SMPTE ST 334-2:2015
Revision of
SMPTE 334-2-2007

SMPTE STANDARD

Caption Distribution Packet (CDP) Definition

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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 its Standards Operations Manual.

SMPTE ST 334-2 was prepared by Technology Committee 24TB in cooperation with the Consumer Electronics Association (CEA).

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

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

The following suite of SMPTE Engineering Documents defines the carriage of Closed-Caption data in production and distribution television systems:

SMPTE ST 334-1	Vertical Ancillary Data Mapping of Caption Data and Other Related Data
SMPTE ST 334-2	Caption Distribution Packet (CDP) Definition
SMPTE RP 2007	Closed-Caption CDP and "Grand Alliance" Serial Interfaces for DTV
SMPTE EG 43	System Implementation of CEA-708 and CEA-608 Closed Captioning and Program-Related Data

This standard was originally Section 11 of CEA-708-B with amendments specified by CEB-10-A. CEA has transferred copyright on this material to SMPTE and it appears here on the basis of that agreement. The material in this document has undergone editorial corrections beyond simple structural adjustments.

1 Scope

This standard defines the structure of the Caption Distribution Packet (CDP). A CDP may contain time code, CEA-608 data, CEA-708 closed captioning data, and ATSC A/65 closed caption service information.

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 recommended practice. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this recommended practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ATSC A/65:2013, Program and System Information Protocol for Terrestrial Broadcast and Cable

CEA-608-E (2008), Line 21[1] Data Services

CEA-708-E (2013), Digital Television (DTV) Closed-Captioning

SMPTE ST 12-1:2014, Time and Control Code

[1] CEA 608-D refers to line 21 data services on fields 1 and 2. Using current numbering notation such as SMPTE ST 170 and SMPTE ST 125 there is no line 21 on field two, The more recent number schemes define line 21 on field two as line 284.

4 Overview (Informative)

The process of creating and delivering closed captions for ATSC Digital Television (or "DTV") involves authoring captions into a representation which represents the frame accurate captioning intentions, rendering the intentions into the CEA-708 caption syntax, transport of this CEA-708 data via storage and/or streaming media to the point of emission, and then, for example, packaging the CEA-708 data into the MPEG-2 video picture user data as specified in ATSC A/53. During this process the caption data must be kept synchronized to the picture and sound.

It is also necessary to create, transport, and include the caption service information in order, for example, to create the Caption Service Descriptor that is carried in the PMT and EIT tables in the MPEG-2 emission transport stream as specified in ATSC A/65. Along the distribution chain, the CEA-708 captioning data may be rendered and displayed for quality control purposes.

This section describes the structure of the captioning content package, consisting of a defined sequence of bytes, which may carry the following:

a) time code;

b) CEA-708 caption data;

c) CEA-608 data;

d) caption service information to form the caption service descriptor; and/or

e) sequence counts to detect discontinuities in the stream of caption data packets.

While all of these constructs are not required to be present in any given CDP, it is expected that over the length of a program or commercial, all constructs probably will be present at least once. In transports where CDPs are bound to video, time code might not be present at all.

4.1 Frame Rates

The transport of closed captioning information over the ATSC emission system involves packaging the closed captioning data into the MPEG-2 video picture user data area. In order to do this the captioning data must be packaged at the same frame rate as that used by the video encoder. Rendering the captioning data into a particular frame rate is done prior to or during creation of the CDP. Those engaging in captions authoring may or may not be aware of the delivery frame rate utilized by the video encoder.

If the video encoder encodes at a frame rate that differs from the frame rate of the CDP, the captioning data must be re-framed. Since the video encoder is ultimately responsible for the determination of the encoded picture frame rate, in most cases this re-framing is done in the video encoder.

From the point of view of captioning, frame rates which differ by 0.1% may be considered identical. For example, if picture and captions are rendered at a 30-Hz frame rate, they may both be played at 29.97 Hz without any reframing of the caption data. As long as captions are delivered at the same rate as the picture, and this rate does not change by more than 0.1 %, no reframing is needed.

4.2 Time Code

The CDP may carry a time code which may be derived from SMPTE ST 12M (VITC or LTC) taken from the original video source. Carriage of a time code provides an important tool to allow captions to be kept properly synchronized with pictures. The picture, sound, and caption data elements may flow through differing paths to the emission encoding and multiplexing equipment. The inclusion of time code within each type of element makes it possible for a caption server to resynchronize the caption data to the associated video.

4.3 Caption Data

This is comprised of CEA-708 captions and CEA-608 data.

If a CDP stream is intended to carry only caption service information to a PSIP table generator, then this data might not be present. However, a CDP stream typically conveys both closed caption data and closed caption service information in parallel for use by both the emission encoder and to the PSIP table generator.

4.4 Caption Service Information

To reduce the data rate required to carry the CDP stream or to signal more than 15 services, caption service information may be spread over a sequence of CDPs. The receiver of the CDP stream shall be able to collect service information from this sequence of CDPs, and shall be able to detect when the service information has changed.

Two general types of change may be envisioned. The first is a controlled change, where the generator of the CDP stream may insert an explicit indication that service information has changed, or that a service has been added or dropped. The second is an uncontrolled change that could be caused by a switch from one CDP stream to another CDP stream. In the case of an unsupervised switch, there can be no controlled signalling of the change, yet the receiver of the CDP stream shall be able to easily detect that a change has occurred.

In the event that a CDP stream is switched, the switch could result in a stream that has an incomplete, incorrect, or damaged caption descriptor that should be discarded (and not transmitted to a consumer DTV receiver). To provide the ability to detect stream switches, 16-bit sequence counts are included in the CDP header and footer. If the received sequence counts do not increment smoothly, a switch or error has occurred.

5 CDP Detailed Specification

The "top to bottom" order of syntax elements in the table shall correspond to a "left to right", or "most significant to least significant" order within the byte which contains those syntax elements. Syntax elements containing a numerical value represented by more than 8 bits shall be transmitted with the most significant byte first.

Notes:

1 The bit and byte order is consistent with the "uimsbf" indication in CEA-708. It is the reverse of the bit and byte order in SMPTE serial digital interfaces.

2 The transmission order in the format column of the CDP syntax tables is correct for an ATSC signal, but does not imply the bit-order for transmission for any other particular interface.

5.1 General Syntax

The overall syntax of the CDP shall be as defined in Table 1.

Table 1 – CDP General Syntax

Syntax	Comment
cdp() {	Caption Distribution Packet (CDP)
cdp_header();	Required
time_code_section();	Optional
ccdata_section();	Optional
ccsvcinfo_section();	Optional
cdp_footer();	Required
}	

The CDP shall contain one header section and one footer section. The CDP may contain one time code section, one cc data section, and one cc service information section. The CDP shall not contain more than one of each of these sections. These sections shall be multiplexed in the order shown in Table 1. It is possible to extend the CDP to include additional sections. Any sections that are defined in the future shall be placed just prior to the cdp_footer. Any newly defined sections would begin with a unique identifier byte, and contain a length code. The syntax that a new section would follow is shown in Section 5.7. Equipment that receives the CDP shall skip over sections that begin with an unknown id byte, by means of the length byte.

5.2 cdp_header

The CDP header is a required element, and shall be present in all CDP's. The CDP header syntax shall be as indicated in Table 2. The length of the cdp_header structure is fixed at 7 bytes.

Table 2 – CDP Header Syntax

Syntax	Bits	Format
cdp_header() {		
cdp_identifier	16	uimsbf
cdp_length	8	uimsbf
cdp_frame_rate	4	uimsbf
Reserved	4	'1111'
time_code_present	1	Bit
ccdata_present	1	Bit
svcinfo_present	1	Bit
svc_info_start	1	Bit
svc_info_change	1	Bit
svc_info_complete	1	Bit
caption_service_active	1	Bit
Reserved	1	'1'
cdp_hdr_sequence_cntr	16	uimsbf
}		

cdp_identifier – This is a 16-bit value set to 0x9669. All CDPs begin with this value.

cdp_length – This 8-bit integer shall indicate the number of bytes of data in the entire CDP, from the first byte of the CDP_identifier, to the packet checksum, inclusive.

cdp_frame_rate – This field shall indicate the frame rate of the CDP stream. It shall be coded as indicated in Table 3. Also shown are the values of cc_count and the number of cc_data bytes that shall be included in each packet at each frame rate.

Table 3 – CDP Frame Rate

cdp_frame_rate	frame rate	cc_count	CEA-608 cc_data bytes	CEA-708 cc_data bytes
'0000'	Forbidden			
'0001'	24000÷1001 (~23.976)	25	4/6	46/44
'0010'	24	25	4/6	46/44
'0011'	25	24	4	44
'0100'	30000÷1001 (~29.97)	20	4	36
'0101'	30	20	4	36
'0110'	50	12	2	22
'0111'	60000÷1001 (~59.94)	10	2	18
'1000'	60	10	2	18
. . .	Reserved			
'1111'	Reserved			

Note: There is no practical difference between the pairs of frame rates which differ by 0.1%. Captions and pictures rendered at one rate may be played 0.1% fast or slow, with no practical impact on presentation to the viewer, as the number of bytes per frame does not change.

time_code_present – This bit shall be set to '1' for CDPs which include the time code section. Otherwise this bit shall be set to '0'.

Note: Time code carriage in the CDP is optional and may not be required with transport methods where the CDP is directly associated with video frames.

cc_data_present – This bit shall be set to '1' for CDPs which include the cc data section. Otherwise this bit shall be set to '0'.

svcinfo_present – This bit shall be set to '1' for CDPs which include the service information section. Otherwise this bit shall be set to '0'.

svc_info_start – This bit shall be set to '1' to indicate that the current packet begins a complete set of service information. Otherwise this bit shall be set to '0'. This bit shall also be set to '0' if this CDP does not contain a service information section. This bit is duplicated in the cc service information section. The value of this bit shall not be different from the value of the svc_info_start bit in the cc service information section. See Section 5.5.

svc_info_change – This bit shall be set to '1' beginning with the packet which begins a complete set of service information to indicate that the service information in the following set of information has changed from the previously delivered set of information. Otherwise this bit shall be set to '0'. This bit shall also be set to '0' if this CDP does not contain a service information section. This bit is duplicated in the cc service information section. The value of this bit shall not be different from the value of the svc_info_change bit in the cc service information section. See Section 5.5.

svc_info_complete – This bit shall be set to '1' to indicate that the current packet concludes a full set of service information. Otherwise this bit shall be set to '0'. This bit shall also be set to '0' if this CDP does not contain a service information section. This bit is duplicated in the cc service information section. The value of this bit shall not be different from the value of the svc_info_complete bit in the cc service information section. See Section 5.5.

caption_active – This bit shall be set to '1' to indicate that the CDP stream is conveying an active caption service. This bit shall be set to '0' in the case that the CDP stream is not conveying an active caption service.

cdp_hdr_sequence_cntr – This is an unsigned 16-bit integer which shall be set to a value of 1 plus the value of cdp_hdr_sequence_cntr in the previous CDP. The value of this counter shall wrap from 65535 to 0. For the first CDP in a sequence of CDPs, cdp_hdr_sequence_cntr may be set to any 16-bit value.

5.3 time_code_section

The time code section is optional in a CDP. Time code syntax is indicated in Table 4. This section shall be composed of a section id byte and 4 bytes of time code information. The length of the time code section shall be 5 bytes. Inclusion of this section may help assure that synchronization between captions and pictures is maintained throughout the distribution chain and into the final emission transport stream.

Table 4 – CDP Time Code Section Syntax

Syntax	Bits	Format	Comment
time_code_section() {			
time_code_section_id	8	0x71	
Reserved	2	'11'	
tc_10hrs	2	uimsbf	Tens of hours
tc_1hrs	4	uimsbf	Units of hours
Reserved	1	'1'	
tc_10min	3	uimsbf	Tens of minutes
tc_1min	4	uimsbf	Units of minutes
tc_field_flag	1	uimsbf	see text
tc_10sec	3	uimsbf	Tens of seconds
tc_1sec	4	uimsbf	Units of seconds
drop_frame_flag	1	uimsbf	Drop frame flag
zero	1	'0'	
tc_10fr	2	uimsbf	Tens of frames
tc_1fr	4	uimsbf	Units of frames
}			

Note: Implementers ought to verify consistency of field sizes versus SMPTE ST 12-1 time code syntax.

time_code_section_id – This 8-bit field shall have the value of 0x71.

tc_field_flag – For interlaced pictures, the value of this flag shall be '0' for interlace first field, and shall be '1' for interlace second field. In the case of frame rates equal to or greater than 50 Hz, the frame count shall be interpreted as follows. The frame count shall be doubled, and the tc_field_flag shall be interpreted as an adder to the indicated frame count. The frame count shall be interpreted as (2 * frame + flag). I.e. the frame:flag sequence shall be 0:0, 0:1, 1:0, 1:1, 2:0, 2:1, etc., and this frame:flag sequence shall be interpreted as progressive frame counts 0, 1, 2, 3, 4, 5, etc.

Note: In the case of Digital television definitions, there is only field 0 and field 1. The field numbering convention is as follows: Analog field 1 = Digital field 0, and Analog field 2 = Digital field 1. Readers are cautioned that, as this document is based upon original analog terminology, some text may appear in conflict with current nomenclature.

drop_frame_flag – This flag shall be set to '1' when the time code count is being drop-frame compensated. When the count is not drop-frame compensated, this flag bit shall be set to '0'.

5.4 ccdata_section

The ccdata_section should normally be present. If present, the ccdata_section syntax shall be as indicated in Table 5.

This section shall be composed of a section id byte, a count value cc_count, and cc_count groups of 3 bytes. The total length of this section is 2 + 3 * cc_count bytes. The value of cc_count shall be dependent on the frame rate that is indicated in the CDP_header.

The actual caption data is carried in the cc_data_1 and cc_data_2 fields. The value of cc_count is found in CEA 708, Table 4, and provides sufficient space to carry both CEA-608 data and CEA-708 caption data. The CEA-708 caption data may represent up to 16 caption services. If either the CEA-608 data or CEA-708 caption data is not present, the space is still allocated and filled with null (0x0) values. The CEA-608 data shall come first in this section, followed by the CEA-708 caption data.

Table 5 – CDP CC Data Section Syntax

Syntax	Bits	Format	Comment
ccdata_section() {			
ccdata_id	8	0x72	Indicates ccdata_section
marker_bits	3	'111'	
cc_count	5	uimsbf	number of cc constructs in section
for (i = 0 ; i < cc_count ; i++) {			
marker_bits	5	'1111 1'	
cc_valid	1	bslbf	
cc_type	2	bslbf	
cc_data_1	8	bslbf	
cc_data_2	8	bslbf	
}			
}			

ccdata_id – This 8-bit field shall have the value 0x72.

cc_count – This 5-bit field shall indicate the number of repetitions of the following 3-byte structure carried in this section, and shall have the value appropriate to the frame rate as indicated in Table 3.

cc_valid – This bit shall be as defined in CEA-708.

cc_type – This 2-bit field shall be as defined in CEA-708.

cc_data_1 – This byte shall be as defined in CEA-708.

cc_data_2 – This byte shall be as defined in CEA-708.

5.5 ccsvcinfo_section

The ccsvcinfo section carries information for the Caption Service Descriptor. This section shall be composed of a section id byte, indication of controlled changes in the service information, an indication of the number of services that are described in the current packet, and caption service information. The ccsvcinfo_section syntax shall be as described in Table 6.

The set of caption service information in one packet may contain from 0 to 15 different caption services. A complete set of service information may be included in the current packet, or may be distributed over a number of packets.

Note: ATSC A/65 constrains the total number of simultaneous services to a maximum of 16.

The total length of this section is 2 + 7 * svc_count bytes.

Tale 6 – CC Service Information Syntax

Syntax	Bits	Format	Comment
ccsvcinfo_section() {			
ccsvcinfo_id	8	0x73	Indicates ccsvcinfo section
reserved	1	'1'	
svc_info_start	1	bit	
svc_info_change	1	bit	
svc_info_complete	1	bit	
svc_count	4	uimsbf	number of svc constructs in section
for (i = 0 ; i < svc_count ; i++) {			
reserved	1	'1'	
csn_size	1	bit	
If (csn_size == 1) {			
reserved	1	'1'	
caption_service_number	5	uimsbf	
} else			
caption_service_number	6	uimsbf	
svc_data_byte_1	8	bslbf	
svc_data_byte_2	8	bslbf	
svc_data_byte_3	8	bslbf	
svc_data_byte_4	8	bslbf	
svc_data_byte_5	8	bslbf	
svc_data_byte_6	8	bslbf	
}			
}			

svc_info_start – This bit shall be set to '1' to indicate that the current packet begins a complete set of service information. Otherwise this bit shall be set to '0'. This bit shall be duplicated in the CDP header section. The value of this bit shall not be different from the value of the svc_info_start bit in the CDP header section.

svc_info_change – This bit shall be set to '1' beginning with the packet which begins a complete set of service information to indicate that the service information in the following set of information has changed from the previously delivered set of information. Otherwise, this bit shall be set to '0'. This bit is duplicated in the CDP header section. The value of this bit shall not be different from the value of the svc_info_change bit in the CDP header section.

svc_info_complete – This bit shall be set to '1' to indicate that the current packet concludes a full set of service information. Otherwise this bit shall be set to '0'. This bit is duplicated in the CDP header section. The value of this bit shall not be different from the value of the svc_info_complete bit in the CDP header section.

If a single packet contains a complete set of service information, then both the svc_info_start and svc_info_end bits shall be set to '1'.

svc_count – This 4-bit field shall be set to a value equal to the number of services which have service information included in this service information section, and shall have the value 0-15 inclusive. Note: The maximum number of services signaled in a single CDP is 15.

csn_size – This 1-bit field signals the size of the caption_service_number field. The value of ‘1’ shall indicate 5-bits, and the value of ‘0’ shall indicate 6-bits.

caption_service_number – This 5- or 6-bit field carries the caption service number for the service delivered by the following 6 service data bytes. This field shall have a value of 0 when the service data applies to the line 21 (CEA-608) service, and shall have a value (between 1 – 31 or 63 inclusive, depending on the value of csn_size field) that matches the caption_service_number contained within svc_data_byte_4 when the service data applies to one of the DTVCC services.

svc_data_byte_n – These bytes shall carry the caption service data for one service, encoded as described by the caption service descriptor loop in ATSC A/65, Section 6.9.2, Table 6.26.

5.5.1 Service information signaling

The svc_info start, change, and end bits allow the receiver of a CDP stream to build up a complete set of closed caption service information from multiple packets, and to follow changes in the captioning services which are intentionally introduced by the source of the CDP stream. These changes may include beginning and ending of one or more captioning services, or an alteration in a particular service.

The svc_info section is optional in any given packet, but when present shall conform to the following.

When a service is terminated, the svc_info_change bit shall be set to '1' during the first packet containing the next full set of service information. The following full sets of service information shall not contain any service information for the terminated service. The caption service number of the terminated service shall not appear in any of the svc info sections.

When a service is changed, the svc_info_change bit shall be set to '1' beginning with the first packet containing the next full set of service information. The following full sets of service information shall contain service information representing the new service information for the changed service.

When CDP streams are switched, a discontinuity in the sequence counter (between the cdp_header() and cdp_footer() cdp_hdr_sequence_cntr fields) will typically occur, although note that it is possible (by coincidence) that the sequence counter will not be disrupted. If the switch occurs between packets, the discontinuity will occur between the previous footer value and the following header value. If the switch disrupts a packet the balance of the new packet may not be received correctly and there will not be a correct sequence number or checksum in the footer. If a CDP receiver detects that a CDP stream-switch has occurred, the CDP receiver should assume that all service information has changed and take the next full set of service information as being the current set.

Note: In this case, the svc_info_change bit will not signal a change of service information. Uncontrolled switches of CDP streams might cause disruption in the delivery of caption data and caption service information to emission equipment until correct caption service information is again sent.

5.6 cdp_footer

The CDP footer shall be present in all CDPs. The CDP footer syntax shall be as defined in Table 7. This section contains a section id byte, a sequence counter value, and a checksum. The sequence counter provides good detection ability as to whether a switch occurred during the transmission of the current CDP. The check sum provides a simple means of detecting most transmission errors. The total length of this section is 4 bytes.

Table 7 – CDP Footer Syntax

Syntax	Bits	Format	Comment
cdp_footer() {			
cdp_footer_id	8	0x74	Indicates CDP footer section
cdp_ftr_sequence_cntr	16	uimsbf	
packet_checksum	8	uimsbf	
}			

cdp_ftr_sequence_cntr – This 16-bit unsigned integer shall be set to the same value as the cdp_hdr_sequence_cntr. CDP receivers may use the values of cdp_hdr_sequence_cntr and cdp_ftr_sequence_cntr to detect that the entire packet has been received.

packet_checksum – This 8-bit field shall contain the 8-bit value necessary to make the arithmetic sum of the entire packet (first byte of cdp_identifier to packet_checksum, inclusive) modulo 256 equal zero.

5.7 future_section()

It is possible to define new sections to be included in the CDP. Any newly defined sections shall follow the syntax defined in this clause and in Table 8. All equipment that can receive the CDP shall be capable of ignoring these new sections. The length value is provided so that decoders will know how many bytes of data to skip.

Table 8 – future_section syntax

Syntax	Bits	Format	Comment
future_section() {			
future_section_id	8	uimsbf	Value in range 0x75-0xEF
length	8	uimsbf	Number of bytes of data
for (i = 0 ; i < length ; i++) {			
new_data_byte(i)	8		New data content
}			
}			

future_section_id – Sections defined in the future shall be specified to have a section id value in the range 0x75 to 0xEF, inclusive. Decoders shall be designed to skip over sections that have id values that are not understood.

length – shall be set to the number of remaining bytes in future_section().

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.

ATSC A/53, Part 4:2009, ATSC Digital Television Standard, Part 4 – MPEG-2 Video System Characteristics

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 4:2:2 and 4:4:4 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 336:2007, Data Encoding Protocol Using Key-Length-Value

SMPTE RP 207:2005, Transport of Program Description Data in Ancillary Data Packets

SMPTE RP 208:2002, Transport of VBI Packet Data in Ancillary Data Packets [Archived 2004]

SMPTE EG 43:2009, System Implementation of CEA-708 and CEA-608 Closed Captioning and Program-Related Data