SMPTE STANDARD

Source Image Format and Ancillary Data Mapping for Stereoscopic Image Formats on a Single-Link 3 Gb/s Serial Interface

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Approved
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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 425-2 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 acquisition, production and post-production segments of the industry to have an interface for transporting stereoscopic images complying with 4:2:2 10 bit image formats that have a payload capacity of nominally 1.5 Gb/s defined by SMPTE ST 274, SMPTE ST 2048-2 and SMPTE ST 296.

SMPTE ST 292-2 defines a means of transporting these stereoscopic images over 2 × 1.5 Gb/s (nominal) serial interfaces.

This standard defines the mapping of the stereo image formats referenced in SMPTE ST 292-2 into a single 3 Gb/s (nominal) serial interface, including a payload identifier that will identify the Left Eye and Right Eye (Le and Re) images, audio and other associated ancillary data.

1 Scope

This standard defines a means of transporting a stereoscopic image pair consisting of a Left Eye and Right Eye image (Le and Re) using an interface consisting of a single 3 Gb/s (nominal) link.

The stereoscopic image formats to be transported using this standard are those 4:2:2 10-bit image formats having a sampling frequency of 74.25 MHz or 74.25/1.001 MHz

Audio and other associated ancillary data may also be transported. This standard also defines a payload identifier.

It is not necessary for implementations to include support for all formats defined in this standard to be compliant. Implementers should indicate supported formats in commercial publications.

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 292-1:2012, 1.5 Gb/s Signal/Data Serial Interface

SMPTE ST 292-2:2011, Dual 1.5 Gb/s Serial Digital Interface for Stereoscopic Image Transport

SMPTE ST 425-1:2011, Source Image Format and Ancillary Data Mapping for the 3 Gb/s Serial Interface

4 Source Format and 10-Bit Interface Data Structure

For this standard, the source image formats for each Left Eye (Le) and Right Eye (Re) stereoscopic image pair, shall be all of the formats referenced by SMPTE ST 292-2. Table 1 — repeated from SMPTE ST 292-2 for convenience — shows the source formats so referenced.

The 10-bit interface data structure shall be constructed in conformance with the interleaved data stream defined in SMPTE ST 292-1, for those formats so referenced by SMPTE ST 292-2.

Table 1 – Source Image Formats referenced by SMPTE ST 292-2 (Informative)

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.

NOTE: Not all formats referenced in indicated reference documents are shown — for example 4:4:4 sampling is not supported. It should also be noted that the image formats enumerated in the above table represent uncompressed video source data only. As such this standard supports a subset of the source data formats defined in SMPTE ST 425-1 Level B-DS mapping.

Each Le and Re image of the stereoscopic image pair shall be of the same format and structure and shall be constructed as an individual 10-bit interface in accordance with SMPTE ST 292-2.

The 10-bit interfaces so constructed shall contain timing reference code words (SAV/EAV), line numbers and line based CRC's as defined in SMPTE ST 292-1 and/or the source image format document.

Each parallel 10-bit interface shall be frame, line and word aligned, having an interface frequency of 148.5 MHz or 148.5/1.001 MHz as shown in Figure 1.

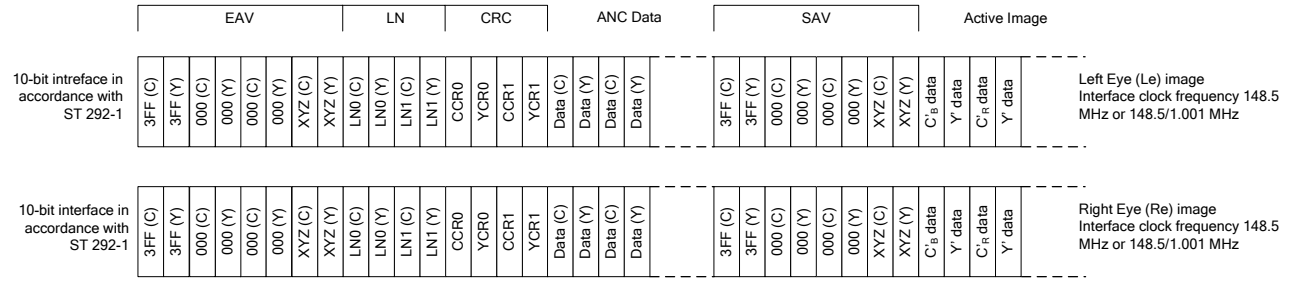

Figure 1 – Example of SMPTE ST 292-2 Stereoscopic 10-bit interface

4.1 Payload Identifier Mapping

The payload identifier shall be mapped onto each Le and Re 10-bit interface of the stereoscopic image pair. The recommended location of the payload identifier shall be as defined in ST 292-1, and Bytes 2, 3 and 4 of the payload identifier shall be in conformance with the picture rate, sampling structure, aspect ratio, and bit depth etc. as defined in SMPTE ST 292-2.

Byte 1 of the payload identifier shall be as defined in Table 2 below.

Table 2 – Payload and Digital Interface Identification for the mapping of stereo the 3 Gb/s Serial Digital Interface

Mapping Nomenclature	Byte 1: Payload and Digital Interface
Stereoscopic 720-line video payloads on a 3 Gb/s serial digital interface	8Eh
Stereoscopic 1080-line video payloads on a 3 Gb/s serial digital interface	8Fh

4.2 Audio and Other Ancillary Data Mapping

When present, ancillary data including audio data, shall be mapped into the Le and Re 10-bit interface of the stereoscopic image pair in conformance with SMPTE ST 292-2.

5 Dual Stream Mapping of Stereoscopic Images

The Le and Re 10-bit interfaces so constructed shall be mapped into the 20-bit Virtual Interface defined in SMPTE ST 425-1, in accordance with the Level B-DS (Dual Stream) mapping rules.

The Le interface shall be mapped into data stream 1 of the virtual interface and the Re interface shall be mapped into data stream 2 of the virtual interface.

In accordance with SMPTE ST 292-2, the timing difference between the serial digital clocks and EAV / SAV alignment of the Left eye stream and the Right eye stream may differ by up to 400 ns at the source. Further delays may occur within a system configuration. Any such timing difference shall be corrected prior to mapping into the virtual interface of this standard.

This requirement in conjunction with the requirements defined in Section 4 of this standard, ensures that the Le and Re images are frame aligned when carried on the 3 Gb/s link. The frame alignment of source images in this standard differs from the general requirements defined for the Level B-DS mapping rules as described in SMPTE ST 425-1.

Annex A Bibliography (Informative)

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.

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

SMPTE ST 291:2011, Ancillary Data Packet and Space Formatting

SMPTE ST 296:2011, 1280 x 720 Progressive Image Sample Structure — Analog and Digital Representation and Analog Interface

SMPTE ST 299-1:2009, 24-Bit Digital Audio Format for SMPTE 292 Bit-Serial Interface

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

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

SMPTE ST2048-2:2011, 2048 × 1080 Digital Cinematography Production Image FS/709 Formatting for Serial Digital Interface

Annex B SMPTE ST 425-2 Document Road Map (Informative)

This road map shows the relations between SMPTE ST 425-2 and its normative reference documents.