SMPTE REGISTERED DISCLOSURE DOCUMENT

Track File for JPEG 2000 Codestreams with Time-Synchronous Metadata

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Table of Contents

1 Scope

JPEG 2000 is a picture-by-picture compression coding defined by ISO/IEC 15444-1 and used for both individual pictures and picture sequences. Extensible Markup Language (XML) is a structured encoding for text with markup. This document specifies the mapping of JPEG 2000 codestreams and time-synchronous XML metadata into a single File Package, compatible with the MXF generic container, in a frame-wrapped configuration. Clip wrapping is not supported.

This document defines the data structure at the signal interfaces of networks or storage media. This document does not define internal storage formats for MXF compliant devices.

2 Conformance Notation

Normative text instructs all operational aspects that are indispensable to this specification or contains the conformance keywords “shall”, “should”, or “may”. All text in this specification is normative except explicitly labeled as informative or paragraphs that start with the word “NOTE” or “EXAMPLE.”

Informative text can be helpful but can be edited without affecting any operational aspects of this specification. Informative text does not contain any conformance keywords.

The keyword “shall” indicates requirements to be followed for strict conformance to this specification, with no exceptions.

The keyword “should” recommends the most suitable alternative implementation without mentioning or excluding others. The negative form “should not” deprecate, but does not prohibit, the described implementation.

The keywords “may” and “need not” permit the described implementation within the limits of this specification.

A paragraph starting with the word “NOTE” provides helpful information for the implementer although such paragraph will not affect conformance to this specification.

An implementation conformant to this specification includes all required features specified by the word “shall” and, if implemented, all recommended features as specified by the word “should.” Such implementation need not implement permitted but not required features specified by the word “may” and need not implement them as described.

Unless specified explicitly, the normative prose shall take precedence as authoritative definition. Then the order of precedence shall be Tables, Figures, and other language forms.

3 References

SMPTE ST 410:2008, Material Exchange Format – Generic Stream Partition

SMPTE ST 422:2019, Material Exchange Format – Mapping JPEG 2000 Codestreams into the MXF Generic Container

SMPTE ST 429-17:2017, XML Constraints

SMPTE ST 2067-2:2020, Interoperable Master Format – Core Constraints

SMPTE ST 2067-5:2020, Interoperable Master Format – Essence Component

SMPTE ST 2067-21:2020, Interoperable Master Format – Application #2E

World Wide Web Consortium (W3C) (2004 February 4). Extensible Markup Language (XML) 1.0 (Third Edition)

ISO/IEC 10646:2017 Information Technology — Universal Coded Character Set (UCS)

ISO/IEC 15444-1:2016, Information Technology — JPEG 2000 Image Coding System: Core Coding System

4 Overview (Informative)

This document maps the codestream for each JPEG 2000 (ISO/IEC 15444-1) coded still picture into an MXF essence container, where each codestream is paired with an XML document that contains metadata related to the respective codestream.

This document maps the JPEG 2000 codestream-XML metadata pairs using frame wrapping, where each codestream-metadata pair is coded as a pair of discrete KLV items, and where each pair comprises an editable unit in the essence container timeline.

This document defines the KLV coding, essence container, essence subdescriptor, labels and formulation of a Track File for JPEG 2000 Codestreams with Time-Synchronous Metadata.

5 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

5.1 PHDR Track File

a Track File that interleaves JPEG 2000 codestreams with time-synchronous metadata as an extension of SMPTE ST 2067-2, as specified in this document

NOTE The term “PHDR” is historical and its use in this document is intended to reduce confusion when comparison is made to existing implementations of the format.

5.2 constrained XML document

a UTF-8 ISO 10646 character string as defined in W3C Extensible Markup Language (XML) 1.0 and as constrained by ST 429-17

5.3 static XML document

a constrained XML document pertaining globally to the entire track file

6 PHDR Track File

6.1 Overall

The PHDR Track File is an extension of the Image Track File for IMF Application #2E as defined in SMPTE ST 2067-21. PHDR tightly associates the picture essence with accompanying time-synchronous metadata.

6.2 General Constraints

A PHDR Track File extends the Image Track File defined in SMPTE ST 2067-21. A PHDR Track File shall contain extensions as defined in this document. The extensions shall comprise:

1. An additional Source Clip in the File Package that provides the Source Track ID of the Data essence;

2. An Essence Subdescriptor group “PHDRMetadataTrackSubDescriptor” which links the Data Essence Source Track ID to the Data Definition UL and an optional static XML document Track ID;

3. A companion KLV Data Item following the Picture Item in each Content Package;

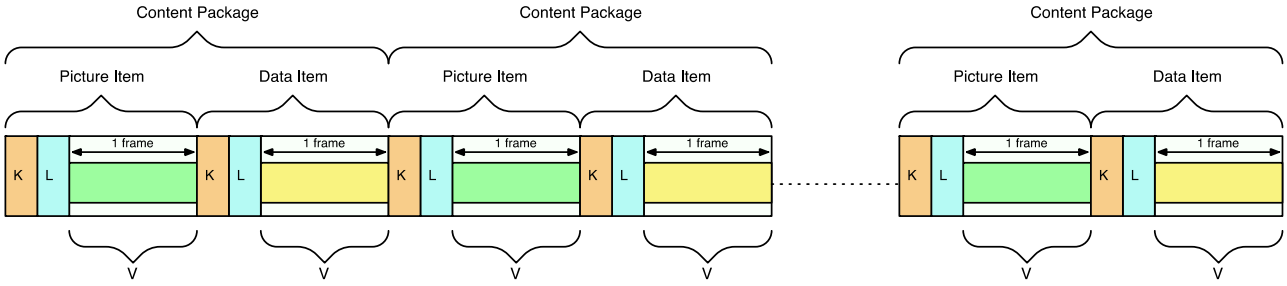
4. An optional Generic Stream Partition containing a static XML document.

The provisions in this specification shall take precedence when in conflict with the SMPTE ST 2067 suite of engineering documents.

NOTE The PHDR Track File contains picture and data essence elements, and not in compliance with the requirement of only one essence element type in the essence container as specified in Clause 5.1.3 of SMPTE ST 2067-5:2020.

6.3 Wrapping

Essence in a PHDR Track File shall be frame wrapped. Each Content Package shall contain one (1) picture item and one (1) Data Item, in that order, as illustrated below:



Picture Items shall use the “Key value for the JPEG 2000 picture element” essence element key as defined in SMPTE ST 422. Picture Items shall have the same Source Track ID.

Data Items shall use the “PHDRImageMetadataItem” essence element key defined in Table 1. Data Items shall have the same Source Track ID, which shall be distinct from that used for Picture Items.

Table 1. PHDR Universal Labels

Symbol	Kind	Item UL
PHDRImageMetadataWrappingFrame	LEAF	urn:smpte:ul:060e2b34.04010105.0e090607.01010101
PHDRImageMetadataItem	LEAF	urn:smpte:ul:060e2b34.01020105.0e090607.01kk01nn

The wildcard bytes (14 and 16) in the UL for PHDRImageMetadataItem, “kk” and “nn”, are replaced with the hexadecimal value 7fh in an essence register.

Byte 14 (“kk”) in the UL for PHDRImageMetadataItem has the hexadecimal value 01h.

Byte 16 (“nn”) in the UL for PHDRImageMetadataItem has the hexadecimal value 00h.

6.4 Essence Sub Descriptors

MXF header metadata items shall include essence descriptors as required by SMPTE ST 2067-21, i.e., the JPEG2000PictureSubdescriptor shall be present.

In addition, a PHDRMetadataTrackSubDescriptor (see Clause 7) shall be present, and shall be strongly referenced from the same file descriptor item that owns the aforementioned JPEG2000PictureSubdescriptor item. The PHDRMetadataTrackSubDescriptor elements shall be set as follows:

- The DataDefinition element shall be the UL PHDRImageMetadataWrappingFrame as defined in Table 1.
- The SourceTrackID element shall contain the Source Track ID of the Data Items.
- The SimplePayloadSID element shall contain the Source Track ID of the Generic Stream Partition (per SMPTE ST 410) if static metadata is present as described in Clause 6.6.

6.5 Essence Coding

Each frame-wrapped Picture Item in a PHDR Track File shall be coded as defined in SMPTE ST 2067-21.

Each frame-wrapped Data Item in a PHDR Track file shall contain a constrained XML document.

6.6 Static XML Document Instances

A PHDR Track File may contain a static XML document instance in a Generic Stream Partition as defined in SMPTE ST 410.

6.7 Indexing

Index partitions shall follow essence partitions, as defined in SMPTE ST 2067-5.

7 PHDRMetadataTrackSubDescriptor

The PHDRMetadataTrackSubDescriptor item is coded as a local set using 2-byte tag values and 2-byte length values consistent with all MXF descriptors. The Group and Element Labels associated with PHDRMetadataTrackSubDescriptor shall be defined in Tables 2 and 3, respectively.

Table 2. PHDRMetadataTrackSubDescriptor Group Label

Symbol	Kind	Item UL
PHDRMetadataTrackSubDescriptor	LEAF	urn:smpte:ul:060e2b34.02530105.0e090607.01010103

Table 3. PHDRMetadataTrackSubDescriptor Element Labels

Symbol	Kind	Item UL
DataDefinition	LEAF	urn:smpte:ul:060e2b34.01010105.0e090607.01010104
SourceTrackID	LEAF	urn:smpte:ul:060e2b34.01010105.0e090607.01010105
SimplePayloadSID	LEAF	urn:smpte:ul:060e2b34.01010105.0e090607.01010106