-Extended Main 4:4:4 | X | 4.0 and higher | N/A | |
| Current picture reference | bi-prediction restriction (conversion from bi to uni) | Bipred\_8×8\_A | Bipred\_8×8\_A\_Qualcomm\_2 | Screen-Extended Main | X | 2.0 and higher | 30 | |
| Adaptive residual transform | slice ACT QP offsets | Slice\_ACT\_QP\_Offsets\_A | Slice\_ACT\_QP\_Offsets\_A\_Qualcomm\_2 | Screen-Extended Main 4:4:4 | X | 4.0 and higher | 60 | |
| Intra coding | Disable intra boundary filtering | IBF\_Disabled\_A | IBF\_Disabled\_A\_MediaTek\_2 | Screen-Extended Main 4:4:4 | X | 4.0 and higher | 60 | |
| IBF\_Disabled\_B | IBF\_Disabled\_B\_MediaTek\_2 | Screen-Extended Main | X | 4.0 and higher | 60 | |
| pps\_curr\_pic\_ref\_enabled\_flag | DPB | DPB\_Loop\_Filters\_A | DPB\_Loop\_Filters\_A\_MediaTek\_2 | Screen-Extended Main 4:4:4 | X | 4.0 and higher | 60 | |
| Quantization | delta QP and chroma QP offsets signalled in the palette block | Delta\_QP\_Chroma\_QP\_Offsets\_A | Delta\_QP\_Chroma\_QP\_Offsets\_A\_Qualcomm\_2 | Screen-Extended Main 4:4:4 | X | 4.0 and higher | 60 | |
| Motion vector resolution | Motion vector resolution is set to full pel or quarter pel | MVRESIDC\_A | MVRESIDC\_A\_MS\_2 | Screen-Extended Main 4:4:4 | X | 4.0 and higher | 60 | |
| MVRESIDC\_B | MVRESIDC\_B\_MS\_2 | Screen-Extended Main 4:4:4 | X | 4.0 and higher | 60 | |
| MVRESIDC\_C | MVRESIDC\_C\_MS\_3 | Screen-Extended Main 4:4:4 | X | 4.0 and higher | 60 | |
| High throughput profiles | Enable tiles and wavefronts in the same bitstream. | HT\_A\_SCC | HT\_A\_SCC\_Apple\_2 | Screen-Extended High Throughput 4:4:4 10 | X | 4.1 and higher | 50 | |
|  |  | HT\_B\_SCC | HT\_B\_SCC\_Apple\_3 | Screen-Extended High Throughput 4:4:4 14 | X | 4.0 and higher | 60 | |
|  |  | HT\_C\_SCC | HT\_C\_SCC\_Apple\_3 | Screen-Extended High Throughput 4:4:4 14 | X | 4.0 and higher | 60 | |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_