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| *Title:* | **On sRGB and sYCC** | | |
| *Status:* | Input document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

This contribution proposes to correct transfer\_characteristics and matrix coefficients to support IEC 61966-2-1. The semantics of transfer characteristics (Table E.4), and the semantics of matrix coefficients (Table E.5) should be corrected.

# Introduction

The colorimetry information can be signaled in VUI and the semantics are specified in E.3 (colour primaries), E.4 (transfer\_charcterisctics) and E.5 (matrix coefficients).

IEC 61966-2-1 defines sRGB colour space, and its amendment (IEC 61966-2-1 AMD1) defines a default transformation between sRGB and a standard luma-chroma-chroma colour space (sYCC). There are some incorrect descriptions for IEC 61966-2-1 in TableE.4 and E.5.

a) In Table E.4, transfer characteristics described in Value 13 is insufficient for sYCC.

b) In Table E.5, sYCC is currently categorized in the wrong value.

# Proposal

This contribution proposes to fix Table E.4 and E.5 as follows.

1. In Table E.4, transfer characteristics in Value 13 shall be extended as follows;

**V = α \* Lc( 1 ÷ 2.4 ) − ( α − 1 ) for Lc > β**

**V = 12.92 \* Lc for β >= Lc >= −β**

**V = − α \*(− Lc) ( 1 ÷ 2.4 ) + ( α − 1 ) for Lc < −β**

and, add the note in informative remarks column that **Lc** isclipped between 0 and 1 for sRGB.

1. In Table E.5, “IEC 61966-2-1” shall be included in Value 5 (instead of Value 1).

This contribution proposes to correct Table E.4 as follows.

| Value | Transfer characteristic | Informative remark |
| --- | --- | --- |
| 0 | Reserved | For future use by ITU-T | ISO/IEC |
| 1 | V = *α* \* Lc0.45 − ( *α* − 1 ) for 1 >= Lc >= *β*  V = 4.500 \* Lc for *β* > Lc >= 0 | Rec. ITU-R BT.709-6  Rec. ITU-R BT.1361-0 conventional colour gamut system (historical)  (functionally the same as the values 6, 14, and 15) |
| 2 | Unspecified | Image characteristics are unknown or are determined by the application. |
| 3 | Reserved | For future use by ITU-T | ISO/IEC |
| 4 | Assumed display gamma 2.2 | Rec. ITU-R BT.470-6 System M (historical)  NTSC Recommendation for transmission standards for colour television (1953)  FCC, Title 47 Code of Federal Regulations (2003) 73.682 (a) (20) |
| 5 | Assumed display gamma 2.8 | Rec. ITU-R BT.470-6 System B, G (historical)  Rec. ITU-R BT.1700-0 625 PAL and 625 SECAM |
| 6 | V = *α* \* Lc0.45 − ( *α* − 1 ) for 1 >= Lc >= *β*  V = 4.500 \* Lc for *β* > Lc >= 0 | Rec. ITU-R BT.601-7 525 or 625  Rec. ITU-R BT.1358-1 525 or 625 (historical)  Rec. ITU-R BT.1700-0 NTSC  SMPTE ST 170 (2004)  (functionally the same as the values 1, 14, and 15) |
| 7 | V = *α* \* Lc0.45 − ( *α* − 1 ) for 1 >= Lc >= *β*  V = 4.0 \* Lc for *β* > Lc >= 0 | SMPTE ST 240 (1999, historical) |
| 8 | V = Lc for all values of Lc | Linear transfer characteristics |
| 9 | V = 1.0 + Log10( Lc ) ÷ 2 for 1 >= Lc >= 0.01  V = 0.0 for 0.01 > Lc >= 0 | Logarithmic transfer characteristic (100:1 range) |
| 10 | V = 1.0 + Log10( Lc ) ÷ 2.5 for 1 >= Lc >= Sqrt( 10 ) ÷ 1000  V = 0.0 for Sqrt( 10 ) ÷ 1000 > Lc >= 0 | Logarithmic transfer characteristic (100 \* Sqrt( 10 ) : 1 range) |
| 11 | V = *α* \* Lc0.45 − ( *α* − 1 ) for Lc >= *β*  V = 4.500 \* Lc for *β* > Lc > −*β*  V = −*α* \* ( −Lc )0.45 + ( *α* − 1 ) for −*β* >= Lc | IEC 61966-2-4 |
| 12 | V = *α* \* Lc0.45 − ( *α* − 1 ) for 1.33 > Lc >= *β*  V = 4.500 \* Lc for *β* > Lc >= −*γ*  V = −( *α* \* ( −4 \* Lc )0.45 − ( *α* − 1 ) ) ÷ 4 for −*γ* > Lc >= −0.25 | Rec. ITU-R BT.1361-0 extended colour gamut system (historical) |
| 13 | V = *α* \* Lc( 1 ÷ 2.4 ) − ( *α* − 1 ) for Lc > *β*  V = 12.92 \* Lc for *β* >= Lc >= −*β*  V = − *α* \*(− Lc) ( 1 ÷ 2.4 ) + ( *α* − 1 ) for Lc < −*β* | IEC 61966-2-1 sRGB\* or sYCC |
| 14 | V =*α* \* Lc0.45 − ( *α* − 1 ) for 1 >= Lc >= *β*  V = 4.500 \* Lc for *β* > Lc >= 0 | Rec. ITU-R BT.2020-2 (functionally the same as the values 1, 6, and 15) |
| 15 | V =*α* \* Lc0.45 − ( *α* − 1 ) for 1 >= Lc >= *β*  V = 4.500 \* Lc for *β* > Lc >= 0 | Rec. ITU-R BT.2020-2 (functionally the same as the values 1, 6, and 14) |
| 16 | V = ( ( c1 + c2 \* Lon ) ÷ ( 1 + c3 \* Lon ) )m for all values of Lo  c1 = c3 − c2 + 1 = 3424 ÷ 4096 = 0.8359375  c2 = 32 \* 2413 ÷ 4096 = 18.8515625  c3 = 32 \* 2392 ÷ 4096 = 18.6875  m = 128 \* 2523 ÷ 4096 = 78.84375  n = 0.25 \* 2610 ÷ 4096 = 0.1593017578125  for which Lo equal to 1 for peak white is ordinarily intended to correspond to a reference output luminance level of 10 000 candelas per square metre | SMPTE ST 2084 (2014) for 10, 12, 14, and 16-bit systems  Rec. ITU-R BT.2100-1 perceptual quantization (PQ) system |
| 17 | V = ( 48 \* Lo ÷ 52.37 )( 1 ÷ 2.6 ) for all values of Lo  for which Lo equal to 1 for peak white is ordinarily intended to correspond to a reference output luminance level of 48 candelas per square metre | SMPTE ST 428-1 (2006) |
| 18 | V = a \* Ln( 12 \* Lc − b ) + c for 1 >= Lc > 1 ÷ 12  V = Sqrt( 3 ) \* Lc0.5 for 1 ÷ 12 >= Lc >= 0  a = 0.17883277, b = 0.28466892, c = 0.55991073 | Association of Radio Industries and Businesses (ARIB) STD-B67  Rec. ITU-R BT.2100-1 hybrid log-gamma (HLG) system |
| 19..255 | Reserved | For future use by ITU-T | ISO/IEC |

NOTE  – For transfer\_characteristics equal to 13, Lc values between 0 and 1are allowed for sRGB.

Table E.5 should be revised as follows.

Table E.5 – Matrix coefficients interpretation using the matrix\_coeffs syntax element

|  |  |  |
| --- | --- | --- |
| Value | Matrix | Informative remark |
| 0 | Identity | The identity matrix.  Typically used for GBR (often referred to as RGB); however, may also be used for YZX (often referred to as XYZ)  IEC 61966-2-1 sRGB  SMPTE ST 428-1 (2006)  See Equations E‑31 to E‑33 |
| 1 | KR = 0.2126; KB = 0.0722 | Rec. ITU-R BT.709-6  Rec. ITU-R BT.1361-0 conventional colour gamut system and extended colour gamut system (historical)  ~~IEC 61966-2-1 sYCC~~  IEC 61966-2-4 xvYCC709  SMPTE RP 177 (1993) Annex B  See Equations E‑28 to E‑30 |
| 2 | Unspecified | Image characteristics are unknown or are determined by the application. |
| 3 | Reserved | For future use by ITU‑T | ISO/IEC |
| 4 | KR = 0.30; KB = 0.11 | FCC Title 47 Code of Federal Regulations (2003) 73.682 (a) (20)  See Equations E‑28 to E‑30 |
| 5 | KR = 0.299; KB = 0.114 | Rec. ITU‑R BT.470‑6 System B, G (historical)  Rec. ITU‑R BT.601‑7 625  Rec. ITU‑R BT.1358-0 625 (historical)  Rec. ITU‑R BT.1700-0 625 PAL and 625 SECAM  IEC 61966 2-1 sYCC  IEC 61966-2-4 xvYCC601  (functionally the same as the value 6)  See Equations E‑28 to E‑30 |
| 6 | KR = 0.299; KB = 0.114 | Rec. ITU‑R BT.601‑7 525  Rec. ITU‑R BT.1358-1 525 or 625 (historical)  Rec. ITU‑R BT.1700-0 NTSC  SMPTE ST 170 (2004)  (functionally the same as the value 5)  See Equations E‑28 to E‑30 |
| 7 | KR = 0.212; KB = 0.087 | SMPTE ST 240 (1999, historical)  See Equations E‑28 to E‑30 |
| 8 | YCgCo | See Equations E‑34 to E‑48 |
| 9 | KR = 0.2627; KB = 0.0593 | Rec. ITU-R BT.2020-2 non-constant luminance system  Rec. ITU-R BT.2100-1 Y′CbCr  See Equations E‑28 to E‑30 |
| 10 | KR = 0.2627; KB = 0.0593 | Rec. ITU-R BT.2020-2 constant luminance system  See Equations E‑49 to E‑58 |
| 11 | Y′D′ZD′X | SMPTE ST 2085 (2015)  See Equations E‑59 to E‑61 |
| 12 | See Equations E‑22 to E‑27 | Chromaticity-derived non-constant luminance system  See Equations E‑28 to E‑30 |
| 13 | See Equations E‑22 to E‑27 | Chromaticity-derived constant luminance system  See Equations E‑49 to E‑58 |
| 14 | ICTCP | Rec. ITU-R BT.2100-1 ICTCP  See Equations E‑62 to E‑64 |
| 15..255 | Reserved | For future use by ITU‑T | ISO/IEC |

# Conclusions

This contribution proposes to correct transfer\_characteristics and matrix coefficients to support IEC 61966-2-1 correctly. The semantics of transfer characteristics (Table E.4), and the semantics of matrix coefficients (Table E.5) should be corrected.

# Patent rights declaration

**Sony Corporation 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).**