

# SMPTE STANDARD

## MXF Multichannel Audio Labeling Framework



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## 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 ST 377-4 was prepared by Technology Committee 31FS.

## Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Standard. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

## Introduction

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

Developments in the moving image production industries have led to increasing definition and use of many multichannel audio (herein abbreviated "MCA") schemes, with channel counts in excess of 20. Since the MXF file format was published in 2004 the requirement to identify such audio for efficient production, storage and distribution within MXF has led to this standard for audio labeling. Metadata associated with content adds value to that content in both automation – with the ability to save on costly and error-prone human input; and in manual handling – where the efficient searching and description of these assets enhances their re-use and thus the realizable value. This standard attempts to meet both these usage cases with the use of regular text-based structures for easy human and machine recognition.

This document defines a set of hierarchical SubDescriptors designed to be associated with audio essence contained in MXF file structures, which are illustrated in Figure 1. The parent abstract superclass is the "MCALabelSubDescriptor", which has three concrete subclasses. At the base of the hierarchy is the AudioChannelLabelSubDescriptor, which is applied to an *Audio Channel*. Above the AudioChannelLabelSubDescriptor is the SoundfieldGroupLabelSubDescriptor, which is applied to a *Soundfield Group* of audio channels. Above the SoundfieldGroupLabelSubDescriptor is the GroupOfSoundfieldGroupsLabelSubDescriptor, which is applied to a *Group Of Soundfield Groups* which are meant to be transmitted simultaneously. The MCALabelSubDescriptor and its three subclasses are the core of the Multichannel Audio Labeling Framework and are all derived from the MXF SubDescriptor as defined in SMPTE ST 377-1, Annex B.3. The metadata elements associated with each are considered the "set" of metadata elements for that subclass and are referred to as such in this document.

Robustness is increased with redundancy in the identification labels to reduce orphaned elements and aid disaster recovery. Use of externally registered elements such as RFC 5646 language codes increases commonality with other application areas to ease interoperability.

This document specifies only the MCA Labeling Framework. In order to utilize the framework in an application, it must be extended or constrained to fit that application, and metadata item values must be defined in the application-specific documents. See Annex C for more details.

It is expected that a number of applications will utilize the MCA Labeling Framework and write documents to standardize its use within the specific application space. Current examples include but are not limited to Digital Cinema and IMF.

## 1 Scope

This standard defines a labeling framework for multichannel audio essence in MXF file structures. It specifies the basic object model, structures and metadata items for the MCA Labeling Framework.

This standard enables text-based representation of Multichannel Audio Labels and defines one such representation.

## 2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

## 3 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 395:2003) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 395M-2003). Documents with the same root number (e.g. 395) and publication year (e.g. 2003) are functionally identical.

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 ST 335:2001, Television — Metadata Dictionary Structure

SMPTE ST 395:2003, Television — Metadata Groups Registry Structure

SMPTE ST 336:2007, Data Encoding Protocol Using Key-Length-Value

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

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

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

Amendment 1:2012 to SMPTE 382-2007

SMPTE ST 400:2004, Television — SMPTE Labels Structure

SMPTE RP 428-4:2010, D-Cinema Distribution Master — Audio File Format and Delivery Constraints

IETF RFC 5646, Tags for Identifying Languages

IETF RFC 5234, Augmented BNF for Syntax Specifications: ABNF

## 4 Glossary of Acronyms, Terms and Data Types

For the purposes of this document, the following terms and definitions apply in addition to those stated in SMPTE ST 377-1:

### 4.1

#### **Audio Channel**

distinct collection of sequenced audio samples that are intended for delivery to a single loudspeaker or other reproduction device

### 4.2

#### **Soundfield**

acoustical space created by simultaneously reproducing one or more audio channels

### 4.3

#### **Soundfield Configuration**

defined arrangement or configuration of loudspeakers that convey the intended Soundfield

### 4.4

#### **Soundfield Group**

##### **SG**

collection of Audio Channels meant to be played out simultaneously through a given Soundfield Configuration

### 4.5

#### **Group of Soundfield Groups**

##### **GSG**

collection of one or more Soundfield Groups which are meant to be transmitted simultaneously

## 5 MCALabelSubDescriptors

This specification defines three subclasses of MCALabelSubDescriptors arranged in a hierarchical fashion.

### 5.1 MCALabelSubDescriptor Subclasses

#### 5.1.1 AudioChannelLabelSubDescriptor

The AudioChannelLabelSubDescriptor shall contain the intended routing destination of the audio channel, which may be a loudspeaker position such as Left Surround or a non-loudspeaker destination such as a HI connection.

Each AudioChannelLabelSubDescriptor shall be associated with a single Audio Channel. The structure and metadata items of the AudioChannelLabelSubDescriptor are specified in Section 6.4.

If an audio channel is part of a soundfield group, then its AudioChannelLabelSubDescriptor shall include the SoundfieldGroupLinkID that identifies that soundfield group as specified in Section 6.4.1.

Each AudioChannelLabelSubDescriptor may reference zero or one SoundfieldGroupLabelSubDescriptor as illustrated in Figure 1.

#### 5.1.2 SoundfieldGroupLabelSubDescriptor

The SoundfieldGroupLabelSubDescriptor shall contain the intended Soundfield Configuration for the audio channels in the group, such as 5.1.

Each SoundfieldGroupLabelSubDescriptor shall be associated with a unique Soundfield Group. The structure and metadata items of the SoundfieldGroupLabelSubDescriptor are specified in Section 6.5.

Note: For redundancy, applications can duplicate all of the metadata items in the underlying AudioChannelLabelSubDescriptor (except the intended routing destination).

If a soundfield group is part of a group of soundfield groups, then its SoundfieldGroupLabelSubDescriptor shall include the GroupOfSoundfieldGroupsLinkID that identifies that group of soundfield groups as specified in Section 6.5.1.

A SoundfieldGroupLabelSubDescriptor may reference zero or more GroupOfSoundfieldGroupsLabelSubDescriptors.

A SoundfieldGroupLabelSubDescriptor shall be referenced by one or more AudioChannelLabelSubDescriptors.

#### 5.1.3 GroupOfSoundfieldGroupsLabelSubDescriptor

The GroupOfSoundfieldGroupsLabelSubDescriptor should contain the intended use of the soundfield groups in the group, such as "English and Spanish Program".

Each GroupOfSoundfieldGroupsLabelSubDescriptor shall be associated with a unique Group of Soundfield Groups. The structure and metadata items of the GroupOfSoundfieldGroupsLabelSubDescriptor are specified in Section 6.6.

Note: For redundancy, applications can duplicate all of the common metadata items in the underlying SoundfieldGroupLabelSubDescriptor.

A GroupOfSoundfieldGroupsLabelSubDescriptor shall be referenced by one or more SoundfieldGroupLabelSubDescriptors.

## 5.2 MCA Label Dictionary ID Semantics

The specific meaning of each MCALabelSubDescriptor is domain dependent and relies upon the standard vocabulary created for the specific domain. Such meaning may include, for instance, actual speaker locations or rendering intent.

Specifically, documents utilizing the MCA Framework shall associate a unique UL appropriate for use as the value of the MCA Label Dictionary ID item in each MCALabelSubDescriptor. The same documents should also specify appropriate values for the MCA Tag Symbol.

## 5.3 MCALabelSubDescriptorExtension

The specification defines only a minimal set of items for each MCALabelSubDescriptor subclass. Applications using the framework may therefore define additional items, and MCALabelSubDescriptors may therefore contain items that are particular to only that application. MCALabelSubDescriptor extension shall be accomplished in one of three ways: By registering additional metadata items and associated UL's for the MCALabelSubDescriptors defined herein, extending the subclasses and creating new MCALabelSubDescriptor subclasses by registering new KLV keys as specified in Table 1 and Table 2, or by standardizing application specific metadata as described in Section 9 of SMPTE ST 377-1. These additional items shall be ignored if they are not recognized by a different implementation.

## 5.4 MCALabelSubDescriptor Uniqueness and Reference Schema (Informative)

The MCALabelSubDescriptor is the parent subclass and contains a set of metadata elements that are shared by the other three SubDescriptor subclasses. It is not used directly to label audio essence. Each SubDescriptor subclass is unique in its Set Key and includes the MCA Label Dictionary ID, MCA Link ID and MCA Tag Symbol from the superclass. The metadata sets for the three types of labels are intentionally redundant in order to allow for a number of uses and delivery scenarios. Different implementations can choose to use some or all of the redundant metadata fields depending on the nature of the implementation.

The MCA Link ID item is a required item. References between MCALabelSubDescriptor instances are accomplished by referencing the other MCALabelSubDescriptor's MCA Link ID in its metadata set. This allows a single audio channel to either stand on its own or to be associated with a soundfield group, and allows a soundfield group to either stand on its own or to be associated with a group of soundfield groups. It also allows audio channels that are part of a soundfield group to be transmitted separately and later associated to the correct soundfield group. By the same token, it allows soundfield groups that are part of a group of soundfield groups to be transmitted separately and later associated with the other soundfield groups in the group of soundfield groups.

The specific values for metadata items in the set are defined and registered by the individual application and as such are left to other application-specific documents.

# 6 MXF Structures

This section describes the structure of the MCALabelSubdescriptor in MXF. See Annex B for an informative discussion of the MCA Framework hierarchical class system.

## 6.1 MCA Framework Object Model

Figure 1 illustrates the MCA Framework object model.

The MCA Framework shall consist of instances of subclasses of the abstract class MCALabelSubDescriptor. This standard defines three concrete subclasses of the abstract MCALabelSubDescriptor, namely AudioChannelLabelSubDescriptor, SoundfieldGroupLabelSubDescriptor and GroupOfSoundfieldGroupsLabelSubDescriptor. The metadata elements associated with each are considered the "set" of metadata elements for that subclass and are referred to as such in this document.