SMPTE STANDARD

Vertical Ancillary Data Mapping of Audio Metadata — Method A

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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 2020-2 was prepared by Technology Committee A29 on Television Audio Technology.

Introduction

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

Audio data-rate reduction technologies use metadata which is multiplexed into the encoded audio bitstream, to describe the encoded audio and convey information that precisely controls downstream encoders and decoders.

Metadata is first created during program creation or mastering. It may need to be carried in the vertical ancillary data space of a digital television signal.

There are currently two methods of mapping the metadata into the vertical ancillary data space. The following suite of SMPTE standards, defines the basic characteristics of the audio metadata, its serial transport used to convey the metadata between devices, and both of the mappings into the VANC space.

SMPTE 2020-1 Format of Audio Metadata and Description of the Asynchronous Serial Bitstream Transport

SMPTE 2020-2 Vertical Ancillary Data Mapping of Audio Metadata – Method A

SMPTE 2020-3 Vertical Ancillary Data Mapping of Audio Metadata – Method B

1 Scope

This standard defines one of two methods for mapping the serial audio metadata stream related to encoded audio bitstreams into the 10-bit vertical ancillary (VANC) data space of a standard definition or high definition digital component television signal in accordance with SMPTE 291M. This VANC mapping conveys the audio metadata elements and carries information about the location of the embedded audio with which the metadata is associated.

An associated standard 2020-1 defines the DID and SDID values assigned to the VANC packets carrying this metadata, the location where packets are to be located, the basic structure of the metadata, and the asynchronous serial data transport which is used to convey the metadata from device to device (when not embedded in a video signal).

Note: An associated standard 2020-3 defines an alternate method of mapping the metadata into ancillary data packets.

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

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, Television — Ancillary Data Packet and Space Formatting

SMPTE 2020-1-2008, Format of Audio Metadata and Description of the Asynchronous Serial Bitstream Transport

4 Definitions

Byte: Throughout this standard the term 'byte' shall refer to 8-bit values unless otherwise stated.

Payload Descriptor: A one byte value that occurs at the beginning of the payload of each ancillary data packet. The descriptor byte gives information about how to interpret the remainder of the UDW.

5 Format of VANC Data Packets

5.1 UDW Format

The ancillary space packet UDW shall be a sequence of 10-bit words. The audio metadata and payload descriptor information is transmitted in bits b7 through b0 of the 10-bit data word. Bit b8 is even parity for bits b7 through b0 of the 10-bit data word, and bit b9 equals not bit b8.

5.2 Overview of the Audio Metadata Packets

The metadata frame structure is described in SMPTE 2020-1. The number of bytes in each metadata frame depends on the number of audio programs being carried, in the encoded audio signal. Because the total length of a metadata frame can be longer than 254 bytes (the maximum length allowed for a single ancillary data packet payload, minus one for the descriptor byte) it may be necessary to map the metadata frame into two separate ancillary data packets.

The UDW of each metadata packet starts with a one byte Payload Descriptor, followed by one or more bytes from the metadata frame. In this mapping, carrying the Null characters (00_h) preceding the first metadata subframe is optional. Null characters (00_h) between the first and second metadata subframes shall be carried. The audio metadata packets shall be inserted in sequence.

Where more than one metadata stream is carried in the VANC space (corresponding to the audio from multiple encoded audio signals present in a video bitstream), separate SDIDs shall be used for the ancillary data packets corresponding to each metadata stream. See § 7 of SMPTE 2020-1 for information about the SDID values.

Note: it is possible for downstream equipment to change the order of the packets. Receiving equipment should parse the individual Payload Descriptors to determine the packet order. See § 5.4 for detailed information about the contents of the Payload Descriptor.

5.3 Mapping of VANC Packets

Figures 1a and 1b show the structure of the VANC packets. If the metadata frame length (MDF) is less than or equal to 254 bytes long, the complete metadata frame shall be mapped into a single VANC packet (VANC packet 1 in Figure 1a) with Data Count 1 (DC1) given by:

DC1 = MDF +1

If the metadata frame length is more than 254 bytes, then the first part of the metadata frame shall be carried by VANC packet 1 (Fig 1a) and the remainder of the metadata frame shall be carried by VANC packet 2 (Figure 1b) with Data Count 1 and 2 (DC1 and DC2) given by:

DC1 = n +1 where n is the number of bytes from the metadata frame carried in packet 1 (a number less than or equal to 254, and chosen such that MDF-n is less than or equal to 254). Note: The division of metadata bytes between the first and second VANC packets is not specified and may be implementation-dependent.

and

DC2 = MDF – DC1 + 2

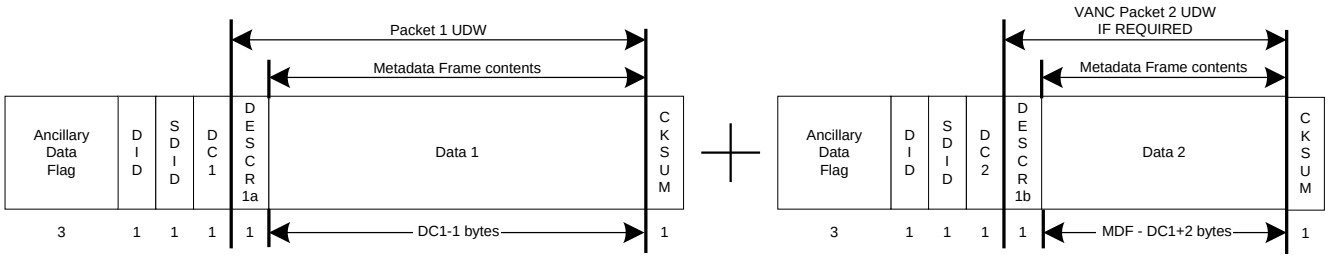

Figure 1a

Figure 1b

Figure 1 – Structure of the VANC Packets

5.4 Payload Descriptor

The Payload Descriptor is a one byte value that shall be at the beginning of the UDW. The descriptor byte gives information about how to interpret the remainder of the UDW. Table 1 summarizes the function of each bit of the Payload Descriptor byte.

Table 1 – Payload Descriptor Byte Overview

Bit Position	Name	Description
7 (MSB)	COMPATIBILITY	Set to “0”
6	Reserved	Future Use – set to “0”
5	Reserved	Future Use – set to “0”
4	VERSION (MSB)	Two bit value used to indicate syntax revision for mapping scheme - set to ”01”
3	VERSION (LSB)	
2	DOUBLE_PKT	Set to “1” when the metadata frame is carried in two VANC packets
1	SECOND_PKT	Set to “1” when this VANC packet is the second of two packets in a video frame
0 (LSB)	DUPLICATE_PKT	Set to “1” when this VANC packet duplicates the one in the previous video frame

5.4.1 Compatibility Flag

Bit 7 of the Payload Descriptor byte shall be set to logical zero. See Annex C of SMPTE 2020-1 for more information on the use of the compatibility flag.

5.4.2 Mapping Syntax Version Flags

Two bits in the descriptor byte are used to signal different versions of the mapping syntax to decoding devices. Bit 4 shall be set to logical zero and bit 3 shall be set to logical one for the mapping syntax described in this standard. Table 2 summarizes other combinations of the syntax version Flag bits.

Table 2 – Mapping Syntax Version (Bits 3 and 4)

	Bit 4	Bit 3
Reserved (legacy implementations)	0	0
Version 1 Mapping (current)	0	1
Reserved (legacy implementations)	1	0
Reserved (future assignment)	1	1

Note: Designers of VANC receivers should be aware that there are legacy implementations that use syntax versions '00' and '10'. VANC mappings done with these legacy implementations are not fully compliant with this standard.

5.4.3 Double Packet and Second Packet Flags

Metadata frames longer than 254 bytes must be encoded in two consecutive packets. This pair of packets should be inserted on the same line of the video signal. The "Double_Pkt" flag (bit 2 of the descriptor byte) in both VANC packets shall be set to logical one to signal that the metadata frame is split across two packets. The "Second_Pkt" flag (bit 1 of the descriptor byte) in the packet containing the first part of the metadata frame shall be set to logical zero. The "Second_Pkt" flag in the packet containing the second part of the metadata frame shall be set to logical one.

Table 3 – Double Packet and Second Packet Flag Bits (Bits 1 and 2)

		DOUBLE_PKT Bit 2	SECOND_PKT Bit 1
Metadata frames are contained within a single packet		0	N/A
Metadata frames are contained within a pair of packets	First packet	1	0
	Second packet	1	1

5.4.4 Duplicate Packet Flag

The audio metadata frames arrive only once per video frame for 24, 25 and 30 (29.97) frames per second video formats, and once per pair of video frames for 50 and 60 (59.94) frames per second video formats.

For video formats at 50 and 60 (59.94) frames per second rates the first video frame of the pair is the one that is most closely aligned to the beginning of the metadata frame as defined in § 5.2 of SMPTE 2020-1. The packet(s) containing the complete contents of the metadata frame shall be inserted in each video frame. When inserting the metadata into 50 and 60 frames per second video signals, the second video frame of a frame pair shall have its packets marked as "Duplicate" by setting the Duplicate_Pkt flag bit (bit 0 of the Payload Descriptor byte) to logical one.

The second function of the Duplicate_Pkt flag bit is to assist downstream devices in handling interruptions to the metadata stream. When the incoming serial metadata stream to the insertion device is interrupted, and no new metadata frame is available for insertion, the inserting device should repeat the last received metadata frame for up to 2 seconds. These repeated metadata frames shall be marked as "Duplicate" by setting the Duplicate_Pkt flag bit (bit 0 of the Payload Descriptor byte) to logical one.

Note: Receiving equipment may use packets with the Duplicate_Pkt flag bit set to logical one to assist downstream equipment with recovery from interruptions in the metadata stream. Receiving equipment may have the ability to ignore received duplicate metadata frames or not.

6 Location of the Vertical Ancillary Data

The location of the ANC data packets is defined in SMPTE 2020-1 § 8.

For interlaced systems, the ANC data packets shall be placed in the VANC area of the first field. For progressive segmented frame systems, the ANC data packets shall be placed in the VANC area of the first segment of the frame. For progressive formats, the ANC data packet shall be placed in the VANC area of each frame.

7 Levels of Operation

The level of support for the insertion or extraction of audio metadata VANC packets mapped according to this practice is SMPTE 2020-A. See SMPTE 2020-1 § 9 for more information on levels of operation.