

AVA Documents
Document Sharing Hub

SMPTE STANDARD

for Television — Mapping of Vertical Ancillary Data Packets and Extended Video Line Data into Video DIF Blocks of DV-Based 50 Mb/s DIF Stream Format



Page 1 of 19 pages

Table of contents

- 1 Scope
- 2 Normative references
- 3 General description
- 4 Division and control of the mapped space
- 5 Conversion and mapping process of VANC data packets
- 6. Extended Video Line compression and mapping coded pixels into the Compressed Macro Block data area
- 7 Mapping of VANC data and Extended Video Line into the CMBs of video DIF Blocks
- Annex A Abbreviations
- Annex B Bits from SDI VANC
- Annex C Structure of the mapping process

1 Scope

The purpose of this standard is to specify mapping of the extended video line data and the vertical ancillary data packets (VANC) present in the vertical blanking interval (VBI) space of the serial digital interface (SDI) into a 50 Mb/s digital interface format (DIF) structure defined in SMPTE 314M. Format of a VANC packet is defined in SMPTE 291M.

Mapping of the extended video line data permits an increase of video aperture of 7.5 lines in the 525 system and an aperture increase of 9 lines in the 625 system. Mapping of VANC packets provides for carriage of metadata and data essence through the 50 Mb/s DV-based DIF stream structure.

2 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 editions of the standards indicated below:

ANSI/SMPTE 259M-1997, Television — 10-Bit 4:2:2 Component and $4f_{sc}$ Composite Digital Signals — Serial Digital Interface

SMPTE 291M-1998, Television — Ancillary Data Packet and Space Formatting

SMPTE 314M-1999, Television — Data Structure for DV-Based Audio, Data and Compressed Video — 25 and 50 Mb/s

SMPTE RP 168-2002, Definition of Vertical Interval Switching Point for Synchronous Video Switching

3 General description

Metadata and data essence can be carried in the ancillary space of the SDI stream structures. These data are formatted according SMPTE 291M as ancillary packets and located in VBI space as VANC packets. VANC packets are transformed into digital ancillary packets (DANC) and then mapped into available data space of the 50 Mb/s DV-based DIF stream. The space that is used for mapping data contained in VANC packets and extended video line data is located in reserved space within a compressed macro block (CMB). Compressed macro blocks are located in multiple video DIF blocks of a DIF frame. Multiple DIF blocks of 80 bytes each form a DIF frame and are defined in the SMPTE 314M.

Due to limited CMB data space, and to achieve maximum benefit of the available space by the user, management of the data space should be established (see note 1). A specific data management method is beyond the scope of this standard.

NOTE 1 – Designers should be aware that the size of VANC data can exceed the capacity of the VAUX packs. It is the responsibility of the application to manage the mapping of VANC data into VAUX packs such that only complete VANC packets are mapped into VAUX DIF blocks. Where the VAUX capacity is exceeded, it is the responsibility of the application to manage this mapping in such a way as to minimize the effect on system performance of not mapping all of the VANC data.

Mapping schemes —

This standard specifies three similar mapping schemes. The first scheme (see 7.1) maps only a single extended video line from the end of a frame. This is either line 525 in the 525-line system or line 623 in the 625-line system. The second mapping scheme (see 7.2) maps additional information as well as the vertical ancillary data packets contained in the last video line. The third mapping scheme (see 7.3) maps an additional 7.5 lines of the 525-line system or an additional 9 lines of the 625-line system. These include the last line located at the end of a frame.

i) Extended video line aperture —

The purpose of mapping the extended video line data is to expand the video aperture of the existing 50 Mb/s DV-based compressed signal. Video aperture of this compressed signal is nominally determined by SMPTE 314M and equals 480 lines in the 525-line system and 576 lines in the 625-line system. The extended video line data mapping technique for expansion of the video aperture uses mild compression that is suitable for video signals and similar types of digital data signals, as is, for example, teletext. The method of compressing this data is defined in this standard.

ii) VANC packet mapping —

A VANC packet is located within VBI space of a SDI stream. The SDI interface operates as a 10-bit interface. However, the VANC data packets carry only 8-bit information and it is located in bits b0 to b7 of the VANC packet. The upper two bits of the VANC packet (b8 and b9) can be derived during the reverse conversion process, when the DANC packet is converted back into a VANC packet, and placed back onto the SDI interface.

Before the VANC packets are mapped into the video DIF blocks, they are converted (transformed) into a string of DANC packets. The DANC packets contain all necessary information present in the original VANC

packet, including VANC header packet information. The only information not directly mapped is the ADF (ancillary data flag) bytes and bit 9 of the CS byte (check sum).

The ancillary packet conversion/transform to a DANC packet is a direct conversion technique, fully transparent for data content, and defined in this document.

3.1 Data capacity and structure of the available data area

Figure 1 shows organization of a 50 Mb/s DIF frame as defined in SMPTE 314M. Every video DIF block that carries DV-based compressed video essence contains reserved data space used for mapped data. The data payload of a video DIF block is called the compressed macro block (CMB), as shown in figure 2.

A compressed macro block contains two data areas, each occupying the space of two bytes, marked X0, X1. The 12-bits of each CMB data area (X0, X1) is a reserved data space, and used by the mapped data. The remaining lower 4 bits of the X0, X1 data area is set to code 0110.

Capacity (see note 2) of the CMB data area for different television systems is calculated below, and represents the total available mapping space in a DIF frame:

525 /60 system
 $(12 \text{ bits} \times 2 \text{ areas} \times 135 \text{ compressed macro blocks} \times 20 \text{ DIF sequences}) / 8 \text{ bits} = 8100 \text{ bytes}$

625 /50 system
 $(12 \text{ bits} \times 2 \text{ areas} \times 135 \text{ compressed macro blocks} \times 24 \text{ DIF sequences}) / 8 \text{ bits} = 9720 \text{ bytes}$

NOTE 2 – The total data space available for mapping is allocated into two sections, where one section is dedicated to mapping of VANC packets and the other section is dedicated to mapping of extended video line data to achieve a larger video aperture.

4 Division and control of the mapped space (CMB data area)

Figure 1 also shows VAUX DIF blocks located in each of the DIF sequences. DIF frame/stream control information is located in the payload space of these VAUX DIF blocks (3 VAUX DIF blocks are contained in each DIF sequence). This control information is called VAUX source pack (VS) and is defined in SMPTE 314M.

The structure of a VAUX source pack is shown in table 1. While SMPTE 314M does not define the extension flag (EXT) control bits (EXT bits shown in SMPTE 314M are marked as “Reserved” bits for future use), these EXT bits are defined in this standard. The EXT control flag identifies which type of mapped information (VANC or extended video line video content) is located in the CMB data area as indicated in tables 2 and 3.

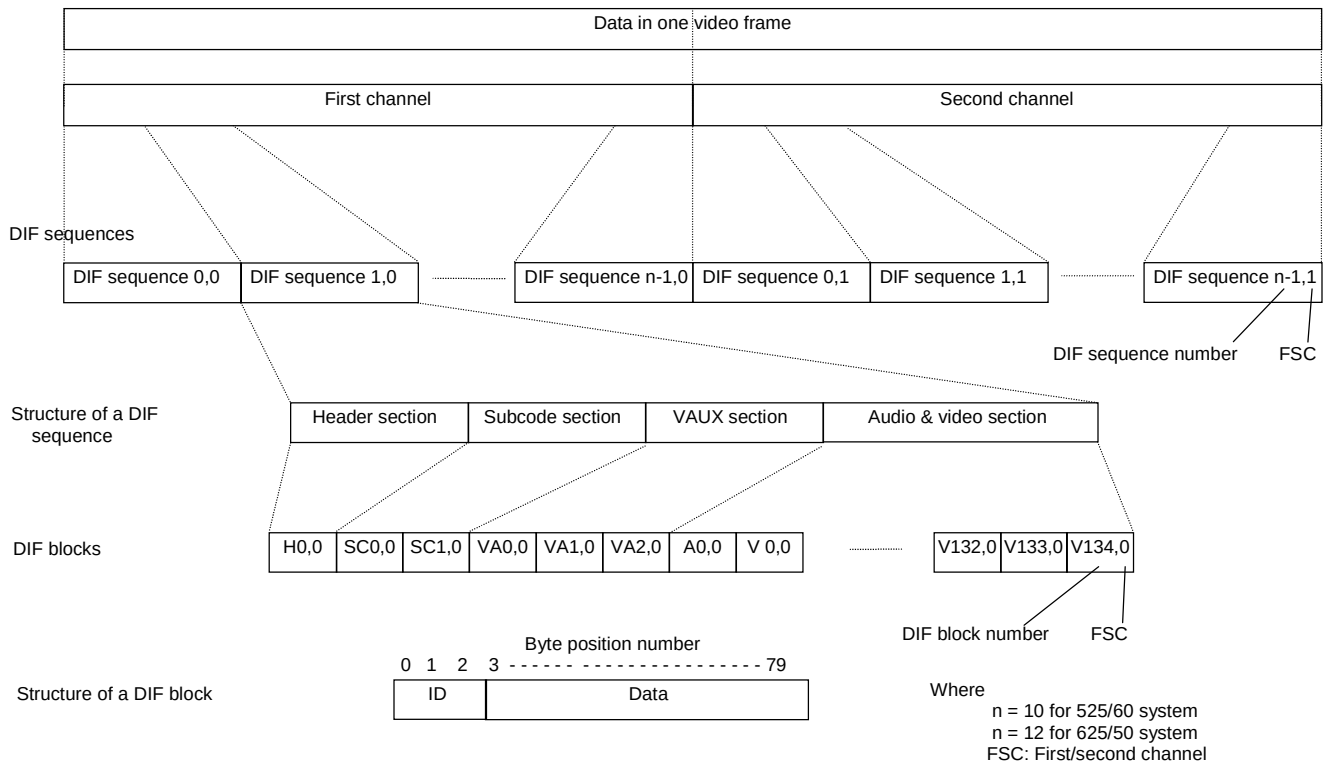


Figure 1 – Organization of a DIF frame for 50-Mb/s DV-based compression

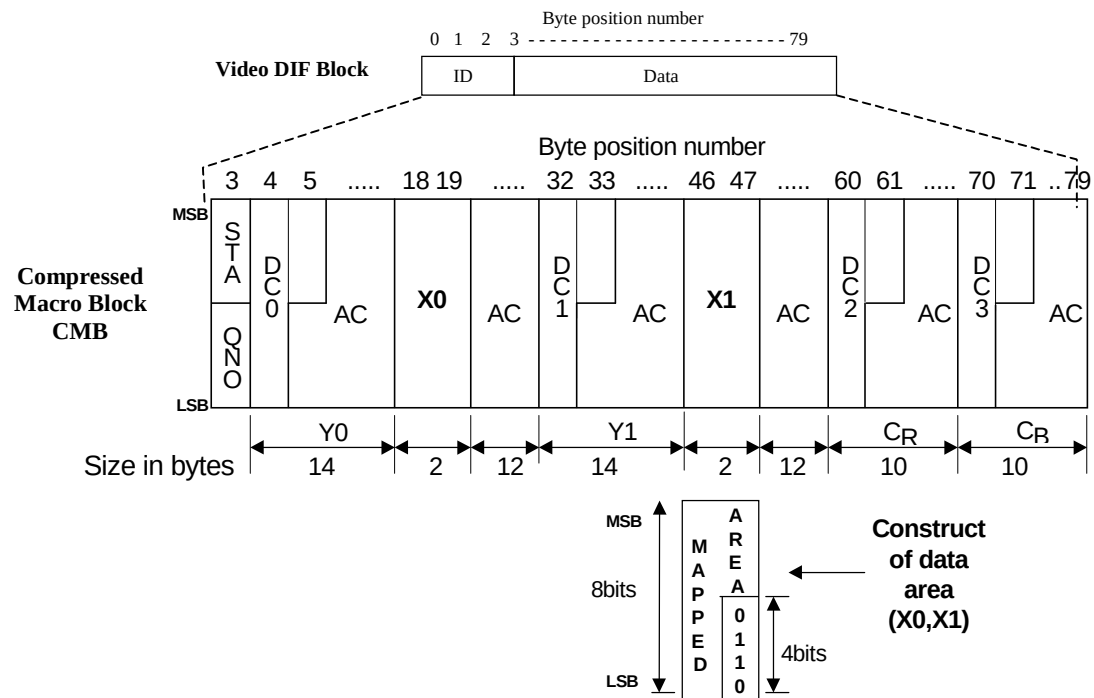


Figure 2 – Construct of a 50-Mb/s DV-based compressed macro block (CMB)

Table 1 – Structure of a VAUX Source Pack

MSB							LSB	
PC0	0	1	1	0	0	0	0	0
PC1	Res							
PC2	B/W	EN	CLF		EXT			
PC3	Res		50/60	STYPE (00100)				
PC4	VISC							

EXT: Extension flag – defines use of CMB data areas in a 50 Mb/s DV-based DIF block
 Note: EXT bits in SMPTE 314M are “Reserved” bits.

MSB LSB

1001b = ELA data - Data Reduced Video Recoding Data set (defined in a separate document.)

1010b = ELA data

1011b = ELA data and DANC (VANC) data

1101b = ELA and ELB data

Other = Reserved

ELA: Extended Video Line data of line A

A = content of line 525 in 525/60 or 623 in 625/50 system

ELB: Extended Video Line data of lines B

B = content of lines 20, 21, 22, 263, ½ of 282, 283, and 284 in 525/60 system

B = content of lines 19, 20, 21, 22, 331, 332, 333, and 334 in 625/50 system

DANC: A string of DIF ancillary data packets carrying mapped SDI VANC packets

4.1 Structural division of the CMB space in a single DIF frame

The available CMB data area for mapping external data consists of multiple CMBs located in DIF blocks within a single frame. This total area is divided into two areas, called “1st CMB data area” and “2nd CMB data area”, as shown in tables 2 and 3. The size of each area is dependent on the number of DIF sequences relative to the television line system that is used. The 50 Mb/s DIF frame of a 525/60 system contains 20 DIF sequences, while a 625/50 DIF frame contains 24 DIF sequences.

4.2.1 Description of EXT flag control bits of a VAUX source pack

In case that EXT bits are set to 1010 code, non-valid data is mapped into the 2nd CMB data area. In addition content of an extended video line (ELA) from the bottom of a video frame is mapped into the 1st CMB data area (see table 2 or 3).

When the EXT bits are set to 1011 code, the DANC packet string (VANC data) is mapped into the 2nd CMB data area. Similarly the content of an extended video line (ELA) from the bottom of a video frame is mapped in to the 1st CMB data area (see table 2 or 3).

When the EXT bits are set to 1101 code, the content of multiple extended video lines (ELB) is mapped into the 2nd CMB data area and content of an extended video line (ELA) from the bottom of a frame is mapped into the 1st CMB data area (see table 2 or 3).

When the EXT bits are set to 1001 code, the data reduced video recoding data set is mapped into the 2nd CMB data area content of an extended video line (ELA) from the bottom of a frame is mapped into the 1st CMB data area. The mapping method of the data reduced video recoding data set is specified in a separate document.