

SMPTE STANDARD

Dual 1.5 Gb/s Serial Digital Interface for Stereoscopic Image Transport



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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 Administrative Practices.

SMPTE ST 292-2 was prepared by Technology Committee 32NF.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Standard. 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.

Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

There is a need in the industry to have an interface for the transporting of stereoscopic images complying with 4:2:2/10-bit image formats defined by SMPTE ST 274, SMPTE ST 2048-2 and SMPTE ST 296, which can be transported by a single SMPTE ST 292-1 serial interface. This standard also defines the payload identifier that will identify the Left/Right (L/R) eye images, audio and other associated ancillary data.

This standard provides explicit labeling for 16:9 aspect ratios. Unknown aspect ratios are signaled with no further details.

1 Scope

This standard defines a means of transporting stereoscopic images (Left eye and Right eye images) using an interface consisting of two streams based on the SMPTE ST 292-1 data structure. The Left eye images are carried on one stream of the interface and the Right eye images are carried on the other stream. The stereoscopic image formats to be transported using this standard are the 4:2:2/10-bit image formats defined by SMPTE ST 274, SMPTE ST 2048-2 and SMPTE ST 296, which can be transported by a single SMPTE ST 292-1 serial interface. Audio and other associated ancillary data may also be transported. This standard also defines a payload identifier.

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.

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 12-2:2008) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 12M-2-2008). Documents with the same root number (e.g. 12-2) and publication year (e.g. 2008) are functionally identical.

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

SMPTE ST 12-2:2008, Television — Transmission of Time Code in the Ancillary Data Space

SMPTE ST 291:2010, Ancillary Data Packet and Space Formatting

SMPTE ST 292-1:2011, 1.5 Gb/s Signal/Data Serial Interface

SMPTE ST 297:2006, Television — Serial Digital Fiber Transmission System for SMPTE ST 259, SMPTE ST 344, SMPTE ST 292-1 and SMPTE ST 424 Signals

SMPTE ST 299-1:2009, 24-Bit Digital Audio Format for SMPTE 292 Bit-Serial Interface (NOTE: This document previously numbered SMPTE 299-2009 — Content Unchanged)

SMPTE ST 352:2011, Payload Identification Codes for Serial Digital Interfaces

4 Source Format and Interface Data Structure

This interface for stereoscopic images shall carry the Left eye and the Right eye images along with associated audio and ancillary data packets as two separate streams

The source image formats shall be the 4:2:2/10-bit image formats referenced by SMPTE ST 292-1, which can be transported by a single SMPTE ST 292-1 serial interface as shown in Table 1. The Left eye image and the Right eye image shall have the identical image pixel format structure and they shall be a stereo image pair.

The electrical or optical characteristics of each stream of the interface shall be in conformance with SMPTE ST 292-1 or SMPTE ST 297, respectively.

Table 1 – Source Image Formats

Reference SMPTE Standard	Image Format	Signal Format Sampling Structure/Pixel Depth	Frame/Field Rates	Transport
ST 274	1920 × 1080	4:2:2 (Y'C _B C _R)/10-bit	60, 60/1.001 and 50 Fields Interlaced	Interlaced
			30, 30/1.001, 25, 24 and 24/1.001 Frames Progressive	Progressive
			30, 30/1.001, 25, 24 and 24/1.001 PsF	PsF ^{*1}
ST 2048-2	2048 x 1080 ^{*2}	4:2:2 (Y'C _B C _R)/10-bit	60, 60/1.001 and 50 Fields Interlaced	Interlaced
			30, 30/1.001, 25, 24 and 24/1.001 Progressive	Progressive
			30, 30/1.001, 25, 24 and 24/1.001 PsF	PsF ^{*1}
ST 296	1280 x 720	4:2:2 (Y'C _B C _R)/10-bit	60, 60/1.001, 50, 30, 30/1.001, 25, 24 and 24/1.001 Frames Progressive	Progressive

*1 PsF structure as defined in SMPTE ST 274.

*2 This is the maximum pixel array, the active image may not fill the maximum array.

5 Left/Right Eye Image, Audio and Ancillary Data Mapping

One stream of this interface shall carry a Left eye image and the other stream shall carry a Right eye image. The images on the Left eye stream and the Right eye stream shall be a stereo image pair. Both streams shall be identified by the payload identifier defined in § 6.

The timing difference between the serial digital clocks and EAV / SAV of the Left eye stream and the Right eye stream shall not exceed 400 ns at the source. This difference should be taken into consideration when designing systems and destination equipment input stages.

When present, audio data shall be mapped into the ancillary data space of the Left eye stream in conformance with SMPTE ST 299-1. Audio may also be mapped into the ancillary data space of the Right eye stream. The Right eye audio may be a copy of the Left eye audio, or it may contain additional channels.

When present the time code shall be mapped into the ancillary data space of the Left eye stream in conformance with SMPTE ST 12-2. When present the timecode should also be mapped into the Right eye stream in which case the corresponding Time Address values shall be identical between the two streams.

When present, ancillary data shall be mapped into the ancillary data space of the Left or the Right eye streams and shall be in conformance with SMPTE ST 291. Ancillary data specifically intended for the Right or Left eye stream shall be inserted into the appropriate stream.

6 Payload Identifier

The payload identifier data structure shall be in conformance with SMPTE ST 352 and shall be mapped onto each stream of the interface to identify the Left/Right eye images, picture frame rate, sampling structure, etc. Payload ID packets shall be inserted into the Y channel of the data stream of each stream. The recommended payload location is defined in SMPTE ST 292-1.

6.1 Payload Identifier Structure

The payload identifier shall be 4 bytes where each byte has a separate significance. The first byte of the payload identifier shall have the highest significance and subsequent bytes shall define lower order video and ancillary payload information.

Table 2 – Payload Identifier

Bits	Byte 1	Byte 2	Byte 3	Byte 4
Bit 7	1	Interlaced (0h) or progressive (1h) transport	Horizontal pixel count 1920 (0h) 1280 (2h) or 2048 (1h) Reserved (3h)	Reserved (0h)
Bit 6	0	Interlaced (0h) or progressive (1h) picture		Stream assignment Left eye stream (0h) or Right eye stream (1h)
Bit 5	1	Reserved	Aspect Ratio 16:9(1h) Unknown (0h)	Reserved (0h)
Bit 4	1	Reserved	Reserved	Reserved (0h)
Bit 3	0	Picture rate see Table 3	Sampling structure see Table 4	Right eye stream, audio not present or status unknown (0h) Right eye stream carries a copy of Left eye audio (1h) Right eye stream carries additional channels (2h) Reserved (3h)
Bit 2	0			
Bit 1	0			
Bit 0	1			Bit depth Reserved (0h), 10-bit (1h), Reserved (2h & 3h)

The value for byte 1 shall be [B1h] and is contained in a register published on line at SMPTE Registration Authority (see www.smp-te-ra.org). Readers are encouraged to check the online site for the current registered values for each payload format and interface combination.

Byte 2 shall identify the picture rate and the picture and transport scanning methods as shown in Table 2.

Bit b7 shall identify whether the digital interface uses a progressive or interlaced transport structure such that:

b7 = (0h) shall Identify an interlaced transport

b7 = (1h) shall Identify progressive transport

Bit b6 shall identify whether the picture has a progressive or interlace structure such that.

b6 = (0h) shall identify an interlaced structure

b6 = (1h) shall identify a progressive structure

Note: PsF payloads are defined as the carriage of a progressively scanned image transported over an interlaced digital interface. The progressive image is segmented into a first and second picture segment within the transport frame duration. These first and second picture segments are indicated by the first and second field indicators in the digital interface transport.

Bits b5 to b4 shall be set to (0h),

Bits b3 to b0 shall identify the picture rate in Hz in accordance with Table 3. Picture rate is defined in SMPTE ST 352.

Table 3 – Picture Rate

Value	Picture rate	Value	Picture rate	Value	Picture rate	Value	Picture rate
0h	No defined value	1h	Reserved	2h	24/1.001	3h	24
4h	48/1.001	5h	25	6h	30/1.001	7h	30
8h	48	9h	50	Ah	60/1.001	Bh	60
Ch	Reserved	Dh	Reserved	Eh	Reserved	Fh	Reserved

Byte 3 shall identify the aspect ratio and sampling structure as shown in Table 4.

Bit b6 and b7 shall identify the horizontal Pixel count-

(0h) shall identify 1920 Pixels

(1h) shall Identify 2048 Pixels

(2h) shall identify 1280 Pixels

(3h) Reserved.

Bit b5 shall identify the image aspect ratio;

b5 = (0h) shall identify an image with unknown aspect ratio

b5 = (1h) shall identify an image with a 16x9 aspect ratio

Bit b4 is reserved and shall be set to (0h)

Bits b3 to b0 of byte 3 shall identify the sampling structure in accordance with Table 4. This standard shall be constrained to value (0h). The sampling structure is defined in SMPTE ST 352.

Table 4 – Sampling Structure

Value	Sampling	Value	Sampling	Value	Sampling	Value	Sampling
0h	4:2:2 (Y'C _B C _R)	1h	4:4:4 (Y'C _B C _R)	2h	4:4:4 (G'B'R')	3h	4:2:0
4h	4:2:2:4 (Y'C _B C _R A)	5h	4:4:4:4 (Y'C _B C _R A)	6h	4:4:4:4 (G'B'R'A)	7h	SMPTE ST 2048-2 FS ¹
8h	4:2:2:4 (Y'C _B C _R D)	9h	4:4:4:4 (Y'C _B C _R D)	Ah	4:4:4:4 (G'B'R'D)	Bh	Reserved
Ch	Reserved	Dh	Reserved	Eh	4:4:4 (X'Y'Z)	Fh	Reserved

Byte 4 identifies extended aspects of the payload identifier.

¹ An additional Color ANC packet to describe the FS characteristics is defined by SMPTE ST 2048-2.

Bit b7 is reserved and shall be set to (0h)

Bit b6 shall identify whether the stream carries the Left eye or Right eye images

b6 = (0h) shall Identify a Left eye image

b6 = (1h) shall identify a Right eye image

Bits b4 and b5 shall be reserved and set to (0h)

For the Left eye stream, bits b2 and b3 shall be reserved and set to (0h)

For the Right eye stream, bits b2 and b3 shall signal the nature of any audio data carried in the Right eye stream.

(0h) shall identify that no audio is present in the Right eye stream or that the status of any audio signals is unknown

(1h) shall identify that the Right eye stream carries a copy of the Left eye stream audio

(2h) shall identify that Right eye stream carries additional audio channels 17-32. When the audio sampling is 96 kHz these additional channels shall be channels 9-16.

(3h) is reserved

Bits b1 and b0 shall identify the bit depth of the sample such that:

(0h) reserved

(1h) shall identify quantization using 10 bits per sample;

(2h) and (3h) are reserved

Annex A Bibliography (Informative)

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 12-1:2008) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 12M-1-2008). Documents with the same root number (e.g. 12-1) and publication year (e.g. 2008) are functionally identical.

SMPTE ST 12-1:2008, Television — Time and Control Code

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

SMPTE ST 296:2001, Television — 1280 x 720 Progressive Image Sample Structure — Analog and Digital Representation and Analog Interface

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

SMPTE ST 2048-2:2011, 2048 x 1080 Digital Cinematography Production Image FS/709 Formatting for Serial Digital Interface

Annex B SMPTE ST 292-2 Document Road Map (Informative)

This road map shows the relations between SMPTE ST 292-2 and its normative reference documents.

