

for Television —
**MXF Mappings for VBI Lines
and Ancillary Data Packets**

Table of contents	Page
Foreword	2
Introduction.....	2
1 Scope	2
2 Normative references.....	2
3 Definitions	3
4 Common provisions for MXF wrapping of VBI lines and ANC packets	4
4.1 The sequence of MXF-Wrapped VBI Lines and ANC Packets in a frame.....	5
4.2 The synchronization of VBI Frame Elements, ANC Frame Elements, and video	5
4.3 Essence Container ULs	6
4.4 Sample coding	6
4.4.1 1-bit sample coding for VBI data.....	6
4.4.2 8-bit sample coding for VBI data.....	7
4.4.3 8-bit sample coding for ANC packet data	7
4.4.4 10-bit sample coding.....	8
5 MXF Vertical Blanking Interval line wrapping specifications.....	8
5.1 VBI Frame Elements.....	9
5.2 VBI Payload Byte Array and Sample Coding.....	11
6 MXF Ancillary Data Packet wrapping specifications.....	11
6.1 ANC Frame Element.....	11
6.2 ANC Payload Byte Array and Sample Coding.....	14
7 Descriptors	14
7.1 VBI Data Descriptor	14
7.2 Key for the VBI Data Descriptor.....	15
7.3 ANC Data Descriptor.....	15
7.4 Key for the ANC Data Descriptor	15
Annex A Bibliography.....	16

Warning

This document is not a SMPTE Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as a SMPTE Standard. Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation. Distribution does not constitute publication.

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 436M was prepared by Technology Committee Metadata and Wrapper Technology (W25).

Introduction

Many of the established broadcast file formats transport opaque (without knowledge of the contents) Vertical Blanking Interval lines (VBI lines or VBI data) and Ancillary Data Packets (ANC packets). This standard is intended to allow the transport of opaque VBI lines and ANC packets for compatibility with established formats and to facilitate the use of MXF for existing and new applications.

VBI lines and ANC packets have many applications. In some cases this information can be encapsulated as standardized MXF essence or metadata items (e.g. embedded audio). In other cases this approach is not practical. For example some stations and networks encode non-standard data in VBI lines. Attempting to write additional MXF standards to describe each of these applications is outside the scope of this standard. Adding a capability to MXF which supports opaque VBI lines and opaque Ancillary data packets is a better solution. This standard provides a rich set of VBI data and ANC packet transport facilities which supports a broad range of MXF applications. In some applications the VBI line or ANC packet mapping defined in SMPTE 385M / SMPTE 331M may be the best transport model (e.g. SMPTE 386M and SMPTE 387M.) It is recommended that new MXF standards use the VBI line and ANC packet mapping that is most appropriate for the application.

If an MXF file's contents are converted from one video format to another, the VBI lines and ANC data packets could require processing. In some cases the conversions are simple and in others they are complex. The specification of these conversions is beyond the scope of this standard.

This standard describes the transport of VBI lines and ANC packets in MXF files. This standard establishes a partial set of requirements and policies for the capture of SDI signals by encoders and for the regeneration of SDI signals by decoders. Specifications of some requirements (e.g. illegal input signal processing) are not part of the specification for MXF systems components. These specifications may be part of other Standards and Recommended Practices.

1 Scope

This standard describes the carriage of VBI data and all ANC packets (HANC and VANC) in an MXF file. This standard supports standard definition television and high-definition television for 8-bit and 10-bit digital component systems. This standard also defines the encoding of additional information so an MXF decoder can place the VBI data and ANC packets at the specified location in a reconstructed television signal. This standard does not describe the content of the MXF VBI data and MXF ANC packet payloads, or their conversion to and from networks and systems other than MXF.

2 Normative references

The following standards contain provisions which, through referenced 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 259M-2006, Television — SDTV Digital Signal/Data — 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 377M-2004, Television — Material Exchange Format (MXF) — File Format Specification

SMPTE 379M-2004, Television — Material Exchange Format (MXF) — MXF Generic Container

SMPTE 424M-2006, Television — 3 Gb/s Signal/Data Serial Interface

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

3 Definitions

The full glossary of acronyms, terms and data types used in the MXF specification is given in the MXF File Format Specification (SMPTE 377M). It is not repeated here to avoid any divergence of meaning. The following definitions shall be used when interpreting this standard.

Active video: The lines in the television raster and the samples within each of these lines that are part of the visible image.

ANC packets: Ancillary packets contain up to 255 10-bit words of user data and most control and identifier words. These packets are transported in the vertical and horizontal blanking intervals of a television signal. See SMPTE 259M, SMPTE 291M, SMPTE 292M, and SMPTE 424M.

NOTE – SMPTE 291M allows multiple type 1 ANC packets to be logically combined to transport ANC user data blocks with more than 255 user data words. This standard transports the opaque ANC packets of all types and not the logically combined user data blocks.

ANC Frame Element: The collection of MXF-Wrapped ANC Packets for one field or frame of video.

ANC Payload Byte Array: The ANC packet data for one ANC packet including the DID, data block number or SDID, data block count, ANC user data words, and possibly the check sum word.

NOTE – The use of ANC Payload Byte Array should not be confused with the ANC payload (ANC user data) used in some other SMPTE documents.

MXF-Wrapped ANC Packet: The MXF properties for an ANC packet and the ANC Payload Byte Array. This represents one ANC packet in an MXF file.

Data Element: See SMPTE S379M.

End active video (EAV): A four 8-bit code sequence in an 8-bit or 10-bit word stream that immediately follows the active video samples in a line. See SMPTE 125M.

Frame-wrapped: This standard uses the definitions of frame wrapping from the MXF family of standards.

NOTE – Frame wrapping in these documents means one of the following: 1) “frame wrapping” of a single frame (field 1 and field 2 of an interlaced image or both fields of a progressive segmented frame image); 2) “field wrapping” of a single field of an interlaced image; or 3) “progressive frame wrapping” of a progressive frame (ascending lines within the frame).

Line numbers: Line numbers in this standard shall follow the model defined in SMPTE 377M Section “E.1.5. Signal Raster” for component digital formats.

Picture Element: See SMPTE S379M and S381M.

Start active video (SAV): A four 8-bit code sequence in an 8-bit or 10-bit word stream that immediately precedes the active video samples in a line. See SMPTE 125M.

Switching line: The line in a video signal where switching between two synchronous video signals should occur. See SMPTE RP 168.

VBI Frame Element: The collection of MXF-Wrapped VBI Lines for one field or frame of video in an MXF file.

VBI Payload Byte Array: A VBI line’s data.

MXF-Wrapped VBI Line: The MXF properties for a VBI line and the VBI Payload Byte Array. This represents one VBI line in an MXF file.

Vertical blanking interval (VBI): The lines starting with the first line in a field or frame and ending with the line before the first active video line. “VBI line” is used where the concept refers to the raster line containing VBI data. The phrase “VBI data” is used where the concept is the payload of the VBI line.

4 Common provisions for MXF wrapping of VBI lines and ANC packets

The VBI data and ANC packets are carried in this standard as frame-wrapped Data Elements in the Generic Container. This allows the VBI data and ANC packets to be synchronized and co-located with the associated audio and video

VBI lines and ANC packets encoded using this standard shall be frame wrapped as defined in SMPTE 379M. A single VBI Frame Element shall contain all of the MXF-Wrapped VBI Lines for a given frame or field. A single ANC Frame Element shall contain all of the MXF-Wrapped ANC Packets for a given frame or field.

NOTE – Clip and custom wrapping is not permitted because long-form material encoding will have high latencies and require large buffers in decoders. The encoder latency is a result of capturing all of the VBI lines and ANC packets before the encoder can start writing the MXF file.

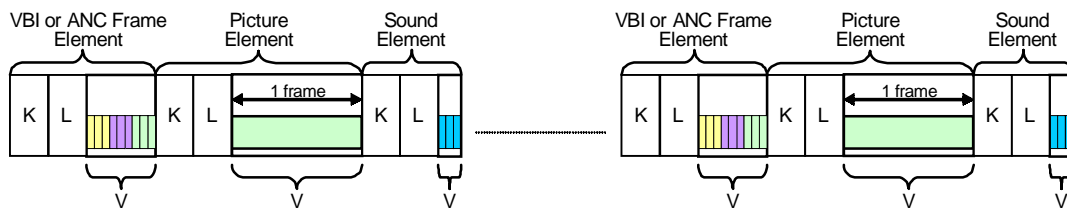


Figure 1 – Frame-wrapped VBI Frame Elements or ANC Frame Elements

KAG usage shall comply with SMPTE 377M and there are no additional provisions in this document.

Index table usage shall comply with SMPTE 377M.

4.1 The sequence of MXF-Wrapped VBI Lines and ANC Packets in a frame

ANC packets and VBI lines shall be placed at the specified location in the reconstructed video signal. The sequence of ANC packets within a line shall not be changed by the MXF file encoder or decoder.

NOTE – Devices such as ANC packet inserters, extractors, format converters, and other video signal processors may reorder ANC packets, VBI lines, or make other changes as required.

Within a given line, the MXF-Wrapped ANC Packets shall be in the sequence the ANC packets are intended to be in the reconstructed video signal.

For progressive images — The MXF-wrapped VBI Lines and MXF-wrapped ANC Packets shall be in line number sequence.

For interlaced images represented as frames — The MXF-wrapped VBI Lines and MXF-wrapped ANC Packets for field 1 shall precede the MXF-wrapped VBI Lines and MXF-wrapped ANC Packets for field 2 in a single VBI Frame element and/or a single ANC Frame Element. The MXF-wrapped VBI Lines and MXF-wrapped ANC Packets for each field shall be in line number sequence within the field.

For interlaced images represented as fields — The MXF-wrapped VBI Lines and MXF-wrapped ANC Packets for each field shall be in line number sequence.

For progressive segmented frame images — The MXF-wrapped VBI Lines and MXF-wrapped ANC Packets shall be in the same sequence as the interlaced images represented as frames. See the definition above.

4.2 The synchronization of VBI Frame Elements, ANC Frame Elements, and video

The optional VBI Frame Element for frame N and the optional ANC Frame Element for frame N shall be in the Content Package for Frame N. The sequence of Elements in a Content Package shall be zero or more Systems Elements, zero or one VBI Frame Element, zero or one ANC Frame Element, zero or more additional Data Elements, zero or one Picture Element, and any other optional Sound or Compound Elements. The number of Elements of any particular type shall be constant in each Content Package of the Generic Container.

NOTE – These rules allow OP-Atom compliant VBI data and ANC packet files to be created when the only Elements contained in the MXF file are VBI Frame Elements, ANC Frame Elements, and other Data Elements. Additional information on “Atom” files can be found in SMPTE 390M.

The VBI Frame Elements or ANC Frame Elements shall be in the same sequence as their corresponding playout Picture Elements. If the Picture Elements are reordered by a compression technology, the VBI Frame Elements and ANC Frame Elements shall not be reordered. The goal is to minimize hardware buffers and latency for capture and insertion of MXF VBI Lines and ANC packets.

NOTES

(1) For essence types such as long GoP MPEG where the displayed order and stored order are different, the VBI Frame Elements and ANC Frame Elements will be stored in display order. For example:

- an MPEG Display order of B₀ B₁ I₂ B₃ B₄ P₅ B₆ B₇ P₈
- has an MPEG stored order of I₂ B₀ B₁ P₅ B₃ B₄ P₈ B₆ B₇
- has ANC and VBI packets A₀ A₁ A₂ A₃ A₄ A₅ A₆ A₇ A₈
- and the elements are stored (A₀ I₂) (A₁ B₀) (A₂ B₁) (A₃ P₅) (A₄ B₃) (A₅ B₄) (A₆ P₈) (A₇ B₆) (A₈ B₇)

(2) It is recommended that an MXF file processor or decoder only start processing the file at a location where the video transmission sequence and the playout sequence match. This is a location where no re-ordering has occurred. This

synchronization is required for proper decoding of the video as well as proper reconstruction of the VBI lines and ANC packets information in the reconstructed video signal.

(3) Keeping the VBI lines and ANC packets in playout sequence and synchronizing them with the MXF encoded audio and MXF encoded video using established MXF mechanisms offers the best solution for many applications. In certain applications this is not true. For example; merging playout order ANC packets into MPEG user data space in a long GoP transmission order MPEG stream adds latency and complexity. One solution is to add the ANC packets to the MPEG user data space before encapsulating the MPEG stream in a MXF file. In this case the reordering and synchronization is supported by MPEG mechanisms, not this standard.

4.3 Essence Container ULs

The Essence Container UL is defined in SMPTE 379M. If an MXF file contains VBI Frame Elements then the VBI Data Essence Container Label shall appear in the Essence Container UL batches in the file as defined in SMPTE 377M. If an MXF file contains ANC Frame Elements then the ANC Packet Essence Container Label shall appear in the Essence Container UL batches in the file.

NOTE – The Essence Container UL, VBI Frame Element Key, and ANC Frame Element Key are not used to define the coding of individual VBI lines or ANC packets since there may be multiple VBI line types or ANC packet types in a frame or an MXF file.

Table 1 – Specification of the VBI Data and ANC Packet Essence Container Label

Byte No.	Description	Value (hex)	Meaning
1-12	Defined by Generic Container		
13	Essence Container Kind	02h	MXF Generic Container
14	Mapping Kind	0Dh 0Eh	VBI Data ANC Packet
15	Reserved	00h	Not used
16	Reserved	00h	Not used

NOTE – This standard provides for optional properties that can be used to describe the contents of VBI data items and ANC packets. See section 7.

4.4 Sample coding

MXF files are a collection of 8-bit bytes. VBI data may be represented by 1, 8, or 10 bits per sample and ANC packets can be represented by 8 or 10 bits per sample.

The Payload Byte Array is an MXF array including an array element count. Since the array elements are bytes, the array length is also the number of bytes stored. The Payload Byte Array includes the MXF VBI lines data or MXF ANC packets data and any padding bytes.

The Payload Byte Array shall be padded to achieve UInt32 alignment. The padding bits should have a value of zero.

The sample words in the video stream and the bytes in the MXF stream shall be in big-endian sequence. This is in keeping with the established MXF big-endian bit and byte sequencing policy.

A separate property describes the number of samples stored in the Payload Byte Array. This property’s value is defined later in this document.

4.4.1 1-bit sample coding for VBI data

For a 1-bit coding, a single bit represents the most-significant-bit of the source samples. An encoder’s source sample processing and/or filtering is not specified in this standard. The decoder output sample should be black (not 0) for a zero-bit and white (not all ones) for a one-bit. The bits representing the samples shall be packed 8-bits to the byte. The first bit is the high-order bit as shown in Figure 2.

NOTE – This coding can be used for low-bandwidth VBI signals. An encoder needs to use appropriate filtering to prevent artifacts. Likewise, the decoder needs to reconstruct legal signals.

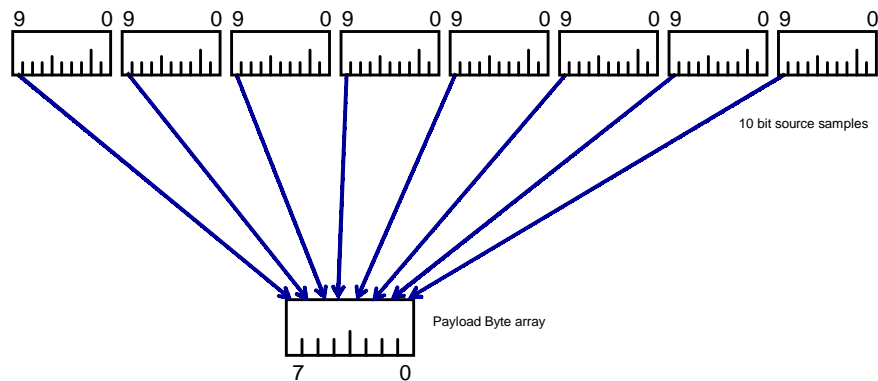


Figure 2 – 1-bit samples mapped to Payload Byte Array

4.4.2 8-bit sample coding for VBI data

For an 8-bit VBI data coding, each byte in the MXF file represents the high-order 8 bits of the 10-bit source samples as shown in Figure 3. When encoding the low-order 2 bits from the 10-bit source samples are lost. A decoder should set the two low-order bits to zero.

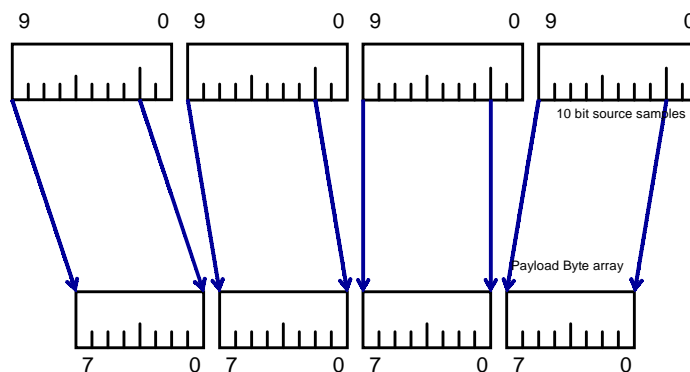


Figure 3 – 8-bit samples mapped to VBI Payload Byte Array

4.4.3 8-bit sample coding for ANC packet data

For an 8-bit ANC packet coding, each byte in the stream represents the low-order 8 bits of the 10-bit source samples as shown in Figure 4. When encoding the high-order 2 bits (parity and inverted parity) from the 10-bit source samples are lost. A decoder shall set the two high-order bits to parity and inverted parity as required by SMPTE 291M.

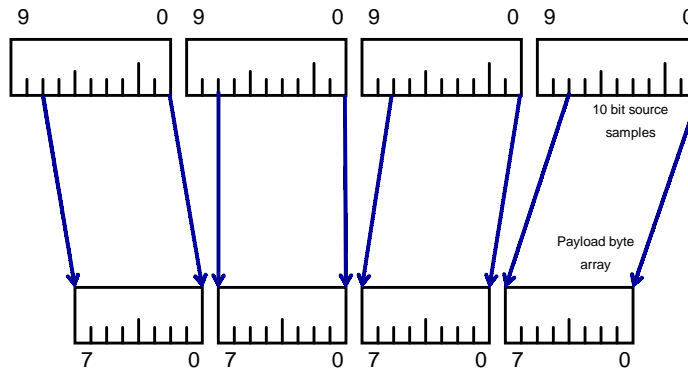


Figure 4 – 8-bit samples mapped to ANC Payload Byte Array

4.4.4 10-bit sample coding

For a 10-bit coding, 4 bytes representing 3 source samples shall be coded using the high-order 30-bits (bits 2 to 31) of a 32-bit (4 byte) Payload Byte Array data word. The 2 low-order bits of the payload data 32-bit word (bits 0 and 1) should be set to zero. See Figure 5.

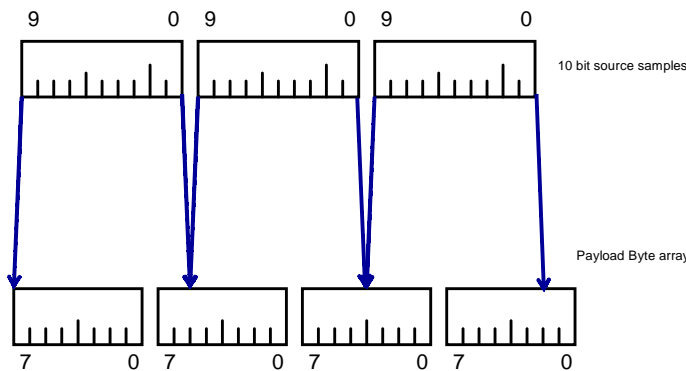


Figure 5 – 10-bit samples mapped to Payload Byte Array

5 MXF Vertical Blanking Interval line wrapping specifications

This standard provides an MXF encoding of VBI lines for 8-bit and 10-bit digital component signals as defined by SMPTE 259M, SMPTE 292, and SMPTE 424M.

A device shall be capable of encoding or decoding VBI lines after the switching line and up to and including the first line of active video. A device may encode or decode other lines.

When a decoder is assembling the reconstructed video signal, there may be a conflict between VBI lines decoded using this standard and lines the reconstructed video image. In this case, the VBI data from this standard should take precedence in the reconstructed video signal.

NOTE – If an encoder encounters an incorrectly formed or missing VBI line, the encoder can represent the missing VBI line by not generating a VBI Frame Element for that line.

5.1 VBI Frame Elements

Each VBI Frame Element shall be KLV-coded according to tables 2 and 4. The properties in the VBI Frame Element shall be stored in the order presented in tables 2 and 4. All properties shall be provided (“required” in MXF terminology.)

As specified in Table 4 and illustrated in Figure 6, the VBI Frame Element Value shall start with the number of VBI lines for the associated Picture Element. This shall be followed by the MXF-Wrapped VBI Line consisting of a line number, wrapping type, sample coding, and sample count for the VBI Payload Byte Array, and the VBI Payload Byte Array. This data is repeated for each MXF-Wrapped VBI Line in the VBI Frame Element.

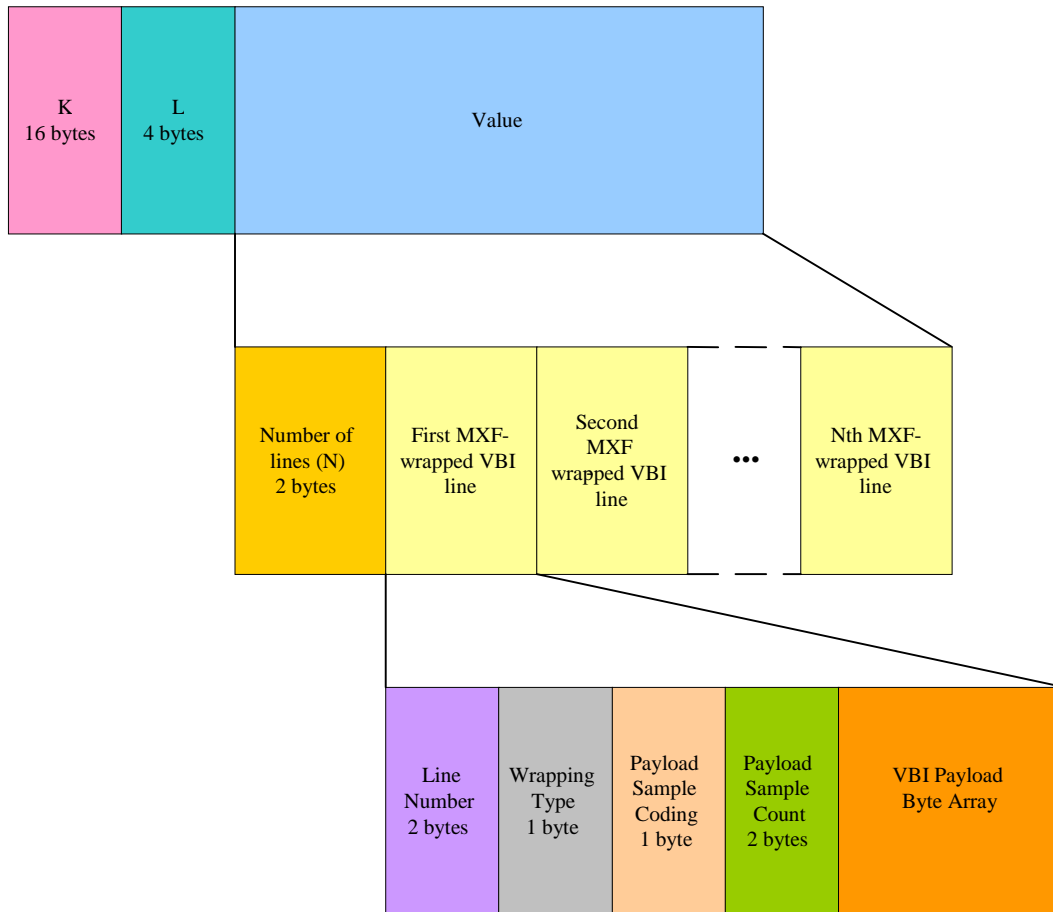


Figure 6 – VBI Frame Element

Table 2 – VBI Frame Element

Item Name	Type	Len	UL Designator	Meaning	Default
VBI Frame Element Key	Element Key	16	Table 3	Identifies a Frame Element	
Length	BER Length	4	83.xx.xx.xhx	Overall Length of VBI Frame Element Value	
VBI Frame Element Value	Element Value	see Table 4	Given in Table 4	N lines of MXF-wrapped VBI data	

Table 3 – VBI Frame Element Key

Byte No.	Description	Value (hex)	Meaning
1-12	See MXF Generic Container Specification		
13	Item Type Identifier	17h	Data Item
14	Essence Element Count	01h	Count of VBI Frame Elements in this Data Item
15	Essence Element Type	01h	Frame-Wrapped VBI Data Element
16	Essence Element Number	01h	The Number (used as an Index) of this VBI Frame Element in this Data Item

Table 4 – VBI Frame Element Value

Item Name	Type	Len	UL Designator	Meaning	Default
Number of Lines	UInt16	2	04.01.05.02.03	Number of VBI Lines in this element (N)	
The following group of properties is repeated N times (each Line Number follows the Payload Byte Array of the previous line)					
Line Number	UInt16	2	04.01.05.02.04	The line number of this stored line according to SMPTE 377M E.1.5	
Wrapping Type	UInt8	1	04.01.05.02.05	Wrapping type of the VBI data payload: 1 - Frame (Interlaced or progressive segmented frame) 2 - Field 1 3 - Field 2 4 - Progressive frame	
Payload Sample Coding	UInt8	1	04.01.05.03.0F	An enumerated Sample Coding: 1 - 1-bit component luma samples 2 - 1-bit component color difference samples 3 - 1-bit component luma and color difference samples 4 - 8-bit component luma samples 5 - 8-bit component color difference samples 6 - 8-bit component luma and color difference samples 7 - 10-bit component luma samples 8 - 10-bit component color difference samples 9 - 10-bit component luma and color difference samples 10 - Reserved 11 - Reserved 12 - Reserved	
Payload Sample Count	UInt16	2	04.01.05.02.06	A count of the number of samples stored in the VBI Payload Byte Array	
VBI Payload Byte Array	Array of UInt8	Var (8+n)	04.01.05.02.07	An array of UInt8 samples containing the coded data. This array may contain extra UInt8 values to pad the length of the element to a UInt32 boundary. The array count (n) is the number of payload data bytes in the array, including any padding bytes.	

The length field of the KLV coded VBI Frame Element shall be 4 bytes BER long-form encoded which is 1 byte for the length field's length (83h) and 3 bytes for the length field's actual value (i.e. 83h.xx.yy.zz) where xx.yy.zz is a 24 bit unsigned integer. The value of the length field property shall be the length of the VBI Frame Element value.

The value of the VBI Frame Element Key shall be constant throughout the entire Generic Container. This is to ensure proper linking to the header metadata as required by SMPTE 379M.

5.2 VBI Payload Byte Array and Sample Coding

The information representing the samples shall be in first sample to last sample sequence. The first sample shall be the sample following SAV. The final sample shall be the last sample before EAV. The MXF file's VBI Payload Byte Array shall include only the luma samples, only the color difference samples, or both.

The payload sample count property shall be the number of samples placed in the VBI Payload Byte Array.

An implementation shall support 8-bit sample words. In addition an implementation may also support 1-bit and/or 10-bit sample coding. See section 4.4.

6 MXF Ancillary Data Packet wrapping specifications

This standard provides an MXF encoding of ANC packets (HANC and VANC) as defined in SMPTE 291M for 8-bit and 10-bit digital component signals as defined by SMPTE 259M, SMPTE 292M, and SMPTE 424M.

When a decoder is assembling the reconstructed video signal, there may be a conflict between VANC packets decoded using this standard and the lines for the reconstructed video image. In this case, the VANC packets decoded from this standard should take precedence in the reconstructed video signal.

NOTE – The use of ANC packets from the first lines of the uncompressed field or frame up to and including the switching line is discouraged; however, it is not prohibited by this standard.

ANC packets shall be coded using an 8-bit or a 10-bit coding format. The details of the 8-bit and 10-bit coding formats are defined in section 6.2.

For the 8-bit sample format, two Essence Container ULs shall be defined. One is used to signal ANC packets without parity or check-sum errors and the other is used to signal ANC packets which may have corrupt data. The appropriate Essence Container UL shall be placed in the Essence Container UL batch property as defined in SMPTE 377M.

NOTE – The 10-bit format is intended to be used as a “pass-through” when it is necessary to transport the parity-bits, inverted parity-bits and check-sum word. This can be used when the integrity of the complete data stream is unknown or its exact transport is critical.

6.1 ANC Frame Element

Each ANC Frame Element shall be KLV-coded according to Tables 5 and 7. The properties in the ANC Frame Element shall be stored in the order presented in Tables 5 and 7. All properties shall be provided.

As specified in Tables 5 and 7 and illustrated in Figure 7, the ANC Frame Element shall start with the number of MXF-Wrapped ANC Packets for the associated Picture Element. This shall be followed by the line number, wrapping type, sample coding, sample count for the ANC Payload Byte Array, and the ANC Payload Byte Array. This data shall be repeated for each MXF-Wrapped ANC Packet in the ANC Frame Element.

ANC packets that are in the vertical blanking interval before SAV shall be marked as HANC packets.

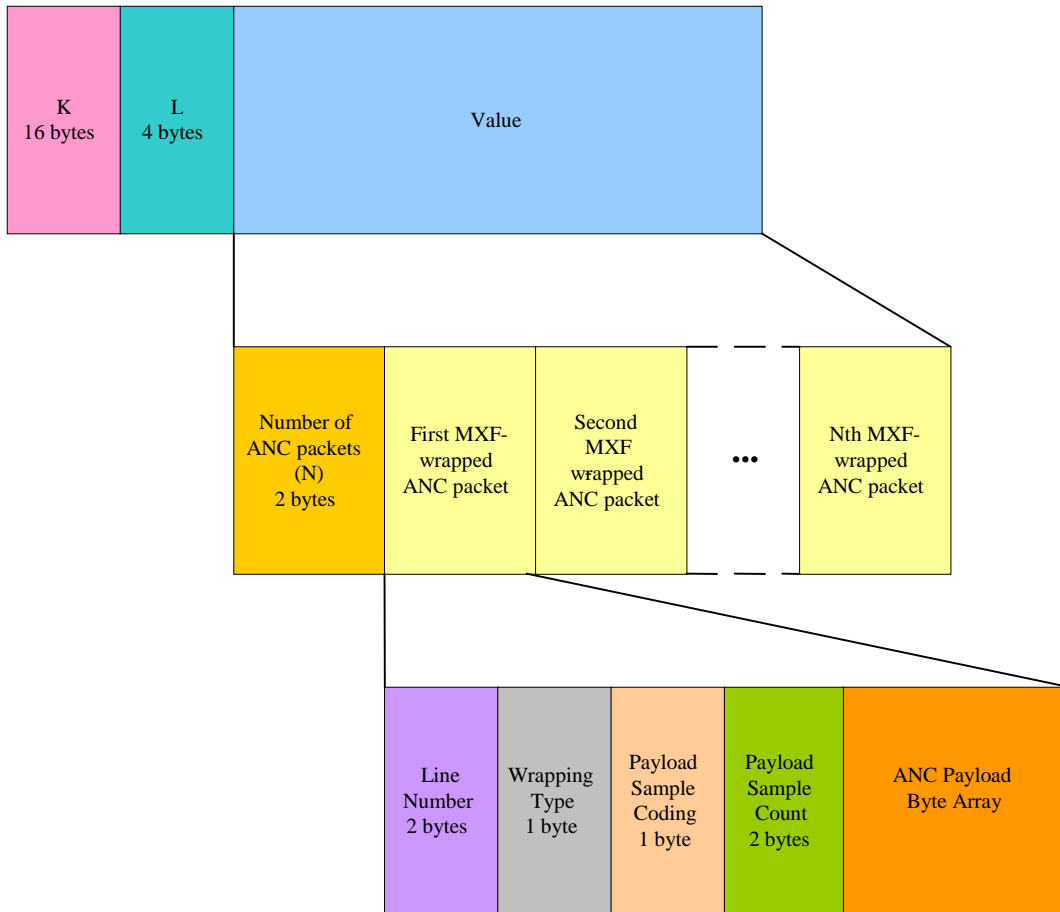


Figure 7 – ANC Frame Element

Table 5 – ANC Frame Element

Item Name	Type	Len	UL Designator	Meaning	Default
ANC Frame Element Key	Element Key	16	Table 6	Identifies an ANC Frame Element	
Length	BER Length	4	83.xx.xx.xxh	Overall Length of Element	
ANC Frame Element Value	Element Value	Refer to Table 7	Given in Table 7	ANC Packets Elements associated with a Picture Element	

Table 6 – Key Value for the ANC Frame Element

Byte No.	Description	Value (hex)	Meaning
1-12	See MXF Generic Container Specification		
13	Item Type Identifier	17h	Data Item
14	Essence Element Count	01h	Count of ANC Frame Elements in this Data Item
15	Essence Element Type	02h	Frame-Wrapped ANC Data Element
16	Essence Element Number	01h	The Number (used as an Index) of this ANC Frame Element in this Data Item

Table 7 – ANC Frame Element Value

Item Name	Type	Len	UL Designator	Meaning	Default
Number of ANC packets	UInt16	2	04.01.05.02.08	Number of ANC packets in this element (N)	
The following group of properties is repeated N times (each Line Number follows the Payload Byte Array of the previous ANC packet)					
Line Number	UInt16	2	04.01.05.02.09	The line number of this ANC packet according to SMPTE 377M E.1.5	
Wrapping Type	UInt8	1	04.01.05.02.0A	Wrapping type of the ANC Packet payload: 001h VANC Frame (Interlaced or segmented progressive frame) 002h VANC Field 1 003h VANC Field 2 004h VANC Progressive frame 011h HANC Frame (Interlaced or progressive segmented frame) 012h HANC Field 1 013h HANC Field 2 014h HANC Progressive frame	
Payload Sample Coding	UInt8	1	04.01.05.03.10	An enumerated Sample Coding: 1 reserved 2 reserved 3 reserved 4 8-bit luma samples 5 8-bit color difference samples 6 8-bit luma and color difference samples 7 10-bit luma samples 8 10-bit color difference samples 9 10-bit luma and color difference samples 10 8-bit luma samples – with parity error 11 8-bit color difference samples – with parity error 12 8-bit luma and color difference samples – with parity error	
Payload Sample Count	UInt16	2	04.01.05.02.0B	A count of the number of samples stored in the ANC Payload Byte Array	
ANC Payload Byte Array	Array of UInt8	Var (8 + n)	04.01.05.02.0C	An array of UInt8 containing the coded data. This array may contain extra UInt8 values to pad the length of the Element to a UInt32 boundary. The array count (n) is the number of payload data bytes in the array, including any padding bytes.	

The length field of the KLV coded ANC Frame Element shall be 4 bytes BER long-form encoded which is 1 byte for the length field's length (83h) and 3 bytes for the length field's actual value (i.e. 83h.xx.yy.zz) where xx.yy.zz is a 24 bit unsigned integer. The value of the length field property shall be the length of the ANC Frame Element value.

The value of the ANC Frame Element Key shall be constant throughout the entire Generic Container. This is to ensure proper linking to the header metadata as required by SMPTE 379M.

Payload Sample Coding that indicates parity errors may be used by an encoder to represent ANC packets that are known or found to be in error but are still valuable in a specific application.

This standard does not specify when these enumerated values for parity errors should be used by an encoder nor does it specify how a decoder should process these packets.

6.2 ANC Payload Byte Array and Sample Coding

8-bit encoding: This ANC Payload Byte Array shall include words from the source ANC packets starting with the ANC DID word and ending with the last word of ANC user data. The low-order 8-bits from the source ANC packet shall be placed in this standard’s ANC Payload Byte Array. The two bits representing the parity, the inverted parity, and the complete check sum from the source ANC packet’s words are lost. See sections 4.4 and 4.4.3.

8-bit decoding: A decoder regenerating a video signal using this standard shall generate the required ANC packet flag words, the checksum word, parity and inverted parity-bits for all ANC packet words according to SMPTE 291M.

10-bit coding: For 10-bit samples the first source sample word captured shall be the ANC packets DID and the last source sample word captured shall be the check-sum. The 10-bit coding mode is designed to allow “pass through” of ANC packets without correcting the parity or check sum. This allows faithful bit-accurate reproduction of the source sample words as seen by the MXF encoder. Mapping of 10-bit words into the 8-bit Payload Byte Array shall be performed according to section 4.4.4.

The payload sample count property shall be the number of 8-bit or 10-bit samples stored in the ANC Payload Byte Array. This count includes the DID, SDID or DBN, DC, user data words, and possibly the check-sum. See the 8 and 10-bit coding rules below for the exact list of sample words stored.

7 Descriptors

Data Essence Descriptors are provided for files containing VBI Frame Elements and ANC Frame Elements. Although no additional properties are defined here, optional properties defined in other documents may be stored in this descriptor.

When VBI lines or ANC packets exist in an MXF file, the appropriate descriptor from section 7.1 or 7.3 shall be present in the file. The descriptor shall be associated with a Data Track using the mechanisms defined in SMPTE 377M.

NOTE – This specification details an opaque transport mechanism for VBI data and ANC packets in MXF files. MXF descriptors are provided for the identification of the VBI line and ANC packet essence contained within the file. If an application needs to signal additional properties, this can be done by inserting optional properties within these descriptors. The definition of these optional properties may be public or private and is outside the scope of this document.

7.1 VBI Data Descriptor

The VBI Data Descriptor may contain optional properties that describe the VBI lines content.

Table 8 – VBI Data Descriptor

Item Name	Type	Len	UL Designator	Req ?	Meaning	Default
VBI Data Descriptor	Set UL	16	See Table 9	Req	Defines the VBI Data Descriptor Set	
↔ Length	BER Length	4		Req	Set length	
All items from the MXF Generic Data Descriptor – no additional properties are defined here						

7.2 Key for the VBI Data Descriptor

The Key (UL) for this universal set is defined below:

Table 9 – Key for VBI Data Descriptor

Byte No.	Description	Value (hex)	Meaning
1-13	Defined in Section “8.6 Structural Header Metadata Implementation” of SMPTE 377M (File Format Specification)		
14	Set Kind (1)	01h	VBI Data Descriptor
15	Set Kind (2)	5Bh	
16	Reserved	00h	Reserved

7.3 ANC Data Descriptor

The ANC packets data descriptor may contain optional properties that describe the ANC packet contents.

Table 10 – ANC Packets Descriptor

Item Name	Type	Len	UL Designator	Req ?	Meaning	Default
ANC Data Descriptor	Set UL	16	See Table 11	Req	Defines the ANC Data Descriptor Set	
Length	BER Length	4		Req	Set length	
All items from the MXF Generic Data Descriptor – no additional properties are defined here						

7.4 Key for the ANC Data Descriptor

The Key (UL) for this universal set is defined below:

Table 11 – Key for ANC Packets Descriptor

Byte No.	Description	Value (hex)	Meaning
1-13	Defined in Section “8.6 Structural Header Metadata Implementation” of SMPTE 377M (File Format Specification)		
14	Set Kind (1)	01h	ANC Data Descriptor
15	Set Kind (2)	5Ch	
16	Reserved	00h	Reserved

Annex A (informative)
Bibliography

SMPTE 272M-2004, Television — Formatting AES/EBU Audio and Auxiliary Data into Digital Video Ancillary Data Space

SMPTE 299M-2004, Television — 24-Bit Digital Audio Format for SMPTE 292M Bit-Serial Interface

SMPTE 331M-2004, Television — Element and Metadata Definitions for the SDTI-CP

SMPTE 381M-2005, Television — Material Exchange Format (MXF) — Mapping MPEG Streams into the MXF Generic Container

SMPTE 385M-2004, Television — Material Exchange Format (MXF) — Mapping SDTI-CP Essence and Metadata into the MXF Generic Container

SMPTE 386M-2004, Television — Material Exchange Format (MXF) — Mapping Type D-10 Essence Data to the MXF Generic Container

SMPTE 387M-2004, Television — Material Exchange Format (MXF) — Mapping Type D-11 Essence Data to the MXF Generic Container

SMPTE 390M-2004, Television — Material Exchange Format (MXF) — Specialized Operational Pattern “Atom” (Simplified Representation of a Single Item)

SMPTE RP-208-2002, Transport of VBI Packet Data in Ancillary Data Packets

SMPTE EG 41-2004, Television — Material Exchange Format (MXF) — Engineering Guideline