SMPTE ST 2067-30:2013

SMPTE STANDARD

Interoperable Master Format — Application #3

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Approved
August 29, 2013

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'BC'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'BC'R)		
		4:4:4 (R'G'B')		
1280 x 720	10 bits	4:2:2 (Y'C'BC'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'BC'R)		
		4:4:4 (R'G'B')		
2048 x 1080[*1]	10 or 12 bits	4:2:2 (Y'C'BC'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'BC'R)		
		4:4:4 (R'G'B')		
4096 x 2160[*1]	10 or 12 bits	4:2:2 (Y'C'BC'R)		
		4:4:4 (Y'C'BC'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:

$$L'_D = INT[DL']; \qquad D = 2^n - 1$$

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 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.

Table 3 – Shim Parameter Values Definitions

Shim Parameter	Value
shim_id	http://www.smpte-ra.org/schemas/2067-30/2013
gc_type	379-2-constrained-gc
picture_family	MPEG-4 Visual Simple Studio Profile
picture_bitrate	MAX 600 Mbps at Level 2 MAX 900 Mbps at Level 3 MAX 1350 Mbps at Level 4 MAX 1800 Mbps at Level 5 MAX 3600 Mbps at Level 6
picture_format	1920/1080/23.98p, 24p, 25p, 29.97p, 30p, 50p, 59.94p, 60p 1920/1080/50i, 59.94i, 60i 1280/720/23.98p, 24p, 25p, 29.97p, 30p, 50p, 59.94p, 60p 2048/1080/23.98p, 24p, 25p, 29.97p, 30p, 47.95p, 48p, 50p, 59.94p, 60p 4096/2160/23.98p, 24p, 25p, 29.97p, 30p, 47.95p, 48p, 50p, 59.94p, 60p
picture_custom_ANC	false[*1]
picture_render_ANC	false[*1]

[*1] Not applicable in this application.

5.2 Image Track Files

5.2.1 Essence

The Image Essence contained in Image Track Files shall conform to Section 4.

5.2.2 Track Format and Mapping

An Image Track File shall conform to SMPTE ST 381-2:

- The values of the Essence Element Key and Essence Container UL are defined in SMPTE ST 381-2. The value of Byte 15 of the Essence Element Key shall indicate frame-wrapped essence. The values of Byte 14 of the Essence Container UL shall indicate MPEG ES.
- The Edit Rate and Sample Rate are equal to the image frame rate as defined in SMPTE ST 379-2.
- Indexing is image frame-based, using Index Edit Rates defined by the Edit Rates of the Essence Track, as defined in SMPTE ST 377-1.

In the case of progressive source image:

- each frame-coded Access Unit (AU) shall be wrapped in a single KLV

In the case of interlaced source image:

- two field-coded AUs each shall be wrapped in a single KLV where the first field AU precedes the second field AU

The Top-Level File Package of Image Track File shall reference:

- a CDCI Picture Essence Descriptor in SMPTE ST 377-1 if the Image Essence uses Y'C'$_B$C'$_R$ color components; or
- an RGBA Picture Essence Descriptor in SMPTE S T377-1 if the Image Essence uses R'G'B' or *X'Y'Z'* color components.

5.2.2.1 Generic Picture Essence Descriptor

5.2.2.1.1 General

The Generic Picture Essence Descriptor items shall be as specified in Annex G of SMPTE ST 377-1 and Annexes G and H of SMPTE ST 2067-2 and then further constrained as specified in this section. Table 4 specifies the following items:

- Items which are further constrained, i.e. required items which are specified as Optional or Decoder Required in SMPTE ST 377-1, StoredF2Offset, DisplayF2Offset and FieldDominance
- Best Effort items which are specified in SMPTE ST 377-1
- Optional items which are specified in SMPTE ST 2067-2

Table 4 – Generic Picture Essence Descriptor Items

Generic Picture Essence Descriptor Item	Constraints	Required status of SMPTE ST 377-1	Required status of SMPTE ST 2067-2
Frame Layout	See Section 5.2.2.1.2.	B.Effort	–
Stored Width	See Section 5.2.2.1.3.	B.Effort	–
Stored Height	See Section 5.2.2.1.4.	B.Effort	–
StoredF2Offset	Shall be present if the image is Interlaced. See Section 5.2.2.1.5.	Opt	–
Sampled Width	Shall be present. See Section 5.2.2.1.6.	Opt	–
Sampled Height	Shall be present. See Section 5.2.2.1.7.	Opt	–
SampledXOffset	Shall be present. See Section 5.2.2.1.8.	Opt	–
SampledYOffset	Shall be present. See Section 5.2.2.1.9.	Opt	–
DisplayHeight	Shall be present. See Section 5.2.2.1.10.	Opt	–
DisplayWidth	Shall be present. See Section 5.2.2.1.11.	Opt	–
DisplayXOffset	Shall be present. See Section 5.2.2.1.12.	Opt	–
DisplayYOffset	Shall be present. See Section 5.2.2.1.13.	Opt	–
DisplayF2Offset	Shall be present if the image is Interlaced. See Section 5.2.2.1.14.	Opt	–
ActiveHeight	See Section 5.2.2.1.15.	–	Opt
ActiveWidth	See Section 5.2.2.1.16.	–	Opt

ActiveXOffset	See Section 5.2.2.1.17.	–	Opt
ActiveYOffset	See Section 5.2.2.1.18.	–	Opt
Aspect Ratio	See Section 5.2.2.1.19.	B.Effort	–
Video Line Map	See Section 5.2.2.1.20.	B.Effort	–
Transfer Characteristic	Shall be present. See Section 5.2.2.1.21.	Opt	–
FieldDominance	Shall be present if the image is Interlaced. See Section 5.2.2.1.22.	Opt	–
Picture Essence Coding	Shall be present. See Section 5.2.2.1.23.	D/req	–
Alternative Center Cuts	See Section 5.2.2.1.24.	–	Opt

5.2.2.1.2 Frame Layout

The value of the Frame Layout item shall be equal to:

- 00h (FULL_FRAME) if the image structure is progressive
- 01h (SEPARATE_FIELDS) if the image structure is interlaced.

5.2.2.1.3 Stored Width

The value of the Stored Width item shall be equal to:

- 1920 if the image format is 1920x1080
- 2048 if the image format is 2048x1080
- 4096 if the image format is 4096x2160
- 1280 if the image format is 1280x720.

5.2.2.1.4 Stored Height

The value of the Stored Height item shall be equal to:

- 1088[*1] if the image format is 1920x1080 and progressive
- 544[*1] if the image format is 1920x1080 and interlaced
- 1088[*1] if the image format is 2048x1080 and progressive
- 2160 if the image format is 4096x2160 and progressive
- 720 if the image format is 1280x720 and progressive.

*[1] The displayable part of the Stored Rectangle is top-aligned in the encoded video object planes (VOPs) as defined in ISO/IEC 14496-2.

5.2.2.1.5 StoredF2Offset

The default value is 0.

5.2.2.1.6 Sampled Width

The value of the Sampled Width item shall be equal to:

- 1920 if the image format is 1920x1080

- 2048 if the image format is 2048x1080
- 4096 if the image format is 4096x2160
- 1280 if the image format is 1280x720.

5.2.2.1.7 Sampled Height

The value of the Sampled Height item shall be equal to:

- 1080 if the image format is 1920x1080 and progressive
- 540 if the image format is 1920x1080 and interlaced
- 1080 if the image format is 2048x1080 and progressive
- 2160 if the image format is 4096x2160 and progressive
- 720 if the image format is 1280x720 and progressive.

5.2.2.1.8 SampledXOffset

The typical value is 0.

5.2.2.1.9 SampledYOffset

The typical value is 0.

5.2.2.1.10 DisplayHeight

The value of the DisplayHeight item shall be equal to:

- 1080 if the image format is 1920x1080 and progressive
- 540 if the image format is 1920x1080 and interlaced
- 1080 if the image format is 2048x1080 and progressive
- 2160 if the image format is 4096x2160 and progressive
- 720 if the image format is 1280x720 and progressive.

5.2.2.1.11 DisplayWidth

The value of the DisplayWidth item shall be equal to:

- 1920 if the image format is 1920x1080
- 2048 if the image format is 2048x1080
- 4096 if the image format is 4096x2160
- 1280 if the image format is 1280x720.

5.2.2.1.12 DisplayXOffset

The typical value is 0.

5.2.2.1.13 DisplayYOffset

The typical value is 0.

5.2.2.1.14 DisplayF2Offset

The default value is 0.

5.2.2.1.15 ActiveHeight

The value of the ActiveHeight is the number of vertical pixels of the Active Area Rectangle, as defined in Annex H of SMPTE ST 2067-2.

5.2.2.1.16 ActiveWidth

The value of the ActiveWidth is the number of horizontal pixels of the Active Area Rectangle, as defined in Annex H of SMPTE ST 2067-2.

5.2.2.1.17 ActiveXOffset

The value of the ActiveXOffset is the horizontal offset in Pixels of the Active Area Rectangle relative to the Display Rectangle, as defined in Annex H of SMPTE ST 2067-2.

5.2.2.1.18 ActiveYOffset

The value of the ActiveYOffset is the vertical offset in Pixels of the Active Area Rectangle relative to the Display Rectangle, as defined in Annex H of SMPTE ST 2067-2.

5.2.2.1.19 Aspect Ratio

The value of the Aspect Ratio item shall be equal to:

- 16:9 if the image format is 1920x1080
- 256:135 if the image format is 2048x1080
- 256:135 if the image format is 4096x2160
- 16:9 if the image format is 1280x720.

5.2.2.1.20 Video Line Map

The value of the Video Line Map item should be equal to:

- {42,0} if the image format is 1920x1080 and progressive
- {21,584} if the image format is 1920x1080 and interlaced
- {42,0} if the image format is 2048x1080 and progressive
- {42,0} if the image format is 4096x2160 and progressive
- {26,0} if the image format is 1280x720 and progressive.

5.2.2.1.21 Transfer Characteristic

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

- 06.0E.2B.34.04.01.01.01.04.01.01.01.01.02.00.00 listed in RP 224 as “ITU-R BT709 Transfer Characteristic” if the color components are R’G’B’ or Y’C’$_B$C’$_R$.,
- 06.0E.2B.34.04.01.01.08.04.01.01.01.01.07.00.00 listed in RP 224 as “SMPTE-DC28 DCDM Transfer Characteristic” if the color components are *X'Y'Z'*.

5.2.2.1.22 FieldDominance

The default value is 1.

5.2.2.1.23 Picture Essence Coding

The value of the Picture Essence Coding item shall be one of the ULs of Table 5. The value reflects MPEG-4 Visual Simple Studio Profile used to encode the Image Essence (see Section 4.3).

Table 5 – Specification of the Picture Essence Coding UL

Byte No.	Description	Value (hex)	Meaning
1-15	06.0E.2B.34.04.01.01.03.04.01.02.02.01.20.10		
16	Level	02h	MPEG-4 Visual Simple Studio Profile Level 2 per ISO/IEC 14496-2
		03h	MPEG-4 Visual Simple Studio Profile Level 3 per ISO/IEC 14496-2
		04h	MPEG-4 Visual Simple Studio Profile Level 4 per ISO/IEC 14496-2
		05h	MPEG-4 Visual Simple Studio Profile Level 5 per ISO/IEC 14496-2
		06h	MPEG-4 Visual Simple Studio Profile Level 6 per ISO/IEC 14496-2

The Level is specified for each case as listed in Table 6.

Table 6 – Level Value for each case

Sampling	Image Sample Structure	Frame Rate	Max. bitrate (Mbit/s)	Level
4:2:2	1280x720	60,59.94,50	600	02h
	1920x1080	30,29.97,25,24,23.98	600	02h
	1920x1080	60,59.94,50	1350	04h
4:4:4	1920x1080	30,29.97,25,24,23.98	900	03h
	2048x1080	30,29.97,25,24,23.98	1350	04h
	1920x1080	60,59.94,50	1350	04h
	2048x1080	50	1350	04h
	2048x1080	60,59.94	1800	05h
	4096x2160	30,29.97,25,24,23.98	1800	05h
	4096x2160	60,59.94,50	3600	06h

5.2.2.1.24 Alternative Center Cuts

The Alternative Center Cuts item specifies the alternate aspect ratio subset(s) of the active area as specified in Annex G of SMPTE ST 2067-2.

Active area is defined in Annex H of SMPTE ST 2067-2.

5.2.2.2 RGBA Picture Essence Descriptor

5.2.2.2.1 General

The RGBA Picture Essence Descriptor items shall be as specified in Annex G of SMPTE ST 377-1 and then further constrained as specified in this section. Table 7 specifies the following items:

- Items which are further constrained, i.e. required items which are specified as Optional in SMPTE ST 377-1
- Best Effort items which are specified in SMPTE ST 377-1

Table 7 – RGBA Picture Essence Descriptor items

RGBA Picture Essence Descriptor Item	Constraints	Required status of SMPTE ST 377-1
Component Max Ref	Shall be present. See Section 5.2.2.2.2.	Opt
Component Min Ref	Shall be present. See Section 5.2.2.2.2.	Opt
PixelLayout	See Section 5.2.2.2.3.	B.Effort

5.2.2.2.2 Component Max Ref and Component Min Ref

Component Max Ref is an item, whose unsigned 32-bit integer value shall specify the R'G'B'/Y'(of *X'Y'Z'*) sample value for reference white level. Similarly, Component Min Ref is an item, whose unsigned 32-bit integer value shall specify the R'G'B'/Y'(of *X'Y'Z'*) sample value for reference black level.

Example: For 10-bit Recommendation ITU-R BT.709, Component Max Ref is 940 and Component Min Ref is 64; For DCDM, Component Max Ref (Y') is 3960 and Component Min Ref is 0; For 10-bit full range linear, Component Max Ref is 1023 and Component Min Ref is 0 as specified in Table 8.

Table 8 – Component Max Ref and Component Min Ref values

Range	ST 274 R'G'B'		DCDM *X'Y'Z'*	Full-Range R'G'B'	
Component Bit Depth	10	12	12	10	12
Component Min Ref	64	256	0	0	0
Component Max Ref	940	3760	3960(Y')	1023	4095

5.2.2.2.3 PixelLayout

The value of the PixelLayout item shall be equal to { 'G', x, 'B', x, 'R', x, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 } or { *'Y'*, 12, *'Z'*, 12, *'X'*, 12, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 } where x is equal to 10 or 12 if 10-bit or 12-bit color components are used per Section 4.1, respectively.

5.2.2.3 CDCI Picture Essence Descriptor

5.2.2.3.1 General

The CDCI Picture Essence Descriptor items shall be as specified in Annex G of SMPTE ST 377-1 and then further constrained as specified in this section. Table 9 specifies the following items:

- Items which are further constrained, i.e. required items which are specified as Optional in SMPTE ST 377-1
- Best Effort items which are specified in SMPTE ST 377-1

Table 9 – CDCI Picture Essence Descriptor items

CDCI Picture Essence Descriptor Item	Constraints	Required status of SMPTE ST 377-1
Component Depth	See Section 5.2.2.3.2	B.Effort
Horizontal Subsampling	See Section 5.2.2.3.3	B.Effort
Vertical Subsampling	Shall be present. See Section 5.2.2.3.4	Opt
Color Siting	Shall be present. See Section 5.2.2.3.5	Opt
ReversedByteOrder	See Section 5.2.2.3.6	Opt
PaddingBits	See Section 5.2.2.3.7	Opt
Black Ref Level	Shall be present. See Section 5.2.2.3.8.	Opt
White Ref level	Shall be present. See Section 5.2.2.3.8.	Opt
Color Range	Shall be present. See Section 5.2.2.3.8.	Opt

5.2.2.3.2 Component Depth

The value shall be equal to the Bit Depth used. (see Section 4.1)

5.2.2.3.3 Horizontal Subsampling

The value of Horizontal Subsampling item shall be equal to:

- 01h if 4:4:4 sampling is used per Section 4.1.
- 02h if 4:2:2 sampling is used per Section 4.1.

5.2.2.3.4 Vertical Subsampling

The value shall be 1.

5.2.2.3.5 Color Siting

The value shall be 00h.

5.2.2.3.6 ReversedByteOrder

The typical value is 0.

5.2.2.3.7 PaddingBits

The typical value is 0.

5.2.2.3.8 Black Ref Level, White Ref Level and Color Range

The values of the Black Ref Level, White Ref Level and Color Range items shall be set according to the component bit depth used.

Example: For 10-bit, Black Ref Level is 64 and White Ref Level is 940; For 12-bit, Black Ref Level is 256 and White Ref Level is 3760 as specified in Table 10.

Table 10 – Black Ref Level, White Ref Level and Color Range values

Component Bit Depth	10	12
Black Ref Level	64	256
White Ref Level	940	3760
Color Range	897	3585

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.

5.2.2.4 MPEG-4 Visual Sub Descriptor

The MPEG-4 Visual Sub Descriptor is strongly referenced from either of an RGB or a CDCI Picture Essence Descriptor as defined in SMPTE ST 381-2.

6 Composition

Composition shall conform to SMPTE ST 2067-2.

6.1 Application Identification

The ApplicationIdentification element (see SMPTE ST 2067-2) shall include the value listed in Table 11.

Table 11 – Application Identification.

`http://www.smpte-ra.org/schemas/2067-30/2013`

6.2 Homogenous Essence

6.2.1 Image

Within a given a composition, the following shall remain constant:

- all Image Essence characteristics specified in Section 4.1.
- the codestream profile specified in Section 4.3.

6.3 Virtual Tracks

6.3.1 Main Image Virtual Track

All Image Track Files referenced by Resource elements of type StereoImageTrackFileResourceType and type TrackFileResourceType shall conform to Section 5.2.

6.4 Segment Duration

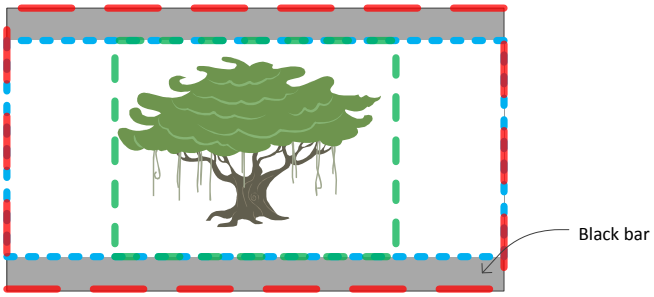
If the average number of audio samples per Composition Edit Unit is not an integer, the duration of each Segment shall be an integer multiple of 5/Composition Edit Rate.

Annex A Display Rectangle, Active Area Rectangle and Alternative Center Cut Examples (Informative)

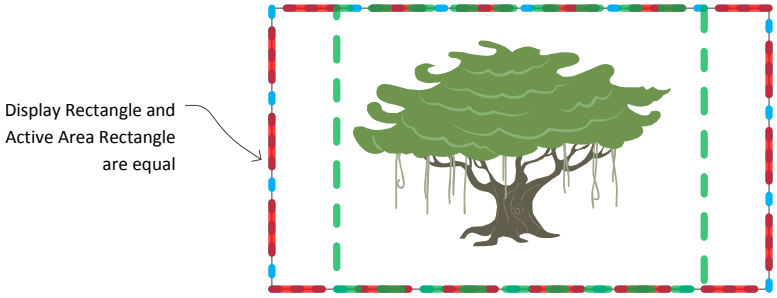
As illustrated in Figure A.1, this specification allows the user to choose which portion of the Display Rectangle to identify as the active area, which can be associated with each of the Alternative Center Cut. For instance, as shown in (a) and (b), two different users or the same user in different circumstances can elect to identify a different portion of the same image as active.

The process by which the dimension of the active area is set depends on individual workflows and can include a combination of manual and automated processing, during and after ingest.

(a) Alternate 4:3 Center in the 16:9 Source Image which includes black bars



(b) Alternate 4:3 Center in >16:9 Active Area in the 16:9 Source Image



(c) Alternate 4:3 Center in the 16:9 Source Image

Figure A.1 – Active Area Examples