

SMPTE STANDARD

Interoperable Master Format — Application #2E



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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 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;
- color primaries specified in SMPTE RP 431-2;
- high-dynamic range using the transfer function specified in SMPTE ST 2084; and
- a maximum width and height of 4096 and 3112 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 2067-20:2016, Interoperable Master Format — Application #2

SMPTE ST 2084:2014, High Dynamic Range Electro-Optical Transfer Function of Mastering Reference Displays

SMPTE ST 2086:2014, Mastering Display Color Volume Metadata Supporting High Luminance and Wide Color Gamut Images

CEA 861.3, CEA Standard, HDR Static Metadata Extensions (January 2015)

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

ISO/IEC 15444-1:2004/Amd.7:2015, Information Technology — JPEG 2000 Image Coding System: Core Coding System — Part 1 – Amendment 7: Profiles for an Interoperable Master Format (IMF)

ISO 11664-3:2012 (CIE S014-3/E:2011), Colorimetry — Part 3: CIE Tristimulus Values

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

4 Overall

4.1 General

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

Note: A Composition that conforms to SMPTE ST 2067-20 also conforms to this specification.

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.smptra.org/schemas/2067-21/2016
picture_bitrate	ST 2067-21
picture_format	ST 2067-21

4.3 XML Schema and Namespace

XML elements defined by this specification shall conform to the XML schema definitions (see W3C XML Schema Part 1: Structures as referenced in SMPTE ST 2067-20) found in this specification. In the event of a conflict between schema definitions and the prose, the prose shall take precedence.

The XML schema root element shall be as defined in Table 2.

Table 2 – XML Schema root element definition

```
<xs:schema targetNamespace="http://www.smpte-ra.org/schemas/2067-21/2016"
  xmlns:app2e="http://www.smpte-ra.org/schemas/2067-21/2016"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  elementFormDefault="qualified" attributeFormDefault="unqualified">

<!-- schema definitions found in this document -->

</xs:schema>
```

5 Image Essence

5.1 Constraints

Implementations shall support the combinations of image frame characteristics listed in Table 3.

The notation $a..b$ indicates that any value between a and b , including a and b , is allowed. For instance, the range $1..4096$ includes the value 3840 and the range $1..3112$ includes the value 2160.

Table 3 – Image Characteristics

Characteristic	Constraint						
Image Frame Width	1..3840				1..4096		
Image Frame Height	1..2160				1..3112		
Colorimetry	COLOR.3	COLOR.4	COLOR.5	COLOR.7	COLOR.3	COLOR.5	COLOR.6 COLOR.7
Pixel Bit Depth	8 10		10 12	10 12 16	8 10	10 12	10 12 16
Frame Structure	Progressive						
Stereoscopy	Monoscopic Stereoscopic						
Frame Rate	24 24000/1001 25 30 30000/1001 50 60000/1001 60				24 24000/1001 25 30 30000/1001 50 60000/1001 60 120		
Sampling	4:2:2				4:4:4		
Quantization	QE.1				QE.1 QE.2		
Color Components	Y'C _B C _R				R'G'B'		

EXAMPLE 1: An image frame that combines COLOR.6 colorimetry with Y'C_BC_R color components is not supported.

EXAMPLE 2: A monoscopic progressive R'G'B' 4:4:4 image frame with dimensions 3840x2160 that combines COLOR.7 colorimetry with 12-bit pixel bit depth, 60 Hz frame rate, and QE.2 quantization is supported.

Note 1: QE.1, QE.2 and COLOR.3 are defined in SMPTE ST 2067-20.

Note 2: This specification does not support the Y'C_BC_RC_{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.