|  |  |
| --- | --- |
| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11**  31st Meeting: San Diego, CA, 13–20 April, 2018 | Document: JCTVC-AE0030 |

|  |  |  |  |
| --- | --- | --- | --- |
| *Title:* | **Content colour volume SEI message for AVC** | | |
| *Status:* | Input document | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | **Sean McCarthy**  **Walt Husak** Dolby Laboratories, Inc.  1275 Market Street  San Francisco, CA 94114 | Tel: Email: | +1 415-518-5287 [sean.mccarthy@dolby.com](mailto:sean.mccarthy@dolby.com)  [wjh@dolby.com](mailto:wjh@dolby.com) |
| *Source:* | Dolby Laboratories, Inc. | | |

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

# Abstract

The content colour volume SEI message was added to HEVC in ISO/IEC 23008-2:2017/FDAM 3 but was not added to AVC (14496-10).

This JCT-VC input document requests that the next update of AVC (14496-10) add the content colour volume SEI message.

# Introduction

The following proposed text is the same as the text for the corresponding content colour volume SEI message in ISO/IEC 23008-2:2017/FDAM 3, with the following differences required to conform to ISO/IEC 14496–10:

1. Syntax element **ccv\_repetition\_period** is used instead of **ccv\_persistence\_flag**, which is consistent with the use in other SEI messages that appear in both ISO/IEC 14496–10 and ISO/IEC 23008–2 (e.g., pan-scan rectangle, film grain characteristics, and frame packing arrangement SEI messages). Likewise, colour content volume SEI message semantics for **ccv\_repetition\_period** correspond to the semantics of other ISO/IEC 14496–10 SEI messages.
2. “coded video sequence” is used instead of “CLVS.” The latter is not defined in ISO/IEC 14496–10.

The differences noted above are highlighted in yellow in the following proposed syntax and semantics.

# Proposed syntax and semantics

Add the following payload type to the General SEI message syntax in appropriate sequence in table in section D.1.1

**D.1.1 General SEI message syntax**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | | |
| else if( payloadType  = =  149 ) |  |  |
| content\_colour\_volume( payloadSize ) | 5 |  |

Add the following content colour volume SEI message syntax in section D.1.32. Renumber existing section D.1.32 Reserved SEI message syntax as appropriate.

**D.1.32 Content colour volume SEI message syntax**

|  |  |  |
| --- | --- | --- |
| content\_colour\_volume( payloadSize ) { | **C** | **Descriptor** |
| **ccv\_cancel\_flag** | 5 | u(1) |
| if( !ccv\_cancel\_flag ) { |  |  |
| **ccv\_repetition\_period** | 5 | ue(v) |
| **ccv\_primaries\_present\_flag** | 5 | u(1) |
| **ccv\_min\_luminance\_value\_present\_flag** | 5 | u(1) |
| **ccv\_max\_luminance\_value\_present\_flag** | 5 | u(1) |
| **ccv\_avg\_luminance\_value\_present\_flag** | 5 | u(1) |
| **ccv\_reserved\_zero\_2bits** | 5 | u(2) |
| if( ccv\_primaries\_present\_flag ) |  |  |
| for( c = 0; c < 3; c++ ) { |  |  |
| **ccv\_primaries\_x**[ c ] | 5 | i(32) |
| **ccv\_primaries\_y**[ c ] | 5 | i(32) |
| } |  |  |
| if( ccv\_min\_luminance\_value\_present\_flag ) |  |  |
| **ccv\_min\_luminance\_value** | 5 | u(32) |
| if( ccv\_max\_luminance\_value\_present\_flag ) |  |  |
| **ccv\_max\_luminance\_value** | 5 | u(32) |
| if( ccv\_avg\_luminance\_value\_present\_flag ) |  |  |
| **ccv\_avg\_luminance\_value** | 5 | u(32) |
| } |  |  |
| } |  |  |

**D.2.40 Content colour volume SEI message semantics**

The content colour volume SEI message describes the colour volume characteristics of the associated pictures. These colour volume characteristics are expressed in terms of a nominal range, although deviations from this range may occur.

The variable transferCharacteristics is specified as follows:

– If an alternative transfer characteristics SEI message is present for the coded video sequence, transferCharacteristics is set equal to preferred\_transfer\_characteristics;

– Otherwise, (an alternative transfer characteristics SEI message is not present for the coded video sequence), transferCharacteristics is set equal to transfer\_characteristics.

The content colour volume SEI message shall not be present, and decoders shall ignore it, when any of the following conditions is true:

– Any of the values of transferCharacteristics, colour\_primaries, and matrix\_coeffs has a value defined as unspecified.

– The value of transfer\_characteristics is equal to 2, 4, or 5.

– The value of colour\_primaries is equal to 2.

The following applies when converting the signal from a non-linear to a linear representation:

– If the value of transferCharacteristics is equal to 1, 6, 7, 14, or 15, the Rec. ITU‑R BT.1886-0 reference electro-optical transfer function should be used to convert the signal to its linear representation, where the value of screen luminance for white is set equal to 100 cd/m2, the value of screen luminance for black is set equal to 0 cd/m2, and the value of the exponent of the power function is set equal to 2.4.

– Otherwise, if the value of transferCharacteristics is equal to 18, the hybrid log-gamma reference electro-optical transfer function specified in Rec. ITU-R BT.2100-1 should be used to convert the signal to its linear representation, where the value of nominal peak luminance of the display is set equal to 1000 cd/m2, the value of the display luminance for black is set equal to 0 cd/m2, and the value of system gamma is set equal to 1.2.

– Otherwise (the value of transferCharacteristics is not equal to 1, 6, 7, 14, 15, or 18) when the content colour volume SEI message is present, the exact inverse of the transfer function specified in Table E-4 should be used to convert the non-linear signal to a linear representation.

**ccv\_cancel\_flag** equal to 1 indicates that the content colour volume SEI message cancels the persistence of any previous content colour volume SEI message in output order. ccv\_cancel\_flagequal to 0 indicates that content colour volume information follows.

**ccv\_repetition\_period** specifies the persistence of the content colour volume SEI message and may specify a picture order count interval within which another content colour volume SEI message or the end of the coded video sequence shall be present in the bitstream. The value of ccv\_repetition\_period shall be in the range 0 to 16 384, inclusive.

ccv\_repetition\_period equal to 0 specifies that the content colour volume SEI message applies to the current decoded picture only.

ccv\_repetition\_period equal to 1 specifies that the content colour volume SEI message persists in output order until any of the following conditions are true:

* A new coded video sequence begins.
* A picture in an access unit containing a content colour volume SEI message is output having PicOrderCnt( ) greater than PicOrderCnt( CurrPic ).

ccv\_repetition\_period greater than 1 specifies that the content colour volume SEI message persists until any of the following conditions are true:

* A new coded video sequence begins.
* A picture in an access unit containing a content colour volume SEI message is output having PicOrderCnt( ) greater than PicOrderCnt( CurrPic ) and less than or equal to PicOrderCnt( CurrPic ) + ccv\_repetition\_period.

ccv\_repetition\_period greater than 1 indicates that another content colour volume SEI message shall be present for a picture in an access unit that is output having PicOrderCnt( ) greater than PicOrderCnt( CurrPic ) and less than or equal to PicOrderCnt( CurrPic ) + ccv\_repetition\_period; unless the bitstream ends or a new coded video sequence begins without output of such a picture.

**ccv\_primaries\_present\_flag** equal to 1 specifies that the syntax elements ccv\_primaries\_x[ c ] and ccv\_primaries\_y[ c ] are present. ccv\_primaries\_present\_flag equal to 0 specifies that the syntax elements ccv\_primaries\_x[ c ] and ccv\_primaries\_y[ c ] are not present.

**ccv\_min\_luminance\_value\_present\_flag** equal to 1 specifies that the syntax element ccv\_min\_luminance\_value is present. ccv\_min\_luminance\_value\_present\_flag equal to 0 specifies that the syntax element ccv\_min\_luminance\_value is not present.

**ccv\_max\_luminance\_value\_present\_flag** equal to 1 specifies that the syntax element ccv\_max\_luminance\_value is present. ccv\_max\_luminance\_value\_present\_flag equal to 0 specifies that the syntax element ccv\_max\_luminance\_value is not present.

**ccv\_avg\_luminance\_value\_present\_flag** equal to 1 specifies that the syntax element ccv\_avg\_luminance\_value is present. ccv\_avg\_luminance\_value\_present\_flag equal to 0 specifies that the syntax element ccv\_avg\_luminance\_value is not present.

It is a requirement of bitstream conformance that the values of ccv\_primaries\_present\_flag, ccv\_min\_luminance\_value\_present\_flag, ccv\_max\_luminance\_value\_present\_flag, and ccv\_avg\_luminance\_value\_present\_flag shall not all be equal to 0.

**ccv\_reserved\_zero\_2bits**[ i ] shall be equal to 0 in bitstreams conforming to this version of this Specification. Other values for reserved\_zero\_2bits[ i ] are reserved for future use by ITU-T | ISO/IEC. Decoders shall ignore the value of reserved\_zero\_2bits[ i ].

**ccv\_primaries\_x**[ c ] and **ccv\_primaries\_y**[ c ] specify the normalized x and y chromaticity coordinates, respectively, of the colour primary component c of the nominal content colour volume in normalized increments of 0.00002, according to the CIE 1931 definition of x and y as specified in ISO 11664-1 (see also ISO 11664-3 and CIE 15), in normalized increments of 0.00002. For describing colour volumes that use red, green, and blue colour primaries, it is suggested that index value c equal to 0 should correspond to the green primary, c equal to 1 should correspond to the blue primary, and c equal to 2 should correspond to the red colour primary (see also Annex E and Table E.3).

The values of ccv\_primaries\_x[ c ] and ccv\_primaries\_y[ c ] shall be in the range of −5 000 000 to 5 000 000, inclusive.

When ccv\_primaries\_x[ c ] and ccv\_primaries\_y[ c ] are not present, they are inferred to be equal to the normalized x and y chromaticity coordinates, respectively, specified by colour\_primaries.

**ccv\_min\_luminance\_value** specifies the normalized minimum luminance value, according to CIE 1931, that is expected to be present in the content, where values are normalized to Lo or Lc as specified in Table E.4 according to the indicated transfer characteristics of the signal. The values of ccv\_min\_luminance\_value are in normalized increments of 0.0000001.

**ccv\_max\_luminance\_value** specifies the maximum luminance value, according to CIE 1931, that is expected to be present in the content, where values are normalized to Lo or Lc as specified in Table E.4 according to the transfer characteristics of the signal. The values of ccv\_max\_luminance\_value are in normalized increments of 0.0000001.

**ccv\_avg\_luminance\_value** specifies the average luminance value, according to CIE 1931, that is expected to be present in the content, where values are normalized to Lo or Lc as specified in Table E.4 according to the transfer characteristics of the signal. The values of ccv\_avg\_luminance\_value are in normalized increments of 0.0000001.

NOTE  The resulting domain from this conversion process may or may not represent light in a source or display domain – it is merely a gamut representation domain rather than necessarily being a representation of actual light in either the scene or display domain. Therefore, the values corresponding to ccv\_min\_luminance\_value, ccv\_max\_luminance\_value, and ccv\_avg\_luminance\_value might not necessarily correspond to a true luminance value.

The value of ccv\_min\_luminance\_value, when present, shall be less than or equal to ccv\_avg\_luminance\_value, when present. The value of ccv\_avg\_luminance\_value, when present, shall be less than or equal to ccv\_max\_luminance\_value, when present. The value of ccv\_min\_luminance\_value, when present, shall be less than or equal to ccv\_max\_luminance\_value, when present.

When the visually relevant region does not correspond to the entire cropped decoded picture, such as for "letterbox" encoding of video content with a wide picture aspect ratio within a taller cropped decoded picture, the indicated ccv\_min\_luminance\_value, ccv\_max\_luminance\_value, and ccv\_avg\_luminance\_value should correspond only to values within the visually relevant region.

# References

1. w17202 “Text of ISO/IEC 23008-2:2017/FDAM3 Additional supplemental enhancement information.” 120th meeting of MPEG, Macau, October 2017.

# Patent rights declaration(s)

**Dolby Laboratories, Inc. may have current or pending patent rights relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**