

SMPTE STANDARD

for Television — Material Exchange Format (MXF) — Operational Pattern 1b (Single Item, Ganged Packages)



Table of contents

- 1 Scope
- 2 Normative references
- 3 Glossary of acronyms, terms and data types
- 4 Introduction
- 5 Application
- 6 Header metadata specification
- 7 MXF file interchange: Essence container issues
- Annex A Bibliography

1 Scope

This standard defines operational pattern 1b for the exchange of a MXF file with a single item contained in multiple, synchronized, playable essence containers, each comprising either a single essence element or interleaved essence elements. It defines the operating restrictions, structural metadata objects and individual attributes that shall be applied to the MXF file format specification to achieve interoperability when exchanging an MXF file as a single, continuously playable item comprising a set of synchronized essence containers.

Operational pattern 1b is intended to meet the requirements of acquisition, storage and interchange applications where more than one essence component is required and it is wished to carry these in two or more essence containers. Operational pattern 1b does require the use of body partitions for internal essence containers. Subdivision of each essence container by using body partitions is optional.

2 Normative references

The following standard contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was 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 standard indicated below.

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

3 Glossary of acronyms, terms and data types

The full glossary of acronyms, terms and data types used in the MXF specification is given in the MXF file format specification. It is not repeated here to avoid any divergence of meaning.

Essence element: An essence container may contain many essence elements interleaved together. An essence element in this standard corresponds to a separable part of the interleave which is described by an MXF essence track, such as a picture track, a sound track or a data track.

4 Introduction

This standard defines MXF operational pattern 1b. In SMPTE 377M, the properties of the generalized operational patterns are defined. In the MXF engineering guideline (SMPTE EG 41), the concepts of operational patterns and the general conditions for audio-visual material interchange and interoperability are described in outline form. The introductory sections of these documents are not repeated here.

4.1 Operational pattern 1b overview

Generalized MXF operational patterns are defined as a combination of the two dimensions as defined SMPTE 377M. This operational pattern shall be defined as follows:

4.1.1 Item complexity

Single item: The file contains only one item which is made up from two or more ganged essence elements from two or more essence containers. Each material package SourceClip shall have an identical duration which shall be the same duration as each of the top-level file package(s).

4.1.2 Package complexity

Ganged packages: The material package references multiple top-level file packages that are “played” together against a common output timeline. The “ganged” essence streams can be regarded as a single stream that represents a continuous recording as indicated in figure 2. These two dimensions are broadly illustrated in informative figure 1.

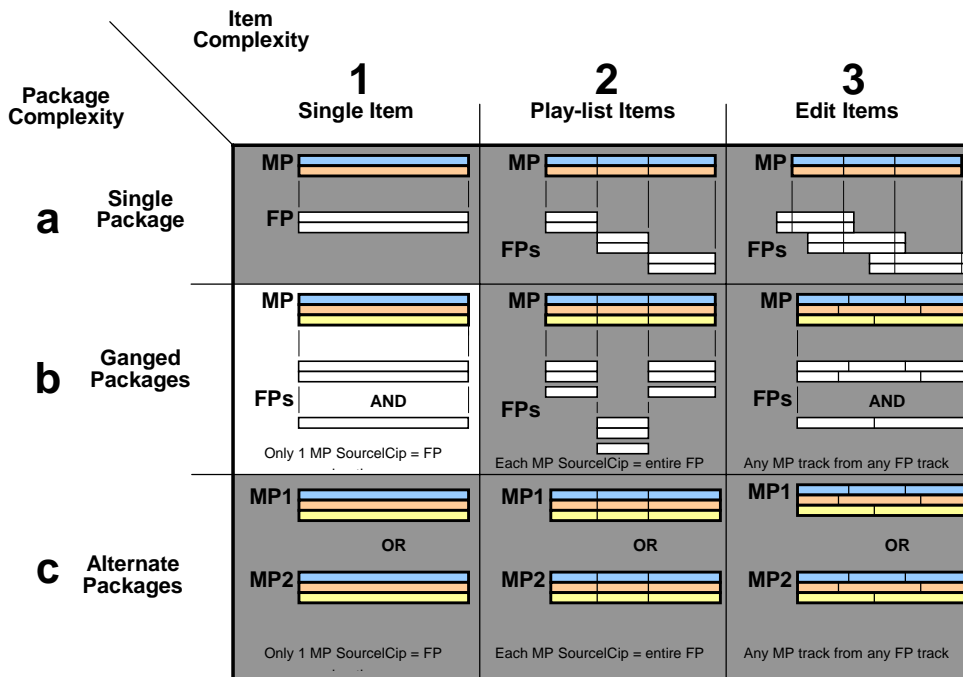


Figure 1 (informative) – Item and package complexity

This operational pattern defines an MXF file as a single item, comprising ganged packages as illustrated in the center-left box of figure 1.

4.2 Material, file and source package relationships

This operational pattern has a number of essence containers that are intended to be synchronized when played. Each essence container is comprised of either a single essence element or interleaved essence elements. The essence containers comprise essence stream data that represents a continuous recording as indicated in figure 2

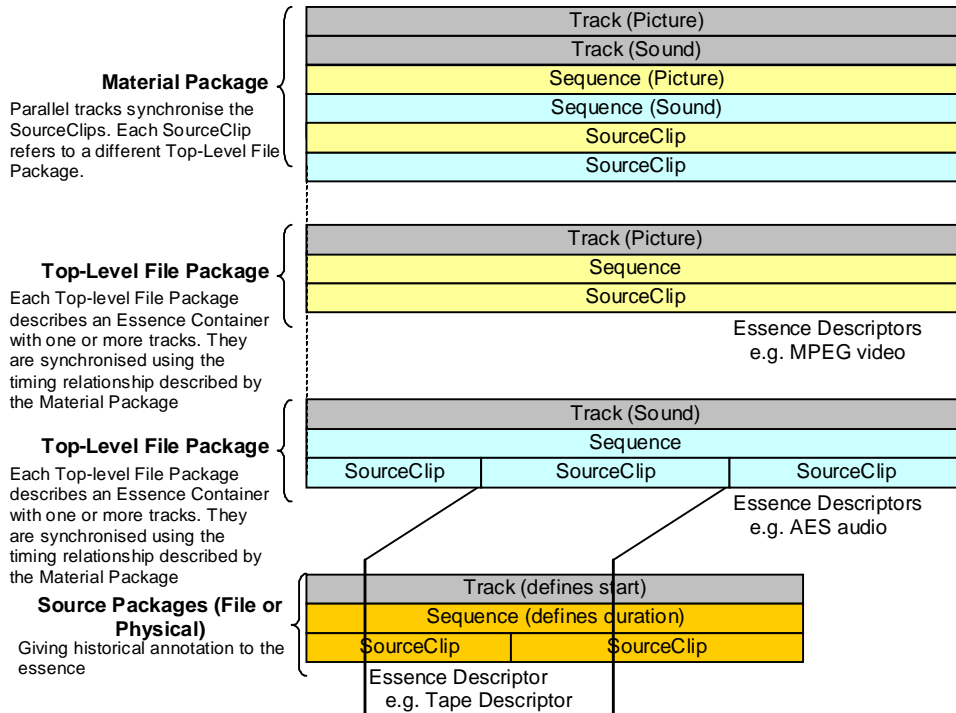


Figure 2 (informative) – Outline of operational pattern 1b

5 Application

Operational pattern 1b is an extension of the simplest generalized operational pattern (1a) where the single playable essence container is replaced by multiple ganged essence containers which together make up the single audio-visual item. The ganged essence containers may, for example, contain a single shot, a single clip or a single item of program material. The essence containers shall provide for the continuous decoding of contiguous essence elements with no additional processing for discontinuities.

Operational pattern 1b is intended to meet the requirements of acquisition, storage and interchange applications where more than one essence component is required. In operational pattern 1b, these components are carried in two or more essence containers in a single file or in multiple files.

The minimum implementation of operational pattern 1b will satisfy the requirement for the definition of a single item comprising several synchronized essence containers with metadata support for each essence container and for the resulting synchronized file.

NOTE – An example of the use of this operational pattern is where a video data stream is carried by one essence container with other essence containers carrying the associated audio data stream. This may be needed where production of the video and audio are carried out by separate facilities or where audio is produced in both stereo and multi-channel formats.

5.1 Constraints

A list of general constraints for this operational pattern is given in table 1.

Table 1 – General constraints for operational pattern 1b

File Kind	MXF
“Operational Pattern”	1b: (Single item with multiple ganged essence containers)
Role	Exchange of production items in multiple essence containers
Essence	Multiple ganged essence containers, operational pattern qualifiers apply (see MXF format document SMPTE 377M)
Material Packages	1
Number of Material Package SourceClips per Essence Track	1
Top-level File Packages	2 or more shall be referenced by the material package. Any or all of these may be external to the file.
Number of Essence Container Types	1 or more
Lower-level Source Packages	0 or more
Partition limits	None
Body Partitions	Required. If there are <i>N</i> Internal essence containers, a file shall have at least <i>N-1</i> body partitions
Index Tables	Optional, but recommended
Editing Support	None
Streaming Support	According to operational pattern qualifiers (see 6.4)

6 Header metadata specification

6.1 General

The structural metadata sets and the normative universal label used to identify this operational pattern are defined in the MXF file format specification document with specific constraints and additions detailed below.

6.2 Constraints on the MXF packages

- The material package shall have one SourceClip per essence track.
- Each top-level file package shall have one essence track for each essence element in the essence container.
- All tracks/sequences in the material package and top-level file package shall have the same duration.
- All tracks/sequences in the material package and top-level file packages shall start and end synchronously (i.e., the normalized material package start position properties shall have the same value — *normalized Start Position*= (Start Position of Track+Origin of Track)/Edit Rate of Track).

- The material package may have a different start time to the top-level file packages to allow a change to the initial time code on playback.
- Lower-level source packages, when present, shall be used to define the historical context of editing.

6.3 Universal label for operational pattern 1b

The universal label value to define this operational pattern shall be as defined in the table below.

Table 2 – Value of the MXF operational pattern identification universal label

Byte No.	Description	Value (hex)
1-12	Defined in the MXF File Format Specification Operational Patterns Section	—
13	Operational Pattern: Item Complexity	01h
14	Operational Pattern: Package Container Complexity	02h
15	Operational Pattern: Qualifiers (application dependent)	(see SMPTE 377M)
16	Reserved	0

The meanings of the bytes in this label are specified in the operational pattern section of the MXF file format specification. Bytes 13 and 14 uniquely identify this operational pattern specification. Byte 15 contains generic qualifiers which are defined in the MXF file format specification.

6.4 Operational pattern qualifiers

This operational pattern shall support the qualifiers as specified in byte 15 of the operational pattern Universal label. Each bit of byte 15 shall be correctly set, as defined by SMPTE 377M, to reflect the status of the essence containers.

6.4.1 Essence container location

The essence containers should be embedded in the file body for interchange applications.

The essence containers may be externally referenced for certain specialized applications. Example applications might include shared-storage networks, archives and other applications where the access to an essence container is localized and the locator value (defined in the locator set in SMPTE 377M) is persistent.

If all essence containers are internal to the file, then bit 1 shall be set to zero. Guidance on external essence is given in SMPTE EG 41 (the MXF engineering guideline).

6.4.2 Interleaving of multiple essence tracks

Essence containers used in this operational pattern should be streamable.

If the essence containers are streamable and have been multiplexed in a way that makes the overall file streamable, then bit 2 shall be set to zero. Typically, this requires the use of body partitions that provide multiplexing over a relatively short duration. If the primary package references any external essence, then the file shall not be indicated as streamable. Guidance on streamability is given in SMPTE EG 41.

6.4.3 Number of essence tracks

This operational pattern supports multiple essence containers each with one or more essence tracks.

If all essence containers have a single essence track, then bit 3 shall be set to zero.

6.5 Minimum implementation

All constraints given in the MXF file format specification shall apply unless specifically overridden or extended in this standard. The minimum implementation of operational pattern 1b has the following recommended structural metadata. This section is a recommendation because the exact structure of the sets depends on how many of the top-level file packages reference external data.

1 preface set, 1 or more identification sets and 1 content storage set, 2 or more essence container data sets.

One material package including:

- the sets for the time code track
- the sets for each picture track as required by the essence containers
- the sets for each sound track as required by the essence containers
- the sets for each data track as required by the essence containers

References or two or more top-level file packages. Each package including:

- the sets for each picture track as required by the essence container
- the sets for each sound track as required by the essence container
- the sets for each data track as required by the essence container

NOTE – Support for descriptive metadata is optional but at least one scheme should be included in order to get the best from an MXF file.

The annexes of the MXF format specification give the properties of the sets which should be implemented. All required set properties should be supported by MXF encoders that comply with this operational pattern.

7 MXF file interchange: Essence container issues

7.1 Essence container identification

The value of the essence container universal label shall be defined by the appropriate essence container specification document. This value shall be recorded in the essence containers property of the preface set and all partition packs and in the essence container property of the appropriate essence descriptor set.

7.2 Essence container requirements in operational pattern 1b

7.2.1 Number of essence elements

There are no constraints on the number of essence elements in an individual essence container. It is not permitted to have a metadata only operational pattern 1b file. There must be at least one essence container type with essence (see table 1).

7.2.2 Interleaving of essence elements

For operational pattern 1b, interleaving of essence elements within an essence container is optional.

7.2.3 Continuity of essence elements

As stated in section 5, each essence container shall provide for the continuous decoding of contiguous essence elements. The essence container or essence element specifications may add extra restrictions to this condition.

7.2.4 Number of essence tracks

The number of picture, sound and data essence tracks in the material package is determined by the number of picture, sound and data essence elements in all the essence containers.

7.2.5 Use of body partitions

This operation pattern requires the use of at least one partition for each internal essence container. If there are **N** internal essence containers, there will be at least **N-1** body partitions within the file.

NOTE – Files meeting this operational pattern can be created without using body partitions to further subdivide each essence container. However, body partitions maybe used to provide certain features needed to satisfy some of the user requirements outlined in the MXF engineering guideline.

Annex A (Informative)
Bibliography

ANSI/SMPTE 298M, 1997, Television — Universal Labels for Unique Identification of Digital Data

SMPTE 336M-2001, Television — Data Encoding Protocol Using KLV

SMPTE RP 224, SMPTE Labels Registry

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