



The attached SMPTE Engineering Document has been declared “Stable” by the controlling Technology Committee.

The SMPTE Operations Manual for Standards states:

A document should be stabilized if it is believed to be substantially correct, does not contain harmful or misleading recommendations, may still be relevant to equipment or practices in use, is stable, but does not represent current technology, and need not be subject to future reviews.

A Stable document shall still be made available and offered for sale by the Society, but it shall be prefaced by a cover page explaining its current status.

At any time, a Technology Committee may revise, amend, or otherwise initiate a new Project on a Stable document.

A Stable document is “In Force”, and not deprecated or withdrawn.

*** * * * ***

Note:

SMPTE “Stable” documents were previously described as “Archived” and the attached document may be marked as “Archived”. The status of a SMPTE document described as “Archived” is exactly as described above for a “Stable” document.

Stable documents may not adhere to the latest style and format of SMPTE documents, or to current usage of normative language. Suitable care should be taken in interpretation.

SMPTE STANDARD

for Television —

Mapping of Vertical Ancillary Data Packets (VANC)
into VAUX DIF Blocks of DV-Based 25 Mb/s or 50
Mb/s Streams and Extended Video Line Data into
VAUX DIF Blocks of DV-Based 25 Mb/s Stream



Table of contents

- 1 Scope
- 2 Normative references
- 3 General specifications
- 4 Mapping of vertical ancillary data packets
- 5 Extended video line data content
- 6 VAUX pack structures
- 7 Data mapping in a frame
- Annex A Abbreviations

1 Scope

The purpose of this standard is to define a method to uniformly map metadata and data essence present within vertical ancillary packets (VANC) on the serial digital Interface (SDI), into VAUX DIF blocks of a DV-based 25 Mb/s or 50 Mb/s stream. Additionally, the standard defines a mapping method that results in an increase of the video aperture by one video line (extended video line) for the 25 Mb/s DV-based compression scheme.

The VANC mapping is applicable to 525/60 and 625/50 signal formats that use the 25 Mb/s or 50 Mb/s DV-based compression system. The mapping of the extended video line is applicable only to the 25 Mb/s DV-based stream.

This mapping process requires use of a 10-bit SDI interface for the incoming video signal.

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-1997, 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 374M-2003, Television — Mapping of Vertical Ancillary Data Packets and Extended Video Line Data into Video DIF Blocks of a DV-Based 50 Mb/s DIF Stream Structure

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

3 General specifications

Metadata and data essence can be carried in the ancillary space of the serial digital interface (SDI), or serial data transport interface (SDTI) video stream structure. The data is formatted according to SMPTE 291M as vertical ancillary packets located in VBI space.

VANC packets are mapped into the VAUX DIF data area of the 25 or 50 Mb/s DV-based DIF streams. During the mapping process, the VANC packets are converted into digital ancillary packets (DANC) and these are then mapped into VAUX DIF blocks, VAUX packs, as defined in SMPTE 314M. A line number generator is used to identify the position of the VANC packet on the SDI signal interface to prevent a possible temporal skew.

NOTE – Data content identification carried in a DIF frame that is defined in SMPTE 314M or IEC 61834 is located in the VSC and VS packs of the VAUX DIF blocks. Designers should be aware that data identification present in the VSC and VS packs of the SMPTE 314M DIF frame differs from data ID present in IEC 61834. The VSC and VS packs carry not only the data content ID of DV-based data (SMPTE 314M), but may also carry ID for DV data defined in IEC 61834. The mapping method proposed in this standard is based on use of two different VAUX pack structures (see figure 3), 5-byte and 75-byte. SMPTE 314M and IEC 61834 specify only a single 5-byte long VAUX pack structure and they do not support the 75-byte VAUX pack structure.

Some broadcast operations require a larger video aperture than that defined by the DV-based compression system standard. The nominal video aperture of the compressed signal in DV-based compression is defined in SMPTE 314M and is equal to 480 lines in 525 TV line systems and 576 lines in 625 TV line systems.

The extended video line video information mapping extends the range of the nominal compressed video aperture by one line in both 525- and 625-line systems. The enlarged video aperture ads line 525 in the 525-line system and line 623 in the 625-line system. In addition, this method can be applied to a user selectable single line video signal. These lines are not processed by the DV-based compression system, and are therefore mapped into the VAUX DIF blocks of the compressed DV-based stream. This standard defines only a mapping of an extended video line into 25 Mb/s VAUX DIF blocks. Mapping of an extended video line into 50 Mb/s DIF video blocks is defined in SMPTE 374M.

Due to a fixed size of the bit space within the VAUX DIF blocks, it is necessary to establish management of the mapped space so maximum benefit of the VAUX DIF block space is achieved (see note 1)

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.

Processing of data content located in VANC packets uses a technique of directly mapping it into VAUX DIF blocks. Data content contained in the extended video line, applies additional 4:2:2/4:1:1 sampling rate conversion before the content is mapped into the VAUX DIF blocks.

The structure of this standard is as shown below:

Clause 3.1 describes the data mapping space in the VAUX DIF block;
 Clause 4 describes the VANC data;
 Clause 5 describes extended video line data;
 Clause 6 describes VAUX pack structure;
 Clause 7 describes data mapping in a frame.

3.1 Organization of the VAUX DIF block payload

Figure 1 shows the typical organization of a DIF sequence for 25 and 50 Mb/s stream structures as described in SMPTE 314M.

The VAUX DIF block space consists of three VAUX DIF blocks VA 0,i; VA 1,i; and VA 2,i located in each DIF sequence. Conforming to SMPTE 314M, payload space of each VAUX DIF block is further subdivided into 15 VAUX packs and each VAUX pack is 5-byte long (see figure 3a). These 5-byte long VAUX packs are used in any VAUX DIF blocks, regardless of odd or even DIF sequence.

This standard defines, as well, a different VAUX DIF block payload structure space (see figure 3b) that is not defined in SMPTE 314M. This new structure is a 75-byte long VAUX pack. The reason for additional structures is to increase payload efficiency. The 75-byte long VAUX pack is used with VAUX DIF blocks VA 0,i and VA 1,i of an even DIF sequence, and VAUX DIF blocks VA 1,i and VA 2,i of an odd DIF sequence (see note 2).

A typical DIF sequence (odd or even) containing VAUX DIF blocks for data placement in both DIF sequences is shown in figure 2. VAUX DIF block VA 2,i in an even DIF sequence and VAUX DIF block VA 0,i in an odd DIF sequence contain mandatory VAUX packs called video source (VS) and video source control (VSC). These VAUX packs contain information about the video source and control information defined in other documents. VAUX DIF blocks limit the use of a space for data placement to byte position number 3 to 77 as shown in figure 2. In VAUX DIF block VA 2,i in an even DIF sequence, data is mapped into byte position number 3 to 47; while in VAUX DIF block VA 0,i in an odd DIF sequence, data is mapped into byte position number 33 to 77 (see figure 2).

NOTE 2 – The DIF VAUX payload capacity excluding the pack header is indicated below:

In case of 25 Mb/s stream that uses the 5-byte VAUX Pack structure only:

For 525/60 system: $4 \text{ bytes} \times (15 + 15 + 9) \text{ packs} \times 10 \text{ DIF sequences} = 1560 \text{ bytes/frame}$

For 625/50 system: $4 \text{ bytes} \times (15 + 15 + 9) \text{ packs} \times 12 \text{ DIF sequences} = 1872 \text{ bytes/frame}$

In the case of a 25 Mb/s stream that uses the combined 5-byte / 75-byte VAUX pack structure:

For 525/60 system: $(74 + 74 + 4 \times 9) \text{ bytes} \times 10 \text{ DIF sequences} = 1840 \text{ bytes/frame}$

For 625/50 system: $(74 + 74 + 4 \times 9) \text{ bytes} \times 12 \text{ DIF sequences} = 2208 \text{ bytes/frame}$

In the case of a 50 Mb/s stream that uses the 5-byte VAUX pack structure only:

For 525/60 system: $4 \text{ bytes} \times (15 + 15 + 9) \text{ packs} \times 20 \text{ DIF sequences} = 3120 \text{ bytes/frame}$

For 625/50 system: $4 \text{ bytes} \times (15 + 15 + 9) \text{ packs} \times 24 \text{ DIF sequences} = 3744 \text{ bytes/frame}$

In the case of a 50 Mb/s stream that uses the combined 5-byte / 75-byte VAUX pack structure:

For 525/60 system: $(74 + 74 + 4 \times 9) \text{ bytes} \times 20 \text{ DIF sequences} = 3680 \text{ bytes/frame}$

For 625/50 system: $(74 + 74 + 4 \times 9) \text{ bytes} \times 24 \text{ DIF sequences} = 4416 \text{ bytes/frame}$

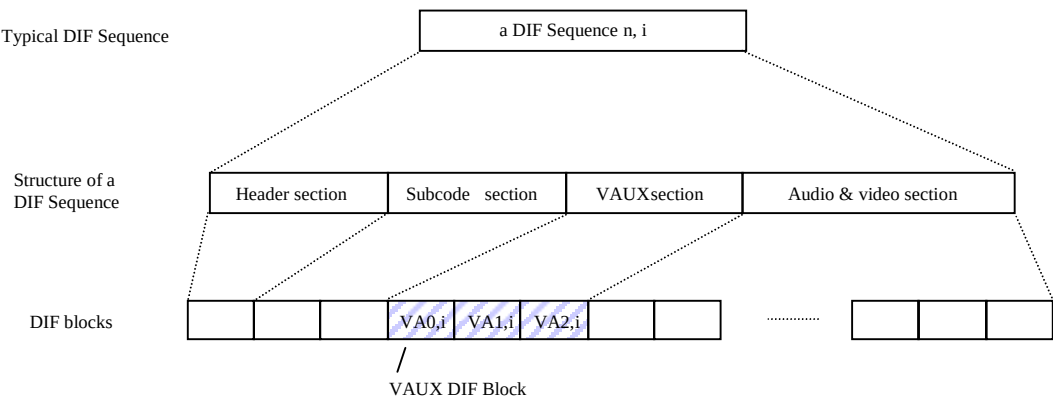


Figure 1 – Organization of a typical DIF sequence structure

Even DIF Sequence

		Byte position number										
		0	1	2	3		77	79				
VA0,i	ID	Payload										
		0	1	2	3		77	79				
VA1,i	ID	Payload										
		0	1	2	3		47	48		77	79	
VA2,i	ID	Payload						*	*		*	
								VS	VSC		Reserved	

Odd DIF Sequence

		0	1	2	3	32	33	77	79
VA0,i	ID	*	*	*	*	Reserved			Payload
VA1,i	ID	Payload							
VA2,i	ID	Payload							

Where i: first/second channel
VS: VAUX Source Pack
VSC: VAUX Source Control Pack
Refer to SMPTE 314
Byte 78, 79, reserved and filled with FFh

Figure 2 – VAUX payload area for data for 25 or 50 Mb/s DIF blocks

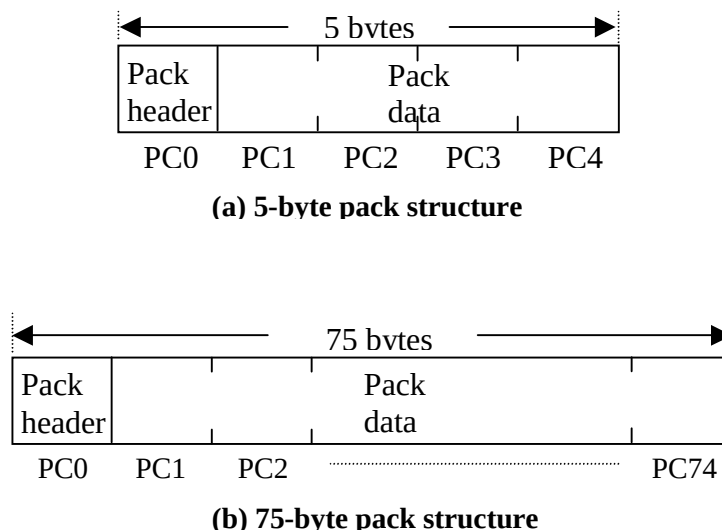


Figure 3 – VAUX pack structures

4 Mapping of vertical ancillary data (VANC) packets

VANC data packets present on the 10-bit SDI interface are converted into DIF ancillary data packets (DANC). Figure 4 shows the mapping process between a VANC packet and a DANC packet.

DANC packet length ($B_0, \dots, B_m$) is identical to the VANC packet length present on the SDI interface. Only the lower 8 bits of the 10 bits DID, SDID (DBN), DC, UDW and CS VANC packet words, are processed.

In space where the original three ADF data bytes of the VANC packet were located, LE, LN, and Res bits are substituted. The ADF flag bytes are discarded during this process. The LE bit defines a line number enable flag. LN bits define the SDI line number on which the original VANC packet resided. Res bits are reserved bits for future use. Default value for Res shall be set to 1.

The LN bits are used in a reverse mapping process, during which the recovered DANC packets are re-mapped back as VANC packets and re-located into VBI data space of the SDI interface. Use of the LN bits assures that possible temporal skew of the recovered VANC packets (based on field/frame location) is prevented during the re-mapping process. When data from a DANC packet is converted back to a VANC packet, the upper 2 bits are generated from the lower 8 bits.

VANC packets that are located in the vertical blanking interval (VBI) are converted into DANC packets. This conversion process is applied only to VANC packets located in one frame. The resulting DANC packets are then mapped into the payload area of VAUX DIF blocks as shown in figure 2.