SMPTE RDD 32:2017
Revision of RDD 32:2014

SMPTE REGISTERED DISCLOSURE DOCUMENT

XAVC™ MXF Mapping and Operating Points

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This document is intended to support the development of applications that read and process XAVC MXF files. It is not intended to support the development of hardware or software applications that create XAVC MXF files, and creation of such files is reserved to individuals and organizations that have entered into agreements with the proponent identified below for such file creation.

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1 Scope

This RDD specifies the MXF mapping of XAVC, i.e. MPEG-4 AVC picture, AES3 audio and ANC packets into the MXF Generic Container or MXF Constrained Generic Container, and two types of essence location style that are compliant with the OP-1a Frame Wrapping.

This document also provides the XAVC specification to support the development of applications that read and process XAVC MXF files at the specified operating points.

2 Related Documents

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 326:2000) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 326M-2000). Documents with the same root number (e.g. 326) and publication year (e.g. 2000) are functionally identical.

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

SMPTE ST 326:2000, Television — SDTI Content Package Format (SDTI-CP)

SMPTE ST 331:2011, Element and Metadata Definitions for the SDTI-CP

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

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

SMPTE ST 378:2004, Television — Material Exchange Format (MXF) — Operational pattern 1A (Single Item, Single Package)

SMPTE ST 379-1:2009, Material Exchange Format (MXF) — MXF Generic Container

SMPTE ST 379-2:2010, Television — 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 — Mapping AES3 and Broadcast Wave Audio into the MXF Generic Container

SMPTE ST 385:2012, Material Exchange Format (MXF) — Mapping SDTI-CP Essence and Metadata into the MXF Generic Container

SMPTE ST 400:2012, SMPTE Labels Structure

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

SMPTE Metadata Elements Dictionary

SMPTE Labels Register

SMPTE RP 2027:2012, AVC Intra-Frame Coding Specification for SSM Card Applications

SMPTE RDD 18:2012, Acquisition Metadata Sets for Video Camera Parameters

Recommendation ITU-R BT.709-6 (06/2015), Parameter values for the HDTV standards for production and international programme exchange

Recommendation ITU-R BT.2020-2 (10/2015), Parameter values for ultra-high definition television systems for production and international programme exchange

Recommendation ITU-R BT.2100-0 (07/2016), Image parameter values for high dynamic range television for use in production and international programme exchange

3 Introduction

The MXF Generic Container is a streamable Essence Container that can be placed on any suitable transport and stored. SMPTE ST 379-1 defines the MXF Generic Container as the native Essence Container in MXF files. Also, SMPTE ST 379-2 defines the MXF Constrained Generic Container. SMPTE ST 381-3 defines how AVC streams, as defined in ISO/IEC 14496-10 | Rec. ITU-T H.264, can be mapped in the MXF Generic Container and MXF Constrained Generic Container. SMPTE ST 382 defines how AES3 Audio can be mapped in the MXF Generic Container. SMPTE ST 385 defines the System Item that is compatible with SMPTE ST 326 (SDTI-CP) and also defines how SDTI-CP essence and metadata can be used in the MXF Generic Container.

This document specifies the MXF mapping of XAVC, i.e. MPEG-4 AVC picture, AES3 audio and ANC packets into the MXF Generic Container or MXF Constrained Generic Container. This document also specifies the MXF file format that includes unique identifiers, Operation Pattern, Partitions, Index Table Segments and RIP. The common basic structure is described in this document.

4 Outline of MXF File Structure for this Mapping

4.1 General

XAVC MXF files specified by this document shall have one of the two structures illustrated in Figure 1 and Figure 2 respectively.

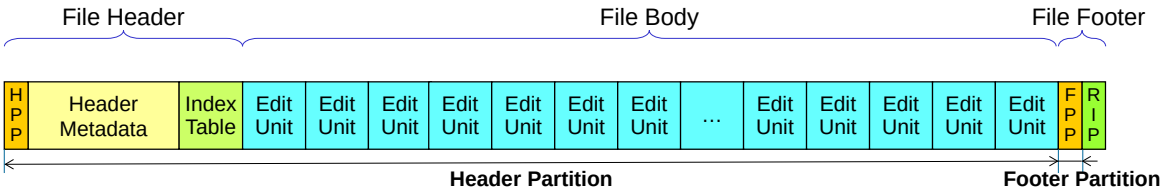

Figure 1 – Single Essence Location Style

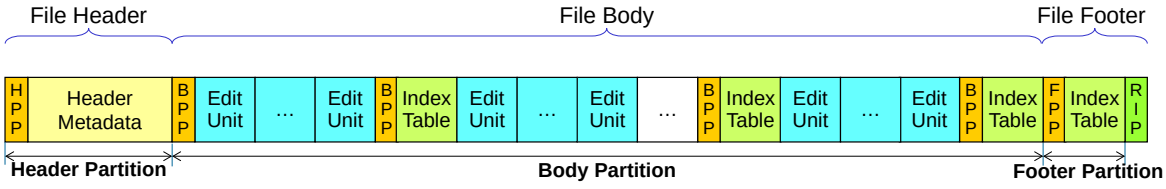

Figure 2 – Multiple Essence Location Style

HPP: Header Partition Pack, **BPP**: Body Partition Pack, **FPP**: Footer Partition Pack

RIP: Random Index Pack

A list of major constraints common to these file structures is given in Table 1.

Table 1 – Constraints for SMPTE RDD 32 Stream Products

Item	Constraints
Operational Pattern	1a - *Origin* and *Duration*[1] are used to express GOP Pre-Charge and Roll-Out in the case of Long GOP.
Wrapping (Interleaving)	Frame by Frame (coded order)
KAG size	512
System Item	Compliant to SMPTE ST 326 and SMPTE ST 385, includes the Frame by Frame Timecode and UMID
Video mapping	Compliant to SMPTE ST 381-3, AVC byte stream
GOP structure (in the case of Long GOP)	0.5 second (e.g. 24 frames for 50p), M=3 (display order: BBIBBPBBP…BBP)
Audio sampling	48 kHz locked to Video
Audio mapping	Compliant to SMPTE ST 382, AES3, 1ch/Element (min 2 to max 16 channels[2])
Data Item	Compliant to SMPTE ST 436-1, used for Ancillary packet
Timecode	System Item and Header Metadata

Detailed constraints are listed in Annex B.

4.2 Single Essence Location Style

As shown in Figure 1, this style consists of a Header Partition, a Footer Partition, and a Random Index Pack. The Index Table is placed prior to the Essence Container.

Some of the aspects of this style are shown below.

- It is easy to handle because of a simple structure.
- It is easy to edit while file transferring.
- It is easy to pick extract a “Partial file”.

It is recommended to have the following Index Layout Properties defined in Amendment 2 to SMPTE ST 377-1.

- Index Table Segment::Single Index Location TRUE (Single Location)
- Index Table Segment::Single Location TRUE (Single Location)
- Index Table Segment::Forward Index Direction TRUE (Forward)
- Preface:: is RIP present TRUE

4.3 Multiple Essence Location Style

As shown in Figure 2, this style consists of a Header Partition, segmented Body Partition(s), a Footer Partition, and a Random Index Pack. Every Partition except Header and the first Body Partitions has one Index Table Segment that carries the Index Entries indexing the Edit Units.

[1] The duration of the top level file package contains the Pre-Charge but does not contain Roll-Out as defined in SMPTE ST 377-1.

[2] Even number only