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BT.601 Transport Over IEEE-1394

Revision 1.4

March 29, 2010

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Abstract

This specification describes a method of transmitting 4:2:2 YUV formatted video signals, including, but not limited to, ITU-R BT.601-5 formatted video signals, over IEEE-1394 both compressed and uncompressed. It also describes methods for transmitting 4:4:4 YUV and RGB formatted video signals.

Keywords

IEEE 1394, Serial Bus, ITU-R BT.601, Video, Compression, Transport.

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Foreword (This foreword is not part of 1394 Trade Association Specification 2006020)

This specification defines a mechanism for transmitting uncompressed video data over IEEE 1394. It provides scope for compressing the video data to allow the transport of video resolutions that have a higher bandwidth than that provided by the IEEE 1394 bus.

There are 8 annexes in this specification. Annexes A, B, D, F and G are informative and are not considered part of this specification.

This specification was accepted by the Board of Directors of the 1394 Trade Association. Board of Directors acceptance of this specification does not necessarily imply that all board members voted for acceptance. At the time it accepted this specification, the 1394 Trade Association. Board of Directors had the following members:

The AV Working Group, which revised and reviewed this specification, had the following members:

Revision history

Revision 1.0 (September 14, 2005)

Original Version

Revision 1.1 (October 02, 2006)

This revision has been produced by AV Working Group, rather than Architecture Working Group

Document number changed from 2003003 to 2006020

Technical changes:

- Addition of Codec 2 – Fujitsu SmartCODEC
- Addition of Color Space 3 – RGB 18 bit
- Addition of Video Modes 62 and 63
- Addition of CCI block in SIM packet

Editorial changes

- Minor corrections of typographic errors in version 1.0

Revision 1.3 (March 4, 2010)

This revision has been produced by the AV Working Group.

Technical change:

- Added the Analog Sunset Token (AST) to the CCI descriptor block in Annex H.

Revision 1.4 (March 29, 2010)

This revision has been produced by the AV Working Group.

Editorial changes:

- Updated Annex F (Informative) to comply with the new CCI structure.

BT.601 Transport Over IEEE-1394

1 Scope and purpose

1.1 Scope

This document specifies a protocol for the transport of uncompressed or compressed video data in the 4:2:2 format of recommendation ITU-R BT.601 (including compatible extensions to this format for the higher and lower resolutions of other commonly used video resolutions) over High Performance Serial Bus, as specified by IEEE Std 1394-1995 as amended by IEEE Std 1394a-2000 and IEEE Std 1394b-2002 (collectively IEEE 1394). The data formats for the encapsulation of video data are compatible with those specified by IEC 61883-1. Associated audio data, if any, should be formatted as specified by IEC 61883-6.

1.2 Purpose

There are many commonly used video formats unsupported by IEC 61883, such as MPEG-4, Windows Media Format (WMF) and the format used by automotive navigation applications. Support for all or most of these formats in rendering devices would require implementation of multiple video codecs this is an undue burden that may be avoided if the source device converts to ITU-R BT.601 4:2:2 format and, if necessary, compresses the data with a codec supported by all destination devices. An additional advantage is that on-screen display (OSD) information may be mixed with video data prior to transmission to the rendering device.

Because ITU-R BT.601 4:2:2 format is widely used internally in contemporary AV equipment, this specification permits straight-forward integration of IEEE 1394 into these devices and enables markets whose usage scenarios include single video sources transmitting to one or more video displays, such as:

- consumer electronic STB or DVD video rendered by multiple displays in the home;
- automotive navigation and entertainment; and
- aeronautical in-flight entertainment.

For the sake of interoperability and bounded implementation complexity, it is essential that the specification provide the following:

- a 1394TA controlled list of compression codecs; and
- at a minimum, a reference to one video compression codec.

2 Normative references

2.1 Reference scope

The specifications and standards named in this section contain provisions, which, through reference in this text, constitute provisions of this 1394 Trade Association Specification. At the time of publication, the editions indicated were valid. All specifications and standards are subject to revision; parties to agreements based on this 1394 Trade Association Specification are encouraged to investigate the possibility of applying the most recent editions of the specifications and standards indicated below.

2.2 Approved references

The following approved specifications and standards may be obtained from the organizations that control them.

IEEE Std 1394-1995, Standard for a High Performance Serial Bus

IEEE Std 1394a-2000, Standard for a High Performance Serial Bus—Amendment 1

IEEE Std 1394b-2002, Standard for a High Performance Serial Bus—Amendment 2

Throughout this document, the term “IEEE 1394" shall be understood to refer to IEEE Std 1394-1995 as amended by IEEE Std 1394a-2000 and IEEE Std 1394b-2002.

1394 Trade Association 2004006, AV/C Digital Interface Command Set General Specification Version 4.2

1394 Trade Association 2003017, IIDC 1394-based Digital Camera SpecificationVer.1.31

EIA/CEA-861-B 2002, A DTV Profile for Uncompressed High Speed Digital Interfaces

IEC 61883, Consumer Audio/Video Equipment – Digital Interface Parts 1 to 6

IEEE Std 1394.1-2004, Standard for High Performance Serial Bus Bridges

ISO/IEC 11172-2 1993, Information technology - Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s - Part 2: Video

ITU-R BT.601-5 1995, Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios

ITU-R BT.656-4 1998, Interfaces for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of recommendation ITU-R BT.601

ITU-R BT.709-4 2000, Parameter values for the HDTV standards for production and international programme exchange

ITU-R BT.1358 1998, Studio parameters of 625 and 525 line progressive scan television systems

ITU-T H.263 1998, Video coding for low bit rate communication

SMPTE 267M-1995, Television — Bit-Parallel Digital Interface — Component Video Signal 4:2:2 16x9 Aspect Ratio

SMPTE 274M-1998, Television — 1920 x 1080 Scanning and Analog and Parallel Digital Interfaces for Multiple Picture Rates

SMPTE 293M-1996, Television — 720 x 483 Active Line at 59.94-Hz Progressive Scan Production — Digital Representation

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

VESA Monitor Timing Specifications, VESA and Industry Standards and Guidelines for Computer Display Monitor Timing, Version 1.0, Revision 0.8

2.3 Proprietary Specifications

The following specifications may be obtained from the organizations that control them.

Oxford Semiconductor Light Codec Specification, Version 1.0

Fujitsu SmartCODEC Specification, Version 1.0

2.4 Reference acquisition

The references cited may be obtained from the organizations that control them:

1394 Trade Association, 315 Lincoln Ave, Suite E, Mukilteo, WA 98275 USA; (817) 410-5750 / (817) 410-5752 (FAX); http://www.1394ta.org/

American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036, USA; (212) 642-4900 / (212) 398-0023 (FAX); http://www.ansi.org/

Institute of Electrical and Electronic Engineers (IEEE), 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331, USA; (732) 981-0060 / (732) 981-1721 (FAX); http://www.ieee.org/

In addition, many of the documents controlled by the above organizations may also be ordered through a third party:

Global Engineering Documents, 15 Inverness Way, Englewood, CO 80112-5776; (800) 624-3974 / (303) 792-2192; http://www.global.ihs.com/

Documentation for the Light Codec is available under license from Oxford Semiconductor Ltd:

Oxford Semiconductor Ltd, 25 Milton Park, Abingdon, Oxfordshire, OX14 4SH, United Kingdom; +44 (0)1235 824900; http://www.oxsemi.com/

Documentation for the SmartCODEC is available under license from Fujitsu Limited:

Fujitsu Limited, 4-1-1 Kamikodanaka, Nakahara-ku, Kawasaki, Kanagawa, 211-8588, Japan; +81-44-777-1111; http://www.fujitsu.com/

3 Definitions and notation

3.1 Definitions

3.1.1 Conformance

Several keywords are used to differentiate levels of requirements and optionality, as follows:

3.1.1.1 expected: A keyword used to describe the behavior of the hardware or software in the design models assumed by this specification. Other hardware and software design models may also be implemented.

3.1.1.2 ignored: A keyword that describes bits, bytes, quadlets, octlets or fields whose values are not checked by the recipient.

3.1.1.3 may: A keyword that indicates flexibility of choice with no implied preference.

3.1.1.4 reserved: A keyword used to describe objects (bits, bytes, quadlets, octlets and fields) or the code values assigned to these objects in cases where either the object or the code value is set aside for future standardization. Usage and interpretation may be specified by future extensions to this or other specifications. A reserved object shall be zeroed or, upon development of a future specification, set to a value specified by such a specification. The recipient of a reserved object shall ignore its value. The recipient of an object defined by this specification as other than reserved shall inspect its value and reject reserved code values.

3.1.1.5 shall: A keyword that indicates a mandatory requirement. Designers are required to implement all such mandatory requirements to assure interoperability with other products conforming to this specification.

3.1.1.6 should: A keyword that denotes flexibility of choice with a strongly preferred alternative. Equivalent to the phrase “is recommended.”

3.1.2 Glossary

The following terms are used in this specification:

3.1.2.1 4:2:2: Denotes the proportion of luma (Y) to chroma (U&V) components. For 4:2:2 there is one U and one V for every two Y components. For 8 bit samples this results in there being effectively 16 bits per pixel.

3.1.2.2 4:4:4: Denotes the proportion of luma (Y) to chroma (U&V) components. For 4:4:4 there is one U and one V for each Y component. For 8 bit samples this results in there being effectively 24 bits per pixel.

3.1.2.3 AV/C: Audio/video control. The AV/C Digital Interface Command Set of which a part is specified by [B5] and other AV/C documents.

3.1.2.4 Chroma: The color part of a video signal.

3.1.2.5 CIP Header: The Common Isochronous Packet header defined in IEC 61883-1 [B6].

3.1.2.6 Color Space: A mathematical representation of a color.

3.1.2.7 CYCLE_TIMER: The value given in the node’s CYCLE_TIME register.

3.1.2.8 Luma: The intensity (or black & white) part of a video signal.

3.1.2.9 MAX_VDSP: The maximum number of Video Data Source Packets allowed in a single IEEE-1394 isochronous packet.

3.1.2.10 RGB: A color space that defines each color in terms of its red, green and blue element.

3.1.2.11 YUV: A color space that defines each color in terms of its luma component (Y) and its chroma components (U & V).

3.1.3 Abbreviations

The following are abbreviations that are used in this specification:

AV/C	Audio Video Control
BCD	Binary Coded Decimal
BT.601	ITU-R BT.601-5 1995, [B7]
CIP	Common Isochronous Packet
CCI	Copy Control Information
CSR	Control and status register [B1]
DAC	Digital Analog Converter
DCT	Discrete Cosine Transform
DV	Digital Video
OSD	Onscreen Display
OUI	Organizationally Unique Identifier
r	Reserved, as defined in 3.1.1.4 above
MPEG	Moving Picture Experts Group
SIM	Stream Information & Metadata
VDSP	Video Data Source Packet
WMF	Windows Media Format

3.2 Notation

3.2.1 Numeric values

Decimal and hexadecimal are used within this specification. By editorial convention, decimal numbers are most frequently used to represent quantities or counts. Addresses are uniformly represented by hexadecimal numbers. Hexadecimal numbers are also used when the value represented has an underlying structure that is more apparent in a hexadecimal format than in a decimal format.

Decimal numbers are represented by Arabic numerals without subscripts or by their English names. Hexadecimal numbers are represented by digits from the character set 0 – 9 and A – F followed by the subscript 16. When the subscript is unnecessary to disambiguate the base of the number it may be omitted. For the sake of legibility hexadecimal numbers are separated into groups of four digits separated by spaces.

As an example, 42 and $2A_{16}$ both represent the same numeric value.

3.2.2 Bit, byte and quadlet ordering

This specification uses the facilities of Serial Bus, IEEE 1394, and therefore uses the ordering conventions of Serial Bus in the representation of data structures. In order to promote interoperability with memory buses that may have different ordering conventions, this specification defines the order and significance of bits within bytes, bytes within quadlets and quadlets within octlets in terms of their relative position and not their physically addressed position.

Within a byte, the most significant bit, *msb*, is that which is transmitted first and the least significant bit, *lsb*, is that which is transmitted last on Serial Bus, as illustrated below. The significance of the interior bits uniformly decreases in progression from *msb* to *lsb*.

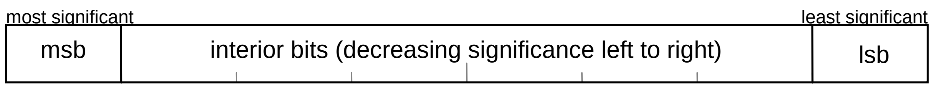

Figure 1 – Bit ordering within a byte

Within a quadlet, the most significant byte is that which is transmitted first and the least significant byte is that which is transmitted last on Serial Bus, as shown below.

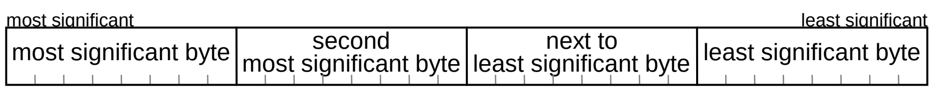

Figure 2 – Byte ordering within a quadlet

Within an octlet, which is frequently used to contain 64-bit Serial Bus addresses, the most significant quadlet is that which is transmitted first and the least significant quadlet is that which is transmitted last on Serial Bus, as the figure below indicates.

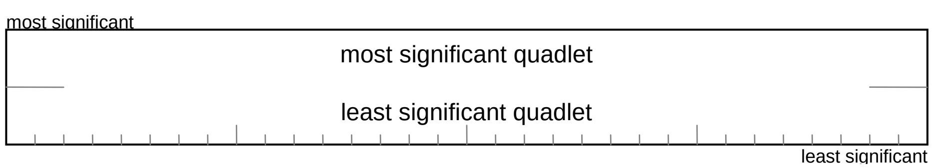

Figure 3 – Quadlet ordering within an octlet

When block transfers take place that are not quadlet aligned or not an integral number of quadlets, no assumptions can be made about the ordering (significance within a quadlet) of bytes at the unaligned beginning or fractional quadlet end of such a block transfer, unless an application has knowledge (outside of the scope of this specification) of the ordering conventions of the other bus.

4 Model (informative)

4.1 Model overview

The presently defined compression standards for IEEE 1394 transport, DV and MPEG2, have difficulties at the system level in a practical consumer AV network. Both offer excessive compression for simple transport over a wide bandwidth network and carry the associated complexity of coding and decoding signals. Each are fine for their intended purpose, but have excessive cost for simple video transport. Conventional video equipment is interfaced with analog cables carrying a number of signal formats, and it is this low cost and universal connection capability which digital interfaces need to emulate. Thus the analog output from any DVD player will connect to any TV, and this is seen as adequate by equipment manufacturers. Digital interfaces would allow many additional features, but providing every input with the capability of decoding both DV and MPEG2 in all available standards and resolutions is unnecessarily expensive. Inside equipment variations on the broadcast equipment ITU-R BT.601-5/BT.656-4 interface are common and provide a universal interface standard for digital video transport. The coding system in ITU-R BT.601-5 sends YUV data across an 8 bit interface between integrated circuits, for example an MPEG decoder and DAC. If the decoder and DAC are separated by 1394 in their separate boxes there will be a reduction in cost at the source device and the sink device will be independent from the video encoding mechanism.

This specification describes the method of passing YUV video signals across IEEE 1394 based upon the formats defined by ITU-R BT.601-5. Familiarity with the specifications ITU-R BT.601-5, ITU-R BT.656-4 and IEC 61883 is necessary to follow the technical details.

There is also the capability to transfer data in YUV 4:4:4 and 24 bit RGB formats. This allows video to be transferred without the need for color space sub-sampling.

It is valid to transmit all video modes as uncompressed data as long as the IEEE 1394 bus bandwidth is available. In practice some video modes will not be transportable in an uncompressed state.

This model also allows for the future development of video codecs. Since the transport of the video data is independent of the original source encoding as new codecs are deployed, such as MPEG-4, the transport mechanism described in this document will not need to change.

4.2 Compression

To allow the transport of High Definition video signals at bus speeds less than S1600 or to allow the transport of multiple video streams it is essential that the video stream is compressed. This compression need not be more than about 10:1 and should have minimal discernable impact on the displayed image. Since compression is required to transport some of the video modes it is necessary to reference at least one compression codec in this specification. A suitable video compression codec is referenced for this purpose in Table 2. There is no requirement that a source or sink device implement this codec. Other suitable video compression codecs may be added in the future.

5 Packet Format

5.1 Isochronous Packet Header

The header quadlet of an IEEE 1394 isochrononous packet (*tcode* A_{16}) is shown in the Figure 4 below.

most significant

data length	tag	channel	tcode	sy

least significant

Figure 4 – Isochronous packet header

The *tag* field shall be set to 1_{16} indicating that the packet has the Common Isochronous Packet (CIP) Header as defined in IEC 61883-1. The contents of the CIP Header are described in section 5.2.

The definition of the remaining fields is outside of the scope of this specification.

5.2 CIP Header

The definition of the CIP header is shown in Figure 5 below.

0	0	SID	DBS	FN	QPC	SPH	r	DBC
1	0	FMT	FDF	SYT				

Figure 5 – CIP header

- *SID* denotes the source node ID. This is bus configuration dependent.
- *DBS* value depends upon the video mode being transported and the color space used. This value is dependent upon the compression mode, color space and video mode. The DBS value for compression mode 0_{16} can be calculated from the source packet size given in Table 1 by dividing the value by 4. For other compression modes refer to the documention available from the codec vendor.
- *FN* shall always have a value of 0_{16}. There shall only be 1 data block per source packet.
- *QPC* shall always have a value of 0_{16}. There shall be no padding.
- *SPH* shall be 0_{16}. The source packet header is not present.
- Since *FN* is 0_{16} the value of *DBC* shall always increment by the number of source packets present in the Isochronous packet. This field indicates the count value of the first data block in the current isochronous packet.
- The value of *FMT* shall be 000001_2. This value indicates that the source packet format is as defined in this specification. This also indicates that the *SYT* field is present in the CIP header.
- The *FDF* field is encoded as shown in Figure 6 below.
- The *SYT* field is encoded as defined in IEC 61883-1.

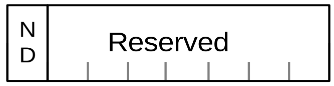

Figure 6 – FDF field

The *ND* (No Data) field is used to signify whether the data payload of the isochronous packet after the CIP header is valid. If ND is set to 1_2 it indicates that the data is not valid and shall be ignored, this setting is only used in blocking transmission mode (see section 5.5.1.3). The *DBC* field in the CIP header of a packet which has *ND* set to 1_2 shall be the count value of the next valid data block. The transmission of an isochronous packet with this bit set shall not cause the value of *DBC* to increment. If ND is set to 0_2 it indicates that the data payload of the isochronous packet after the CIP header is valid. In non-blocking transmission mode, see section 5.5.1.2, ND shall be set to 0_2 for all isochronous packets.

5.3 Stream definition

A stream that conforms to this specification is governed by three key parameters:

1. Video Mode, see Table 1 below. Additional information for each video mode is given in Annex C.

2. Compression Mode, see Table 2 below.

3. Color Space, see Table 3 below.

Each of these parameters includes an unconstrained mode that allows modes not explicitly defined to be transmitted. The use of these unconstrained modes is beyond the scope of this specification. However, it is expected that their use will be determined by negotiation before transmission.

For transmission of Compression Mode 0_{16} data the packetization and timing characteristics are defined in this specification.

For transmission of Compression Modes 1_{16} and 2_{16} data the packetization and timing characteristics are defined in the applicable specification document referenced in Table 2.

Table 1 - Video Mode

Video mode	Active Vertical Lines	Active Horizontal Pixels	Interlace or Progressive	Vertical Frequency	Source Packet size for Color Space 0[1,2,5] (bytes)	Source Packet size for Color Spaces 1 & 2[1,2,5] (bytes)	SYT Interval for Color Space 0,[1,2]	SYT Interval for Color Spaces 1 & 2[1,2]	MAX VDSP for Color Space 0,[1,2]	MAX VDSP for Color Spaces 1 & 2[1,2]	Specification
0	480	640	Progressive	59.94	644	644	8	12	8	12	VESA
1	480	640	Progressive	60	644	644	8	12	8	12	VESA
2	240	720	Progressive	59.94	724	724	4	6	4	6	EIA/CEA-861-B
3	240	720	Progressive	60	724	724	4	6	4	6	EIA/CEA-861-B
4	480	720	Progressive	59.94	724	724	8	12	8	12	BT.1358 SMPTE 293M

Video mode	Active Vertical Lines	Active Horizontal Pixels	Interlace or Progressive	Vertical Frequency	Source Packet size for Color Space 0[1,2,5] (bytes)	Source Packet size for Color Spaces 1 & 2[1,2,5] (bytes)	SYT Interval for Color Space 0,[1,2]	SYT Interval for Color Spaces 1 & 2[1,2]	MAX VDSP for Color Space 0,[1,2]	MAX VDSP for Color Spaces 1 & 2[1,2]	Specification
5	480	720	Progressive	60	724	724	8	12	8	12	BT.1358 SMPTE 293M
6	480	720	Interlace	59.94	724	724	4	6	4	6	BT.601 SMPTE 267M
7	480	720	Interlace	60	724	724	4	6	4	6	BT.601 SMPTE 267M
8	720	1280	Progressive	59.94	644	964	24	24	23	23	SMPTE 296M
9	720	1280	Progressive	60	644	964	24	24	23	23	SMPTE 296M
10	480	1440	Progressive	59.94	724	724	16	24	16	24	EIA/CEA-861-B
11	480	1440	Progressive	60	724	724	16	24	16	24	EIA/CEA-861-B
12	1080	1920	Progressive	59.94	964	964	36	54	34	51	BT.709 SMPTE 274M
13	1080	1920	Progressive	60	964	964	36	54	34	51	BT.709 SMPTE 274M
14	1080	1920	Interlace	59.94	964	964	20	30	17	26	BT.709 SMPTE 274M
15	1080	1920	Interlace	60	964	964	20	30	17	26	BT.709 SMPTE 274M
16	288	720	Progressive	50	724	724	4	6	4	6	EIA/CEA-861-B
17	576	720	Progressive	50	724	724	8	12	8	12	BT.1358
18	576	720	Interlace	50	724	724	4	6	4	6	BT.601
19	720	1280	Progressive	50	644	964	20	20	19	19	SMPTE 296M
20	576	1440	Progressive	50	724	724	16	24	16	24	EIA/CEA-861-B
21	480	960	Interlace	59.94	644	724	6	8	6	8	BT.601 SMPTE 267M
22	576	960	Interlace	50	644	724	6	8	6	8	BT.601

Video mode	Active Vertical Lines	Active Horizontal Pixels	Interlace or Progressive	Vertical Frequency	Source Packet size for Color Space 0[1,2,5] (bytes)	Source Packet size for Color Spaces 1 & 2[1,2,5] (bytes)	SYT Interval for Color Space 0,[1,2]	SYT Interval for Color Spaces 1 & 2[1,2]	MAX VDSP for Color Space 0,[1,2]	MAX VDSP for Color Spaces 1 & 2[1,2]	Specification
23	-	Reserved	-	-	-	-	-	-	-	-	-
24	-	Reserved	-	-	-	-	-	-	-	-	-
25	1080	1920	Progressive	23.976	964	964	16	24	14	21	BT.709 SMPTE 274M
26	1080	1920	Progressive	24	964	964	16	24	14	21	BT.709 SMPTE 274M
27	1080	1920	Progressive	25	964	964	16	24	15	22	BT.709 SMPTE 274M
28	1080	1920	Progressive	29.97	964	964	20	30	17	26	BT.709 SMPTE 274M
29	1080	1920	Progressive	30	964	964	20	30	17	26	BT.709 SMPTE 274M
30	1080	1920	Progressive	50	964	964	32	48	29	43	BT.709 SMPTE 274M
31	1080	1920	Interlace	50	964	964	16	24	15	22	BT.709 SMPTE 274M
32	288	352	Progressive	25	356	532	2	2	2	2	H.263 (CIF)
33	240	352	Progressive	30	356	532	2	2	2	2	ISO-IEC 11172-2 (SIF)
34	144	176	Progressive	25	180	268	2	2	1	1	H.263 (QCIF)
35	120	176	Progressive	30	180	268	2	2	1	1	ISO-IEC 11172-2 (QSIF)
36	288	352	Progressive	29.97	356	532	6	6	3	3	H.263 (CIF)
37	144	176	Progressive	29.97	180	268	2	2	2	2	H.263 (QCIF)
38	234	480	Progressive	29.97	324	364	3	4	3	4	Automotive[3]
39	234	480	Progressive	15	324	364	3	4	2	2	Automotive[3]

Video mode	Active Vertical Lines	Active Horizontal Pixels	Interlace or Progressive	Vertical Frequency	Source Packet size for Color Space 0[1,2,5] (bytes)	Source Packet size for Color Spaces 1 & 2[1,2,5] (bytes)	SYT Interval for Color Space 0,[1,2]	SYT Interval for Color Spaces 1 & 2[1,2]	MAX VDSP for Color Space 0,[1,2]	MAX VDSP for Color Spaces 1 & 2[1,2]	Specification
40	480	800	Progressive	15	804	804	2	3	2	3	Automotive[3]
41	240	320	Progressive	15	324	244	2	4	1	2	IIDC v.1.31
42	240	320	Progressive	30	324	244	2	4	2	4	IIDC v.1.31
43	240	320	Progressive	60	324	244	4	8	4	8	IIDC v.1.31
44	480	640	Progressive	15	644	644	2	3	2	3	IIDC v.1.31
45	480	640	Progressive	30	644	644	4	6	4	6	IIDC v.1.31
46	480	640	Progressive	60	644	644	8	12	8	11	IIDC v.1.31
47	600	800	Progressive	15	804	804	4	6	3	4	IIDC v.1.31
48	600	800	Progressive	30	804	804	6	9	5	7	IIDC v.1.31
49	600	800	Progressive	60	804	804	10	15	9	14	IIDC v.1.31
50	768	1024	Progressive	15	516	772	8	8	6	6	IIDC v.1.31
51	768	1024	Progressive	30	516	772	12	12	12	12	IIDC v.1.31
52	768	1024	Progressive	60	516	772	24	24	24	24	IIDC v.1.31
53	960	1280	Progressive	15	644	964	8	8	8	8	IIDC v.1.31
54	960	1280	Progressive	30	644	964	16	16	15	15	IIDC v.1.31
55	960	1280	Progressive	60	644	964	32	32	29	29	IIDC v.1.31
56	1024	1280	Progressive	15	644	964	8	8	8	8	like IIDC v1.31[4]
57	1024	1280	Progressive	30	644	964	16	16	16	16	like IIDC v1.31[4]
58	1024	1280	Progressive	60	644	964	32	32	31	31	like IIDC v1.31[4]
59	1200	1600	Progressive	15	804	964	12	15	9	12	IIDC v.1.31
60	1200	1600	Progressive	30	804	964	20	25	18	23	IIDC v.1.31
61	1200	1600	Progressive	60	804	964	36	45	36	45	IIDC v.1.31
62	480	800	Progressive	30	804	804	4	6	4	6	Wide VGA
63	480	800	Progressive	60	804	804	8	12	8	12	Wide VGA
255	-	Other Video Mode	-	-	-	-	-	-	-	-	-
Others	-	Reserved for future specification	-	-	-	-	-	-	-	-	-

[1] These columns are applicable when the compression mode is 0, i.e. uncompressed video data only.
[2] This value includes the quadlet that contains the Type Specific Information field.
[3] These modes were requested by members of the IDB-Forum.
[4] These video modes are not in IIDC specification but are comparable to the modes that are.
[5] DBS can be calculated as: (Source packet size / 4).

The use of Video Mode FF_{16} is beyond the scope of this specification. However, it is expected that the use of this video mode will be determined by negotiation before transmission.

The Compression Mode field is encoded as defined in Table 2 below. The use of Compression Mode FF_{16} is beyond the scope of this specification. However, it is expected that the use of this compression mode will be determined by negotiation before transmission.

Table 2 - Compression Mode

Compression Mode Value	Compression Mode Description	Specification Document Reference
0_{16}	Uncompressed Video Data	None applicable
1_{16}	Compressed Video using Light Codec	Oxford Semiconductor Light Codec Specification, Version 1.0, [B10]
2_{16}	Compressed Video using SmartCODEC	Fujitsu SmartCODEC Specification, Version 1.0, [B11]
FF_{16}	Compressed Video using other video codec	None applicable
Others	Reserved for future specification	None applicable

The Color Space field is encoded as defined in Table 3 below. The use of Color Space FF_{16} is beyond the scope of this specification. However, it is expected that the use of this color space will be determined by negotiation before transmission.

Table 3 - Color Space

Color Space Format	Color Space Description
0_{16}	YUV 4:2:2 (16bits/pixel, 8bits/sample)
1_{16}	YUV 4:4:4 (24 bits/pixel, 8bits/sample)
2_{16}	RGB (24 bits/pixel, 8bits/sample)
3_{16}	RGB (18 bits/pixel, 6bits/sample)
FF_{16}	Other Color Space
Others	Reserved for future specification

5.4 Packetization

5.4.1 Source Packet Format

For a stream that conforms to this specification each IEEE-1394 isochronous packet consists of the CIP header followed by zero or more source packets. The general format of the source packet for all compression modes and all source packet types is shown in Figure 7 below. It contains a single quadlet of type specific information followed by data. The size of each source packet is compression mode, video mode and color space mode dependent. The permitted video, compression and color space modes are detailed in Table 1, Table 2 and Table 3 respectively. Table 1 indicates the source packet size for each video mode and color space mode for compression mode 0. This size is the total number of bytes per source packet, i.e. type specific information and source packet data. All the source packets of a given stream are this size.

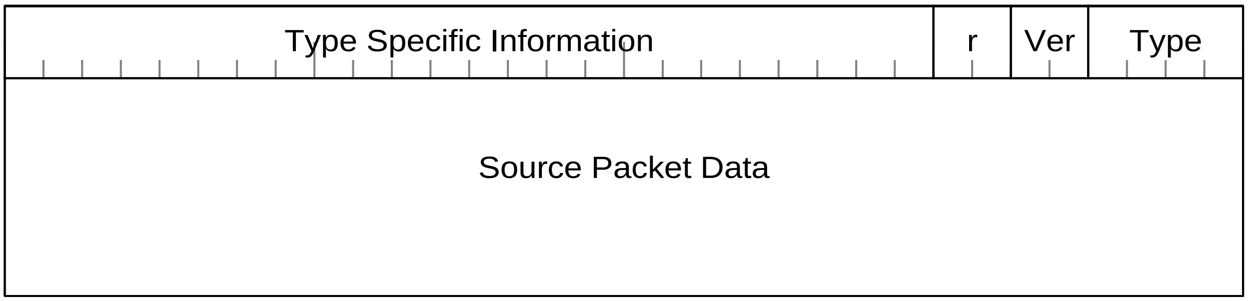

Figure 7 - General Format of a Source Packet

The *Type* field indicates the type of data contained within the source packet. It is encoded as defined in Table 4 below.

The *Ver* field indicates the version of the source packet. Its value is defined in the type specific sections below.

The *Type Specific Information* field contents depends on the *Type* field. Its encoding is defined in the type specific sections 5.4.2, 5.4.3 and 5.4.4 below.

The *Source Packet Data* field contents depends on the *Type* field. Its encoding is defined in the type specific sections 5.4.2, 5.4.3 and 5.4.4 below.

Table 4 - Source Packet Type Encoding

Type	Description of Type
0_{16}	Source packet contains video data as described in 5.4.2 below
1_{16}	Source packet contains stream information and metadata as described in 5.4.3 below.
2_{16}	Reserved for the future specification of the transport of audio data. Further information regarding this type is given in 5.4.4 below.
others	Reserved for future use

5.4.2 Type 0_{16} Source Packet – Video Data Source Packet

Figure 8 shows the definition and arrangement of the fields in the Video Data Source Packet.

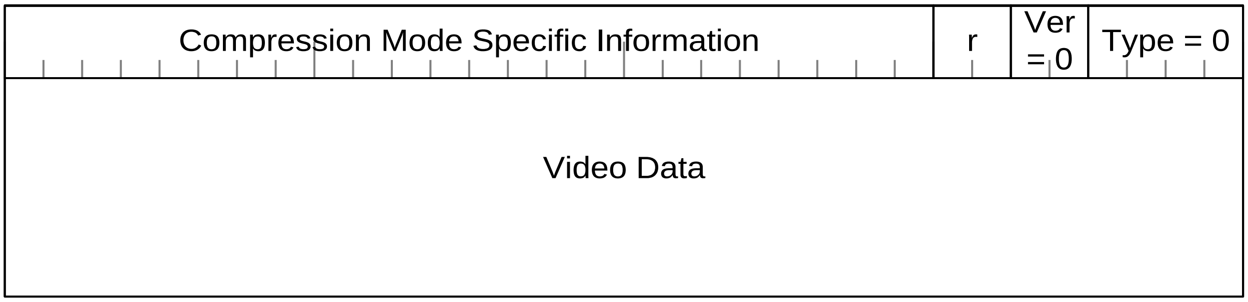

Figure 8 - Video Source Packet

The *Type* field shall be set to 0_{16} to indicate that this is a Video Data Source Packet

The *Ver* field shall be set to 0_{16} to indicate that this is version 0 of the Video Data Source Packet.

The *Compression Mode Specific Information* field has a different definition for each of the compression modes. Refer to Table 2 for a list of defined Compression Modes. The *Compression Mode Specific Information* for compression modes 0_{16}, 1_{16}, 2_{16} and FF_{16} are detailed in sections 5.4.2.1, 5.4.2.2, 5.4.2.3 and 5.4.2.4 respectively.

The *Video Data* field definition is determined by a combination of video mode, compression mode and color space. The reference to the applicable definition of the formatting of the *Video Data* field is given in Table 5 below.

Table 5 - References for Video Data Definition

Compression Mode	Color Space	Video Mode	Reference to Video Data definition
0_{16}	0_{16}	All defined except FF_{16}	See 5.4.2.5 and 5.4.2.9
0_{16}	1_{16}	All defined except FF_{16}	see 5.4.2.5 and 5.4.2.10
0_{16}	2_{16}	All defined except FF_{16}	see 5.4.2.5 and 5.4.2.11
0_{16}	3_{16}	All defined except FF_{16}	see 5.4.2.5 and 5.4.2.12
0_{16}	FF_{16}	All defined except FF_{16}	see 5.4.2.5 and 5.4.2.13
0_{16}	All defined	FF_{16}	see 5.4.2.5 and 5.4.2.14
1_{16}	All defined	All defined	see 5.4.2.6
2_{16}	All defined	All defined	see 5.4.2.7
FF_{16}	All defined	All defined	see 5.4.2.8

5.4.2.1 Compression Mode 0_{16} Type Specific Information

Figure 9 shows the definition and arrangement of the fields within the *Type Specific Information* field for Video Data source packets being transmitted in compression mode 0_{16}.

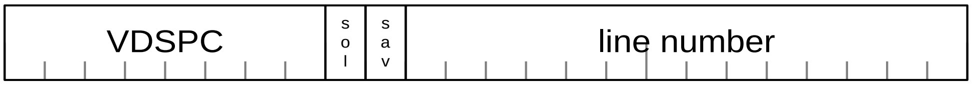

Figure 9 - Compression Mode 0_{16} Specific Information

The *VDSPC* (Video Data Source Packet Count) field contains a running count of Video Data Source Packets. It is incremented by 1 for every Video Data Source Packet created by the transmitter. When a stream commences the first Video Data Source Packet created has a VDSPC of 0. Since VDSPC is only 8 bits wide the value placed in VDSPC is the lowest 8 bits of the running count.

The *sol* (start of line) field is set in the source packet that contains the first pixel of a video line. There is no requirement that the start of a video line be coincident with the start of an IEEE-1394 isochronous packet.

The *sav* (start of active video) field is set in the source packet that contains the first pixel of the first active video line of each frame (progressive modes) or of each field (interlace modes). This field can only be set in a source packet that has *sol* set. There is no requirement that the start of an active video line be coincident with the start of an IEEE-1394 isochronous packet.

The *line number* field is the line on which the video data in the source packet resides as defined by the video specification given in Table 1 of the given video mode. If no line numbering is defined by the video specification the *line number* field shall be a sequential count of the lines in a frame starting with the first line that is transmitted having a *line number* of zero.

5.4.2.2 Compression Mode 1_{16} Type Specific Information

The *Type Specific Information* field definition for this compression mode is defined in the applicable specification document referenced in Table 2.

5.4.2.3 Compression Mode 2_{16} Type Specific Information

The *Type Specific Information* field definition for this compression mode is defined in the applicable specification document referenced in Table 2.

5.4.2.4 Compression Mode FF_{16} Type Specific Information

The *Type Specific Information* field definition for compression mode FF_{16} is beyond the scope of this specification.

5.4.2.5 Compression Mode 0_{16} Video Data Packetization

For transmission of Compression Mode 0_{16} data the video data that is transmitted is the active horizontal pixels for both the active lines and the lines of the vertical blanking period (unless they do not exist). The first pixel of a video line shall always be the first pixel in a source packet and each video line shall always fill an integer number of source packets. The number of pixels in each source packet is dependent upon the video mode and color space and is detailed in Table 1. An IEEE-1394 isochronous channel that is used to transmit data according to this specification shall only transmit a single stream of video per 1394 isochronous channel.

5.4.2.6 Compression Mode 1_{16} Video Data Packetization

The video data packetization for this compression mode is defined in the applicable specification document referenced in Table 2.

5.4.2.7 Compression Mode 2_{16} Video Data Packetization

The video data packetization for this compression mode is defined in the applicable specification document referenced in Table 2.

5.4.2.8 Compression Mode FF_{16} Video Data Packetization

The video data packetization for the this compression mode is beyond the scope of this specification.

5.4.2.9 Color Space 0_{16} Video Data Packetization – YUV 4:2:2 8 bits/sample

There is a Y sample for each pixel. Each U and V sample is used for two pixels. The subscript *n* denotes the pixel number within the source packet.

U_0	Y_0	V_0	Y_1
U_2	Y_2	V_2	Y_3
U_4	Y_4	V_4	Y_5
...	...	...	...
...	...	...	...
...	...	...	...
U_{n-5}	Y_{n-5}	V_{n-5}	Y_{n-4}
U_{n-3}	Y_{n-3}	V_{n-3}	Y_{n-2}
U_{n-1}	Y_{n-1}	V_{n-1}	Y_n

Figure 10- Color Space 0_{16} Video Data Packetization

5.4.2.10 Color Space 1_{16} Video Data Packetization – YUV 4:4:4 8 bits/sample

Each pixel contains a Y, U and V sample. The arrangement of the samples is shown in Figure 11. The subscript *n* denotes the pixel number within the source packet.

U_0	Y_0	V_0	U_1
Y_1	V_1	U_2	Y_2
V_2	U_3	Y_3	V_3
...	...	...	...
...	...	...	...
...	...	...	...
U_{n-3}	Y_{n-3}	V_{n-3}	U_{n-2}
Y_{n-2}	V_{n-2}	U_{n-1}	Y_{n-1}
V_{n-1}	U_n	Y_n	V_n

Figure 11 - Color Space 1_{16} Video Data Packetization

5.4.2.11 Color Space 2_{16} Video Data Packetization – RGB 8 bits/sample

Each pixel contains a R, G and B sample. The arrangement of the samples is shown in Figure 12. The subscript *n* denotes the pixel number within the source packet.

R_0	G_0	B_0	R_1
G_1	B_1	R_2	G_2
B_2	R_3	G_3	B_3
...	...	...	...
...	...	...	...
...	...	...	...
R_{n-3}	G_{n-3}	B_{n-3}	R_{n-2}
G_{n-2}	B_{n-2}	R_{n-1}	G_{n-1}
B_{n-1}	R_n	G_n	B_n

Figure 12 - Color Space 2_{16} Video Data Packetization

5.4.2.12 Color Space 3_{16} Video Data Packetization – RGB 6 bits/sample

The video data packetization for this color space is only applied for Compression Mode 2_{16} and is defined in the applicable specification document referenced in Table 2.

5.4.2.13 Color Space FF_{16} Video Data Packetization

The video data packetization for the this color space is beyond the scope of this specification.

5.4.2.14 Video Mode FF_{16} Video Data Packetization

The video data packetization for the this video mode is beyond the scope of this specification.

5.4.3 Type 1_{16} Source Packet – Stream Information and Metadata (SIM) Source Packet

A SIM source packet is transmitted exactly once per video frame for all compression modes. This type of source packet contains six data-types. Figure 13 shows the definition and arrangement of the fields of the Stream Information and Metadata Source Packet.

reserved	Total Length	reserved	Ver = 1	Type = 1
reserved	Stream Info Length (bytes)	Stream Info Data (variable length field, zero or more bytes)		
reserved	Auxiliary Data Length (bytes)	Auxiliary Data (variable length field, zero or more bytes)		
reserved	Video Mode Specific Info Length (bytes)	Video Mode Specific Info Data (variable length field, zero or more bytes)		
reserved	Compression Mode Specific Info Length (bytes)	Compression Mode Specific Info Data (variable length field, zero or more bytes)		
reserved	Color Space Specific Info Length (bytes)	Color Space Specific Info Data (variable length field, zero or more bytes)		
reserved	Vendor Specific Info Length (bytes)	Vendor Specific Info Data (variable length field, zero or more bytes)		
reserved	Copy Control Info Length (bytes)	Copy Control Info Data (variable length field, zero or more bytes)		

Figure 13 - Stream Information and Metadata Source Packet

For transmission of Compression Mode 0_{16} only the SIM source packet shall denote the start a video frame, i.e. the next video data source packet shall be the start of the first line of video data of a frame.

The seven data-types included in the SIM source packet are:

- Stream Information
- Auxiliary Data
- Video Mode Specific Information
- Compression Mode Specific Information
- Color Space Specific Information
- Vendor Specific Information
- Copy Control Information

Each data-type consists of a six bit reserved field, a ten bit length and a variable number of data bytes. The six bit reserved field and the ten bit length shall be present for all data-types in all SIM source packets. If the length field is zero then no data bytes are included in the SIM source packet for that data-type. Annex E provides an example of a typical SIM source packet.

The *Type* field shall be set to 1_{16} to indicate that this is a SIM source packet

The *Ver* field shall be set to 1_{16} to indicate that this is version 1 of the SIM source packet. This version is backward compatible with version 0. All future versions shall be backward compatible, they shall only add additional data-types in a manner consistent with those already defined. A node that receives a SIM source packet with a version number later than that which it supports should ignore the additional data-types.

The *Total Length* field indicates the number of valid bytes in the *Source Packet Data* portion of the source packet. Its value is the summation of the seven length fields plus 14 bytes for the length and reserved fields themselves. The *Total Length* shall be less than or equal to (*source packet size* – 4) where *source packet size* is determined by the combination of video, compression and color space modes. Since there are a number of different source packet sizes it is unlikely that the *Total Length* will be equal to (*source packet size* – 4) therefore all remaining bytes in the source packet beyond those indicated by *Total Length* are reserved and shall be set to 00_{16}.

5.4.3.1 Stream Information

The stream information data type shall be included in all SIM source packets. The definition of the fields in this data-type is shown in Figure 14 below.

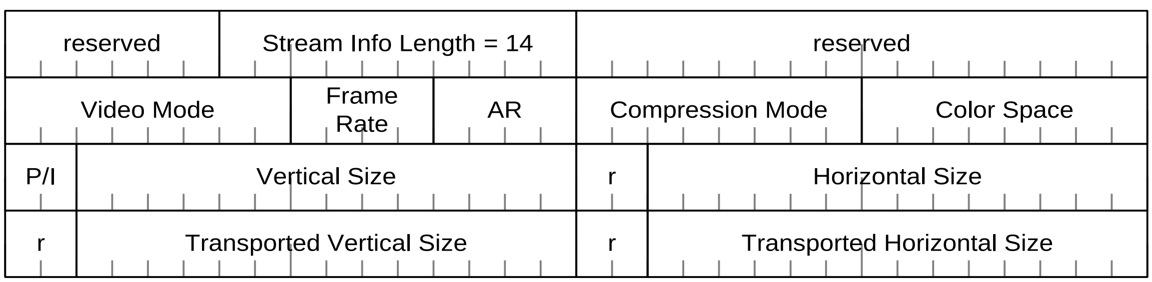

Figure 14 - Stream Information Field Definitions

The *Stream Info Length* field shall be set to 14 (E_{16}) to indicate that there are 14 bytes of stream information.

The *Video Mode* field is encoded as defined in Table 1. For all video modes except mode FF_{16} the values of *Frame Rate*, *P/I*, *Vertical Size*, *Horizontal Size*, *Transported Vertical Size* and *Transported Horizontal Size* are fixed and are given in Annex C. When video mode FF_{16} is used these fields shall be set to the applicable value from the tables below. Where no value matches the required parameter the “No Information” value shall be used, this value has all the bits set to 1_2. The action taken by the sink node when receiving a field set to “No Information” is beyond the scope of this specification.

The *Frame Rate* field is encoded as defined in Table 6 below.

Table 6 - Frame Rate

Frame Rate	Frame Rate Value (frames per second)
0_{16}	Reserved for future specification
1_{16}	24/1.001 (23.976…)
2_{16}	24
3_{16}	25
4_{16}	30/1.001 (29.97…)
5_{16}	30
6_{16}	50
7_{16}	60/1.001 (59.94…)
8_{16}	60
9_{16}	15
F_{16}	No information
others	Reserved for future specification

The *AR* field is described in Table 7 below.

Table 7 - Aspect Ratio

AR	Aspect Ratio
2_{16}	4:3
3_{16}	16:9
4_{16}	2.21:1
F_{16}	No information
others	Reserved for future specification

The *P/I* field indicates whether the video stream is Progressive or Interlaced. It is encoded as defined in Table 8 below.

Table 8 - Progressive/Interlace mode

P/I	Progressive/Interlace information
0_{16}	Stream contains Interlaced video frames
1_{16}	Stream contains Progressive video frames
2_{16}	Reserved for future specification
3_{16}	No Information

The *Vertical Size* gives the value in lines of the vertical resolution of the video stream. This figure includes the vertical blanking if appropriate.

The *Horizontal Size* gives the value in pixels (not samples) of the horizontal resolution of the video stream. This figure includes the horizontal blanking if appropriate.

The *Transported Vertical Size* gives the value in lines of the vertical resolution of the video stream that is actually transported. For all video modes currently defined, except FF_{16}, every line is transported and so this figure includes any vertical blanking. Whether vertical blanking is transported for video mode FF_{16} is beyond the scope of this specification.

The *Transported Horizontal Size* gives the value in pixels (not samples) of the horizontal resolution of the video stream that is actually transported. For all video modes currently defined, except FF_{16}, only the active portion of each video lines is transported and so this figure excludes any horizontal blanking. Whether horizontal blanking is transported for video mode FF_{16} is beyond the scope of this specification.

5.4.3.2 Auxiliary Information

The auxiliary information data type should be included in all SIM source packets when transporting video data for which the auxiliary data is available. The definition of the fields in this data-type is shown in Figure 15 below.

reserved						Auxiliary Data Length (bits 9:8) = 0_2	
Auxiliary Data Length (bits 7:0) = 14							
TC VAL	TC tens of frames			TC units of frames			
Drop	TC tens of seconds			TC units of seconds			
r	TC tens of minutes			TC units of minutes			
TC tens of hours				TC units of hours			
RD VAL	DS	tens of time zone		units of time zone			
r		tens of day		units of day			
day of week			tens of month	units of month			
tens of year				units of year			
thousands of year				hundreds of year			
RT VAL	RT tens of frames			RT units of frames			
r	RT tens of seconds			RT units of seconds			
r	RT tens of minutes			RT units of minutes			
r		RT tens of hours		RT units of hours			
reserved							

Figure 15 - Auxiliary Data Field Definitions

The *Auxiliary Data Length* field shall be set to 14 (E_{16}) to indicate that there are 14 bytes of auxiliary data.

The remaining fields are defined below. The acquisition of the data contained in these fields is beyond the scope of this specification. The usage of the information contained in these fields by the sink device is implementation dependent.

TC VAL: A 1 if the Time-Code fields contain valid information.

TC tens of frames: The time-code tens of frames value in BCD.

TC units of frames: The time-code units of frames value in BCD.

Drop: A 1 if the time-code is based on drop-mode counting.

TC tens of seconds: The time-code tens of seconds value in BCD.

TC units of seconds: The time-code units of seconds value in BCD.

TC tens of minutes: The time-code tens of minutes value in BCD.

TC units of minutes: The time-code units of minutes value in BCD.

TC tens of hours: The time-code tens of hours value in BCD.

TC units of hours: The time-code units of hours value in BCD.

RD VAL: A 1 if the Record-Date fields contain valid information.

DS: A 1 if the record-time is based on daylight-savings-time.

tens of time zone : The record-time tens of time-zone value in BCD.

units of time zone: The record-time units of time-zone value in BCD.

tens of day: The record-date tens of day value in BCD.

units of day: The record-date units of day value in BCD.

day of week: The day of week, 0 (Sunday) through 6 (Saturday).

tens of Month: The record-date tens of months value in BCD.

units of month: The record-date units of month value in BCD.

tens of year: The record-date tens of year value in BCD.

units of year: The record-date units of year value in BCD.

hundreds of year: The record-date hundreds of year value in BCD.

thousands of year: The record-date thousands of year value in BCD.

RT VAL: A 1 if the Record-Time fields contain valid information.

RT tens of frames: The record-time tens of frames value in BCD.

RT units of frames: The record-time units of frames value in BCD.

RT tens of seconds: The record-time tens of seconds value in BCD.

RT units of seconds: The record-time units of seconds value in BCD.

RT tens of minutes: The record-time tens of minutes value in BCD.

RT units of minutes: The record-time units of minutes value in BCD.

RT tens of hours: The record-time tens of hours value in BCD.

RT units of hours: The record-time units of hours value in BCD.

5.4.3.3 Video Mode Specific Information

For all video modes except FF_{16} there are no data fields currently defined for this data-type. Therefore *Video Mode Specific Info Length* shall be 00_{16} and no data bytes shall be present in the data field of this data-type.

For video mode FF_{16} the first 3 bytes following the length field shall be the OUI of the vendor that has specified the video mode specific information data-type structure that is being transported. Therefore *Video Mode Specific Info Length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

5.4.3.4 Compression Mode Specific Information

For compression modes 0_{16} there are no data fields currently defined for this data-type. Therefore *Compression Mode Specific Info Length* shall be 00_{16} and no data bytes shall be present in the data field of this data-type.

For compression modes 1_{16} and 2_{16} the data-type length and structure is defined in the applicable specification document referenced in Table 2.

For compression mode FF_{16} the first 3 bytes following the length field shall be the OUI of the vendor that has specified the compression mode specific information data-type structure that is being transported. Therefore *Compression Mode Specific Info Length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

5.4.3.5 Color Space Specific Information

For all color space modes except FF_{16} there are no data fields currently defined for this data-type. Therefore *Color Space Specific Info Length* shall be 00_{16} and no data bytes shall be present in the data field of this data-type.

For color space FF_{16} the first 3 bytes following the length field shall be the OUI of the vendor that has specified the color space specific information data-type structure that is being transported. Therefore *Color Space Specific Info Length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

5.4.3.6 Vendor Specific Information

If this field is unused the *Vendor Specific Info Length* shall be 00_{16} and no data bytes shall be present in the data field of this data-type.

If this field is used the first 3 bytes following the length field shall be the OUI of the vendor that has implemented the device. In this case the *Vendor Specific Info Length* shall be at least $03_{16.}$ The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

5.4.3.7 Copy Control Information

The Copy Control Information block shall be included in all SIM source packets.

If there is no CCI to convey the *Copy Control Info Length* shall be 00_{16} and no data bytes shall be present in the data field of this data-type.

If this field is used the first 3 bytes following the length field shall be the OUI of the vendor that has defined the copy control information. In this case the *Copy Control Info Length* shall be at least 03_{16}. The remaining fields of this data-type structure are defined by the vendor indicated by the value of OUI.

Annex H contains the definition of a CCI descriptor structure that has been defined by the 1394 Trade Association.

5.4.4 Type 2_{16} Source Packet – Audio Source Packet

The specification of the transportation of audio data within the same 1394 stream as video data is a likely update to this specification. Until such time as this has been specified it is recommended that audio data be transmitted as a separate 1394 stream as described by IEC 61883-6, [B6]. Source packet type 2_{16} has been reserved for this purpose.

A suggested method for synchronizing the video and audio on two separate 1394 channels is given in Annex B. The actual method of audio/video synchronization is implementation dependent.

5.5 Packet Transmission Method

5.5.1 Packet Transmission for Compression Mode 0_{16}

5.5.1.1 Overview of transmission

When a non-empty packet is ready to be transmitted, the transmitter shall transmit it within the most recent isochronous cycle initiated by a cycle start packet. The behavior of packet transmission depends on the definition of the condition in which "a non-empty packet is ready to be transmitted." There are two situations in which this condition is defined:

1. A non-empty packet being ready for transmission is defined to be true if one or more Video Data source packets have arrived within an isochronous cycle. This transmission method is called Non-Blocking Transmission, and is described in section 5.5.1.2.

2. The condition of "a non-empty packet is ready to be transmitted" can also be defined as true when a fixed number of data blocks have arrived. This transmission method is called Blocking Transmission, and is described in section 5.5.1.3.

Since a there is no source packet header (SPH) there is only one time stamp and this is in the SYT field of the CIP header. If a CIP contains multiple Video Data source packets, it is necessary to specify which source packet corresponds to the time stamp.

Since the stream contains a SIM Source Packet at the frequency of once per frame a mechanism is required to ensure that the SYT time stamp is generated at a regular interval of Video Data Source Packets. The *VDSPC* (Video Data Source Packet Count) field in Video Data Source Packet is used for this purpose.

The transmitter prepares the time stamp for the Video Data Source Packet, which meets this condition:

mod(VDSPC, SYT_INTERVAL) = 0

where:

VDSPC is the running count of transmitted video data source packets;

SYT_INTERVAL denotes the number of video data source packets between two successive valid SYT timestamps, which includes one of the video data source packets with a valid SYT. For example, if there are three video data source packets between two valid SYT timestamps, then the SYT_INTERVAL would be 4. The SYT_INTERVAL is dependent upon the video mode and color space used. The values of SYT_INTERVAL are given in Table 1.

The receiver knows the video data source packet for which the SYT timestamp is valid since it is the source packet whose VDSPC solve the following equation:

mod(VDSPC, SYT_INTERVAL) = 0

The receiver is responsible for estimating the timing of data blocks between valid time stamps. The method of timing estimation is implementation-dependent.

The SYT timestamp specifies the presentation time of the video data source packet at the receiver. A receiver must have the capability of presenting events at the time specified by the transmitter.

The TRANSFER_DELAY value is 875µs, which accommodates the maximum latency time of isochronous packet transmission through an arbitrated short bus reset, worst case packetization delay and provides scope for encryption/decryption that may be required. The derivation of the TRANSFER_DELAY value is given in Annex G.

The transmitter quantizes the timing of the "synchronization clock", for instance the rising edge of the video clock, by referring to its own CYCLE_TIME. It transmits the sum of this cycle time and TRANSFER_DELAY in the SYT field of the CIP. If the timing information is not required for a CIP the SYT shall indicate the "No Information" code, i.e. $FFFF_{16}$.

5.5.1.2 Non-Blocking transmission method

The transmitter shall construct a packet in every nominal isochronous cycle. Each packet shall comply with the following constraint:

0 <= N <= MAX_VDSP

where

N is the number of video data source packets in the isochronous packet;

MAX_VDSP is given in Table 1.

In normal operation the transmitter shall not transmit events late, and shall not transmit packets early. The

resulting conditions may be expressed as follows:

Packet_arrival_time_L <= Event_arrival_time[0] + TRANSFER_DELAY

Event_arrival_time[N-1] <= Packet_arrival_time_F

where

Packet_arrival_time_F is the time (measured in µs) when the first bit of the isochronous packet arrives at the receiver;

Packet_arrival_time_L is the time (measured in µs) when the last bit of the isochronous packet arrives at the receiver;

Event_arrival_time[M] is the time (measured in µs) of the arrival at the transmitter of video data source packet M of the isochronous packet. The first video data source packet of the isochronous packet has M=0;

Since MAX_VDSP is always greater than or equal to SYT_INTERVAL for all video modes there will only ever be a maximum of one SYT timestamp in a video data source packet.

5.5.1.3 Blocking transmission method

The blocking method may be used by a transmitter, which has only the ability to transmit isochronous packets of the same size. In order to indicate "no data", the transmitter may transmit an isochronous packet containing just a CIP header or a special nonempty packet which has the ND (NO DATA) flag set to 1_2 in its FDF field and has the same size of dummy data as a nonempty packet.

The transmitter shall construct a packet that contains no more than MAX_VDSP + 1 source packets.

For blocking, the duration of the successive Video Data source packets in a CIP must be added to the default TRANSFER_DELAY.

If a CIP contains N Video Data source packets, then:

ACTUAL_TRANSFER_DELAY >= TRANSFER_DELAY + (N * VDSP_DURATION)

where

TRANSFER_DELAY is the latency of transmission of 875µs as given in section 5.5.1.1;

VDSP_DURATION is the duration of a Video Data source packet, it is dependent upon video mode and color space. The VDSP_DURATION for each video mode is given in Annex C. The total delay for MAX_VDSP video source packets is also given in Annex C.

It is recommended that the receiver have sufficient extra buffer to compensate for the delay in receiving data due to blocking transmission's characteristics. The actual value of extra delay required, and hence additional buffer size required, depends upon the video modes and color spaces supported by the receiving node.

5.5.1.4 Bandwidth Allocation

Prior to stream transmission the appropriate bandwidth must be reserved at the Isochronous Resource Manager.

The calculation of Bandwidth Allocation Units for this purpose uses the following equations:

Maximum number of bytes per packet = ((MAX_VDSP + 1) * Source Packet Size) + 20 [A]

Maximum number of quadlets per packet = (Maximum number of bytes per packet / 4)

Bandwidth Allocation Units = Maximum number of quadlets per packet * SPEED_FACTOR

SPEED_FACTOR takes the following values:

- For S100 SPEED_FACTOR = 16

- For S200 SPEED_FACTOR = 8
- For S400 SPEED_FACTOR = 4
- For S800 SPEED_FACTOR = 2
- For S1600 SPEED_FACTOR = 1
- For S3200 SPEED_FACTOR = 0.5 (This may result in a fractional result for the Bandwidth Allocation Units, in this circumstance the value shall be rounded up to the next integer value)

The addition of 1 to the MAX_VDSP is required to guarantee sufficient bandwidth for the SIM source packet that is sent once per frame. In the normal non-blocking transmission method, fewer than MAX_VDSP Video Data source packets will be transmitted in each packet, for some video modes this may allow sufficient bandwidth for the transmission of the SIM source packet without any extra bandwidth being allocated such that equation [A] becomes:

Maximum number of bytes per packet = (MAX_VDSP * Source Packet Size) + 20 [B]

For Color Space 0_{16} the following video modes require equation [A]:

- Modes 49, 59, 60 and 61

For Color Spaces 1_{16} and 2_{16} the following video modes require equation [A]:

- Mode 61 only

For modes that do not require equation [A] for Bandwidth Allocation Unit calculation it is recommended that they do use equation [A] since in the event of lost opportunities to transmit a packet (such as a cycle start packet drop after a bus reset) a transmitter can catch up by transmitting up to MAX_VDSP events in one or more of the subsequent packets. Also, since the SIM source packet is only sent once per frame the bandwidth allocation calculated in equation [A] provides sufficient allocated bandwidth such that one additional Video Data source packet over and above MAX_VDSP can be sent per isochronous packet for most isochronous packets without violating the allocated bandwidth. Whilst this additional bandwidth will be unused most of the time it provides the extra bandwidth needed to catch up with transmission sooner.

The Bandwidth Allocation Units have been calculated for all modes using equation [A] and are listed in Annex C.

5.5.2 Packet Transmission for Compression Mode 1_{16}

The transmission timing parameters for this compression mode are defined in the applicable specification document referenced in Table 2.

5.5.3 Packet Transmission for Compression Mode 2_{16}

The transmission timing parameters for this compression mode are defined in the applicable specification document referenced in Table 2.

5.5.4 Packet Transmission for Compression Mode FF_{16}

The definition of the transmission timing parameters for this compression mode is beyond the scope of this specification.

Annex A
(Informative)

Bibliography

[B1] IEEE Std 1212-2001, Standard for a Control and Status Registers (CSR) Architecture for microcomputer buses

[B2] IEEE Std 1394-1995, Standard for a High Performance Serial Bus

[B3] IEEE Std 1394a-2000, Standard for a High Performance Serial Bus—Amendment 1

[B4] IEEE Std 1394b-2002, Standard for a High Performance Serial Bus—Amendment 2

[B5] 1394 Trade Association 2004006, AV/C Digital Interface Command Set General Specification Version 4.2

[B6] IEC 61883, Consumer Audio/Video Equipment – Digital Interface Parts 1 to 6

[B7] ITU-R BT.601-5 1995, Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios

[B8] ITU-R BT.656-4 1998, Interfaces for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of recommendation ITU-R BT.601

[B9] IEEE Std 1394.1-2004, Standard for High Performance Serial Bus Bridges

[B10] Oxford Semiconductor Light Codec Specification, Version 1.0

[B11] Fujitsu SmartCODEC Specification, Version 1.0

Annex B
(Informative)

Audio/Video Synchronization

Logical association of audio and video streams

There is sufficient capability in the AV/C specifications, [B5], to identify 1394 isochronous streams that are associated.

Time synchronization of audio and video streams

Time synchronization may be achieved using the following principles:

A device that supports this specification and also sources 61883-6 audio streams should ensure that both streams are synchronized with respect to presentation timestamp, i.e. audio and video data that arrived coincidently at the transmitter should be presented at the receiver coincidently.

The TRANSFER_DELAY for these streams is different, with TRANSFER_DELAY given by this specification being greater than that given by IEC 61883-6, [B6]. Therefore the source should delay the IEC 61883-6 data prior to entering the 1394 system by a time equal to:

(TRANSFER_DELAY for 601 Over 1394) – (TRANSFER_DELAY for IEC 61883-6)

This buffering should be done in the audio clock domain. It must be noted that the IEC 61883-6 specification provides the capability to vary the 61883-6 TRANSFER_DELAY, a transmitter that allows this functionality will have to vary this additional delay accordingly. It is be permissible to adjust the IEC 61883-6 TRANSFER_DELAY to a value greater than that used by this specification, in this situation the video data would be delayed in the video clock domain by the difference in the TRANSFER_DELAY values.

The delay in the system after the presentation time may be different between the audio and video path. The receiver should ensure that this delay is the same, and if this is not possible then the audio delay should be greater than the video delay to avoid lip-sync issues but by no more than about 10ms.

Annex C
(Normative)

Additional Video Mode Parameters

This annex contains the additional parameters associated with the video modes defined in Table 1. It includes the fixed parameters that are used in the SIM source packet.

Note: Due to the width of the tables there are two tables in this annex.

Table 9 - Additional Video Mode Parameters, 1 of 2

Video mode	Transported Vertical Size[1]	Transported Horizontal Size[1,4]	Vertical Size[1]	Horizontal Size[1,4]	Vertical Blanking	Horizontal Blanking	P/I[1]	Frame Rate[1]	Minimum Bus Speed Comp Mode 0_{16} Color Space 0_{16}	Minimum Bus Speed Comp Mode 0_{16} Color Spaces 1_{16} & 2_{16}
0	500	640	500	800	20	160	1_{16}	7_{16}	S800	S1600[2]
1	500	640	500	800	20	160	1_{16}	8_{16}	S800	S1600[2]
2	263	720	263	858	23	138	1_{16}	7_{16}	S400	S800
3	263	720	263	858	23	138	1_{16}	8_{16}	S400	S800
4	522	720	522	858	42	138	1_{16}	7_{16}	S800	S1600
5	522	720	522	858	42	138	1_{16}	8_{16}	S800	S1600
6	525	720	525	858	45	138	0_{16}	4_{16}	S400	S800
7	525	720	525	858	45	138	0_{16}	5_{16}	S400	S800
8	750	1280	750	1650	30	370	1_{16}	7_{16}	S1600	S3200
9	750	1280	750	1650	30	370	1_{16}	8_{16}	S1600	S3200
10	525	1440	525	1716	45	276	1_{16}	7_{16}	S1600	S3200
11	525	1440	525	1716	45	276	1_{16}	8_{16}	S1600	S3200
12	1125	1920	1125	2200	45	280	1_{16}	7_{16}	>[3]	>[3]
13	1125	1920	1125	2200	45	280	1_{16}	8_{16}	>[3]	>[3]
14	1125	1920	1125	2200	45	280	0_{16}	4_{16}	S3200	S3200
15	1125	1920	1125	2200	45	280	0_{16}	5_{16}	S3200	S3200
16	314	720	314	864	26	144	1_{16}	6_{16}	S400	S800
17	625	720	625	864	49	144	1_{16}	6_{16}	S800	S1600
18	625	720	625	864	49	144	0_{16}	3_{16}	S400	S800
19	750	1280	750	1980	30	700	1_{16}	6_{16}	S1600	S3200
20	625	1440	625	1728	49	288	1_{16}	6_{16}	S1600	S3200

Video mode	Transported Vertical Size[1]	Transported Horizontal Size[1,4]	Vertical Size[1]	Horizontal Size[1,4]	Vertical Blanking	Horizontal Blanking	P/I[1]	Frame Rate[1]	Minimum Bus Speed Comp Mode 0_{16} Color Space 0_{16}	Minimum Bus Speed Comp Mode 0_{16} Color Spaces 1_{16} & 2_{16}
21	525	960	525	1144	45	184	0_{16}	4_{16}	S800[2]	S800
22	625	960	625	1152	49	192	0_{16}	3_{16}	S800[2]	S800
23	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-
25	1125	1920	1125	2750	45	830	1_{16}	1_{16}	S1600	S3200
26	1125	1920	1125	2750	45	830	1_{16}	2_{16}	S1600	S3200
27	1125	1920	1125	2640	45	720	1_{16}	3_{16}	S1600	S3200
28	1125	1920	1125	2200	45	280	1_{16}	4_{16}	S3200	S3200
29	1125	1920	1125	2200	45	280	1_{16}	5_{16}	S3200	S3200
30	1125	1920	1125	2640	45	720	1_{16}	6_{16}	S3200	>[3]
31	1125	1920	1125	2640	45	720	0_{16}	3_{16}	S1600	S3200
32	288	352	288	352	0	0	1_{16}	3_{16}	S200[2]	S200
33	240	352	240	352	0	0	1_{16}	5_{16}	S200[2]	S200
34	144	176	144	176	0	0	1_{16}	3_{16}	S100	S100
35	120	176	120	176	0	0	1_{16}	5_{16}	S100	S100
36	288	352	288	352	0	0	1_{16}	4_{16}	S200	S400[2]
37	144	176	144	176	0	0	1_{16}	4_{16}	S100	S100
38	234	480	234	480	0	0	1_{16}	4_{16}	S200[2]	S200
39	234	480	234	480	0	0	1_{16}	9_{16}	S100	S200[2]
40	480	800	480	800	0	0	1_{16}	9_{16}	S400[2]	S400
41	240	320	240	320	0	0	1_{16}	9_{16}	S100	S100
42	240	320	240	320	0	0	1_{16}	5_{16}	S100	S200[2]
43	240	320	240	320	0	0	1_{16}	8_{16}	S200	S400[2]
44	480	640	480	640	0	0	1_{16}	9_{16}	S200	S400[2]
45	480	640	480	640	0	0	1_{16}	5_{16}	S400	S800[2]
46	480	640	480	640	0	0	1_{16}	8_{16}	S800	S800
47	600	800	600	800	0	0	1_{16}	9_{16}	S400	S400
48	600	800	600	800	0	0	1_{16}	5_{16}	S800[2]	S800
49	600	800	600	800	0	0	1_{16}	8_{16}	S800	S1600
50	768	1024	768	1024	0	0	1_{16}	9_{16}	S400	S800
51	768	1024	768	1024	0	0	1_{16}	5_{16}	S800	S1600

Video mode	**Transported Vertical Size**[1]	**Transported Horizontal Size**[1,4]	**Vertical Size**[1]	**Horizontal Size**[1,4]	**Vertical Blanking**	**Horizontal Blanking**	**P/I**[1]	**Frame Rate**[1]	**Minimum Bus Speed Comp Mode 0_{16} Color Space 0_{16}**	**Minimum Bus Speed Comp Mode 0_{16} Color Spaces 1_{16} & 2_{16}**
52	768	1024	768	1024	0	0	1_{16}	8_{16}	S1600	S3200
53	960	1280	960	1280	0	0	1_{16}	9_{16}	S800	S1600[2]
54	960	1280	960	1280	0	0	1_{16}	5_{16}	S1600	S1600
55	960	1280	960	1280	0	0	1_{16}	8_{16}	S3200	S3200
56	1024	1280	1024	1280	0	0	1_{16}	9_{16}	S800	S1600[2]
57	1024	1280	1024	1280	0	0	1_{16}	5_{16}	S1600	S3200[2]
58	1024	1280	1024	1280	0	0	1_{16}	8_{16}	S3200	S3200
59	1200	1600	1200	1600	0	0	1_{16}	9_{16}	S800	S1600
60	1200	1600	1200	1600	0	0	1_{16}	5_{16}	S1600	S3200
61	1200	1600	1200	1600	0	0	1_{16}	8_{16}	S3200	>
62	480	800	480	800	0	0	1_{16}	5_{16}	S400	S800
63	480	800	480	800	0	0	1_{16}	8_{16}	S800	S1600
255	Other Video Mode	-	-	-	-	-	-	-	-	-
Others	Reserved for future specification	-	-	-	-	-	-	-	-	-

[1] The values represent the encodings that should be used in the SIM source packet.

[2] These modes can be sent at the next lower bus speed if equation [B] is used to calculate Bandwidth Allocation Units in section 5.5.1.4.

[3] This video mode requires bus speeds greater than S3200 and so must be compressed if it is to be transported until such time as bus speeds increase beyond S3200.

[4] Horizontal blanking can be calculated as: (Horizontal Size – Transported Horizontal Size)

Table 10 - Additional Video Mode Parameters, 2 of 2

Video Mode	Lines per SYT Interval, all Color spaces	Duration of a source packet for Color Space 0 (us)	Duration of an isochronous packet for Color Space 0 (us)	Duration of a source packet for Color Space 1 & 2 (us)	Duration of an isochronous packet (us) for Color Space 1 & 2	Bandwidth Allocation Units[1] at minimum allowed speed for Color Space 0	Bandwidth Allocation Units[1] at minimum allowed speed for Color Space 1 & 2
0	4	16.69	133.52	11.13	133.56	2908	2098
1	4	16.67	133.36	11.12	133.44	2908	2098
2	2	31.72	126.88	21.15	126.9	3640	2544
3	2	31.69	126.76	21.13	126.78	3640	2544
4	4	15.99	127.92	10.66	127.92	3268	2358
5	4	15.97	127.76	10.65	127.8	3268	2358
6	2	31.78	127.12	21.19	127.14	3640	2544
7	2	31.75	127	21.17	127.02	3640	2544
8	6	5.57	128.11	5.57	128.11	3869	2895
9	6	5.56	127.88	5.56	127.88	3869	2895
10	4	7.95	127.2	5.3	127.2	3082	2265
11	4	7.94	127.04	5.3	127.2	3082	2265
12	9	3.71	126.14	2.48	126.48	0	0
13	9	3.71	126.14	2.47	125.97	0	0
14	5	7.42	126.14	4.95	128.7	2172	3256
15	5	7.41	125.97	4.94	128.44	2172	3256
16	2	31.85	127.4	21.24	127.44	3640	2544
17	4	16	128	10.67	128.04	3268	2358
18	2	32	128	21.34	128.04	3640	2544
19	5	6.67	126.73	6.67	126.73	3225	2413
20	4	8	128	5.34	128.16	3082	2265
21	2	21.19	127.14	15.89	127.12	2264	3268
22	2	21.34	128.04	16	128	2264	3268
23	-	0	0	0	0	0	0
24	-	0	0	0	0	0	0
25	4	9.27	129.78	6.18	129.78	3620	2654
26	4	9.26	129.64	6.18	129.78	3620	2654

Video Mode	Lines per SYT Interval, all Color spaces	Duration of a source packet for Color Space 0 (us)	Duration of an isochronous packet for Color Space 0 (us)	Duration of a source packet for Color Space 1 & 2 (us)	Duration of an isochronous packet (us) for Color Space 1 & 2	Bandwidth Allocation Units[1] at minimum allowed speed for Color Space 0	Bandwidth Allocation Units[1] at minimum allowed speed for Color Space 1 & 2
27	4	8.89	133.35	5.93	130.46	3861	2774
28	5	7.42	126.14	4.95	128.7	2172	3256
29	5	7.41	125.97	4.94	128.44	2172	3256
30	8	4.45	129.05	2.97	127.71	3618	0
31	4	8.89	133.35	5.93	130.46	3861	2774
32	1	69.45	138.9	69.45	138.9	2176	3232
33	1	69.45	138.9	69.45	138.9	2176	3232
34	1	138.89	138.89	138.89	138.89	1520	2224
35	1	138.89	138.89	138.89	138.89	1520	2224
36	3	57.93	173.79	57.93	173.79	2888	2148
37	1	115.86	231.72	115.86	231.72	2240	3296
38	1	47.54	142.62	35.65	142.6	2632	3680
39	2	94.97	189.94	71.23	142.46	3968	2224
40	1	69.45	138.9	46.3	138.9	2432	3236
41	1	138.89	138.89	69.45	138.9	2672	3008
42	1	69.45	138.9	34.73	138.92	3968	2480
43	2	34.73	138.92	17.37	138.96	3280	2216
44	1	69.45	138.9	46.3	138.9	3904	2596
45	2	34.73	138.92	23.15	138.9	3240	2264
46	4	17.37	138.96	11.58	127.38	2908	3874
47	4	55.56	166.68	37.04	148.16	3236	4040
48	3	27.78	138.9	18.52	129.64	2422	3226
49	5	13.89	125.01	9.26	129.64	4030	3020
50	2	21.71	130.26	21.71	130.26	3632	2712
51	3	10.86	130.32	10.86	130.32	3364	2514
52	6	5.43	130.32	5.43	130.32	3230	2415
53	2	17.37	138.96	17.37	138.96	2908	2174
54	4	8.69	130.35	8.69	130.35	2581	3861
55	8	4.35	126.15	4.35	126.15	2418	3618

Video Mode	Lines per SYT Interval, all Color spaces	Duration of a source packet for Color Space 0 (us)	Duration of an isochronous packet for Color Space 0 (us)	Duration of a source packet for Color Space 1 & 2 (us)	Duration of an isochronous packet (us) for Color Space 1 & 2	Bandwidth Allocation Units[1] at minimum allowed speed for Color Space 0	Bandwidth Allocation Units[1] at minimum allowed speed for Color Space 1 & 2
56	2	16.28	130.24	16.28	130.24	2908	2174
57	4	8.14	130.24	8.14	130.24	2742	2051
58	8	4.07	126.17	4.07	126.17	2579	3859
59	3	13.89	125.01	11.12	133.44	4030	3138
60	5	6.95	125.1	5.56	127.88	3824	2895
61	9	3.48	125.28	2.78	125.1	3721	0
62	2	34.73	138.92	23.15	138.9	4040	2824
63	4	17.37	138.96	11.58	138.96	3628	2618
255	-	-	-	-	-	-	-
others	-	-	-	-	-	-	-

[1] The bandwidth allocation units have calculated using the minimum bus speed and equation [A] given in section 5.5.1.4. The maximum value of bandwidth allocation units available on an IEEE-1394 bus is 4915, [B2]. Some modes are limited to a certain speed due to the packet size rather than the availability of bandwidth allocation units.

Color Space 3 is defined for use with Compression Mode 2 only. Refer to the documentation referenced in Table 2 for the applicable additional video parameters.

Annex D
(Informative)

Using IEC 61883-1 Plug Control Registers beyond S400

IEC 61883-1 [B6] defines a mechanism for configuring isochronous streams up to S400. IEEE Std 1394.1-2004, Standard for High Performance Serial Bus Bridges [B9] Annex F defines a mechanism for extending this configuration for streams up to S3200.

Annex E
(Normative)
Compliance Annex

It is expected that a device that implements this specification will be an AV/C specification, [B5], compliant device.

It is expected that the AV/C STREAM FORMAT command will be extended to allow the identification and selection of video, compression and color space modes. Implementation dependent means for the identification and selection of video, compression and color space modes is permitted.

A source device that supports this specification shall support at least one video mode. Video mode FF_{16} is a valid mode in this context.

A source device that supports this specification shall support at least one compression mode. Compression mode FF_{16} is a valid mode in this context.

A source device that supports this specification shall support at least one color space. Color Space FF_{16} is a valid color space in this context.

A sink device that that supports this specification and outputs the video stream, whether directly or indirectly, to a display shall support at least one video mode. Video mode FF_{16} is a valid mode in this context.

A sink device that that supports this specification and outputs the video stream, whether directly or indirectly, to a display shall support at least one compression mode. Compression mode FF_{16} is a valid mode in this context.

A sink device that that supports this specification and outputs the video stream, whether directly or indirectly, to a display shall support at least one color space. Color Space FF_{16} is a valid color space in this context.

A sink device that that supports this specification but does not output the display, e.g. a device used for recording or stream monitoring purposes, need only recognize the format of the isochronous stream and its source packets and process them according to its implementation dependent requirements.

This specification defines many different video, compression and color space modes. Different deployment situations will require different levels of functionality, for example it is likely that the automotive industry and the consumer electronic industry will require the support of different video modes. Therefore no particular video mode, compression mode or color space is mandated by this specification. It is left to implementers to choose the level of support they deem suitable for their application. Implementers are encouraged to produce implementation guidelines to provide consistency and interoperability in any given application space.

Annex F
(Informative)

Typical SIM Source Packet

The SIM source packet shown below is a typical example.

If video mode is 0, compression mode is 0 and color space is zero then *source packet size* is 644 bytes (taken from Table 1). Therefore there would be (644 – (56+4)) reserved bytes at the end of the source packet, i.e. 584 reserved bytes.

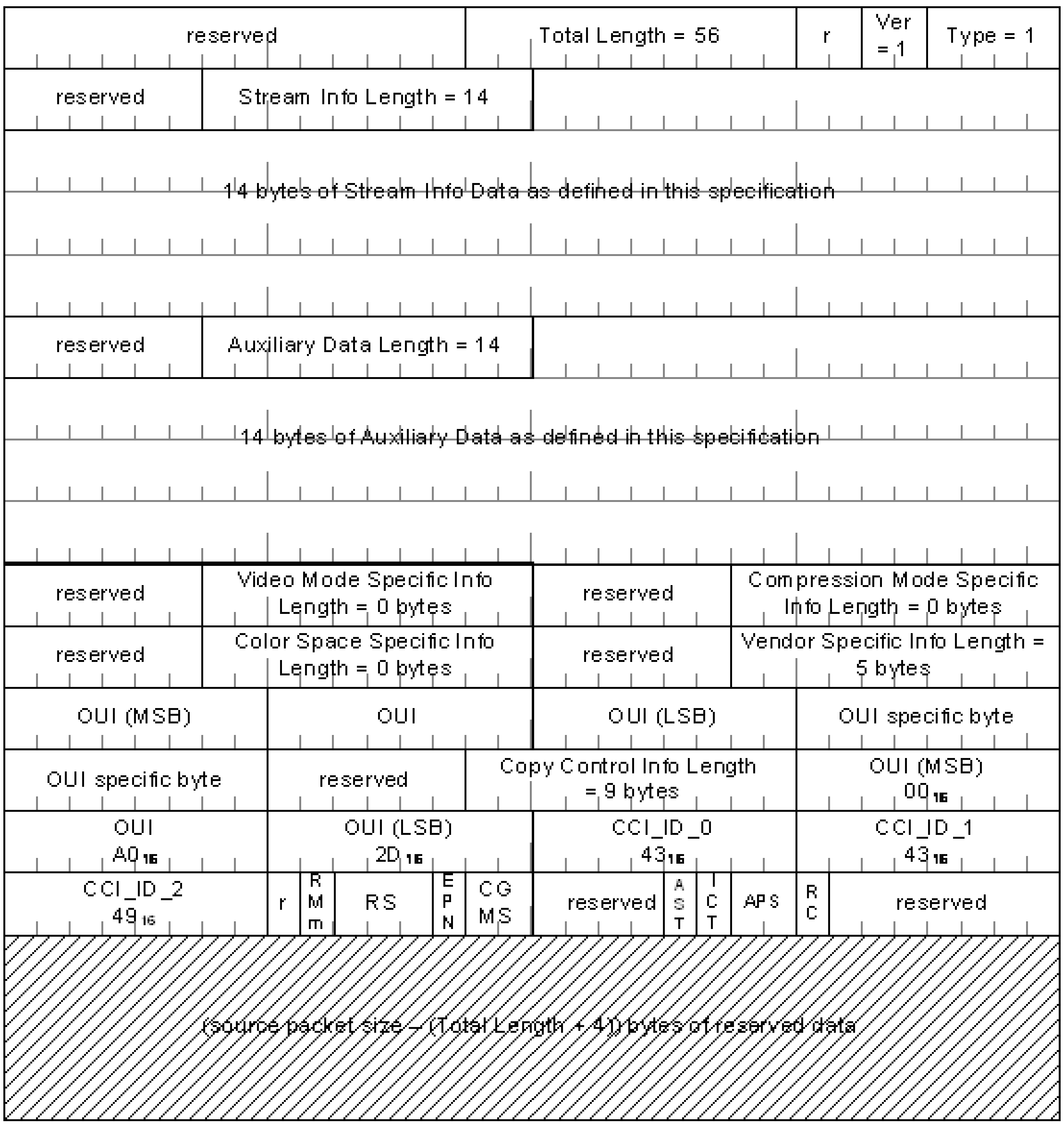

Figure 16 - Typical SIM Source Packet

Annex G
(Informative)

Derivation of TRANSFER_DELAY

The derivation of the TRANSFER_DELAY parameter is given below:

1394 worst case transmission delay	358µs
Allowance for Encryption (after packetisation)	125µs
Allowance for Decryption (before depacketisation)	125µs
Decision point to transmit the packet just missed	125µs
Slowest 601 Packetisation (time to fill 1 source packet)	140µs
Allowance for 1394 clock discrepancy at source & sink	25ns
Total	**873.025µs**

This is rounded up to 875µs so that it is exactly 7 isochronous periods thus requiring only a simple addition to the cycle timer to generate the SYT value.

The allowance for encryption/decryption is to provide scope for implementation flexibility.

The 601 packetization delay is typically much lower than 140µs but this is the worst case.

Annex H
(Normative)

1394 Trade Association CCI Descriptor Block

The structure of the 1394TA CCI descriptor block is given in the Figure 17. The definition of the setting of fields other than OUI and CCI_ID to particular values is beyond the scope of this specification.

reserved	Copy Control Info Length = 9 bytes	OUI (MSB) 00_{16}	OUI $A0_{16}$
OUI (LSB) $2D_{16}$	CCI_ID_0 43_{16}	CCI_ID_1 43_{16}	CCI_ID_2 49_{16}

r	RMm	RS	EPN	CGMS	reserved	AST	ICT	APS	RC	reserved

Figure 17 - CCI Descriptor Block

OUI – This is the three byte 1394TA OUI, $00A02D_{16}$.

CCI_ID_x – This is the three byte 1394TA designated identifier for this CCI descriptor block, 434349_{16}.

RMm – Retention Move mode is used in combination with CGMS to define the Move function or the Retention function. The combination of values is described below:

RMm	CGMS	Modes
0_2	10_2	Move mode
0_2	11_2	Retention mode
Other Combinations		Neither move nor retention mode

RS – Retention State is encoded as defined below:

RS	Retention Time
000_2	Forever
001_2	1 week
010_2	2 days
011_2	1 day
100_2	12 hours
101_2	6 hours
110_2	3 hours
111_2	90 minutes

EPN – Encryption Plus Non-assertion is encoded as defined below:

EPN	Meaning
0_2	EPN asserted
1_2	EPN not asserted

CGMS – CGMS is encoded as defined below:

CGMS	Meaning
00_2	Copy free
01_2	No more copies
10_2	Copy one generation
11_2	Copy never

RC – Redistribution Control is as defined below:

RC	Meaning
0_2	Technological control of consumer redistribution is not signaled
1_2	Technological control of consumer redistribution is signaled

AST – Analog Sunset Token as defined below

AST	Meaning
0_2	AST asserted
1_2	AST unasserted

ICT – Image Constraint Token is encoded as described below:

ICT	Meaning
0_2	High Definition Analog Output in the form of Constrained Image
1_2	High Definition Analog Output in High Definition Analog Form

ACS – ACS is encoded as described below:

ACS	Meaning
00_2	Copy free
01_2	APS is on : Type 1 (AGC)
10_2	APS is on : Type 2 (AGC + 2L Colorstripe)
11_2	APS is on : Type 3 (AGC + 4L Colorstripe)

NOTE – This annex may, at some point in the future, move to a separate 1394 Trade Association specification document.