INTERNATIONAL STANDARD

ISO 26429-3

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Digital cinema (D-cinema) packaging —

Part 3: Sound and picture track file

Emballage du cinéma numérique (cinéma D) —

Partie 3: Fichier de la piste sonore et visuelle

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Foreword

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ISO 26429-3 was prepared by the Society of Motion Picture and Television Engineers (as SMPTE 429-3-2007) and was adopted, under a special “fast-track procedure”, by Technical Committee ISO/TC 36, *Cinematography*, in parallel with its approval by the ISO member bodies.

ISO 26429 consists of the following parts, under the general title *Digital cinema (D-cinema) packaging*:

— *Part 3: Sound and picture track file*

— *Part 4: MXF JPEG 2000 application*

— *Part 6: MXF track file essence encryption*

— *Part 7: Composition playlist*

Introduction

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SMPTE STANDARD

SMPTE 429-3-2007
Revision of
SMPTE 429-3-2006

D-Cinema Packaging — Sound and Picture Track File

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Approved
August 14, 2007

NOTE – Reference RFC 2045 corrected to RFC 2046 in Sections 2 and 9.

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 Standard 429-3 was prepared by Technology Committee DC28.

1 Scope

This standard specifies the common features of the format of sound and picture Tracks Files for distribution of D-Cinema content using the MXF file format. It defines data structures for interchange at the signal interfaces of networks or storage media, but does not define internal storage formats for compliant devices or mappings for particular essence encodings. This document is an Application Specification for D-Cinema applications. It is based on the SMPTE 390M OP-ATOM standard, but is further constrained to address the needs of distribution of D-Cinema content to exhibition sites.

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.

SMPTE 330M-2004, Television — Unique Material Identifier (UMID)

SMPTE 377M-2004, Television — Material Exchange Format (MXF) — File Format Specification

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

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

SMPTE RP 224, SMPTE Labels Registry

Internet Engineering Task Force (IETF) RFC 2046 (November 1996), Multipurpose Internet Mail Extensions (MIME), Part Two: Media Types

3 Overview

A D-Cinema Sound and Picture Track File is an indexed, randomly-accessible MXF container for a single clip of a single essence track. D-Cinema Sound and Picture Track Files shall not contain interleaved, multiplexed, multi-scene or multi-format essence.

This standard is implemented as a set of restrictions on SMPTE 377M (MXF) and 390M (OP-ATOM). These restrictions fall in four broad categories:

- Pattern (in this case, a restricted version of SMPTE 390M OP-ATOM)
- Essence (in this case, an essence container that complies with SMPTE 379M)
- Header Metadata (in this case, strict compliance with SMPTE 377M)
- Descriptive Metadata (in this case, a small set of essential data)

This standard is not a complete specification of a Track File for a particular essence type. It is intended to be combined with a standard essence mapping, essence constraints and optional encryption container to form a complete specification. These standards and respective combinations are beyond the scope of this standard.

4 Pattern Constraints

4.1 General

D-Cinema Sound and Picture Track Files shall use the MXF file format [SMPTE 377M] in conjunction with the specialized Operation Pattern, OP-Atom [SMPTE 390M]. Unless otherwise specified, Track Files shall follow the normative provisions of SMPTE 377M, SMPTE 390M and SMPTE 379M (Generic Container) and their references, notably SMPTE 336M (KLV).

The full glossary of terms and acronyms used in the MXF specification is given in the MXF File Format Specification. It is not repeated here to avoid any divergence of meaning. Readers unfamiliar with MXF are strongly encouraged to review the section of that document entitled “Definition of Acronyms, Terms and Data Types”.

Implementers are cautioned that, although Track Files should contain only those structures allowed by this document, SMPTE 377M nonetheless requires decoders to expect unrecognized (A.K.A. “dark”) KLV packets. Please review the section entitled “KLV Coded Dark Components” in SMPTE 377M for more information.

4.2 Baseline Operational Pattern

In accordance with SMPTE 390M, each Track File shall contain one Top-level File Package, representing the Track File in its entirety, and one Material Package. The Material Package shall not be used for playback but may be used to represent the offset and duration of the portion of the track intended for reproduction. SMPTE 390M, Annex A, gives examples of how OP-Atom MXF files can be used including the use of the Material Package tracks, Top-level File Package tracks and any lower-level Source Package tracks.

4.3 Additional Constraints

4.3.1 Container

Track Files shall use the MXF Generic Container (GC) SMPTE 379M. Track Files shall use GC frame-based essence mappings. The Sound and Picture essence mappings shall be defined by associated mapping documents.

4.3.2 Interleaving

Track files shall have a single essence type within the MXF Generic Container. Essence in Track Files shall be neither interleaved[1] nor multiplexed between essence types.

4.3.3 System Item

The GC System Item is not used by Track Files.

4.3.4 Time Code track

Time code tracks within the Essence Container are not used by Track Files. Synthetic time code is, however, present in the Header Metadata – (see Section 6.2).

[1] From SMPTE 377M: “multiplexed” means putting different partitions one after the other whereas "interleaved" means that the Essence Container itself has different components which are interleaved on a time division basis.

4.3.5 Partitions

A Track File shall have three partitions: Header, Body and Footer. The closed and complete Header Metadata shall be carried in the Header Partition, the Essence Container shall be contained in the single Body Partition and the Index Table Segment(s) shall be carried in the Footer Partition (see Section 4.3.6 following).
When possible, Sound and other Essence Partitions should have the same duration as the Picture Essence Partitions to which they relate.

Track Files shall conclude with a Random Index Pack per SMPTE 377M.

4.3.6 Index Tables

Track Files shall include standard MXF Index Tables per SMPTE 377M. These Index Tables shall be divided into one or more Index Table Segments.

NOTE – Large VBR files may require multiple Index Table Segments due to segment space limitations. See SMPTE 377M for details.

Each Index Segment shall be carried in the Footer Partition.

4.3.7 KAG Size

Track Files shall employ the default KLV Alignment Grid of 1 — see “Key Alignment Grid” in SMPTE 377M.

4.3.8 Essence Kinds

Within a Track File, all Essence Containers of the same kind (Picture or Sound) shall be of the same essence type, e.g. JPEG2000, as defined by the relevant property of the essence descriptors.

4.3.8.1 Edit Rate

All essence in a Track File shall have the same edit rate.

4.3.9 Encryption

Track Files may include Essence Containers that have been subject to an encryption process. The Essence Container shall identify that the essence has been encrypted, but the definition of the encryption process is beyond the scope of this standard.

4.3.10 KLV Fill

Track Files may use the KLV Fill item as defined in SMPTE 377M.

4.4 Labeling

Track Files shall be labeled with a registered label, as per SMPTE RP 224, to identify the Essence Container and the Operational Pattern in every Partition Pack and every Preface Set. The Essence Container label shall also be present in the File Descriptor. The Operational Pattern label shall be set according to SMPTE 390M. Since the Material Package within the Track File contains a single Source Clip (Section 4.2), Bit 0 of Byte 14 of the Operational Pattern label will always be 0. The value of Bit 1 of the same byte will depend on the number of essence tracks in the Material Package.

5 Essence Constraints

The Track Files support a wide range of picture and sound essence schemes and are, for instance, compression-agnostic. The following constraints exist independently of the particular essence scheme selected.

5.1 Picture

5.1.1 General

Track Files are compression-agnostic.

Each Content Package of the Picture Track File's essence container shall contain one MXF GC Picture Item, each of which contains a single GC Picture Element.

5.1.2 Picture Parameters

All frames in a Picture Track File shall share the same image structure.

5.1.3 Picture Packetization

Picture essence shall be encoded in KLV Packets using a frame-based mapping and shall be indexed accordingly.

5.2 Sound

5.2.1 General

Track Files are sound format-agnostic.

Each Content Package of the Sound Track File's essence container shall contain one MXF GC Sound Item, each of which contains a single GC Sound Element.

5.2.2 Sound Sampling

All samples within a Sound Track shall have the same sample rate and bit depth.

5.2.3 Sound Packetization

Sound essence shall be encoded in KLV packets using a frame-based mapping and shall be indexed accordingly. Where the soundtrack is multi-channel (for example, a 16 channel theatrical format), the channels should be packed at the sample level or otherwise encoded for simultaneous reproduction from a single Track File.

6 Header Metadata Constraints

6.1 General

The MXF Header Metadata of Track Files shall conform to SMPTE 377M and shall be constrained according to SMPTE 390M. Files shall be Closed and Complete.

Header Metadata shall only be present in the Header Partition. No other Partitions shall contain copies of the Header Metadata.

6.2 Time Code

Time code information shall be present in Track Files in compliance with the OP-ATOM specification. Time code information exists for informational purposes only and is not used by Track Files.

6.2.1 General

Track Files shall contain synthetic time described by TimecodeSegments, i.e. continuously incrementing numbers from a specified starting point. Track Files shall not contain TimecodeStream data partitions.

NOTE – Because the use of the Time Code Track(s) is specifically disclaimed above, the actual value of the starting address is not important for proper operation according to this specification. It is customary to use a default starting time of 01:00:00:00 whenever a specific value is not provided by the source essence or local operating practice.

6.2.2 Material Package Time Code

The Time Code of Material Packages in Track Files shall consist of a single continuous segment.

6.2.3 Top-Level File Package Time Code

The Time Code of the File Package in a Track File shall consist of a single continuous segment, with a starting time that matches that of any historical[2] Source Package if known, else a reasonable default (see note in section 6.2.1).

6.2.4 Source Package Time Code

Where present, the Time Code of each historical Source Package in a Track File shall consist of a single continuous segment, with a starting time that matches that of any preceding Source Package, or incoming master if known, else a reasonable default (see note in section 6.2.1).

6.3 Track File Identity

D-Cinema Packaging uses UUID (Universally Unique Identifier) values to link assets. A Track File shall be identified by the Package UID value of its sole Top-level File Package (referred to simply as "Package UID" for the remainder of this section).

6.3.1 Package UID Creation Method

The Package UID shall be a basic UMID per SMPTE 330M-2003, having a UUID value in the material number part and a material number generation method of UUID/UL. The Package UID value shall be further constrained as follows:

a. Byte 11 of the UL portion of the UMID shall be $0f_h$ (unidentified material type).

b. Byte 12 of the UL portion of the UMID shall be 20_h (UUID/UL material number generation method and undefined instance number generation method).

c. The three bytes of the instance number shall be 0 (zero).

Package UID values generated in accordance with the normative provisions of this subsection will thus have the following contents in the first 16 bytes: $060a2b34_h$ 01010105_h $01010f20_h$ 13000000_h.

[2] A historical Source Package is a header item that describes the source of the essence within a given Material Package. See SMPTE 377M for more details.

6.3.2 UUID Identity Comparison

When testing a Track File for identity against a known UUID, the known UUID shall be compared to the material number part of the Package UID (bytes 17-32).

7 Descriptive Metadata Constraints

The general rules for DMS (Descriptive Metadata Scheme) Frameworks are described in SMPTE EG 42. Optional descriptive metadata, where present, shall be carried in Track Files in a DM (Descriptive Metadata) Segment of a Static DM Track as defined by SMPTE 377M. Track Files having descriptive metadata shall have a DM Label in the Preface Set to identify each DM scheme in use.

8 Other Constraints and Definitions

8.1 File Names and Asset Identity

The identity of the asset contained in the file shall be determined from the Package UID (as defined in Section 6.3.1 above) of the Top-Level File Package in the file, and not from the filename or any other environment-specific file identifier, pointer or link.

8.2 Synchronization

Methods for synchronizing two or more Track Files having the same or differing essence types are beyond the scope of this document. Track Files shall not be required to contain synchronization information other than that provided by the MXF Header Metadata.

9 MIME Type

Applications using MIME type identifiers [RFC 2046] to identify the format of files shall use the MIME type `application/mxf` to identify files conforming to this specification.

Annex A (Informative)
Bibliography

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

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

SMPTE EG 42-2004, Material Exchange Format (MXF) — MXF Descriptive Metadata

IETF RFC 4539, Media Type Registration for the Society of Motion Picture and Television Engineers (SMPTE) Material Exchange Format (MXF)

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