

## for Television — Material Exchange Format (MXF) — Mapping A-law Coded Audio into the MXF Generic Container

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### 1 Scope

This standard specifies the mapping of A-law coded audio into a sound essence track of the MXF generic container. A-law coding is a sample-by-sample coding defined by ITU G-711 and used throughout the audio transmission chain.

The MXF generic container is the native essence container of the material exchange format (MXF) file body. The MXF generic container is defined for the interchange of streamable audio-visual material.

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

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

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

ITU-T Recommendation G.711, Pulse Code Modulation (PCM) of Voice Frequencies

### 3 Glossary of acronyms, terms and data types

The general glossary of acronyms, terms and data types used in the MXF specification is given in SMPTE 377M and is supplemented in SMPTE 379M. These glossaries are not repeated here to avoid any divergence of meaning.

### 4 Introduction

The MXF generic container (GC) is fully described in SMPTE 379M. This standard specifies a mapping of A-law coded audio as a sound element that may be used in the sound item of the MXF GC. A-law coding is defined in ITU G-711.

This standard specifies the key, the length and the value fields of the A-law coded sound element together with the SMPTE Universal label (UL) that uniquely identifies this essence element mapping into the MXF GC.

**4.1 A-law coding summary**

A-law coded audio is used for voice circuits and results in a low bit-rate with albeit a low quality, though almost no codec delay. A-law coded audio is used in some voice-only circuits within broadcast and telecommunications applications. Its applications in MXF lie in its use as a voice-over channel or as a proxy audio track.

The source coding uses 8K samples per second with 14 bits for each sample. Each sample value is divided into coding ranges where each range is assigned an 8-bit code value. The result is a coded bit rate of 64 Kbps.

If used with video, the number of bytes per frame for the commonly used frame rates are as defined in table 1.

**Table 1 – Bytes per frame for the A-law coded audio element**

Frame Rate (Hz)	Coded Bytes per Frame	Minimum Bytes per Frame	Maximum Byte per Frame	Frame Sequence Length
24/1.001	333.666(recurring)	333	334	3
24	333.333(recurring)	333	334	3
25	320	320	320	1
30/1.001	266.9333(recurring)	266	267	15
30	266.666(recurring)	266	267	3
50	160	160	160	1
60/1.001	133.4666(recurring)	133	134	15

The result is that decoders of video frame rates that have a frame sequence of greater than 1 will have to provide a small amount of additional buffering to handle the variable number of coded bytes per frame.

**4.2 Application in the MXF generic container**

This mapping may be used in either a frame-wrapped or clip-wrapped generic container as defined in SMPTE 379M.

**5 Key-length-value**

**5.1 Essence element key**

The values of the first 12 bytes of the essence element key are defined in SMPTE 379M. The values of the last 4 bytes of the sound element key are given in table 2.

**Table 2 – Key value for the A-law sound element**

Byte No.	Description	Value (hex)	Meaning
1~12	Defined in SMPTE 379M		See SMPTE 379M
13	Item Type Identifier	16h	GC Sound Item (as defined in SMPTE 379M)
14	Essence Element Count	kkh	Count of Sound Elements in the Sound item
15	Essence Element Type	08h 09h 0Ah	A-law Frame-wrapped Sound Element A-law Clip-wrapped Sound Element A-law Custom-wrapped Sound Element
16	Essence Element Number	nnh	The Number (used as an Index) of this Sound Element in the Sound Item

### 5.1.1 Essence element count — Byte 14

This is a count of the number of sound elements in the sound item of the generic container.

### 5.1.2 Essence element type — Byte 15

The values are given in table 2. Three types are defined so that frame-wrapped, clip-wrapped and custom-wrapped essence can be simply distinguished from at the first key in the MXF generic container.

### 5.1.3 Essence element number — Byte 16

This is a number used as an index to identify this instance of the element type within the sound item. Each element within an item shall have a unique value between 00h and 7Fh as defined by SMPTE 379M, which shall remain constant throughout all content packages of an essence container.

## 5.2 Length

The length field of the KLV coded element shall be 4 bytes BER long-form encoded (i.e., 83h.xx.yy.zz) for frame-wrapping.

The length field of the KLV coded element shall be 8 bytes BER long-form encoded (i.e., 87h.aa.bb.cc.dd.ee.ff.gg) for clip-wrapping.

The length field of the KLV coded element shall be either 4 or 8 bytes BER long-form encoded for custom-wrapping.

## 5.3 Value

In a clip-wrapped file, the element value shall be the complete A-law audio data.

In a frame-wrapped file, the start position of the first sample of the A-law audio data should be the same as the start position of the synchronized picture frame. When equal start position values cannot be achieved because of complex clocking relationships, the start position of the video access unit should fall within the duration of the first sample or audio frame of the sound element. More information on wrapping to achieve synchronization is given in the MXF engineering guideline, SMPTE EG 41.

In a custom-wrapped file, the element value shall be defined by the primary element in the MXF generic container. This wrapping kind is defined to allow this essence kind to be mapped along with a primary element that may define its own specialized or custom wrapping. The details of this wrapping are beyond the scope of this document and shall be defined by the wrapping of the primary essence element.

## 6 SMPTE ULs for A-law codecs

### 6.1 Essence container UL

The values for the essence container UL are given in table 3.

**Table 3 – Specification of the essence container label**

Byte No.	Description	Value (hex)	Meaning
1-12	Defined by Generic Container		As defined in SMPTE 379M
13	Essence Container Kind	02h	MXF Generic Container
14	Mapping Kind	0Ah	A-law Sound Element (as listed in SMPTE RP224)
15	Content Kind	01h 02h 03h	A-law Frame-wrapped Sound Element A-law Clip-wrapped Sound Element A-law Custom-wrapped Sound Element
16	Reserved	00h	

The essence container UL is used within a batch of ULs in partition packs and the preface set and on its own in the essence descriptor. These UL values are listed in the SMPTE RP 224 (Registry of SMPTE Universal Labels).

### 6.2 Sound essence compression UL

The values for the sound essence compression UL are given in table 4.

**Table 4 – Specification of the sound essence compression label**

Byte No.	Description	Value (hex)	Meaning
1-8	Registry Designator	See SMPTE 379M	Values are defined in SMPTE 379M, table 3
9	Parametric	04h	Node used to define Parametric data
10	Sound Essence	02h	Labels for Sound Essence Coding
11	Sound Coding Characteristics	02h	Labels for Sound Coding Characteristics
12	Compressed Sound Coding	02h	Labels for Compressed Sound Coding
13	Compressed Audio Coding	03h	Labels for Compressed Audio Coding
14	Companded Audio	01h	Identifies sample-based non-linear companded coding
15	A-law Coded Audio (default)	01h	Identifies A-law coding(default variant)
16	Reserved	00h	

The sound essence compression UL is used in the generic sound essence descriptor. This UL is listed in SMPTE RP 224.

## 7 Essence descriptor

This mapping should use the generic sound essence descriptor as defined in SMPTE 377M to describe this sound element.

NOTE – SMPTE 377M requires that an essence descriptor is used to describe an essence track in a top-level file package. At the time of writing, the generic sound essence descriptor is the most appropriate essence descriptor for use with this essence type. Future revisions to the MXF standard may introduce a sub-class of the generic sound essence descriptor that may be more appropriate for use with this essence type.

## 8 Use of the KAG

There are no specific KAG (KLV alignment grid) requirements for the A-law mapping. MXF encoders and decoders shall comply with the KAG rules in SMPTE 377M.

**Annex A** (informative)  
**Bibliography**

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

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

SMPTE RP 224, SMPTE Labels Registry

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