**3GPP TSG SA WG4 Meeting 131-bis-eS4-250470r01**

**online, , 11th Apr 2025 – 17th Apr 2025 revision of S4aV250021**

**Source: Qualcomm Germany, Tencent**

**Title: Pseudo-CR on [VOPS] Updates to Capabilities and Operation Points**

**Spec: 3GPP TS26.265v1.0.0**

**Agenda item: 9.5**

**Document for: Decision**

**1. Introduction**

At the last meeting, agreements on new bitstreams and decoding capabilities were agreed. Not all changes were considered yet. This updates the TS.

**2. Reason for Change**

At the last meeting, agreements on new bitstreams and decoding capabilities were agreed. Not all changes were considered yet. This updates the TS.

**3. Conclusions**

Let’s discuss and have proper resolution by the April meeting.

**4. Proposal**

It is proposed to agree the following changes to 3GPP TS26.265v0.6.0 at SA4-131-bis-e.

**5. Revisions**

**Prior to Meeting**

Based on the discussion in during the first AHG meeting, the changes are done:

|  |  |  |  |
| --- | --- | --- | --- |
| [**S4aV250021**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_VIDEO/Docs/S4aV250021.zip) | [VOPS] Updates to Capabilities and Operation Points | Qualcomm Germany | Thomas Stockhammer |

**Online Discussion**: (March 18, 2025)

* Alexis: Portrait mode has been added. Do we need more metadata for rotation?
	+ Thomas: Good point. I was not aware of this issue. It would be great to document it.
	+ Alexis: OK, I can manage it offline.
* Thomas: If we do upscaling, what would be the aspect ratio?
	+ Alexis: You only need to indicate if this is square pixel or not. I can explain it offline.
* Thomas: I will work for a revision. But not for next week.

**Decision**: Agreed as basis for further work (not implemented into the draft TS).

[S4aV250021](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_VIDEO/Docs/S4aV250021.zip) is **agreed as basis for further work**.

**During Meeting**

Thank you for the contribution. Please see comments below:

1. Some missing words in "3GPP High Definition (HD): is meant to address the distribution of conventional 2D video services including HDTV and ".
	1. *Thanks addressed in this revision*
2. On "3GPP Stereoscopic 3D", “3D” is a bit overloaded and not technically clear, why not renaming to "3GPP Stereoscopic content"
	1. *Ok, addressed, replaced 3D with stereo.*
3. Is "picture aspect ratio" clear? There exist two picture aspect ratio, the one of the coded picture and the one meant to be displayed. For example, it is common to encode portrait video horizontally and rotate at display.
	1. *Understood. Picture aspect ration for me is the source content, not the encoding. If you encode as you refer to above, the content is still 1080x1920. In my opinion. We also mention this. Do you suggest any changes?*
4. In 4.6.2, why so many removal here, what is the explanation, not needed? Redundant?. Was there a decision to no longer align with CTA 5003?
	1. *The reason is that 5003 is primarily focussing on CMAF-based playback, but this text is more generic or one level lower on elementary stream level. Hence it was consider to not be suitable, also be checking existing APIs (WebCodecs, MediaCodec).*

\* \* \* First Change \* \* \* \*

### 4.4.3 3GPP Video Formats

#### 4.4.3.1 Introduction

While a variety of formats may be used based on the video signal parameters defined in clause 4.4.2, for consistent programs and signals, several video formats are defined by a set of restrictions using the video signal parameters in clause 4.4.2. These signals are primarily used to develop interoperability points for TV and movie content distribution.

The present clause describes the signal characteristics of the following3GPP video formats:

- 3GPP High Definition (HD): is meant to address the distribution of conventional 2D video services including HDTV and other conventional 2D formats.

- 3GPP High Dynamic Range (HDR): enables the distribution of 2D video up to 4K, e.g., for Ultra HD TV, and adds the support of high dynamic range capability on top of the 3GPP HD format.

- 3GPP Stereoscopic: is a format suitable for the video consumption of devices creating a depth perception using 2 images, one for each eye.

#### 4.4.3.2 High-Definition

3GPP High-Definition (HD) formats are defined based on Rec. ITU-R BT-709-6 [bt709]. 3GPP HD formats shall conform to Rec. ITU-R BT-709-6 [bt709] with the following restrictions and extensions:

- Only the following formats are included 24/P, 25/P, 30/P, 50/P and 60/P. Interlace and progressive segmented frame signals are excluded.

- Only the Non-Constant Luminance YCbCr signal format is considered.

- Other aspect ratios than 16:9 may be considered to address different screen sizes and orientations.

An informative summary of the parameters of a 3GPP HD format based on the parameters defined in Table 4.4.2-1 is provided in Table 4.4.3.2-1.

Table 4.4.3.2-1 Video Signal Parameters for 3GPP HD format

|  |  |
| --- | --- |
| Parameter | Restrictions |
| Picture aspect ratio | 16:9 is the only format defined in ITU-R BT-709-6 [bt709].In 3GPP, to support different applications with different screen sizes and orientations, other picture aspect ratios may be considered including 9:16 and 1:1.NOTE 1: The display orientation of the pictures in the video signal, for example portrait or landscape mode is implicit to the picture aspect ratio, but may be explicitly signalled.NOTE 2: The aspect ratio of the encoded pictures may be different from the picture aspect ratio of the video signal. |
| Spatial Resolution width x height | 1920 × 1080 is the only format defined in ITU-R BT-709-6 [bt709].Other spatial resolutions may be considered to address different aspect ratios, for example 1080 x 1920, 1024 x 1024, 1440 x 1440.NOTE 1: Down-sampled resolutions may be created for distribution, for example in case of adaptive streaming.NOTE 2: To accommodate the block coding structure of a given specification, quite often the encoded signal may be padded. In such cases, normative cropping is typically applied to remove spatial samples that are not intended to be presented.NOTE 3: The with and the height of the encoded pictures may be different from the with and the height of the pictures in the video signal. |
| Scan Type | The source scan type of the pictures as defined in clause 7.3 of Rec. ITU-T H.273 is progressive. |
| Chroma format indicator | The chroma format indicator is 4:2:0.  |
| Bit depth | The permitted values are 8 or 10 bit. The bit depth is the same for all samples. |
| Colour primaries  | Only the value 1, as defined in clause 8.2 of Rec. ITU-T H.273, is permitted. |
| Transfer Characteristics | Only the value 1, as defined in clause 8.2 of Rec. ITU-T H.273 is permitted. |
| Matrix Coefficients | Only the value 1, as defined in clause 8.2 of Rec. ITU-T H.273, is permitted. |
| Frame rates | The permitted values are 60, 60/1.001, 50, 30, 30/1.001, 25, 24, 24/1.001 fps. |
| Frame packing | No frame packing is applied. |
| Projection | No projection is used. |
| Sample aspect ratio | The pixel aspect ratio is 1 (square pixel), i.e. only the value 1 as defined in clause 7.3 of Rec. ITU-T H.273 is permitted. |
| Chroma sample location type | The location of the chroma samples relative to the luma samples for progressive frames as defined in Rec. ITU-T H.273, clause 8.7, is set to 0 (chroma samples are horizontally co-sited with and vertically centered between the first luma sample at the top-left corner and the first two luma samples at the top-left corner, respectively). |
| Range | The restricted video range is used.  |

#### 4.4.3.3 High Dynamic Range

3GPP High Dynamic Range (HDR) TV formats are defined based on Rec. ITU-R BT-2100-2 [bt2100]. 3GPP HDR TV formats shall conform to ITU-R BT-2100-2 [bt2100] with the following restrictions and extensions:

- Only 4:2:0 colour subsampling is considered

- Only the Non-Constant Luminance YCbCr signal format is considered

- Only 10-bit representations are considered

- Other aspect ratios than 16:9 may be considered in order to address different screen sizes and orientations.

An informative summary of the parameters of a 3GPP HDR format based on the parameters defined in Table 4.4.2‑1 is provided in Table 4.4.3.3-1.

Table 4.4.3.3-1 Video Signal Parameters for 3GPP HDR format

|  |  |
| --- | --- |
| Parameter | Restrictions |
| Picture aspect ratio | 16:9 is the only format defined in ITU-R BT-2100-2 [bt2100].In 3GPP, to support different applications with different screen sizes and orientations, other picture aspect ratios may be considered including 9:16 and 1:1.NOTE 1: The display orientation of the pictures in the video signal, for example portrait or landscape mode is implicit to the picture aspect ratio, but may be explicitly signaled.NOTE 2: The aspect ratio of the encoded pictures may be different from the picture aspect ratio of the video signal. |
| Spatial Resolution width x height | 7680 × 4320, 3840 × 2160, 1920 × 1080 are the only formats supported in ITU-R BT-2100-2 [bt2100].Other spatial resolutions may be considered to address different aspect ratios, for example 1080 x 1920, 1024 x 1024, 1440 x 1440.NOTE 1: Down-sampled resolutions may be created for distribution, for example in case of adaptive streaming.NOTE 2: To accommodate the block coding structure of a given specification, quite often the encoded signal may be padded. In such cases, normative cropping is typically applied to remove spatial samples that are not intended to be presented.NOTE 3: The with and the height of the encoded pictures may be different from the with and the height of the pictures in the video signal. |
| Scan Type | the source scan type of the pictures as defined in clause 7.3 of Rec. ITU-T H.273 is progressive |
| Chroma format indicator | The chroma format indicator is 4:2:0.  |
| Bit depth | The permitted value is 10 bit. |
| Colour primaries  | Only the value 9 as defined in clause 8.2 of Rec. ITU-T H.273 is permitted. |
| Transfer Characteristics | Only the values 14 (for SDR with WCG), 16 (for PQ) and 18 (for HLG) as defined in clause 8.2 of Rec. ITU-T H.273 are permitted. |
| Matrix Coefficients | Only the value 9 as defined in clause 8.2 of Rec. ITU-T H.273 is permitted. |
| Frame rates | The permitted values are 120, 120/1.001,100, 60, 60/1.001, 50, 30, 30/1.001, 25, 24, 24/1.001 fps. |
| Frame packing | No frame packing is applied. |
| Projection | No projection is used. |
| Sample aspect ratio | The pixel aspect ratio is 1 (square pixel), i.e. only the value 1 as defined in clause 7.3 of Rec. ITU-T H.273 is permitted. |
| Chroma sample location type | the location of chroma samples relative to the luma samples for progressive frames as defined in Rec. ITU-T H.273, clause 8.7 is set to 2 (chroma samples are co-sited with the luma samples at the top-left corner). |
| Range | The restricted video range is used.  |

#### 4.4.3.4 Stereoscopic format

The 3GPP Stereoscopic format uses two signals, one for the left eye and another view for the right eye as defined in Table 4.4.2-1. The components for each eye closely follow the specifications of the 3GPP HDR format, but there are some restrictions and extensions, namely:

- Only 4:2:0 colour subsampling is considered.

- Frame rates include high frame rate for movies, namely 48 fps.

- the spatial resolution for each eye is restricted to a maximum value of 4K (3840 × 2160).

- Only the Non-Constant Luminance YCbCr signal format is considered.

- Square picture aspect ratios are supported for different screen sizes.

An informative summary of the parameters of a 3GPP Stereoscopic format based on the parameters defined in Table 4.4.2-1 is provided in Table 4.4.3.4-1.

Table 4.4.3.4-1 Video Signal Parameters for 3GPP Stereoscopic format

|  |  |
| --- | --- |
| Parameter | Restrictions |
| Picture aspect ratio | 16:9, 1:1.  |
| Spatial Resolution width x height | 3840 × 2160, 1920 × 1080, 2048 × 2048, 1024 × 1024. NOTE 1: Down-sampled resolutions may be created for distribution, for example in case of adaptive streaming.NOTE 2: To accommodate the block coding structure of a given specification, quite often the encoded signal may be padded. In such cases, normative cropping is typically applied to remove spatial samples that are not intended to be presented. |
| Scan Type | The source scan type of the pictures as defined in clause 7.3 of Rec. ITU-T H.273 is progressive |
| Chroma format indicator | The chroma format indicator is 4:2:0.  |
| Bit depth | The permitted values are 8 or 10 bit. 8 bit is only permitted for SDR. |

|  |  |
| --- | --- |
| Colour primariesTransfer CharacteristicsMatrix Coefficients | Only the following value combinations are permitted: (1, 1, 1), (9, 14, 9), (9, 16, 9), and (9, 18, 9) for SDR HD, SDR UHD, HDR PQ, and HDR HLG, respectively. |
| Frame rates | The permitted values are 60, 60/1.001, 48, 48/1.001, 50, 30, 30/1.001, 25, 24, 24/1.001 fps. |
| Frame packing | The permitted values are no frame packing, side-by-side, top-and-bottom. |
| Projection | No projection is used. |
| Sample aspect ratio | The pixel aspect ratio is 1 (square pixel), i.e. only the value 1 as defined in clause 7.3 of Rec. ITU-T H.273 is permitted. |
| Chroma sample location type | For SDR HD, the location of chroma samples relative to the luma samples for progressive frames as defined in Rec. ITU-T H.273, clause 8.7 is set to 0.For SDR UHD, HDR PQ, and HDR HLG, the location of chroma samples relative to the luma samples for progressive frames as defined in Rec. ITU-T H.273, clause 8.7, is set to 2. |
| Range | The restricted video range is used.  |
| Stereoscopic Video | A signal for the Left and for the Right Eye is provided whereby the signals have the identical parameters as above and are timely synchronized.The signal may be provided as two individual signals for each eye, or in a frame-packed version. |

\* \* \* Next Change \* \* \* \*

### 4.5.3 HEVC Bitstreams

The following definitions are provided for HEVC/ITU-T H.265 [h265] bitstreams.

For an HEVC/ITU-T H.265 [h265] bitstream, *progressive constraints* are defined that the following flags in the active Sequence Parameter Set (SPS):

 - general\_progressive\_source\_flag shall be set to 1,

- general interlaced\_source\_flag shall be set to 0,

- general\_non\_packed\_constraint\_flag shall be set to 1, and

- general\_frame\_only\_constraint\_flag shall be set to 1.

For an HEVC/ITU-T H.265 [h265] bitstream, *VUI constraints* are defined:

- Video Parameter Sets (VPS) NAL units as defined in Recommendation ITU-T H.265 / ISO/IEC 23008-2 [h265] may be present, but the Bitstream shall be valid if the Receiver ignores the VPS.

- The Video Usability Information (VUI) is present in the active Sequence Parameter Set, i.e. the vui\_parameters\_present\_flag shall be set to 1.

- In the VUI,

- the aspect ratio information is present, i.e. the aspect\_ratio\_info\_present\_flag value shall be set to 1,

- the colour parameter information is present, i.e. video\_signal\_type\_present\_flag value shall be set to 1 and the colour\_description\_present\_flag value shall be set to 1.

- only video range signals are used, i.e. the video\_full\_range\_flag shall be set to 0,

- no overscan signalling is present, i.e. the overscan\_info\_present\_flag shall be set to 0,

- the chroma location shall be signalled, i.e. chroma\_loc\_info\_present\_flag shall be set to 1,

- the timing information may be present. If the timing information is present, i.e. the value of vui\_timing\_info\_present\_flag is set to 1, then the values of vui\_num\_units\_in\_tick and vui\_time\_scale shall be set according to the frame rates allowed for each operation point. The timing information present in the video Bitstream should be consistent with the timing information signalled at the system level. The frame rate shall not change between two RAPs. fixed\_frame\_rate\_flag value, if present, shall be set to 1.

For an HEVC/ITU-T H.265 [h265] bitstream, *frame-packing constraints* are defined:

- the following flags in the active Sequence Parameter Set (SPS):

 - general\_progressive\_source\_flag shall be set to 1,

- general interlaced\_source\_flag shall be set to 0,

- general\_non\_packed\_constraint\_flag shall be set to 0, and

- general\_frame\_only\_constraint\_flag shall be set to 1.

- The frame packing arrangement SEI message shall be present with the following characteristics:

- The value of frame\_packing\_arrangement\_type shall be set to either the value of 3 for the side-by-side packing arrangement, or the value of 4 for the top-bottom/over-under packing arrangement.

- The value of quincunx\_sampling\_flag shall be set to 0.

- The value of content\_interpretation\_type shall be set to either 1 or 2.

- The value of spatial\_flipping\_flag shall be set to 0.

- The value of frame0\_flipped\_flag shall be set to 0.

- The value of field\_views\_flag shall be set to 0.

- The value of current\_frame\_is\_frame0\_flag shall be set to 0.

- The values of frame0\_grid\_position\_x, frame0\_grid\_position\_y, frame1\_grid\_position\_x, and frame1\_grid\_position\_y, shall remain the same throughout the bitstream.

[

Editor’s Note: It should be discussed which of the two modes are preferred.

Option 1:

- If the value of upsampled\_aspect\_ratio\_flag is set to 0, indicating the presence of full resolution frame packed video, then aspect\_ratio\_idc shall be set to 1 (square).

- If the value of upsampled\_aspect\_ratio\_flag is set to 1, indicating the presence of half resolution frame packed video, then aspect\_ratio\_idc shall be set to 0 (unspecified).

Option 2

- The value of upsampled\_aspect\_ratio\_flag shall be set to 0, indicating the presence of full resolution frame packed video and the aspect\_ratio\_idc shall be set to 1.

]

- All parameters shall remain the same for the entire bitstream.

\* \* \* Next Change \* \* \* \*

### 4.6.2 Video Decoder API Parameters

Video decoders are typically accessed by API parameters. The parameters are used for the following purposes:

- to identify the capability of the device in order to check whether the signal can be played back

- to initialize the decoding and playback platform to allocate the resources for decoding and rendering

Table 4.6.2-1 provide relevant parameters for Video Decoder APIs.

Table 4.6.2-1 Video Decoder API Parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Restrictions | Status |
|  |  |  |
|  |  |  |
| media type | Specifies the media type of the component, in this case video | required |
|  |  |  |
| codecs | Specifies through a well-defined string the codec used for the signal  | required |
| Video format parameters | Specifies additional video format parameters as defined in Table 4.4.2.1 to describe the signal and to initialize the encoder. | optional |

Editor’s Note: The capability of such API for decoding and playback of multilayer content, e.g. for stereoscopic content needs to be documented.

\* \* \* Next Change \* \* \* \*

5.3.2 HEVC Decoding Capabilities

The following decoding capabilities are defined:

- **HEVC-HD-Dec**: the capability to decode bitstreams conforming to both, HEVC/ITU-T H.265 Main Profile, Main Tier, Level 3.1 [h265] bitstreams with *progressive* constraints as defined in clause 4.5.3.

- **HEVC-FullHD-Dec**: the capability to decode bitstreams conforming to HEVC/ITU-T H.265 Main 10 Profile, Main Tier, Level 4.1 [h265] bitstreams with *progressive* and *VUI* constraints as defined in clause 4.5.3.

- **HEVC-UHD-Dec**: the capability to decode bitstreams conforming to HEVC/ITU-T H.265 Main 10 Profile, Main Tier, Level 5.1 [h265] bitstreams with *progressive* and *VUI* constraints as defined in clause 4.5.3.

- **HEVC-8K-Dec**: the capability to decode bitstreams conforming to HEVC/ITU-T H.265 Main10 Profile, Main Tier, Level 6.1 [h265] bitstreams with *progressive* and *VUI* constraints as defined in clause 4.5.3 and further constraints:

- the bitstream does not exceed the maximum luma picture size in samples of 33,554,432,

- the maximum VCL Bit Rate is constrained to be 80 Mbps with CpbVclFactor and CpbNalFactor being fixed to be 1000 and 1100, respectively.

- **MV-HEVC-UHD-Dec**: the capability to decode bitstreams with an HEVC/ITU-T H.265 Main 10 Profile base layer (layer\_id=0), and a single HEVC/ITU-T H.265 Multiview Main 10 [or Multiview Extended 10] layer (layer\_id=1) [h265]. Each layer shall conform to Main Tier, Level 5.1, while the device should be capable of supporting single layer decoding of HEVC/ITU-T H.265 Main 10 Profile bitstreams at Main Tier, Level 5.2. All layers shall follow the *progressive* and *VUI* constraints as defined in clause 4.5.3.

[- **HEVC-Frame-Packed-Stereo-Dec**: the capability to decode bitstreams conforming to HEVC/ITU-T H.265 Main 10 Profile, Main Tier, Level 5.2 [h265] bitstreams with *frame-packing* and *VUI* *constraints* as defined in clause 4.5.3 ]

\* \* \* Next Change \* \* \* \*

# 6 Video Operation Points

## 6.1 Introduction

Video operation points define a restricted subset of representation signals and media capabilities. For each Video Operation Point, requirements for the Bitstream and for the Receiver are defined.

Table 6.1-1 provides an overview of defined video operation points.

Table 6.1-1 Overview of Video Operation Points

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Video Format | Decoding Capabilities | Definition |
| 3GPP-AVC-HD | 3GPP-HD (see clause 4.4.3.2) | AVC-FullHD-Dec (see clause 5.4) | 6.2.2 |
| 3GPP-HEVC-HD | 3GPP-HD (see clause 4.4.3.2) | HEVC-FullHD-Dec (see clause 5.4) | 6.3.2 |
| 3GPP-HEVC-HD-HDR | 3GPP-HDR (see clause 4.4.3.3) | HEVC-FullHD-Dec (see clause 5.4) | 6.3.3 |
| 3GPP-HEVC-UHD-HDR | 3GPP-HDR (see clause 4.4.3.3) | HEVC-UHD-Dec (see clause 5.4) | 6.3.4 |
| 3GPP-HEVC-Stereo | 3GPP-Stereo (see clause 4.4.3.4) | HEVC-Frame-Packed-Stereo-Dec (see clause 5.5) | 6.3.5 |
| 3GPP-MVHEVC-Stereo | 3GPP-Stereo (see clause 4.4.3.4) | MVHEVC-UHD-2 (see clause 5.5) | 6.3.6 |

## 6.2 AVC Video Operation Points

### 6.2.1 Introduction

The clause defines operation points for AVC. The video Bitstream and Receiver shall conform to Recommendation ITU-T H.264 [h264] with the restrictions described in this clause.

### 6.3.2 3GPP AVC HD Operation Point

#### 6.3.2.1 Introduction

The AVC HD Operation Point permits consistent distribution of HD-based video using AVC. The remainder of this clause 6.3.2 defines the Bitstream and Receiver requirements for the 3GPP-AVC-HD receiver.

Editor’s Note: Details need to be completed.

## 6.3 HEVC Video Operation Points

### 6.3.1 Introduction

The clause defines operation points for HEVC. The video Bitstream and Receiver shall conform to Recommendation ITU-T H.265 / ISO/IEC 23008-2 [h265] with the restrictions described in this clause.

### 6.3.2 3GPP HEVC HD Operation Point

#### 6.3.2.1 Introduction

The HEVC HD Operation Point permits consistent distribution of HD-based video using HEVC. The remainder of this clause 6.3.2 defines the Bitstream and Receiver requirements for the 3GPP-HEVC-HD receiver.

#### 6.3.2.2 Bitstream Requirements

A 3GPP-HEVC-HD Bitstream shall conform to the following requirements

- the Bitstream shall conform to HEVC/ITU-T H.265 Main 10 Profile, Main Tier, Level 4.1 [h265] bitstreams with *progressive* and *VUI* constraints as defined in clause 4.5.3.

- the Representation Format included in the Bitstream shall conform to the 3GPP-HD Representation format as defined in clause 4.4.3.2.

- the Bitstream shall be decodable by a decoder with **HEVC-FullHD-Dec** decoding capabilities.

Based on this, the following additional restrictions apply

- The chroma sub-sampling shall be 4:2:0 and the value of chroma\_format\_idc shall be set to 1.

- The aspect\_ratio\_idc value shall be set to 1, indicating a square pixel format.

- In the VUI, the values of colour\_primaries, transfer\_characteristics and matrix\_coeffs each shall be set to 1.

- The value of chroma\_sample\_loc\_type\_top\_field shall be set to 0.

The timing information may be present.

- If the timing information is present, i.e. the value of vui\_timing\_info\_present\_flag is set to 1, then the values of vui\_num\_units\_in\_tick and vui\_time\_scale shall be set according to the frame rates allowed for each operation point. The timing information present in the video Bitstream should be consistent with the timing information signalled at the system level.

- The frame rate shall not change between two RAPs. fixed\_frame\_rate\_flag value, if present, shall be set to 1.

#### 6.3.2.3 Receiver Requirements

Receivers conforming to the Operation Point 3GPP-HEVC-HD shall support decoding and rendering Bitstreams with the restrictions defined in clause 6.3.2.2.

NOTE 1: Rendering includes adherence to the parameters signalled in the bitstream to characterize the distributed Representation format.

Receivers should ignore the content of all Video Parameter Sets (VPS) NAL units as defined in Recommendation ITU-T H.265 / ISO/IEC 23008-2 [h265].

NOTE 2: The VPS may be present to address requirements in other Operation Points, but the Bitstream also conforms to this Operation point.

There are no requirements on output timing conformance for H.265/HEVC decoding (Annex C of [6]). The Hypothetical Reference Decoder (HRD) parameters, if present, should be ignored by the Receiver.

### 6.3.3 3GPP HEVC HDR Operation Point

#### 6.3.3.1 Introduction

The HEVC HDR Operation Point permits consistent distribution of High Dynamic Range based video using HEVC. The remainder of this clause 6.3.3 defines the Bitstream and Receiver requirements for the 3GPP-HEVC-HDR receiver.

#### 6.3.3.2 Bitstream Requirements

A 3GPP-HEVC-HDR Bitstream shall conform to the following requirements

- the Bitstream shall conform to HEVC/ITU-T H.265 Main 10 Profile, Main Tier, Level 4.1 [h265] bitstreams with *progressive* and *VUI* constraints as defined in clause 4.5.3.

- the Representation Format included in the Bitstream shall conform to the 3GPP HDR Representation format as defined in clause 4.4.3.3.

- the Bitstream shall be decodable by a decoder with **HEVC-FullHD-Dec** decoding capabilities as defined in clause 5.3.2.

Based on this, the following additional restrictions apply

- The chroma sub-sampling shall be 4:2:0 and the value of chroma\_format\_idc shall be set to 1.

- The aspect\_ratio\_idc value shall be set to 1, indicating a square pixel format.

- In the VUI, the values of colour\_primaries and matrix\_coeffs each shall be set to 9, and the value of transfer\_characteristics shall be set to one of the following values: 14 (for SDR with WCG), 16 (for PQ) and 18 (for HLG).

- The value of the chroma\_sample\_loc\_type\_top\_field shall be set to 2.

The timing information may be present.

- If the timing information is present, i.e. the value of vui\_timing\_info\_present\_flag is set to 1, then the values of vui\_num\_units\_in\_tick and vui\_time\_scale shall be set according to the frame rates allowed for each operation point. The timing information present in the video Bitstream should be consistent with the timing information signalled at the system level.

- The frame rate shall not change between two RAPs. fixed\_frame\_rate\_flag value, if present, shall be set to 1.

#### 6.3.3.3 Receiver Requirements

Receivers conforming to this Operation Point 3GPP-HEVC-HDR shall support decoding and rendering Bitstreams with the restrictions defined in clause 6.3.3.2.

NOTE 1: Rendering includes adherence to the parameters signalled in the bitstream to characterize the distributed Representation format.

Receivers should ignore the content of all Video Parameter Sets (VPS) NAL units as defined in Recommendation ITU-T H.265 / ISO/IEC 23008-2 [h265].

NOTE 2: The VPS may be present to address requirements in other Operation Points, but the Bitstream also conforms to this Operation point.

There are no requirements on output timing conformance for H.265/HEVC decoding (Annex C of [6]). The Hypothetical Reference Decoder (HRD) parameters, if present, should be ignored by the Receiver.

### 6.3.4 3GPP HEVC UHD

#### 6.3.4.1 Introduction

The HEVC UHD Operation Point permits consistent distribution of Ultra-High-definition content using HEVC. The remainder of this clause 6.3.4 defines the Bitstream and Receiver requirements for the 3GPP-HEVC-UHD receiver.

#### 6.3.4.2 Bitstream Requirements

A 3GPP-HEVC-UHD Bitstream shall conform to the following requirements

- the Bitstream shall conform to HEVC/ITU-T H.265 Main 10 Profile, Main Tier, Level 5.1 [h265] bitstreams with *progressive* and *VUI* constraints as defined in clause 4.5.3.

- the Representation Format included in the Bitstream shall conform to the 3GPP HDR Representation format as defined in clause 4.4.3.3.

- the Bitstream shall be decodable by a decoder with **HEVC-UHD-Dec** decoding capabilities as defined in clause 5.3.2.

Based on this, the following additional restrictions apply

- The chroma sub-sampling shall be 4:2:0 and the value of chroma\_format\_idc shall be set to 1.

- The aspect\_ratio\_idc value shall be set to 1, indicating a square pixel format.

- In the VUI, the values of colour\_primaries and matrix\_coeffs each shall be set to 9, and the value of transfer\_characteristics shall be set to one of the following values: 14 (for SDR with WCG), 16 (for PQ) and 18 (for HLG).

- The value of the chroma\_sample\_loc\_type\_top\_field shall be set to 2.

The timing information may be present.

- If the timing information is present, i.e. the value of vui\_timing\_info\_present\_flag is set to 1, then the values of vui\_num\_units\_in\_tick and vui\_time\_scale shall be set according to the frame rates allowed for each operation point. The timing information present in the video Bitstream should be consistent with the timing information signalled at the system level.

- The frame rate shall not change between two RAPs. fixed\_frame\_rate\_flag value, if present, shall be set to 1.

#### 6.3.4.3 Receiver Requirements

Receivers conforming to this Operation Point 3GPP-HEVC-HDR shall support decoding and rendering Bitstreams with the restrictions defined in clause 6.3.4.2.

NOTE 1: Rendering includes adherence to the parameters signalled in the bitstream to characterize the distributed Representation format.

Receivers should ignore the content of all Video Parameter Sets (VPS) NAL units as defined in Recommendation ITU-T H.265 / ISO/IEC 23008-2 [h265].

NOTE 2: The VPS may be present to address requirements in other Operation Points, but the Bitstream also conforms to this Operation point.

There are no requirements on output timing conformance for H.265/HEVC decoding (Annex C of [6]). The Hypothetical Reference Decoder (HRD) parameters, if present, should be ignored by the Receiver.

### 6.3.5 3GPP HEVC Stereo

#### 6.3.5.1 Introduction

The HEVC Stereo Operation Point permits consistent distribution of stereoscopic content using HEVC with frame-packing. The remainder of this clause 6.3.5 defines the Bitstream and Receiver requirements for the 3GPP-HEVC-S receiver.

#### 6.3.5.2 Bitstream Requirements

A 3GPP-HEVC-Stereo Bitstream shall conform to the following requirements

- the Bitstream shall conform to HEVC/ITU-T H.265 Main 10 Profile, Main Tier, Level 5.2 [h265] bitstreams with frame-packing constraints as defined in clause 4.5.3.

- the Representation Format included in the Bitstream shall conform to the 3GPP Stereoscopic format as defined in clause 4.4.3.4.

- the Bitstream shall be decodable by a decoder with **HEVC-Stereo-Dec** decoding capabilities as defined in clause 5.3.2.

Based on this, the following additional restrictions apply

- The chroma sub-sampling shall be 4:2:0 and the value of chroma\_format\_idc shall be set to 1.

- In the VUI, either

- the values of colour\_primaries, transfer\_characteristics and matrix\_coeffs each shall be set to 1.

- The value of chroma\_sample\_loc\_type\_top\_field shall be set to 0.

- or

- the values of colour\_primaries and matrix\_coeffs each shall be set to 9, and the value of transfer\_characteristics shall be set to one of the following values: 14 (for SDR with WCG), 16 (for PQ) and 18 (for HLG).

- The value of the chroma\_sample\_loc\_type\_top\_field shall be set to 2.

The timing information may be present.

- If the timing information is present, i.e. the value of vui\_timing\_info\_present\_flag is set to 1, then the values of vui\_num\_units\_in\_tick and vui\_time\_scale shall be set according to the frame rates allowed for each operation point. The timing information present in the video Bitstream should be consistent with the timing information signalled at the system level.

- The frame rate shall not change between two RAPs. fixed\_frame\_rate\_flag value, if present, shall be set to 1.

Bitstreams not required to be associated with frame packing information for all coded video sequences. It is also possible that such information, when present, may defer from one coded video sequence to another.

#### 6.3.5.3 Receiver Requirements

Receivers conforming to this Operation Point 3GPP-HEVC-3D shall support decoding and rendering Bitstreams with the restrictions defined in clause 6.3.5.2.

NOTE 1: Rendering includes adherence to the parameters signalled in the bitstream to characterize the distributed Representation format.

Receivers should ignore the content of all Video Parameter Sets (VPS) NAL units as defined in Recommendation ITU-T H.265 / ISO/IEC 23008-2 [h265].

NOTE 2: The VPS may be present to address requirements in other Operation Points, but the Bitstream also conforms to this Operation point.

There are no requirements on output timing conformance for H.265/HEVC decoding (Annex C of [6]). The Hypothetical Reference Decoder (HRD) parameters, if present, should be ignored by the Receiver.

### 6.3.6 3GPP MVHEVC Stereo

#### 6.3.6.1 Introduction

The MVHEVC Stereo Operation Point permits consistent distribution of stereoscopic content using MVHEVC. The remainder of this clause 6.3.6 defines the Bitstream and Receiver requirements for the 3GPP-MVHEVC-Stereo receiver.

#### 6.3.6.2 Bitstream Requirements

A 3GPP-MVHEVC-Stereo Bitstream shall conform to the following requirements

- the bitstream shall conform with

- an HEVC/ITU-T H.265 Main 10 Profile base layer (layer\_id=0) bitstream, and

- a single HEVC/ITU-T H.265 Multiview Main 10 [or Multiview Extended 10] layer (layer\_id=1) [h265] bitstream.

- Each layer shall conform to Main Tier, Level 5.1.

- All layers shall follow the *progressive* and *VUI* constraints as defined in clause 4.5.3.

- the Representation Format included in the Bitstream shall conform to the 3GPP Stereoscopic format as defined in clause 4.4.3.4.

- the Bitstream shall be decodable by

- a decoder with **HEVC-UHD-Dec** decoding capabilities as defined in clause 5.3.2.

- a decoder with **MV-HEVC-UHD** decoding capabilities as defined in clause 5.3.2.

Based on this, the following additional restrictions apply

- The chroma sub-sampling shall be 4:2:0 and the value of chroma\_format\_idc shall be set to 1.

- The aspect\_ratio\_idc value shall be set to 1, indicating a square pixel format.

- In the VUI, either

- the values of colour\_primaries, transfer\_characteristics and matrix\_coeffs each shall be set to 1.

- The value of chroma\_sample\_loc\_type\_top\_field shall be set to 0.

- or

- the values of colour\_primaries and matrix\_coeffs each shall be set to 9, and the value of transfer\_characteristics shall be set to one of the following values: 14 (for SDR with WCG), 16 (for PQ) and 18 (for HLG).

- The value of the chroma\_sample\_loc\_type\_top\_field shall be set to 2.

The timing information may be present.

- If the timing information is present, i.e. the value of vui\_timing\_info\_present\_flag is set to 1, then the values of vui\_num\_units\_in\_tick and vui\_time\_scale shall be set according to the frame rates allowed for each operation point. The timing information present in the video Bitstream should be consistent with the timing information signalled at the system level.

- The frame rate shall not change between two RAPs. fixed\_frame\_rate\_flag value, if present, shall be set to 1.

Bitstreams not required to be associated with frame packing information for all coded video sequences. It is also possible that such information, when present, may defer from one coded video sequence to another.

#### 6.3.6.3 Receiver Requirements

Receivers conforming to this Operation Point 3GPP-MVHEVC-Stereo shall support decoding and rendering Bitstreams with the restrictions defined in clause 6.3.6.2.

NOTE 1: Rendering includes adherence to the parameters signalled in the bitstream to characterize the distributed Representation format.

Receivers should ignore the content of all Video Parameter Sets (VPS) NAL units as defined in Recommendation ITU-T H.265 / ISO/IEC 23008-2 [h265].

NOTE 2: The VPS may be present to address requirements in other Operation Points, but the Bitstream also conforms to this Operation point.

There are no requirements on output timing conformance for H.265/HEVC decoding (Annex C of [6]). The Hypothetical Reference Decoder (HRD) parameters, if present, should be ignored by the Receiver.

\* \* \* End of Changes \* \* \* \*