RP 214-2002

SMPTE RECOMMENDED PRACTICE

Packing KLV Encoded Metadata and Data Essence into SMPTE 291M Ancillary Data Packets

1 Scope

This practice describes a means for packing SMPTE metadata and data essence, encoded by the SMPTE KLV protocol, into SMPTE 291M ancillary data packets for transport. Packing of KLV encoded metadata and data essence in this practice is defined only for a 10-bit SDI component video signal interface.

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 edition 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 292M-1998, Television — Bit-Serial Digital Interface for High-Definition Television Systems

SMPTE 336M-2001, Television — Data Encoding Protocol Using Key-Length-Value

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

3 Introduction

This practice describes a means for packing SMPTE KLV encoded metadata and/or essence into SMPTE 291M ancillary data packets. There is strong interest in carrying audio/visual data, metadata, and/or essence, within the same digital stream. The use of one data stream facilitates delivery of the overall multimedia presentation. Metadata is classified as information about the essence. An example of metadata is information such as camera angle, scene identifier, or property rights. Other information about the essence is supplemental content to the audio and video such as closed captioning, sports statistics, or hyperlinked advertisements.

NOTE – ANSI/SMPTE 272M and SMPTE 299M already define the carriage of embedded digital audio in ANSI/SMPTE 259M (SDI) and SMPTE 292M (HD-SDI), respectively. Carriage of data essence types in SMPTE 291M ancillary data packets is under consideration.

4 Transport Packing

Ancillary data may be present within the horizontal ancillary data space and the vertical ancillary data space of the ANSI/SMPTE 259M or SMPTE 292M video signals. (Note that SMPTE 291M does not specify ancillary data packets over SMPTE 292M (HD-SDI), but the specification is readily carried over to HD-SDI.)

A possible data structure for a 10-bit ancillary data packet type 2 (ancillary packet type 2) carrying KLV encoded data is shown in figure 1 (informative). The KLV packet(s) shall be placed in the user data words of an ancillary data packet. The reader is urged to review SMPTE 291M for a detailed description of each field in the packet.

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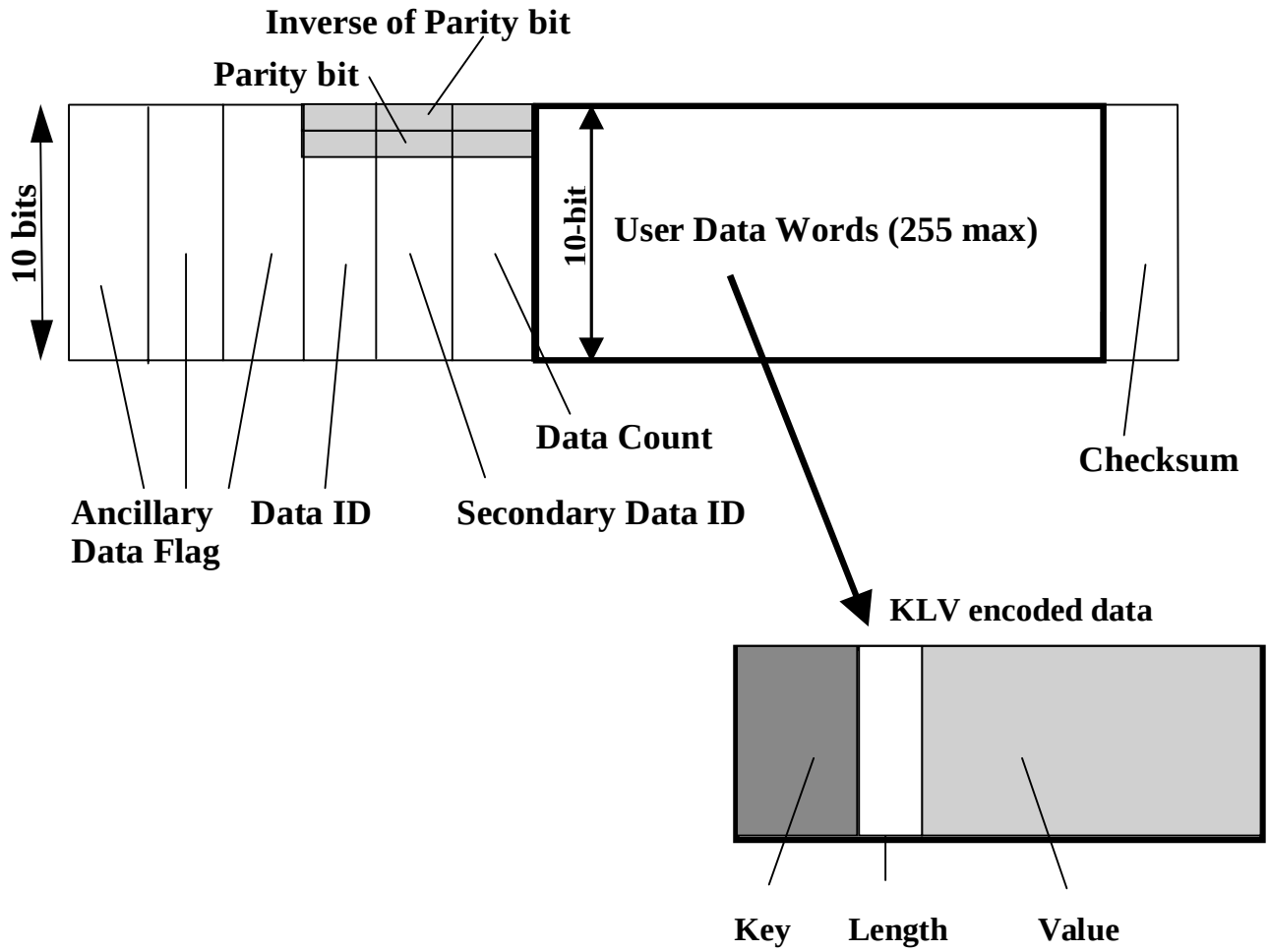

Figure 1 – Possible data structure of an SMPTE 291M ancillary packet (type 2) carrying KLV encoded data

NOTE – Designers of equipment should be aware that KLV encoded data due to its 8-bit nature may be processed and stored by 8-bit based equipment. The ANSI/SMPTE 259M interface supports 8- or 10-bit component video interfaces; however, for this particular application only a 10-bit interface is defined. This is due to the requirement to maintain an unrestrained data count (DC) field value which on an 8-bit interface would allow only user data word lengths (length of KLV encoded data) divisible by four.

4.1 Ancillary packet DID and SDID for KLV encoded data

The type of ancillary packets selected for the carriage of KLV encoded data is type 2. The data ID (DID) field of the ancillary packet carrying KLV-encoded metadata or data essence shall be set to 0x44. The secondary data ID (SDID) field is set to 0x04 for ancillary packets located in the vertical ancillary space and to 0x14 for ancillary packets located in HANC space (see figure 2 - normative).

4.2 Ancillary packet user data word (UDW) for KLV encoded data

KLV data are defined in 8-bit words. These data words are packed into 10-bit ancillary packet words for transportation across ANSI/SMPTE 259M or SMPTE 292M interfaces.

The payload of an ancillary packet carrying KLV encoded data shall consist of 8-bit KLV data located in bit 0 through bit 7 of the 10-bit UDW field. Bit 8 and bit 9 of the 10-bit UDW fields are set to parity and non-parity, respectively, on the interface (see figure 2).

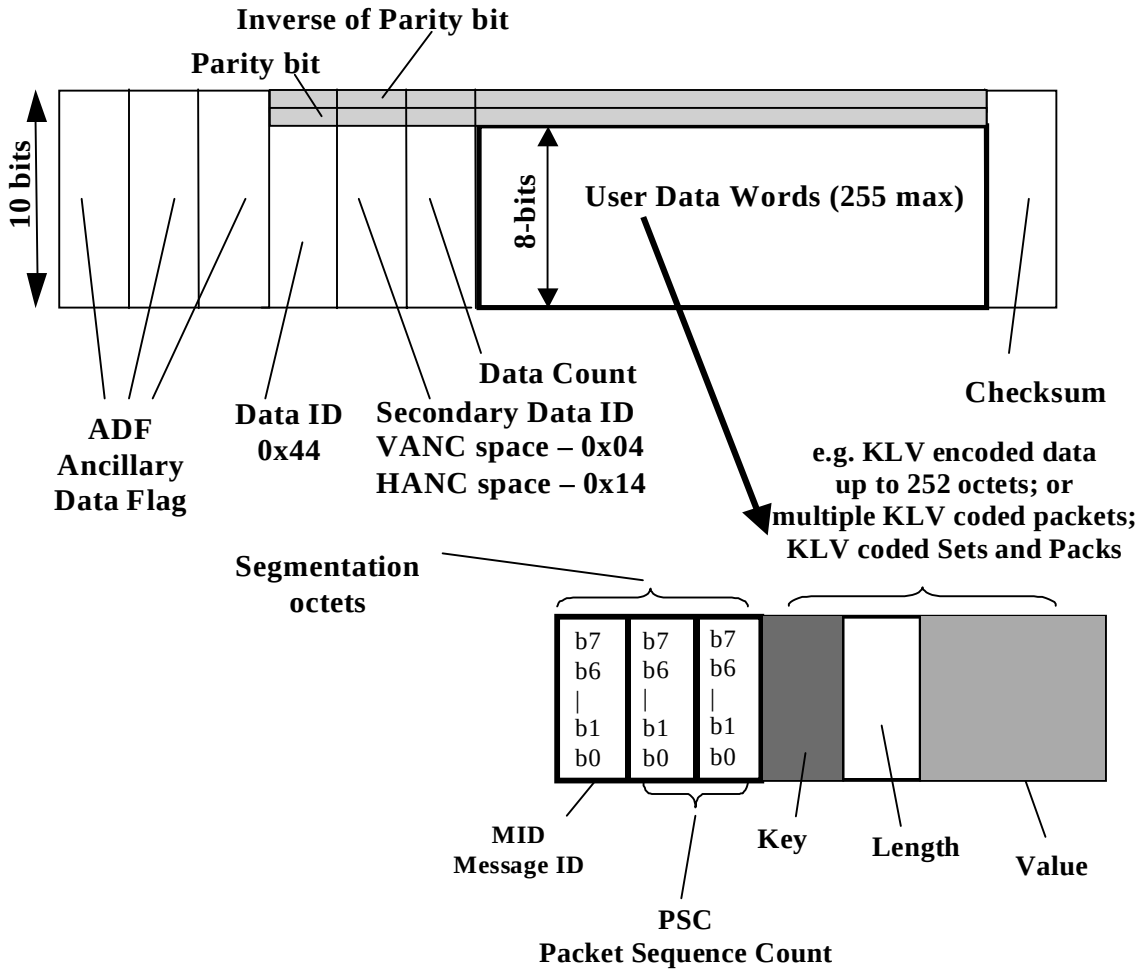

Figure 2 – Data structure of (type 2) ancillary packet payload for carriage of KLV encoded data including packet sequence count (segmentation system)

4.3 Location of metadata in vertical ancillary space

In order to reduce the latency and buffering required for an ancillary data and KLV data reader, and to promote interoperability, ancillary packets containing KLV encoded metadata or data essence should be limited to a specific range of the total ancillary space, the vertical ancillary space. In addition, some metadata may be bound to a specific frame in order to be used. For those reasons, vertical ancillary data packets carrying encoded KLV metadata packets shall, therefore, be placed within the VBI space.

This space is defined in 525-line systems by the first line after the vertical switching point to the third line before the start of active video of a video frame or field.

In a 625-line system, this space is defined by the first line after the vertical switching point to the last line before the start of active video of a video frame or field.

NOTE – VANC space as defined in ANSI/SMPTE 125 is intended for use of VANC data which are not synonymous with the ancillary packets carrying KLV encoded payload in the vertical ancillary space described in this practice.

4.3.1 Digital video interface systems at 525 and 625 lines

SMPTE 291M ancillary data packets carrying metadata or data essence may be added to any line in the VBI VANC space as defined in 4.1 and SMPTE RP 168.

4.3.2 Digital video interface systems at 750 and 1125 lines

SMPTE 291M ancillary data packets carrying metadata or data essence may be added to any line in the VBI VANC space as defined in 4.1 and SMPTE RP 168.

NOTE – Users should be aware that other specifications might constrain the use of certain VBI lines for applications other than just carriage of metadata in ancillary data packets.

4.4 Location of metadata in HANC space

When the location of metadata in ancillary space is not critical, data may be located in the HANC space allowed by SMPTE 291M. When the location of metadata is in the HANC space, the secondary data ID (SDID) field of the ancillary packet carrying the metadata shall be set as defined in 4.1.

NOTE – Users are cautioned that metadata inserted in HANC space defined in 4.1 may not be passed transparently by all storage systems and some systems do not support ancillary packet insertion in full compliance with SMPTE 291M.

4.5 KLV encoded data segmentation

KLV encoded data can reach a large size (up to 2^{64} words) significantly exceeding data carriage capability of single ancillary packets. Therefore, large KLV encoded data must be placed into multiple ancillary packets.

The KLV segmentation process of this practice is applied to the transport level of a specific carrier as is SMPTE 291M ancillary data packet and space formatting. For uniformity reasons and to simplify payload segmentation and reassembly processes, all ancillary packets carrying KLV encoded data shall use the segmentation process defined in 4.5.1.1 and 4.5.1.2. The segmentation process is applied also to KLV encoded data shorter than 252 words.

4.5.1 Segmentation process

Following the DID and SDID field of the ancillary packet header is the data count (DC) field. Each ancillary packet has the capacity to carry a payload of 255 user data words (UDW). For the segmentation process of KLV encoded data, the first three user data words of the ancillary packet payload shall be used to form a segmentation system. The location of these words is shown in figure 2.

4.5.1.1 Message ID (MID) field

The first user word of the ancillary packet payload that follows the DC field defines a message ID (MID) field. This MID field identifies ancillary packets that carry information belonging to the same KLV encoded message. The message ID number increments with each different message with the first message ID number being 1.

NOTE – The segmentation system supports up to 255 different messages. The MID code value 0x00 is not supported.

4.5.1.2 Packet sequence count (PSC)

Two user data words immediately following the message ID (MID) field represent a packet sequence count (PSC). These two words form a 16-bit PSC number that defines the number of ancillary packets with the same MID value necessary to carry the KLV encoded message. The first data word of the PSC number represents the upper 8 bits and the second word of the PSC number represents the lower 8 bits of the 16-bit PSC number (bit 7 of the first word represents the MSB and bit 0 of the seocnd word represents the LSB of the PSC value).

The PSC number is incremented with the value 1 assigned to a first ancillary packet containing the first part of a message

NOTES

1 Eight-bit data payloads of an ancillary packet type 2, carried over 10-bit systems interfaces, are mapped in such a way that bit b8 and bit b9 of the 10-bit data stream are set to parity and non-parity value, respectively. The parity encompasses bit b0 through bit b7 of the UDW.

2 The PSC number supports KLV message lengths up to (2^{16})*252 octet words.

Annex A (informative)
Bibliography

ANSI/SMPTE 125M-1995, Television — Component Video Signal 4:2:2 — Bit-Parallel Digital Interface

ANSI/SMPTE 272M-1994, Television — Formatting AES/EBU Audio and Auxiliary Data into Digital Video Ancillary Data Space

ANSI/SMPTE 299M-1997, Television — 24-Bit Digital Audio Format for HDTV Bit-Serial Interface

SMPTE 334M-2000, Television — Vertical Ancillary Data Mapping for Bit-Serial Interface