SMPTE STANDARD

Carriage of DVB/SCTE VBI Data in VANC

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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Administrative Practices.

SMPTE Standard 2031 was prepared by Technology Committee D27.

Introduction

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

With the spread of "digital turnaround" systems worldwide, where MPEG-2, AVC, or VC-1 compressed video signals are returned to digital baseband before being re-compressed, the proper handling of analog VBI signals in the decoded SDI signal (as reconstructed digital samples of an analog waveform) presents issues, as the decoder's reconstructed sampling instants may not perfectly align with the downstream encoder's sampling instants. In addition, it makes little sense to artificially reconstruct digital representations of analog waveforms which themselves simply carry digital information. This Standard provides a standardized method of retrieving this VBI data from MPEG-2 TS and placing the base data into VANC.

This Standard specifies how to carry the above data types in VANC as binary values based on their root transport standards.

1 Scope

This Standard specifies how to carry the digital values resulting from defined standardized data streams carried in MPEG-2 Transport Streams (TS) as specified by either DVB/ETSI EN 301 775 or SCTE 127 (or both) as ancillary data packets in the vertical ancillary data space (VANC).

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.

3 Normative References

Normative references are external documents referenced in normative text that are indispensable to the user. Bibliographic references are references made in informative text or are those otherwise not indispensable to the user.

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

SMPTE 291M-2006, Ancillary Data Packet and Space Formatting

ETSI EN 301 775, v1.2.1 (2003-05): Specification for the Carriage of Vertical Blanking Information (VBI) Data in DVB Bitstreams

SCTE 127-2007, Carriage of Vertical Blanking Interval (VBI) Data in North American Digital Television Bitstreams

4 Definitions and Acronyms

NOT: The logical function NOT is the logical inverse of the bit or bits designated.

TS: The acronym TS is an abbreviation for (MPEG-2) Transport Stream.

UDW: The acronym UDW is an abbreviation for "user data word." See SMPTE 291M.

Uimsbf: The acronym "uimsbf" is an abbreviation for Unsigned integer, most significant bit first.

NOTE – The byte order of multi-byte uimsbf words is most significant byte first.

5 Format of VANC Data Packets

Each data packet shall comply with the format defined in SMPTE 291M for a 10-bit type 2 ancillary space (ANC) packet. It consists of the ancillary data flag (ADF), the data ID (DID), the secondary data ID (SDID), the data count (DC), the user data words (UDW), and the checksum (CS).

The UDW shall consist of the data_field( ) structures from either EN 301 775 or SCTE 127 as identified in Table 2 of this document, and shall be formatted into SMPTE 291M packets as shown in Table 1 below. The format of the VBI data contained within each data_field( ) structure may be determined from the value of data_identifier and data_unit_id (see Section 4.4.2 of EN 301 775).

The DID word shall be set to the value 41h. The SDID word shall be set to the value of 08h. DC shall be the value of data_unit_length plus three (3).

NOTE – data_unit_length is the size of the data_field( ) structure as defined in Section 4 of EN 301 775 or in Section 7 of SCTE 127.

Each VBI data_field( ) shall begin in a new VANC data packet. In the case where a single PES_data_field( ) contains multiple VBI data_field( ) types, a new VANC data packet shall be constructed for each VBI data_field( ) so contained.

Each SMPTE 291M packet shall be placed into the vertical ancillary data space (VANC) using the structure specified by Table 1 below:

Table 1 – UDW format

Syntax	No. of bits	Format
data_identifier	8	uimsbf
data_unit_id	8	uimsbf
data_unit_length	8	uimsbf
data_field()	variable	

Each byte of the TS data shall be placed into bits 0 to 7 of the 10-bit UDW, with the low order bit going into bit 0 of the 10-bit word. Bit b8 is the even parity for bits b7 through b0 and bit b9 is NOT b8.

Stuffing bytes in the EN 301 775 PES_data_field () shall be ignored.

NOTE – Each (VBI) data_field() structure contains a line_offset and field_parity value which permits correct replacement of the analog VBI waveforms if required.

6 UDW Data Format from MPEG-2 TS

NOTE – The VBI data to be carried in the UDW has been formatted into MPEG-2 PES packets as specified by sections 4.3 through 4.7 of EN 301 775, which resulted in one or more MPEG-2 TS packets in an MPEG-2 Transport Stream.

The value of data_identifier shall be in the range 0x10 to 0x1F or 0x99 as defined in Table 2 of EN 301 775 or in SCTE 127. The value of data_unit_id shall be as shown in Table 2 of this document.

The VBI data_field( ) structure which was used for each value of data_unit_id shall be as defined in Table 2. data_field( ) structures identified by data_unit_id values shown in Table 2 as "Not supported by this document," "SCTE reserved ,"or "DVB reserved" shall not be placed into VANC data packets and should be ignored.

Table 2 – data_unit_id values

data_unit_id Value	Service	data_field()[1]
0x00 to 0x01	DVB reserved	
0x02	EBU Teletext non-subtitle data	txt_data_field ()
0x03	EBU Teletext subtitle data	txt_data_field ()
0x04 to 0x7F	DVB reserved	
0x80 to 0xBF	User defined	
0xC0	Inverted Teletext	txt_data_field ()
0xC1	DVB reserved	
0xC2	DVB reserved	
0xC3	VPS	vps_data_field()
0xC4	WSS	wss_data_field ()
0xC5	CEA-608 data	closed_captioning_data_field ()
0xC6	Not supported by this document	
0xC7 to 0xCF	User defined	
0xD0	AMOL48	amol48_data_field ()
0xD1	AMOL96	amol96_data_field ()
0xD2	SCTE reserved	
0xD3	Protected 1[2]	
0xD4	Protected 2[2]	
0xD5	NABTS	nabts_data_field ()
0xD6	TVG2X	tvg2x_data_field ()
0xD7	Copy Protection	cp_data_field()
0xD8	Protected 3[2]	
0xD9	VITC	vitc_data_field ()
0xDA to 0xE5	SCTE reserved	
0xE6 to 0xFE	SCTE User defined	
0xFF	MPEG stuffing	

[1] data_field() name as specified by either EN 301 775 or SCTE 127 as applicable.

[2] In use by legacy equipment not supported by this document.

NOTE – data_unit_id values in the range 0x00 to 0xCF are DVB defined in EN 301 775, while those in the range 0xD0 to 0xFF are defined in SCTE 127.

Equipment should provide support of VBI data_field( ) structures identified by SCTE user defined data_unit_id values 0xE6 to 0xFE, provided however, that the internal structure of the VBI data_field( ) follows the pattern of those defined in SCTE 127 and the total size of the VBI data_field( ) is less than or equal to 252 bytes.

Annex A (Informative)
Bibliography

CEA-608-C (2005), Line 21 Data Services

ETSI EN 300 472 V1.3.1 (2003-05): Specification for Conveying ITU-R System B Teletext in DVB Bitstreams

Annex B (Informative)
Comments on the Preferred Location of VANC Packets

Notwithstanding the possibility that the VANC packets can be placed on any line in the vertical blanking interval, it is desirable to further constrain the location to a preferred line to improve the probability of successful passage through the production process. Many devices in the studio processing chain will pass data on only a small subset of lines in the vertical ancillary space and some devices (e.g., production switchers, digital video effects units, and video servers) might not pass VANC packets at all.

This must be taken into account in the distribution system design and choice of data location in VANC.

Some recording devices record only one line of data from the vertical blanking interval while others record up to 11 lines. These recorders select the lines that they record, or have other constraints. However, it is a common practice to set them to record three consecutive lines starting at the second line after the switching line. This constrains the available lines to the second line, the third line, and the fourth line after the switching line.

Some devices do not test for existing ANC packets and consequently overwrite existing ANC packets. These devices might insert data on any line after the switching line.

ANC packets containing VBI Data are typically embedded in the video signal late in the production process. There can be routing switchers downstream of the inserting device, and users will need to heed their capabilities.