SMPTE STANDARD

1.5 Gb/s Signal/Data Serial Interface

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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 292-1 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.

This standard has been developed to carry HDTV digital video signals and formatted data within the defined payload areas including ancillary data. The standard can carry 1280×720, 1920×1080 or 2048×1080 active pixel formats through the 1.5 Gb/s Serial Digital Interface and enables the carriage of any ancillary data conforming to SMPTE ST 291.

1 Scope

This standard defines a bit-serial data structure and the coaxial cable interface specifications for 1.5 Gb/s [nominal] Signal/Data Serial Interface to carry either 1280×720, 1920×1080 or 2048×1080 active pixel formats mapped into the 1.5 Gb/s payload. This standard defines the method of serializing the parallel source format data to a serial bit stream. This interface may also carry packetized data mapped into the 1.5 Gb/s transport payload providing the constraints imposed by the reference source image formats are observed.

This standard specifies a coaxial cable interface suitable for application where the signal loss does not exceed an amount specified by the receiver manufacturer, typical loss amounts would be in the range of up to 20 dB at one-half the clock frequency.

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.

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 2077:2013, Full Range Image Mapping

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 Sample Structure — Analog and Digital Representation and Analog Interface

SMPTE ST 352:2013, Payload Identification Codes for Serial Digital Interfaces

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

SMPTE RP 184:2015, Specification of Jitter in Bit-Serial Digital Systems

IEC 61169-8 (2007-2), Part 8: Sectional Specification — R.F. Coaxial Connectors with Inner Diameter of Outer Conductor 6,5 mm (0,256 in) with Bayonet Lock — Characteristic Impedance 50Ω (Type BNC), Annex A (Normative) Information for Interface Dimensions of 75Ω Characteristic Impedance Connector with Unspecified Reflection Factor

Note that the title of this normative reference could be misleading. This standard requires the use of the 75-ohm connector defined in this reference.

Recommendation ITU-R BT.2100-1 (06/2017), Image parameter values for high dynamic range television for use in production and international programme exchange.

4 Source Format Data

4.1 For this interface, the source data shall be 10-bit words. The source data may be an uncompressed video source or packetized data constrained by the pixel array of the referenced source image formats.

4.2 For uncompressed 4:2:2 1280x720, 1920x1080 or 2048×1080 pixel signals, the interface shall be two parallel bit streams forming a 20-bit virtual interface.. One stream shall be defined as the Luma (Y') data channel, and the second stream shall be the Color-Difference (C'$_B$,C'$_R$) data channel. These data channels shall be multiplexed to form the serial data stream. The multiplexing shall be as defined in Figure 3.

For IC$_T$C$_P$ image mapping, Y' shall be replaced with I, C'$_B$ shall be replaced with C$_T$ and C'$_R$ shall be replaced with C$_P$.

NOTE: IC$_T$C$_P$ sampling is only applicable to the High Dynamic Range (HDR) image formats defined in Recommendation ITU-R BT.2100. See Annex C.4. Furthermore, the use of ICtCp for program interchange is by prior agreement between parties as defined in ITU-R BT.2100.

Other mappings shall be defined by application documents.

4.3 Data for each line of the interface shall be divided into four areas: "EAV/LN/CRC (end of active video/line number/cyclic redundancy check code); digital line blanking; SAV (start of active video) timing reference and digital active video as shown in Figure 1. The number of words and defined data in each area shall be specified by the source format or mapping documents.

4.4 Parameters for uncompressed 1280x720, 1920x1080 and 2048×1080 pixel sources and associated ancillary space shall be defined by:

> SMPTE ST 274 for 1920x1080 Standard Dynamic Range TV (SDR-TV)
> SMPTE ST 296 for 1280x720 SDR-TV
> SMPTE ST 2048-2 for 2048x1080 Production Image Formats for Digital Cinematography
> Recommendation ITU-R BT.2100-1 for 1920x1080 HDR
> (See informative Annex C.)

The total data rate shall be either 1.485 Gb/s or 1.485/1.001 Gb/s. The source format or mapping documents determine the precise interface clock frequency.

NOTE: Designers are encouraged to refer to multi-link 1.5 Gb/s-SDI or higher data rate SDI documents for the image formats which require higher than 1.485 Gb/s or 1.485/1.001 Gb/s.