SMPTE REGISTERED DISCLOSURE DOCUMENT

MXF OP-1b Specification for AVC with Chunk Audio

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Proponent contact information:

Hideki Ohtaka
Panasonic Corporation
2-15 Matsuba-cho, Kadoma City,
Osaka 571-8503,
Japan

Email: ohtaka.hideki@jp.panasonic.com

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Introduction

This section is entirely informative and does not form an integral part of this Registered Disclosure Document.

Operational Pattern 1b (OP-1b) is defined as a conformance point of MXF files and specifies the minimum constraints. Additional constraints on OP-1b implementations need to be specified to facilitate interoperability for a specific application, such as tape-less camera recording.

This RDD provides the specification for implementing an MXF OP-1b file to encapsulate AVC video essence, data essence, and uncompressed PCM audio essence in chunk.

OP-1b is employed to carry video, data, and audio essences as separate File Packages in a single MXF file and multiplex them into a specific duration using partitioning.

The feature of the essence wrapping is that the audio essence is Custom-wrapped based on a specific number of audio samples duration, while the Frame-wrapping is used for the video essence and the data essence.

Each Index Table segment is placed in the separate Partition immediately following the essence they Index.

1 Scope

This RDD provides the specification for implementing an MXF OP-1b file that encapsulates AVC Long GOP video essence, uncompressed PCM audio essence in chunk, and data essence originally carried in ancillary packets.

This document specifies the structure of the MXF OP-1b file, partitioning, Essence Containers, and the implementations of the Header Metadata and Index Table.

2 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 382:2007) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 382-2007). Documents with the same root number (e.g. 382) and publication year (e.g. 2007) are functionally identical.

The following standards contain provisions which, through reference in this text, constitute provisions of this RDD. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this RDD are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE ST 377-1:2011, Material Exchange Format (MXF) — File Format Specification

Amendment 1:2012 to SMPTE ST 377-1:2011

Amendment 2:2012 to SMPTE ST 377-1:2011

SMPTE ST 379-2:2010, Material Exchange Format (MXF) — MXF Constrained Generic Container

SMPTE ST 381-2:2011, Material Exchange Format (MXF) — Mapping MPEG Streams into the MXF Constrained Generic Container

SMPTE ST 381-3:2013, Material Exchange Format (MXF) — Mapping AVC Streams into the MXF Generic Container

SMPTE ST 382:2007, Material Exchange Format (MXF) — Mapping AES3 and Broadcast Wave Audio into the MXF Generic Container

Amendment 1:2012 to SMPTE ST 382:2007

Amendment 2:2013 to SMPTE ST 382:2007

SMPTE ST 391:2004, Material Exchange Format (MXF) — Operational Pattern 1b (Single Item, Ganged Packages)

SMPTE ST 436-1:2013, MXF Mappings for VI Lines and Ancillary Data Packets

SMPTE RP 210, Metadata Element Dictionary

SMPTE RP 224, SMPTE Labels Register

ISO/IEC 14496-10 | Rec. ITU-T H.264 (2012), Information Technology — Coding of Audio-Visual Objects — Advanced Video Coding

3 Definition of Acronyms, Terms and Data Types

For the purposes of this RDD, the following definitions apply:

The general glossary of acronyms, terms and data types used in the MXF specification is given in SMPTE ST377-1, SMPTE ST 379-2, SMPTE ST 381-3, and SMPTE ST 382. Definitions of terms, abbreviations and symbols relating to AVC are given in ISO/IEC 14496-10 | Rec. ITU-T H.264.

3.1
AVC
Advanced Video Coding – ISO/IEC 14496-10 I Rec. ITU-T H.264.

3.2
AVC Long GOP 4:2:0
AVC Long GOP coding with 4:2:0 sampling.

3.3
AVC Long GOP 4:2:2
AVC Long GOP coding with 4:2:2 sampling.

3.4
Chunk audio
A constant number of audio sample data presented per Partition.

4 Basic Structure of MXF OP-1b File

Figure 1 illustrates the outline of an MXF OP-1b file defined in this document.

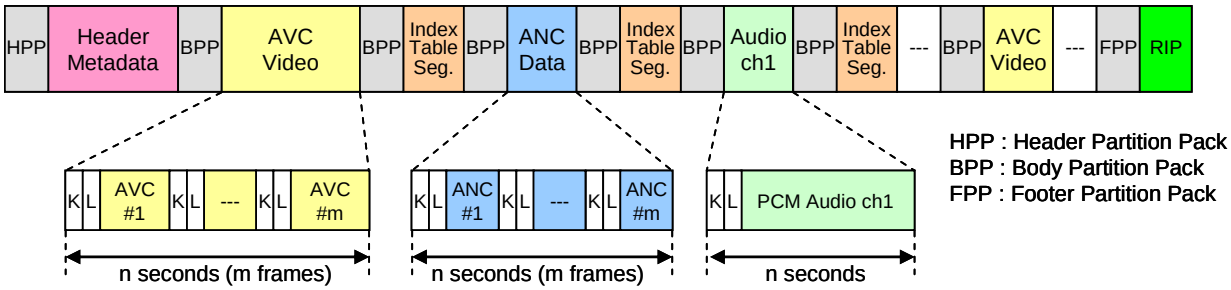


Figure 1 – Basic structure of MXF OP-1b for AVC and Chunk audio

The MXF file consists of one (1) Header Partition, multiple Body partitions, and one (1) Footer Partition.

Body Partition is divided into multiple Partitions in a specific duration and each essence is carried using separate Body Partition. The duration of each Partition is constant throughout a file except the end of the file.

The video essence is an AVC Long GOP encoded stream and mapped into the MXF Generic Container using Frame-wrapping.

The data essence contains Ancillary Data Packets (ANC packets) and is mapped into the MXF Generic Container using Frame-wrapping.

The audio essence is uncompressed PCM audio and is mapped into the MXF Generic Container in chunk using Custom-wrapping.

Each Index Table is placed in the separate Partition immediately following the essence they Index.

5 Partitions

5.1 Partitioning

There shall be one (1) Header Partition, multiple Body Partitions, and one (1) Footer Partition in the file.

Header Partition shall not contain any Essence Containers and any Index Table Segments.

Body Partition shall be divided into multiple Partitions and the duration of each Body Partition shall be up to ten (10) seconds. The recommended Partition duration is two (2) seconds. The duration of each Body Partition shall be constant throughout a file except the end of the file.

The 1st Body Partition shall contain Essence Container only for video essence.

The 2nd Body Partition shall contain the Index Table Segment only for the immediately preceding video essence.

The 3rd Body Partition shall contain Essence Container only for data essence.

The 4th Body Partition shall contain the Index Table Segment only for the immediately preceding data essence.

If multiple channels of audio essence are present, the 5th Body Partition shall contain Essence Container only for the first channel and the 6th Body Partition shall contain the Index Table segment only for the immediately preceding first channel. Body Partitions for the other channels follow those for the first channel.

All following Body Partitions shall follow the above pattern and the Partition order shall not change.

The number of video frames and the number of audio samples in a Body Partition shall be constant depending on frame rates except the end of the file.

Figure 2 illustrates the structure of Body Partitions.

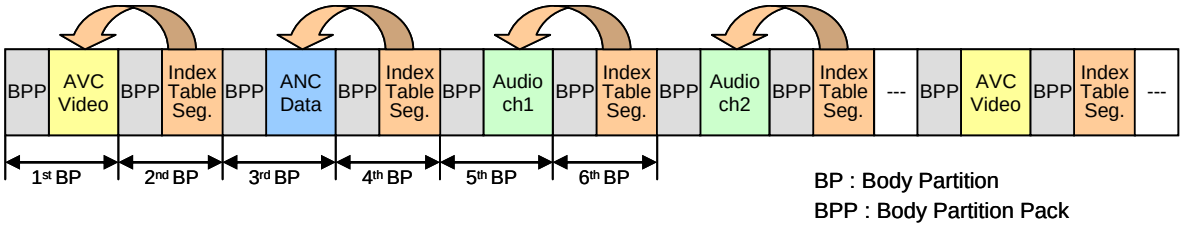


Figure 2 – Structure of Body Partitions

5.2 Partition Pack

Header Partition should be Closed and Complete. The Header should be rewritten as Closed and Complete; with the correct value of the Footer Partition property and updated Header Metadata including the duration.

Body Partition shall be Open and Complete.

Footer Partition shall be Closed and Complete.

6 Operational Pattern

Operational Pattern shall be OP-1b (Single Item, Ganged Packages) as specified in SMPTE ST 391. The value of Universal Label for Operational Pattern 1b shall be as given in Table 1.

Table 1 – Value of MXF Operational Pattern identification Universal Label

Byte No.	Description	Value (hex)	Meaning
1-12	Specified by the MXF Specification SMPTE ST 377-1		
13	Operational Pattern: Item Complexity	01h	Single Item
14	Operational Pattern: Essence container Complexity	02h	Ganged Packages
15	Operational Pattern: Qualifiers	09h	See Table 2 for details
16	Reserved for future use	00h	

Table 2 – Byte 15 value of MXF Operational Pattern UL

Byte No.	Value (bin)	Meaning
0	1	Marker bit to prevent a zero value
1	0	Internal essence
2	0	Stream file
3	1	Multi-track
7-4	0000	Reserved for future use, and should be set to zero

7 Essence Container

7.1 Generic Container

Essence Container shall be the MXF Constrained Generic Container defined in SMPTE ST 379-2.

7.2 Video Essence

7.2.1 Generic Container Mapping

Video essence shall be an AVC Long GOP encoded stream and the bit stream format shall be the AVC byte stream.

The AVC byte stream shall be mapped into the MXF Generic Container using Frame wrapped MPEG Picture Element defined in SMPTE ST 381-2 and SMPTE ST 381-3.

7.2.2 Universal Label for Essence Container Identification

The Essence Container Universal Label for Frame wrapped AVC byte stream is as given in Table 3.

Table 3 – Essence Container Universal Label for AVC byte stream

Byte No.	Description	Value (hex)	Meaning
1-12	Specified by the MXF Generic Container Specification SMPTE ST 379-2		
13	Essence Container Kind	02h	MXF Generic Container
14	Mapping Kind	10h	AVC byte stream
15	Stream_id	60h	ISO13818-1 stream_id bits 6..0
16	Wrapping scheme	01h	Frame wrapping

7.2.3 KLV coding of Picture Element

7.2.3.1 Picture Element Key

The Essence Element Key shall be the MPEG Picture Element Key defined in SMPTE ST 381-2. The Key value of the MPEG Picture Element is as given in Table 4. The value of Byte 15 shall be set to 05h to signal the Frame wrapped Picture Element.

Table 4 – Key Value for the MPEG Picture Element

Byte No.	Description	Value (hex)	Meaning
1-12	Specified by the MXF Generic Container Specification SMPTE ST 379-2		
13	Item Type Identifier	15h	GC Picture Item as defined in SMPTE ST 379-2
14	Essence Element Count	01h	Count of Picture Elements in this Item
15	Essence Element Type	05h	Frame Wrapped Picture Element
16	Essence Element Number	nnh	A number (used as an Index) of this Picture Item in this Generic Container as defined in SMPTE ST 379-2

7.2.3.2 Picture Element Length

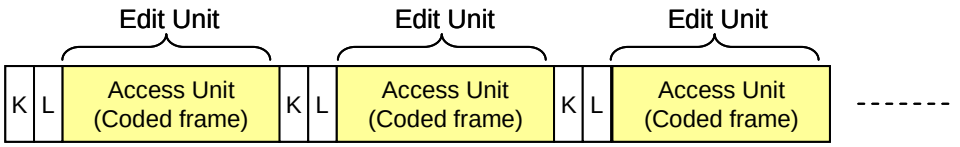
The length field of the KLV coded Element is 4 bytes BER long-form encoded (i.e., 83h.xx.yy.zz) for Frame wrapping.

7.2.3.3 Picture Element Value

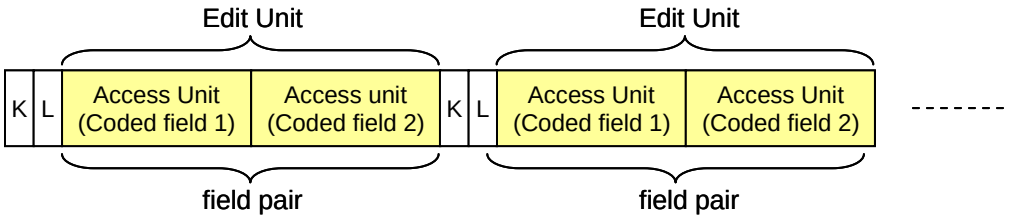
The Essence Element Value within each KLV triplet shall be an AVC-Long GOP coded frame or a pair of coded fields.

In the 1080/59.94i and 50i systems with an interlaced image source, each field is field-encoded and each pair of fields is wrapped into a KLV packet. The Value field of each KLV packet shall contain the field-encoded data of a complete frame.

Figure 3 illustrates the structures of KLV packets for progressive and interlaced source images.



(a) KLV packet for progressive source image



(b) KLV packet for interlaced source image

Figure 3 – KLV packet structure for video essence

7.3 Data Essence

7.3.1 Generic Container Mapping

Data essence consists of Ancillary Data Packets (ANC packets), and shall be mapped into the MXF Generic Container using an ANC Frame Element defined in SMPTE ST 436-1.

7.3.2 Universal Label for Essence Container Identification

The Essence Container Universal Label for an ANC packet is as given in Table 5.

Table 5 – Essence Container Universal Label for an ANC Packet

Byte No.	Description	Value (hex)	Meaning
1-12	Specified by the MXF Generic Container Specification SMPTE ST 379-2		
13	Essence Container Kind	02h	MXF Generic Container
14	Mapping Kind	0Eh	ANC Packet
15	Reserved	00h	Not used
16	Reserved	00h	Not used

7.3.3 KLV coding of Data Element

7.3.3.1 Data Element Key

The Essence Element Key shall be the ANC Frame Element Key defined in SMPTE ST 436-1. The Key value of the ANC Frame Element is as given in Table 6.

Table 6 – Key Value for the ANC Frame Element

Byte No.	Description	Value (hex)	Meaning
1-12	Specified by the MXF Generic Container Specification SMPTE ST 379-2		
13	Item Type Identifier	17h	GC Data Item as defined in SMPTE ST 379-2
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	nnh	A number (used as an Index) of this ANC Frame Element in this Generic Container as defined in SMPTE ST 379-2

7.3.3.2 Data Element Length

The length field of the KLV coded Element is 4 bytes BER long-form encoded (i.e., 83h.xx.yy.zz) for Frame wrapping.

7.3.3.3 Data Element Value

The Essence Element Value within each KLV triplet shall be in ANC packets form as specified by SMPTE ST 436-1.

In the 1080/59.94i and 50i systems, the Value field of each KLV packet shall contain ANC packets carried in a pair of fields. ANC packets carried in the first field shall precede ANC packets carried in the second field within a single ANC Frame Element.

ANC Elements shall be stored in a display order even though AVC Long GOP Picture Essence Elements are reordered.

Any padding should not be used within the Essence Element Value.

7.3.4 Implementation of ANC Frame Element

In the MXF OP-1b file defined in this document, the ANC Frame Element shall be present and the length shall be 512 bytes per frame as a minimum including the KLV Fill item for padding. The structure of the ANC Frame Element shall be identical throughout the file. All ANC Frame Elements shall have the same length.

If no ANC packet is carried, the ANC Frame Element shall contain only the Number of packets item that has a value of zero, and shall be followed by the KLV Fill item for padding. The Data Track shall be present in the Header Metadata even if the ANC Frame Element carries no ANC packets.

7.4 Audio Essence

7.4.1 Generic Container Mapping

Audio essence shall be 16-bit or 24-bit uncompressed PCM audio at a sampling rate of 48 kHz or 96 kHz.

Audio data shall be mapped into the MXF Generic Container in chunk using the AES3 Custom wrapped Element defined in SMPTE ST 382 Amendment 2.

7.4.2 Universal Label for Essence Container Identification

The Essence Container Universal Label for AES audio is as given in Table 7. The value of Byte 15 shall be set to 0Bh to signal the AES3 constant duration audio Custom wrapped Element.

Table 7 – Essence Container Universal Label for AES Audio

Byte No.	Description	Value (hex)	Meaning
1-12	Specified by the MXF Generic Container Specification SMPTE ST 379-2		
13	Essence Container Kind	02h	MXF Generic Container
14	Mapping Kind	06h	AES3-BWF
15	Content Kind	0Bh	AES constant duration audio Custom Wrapped Element
16	Reserved	00h	

7.4.3 KLV coding of Sound Element

7.4.3.1 Sound Element Key

The Essence Element Key shall be the AES Sound Element Key defined in SMPTE ST 382. The Key value of the AES Sound Element is as given in Table 8. The value of Byte 15 shall be set to 0Ch to signal the AES Custom wrapped Element.

Table 8 – Key Value for the Sound Essence Element

Byte No.	Description	Value (hex)	Meaning
1-12	Specified by the MXF Generic Container Specification SMPTE ST 379-2		
13	Item Type Identifier	16h	GC Sound item
14	Essence Element Count	01h	Number of Essence Elements present in this Sound item
15	Essence Element Type	0Ch	AES Custom wrapped Element
16	Essence Element Number	nnh	Unique Number amongst the elements in this Sound item

7.4.3.2 Sound Element Length

The length field of the KLV coded Element is 8 bytes BER long-form encoded (87h.aa,bb,cc,dd,ee,ff,gg) for the Custom wrapping. The value of the length field is a multiple (2x or 3x) of the number of audio samples per Partition.

7.4.3.3 Sound Element Value

The Essence Element Value within each KLV triplet shall be Chunk audio consisting of audio samples presented per Partition duration.

The number of audio samples per one video frame at 48-kHz sampling is the following:

59.94i, 29.97p	: 8008 samples / 5 frames
50i, 25p	: 1920 samples / frame
59.94p	: 4004 samples / 5 frames
50p	: 960 samples / frame
23.976p	: 2002 samples / frame

8 MXF Header Metadata

Figure 4 illustrates the overall structure of the MXF Header Metadata.

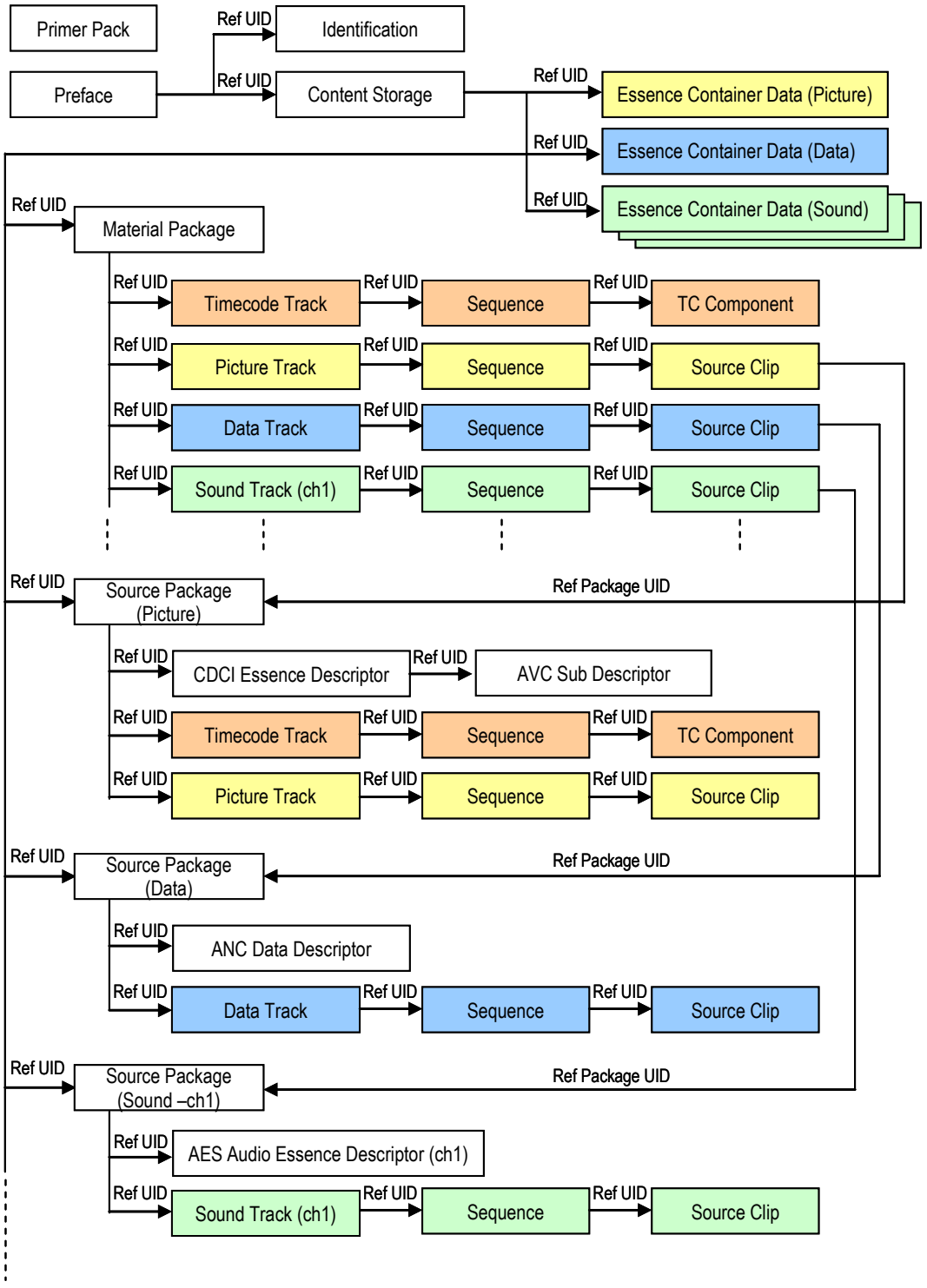


Figure 4 – Structure of MXF Header Metadata

The Material Package shall include the sets for Timecode Track, Picture Track, Data Track, and the sets for multiple Sound Tracks.

The File Package for video essence shall include the sets for Timecode Track and Picture Track.

The File Package for data essence shall include the sets for Data Track.

The File Package for each audio essence shall include the sets for each Sound Track.

The constraint item values of the Essence Descriptors are given in Table 9 through Table 15.

Table 9 – Item values of CDCI Picture Essence Descriptor for 1080-line system

Item Name	Type	Len	Value in this RDD	
			Interlaced	Progressive
SubDescriptors	StrongRef	8+16	Instance UID of AVC Sub Descriptor	
Linked Track ID	UInt32	4	Track ID of the Picture Track	
Sample Rate	Rational	8	59.94i: 30000,1001 50i: 25,1	59.94p: 60000,1001 50p: 50,1 29.97p: 30000,1001 25p: 25,1 23.98p: 24000,1001
Container Duration	Length	8	Number of frames present	
Essence Container	UL	16	06.0E.2B.34.04.01.01.0A.0D.01.03.01.02.10.60.01	
Frame Layout	Uint8	1	1	0
Stored Width	Uint32	4	1920	
Stored Height	Uint32	4	540	1080
Aspect Ratio	Rational	8	16,9	
Video Line Map	Array of Int32	8+8	21,584	42,0
Picture Essence Coding	UL	16	See Table 11	
Component Depth	UInt32	4	AVC Long GOP 4:2:2: 10 AVC Long GOP 4:2:0: 8	
Horizontal Subsampling	UInt32	4	2	
Vertical Subsampling	UInt32	4	AVC Long GOP 4:2:2: 1 AVC Long GOP 4:2:0: 2	

Table 10 – Item values of CDCI Picture Essence Descriptor for 720-line system

Item Name	Type	Len	Value in this RDD
SubDescriptors	StrongRef	8+16	Instance UID of AVC Sub Descriptor
Linked Track ID	UInt32	4	Track ID of the Picture Track
Sample Rate	Rational	8	59.94p: 60000,1001 50p: 50,1 29.97p: 30000,1001 25p: 25,1 23.98p: 24000,1001
Container Duration	Length	8	Number of frames present
Essence Container	UL	16	06.0E.2B.34.04.01.01.0A.0D.01.03.01.02.10.60.01
Frame Layout	Uint8	1	0
Stored Width	Uint32	4	1280
Stored Height	Uint32	4	720

Item Name	Type	Len	Value in this RDD
Aspect Ratio	Rational	8	16,9
Video Line Map	Array of Int32	8+8	26,0
Picture Essence Coding	UL	16	See Table 11
Component Depth	UInt32	4	AVC Long GOP 4:2:2:10 AVC Long GOP 4:2:0: 8
Horizontal Subsampling	UInt32	4	2
Vertical Subsampling	UInt32	4	AVC Long GOP 4:2:2: 1 AVC Long GOP 4:2:0: 2

Table 11 – Picture Essence Coding Label for AVC Long GOP

Codec type	UL
AVC Long GOP 4:2:0	06.0E.2B.34.04.01.01.0D 04.01.02.02.01.31.40.01 H.264/MPEG-4 AVC High Profile Unconstrained Coding
AVC Long GOP 4:2:2	06.0E.2B.34.04.01.01.0D.04.01.02.02.01.31.60.01 H.264/MPEG-4 AVC High 4:2:2 Profile Unconstrained Coding

Table 12 – Item values of AVC Sub Descriptor for AVC Long GOP video essence

Item Name	Type	Len	Value in this RDD
AVC Decoding Delay	UInt8	1	Delay required for decoded pictures in number of access units
AVC Constant B Picture Flag	Boolean	1	TRUE if the number of consecutive B Pictures is always constant
AVC Coded Content Kind	Enum	1	1080p, 720p: 1 (Frame picture, Frame coding) 1080i: 2 (Field picture, Field coding)
AVC Closed GOP Indicator	Boolean	1	FALSE
AVC Identical GOP Indicator	Boolean	1	TRUE if every GOP in the sequence has the same number of pictures and the same types of pictures in the same order
AVC Maximum GOP Size	UInt16	2	Maximum occurring spacing between I Pictures
AVC Maximum B-Picture Count	UInt16	2	Maximum number of consecutive B Pictures between P or I Pictures
AVC Maximum BitRate	UInt32	4	HRD bit rate given by HRD parameters
AVC Average BitRate	UInt32	4	Average bit rate throughout the stream
AVC Profile	UInt8	1	AVC Long GOP 4:2:2: 122 (High 4:2:2 profile) AVC Long GOP 4:2:0: 100 (High profile)
AVC Profile Constraint	UInt8	1	0
AVC Level	UInt8	1	1080/59.94p, 50p: 42 (Level 4.2) 1080/29.97p, 25p, 23.98p: 40 (Level 4) 720p: 40 (Level 4)
AVC Maximum Ref Frames	UInt8	1	Maximum number of reference frames
AVC Sequence Parameter Set Flag	UInt8	1	See Table 13
AVC Picture Parameter Set Flag	UInt8	1	See Table 14]

Table 13 – AVC Sequence Parameter Set Flag

Bit number	Name	Value in this RDD
7	Constancy flag	Specifies whether all sequence parameter sets are constant 0: unknown 1: constant
6-4	In-band location	3: Periodically placed at the first access unit in each GOP
3-0	reserved	0

Table 14 – AVC Picture Parameter Set Flag

Bit number	Name	Value in this RDD
7	Constancy flag	Specifies whether all picture parameter sets are constant 0: unknown 1: constant
6-4	In-band location	3: Periodically placed at the first access unit in each GOP
3-0	reserved	0

Table 15 – Item values of AES3 Audio Essence Descriptor

Item Name	Type	Len	Value in this RDD
Linked Track ID	UInt32	4	Track ID of each Sound Track
Sample Rate	Rational	8	48 kHz: 48000,1 96 kHz: 96000,1
Container Duration	Length	8	Created by the application
Essence Container	UL	16	06.0E.2B.34.04.01.01.05.0D.01.03.01.02.06.0B.00
Audio sampling rate	Rational	8	48 kHz: 48000,1 96 kHz: 96000,1
Locked/Unlocked	Boolean	1	1: Locked
ChannelCount	Uint32	4	1
Quantization bits	Uint32	4	16 bits: 16 24 bits: 24
Block Align	Uint16	2	16 bits: 2 24 bits: 3
Average Bytes Per Second	Uint32	4	48 kHz, 16 bit: 96000 48 kHz, 24 bits: 144000 96 kHz, 16 bits:192000 96 kHz, 24 bits:288000

Note: This Descriptor is required for each audio track.

9 Index Table

9.1 General

Index Table Segment shall be generated respectively for the Essence Container in each Body Partition and shall be placed in the separate Partition immediately following the essence they index. The Footer Partition may contain the complete Index Table that includes all the Index Table Segments in the Body.

Figure 5 illustrates the relation between the Index Table Segment and the Essence Container in each Body Partition.

The index Tables for video and data essences shall point to the start of each video frame. The index Table for audio essence shall point to each audio sample.

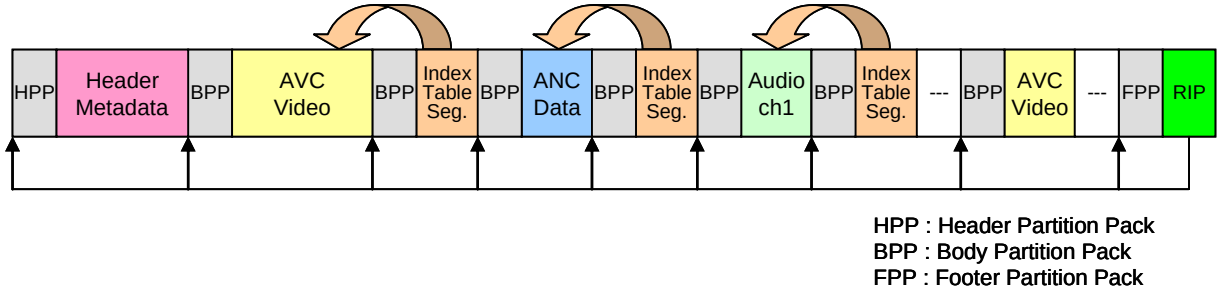


Figure 5 – Essence Container and respective Index Table Segment

9.2 Index Table Segment

9.2.1 Index Table Segment for video essence

The item values of Index Table Segment Set for video essence shall be as given in Table 16.

Index Edit Rate for video essence shall be frame rate.

The Index Entry Array shall be used to provide the byte offset for the start of each Picture Element and shall be as given in Table 17. In the 1080/59.94i and 1080/50i systems, the Index Entry Array provides the byte offset for the first field of a field pair.

Table 16 – Item values of Index Table Segment Set for video essence

Item Name	Type	Len	Value in this RDD
Index Edit Rate	Rational	8	Frame rate
Index Start Position	Position	8	Total number of Edit Units included in the Partitions for video essence preceding this Partition
Index Duration	Length	8	Number of Edit Units in this Partition
Edit Unit Byte Count	Uint32	4	0: Byte count of Edit Unit is variable and is given by the Index Entry Array
Index Entry Array	Array of IndexEntry	var	See Table 17

Table 17 – Index Entry Array for video essence

	N	Item Name	Type	Len	Value in this RDD
	1	NIE	UInt32	4	Equal to number of frames
	1	Length	UInt32	4	11
One Index Entry for each frame	N I E	Temporal Offset	Int8	1	Set according to AVC Picture type
		Key Frame Offset	Int8	1	Set according to AVC Picture type
		Flags	EditUnitFlag	1	See Table 18
		Stream Offset	UInt64	8	Offset from the first byte of the key of the first Picture Element to the first byte of the key of each Picture element

Table 18 – Settings of Flags properties

Bit	Meaning	Value in this RDD
Bit 7	Random Access	Set to one for IDR Picture
Bit 6	Sequence Parameter Set	Set to one if sequence parameter set exists
Bits 5,4	Forward/backwards prediction flag	Naïve setting: 00: I Picture (No prediction) 10: P Picture (Forward prediction) 11: B Picture (Forward or Backward or Forward and Backward)
Bit 3	Offsets out of range	0
Bits 2-0	AVC picture type	000: I Picture 100: IDR Picture 110: P Picture 011: B Picture 111: Br Picture

9.2.2 Index Table Segment for data essence

The item values of Index Table Segment Set for data essence shall be as given in Table 19.

Index Edit Rate for data essence shall be frame rate.

Table 19 – Item values of Index Table Segment Set for data essence

Item Name	Type	Len	Value in this RDD
Index Edit Rate	Rational	8	Frame rate
Index Start Position	Position	8	Total number of Edit Units included in the Partitions for data essence preceding this Partition
Index Duration	Length	8	Number of Edit Units in this Partition
Edit Unit Byte Count	Uint32	4	Byte count of Edit Unit 512 (Default)

9.2.3 Index Table Segment for audio essence

The item values of Index Table Segment Set for audio essences shall be as given in Table 20.

Index Edit Rate for audio essence shall be audio sample rate.

Indexing for each Edit Unit of audio essence shall not include the Key and the Length fields. Each audio essence stream shall start with the first byte of the value field in the first KLV packet.

Table 20 – Item values of Index Table Segment Set for audio essence

Item Name	Type	Len	Value in this RDD
Index Edit Rate	Rational	8	Audio sample rate
Index Start Position	Position	8	Total number of audio samples in the Partitions for each channel of audio essence preceding this Partition
Index Duration	Length	8	Number of audio samples in this Partition
Edit Unit Byte Count	Uint32	4	Byte count of each audio sample 16 bit: 2, 24 bit: 3

10 Random Index Pack (RIP)

The Random Index Pack (RIP) shall be present at the Footer to provide byte offset for all Partitions.

11 Alignment

KAG size shall be the default KLV Alignment Grid of 1.

Each Essence Element shall be four-byte aligned. The Sound Essence Element in the last Body Partition for each audio essence need not be four-byte aligned and may be followed by the KLV Fill item.

Each Index Table Segment followed by the KLV Fill item as needed shall be four-byte aligned.