

SMPTE STANDARD

Interoperable Master Format — Application #3



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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 Part XIII of its Operations Manual.

SMPTE ST 2067-30 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 document defines Compositions for IMF Application #3, i.e. the parameters of Image/Audio/Data Essences, Track Files, and the constraints of Composition Playlist. It is based on Image Essence coded as a MPEG-4 Visual Simple Studio Profile codestream and Audio Essence coded as linear PCM.

Compliant implementations need not implement all formats and format values, manufacturers are encouraged to indicate supported formats.

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

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 274:2008) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 274M-2008). Documents with the same root number (e.g. 274) and publication year (e.g. 2008) are functionally identical.

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 274:2008, Television — 1920 x 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates

SMPTE ST 296:2012, 1280 x 720 Progressive Image 4:2:2 and 4:4:4 Sample Structure — Analog and Digital Representation and Analog Interface

SMPTE ST 377-1:2011, Material Exchange Format (MXF) — File Format Specification

Amendment 1:2012 to SMPTE ST 377-1:2011

Amendment 2:2012 to SMPTE ST 377-1:2011

SMPTE ST 379-2:2010, Television — Material Exchange Format (MXF) — MXF Constrained Generic Container

SMPTE ST 381-2:2011, Material Exchange Format (MXF) — Mapping MPEG Streams into the MXF Constrained Generic Container

SMPTE ST 428-1:2006, D-Cinema Distribution Master — Image Characteristics

SMPTE ST 428-11:2013, Additional Frame Rates for D-Cinema

SMPTE ST 2048-1:2011, 2048 x 1080 and 4096 x 2160 Digital Cinematography Production Image Formats FS/709

SMPTE ST 2067-2:2013, Interoperable Master Format — Core Constraints

SMPTE RP 224, SMPTE Labels Register

ISO/IEC 14496-2 (2004-06), Information Technology — Coding of Audio Visual Objects — Part 2: Visual

ISO/IEC 14496-2:2004/Amendment 5:2009, Simple Studio Profile Levels 5 and 6

Recommendation ITU-R BT.709-5:2002, Parameter Values for the HDTV Standards for Production and International Programme Exchange

4 Image Essence

4.1 Image Formats

The image format characteristics shall be as defined in Table 1.

Table 1 – Image Formats

Image Format	Bit Depth	Signal Format Sampling Structure	Frame/Field Rates	Reference SMPTE Standard
1920 x 1080	10 or 12 bits	4:2:2 (Y'C'B'C'R)	60, 60/1.001, 50, 30, 30/1.001, 25, 24 and 24/1.001 Frames Progressive or 60, 60/1.001 and 50 Fields Interlaced	ST 274
		4:4:4 (Y'C'B'C'R)		
		4:4:4 (R'G'B')		
1280 x 720	10 bits	4:2:2 (Y'C'B'C'R)	60, 60/1.001, 50, 30, 30/1.001, 25, 24 and 24/1.001 Frames Progressive	ST 296
		4:4:4 (Y'C'B'C'R)		
		4:4:4 (R'G'B')		
2048 x 1080 ^{*1}	10 or 12 bits	4:2:2 (Y'C'B'C'R)	60, 60/1.001, 50, 48, 48/1.001, 30, 30/1.001, 25, 24 and 24/1.001 Frames Progressive	ST 2048-1
		4:4:4 (Y'C'B'C'R)		
		4:4:4 (R'G'B')		
4096 x 2160 ^{*1}	10 or 12 bits	4:2:2 (Y'C'B'C'R)		
		4:4:4 (Y'C'B'C'R)		
		4:4:4 (R'G'B')		
2048 x 1080 ^{*1}	12 bits	4:4:4 (X'Y'Z')	48 and 24 Frames Progressive	ST 428-1
4096 x 2160 ^{*1}	12 bits	4:4:4 (X'Y'Z')	24 Frames Progressive	
2048 x 1080 ^{*1}	12 bits	4:4:4 (X'Y'Z')	60, 50, 30 and 25 Frames Progressive	ST 428-11
4096 x 2160 ^{*1}	12 bits	4:4:4 (X'Y'Z')	30 and 25 Frames Progressive	

^{*1} This is the maximum pixel array, the active image may not fill the maximum array.

Note: Digital R'G'B' Full-Range components can be computed as follows:

$$L'_D = \text{INT}[DL']; \quad D = 2^n - 1$$

Where L' is the component value in abstract terms from 0 to 1.0 (both ends inclusive), n takes the value 10 or 12 corresponding to the number of bits to be represented, and L'_D is the resulting digital code. The function $\text{INT}[x]$ gives the value of 0 for fractional parts in the range of 0 to under 0.5, and +1 for fractional parts in the range from 0.5 to under 1. See Section 5.2.2.2.2.

4.2 Stereoscopic and Monoscopic Image Essence

Monoscopic Essence consists of a single sequence of image frames.

Stereoscopic Essence consists of a sequence of pairs of image frames, a left eye frame and a right eye frame, for stereoscopic viewing. The two images of a pair shall be coincident in time.

Stereoscopic Essence shall be used only with progressive frame structure.

4.3 Encoding

The Image Essence shall be encoded using one of the Profile And Level of ISO/IEC 14996 listed in Table 2 .

Table 2 – MPEG-4 Video Profile And Level

Profile And Level	Typical Visual Session formats ^{*1}	Max. bitrate (Mbit/s)
MPEG-4 Visual Simple Studio Profile/Level 2	ITU-R BT.709.60I:422	600
MPEG-4 Visual Simple Studio Profile/Level 3	ITU-R BT.709.60I:444	900
MPEG-4 Visual Simple Studio Profile/Level 4	ITU-R BT.709.60P:444	1350
MPEG-4 Visual Simple Studio Profile/Level 5	4Kx2Kx24P:444 4Kx2Kx30P:444	1800
MPEG-4 Visual Simple Studio Profile/Level 6	4Kx2Kx60P:444	3600

^{*1} This column is for informative use only. It provides an example configuration of max. number of pixels per profile/level combination.

5 Track Files

Track Files shall conform to SMPTE ST 379-2 and SMPTE ST 2067-2.

5.1 Shim Parameters

Track Files shall be associated with the shim parameter values specified in Table 3.