SMPTE ST 2067-20:2016
Revision of
SMPTE ST 2067-20:2013

SMPTE STANDARD

Interoperable Master Format — Application #2

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Foreword

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

SMPTE ST 2067-20 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 specifies Compositions for IMF Application #2. It is a specialization of the IMF Framework.

Application #2 is meant for studio applications where a TV or movie title is transformed into multiple content versions (airline edits, special edition, languages…) that are made available to multiple consumer distribution channels (Internet, optical media, broadcast...) across multiple territories and over the span of many months to over a year. It uses HD image essence coded as a JPEG 2000 codestream and audio essence coded as linear PCM.

The transformation of Application #2 Compositions to the output formats appropriate for each distribution channel is specified in other documents.

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 RP 224, SMPTE Labels Registry

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

SMPTE ST 422:2014, Material Exchange Format — Mapping JPEG 2000 Codestreams into the MXF Generic Container

SMPTE ST 2067-2:2016, Interoperable Master Format — Core Constraints

ISO/IEC 15444-1:2004/Amd 3:2010, Information Technology — JPEG 2000 Image Coding System

Recommendation ITU-R BT.601-5, Studio Encoding Parameters of Digital Television for Standard 4:3 and Wide-Screen 16:9 Aspect Ratios

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

World Wide Web Consortium (W3C) (2004, October 28). XML Schema Part 1: Structures (Second Edition).

4 Overall

4.1 General

All provisions of SMPTE ST 2067-2 shall apply.

4.2 Format

Track Files shall conform to SMPTE ST 379-1.

4.3 Shim Parameters

Track Files shall be associated with the shim parameter values specified in Table 1.

Table 1 – Shim Parameter Values Definitions

Shim Parameter	Value
shim_id	http://www.smpte-ra.org/schemas/2067-20/2016
gc_type	379-1-gc
picture_family	JPEG2000
picture_bitrate	ST 2067-20
picture_format	ST 2067-20
picture_custom_ANC	false
picture_render_ANC	false

5 Essence

5.1 Image Essence

5.1.1 General

Image essence shall consist of image frames, each a rectangular pixel array.

5.1.2 Constraints

Image frames shall conform to the combinations of characteristics allowed in Table 2

Table 2 – Image Characteristics

Image Frame Width	Section 5.1.3	1..1920			
Image Frame Height	Section 5.1.3	1..1080			
Pixel Bit Depth	Section 5.1.3.6	8 10			
Frame Structure	Section 5.1.3.2	Progressive			Interlaced
Stereoscopy	Section 5.1.3.10	Stereoscopic Monoscopic			Monoscopic
Frame Rate	Section 5.1.3.4	24 24000/1001 25 30 30000/1001 50 60 60000/1001			25 30 30000/1001
Sampling	Section 5.1.3.9	4:4:4		4:2:2	4:2:2
Quantization	Section 5.1.3.8	QE.1	QE.2	QE.1	QE.1
Color Components	Section 5.1.3.5	R'G'B' Y'C'$_B$C'$_R$	R'G'B'	Y'C'$_B$C'$_R$	Y'C'$_B$C'$_R$
Colorimetry	Section 5.1.3.7	COLOR.1 COLOR.2 COLOR.3	COLOR.3	COLOR.1 COLOR.2 COLOR.3	COLOR.1 COLOR.2 COLOR.3

5.1.3 Characteristics

5.1.3.1 Frame Dimensions

The width and height of the frame are defined as the number of horizontal and vertical pixel elements, respectively.

5.1.3.2 Frame Structure

5.1.3.2.1 General

Implementations shall support image frames with either a progressive or interlaced structure.

5.1.3.2.2 Progressive Structure

An image frame with progressive structure shall consist of a complete image frame, scanned progressively left to right and from top to bottom.

5.1.3.2.3 Interlaced Structure

An image frame with interlaced structure shall consist of a pair of fields, a first field then a second field. The lines of each field shall have twice the vertical spatial sampling pitch of the frame. Lines in the second field shall be displaced vertically by the vertical sampling pitch and the line timing shall be delayed temporally by half the frame time from the lines in the first field.

The temporal order and relative line positions of the two fields are indicated by the Field Dominance and DisplayF2Offset items described in Section 6.1.2.1.

5.1.3.3 Frame Size

The height and width of the image frame shall be an integer.

Image frames with an interlaced image structure shall have an even number of vertical pixels.

5.1.3.4 Frame Rate

When interlaced frame structure is used, the field rate, i.e. the number of image fields per second, shall be twice the frame rate.

5.1.3.5 Color Components

Implementations shall support image frames sampled using either R'G'B' or Y'C'$_B$C'$_R$ color component triplets.

5.1.3.6 Pixel Bit Depth

Implementations shall support the color component of each pixel being represented by an integer in the set {0..2^n – 1}, with n being the pixel bit depth.

5.1.3.7 Colorimetry

Implementations shall support values of the R'G'B' or Y'C'$_B$C'$_R$ component signals being mapped to red, green and blue tristimulus values according to one of the systems specified in Table 3.

Table 3 – Colorimetry Systems

System	Description
COLOR.1	Mapped as specified for 625-line systems in Section 2.6 of Recommendation ITU-R BT.601
COLOR.2	Mapped as specified for 525-line systems in Section 2.6 of Recommendation ITU-R BT.601
COLOR.3	Mapped as specified in Section 1 of Part 2 of Recommendation ITU-R BT.709

Note: In Recommendation ITU-R BT.601 and Recommendation ITU-R BT.709, the signals R', G', B', Y', C'$_B$ and C'$_R$ are referred to as signals E'$_R$, E'$_G$, E'$_B$, E'$_Y$, E'$_{CB}$ and E'$_{CR}$ respectively, i.e. they correspond to gamma pre-corrected signals.

5.1.3.8 Quantization

Implementations shall support R'G'B' or Y'C'$_B$C'$_R$ component signals being quantized according to one of the systems specified in Table 4.

Table 4 – Quantization Systems

System	Component Triplet	Quantization equations (n is the pixel bit depth)	Notes
QE.1	R'G'B'	$D'_R = INT((219 \cdot R' + 16) \cdot 2^{n-8})$ $D'_G = INT((219 \cdot G' + 16) \cdot 2^{n-8})$ $D'_B = INT((219 \cdot B' + 16) \cdot 2^{n-8})$	Equivalent to quantization equations of Section 3 of Part 2 of Recommendation ITU-R BT.709, and Table 3 and Table 4 of Recommendation ITU-R BT.601
	Y'C'$_B$C'$_R$	$D'_Y = INT((219 \cdot Y' + 16) \cdot 2^{n-8})$ $D'_{CR} = INT((224 \cdot C'_R + 128) \cdot 2^{n-8})$ $D'_{CB} = INT((224 \cdot C'_B + 128) \cdot 2^{n-8})$	
QE.2	R'G'B'	$D'_R = INT(R' \cdot (2^n - 1))$ $D'_G = INT(G' \cdot (2^n - 1))$ $D'_B = INT(B' \cdot (2^n - 1))$	The mapping of components signals using the QE.2 system onto interfaces such as HD-SDI is defined in other specifications.

5.1.3.9 Sampling

In 4:4:4 sampling, each component shall be sampled once at each image frame pixel.

In 4:2:2 Y'C'$_B$C'$_R$ sampling, the Y' component shall be sampled at each pixel, but the C'$_R$ and C'$_B$ components shall be horizontally subsampled by a factor of two with respect to the Y component, co-sited with even-numbered Y' samples.

5.1.3.10 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.

5.1.4 Encoding

5.1.4.1 Profile

Each frame, in the case of progressive structure, or field, in the case of interlaced structure, shall be encoded as a single codestream.

Implementations shall support the profile and level combinations listed in Table 5, as specified in ISO/IEC 15444-1 Amendment 3.

Table 5 – JPEG 2000 Profiles

Broadcast Contribution Single Tile Profile Level 1
Broadcast Contribution Single Tile Profile Level 2
Broadcast Contribution Single Tile Profile Level 3
Broadcast Contribution Single Tile Profile Level 4
Broadcast Contribution Single Tile Profile Level 5
Broadcast Contribution Multi-tile Reversible Profile Level 6
Broadcast Contribution Multi-tile Reversible Profile Level 7

5.1.4.2 Component Ordering

In a codestream, color components shall be ordered as specified in Table 6.

Table 6 – JPEG 2000 Color Component Ordering

Component Index	R'G'B'	$Y'C'_BC'_R$
0	R'	Y'
1	G'	C'_B
2	B'	C'_R

6 Track Files

6.1 Image Track Files

6.1.1 Essence

Image Track Files shall contain image essence conforming to Section 5.

6.1.2 Wrapping

Image Track Files shall conform to SMPTE ST 422.

In the case of progressive frame structure, the image essence shall be wrapped according to mode P1 specified in SMPTE ST 422 ("Frame-wrapping".)

In the case of interlaced frame structure, the image essence shall be wrapped according to mode I1 specified in SMPTE ST 422 ("Interlaced Frame, 1 field per KLV Element".)

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

- a CDCI Picture Essence Descriptor SMPTE ST 377-1 if the image uses $Y'C'_BC'_R$ color components; or
- an RGBA Picture Essence Descriptor SMPTE ST 377-1 if the image essence uses R'G'B' color components.

6.1.2.1 Generic Picture Essence Descriptor

6.1.2.1.1 General

The Generic Picture Essence Descriptor items (including those specified in SMPTE ST 2067-2) shall be constrained as specified in Table 7.

Table 7 – Generic Picture Essence Descriptor Items

Generic Picture Essence Descriptor Item	Constraints
Sample Rate	See Annex A of SMPTE ST 422.
Signal Standard	Shall be ignored.
Frame Layout	See Section 6.1.2.1.3.
Stored Width	See Section 6.1.2.1.2.
Stored Height	See Section 6.1.2.1.2.
StoredF2Offset	Shall not be present
Sampled Width	Shall not be present or shall be equal to Stored Width.
Sampled Height	Shall not be present or shall be equal to Stored Height.
SampledXOffset	Shall not be present or shall be 0.
SampledYOffset	Shall not be present or shall be 0.
DisplayHeight	See Annex B for illustrative examples. Note: Unless explicitly set, the Active Area Rectangle is by default equal to the Display Rectangle — see SMPTE ST 2067-2.
DisplayWidth	
DisplayXOffset	
DisplayYOffset	
ActiveHeight	
ActiveWidth	
ActiveXOffset	
ActiveYOffset	
DisplayF2Offset	Shall be present.
AspectRatio	See Section 6.1.2.1.3.
Active Format Descriptor	Shall be ignored.
Video Line Map	Shall be ignored.
Alpha Transparency	Shall not be present.
Transfer Characteristic	Shall be present. See Section 6.1.2.1.5.
Image Alignment Offset	Shall not be present.

Image Start Offset	Shall not be present.
Image End Offset	Shall not be present.
FieldDominance	Shall be present if interlaced structure is used and shall not be present if progressive structure is used
Picture Essence Coding	Shall be present. See Section 6.1.2.1.8.
Coding Equations	Shall be present if $Y'C'_BC'_R$ sampling is used. See Section 6.1.2.1.6. Shall be ignored if R'G'B' sampling is used.
Color Primaries	Shall be present. See Section 6.1.2.1.7.
Alternative Center Cuts	See Section 6.1.2.1.9.

6.1.2.1.2 Stored Width and Stored Height

The values of the Stored Width and Stored Height items shall be set according to the image frame structure, as specified in Table 8.

Table 8 – Stored Width and Stored Height values

Frame Structure	*Progressive*	*Interlaced*
Stored Width	Image Frame Width	Image Frame Width
Stored Height	Image Frame Height	Image Frame Height / 2

6.1.2.1.3 Aspect Ratio

The value of the Aspect Ratio item shall be the ratio of width to height of the rectangular area into which the pixels within the Display Rectangle are intended to be displayed.

Note: For interlaced image structure, the *rectangular area into which the pixels within the Display Rectangle are intended to be displayed* is the rectangular area resulting from the interlacing of the pixel elements within the Display Rectangle of each of the two fields of the image frame.

See Annex B for illustrative examples.

6.1.2.1.4 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.

6.1.2.1.5 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 ["Identifies ITU-R BT.709 transfer characteristic (also used in SMPTE 170M, 274M and 296M)" in SMPTE RP 224] if COLOR.1, COLOR.2 or COLOR.3 systems are used, as defined in Section 5.1.3.7.

6.1.2.1.6 Coding Equations

The value of the Coding Equations item shall be equal to:

- 06.0E.2B.34.04.01.01.01.04.01.01.01.02.01.00.00 ["Identifies ITU BT-601 Coding Equations" in SMPTE RP 224] if COLOR.1 or COLOR.2 systems are used, as defined in Section 5.1.3.7.
- 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 the COLOR.3 system is used, as defined in Section 5.1.3.7.

6.1.2.1.7 Color Primaries

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

- 06.0E.2B.34.04.01.01.06.04.01.01.01.03.01.00.00 ["Identifies SMPTE 170M color primaries and white point" in RP 224] if the COLOR.2 system is used as defined in Section 5.1.3.7.
- 06.0E.2B.34.04.01.01.06.04.01.01.01.03.02.00.00 ["Identifies ITU-R BT.470 PAL color primaries and white point (note: used in B, D, G, H, I, N/PAL and B, D, G, H, K, K1, L/SECAM systems)" in SMPTE RP 224] if the COLOR.1 system is used as defined in Section 5.1.3.7.
- 06.0E.2B.34.04.01.01.06.04.01.01.01.03.03.00.00 ["Identifies ITU-R BT.709 color primaries and white point" in RP 224] if the COLOR.3 systems are used, as defined in Section 5.1.3.7.

6.1.2.1.8 Picture Essence Coding

The value of the Picture Essence Coding item shall reflect the JPEG 2000 profile and level used to encode the image essence.

Table1 of Annex A specifies Picture Essence Compression ULs corresponding to the profiles and levels specified in Section 5.

6.1.2.1.9 Alternative Center Cuts

The Alternative Center Cuts item is specified in Annex G of SMPTE ST 2067-2.

An empty Alternative Center Cuts item shall be ignored. Any Alternative Center Cut value not specified in SMPTE ST 2067-2 may be safely ignored.

6.1.2.2 RGBA Picture Essence Descriptor

6.1.2.2.1 General

The RGBA Picture Essence Descriptor items shall be constrained as specified in Table 9.

Table 9 – RGBA Essence Descriptor items

RGBA Picture Essence Descriptor Item	Constraints
Component Max Ref	Shall be present. See Section 6.1.2.2.2.
Component Min Ref	Shall be present. See Section 6.1.2.2.2.
Alpha Max Ref	Shall not be present.
Alpha Min Ref	Shall not be present.
ScanningDirection	Shall be present and shall be equal to 00h.
PixelLayout	Shall be ignored.
Palette	Shall not be present.
PaletteLayout	Shall not be present.

6.1.2.2.2 Component Max Ref and Component Min Ref

The values of the Component Max Ref and Component Min Ref items shall be set according to the pixel bit depth and colorimetry system used, as specified in Table 10.

Table 10 – Component Max Ref and Component Min Ref values

System	*QE.1*		*QE.2*	
Pixel Bit Depth	8	10	8	10
Component Min Ref	16	64	0	0
Component Max Ref	235	940	255	1023

6.1.2.3 CDCI Picture Essence Descriptor

6.1.2.3.1 General

The CDCI Picture Essence Descriptor items shall be constrained as specified in Table 11.

Table 11 – CDCI Essence Descriptor items

CDCI Picture Essence Descriptor Item	Constraints
Component Depth	Shall be present and shall be equal to the Pixel Bit Depth used (see Section 5.1.3.6)
Horizontal Subsampling	See Section 6.1.2.3.2.
Vertical Subsampling	Shall be 01h
Color Siting	Shall be present and shall be 00h
ReversedByteOrder	Shall not be present
PaddingBits	Shall not be present
Alpha Sample Depth	Shall not be present
Black Ref Level	Shall be present. See Section 6.1.2.3.3.
White Ref level	Shall be present. See Section 6.1.2.3.3.
Color Range	Shall be present. See Section 6.1.2.3.3.

6.1.2.3.2 Horizontal Subsampling

The value of Horizontal Subsampling item shall be equal to:

- 01h if 4:4:4 sampling is used per Section 5.1.3.8.
- 02h if 4:2:2 sampling is used per Section 5.1.3.8.

6.1.2.3.3 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 pixel bit depth used, as specified in Table 12.

Table 12 – Black Ref Level, White Ref level and Color Range values

Pixel Bit Depth	8	10
Black Ref Level	16	64
White Ref Level	235	940
Color Range	225	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.

6.1.2.4 JPEG 2000 Picture Sub Descriptor

6.1.2.4.1 General

The Top-Level File Package of the Image Track File shall reference a JPEG 2000 Picture Sub Descriptor SMPTE ST 422 as constrained by Table 13.

Table 13 – JPEG 2000 Picture Subdescriptor items

JPEG 2000 Picture Subdescriptor Item	Constraints
Coding Style	Shall be present
J2CLayout	Shall be present. See Section 6.1.2.4.2.

6.1.2.4.2 J2CLayout

The value of the J2CLayoutitem shall be equal to:

- { ‘R’, x, ‘G’, x, ‘B’, x, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 } if R'G'B' sampling is used, where x is the pixel bit depth; or
- { ‘Y’, x, ‘U’, x, ‘V’, x, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 } if Y’C’$_B$C’$_R$ sampling is used where x is the pixel bit depth, respectively.

7 Composition

7.1 Application Identification

The ApplicationIdentification element (see SMPTE ST 2067-2) shall include the value listed in Table 14.

Table 14 – Application Identification.

http://www.smpte-ra.org/schemas/2067-20/2016

7.2 Homogenous Essence

7.2.1 Image

Within a given composition, the following shall remain constant:

- all image essence characteristics specified in Section 5.1.3.
- the codestream profile and level combination (see Section 5.1.4.1).

7.3 Virtual Tracks

7.3.1 Main Image Virtual Track

All Image Track Files referenced by Resource elements of type StereoImageTrackFileResourceType and type TrackFileResourceType shall conform to Section 6.1.

7.4 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 Additional JPEG 2000 Picture Essence Compression Labels

Table A.1 – Additional JPEG 2000 Picture Essence Compression Labels

Byte No.	*Description*	*Value (hex)*	*Meaning*
1-7		See SMPTE ST 422	
8	Version Number	0Dh	Registry Version at the point of registration of this label
9-15		See SMPTE ST 422	
16	Broadcast Contribution Single Tile Profile Level 1	11h	Broadcast Contribution Single Tile Profile Level 1 as specified in ISO/IEC 15444-1
	Broadcast Contribution Single Tile Profile Level 2	12h	Broadcast Contribution Single Tile Profile Level 2 as specified in ISO/IEC 15444-1
	Broadcast Contribution Single Tile Profile Level 3	13h	Broadcast Contribution Single Tile Profile Level 3 as specified in ISO/IEC 15444-1
	Broadcast Contribution Single Tile Profile Level 4	14h	Broadcast Contribution Single Tile Profile Level 4 as specified in ISO/IEC 15444-1
	Broadcast Contribution Single Tile Profile Level 5	15h	Broadcast Contribution Single Tile Profile Level 5 as specified in ISO/IEC 15444-1
	Broadcast Contribution Multi-tile Reversible Profile Level 6	16h	Broadcast Contribution Multi-tile Reversible Profile Level 6 as specified in ISO/IEC 15444-1
	Broadcast Contribution Multi-tile Reversible Profile Level 7	17h	Broadcast Contribution Multi-tile Reversible Profile Level 7 as specified in ISO/IEC 15444-1

Annex B Image Frame and Active Area Rectangle Examples (Informative)

This specification allows the user to choose which rectangular subset of an input image to store and which portion of the resulting stored image to identify as the Active Area Rectangle.

Figure B.1 and Table B.1 depict selected examples using HD progressive image frames. As shown in (a) and (b), two different users or the same user in different circumstances can elect to identify different portions of the same image as the Active Area Rectangle. In (c), only the Active Area Rectangle is stored. As illustrated by (b), the extent of the Display Rectangle is not specified and left to users: Table B.1 lists two valid sets of Display Rectangle and Active Area Rectangle values for (b).

The process by which the dimensions of the stored image and active area are set depends on individual workflows and can include a combination of manual and automated processing during and after ingest.

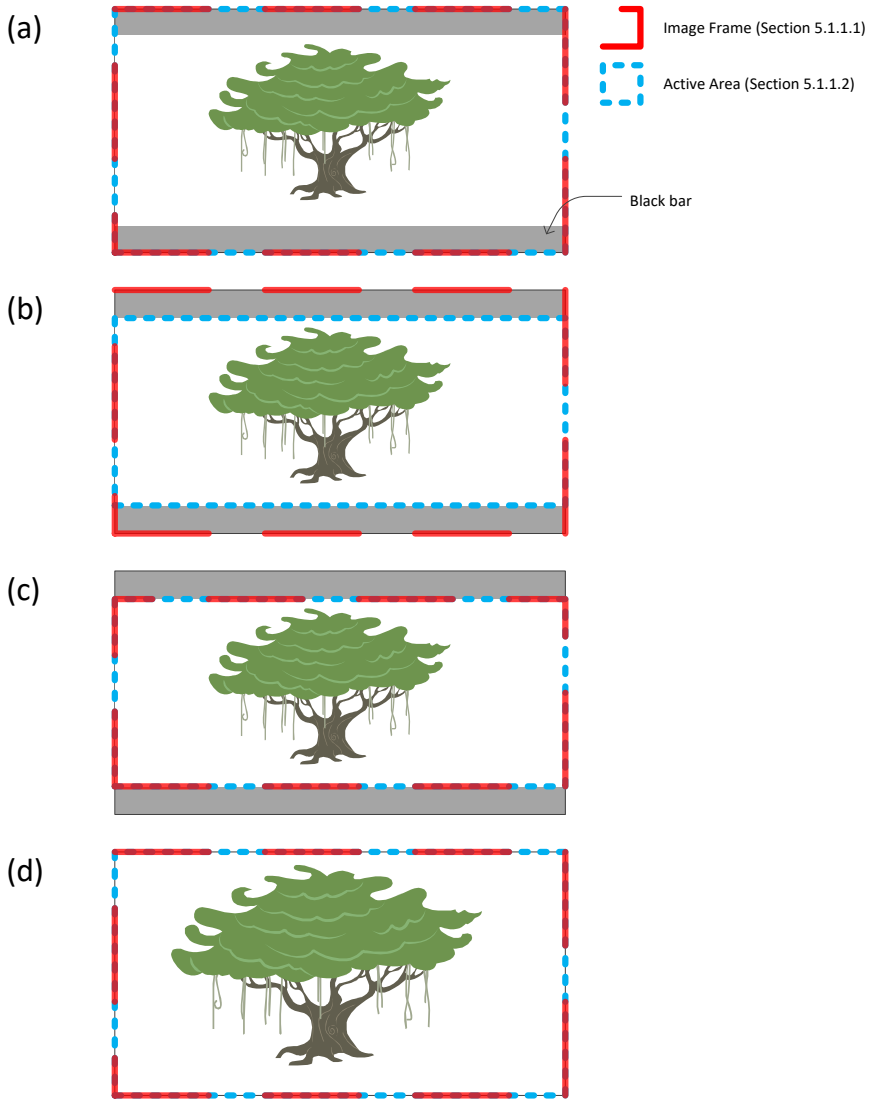

Figure B.1 – High-Definition Progressive Frame Active Area Rectangle Examples

Table B.1 – Selected Property Values for the Examples of Figure B.1

	Figure B.1a	Figure B.1b	Figure B.1b	Figure B.1c	Figure B.1d
Stored Height	1080	1080	1080	800	1080
Stored Width	1920	1920	1920	1920	1920
Sampled Height	1080	1080	1080	800	1080
Sampled Width	1920	1920	1920	1920	1920
Sampled X Offset	0	0	0	0	0
Sampled Y Offset	0	0	0	0	0
Display Height	1080	800	1080	800	1080
Display Width	1920	1920	1920	1920	1920
Display X Offset	0	0	0	0	0
Display Y Offset	0	140	0	0	0
Aspect Ratio	16/9	12/5	16/9	12/5	16/9
Active Height	1080	800	800	800	1080
Active Width	1920	1920	1920	1920	1920
Active X Offset	0	0	0	0	0
Active Y Offset	0	0	140	0	0

Figure B.2 and Table B.2 depict three means of storing the same source SD interlaced anamorphic image frame. The source image frame contains a 720x576 container as well as vertical blanking interval (VBI) information. The container is intended to be displayed at a 16:9 aspect ratio and contains a 2.40 Active Area Rectangle. In (a), the entire source image frame is ingested, including VBI information, which is not included in the Display Rectangle, as specified by SMPTE ST 377-1. In contrast to (a), the VBI information is not stored in (b). In (c), the Aspect Ratio property value is computed to preserve the exact pixel aspect ratio of the source image.

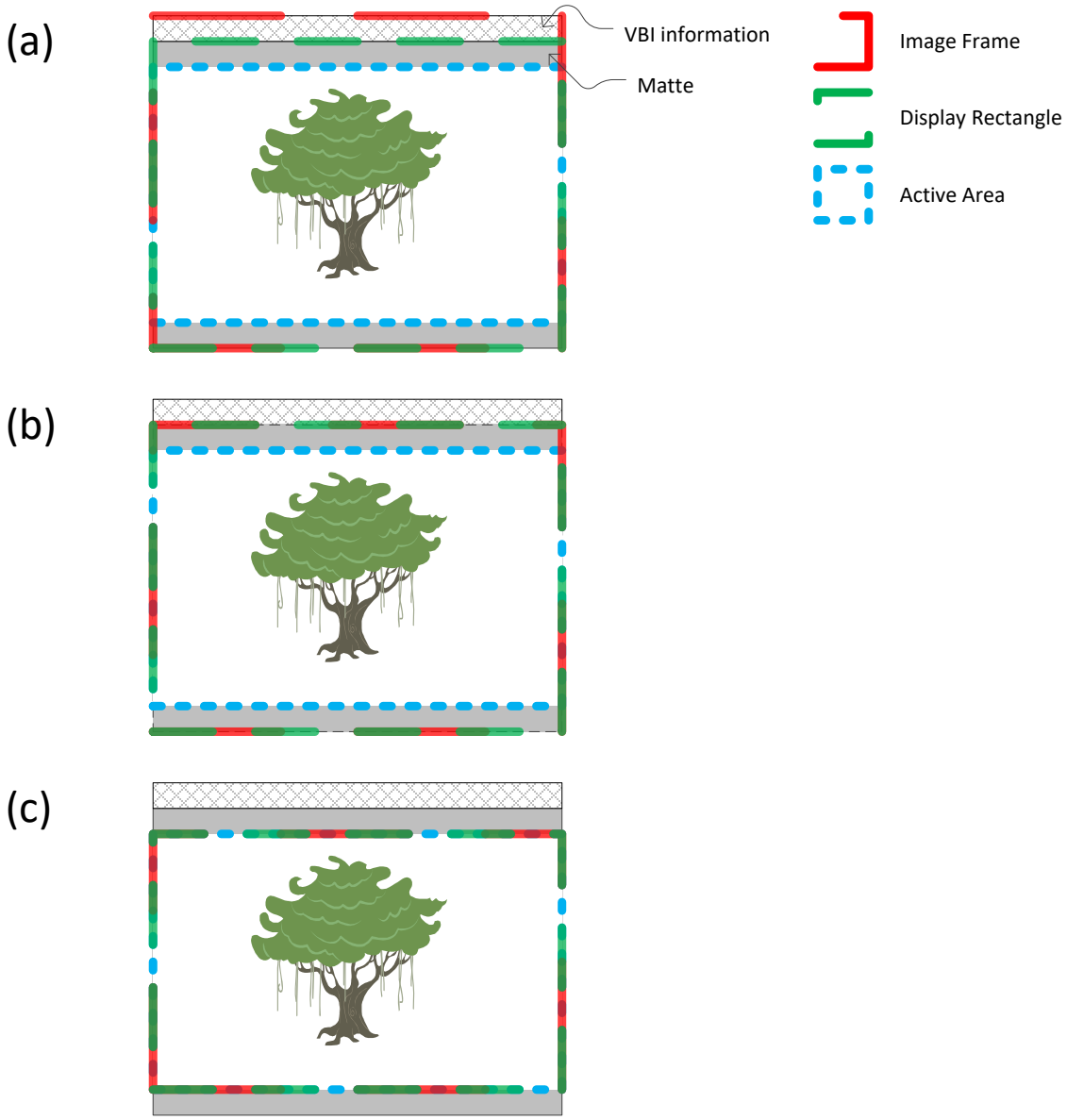

Figure B.2 – Standard Definition Interlaced Frame Examples

Table B.2 – Selected Property Values for the Examples of Figure B.2

	Figure B.2a	Figure B.2b	Figure B.2c
Stored Height	304	288	213
Stored Width	720	720	720
Sampled Height	304	288	213
Sampled Width	720	720	720
Sampled X Offset	0	0	0
Sampled Y Offset	0	0	0
Display Height	288	288	213
Display Width	720	720	720
Display X Offset	0	0	0
Display Y Offset	16	0	0
Aspect Ratio	16/9	16/9	512/213
Active Height	213	213	213
Active Width	720	720	720
Active X Offset	0	0	0
Active Y Offset	37	37	0