SMPTE STANDARD

Vertical Ancillary Data Mapping of Pan-Scan Information

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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 2016-4 was prepared by Technology Committee 24TB.

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

Image formatting information describes certain spatial characteristics of a high definition or standard definition video image. It is generated and carried through all or some of the video production, distribution, and emission chain. The image formatting metadata types are Active Format Description (AFD), Bar Data, and Pan Scan information.

AFD and Bar Data are intended to be broadcast with the video signal that they describe. AFD information is intended to guide DTV receivers and/or intermediate professional video equipment regarding the display of video of one aspect ratio on a display of another aspect ratio. Bar Data information is used to signal the precise unused areas of an image raster when the active video does not completely fill that raster, in particular widescreen cinema material carried letterboxed in a frame with bars top and bottom.

Pan-Scan information is a set of data that is intended to guide professional video equipment in extracting an image to be presented in an aspect ratio that is different from that in which the material was produced or distributed. Independent parameters are provided for pan (horizontal offset), tilt (vertical offset), vertical size, horizontal size, and output aspect ratio. Pan-Scan information is not intended for use beyond the production and distribution environments.

The following suite of SMPTE standards defines the origination and carriage of AFD, Bar Data, and Pan-Scan information:

SMPTE ST 2016-1   Format for Active Format Description and Bar Data
SMPTE ST 2016-2   Format for Pan-Scan Information
SMPTE ST 2016-3   Vertical Ancillary Data Mapping of Active Format Description and Bar Data
SMPTE ST 2016-4   Vertical Ancillary Data Mapping of Pan-Scan Information

Other SMPTE standards can be used for alternative transport methods for this data.

1 Scope

This Standard defines a method of coding that allows Pan-Scan information to be carried in the 10-bit vertical ancillary (VANC) data space of a standard definition or high definition bit-serial component television signal. The standard defines how the Pan-Scan information is placed into an ancillary data packet for carriage in accordance with SMPTE ST 291-1.

An associated standard, SMPTE ST 2016-2, defines the format for Pan-Scan information and identifies the video image and interface standards with which it is associated.

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.

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.

SMPTE ST 291-1:2011, Television — Ancillary Data Packet and Space Formatting

SMPTE ST 2016-2:2014, Format for Pan-Scan Information

SMPTE RP 168:2009, Definition of Vertical Interval Switching Point for Synchronous Video Switching

4 Format of VANC Data Packets

Each data packet shall comply with the format defined in SMPTE ST 291-1 for a type 2 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 consists of the data payload.

The DID word shall be set to the value 41h. The SDID word shall be set to the value of 06h.

DC is a count of the number of words in the UDW and shall be set to a fixed value of 96 (60_h).

4.1 UDW Format

Eight Pan-Scan Data Sets shall be carried in the User Data Words of a SMPTE ST 291-1 ancillary data packet, each Pan-Scan Data Set as shown in Table 1. The format of the Pan-Scan data bytes shall be as defined in Section 7.1 of SMPTE ST 2016-2.

The Pan-Scan information shall be 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.

Table 1 – ANC Data Payload per Data Set

Data Set Words		User Data Word bits									
	Function	**b9**	**b8**	**b7**	**b6**	**b5**	**b4**	**b3**	**b2**	**b1**	**b0**
1	Data Set ID	$\overline{b8}$	P	id7	id6	id5	id4	id3	id2	id1	id0
2	Pan-Scan Flags	$\overline{b8}$	P	Pan	Tilt	Vert	Horiz	rsv	ar2	ar1	ar0
3	Pan	$\overline{b8}$	P	p15	p14	p13	p12	p11	p10	p9	p8
4	Horizontal offset	$\overline{b8}$	P	p7	p6	p5	p4	p3	p2	p1	p0
5	Tilt	$\overline{b8}$	P	t15	t14	t13	t12	t11	t10	t9	t8
6	Vertical offset	$\overline{b8}$	P	t7	t6	t5	t4	t3	t2	t1	t0
7	Vertical size	$\overline{b8}$	P	'0'	'0'	v13	v12	v11	v10	v9	v8
8		$\overline{b8}$	P	v7	v6	v5	v4	v3	v2	v1	v0
9	Horizontal size	$\overline{b8}$	P	'0'	'0'	h13	h12	h11	h10	h9	h8
10		$\overline{b8}$	P	h7	h6	h5	h4	h3	h2	h1	h0
11	Reserved	$\overline{b8}$	P	'0'	'0'	'0'	'0'	'0'	'0'	'0'	'0'
12	Reserved	$\overline{b8}$	P	'0'	'0'	'0'	'0'	'0'	'0'	'0'	'0'

where:

    Pan, Tilt, Vert & Horiz are Pan-Scan parameter presence flags (see SMPTE ST 2016-2 Section 7.1.2);

    id7 - id0 is the Pan-Scan Data Set ID code (see SMPTE ST 2016-2 Section 7.1.1);

    ar2 - ar0 is the output image aspect ratio code (see SMPTE ST 2016-2 Section 7.1.2);

    p15 - p0 is the Horizontal viewport offset (see SMPTE ST 2016-2 Section 7.1.3);

    t15 - t0   is the Vertical viewport offset (see SMPTE ST 2016-2 Section 7.1.3);

    v13 - v0 is the Vertical size coefficient (see SMPTE ST 2016-2 Section 7.1.3);

    h13 - h0 is the Horizontal size coefficient (see SMPTE ST 2016-2 Section 7.1.3);

    rsv is reserved and set to 0 (see SMPTE ST 2016-2 Section 7.1.2)

    P   is the even parity bit for b7 through b0.

Table 2 outlines the ancillary data packet words with values where appropriate. The total size of the ancillary data packet is 103 words.

Table 2– Ancillary data packet structure

Name	Acronym	Value
Ancillary data flag (10-bit words)	ADF	000h, 3FFh, 3FFh
Data identification	DID	41h
Secondary data identification	SDID	06h
Data count	DC	60h
Pan-Scan Data Sets 1-8 (96 words)	UDW	–
Checksum	CS	–
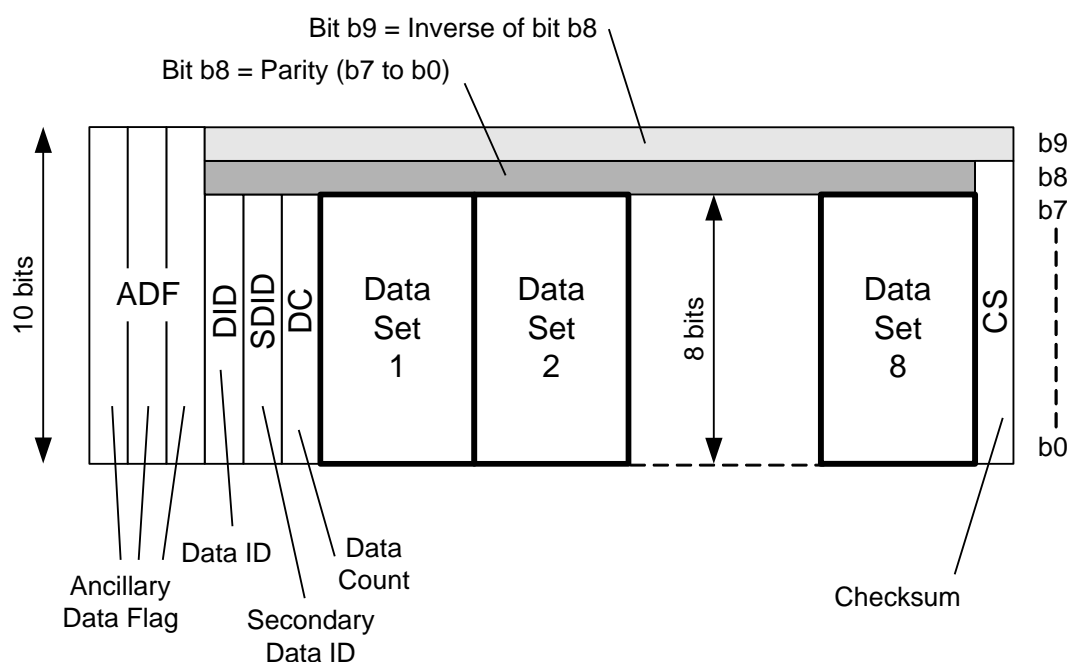
Figure 1 – Data structure of Pan-Scan ANC Packet (type 2)

5 Location of the Vertical Ancillary Data

The ANC data packet(s) containing Pan-Scan and other information shall be located in the active line portion of one line in the vertical ancillary space. Data may be located in any lines in the area from the second line after the line specified for switching, as defined in SMPTE RP 168, to the last line before active video, inclusive.

In order to maximize the time available for processing the active video with which pan-scan information is associated, Pan-Scan data should be located early in the VANC period (see Annex B for further guidance).

The data packets shall be associated with the video frame that is being described and shall be present for every frame.

Pan-Scan information, when coded as ancillary data, shall be placed in the VANC such that:

1. for natively generated interlaced video system signals, the Pan-Scan information for the first and second fields of the same frame shall be identical;

2. for interlace video signals derived from 24p image sequences, the Pan-Scan information for each field shall be identical to the Pan-Scan information for the image from which it was derived;

3. for progressive segmented frame systems, the Pan-Scan information signalled for the first and second segments of the same frame shall be identical.

When the ANC packets defined in this standard are carried in a high definition or UHDTV signal, they shall be carried in the Y stream. For further details see SMPTE ST 292-1 and SMPTE ST 2036-3.

Receiving equipment should identify the ANC packets on the basis of their ANC DID and SDID fields.

Note: Designers are advised that although this standard specifies VANC as the location for the transport of information in an SD-SDI interface, there are legacy devices that will not pass this information if it is located on video lines where the V-bit (see SMPTE ST 125) is set to logical one.

Annex A Bibliography (Informative)

SMPTE ST 125:2013, SDTV Component Video Signal Coding 4:4:4 and 4:2:2 for 13.5 MHz and 18 MHz Systems

SMPTE ST 292-1:2012, 1.5 Gb/s Signal/Data Serial Interface

SMPTE ST 352:2013, Payload Identification Codes For Serial Digital Interfaces

SMPTE EG 43:2004, System Implementation of CEA-708-B and CEA-608-B Closed Captioning and Program-Related Data

SMPTE RP 291-2:2013, Ancillary Data Space Use — 4:2:2 SDTV and HDTV Component Systems and 4:2:2 2048 × 1080 Production Image Formats

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

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. System designers are advised that 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 will record up to 11 lines. 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.

It has been observed that 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 Pan-Scan are preferably embedded with the video signal early in the production process. To reduce the risk of this data being blocked or overwritten by other devices it is suggested that these ANC packets be placed on the fourth line after the switching lines defined in SMPTE RP168. Users can have their own priorities for determining the optimum location of the ANC packet, which could result in a different line being selected.

Similar considerations apply for closed captioning and other data services carried in VANC, as discussed in SMPTE EG 43.