SMPTE STANDARD

Interoperable Master Format — Application #2 Extended

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Approved
July 14, 2014

Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual.

SMPTE ST 2067-21:2014 was prepared by Technology Committee 35PM.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

1 Scope

This specification extends IMF Application #2 with support for image frames with

- colorimetry specified in IEC 61966-2-4 and Recommendation ITU-R BT.2020; and
- a maximum width and height of 3840 and 2160 pixels, respectively.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE ST 2067-20:2013, Interoperable Master Format — Application #2

Recommendation ITU-R BT.2020 (08/2012), Parameter Values for Ultra-High Definition Television Systems for Production and International Programme Exchange

IEC 61966-2-4 Edition 1.0 (2006-01), Multimedia Systems and Equipment — Colour Measurement and Management — Part 2-4: Colour Management — Extended-Gamut YCC Colour Space for Video Applications — xvYCC

4 Overall

4.1 General

The normative provisions of SMPTE ST 2067-20 shall apply in addition to those specified herein unless specified otherwise.

4.2 Shim Parameters

Track Files conforming to this specification shall be associated with the shim parameter values specified in SMPTE ST 2067-20 with the exception of those specified in Table 1.

Table 1 – Shim Parameter Values Definitions

Shim Parameter	Value
shim_id	http://www.smpte-ra.org/schemas/2067-21/2014
picture_bitrate	ST 2067-21
picture_format	ST 2067-21

5 Image Essence

5.1 Constraints

Implementations shall support the combinations of image frame characteristics listed in Table 2.

Table 2 – Image Characteristics

Characteristic	Constraint		
Image Frame Width	1..3840		
Image Frame Height	1..2160		
Colorimetry	COLOR.3	COLOR.4	COLOR.5
Pixel Bit Depth	8 10		10
Frame Structure	Progressive		
Stereoscopy	Monoscopic Stereoscopic		
Frame Rate	24 24000/1001 25 30 30000/1001		
Sampling	4:2:2		
Quantization	QE.1		
Color Components	$Y'C'_BC'_R$		

Note 1: QE.1 and COLOR.3 are defined in SMPTE ST 2067-20.

Note 2: This specification does not support the $Y'_CC'_{BC}C'_{RC}$ (constant luminance) color components specified in Recommendation ITU-R BT.2020.

Note 3: IEC 61966-2-4 uses $Y'C'_BC'_R$ and YCC (luma-chroma-chroma) interchangeably.

5.2 Colorimetry

Implementations shall support the mappings of component signals to red, green and blue tristimulus values listed in Table 3.

Table 3 – Colorimetry Systems

System	Description
COLOR.4	Mapped using method xvYCC709 as specified in IEC 61966-2-4
COLOR.5	Mapped as specified in Recommendation ITU-R BT.2020

6 Image Track Files

6.1 Generic Picture Essence Descriptor

6.1.1 Transfer Characteristic

The value of the Transfer Characteristic item shall be equal to:

- 06.0E.2B.34.04.01.01.0D.04.01.01.01.01.08.00.00 ["IEC 61966-2-4 xvYCC Transfer Characteristic" in SMPTE RP 224] if the COLOR.4 system is used.
- 06.0E.2B.34.04.01.01.0E.04.01.01.01.01.09.00.00 ["ITU-R.BT2020 Transfer Characteristic" in SMPTE RP 224] (see Annex B) if the COLOR.5 system is used.

6.1.2 Coding Equations

The value of the Coding Equations item shall be equal to 06.0E.2B.34.04.01.01.01.04.01.01.01.02.02.00.00 ["Identifies ITU BT-709 Coding Equations" in SMPTE RP 224] if COLOR.4 or COLOR.5 system is used.

6.1.3 Color Primaries

The value of the Color Primaries item shall be equal to:

- 06.0E.2B.34.04.01.01.06.04.01.01.01.03.03.00.00 ["ITU-R.BT709 Color Primaries" in SMPTE RP 224] if the COLOR.4 system is used.
- 06.0E.2B.34.04.01.01.0D.04.01.01.01.03.04.00.00 ["ITU-R.BT2020 Color Primaries" in SMPTE RP 224] if the COLOR.5 system is used.

6.1.4 CDCI Picture Essence Descriptor

If COLOR.4 or COLOR.5 are used, the values of the Black Ref Level, White Ref level and Color Range items shall be set according to Table 4.

Table 4 – Black Ref Level, White Ref level and Color Range values for COLOR.4

Colorimetry	COLOR.4		COLOR.5
Pixel Bit Depth	**8**	**10**	**10**
Black Ref Level	16	64	64
White Ref level	235	940	940
Color Range	254	1013	897

Note: The White Ref level item applies only to the Y' component and the Color Range item to the C'_B and C'_R components.

7 Composition

The ApplicationIdentification element (see SMPTE ST 2067-2 as referenced by SMPTE ST 2067-20) shall include the value listed in Table 5.

Table 5 – Application Identification

`http://www.smpte-ra.org/schemas/2067-21/2014`

Annex A Bibliography (Informative)

SMPTE RP 224, SMPTE Labels Register

Annex B ITU-R BT.2020 Transfer Characteristic Label (Informative)

Table B.1 – ITU-R BT.2020 Transfer Characteristic Label

Byte No.	Description	Value (hex)	Meaning
1-13		Transfer Characteristic	
8	Version Number	0Eh	Registry Version at the point of registration of this label
9-13		Transfer Characteristic	
14	ITU-R BT.2020 Transfer Characteristic	09h	Identifies ITU-R BT.2020 transfer characteristic