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MPEG-H ADM Profile 1.0.0

Requirements and Recommendations

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Introduction

The Audio Definition Model (ADM) according to ITU-R BS.2076 defines an open metadata format for production, exchange and archiving of Next Generation Audio (NGA) content in file-based workflows. The ADM provides a comprehensive metadata syntax, which allows to describe many types of audio content including channel-, object-, and scene-based representations for immersive and interactive audio experiences. The serial representation of the Audio Definition Model (S-ADM) according to ITU-R BS.2125 defines a segmentation of the original ADM for use in linear workflows such as real-time production for broadcasting and streaming applications.

The ADM format can be adopted as native format for NGA production, distribution and emission services. It is acknowledged that application specific ADM profiles are needed to achieve interoperability in ADM-based content ecosystems. Those ADM profiles incorporate the specific requirements for production, distribution and emission. To ensure interoperability with existing NGA workflows, applications adopting the ADM format should be able to convert internal metadata formats to ADM metadata and vice versa such that artistic intent is preserved in a transparent way.

This document specifies the *MPEG-H ADM Profile*, which defines constraints on ITU-R BS.2076 and ITU-R BS.2125 that enable interoperability with established NGA content production and distribution systems for *MPEG-H 3D Audio* as defined in ISO/IEC 23008-3.

1 Scope

This document defines the *MPEG-H ADM Profile*, based on the Audio Definition Model (ADM) according to ITU-R BS.2076-2 and ITU-R BS.2125-0. The constrained set of ADM metadata specified in this profile is intended for the use in advanced Next Generation Audio (NGA) content production and distribution systems for *MPEG-H 3D Audio*. The defined profile may also serve developers who wish to implement ADM-based applications which enable native interoperability with *MPEG-H 3D Audio*.

This document specifies both requirements and recommendations for the *MPEG-H ADM Profile*. Requirements are normative in the sense that ADM-based applications shall fulfil them to claim compliance to the *MPEG-H ADM Profile*. Recommendations are informative and should be fulfilled whenever possible.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ITU-R BS.2051-2 — Advanced sound system for programme production

ITU-R BS.2076-2 — Audio Definition Model

ITU-R BS.2088-1 — Long-form file format for the international exchange of audio programme materials with metadata

ITU-R BS.2094-1 — Common definitions for the Audio Definition Model

ITU-R BS.2125-0 — A serial representation of the Audio Definition Model

SMPTE ST 337 — Format for Non-PCM Audio and Data in an AES3 Serial Digital Audio Interface

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

SMPTE ST 2116 — Format for Non-PCM Audio and Data in AES3 — Carriage of Metadata of Serial ADM

AES67 — AES standard for audio applications of networks — High-performance streaming audio-over-IP interoperability

ISO/IEC 23008-3:2019 — Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 3: 3D audio

ISO/IEC 23091-3:2018 — Information technology — Coding-independent code points — Part 3: Audio

3 Definitions and Abbreviations

3.1 Definitions

For the purpose of this document, the following definitions apply:

“Shall”, “Shall not”	Indicates a normative requirement. The provision of this requirement is mandatory for compliance.
“Should”, “Should not”	Indicates an informative requirement. The provision of this requirement is recommended but not mandatory.
“May”, “Need not”	Indicates a permission. The presence or absence of the corresponding feature does not preclude compliance.
“Can”, “Cannot”	Indicates a possibility and capability.

3.2 Abbreviations

For the purpose of this document, the following abbreviations apply:

ADM	Audio Definition Model as specified in ITU-R BS.2076-2
BWF	Broadcast Wave Format including BWF-compatible formats like BW64 and RF64
BWF/ADM	Broadcast Wave Format with embedded ADM or S-ADM metadata
CICP	Coding-independent code points as specified in ISO/IEC 23091-3
HOA	Higher Order Ambisonics
MPEG-H	Synonym for MPEG-H 3DA in this document
MPEG-H 3DA	Low-bitrate audio codec for Next Generation Audio as specified in ISO/IEC 23008-3
MXF	Material Exchange Format as specified in SMPTE ST 377-1
MXF/ADM	Material Exchange Format with embedded ADM or S-ADM metadata
NGA	Next Generation Audio
PCM	Pulse code modulation for coding of digital audio
S-ADM	Serialized ADM as specified in ITU-R BS.2125-0
UTF-8	8-bit Unicode Transformation Format
XML	Extensible Markup Language

4 Profile Overview

The *MPEG-H ADM Profile* defines a subset of the ADM. This subset limits the scope of ITU-R BS.2076-2 and ITU-R BS.2125-0 to features typically used in NGA content production and distribution systems for *MPEG-H 3D Audio*.

The requirements of this specification shall be fulfilled by any application which claims compliance to the *MPEG-H ADM Profile*. Applications, which generate ADM-based content, shall fulfil the defined requirements on XML elements, sub-elements and attributes. Applications, which import ADM-based content, may be limited to the requirements on XML elements, sub-elements and attributes for a certain *profileID* and *levelID* of the *MPEG-H ADM Profile*.

The requirements and recommendations of the *MPEG-H ADM Profile* are specified in the following clauses with Clause 5 corresponding to ITU-R BS.2076-2 (ADM XML code), Clause 6 corresponding to ITU-R BS.2125-0 (S-ADM XML code) and Clause 7 corresponding to custom metadata for *MPEG-H 3D Audio*.

Some ADM elements, sub-elements and attributes are indicated as not mandatory for compliance in this document and may therefore be omitted. If present, these elements, sub-elements and attributes may be ignored by ADM importers claiming compliance to the current version of the *MPEG-H ADM Profile*.

5 Profile requirements and recommendations on ITU-R BS.2076-2

5.1 General

This clause contains general requirements that do not apply to individual ADM elements or attributes, but to the overall ADM metadata. ADM XML code conforming to the *MPEG-H ADM Profile* shall fulfil the following general requirements:

- ADM XML code shall be conforming to the Extensible Markup Language (XML) 1.0 with UTF-8 character encoding.
- Integer and floating-point numbers shall be given in a decimal representation without leading zeros.
- ADM XML code shall not overwrite elements defined by ITU-R BS.2094-1.
- Name strings (e.g. *audioObjectName*) should not exceed 64 characters. Applications may truncate strings in an appropriate way if displayed by a user interface.
- Label strings (e.g. *audioContentLabel*) should not exceed 30 characters. Labels for specific *language* attributes should be consistently present for all applicable *audioProgrammeLabel*, *audioContentLabel* and *audioComplementaryObjectGroupLabel* sub-elements in all present *audioProgramme*, *audioContent* and *audioObject* elements.
- ADM XML code conforming to the *MPEG-H ADM Profile* shall not exceed the maximum element counts as defined in Table 1. The maximum element counts are dependent on the supported *profileID* and *levelID* as given in Table 1. An illustration of an ADM configuration with maximum element counts is depicted in Figure 1.

Table 1 — Requirements dependent on the MPEG-H ADM *profileID* and *levelID*

Maximum Element Count	profileID							
	1				2			
	levelID							
	1	2	3	4	1 ^(f)	2 ^(f)	3 ^(f)	4 ^(f)
<i>audioProgramme</i> (p_max)	4	4	8	16	4	4	8	16
<i>audioContent</i> (c_max)	5	9	16	28	5	9	16	28
<i>audioObject</i> (c_max *3)	15	27	48	84	15	27	48	84
<i>audioPackFormat</i> (c_max *2) ^(a)	10	18	32	56	10	18	32	56
<i>audioChannelFormat</i> (c_max *2) ^(a)	10	18	32	56	10	18	32	56
<i>audioStreamFormat</i> (c_max *2)	10	18	32	56	10	18	32	56
<i>audioTrackFormat</i> (c_max *2)	10	18	32	56	10	18	32	56
<i>audioTrackUID</i> (c_max *2) ^(b)	10	18	32	56	10	18	32	56
audio track (c_max *2)	10	18	32	56	10	18	32	56
Number of simultaneously active audio tracks (a_max) ^(c)	5	9	16	28	5	9	24 ^(g)	28
Number of complementary <i>audioObject</i> groups (s_max) ^(d)	2	4	8	14	2	4	8	14
Number of complementary <i>audioObject</i> groups plus number of non-complementary top-level <i>audioObject</i> elements ^(e)	16	16	16	16	16	16	16	16

Number of <i>audioProgrammeLabel</i> , <i>audioContentLabel</i> and <i>audioComplementaryObjectGroupLabel</i> sub-elements in its parent element (l_max)	4	4	4	8	4	4	4	8
Maximum number of channels in reference layout (r_max)	2	8	12	24	2	8	12	24

(a) Elements of type '0002' (*Matrix*) shall be ignored for the calculation of element counts.

(b) Elements with an *audioTrackUID* attribute of 'ATU_00000000' shall be ignored for the calculation of element counts.

(c) The maximum number of simultaneously active audio tracks may be less than the number of *audioTrackUID* elements defined in the *audioFormatExtended* element or in the <chna> chunk of a BWF-compatible file (see Clause 7).

(d) A complementary *audioObject* group is a set of mutually exclusive *audioObject* elements defined by a parent *audioObject* element and its *audioComplementaryObjectIDRef* sub-elements.

(e) Top-level *audioObject* elements shall be referenced exactly once by an *audioContent* element. Within this ADM profile definition, each *audioContent* element has exactly one associated top-level *audioObject* element.

(f) Elements of type '0004' (*HOA*) shall not be present.

(g) Elements of type '0001' (*DirectSpeakers*) should not be referenced by any *audioObject* element if the number of simultaneously active audio tracks is greater than 16.

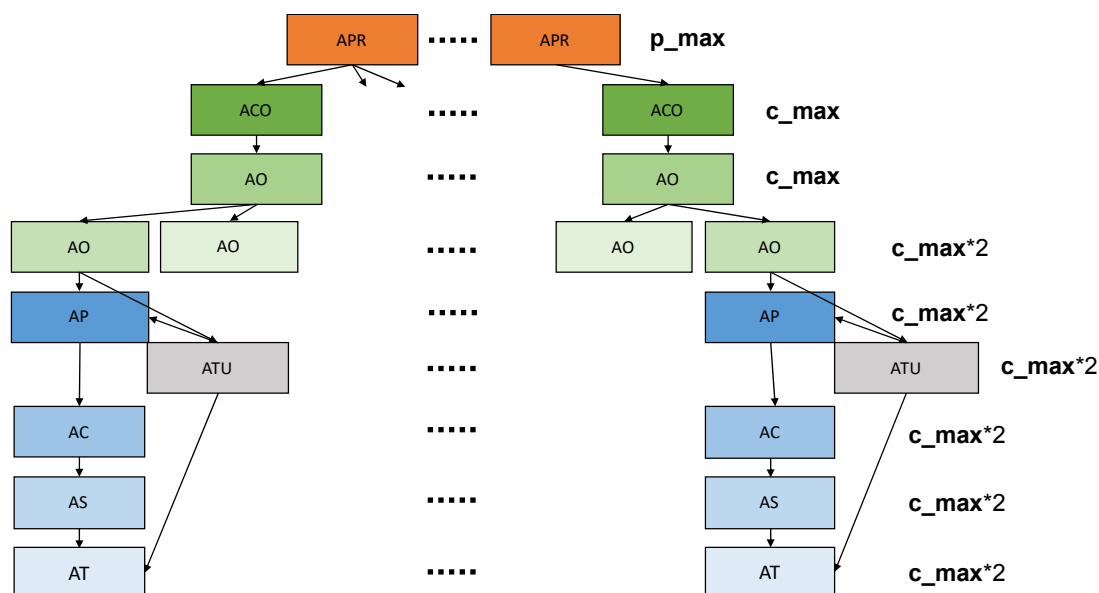


Figure 1 — ADM configuration with maximum element counts

5.2 audioTrackFormat

This clause specifies requirements for the attributes and sub-elements of the *audioTrackFormat* element.

5.2.1 General

Each present *audioTrackFormat* element shall be referenced at least once by a present *audioTrackUID* element.

5.2.2 Configuration

Table 2 — audioTrackFormat attribute requirements

Attribute	Requirements	Required
<i>audioTrackFormatID</i>	Shall be set as follows: 'AT_yyyxxxxx_01' with unique hex digits yyyxxxxx identical to the corresponding <i>audioStreamFormatID</i> attribute.	Yes
<i>audioTrackFormatName</i>	See Subclause 5.1.	Yes
<i>formatLabel</i>	Shall be set to '0001'.	Yes
<i>formatDefinition</i>	Shall be set to 'PCM' if present.	No

Table 3 — audioTrackFormat sub-element requirements

Sub-element	Requirements	Quantity
<i>audioStreamFormatIDRef</i>	Shall correspond to the <i>audioStreamFormatID</i> attribute of a present <i>audioStreamFormat</i> element.	1

5.3 audioStreamFormat

This clause specifies requirements for the attributes and sub-elements of the *audioStreamFormat* element.

5.3.1 General

Each present *audioStreamFormat* element shall be referenced exactly once by a present *audioTrackFormat* element.

5.3.2 Configuration

Table 4 — audioStreamFormat attribute requirements

Attribute	Requirements	Required
<i>audioStreamFormatID</i>	Shall be set as follows: 'AS_yyyxxxxx' with unique hex digits yyyxxxxx identical to the corresponding <i>audioChannelFormatID</i> attribute.	Yes
<i>audioStreamFormatName</i>	See Subclause 5.1.	Yes
<i>formatLabel</i>	Shall be set to '0001'.	Yes
<i>formatDefinition</i>	Shall be set to 'PCM' if present.	No

Table 5 — audioStreamFormat sub-element requirements

Sub-element	Requirements	Quantity
<i>audioChannelFormatIDRef</i>	Shall correspond to the <i>audioChannelFormatID</i> attribute of a present <i>audioChannelFormat</i> element.	1
<i>audioPackFormatIDRef</i>	Shall not be present.	0
<i>audioTrackFormatIDRef</i>	Shall correspond to the <i>audioTrackFormatID</i> attribute of a present <i>audioTrackFormat</i> element. Hex digits yyyxxxxx of the <i>audioTrackFormatIDRef</i> sub-element shall be identical to the <i>audioStreamFormatID</i> attribute.	0 or 1

5.4 audioChannelFormat

This clause specifies requirements for attributes and sub-elements of the *audioChannelFormat* element.

5.4.1 General

Each present *audioChannelFormat* element of type '0001' (*DirectSpeakers*) and '0004' (*HOA*) shall be referenced at least once by a present *audioPackFormat* element. Each present *audioChannelFormat* element of type '0002' (*Matrix*) and '0003' (*Objects*) shall be referenced exactly once by a present *audioPackFormat* element. Each present *audioChannelFormat* element of type '0001' (*DirectSpeakers*), '0003' (*Objects*) and '0004' (*HOA*) shall be referenced at least once by a present *audioStreamFormat* element or a present *audioTrackUID* element.

5.4.2 Configuration

Table 6 — audioChannelFormat attribute requirements

Attribute	Requirements	Required
<i>audioChannelFormatID</i>	Shall be set as follows: 'AC_yyyyyxxx' with unique hex digits xxxx from '1001' to 'FFFF'. Hex digits yyyy shall be set to '0001', '0002', '0003' or '0004' based on the type of the <i>audioChannelFormat</i> element.	Yes
<i>audioChannelFormatName</i>	See Subclause 5.1.	Yes
<i>typeLabel</i>	Shall be set to '0001', '0002', '0003' or '0004'.	Yes
<i>typeDefinition</i>	Shall be consistent to the <i>typeLabel</i> attribute if present.	No

Table 7 — audioChannelFormat sub-element requirements (type '0001', '0002' or '0004')

Sub-element	Requirements	Quantity
<i>audioBlockFormat</i>	Shall be present.	1
<i>frequency</i>	Not mandatory for compliance, may be omitted.	0 ... 2

Table 8 — audioChannelFormat sub-element requirements (type '0003')

Sub-element	Requirements	Quantity
<i>audioBlockFormat</i>	Shall be present.	1 ... *
<i>frequency</i>	Not mandatory for compliance, may be omitted.	0 ... 2

5.5 audioBlockFormat

This clause specifies requirements for attributes and sub-elements of the *audioBlockFormat* element. Requirements for attributes and sub-elements of the *audioBlockFormat* element which apply for S-ADM XML metadata are defined in Subclause 6.7.

5.5.1 General

The sequence of available *audioBlockFormat* elements of an *audioChannelFormat* element shall cover the entire duration of the available audio essence of the corresponding *audioObject* element.

5.5.2 Configuration

Table 9 — audioBlockFormat attribute requirements

Attribute	Requirements	Required
<i>audioBlockFormatID</i>	Shall be set as follows: 'AB_yyyxxxxx_nnnnnnnn' with hex digits yyyxxxxx identical to the parent's <i>audioChannelFormatID</i> attribute. Hex digits nnnnnnnn shall be set to '00000001' for <i>audioBlockFormat</i> elements of type '0001', '0002' and '0004'. For type '0003', considering all <i>audioBlockFormat</i> sub-elements of an <i>audioChannelFormat</i> element, hex digits nnnnnnnn shall be unique, contiguous and increasing in order of appearance in the XML, starting with '00000001' for the first block.	Yes

Table 10 — audioBlockFormat attribute requirements (type '0003')

Attribute	Requirements	Required
<i>rtime</i>	Shall use the time formats as specified in §5.11 of ITU-R BS.2076-2. The value of the <i>rtime</i> attribute of each <i>audioBlockFormat</i> element shall be equal to the sum of the values of the <i>rtime</i> attribute and the <i>duration</i> attribute of the preceding <i>audioBlockFormat</i> element. Rounding errors shall be as small as possible.	Yes
<i>duration</i>	Shall use the time formats as specified in §5.11 of ITU-R BS.2076-2. The value of the <i>duration</i> attribute should not be less than 5 ms.	Yes

Table 11 — audioBlockFormat sub-element requirements (type '0001')

Sub-element	Requirements	Quantity
<i>position</i>	Shall be restricted to polar coordinate attributes 'azimuth', 'elevation' and 'distance'. Azimuth shall be set to a value between '-180.0' and '180.0', elevation shall be set to a value between '-90.0' and '90.0'. If present, distance shall be set to '1.0'. The <i>bound</i> attribute shall not be present. The <i>screenEdgeLock</i> attribute is not mandatory for compliance and may be omitted.	2 ... 3
<i>speakerLabel</i>	If an <i>audioChannelFormat</i> element represents a Low Frequency Effects or Low Frequency Enhancement (LFE) channel, there shall be a <i>speakerLabel</i> sub-element set to 'LFE'.	0 ... *
<i>gain</i>	Shall be set to '0.0' dB or to the equivalent linear value if present.	0 or 1
<i>importance</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>headLocked</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>headphoneVirtualise</i>	The <i>bypass</i> attribute should not be set to '1' if the parent <i>audioChannelFormat</i> element is referenced by any <i>audioPackFormat</i> element which does not represent a	0 or 1

	mono loudspeaker layout or a stereo loudspeaker layout according to ITU-R BS.2051. If the referencing <i>audioPackFormat</i> element represents a stereo loudspeaker layout, the <i>bypass</i> attribute should be set to '1' either for both referenced <i>audioChannelFormat</i> elements or for none of them. The <i>DRR</i> attribute is not mandatory for compliance and may be omitted.	
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Table 12 — audioBlockFormat sub-element requirements (type '0002')

Sub-element	Requirements	Quantity
<i>outputChannelFormatIDRef</i>	Shall correspond to the <i>audioChannelFormatID</i> attribute of a present or common definition <i>audioChannelFormat</i> element. Shall be identical to an <i>audioChannelFormatIDRef</i> sub-element of the <i>outputPackFormat</i> referenced by the <i>audioPackFormat</i> element of type '0002' that the parent <i>audioChannelFormat</i> element belongs to.	1
<i>jumpPosition</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>matrix</i>	The <i>gain</i> attribute of the <i>coefficient</i> sub-element shall be set to a value between '-INF' dB and '20.0' dB or the equivalent linear value. Any attributes of the <i>coefficient</i> sub-element, except the <i>gain</i> attribute and the <i>gainUnit</i> attribute shall not be present. There shall be an injective mapping from the set of <i>coefficient</i> sub-elements to the set of <i>audioChannelFormatIDRef</i> sub-elements of the <i>inputPackFormat</i> referenced by the <i>audioPackFormat</i> element of type '0002' that the parent <i>audioChannelFormat</i> element belongs to. If the <i>gain</i> attribute is not present for a <i>coefficient</i> sub-element, the default gain value is '0.0' dB. If the <i>coefficient</i> sub-element is not present for an <i>audioChannelFormat</i> element of the corresponding <i>inputPackFormat</i> element, the default gain value is '-INF' dB.	1
<i>gain</i>	Shall be set to '0.0' dB or to the equivalent linear value if present.	0 or 1
<i>importance</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>headLocked</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>headphoneVirtualise</i>	Not mandatory for compliance, may be omitted.	0 or 1

Table 13 — audioBlockFormat sub-element requirements (type '0003')

Sub-element	Requirements	Quantity
<i>position</i> (polar)	For polar coordinate system, <i>position</i> sub-elements for coordinates 'azimuth' and 'elevation' shall be present. Azimuth shall be set to a value between '-180.0' and '180.0', elevation shall be set to a value between '-90.0' and '90.0'.	2 ... 3

	The <i>position</i> sub-element for the 'distance' coordinate is optional. The <i>screenEdgeLock</i> attribute is not mandatory for compliance and may be omitted.	
<i>position</i> (Cartesian)	For Cartesian coordinate system, <i>position</i> sub-elements for coordinates 'X', 'Y' and 'Z' shall be set to a value between '-1.0' and '1.0'. The <i>position</i> sub-element for the 'Z' coordinate is optional. The <i>screenEdgeLock</i> attribute is not mandatory for compliance and may be omitted.	2 ... 3
<i>width</i>	Shall be set to a value between '0.0' and '360.0' for polar coordinates. Shall be set to a value between '0.0' and '1.0' for Cartesian coordinates.	0 or 1
<i>height</i>	Should be set to a value between '0.0' and '180.0' for polar coordinates. Shall be set to a value between '0.0' and '1.0' for Cartesian coordinates.	0 or 1
<i>depth</i>	Shall be set to a value between '0.0' and '1.0'.	0 or 1
<i>cartesian</i>	Shall be set to '1' for the Cartesian coordinate system. The coordinate system shall be consistent for all <i>audioBlockFormat</i> elements within the <i>audioFormatExtended</i> element.	0 or 1
<i>diffuse</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>channelLock</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>objectDivergence</i>	Shall be set to a value between '0.0' and '1.0'. The <i>azimuthRange</i> attribute shall be set to a value between '0.0' and '180.0' (polar coordinates). The <i>positionRange</i> attribute shall be set to a value between '0.0' and '1.0' (Cartesian coordinates).	0 or 1
<i>jumpPosition</i>	Shall be set to '1' if the position changes instantly from the previous <i>audioBlockFormat</i> position. Note that a renderer shall always apply interpolation to avoid audible artefacts. The <i>interpolationLength</i> attribute shall not be used.	0 or 1
<i>zoneExclusion</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>screenRef</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>gain</i>	Shall be set to a linear value between '0.0' and '6.0' or to an equivalent value in dB.	0 or 1
<i>importance</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>headLocked</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>headphoneVirtualise</i>	Not mandatory for compliance, may be omitted.	0 or 1

Table 14 — *audioBlockFormat* sub-element requirements (type '0004')

Sub-element	Requirements	Quantity
<i>equation</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>order</i>	Shall be set to a value between '0' and '6'.	1
<i>degree</i>	Shall be set to a value between +/- <i>order</i> .	1

<i>normalization</i>	Shall be set to 'SN3D' if present.	0 or 1
<i>nfcRefDist</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>screenRef</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>gain</i>	Shall be set to '0.0' dB or to the equivalent linear value if present.	0 or 1
<i>importance</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>headLocked</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>headphoneVirtualise</i>	Not mandatory for compliance, may be omitted.	0 or 1

5.6 audioPackFormat

This clause specifies requirements for the attributes and sub-elements of the *audioPackFormat* element.

5.6.1 General

Each present *audioPackFormat* element of type '0001' (*DirectSpeakers*) shall be referenced at least once by present *audioObject* elements or via *outputPackFormatIDRef* sub-elements by present *audioPackFormat* elements of type '0002' (*Matrix*) or via *referenceLayout* sub-elements by *authoringInformation* sub-elements of present *audioProgramme* elements. Each present *audioPackFormat* element of type '0003' (*Objects*) or '0004' (*HOA*) shall be referenced at least once by present *audioObject* elements. There shall not be two or more *audioPackFormat* elements of type '0002' (*Matrix*), which share the same combination of *inputPackFormatIDRef* sub-element and *outputPackFormatIDRef* sub-element.

5.6.2 Configuration

Table 15 — audioPackFormat attribute requirements

Attribute	Requirements	Required
<i>audioPackFormatID</i>	Shall be set as follows: 'AP_yyyyyxxx' with unique hex digits xxxx from '1001' to 'FFFF'. Hex digits yyyy shall be set to '0001', '0002', '0003' or '0004' based on the type of the <i>audioPackFormat</i> element	Yes
<i>audioPackFormatName</i>	See Subclause 5.1.	Yes
<i>typeLabel</i>	Shall be set to '0001', '0002', '0003' or '0004'.	Yes
<i>typeDefinition</i>	Shall be consistent to the <i>typeLabel</i> attribute if present.	No
<i>importance</i>	Not mandatory for compliance, may be omitted.	No

Table 16 — audioPackFormat sub-element requirements (type '0001')

Sub-element	Requirements	Quantity
<i>audioChannelFormatIDRef</i>	Shall correspond to the <i>audioChannelFormatID</i> attribute of a present or common definition <i>audioChannelFormat</i> element of type '0001'.	1 ... a_max
<i>audioPackFormatIDRef</i>	Shall not be present.	0
<i>absoluteDistance</i>	Not mandatory for compliance, may be omitted.	0 or 1

Table 17 — audioPackFormat sub-element requirements (type '0002')

Sub-element	Requirements	Quantity
<i>audioChannelFormatIDRef</i>	Shall correspond to the <i>audioChannelFormatID</i> attribute of a present <i>audioChannelFormat</i> element of type '0002'. There shall be an injective mapping from the set of <i>audioChannelFormatIDRef</i> sub-elements to the set of <i>audioChannelFormatIDRef</i> sub-elements of the <i>outputPackFormat</i> .	1 ... 24
<i>audioPackFormatIDRef</i>	Shall not be present.	0
<i>absoluteDistance</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>encodePackFormatIDRef</i>	Shall not be present.	0
<i>decodePackFormatIDRef</i>	Shall not be present.	0
<i>inputPackFormatIDRef</i>	Shall correspond to the <i>audioPackFormatID</i> attribute of a present or common definition <i>audioPackFormat</i> element of type '0001'. The same <i>audioPackFormat</i> element shall be also referenced by a present <i>audioObject</i> element.	1
<i>outputPackFormatIDRef</i>	Shall refer to an <i>audioPackFormat</i> element as listed in Subclause 9.2, Table 58. Shall not be identical to the <i>inputPackFormatIDRef</i> sub-element.	1

Table 18 — audioPackFormat sub-element requirements (type '0003')

Sub-element	Requirements	Quantity
<i>audioChannelFormatIDRef</i>	Shall correspond to the <i>audioChannelFormatID</i> attribute of a present <i>audioChannelFormat</i> element of type '0003'.	1
<i>audioPackFormatIDRef</i>	Shall not be present.	0
<i>absoluteDistance</i>	Not mandatory for compliance, may be omitted.	0 or 1

Table 19 — audioPackFormat sub-element requirements (type '0004')

Sub-element	Requirements	Quantity
<i>audioChannelFormatIDRef</i>	Shall correspond to the <i>audioChannelFormatID</i> attribute of a present or common definition <i>audioChannelFormat</i> element of type '0004'	1 ... a_max
<i>audioPackFormatIDRef</i>	Shall not be present.	0
<i>absoluteDistance</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>normalization</i>	Shall be set to 'SN3D' if present.	0 or 1
<i>nfcRefDist</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>screenRef</i>	Not mandatory for compliance, may be omitted.	0 or 1

5.7 audioObject

This clause specifies requirements for the attributes and sub-elements of the *audioObject* element.

5.7.1 General

Each *audioObject* element shall be referenced exactly once by either a parent *audioObject* element or by a parent *audioContent* element. If an *audioObject* element is referenced by a parent *audioObject* element, the parent *audioObject* element shall be referenced by a parent *audioContent* element.

The loudness properties of complementary *audioObject* elements linked by the *audioComplementaryObjectIDRef* sub-element shall be aligned:

- *integratedLoudness* of complementary *audioObject* elements shall not differ by more than 3 dB.
- *dialogueLoudness* of complementary *audioObject* elements shall not differ by more than 3 dB.

The loudness properties shall be indicated by the *loudnessMetadata* sub-element attached to the parent *audioContent* element of an *audioObject* element.

The overall number of *audioObject* elements that include at least one *audioComplementaryObjectIDRef* sub-element shall not exceed **s_max**.

5.7.2 Configuration

Table 20 — audioObject attribute configuration

Attribute	Requirements	Required
<i>audioObjectID</i>	Shall be set as follows: 'AO_xxxx' with unique hex digits xxxx in the range '1001' to 'FFFF'. If this <i>audioObject</i> is referenced by a parent <i>audioContent</i> element, xxxx shall be set according to the parent's <i>audioContentID</i> attribute.	Yes
<i>audioObjectName</i>	See Subclause 5.1.	Yes
<i>start</i>	Not mandatory for compliance, may be omitted.	No
<i>duration</i>	Not mandatory for compliance, may be omitted.	No
<i>dialogue</i>	Not mandatory for compliance, may be omitted.	No
<i>importance</i>	Not mandatory for compliance, may be omitted.	No
<i>disableDucking</i>	Not mandatory for compliance, may be omitted.	No

Table 21 — audioObject sub-element configuration

Sub-element	Requirements	Quantity
<i>audioPackFormatIDRef</i>	Shall correspond to the <i>audioPackFormatID</i> attribute of a present or common definition <i>audioPackFormat</i> element of type '0001', '0003' or '0004'. Shall be present if the <i>audioObject</i> element does not include any <i>audioObjectIDRef</i> element.	0 or 1
<i>audioObjectIDRef</i>	Shall correspond to the <i>audioObjectID</i> attribute of a present <i>audioObject</i> element. Shall not be present if the <i>audioObject</i> element includes an <i>audioPackFormatIDRef</i> sub-element. If an <i>audioObject</i> element references multiple <i>audioObject</i> elements, all referenced <i>audioObject</i> elements shall reference <i>audioPackFormat</i> elements of type '0003' (<i>Objects</i>).	0 ... a_max
<i>audioObjectLabel</i>	Not mandatory for compliance, may be omitted.	0 ... *
<i>audioComplementary-ObjectGroupLabel</i>	Shall be used to label a group of complementary <i>audioObject</i> elements.	0 ... l_max

	The <i>language</i> attribute shall be present and set according to ISO 639-2 (3-character code). See also Subclause 5.1. The <i>language</i> attribute shall be unique for each <i>audioComplementaryObjectGroupLabel</i> sub-element.	
<i>audioComplementaryObjectIDRef</i>	Shall not be present in <i>audioObject</i> elements that are not top-level <i>audioObject</i> elements. Shall correspond to the <i>audioObjectID</i> attribute of a present top-level <i>audioObject</i> element. The referenced <i>audioObject</i> element shall not include any <i>audioComplementaryObjectIDRef</i> sub-elements. The <i>interact</i> attributes of complementary <i>audioObject</i> elements shall be identical. The <i>audioObjectInteraction</i>, <i>gain</i> and <i>positionOffset</i> sub-elements of complementary <i>audioObject</i> elements shall be identical. Complementary <i>audioObject</i> elements shall not reference <i>audioPackFormat</i> elements of different types. No <i>audioObject</i> element shall be referenced by more than one <i>audioComplementaryObjectIDRef</i> sub-element. See also Annex A.	0 ... min(c_max -1,32)
<i>audioTrackUIDRef</i>	Shall correspond to the <i>UID</i> attribute of a present <i>audioTrackUID</i> element. If the <i>audioObject</i> element includes an <i>audioPackFormatIDRef</i> sub-element, there shall be exactly as many <i>audioTrackUIDRef</i> sub-elements as there are <i>audioChannelFormatIDRef</i> sub-elements in the referenced <i>audioPackFormat</i> element. Each referenced <i>audioTrackUID</i> element shall refer back to the <i>audioPackFormat</i> element and it shall also refer back to one of the <i>audioChannelFormat</i> elements referenced by this <i>audioPackFormat</i> element. Note that an <i>audioTrackUID</i> element can refer back to an <i>audioChannelFormat</i> element by using the <i>audioChannelFormatIDRef</i> sub-element or by using the <i>audioTrackFormatIDRef</i> sub-element. In this way, each <i>audioChannelFormat</i> element referenced by the <i>audioPackFormat</i> element shall be referred back to by a referenced <i>audioTrackUID</i> element exactly once. Shall not be present if the <i>audioObject</i> element includes <i>audioObjectIDRef</i> sub-elements. Shall not refer to a silent track by using 'ATU_00000000'.	0 ... a_max
<i>audioObjectInteraction</i>	Shall not be present in <i>audioObject</i> elements that are not top-level <i>audioObject</i> elements. Shall be present if and only if the <i>interact</i> attribute of the parent <i>audioObject</i> element is present and set to '1'. See Table 22 and Table 23.	0 or 1
<i>gain</i>	Shall not be present if an <i>audioObjectInteraction</i> sub-element is not present. Shall not be present if the present <i>audioObjectInteraction</i> sub-element does not include <i>gainInteractionRange</i> sub-elements. Shall be set to a value covered by the <i>gainInteractionRange</i> within the present <i>audioObjectInteraction</i> sub-element.	0 or 1

<i>headLocked</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>positionOffset</i>	Shall not be present if an <i>audioObjectInteraction</i> sub-element is not present. Shall not be present if the present <i>audioObjectInteraction</i> sub-element does not include <i>positionInteractionRange</i> sub-elements. Shall be set to a value covered by the <i>positionInteractionRange</i> for the respective coordinate within the present <i>audioObjectInteraction</i> sub-element. Shall not use <i>coordinate</i> attributes 'distance', 'X', 'Y' or 'Z'. Shall not be present if the <i>audioObject</i> element refers to an <i>audioChannelFormat</i> element of a different type than '0003' (<i>Objects</i>).	0 ... 2
<i>mute</i>	Shall not be present.	0
<i>alternativeValueSet</i>	Shall not be present in <i>audioObject</i> elements that are not top-level <i>audioObject</i> elements. See Table 24.	0 ... p_max

Table 22 — *audioObjectInteraction* attribute requirements

Attribute	Requirements	Required
<i>onOffInteract</i>	Shall be set to '0'.	Yes

Table 23 — *audioObjectInteraction* sub-element requirements

Sub-element	Requirements	Quantity
<i>gainInteractionRange</i>	The value of a <i>gainInteractionRange</i> sub-element with the <i>bound</i> attribute set to 'min' shall be less than or equal to '0.0' dB or an equivalent linear value. The value of a <i>gainInteractionRange</i> sub-element with the <i>bound</i> attribute set to 'max' shall be between '0.0' dB and '31.0' dB or an equivalent linear value. Shall be present if and only if the <i>gainInteract</i> attribute of the parent <i>audioObjectInteraction</i> sub-element is present.	0 or 2
<i>positionInteractionRange</i>	The value of a <i>positionInteractionRange</i> sub-element with the <i>coordinate</i> attribute set to 'azimuth' and the <i>bound</i> attribute set to 'min' or 'max', shall be between '-180.0' and '0.0' or '0.0' and '180.0', respectively. The value of a <i>positionInteractionRange</i> sub-element with the <i>coordinate</i> attribute set to 'elevation' and the <i>bound</i> attribute set to 'min' or 'max', shall be between '-90.0' and '0.0' or '0.0' and '90.0', respectively. Shall not use <i>coordinate</i> attributes 'distance', 'X', 'Y' or 'Z'. Shall not be present if the <i>audioObject</i> element refers to an <i>audioChannelFormat</i> element of a different type than '0003' (<i>Objects</i>). Shall be present if and only if the <i>positionInteract</i> attribute of the parent <i>audioObjectInteraction</i> sub-element is present.	0 or 4

Table 24 — *alternativeValueSet* sub-element requirements

Sub-element	Requirements	Quantity
<i>audioObjectLabel</i>	Not mandatory for compliance, may be omitted.	0 ... *
<i>audioObjectInteraction</i>	If present, shall be identical to the <i>audioObjectInteraction</i> sub-element of the parent <i>audioObject</i> element except for the <i>gainInteract</i> and <i>positionInteract</i> attributes.	0 or 1
<i>gain</i>	Shall not be present if an <i>audioObjectInteraction</i> sub-element is not present in the parent <i>audioObject</i> element. Shall not be present if the <i>audioObjectInteraction</i> sub-element of the parent <i>audioObject</i> element does not include a <i>gainInteractionRange</i> sub-element. Shall be set to a value covered by the <i>gainInteractionRange</i> within the <i>audioObjectInteraction</i> sub-element of the parent <i>audioObject</i> element.	0 or 1
<i>headLocked</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>positionOffset</i>	Shall not be present if an <i>audioObjectInteraction</i> sub-element is not present in the parent <i>audioObject</i> element. Shall not be present if the <i>audioObjectInteraction</i> sub-element of the parent <i>audioObject</i> element does not include a <i>positionInteractionRange</i> sub-element. Shall be set to a value covered by the <i>positionInteractionRange</i> for the respective <i>coordinate</i> within the <i>audioObjectInteraction</i> sub-element of the parent <i>audioObject</i> element. Shall not use <i>coordinate</i> attribute 'distance', 'X', 'Y' or 'Z'. Shall not be present if the <i>audioObject</i> element refers to an <i>audioChannelFormat</i> element of any other type than '0003'.	0 ... 2
<i>mute</i>	Shall not be present.	0

5.8 audioContent

This clause specifies requirements for the attributes and sub-elements of the *audioContent* element.

5.8.1 General

Each defined *audioContent* element shall be referenced by at least one *audioProgramme* element.

5.8.2 Configuration

Table 25 — *audioContent* attribute requirements

Attribute	Requirements	Required
<i>audioContentID</i>	Shall be set as follows: 'ACO_xxxx' with unique hex digits xxxx in the range '1001' to 'FFFF', which shall be identical to the hex digits of the <i>audioObjectIDRef</i> sub-element value.	Yes
<i>audioContentName</i>	See Subclause 5.1.	Yes
<i>audioContentLanguage</i>	Shall be set according to ISO 639-2 (3-character code).	No

Table 26 — audioContent sub-element requirements

Sub-element	Requirements	Quantity
<i>audioContentLabel</i>	Shall be used to label an <i>audioContent</i> element. The <i>language</i> attribute shall be present and set according to ISO 639-2 (3-character code). See also Subclause 5.1. The <i>language</i> attribute shall be unique for each <i>audioContentLabel</i> sub-element.	0 ... I_max
<i>audioObjectIDRef</i>	Shall correspond to the <i>audioObjectID</i> attribute of a present <i>audioObject</i> element.	1
<i>loudnessMetadata</i>	Shall be present in linear workflows such as live or real-time production for broadcasting and streaming applications.	0 or 1
<i>dialogue</i>	Should be present.	0 or 1
<i>alternativeValueSetIDRef</i>	Shall not be present.	0

Table 27 — loudnessMetadata attribute requirements for audioContent

Attribute	Requirements	Required
<i>loudnessMethod</i>	If present, the <i>loudnessMethod</i> attribute shall be set to 'ITU-R BS.1770'.	No

Table 28 — loudnessMetadata sub-element requirements for audioContent

Sub-element	Requirements	Quantity
<i>integratedLoudness</i>	Shall be present in linear workflows such as live or real-time production for broadcasting and streaming applications if a <i>dialogueLoudness</i> sub-element is not present. Shall be set to a value between '-57.75' and '6.0' in LKFS.	0 or 1
<i>dialogueLoudness</i>	Should be present in linear workflows such as live or real-time production for broadcasting and streaming applications if dialogue is included in the audio essence associated with the <i>audioContent</i> element. Shall be set to a value between '-57.75' and '6.0' in LKFS.	0 or 1

5.9 audioProgramme

This clause specifies requirements for the attributes and sub-elements of the *audioProgramme* element.

5.9.1 General

There are no general requirements on the *audioProgramme* element.

5.9.2 Configuration

Table 29 — audioProgramme attribute requirements

Attribute	Requirements	Required
<i>audioProgrammeID</i>	Shall be set as follows: 'APR_xxxx' with unique hex digits	Yes

	xxxx in the range '1001' to 'FFFF'.	
<i>audioProgrammeName</i>	See Subclause 5.1.	Yes
<i>audioProgrammeLanguage</i>	Shall be set according to ISO 639-2 (3-character code).	No
<i>start</i>	Shall use the time formats as specified in §5.11 of ITU-R BS.2076-2. If the <i>start</i> attribute is not present, a value of '00:00:00.00000' is assumed. The <i>start</i> attribute shall be identical for all <i>audioProgramme</i> elements.	No
<i>end</i>	Shall use the time formats as specified in §5.11 of ITU-R BS.2076-2. If the <i>end</i> attribute is not present, a value is assumed such that the <i>audioProgramme</i> ends with the last available audio sample. The <i>end</i> attribute shall be identical for all <i>audioProgramme</i> elements.	No
<i>maxDuckingDepth</i>	Not mandatory for compliance, may be omitted.	No

Table 30 — audioProgramme sub-element requirements

Sub-element	Requirements	Quantity
<i>audioProgrammeLabel</i>	Shall be used to label an <i>audioProgramme</i> element. The <i>language</i> attribute shall be present and set according to ISO 639-2 (3-character code). See also Subclause 5.1. The <i>language</i> attribute shall be unique for each <i>audioProgrammeLabel</i> sub-element.	0 ... I_max
<i>audioContentIDRef</i>	Shall correspond to the <i>audioContentID</i> attribute of a present <i>audioContent</i> element. If an <i>audioProgramme</i> element references an <i>audioContent</i> element whose top-level <i>audioObject</i> element belongs to a set of complementary <i>audioObject</i> elements, the <i>audioProgramme</i> element shall not reference any other <i>audioObject</i> element of that set or it shall also reference all other top-level <i>audioObject</i> elements of that set via their corresponding <i>audioContent</i> elements.	1 ... *
<i>loudnessMetadata</i>	Shall be present in linear workflows such as live or real-time production for broadcasting and streaming applications.	0 or 1
<i>audioProgramme-ReferenceScreen</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>authoringInformation</i>	Should be present for the <i>audioProgramme</i> element with the lowest ID. If the <i>authoringInformation</i> sub-element is present in multiple <i>audioProgramme</i> elements, the <i>referenceLayout</i> sub-elements should be identical to the one in the <i>audioProgramme</i> element with the lowest ID.	0 or 1
<i>alternativeValueSetIDRef</i>	Shall correspond to the <i>alternativeValueSetID</i> attribute of an <i>alternativeValueSet</i> sub-element of a top-level <i>audioObject</i> element that is associated with	0 ... *

	one of the <i>audioContent</i> elements referenced by the <i>audioProgramme</i> element. If an <i>audioProgramme</i> element references a set of <i>audioContent</i> elements corresponding to a group of complementary top-level <i>audioObject</i> elements, the <i>audioProgramme</i> element shall not reference an <i>alternativeValueSet</i> element for any complementary <i>audioObject</i> element or it shall reference an <i>alternativeValueSet</i> element for each complementary <i>audioObject</i> element. In the latter case, the referenced <i>alternativeValueSet</i> sub-elements for the group of complementary <i>audioObject</i> elements shall be identical except for their <i>alternativeValueSetID</i> attribute.	
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Table 31 — loudnessMetadata attribute requirements for audioProgramme

Sub-element	Requirements	Required
<i>loudnessMethod</i>	If present, the <i>loudnessMethod</i> attribute shall be set to 'ITU-R BS.1770'.	No

Table 32 — loudnessMetadata sub-element requirements for audioProgramme

Sub-element	Requirements	Quantity
<i>integratedLoudness</i>	Shall be present in linear workflows such as live or real-time production for broadcasting and streaming applications if a <i>dialogueLoudness</i> sub-element is not present. Shall be set to a value between '-57.75' and '6.0' in LKFS.	0 or 1
<i>dialogueLoudness</i>	Should be present in linear workflows such as live or real-time production for broadcasting and streaming applications if dialogue is included in the audio essence associated with the <i>audioProgramme</i> element. Shall be set to a value between '-57.75' and '6.0' in LKFS.	0 or 1

Table 33 — authoringInformation sub-element requirements for audioProgramme

Sub-element	Requirements	Quantity
<i>referenceLayout</i>	The referenced <i>audioPackFormat</i> element shall not contain fewer <i>audioChannelFormatIDRef</i> sub-elements than any <i>audioPackFormat</i> element of type '0001' that is referenced by an <i>audioObject</i> element. The referenced <i>audioPackFormat</i> element shall not contain more than r_max <i>audioChannelFormatIDRef</i> sub-elements.	1
<i>renderer</i>	Not mandatory for compliance, may be omitted.	0 or 1

5.10 audioTrackUID

This clause specifies requirements for the attributes and sub-elements of the *audioTrackUID* element.

5.10.1 General

An *audioTrackUID* element may be defined in the *audioFormatExtended* element or may be derived from the <chna> chunk of a BWF-compatible file. The requirements of this clause hold for *audioTrackUID* element definitions in the *audioFormatExtended* element and those derived from the <chna> chunk.

Each *audioTrackUID* element shall correspond to a unique physical audio track and shall be applicable for the entire duration of the available audio essence of the corresponding physical audio track.

All present *audioTrackUID* elements shall define either *audioTrackFormatIDRef* sub-elements or *audioChannelFormatIDRef* sub-elements in a consistent way.

Each present *audioTrackUID* element shall be referenced by one *audioObject* element. Each *audioTrackUID* element shall be referenced exactly once.

5.10.2 Configuration

Table 34 — audioTrackUID attribute requirements

Attribute	Requirements	Required
<i>UID</i>	Shall be set as follows: 'ATU_nnnnnnnn' with unique hex digits 'nnnnnnnn' to identify an audio track of an audio file or an audio stream. '00000000' is a reserved value.	Yes
<i>sampleRate</i>	Shall correspond to the properties of the referenced audio track.	No
<i>bitDepth</i>	Shall correspond to the properties of the referenced audio track.	No

Table 35 — audioTrackUID sub-element requirements

Sub-element	Requirements	Quantity
<i>audioMXFLookUp</i>	Shall not be present.	0
<i>audioTrackFormatIDRef</i>	Shall correspond to the <i>audioTrackFormatID</i> attribute of a present or common definition <i>audioTrackFormat</i> element of type '0001', '0003' or '0004'. Shall not be present if the <i>audioTrackUID</i> element includes the <i>audioChannelFormatIDRef</i> sub-element.	0 or 1
<i>audioChannelFormatIDRef</i>	Shall correspond to the <i>audioChannelFormatID</i> attribute of a present or common definition <i>audioChannelFormat</i> element of type '0001', '0003' or '0004'. Shall be present if the <i>audioTrackUID</i> element does not include the <i>audioTrackFormatIDRef</i> sub-element.	0 or 1
<i>audioPackFormatIDRef</i>	Shall correspond to the <i>audioPackFormatID</i> attribute of a present or common definition <i>audioPackFormat</i> element of type '0001', '0003' or '0004'.	1

5.11 audioFormatExtended

This clause specifies requirements for the attributes and sub-elements of the *audioFormatExtended* element.

5.11.1 General

The *audioFormatExtended* element shall include at least one *audioProgramme* element. If multiple *audioProgramme* elements are present, the *audioProgramme* element with the lowest *audioProgrammeID* attribute value shall represent the default *audioProgramme* element.

The *audioFormatExtended* element shall not be the root element of the XML document (see Subclause 5.12).

Each sub-element of the *audioFormatExtended* element shall exist for the entire duration covered by the *audioFormatExtended* element.

5.11.2 Configuration

Table 36 — audioFormatExtended attribute requirements

Attribute	Requirements	Required
<i>version</i>	Shall be set to 'ITU-R_BS.2076-2'.	Yes

Table 37 — audioFormatExtended sub-element requirements

Sub-element	Requirements	Quantity
<i>audioProgramme</i>	No general requirements.	1 ... p_max
<i>audioContent</i>	No general requirements.	1 ... c_max
<i>audioObject</i>	No general requirements.	1 ... c_max*3
<i>audioPackFormat</i>	No general requirements.	0 ... c_max*2
<i>audioChannelFormat</i>	Each <i>audioChannelFormat</i> element shall contain <i>audioBlockFormat</i> sub-elements that cover the entire duration of the available audio essence of the corresponding <i>audioObject</i> element.	0 ... c_max*2
<i>audioStreamFormat</i>	No general requirements.	0 ... c_max*2
<i>audioTrackFormat</i>	No general requirements.	0 ... c_max*2
<i>audioTrackUID</i>	Each <i>audioTrackUID</i> element shall correspond to a unique physical audio track and shall be applicable for the entire duration of the available audio essence of the corresponding physical audio track.	1 ... c_max*2

5.12 format

This clause specifies requirements for the sub-elements of the *format* element.

5.12.1 General

The *format* element may be the root element of the XML document. As part of the EBU Core Metadata Set according to EBU Tech 3293, the *format* element is a sub-element of the *ebuCoreMain* and *coreMetadata* element.

5.12.2 Configuration

Table 38 — format sub-element requirements

Sub-element	Requirements	Quantity
<i>audioFormatExtended</i>	No general requirements.	1
<i>audioFormatCustom</i>	Shall be conforming to Clause 7 of this document.	1

6 Profile requirements and recommendations on ITU-R BS.2125-0

6.1 General

There are no general requirements on S-ADM XML metadata.

6.2 frame

This clause specifies requirements for the sub-elements of the *frame* element.

6.2.1 General

There are no general requirements on the *frame* element.

6.2.2 Configuration

Table 39 — frame sub-element requirements

Sub-element	Requirements	Quantity
<i>frameHeader</i>	Shall be conforming to Subclause 6.3.	1
<i>audioFormatExtended</i>	Shall be conforming to Clause 5.	1
<i>audioFormatCustom</i>	Shall be conforming to Clause 7.	1

6.3 frameHeader

This clause specifies requirements for the sub-elements of the *frameHeader* element.

6.3.1 General

There are no general requirements on the *frameHeader* element.

6.3.2 Configuration

Table 40 — frameHeader sub-element requirements

Sub-element	Requirements	Quantity
<i>frameFormat</i>	Shall be conforming to Subclause 6.4.	1
<i>transportTrackFormat</i>	Shall be conforming to Subclause 6.5.	1 ... *

6.4 frameFormat

This clause specifies requirements for the attributes and sub-elements of the *frameFormat* element.

6.4.1 General

There are no general requirements on the *frameFormat* element.

6.4.2 Configuration

Table 41 — frameFormat attribute requirements

Attribute	Requirements	Required
<i>frameFormatID</i>	Shall be set to 'FF_xxxxxxx' with hex digits 'xxxxxxx' giving the number of frames from the start of a flow. The number of digits for 'x' shall not exceed sixteen.	Yes
<i>start</i>	Shall use the time formats as specified in §5.11 of ITU-R BS.2076-2 or the time format 'zzzzSffff' as specified in §A.1.4.2.1 of ITU-R BS.2125-0.	Yes
<i>duration</i>	Shall use the time formats as specified in §5.11 of ITU-R BS.2076-2 or the time format 'zzzzSffff' as specified in §A.1.4.2.1 of ITU-R BS.2125-0.	Yes
<i>type</i>	Shall be set as follows: 'header' or 'full' for the first frame of a flow, 'full' for subsequent frames of the same flow.	Yes
<i>timeReference</i>	Shall be set to 'local'.	Yes
<i>countToFull</i>	Shall be set to '1' if present.	No
<i>numMetadataChunks</i>	Shall not be present.	No
<i>countToSameChunk</i>	Shall not be present.	No
<i>flowID</i>	Shall be set according to ITU-R BS.2125-0 if present.	No

Table 42 — frameFormat sub-element requirements

Sub-element	Requirements	Quantity
<i>changedIDs</i>	Not mandatory for compliance, may be omitted.	0 or 1
<i>chunkAdmElement</i>	Shall not be present.	0

6.5 transportTrackFormat

This clause specifies requirements for the attributes and sub-elements of the *transportTrackFormat* element.

6.5.1 General

There are no general requirements on the *transportTrackFormat* element.

6.5.2 Configuration

Table 43 — transportTrackFormat attribute requirements

Attribute	Requirements	Required
<i>transportID</i>	Shall be set as follows: 'TP_xxxx' with unique hex digits 'xxxx'.	Yes
<i>transportName</i>	See Subclause 5.1.	No
<i>numTracks</i>	Shall not be set to '0'.	Yes
<i>numIDs</i>	Shall not be set to '0'. Shall not be greater than <i>numTracks</i> . Shall not be greater than the number of <i>audioTrackUID</i> elements in the <i>audioFormatExtended</i> element.	Yes

Table 44 — transportTrackFormat sub-element requirements

Sub-element	Requirements	Quantity
<i>audioTrack</i>	See Subclause 6.6.	<i>numIDs</i>

6.6 audioTrack

This clause specifies requirements for the attributes and sub-elements of the *audioTrack* element.

6.6.1 General

Considering all *audioTrack* sub-elements in all *transportTrackFormat* elements, each *audioTrackUID* sub-element in the *audioFormatExtended* element shall be referenced exactly once.

6.6.2 Configuration

Table 45 — audioTrack attribute requirements

Attribute	Requirements	Required
<i>trackID</i>	Shall be set to the physical transport track index of the corresponding audio interface. Shall be unique among <i>trackID</i> attributes of <i>audioTrack</i> elements in the same parent <i>transportTrackFormat</i> element. Shall be set to a value between '1' and <i>numTracks</i> .	Yes
<i>formatLabel</i>	Shall be set to '0001' if present.	No
<i>formatDefinition</i>	Shall be set to 'PCM' if present.	No

Table 46 — audioTrack sub-element requirements

Sub-element	Requirements	Quantity
<i>audioTrackUIDRef</i>	Shall be set to 'ATU_nnnnnnnn' with unique hex digits 'nnnnnnnn' corresponding to the <i>UID</i> attribute of a present <i>audioTrackUID</i> element. '00000000' is a reserved value.	1

6.7 audioBlockFormat

This clause specifies requirements for the attributes of the *audioBlockFormat* element.

6.7.1 General

For S-ADM metadata, the following requirements on *audioBlockFormat* elements of type '0003' (*Objects*) shall be fulfilled in addition to the requirements specified in Subclause 5.5.

Note that in use cases requiring random access on S-ADM flows, *audioBlockFormat* elements providing the initial values for interpolation of dynamic metadata should be present in every *frame* element.

6.7.2 Configuration

Table 47 — *audioBlockFormat* attribute requirements (type '0003')

Attribute	Requirements	Required
<i>rtime</i>	Shall not be present. This requirement replaces the ADM XML metadata requirements for the <i>rtime</i> attribute defined in Table 10.	No
<i>duration</i>	Shall not be present. This requirement replaces the ADM XML metadata requirements for the <i>duration</i> attribute defined in Table 10.	No
<i>lstart</i>	Shall be present unless the <i>initializeBlock</i> attribute is present and set to '1'. Shall use the time formats as specified in §5.11 of ITU-R BS.2076-2 or the time format 'zzzzzSffff' as specified in §A.1.4.2.1 of ITU-R BS.2125-0. The value of the <i>lstart</i> attribute of each <i>audioBlockFormat</i> element shall be equal to the sum of the values of the <i>lstart</i> attribute and the <i>lduration</i> attribute of the preceding <i>audioBlockFormat</i> element. Rounding errors shall be as small as possible. If the same <i>audioBlockFormat</i> element is present in multiple <i>frame</i> elements, the sum of the <i>start</i> attribute of the <i>frameFormat</i> element and the <i>lstart</i> attribute of the respective instance of the <i>audioBlockFormat</i> element shall be identical for all <i>frame</i> elements. Rounding errors shall be as small as possible.	No
<i>lduration</i>	Shall be present unless the <i>initializeBlock</i> attribute is present and set to '1'. Shall use the time formats as specified in §5.11 of ITU-R BS.2076-2 or the time format 'zzzzzSffff' as specified in §A.1.4.2.1 of ITU-R BS.2125-0. The value of the <i>lduration</i> attribute should not be less than 5 ms.	No
<i>initializeBlock</i>	Shall be set to '1' if the <i>audioBlockFormatID</i> attribute is set to 'AB_yyyxxxxx_00000000' and the <i>audioBlockFormat</i> element is used to specify initial values for the frame according to ITU-R BS 2125-0.	No

7 Profile requirements and recommendations on Custom Metadata

The ADM provides an application-agnostic metadata syntax, which is limited in terms of application-specific metadata types that are, e.g. required for the configuration of codec formats like *Extended HE-AAC* or *MPEG-H 3D Audio*. To establish the ADM as a powerful alternative to existing production formats and metadata solutions, a mechanism for carriage of additional metadata types beyond the scope of the ADM is required. This clause defines such a mechanism, which can, e.g. be used for the transport of optional sidecar metadata that relates to the *audioFormatExtended* element while still conforming to ITU-R BS.2076-2 and related recommendations. The clause is concluded by a backwards-compatible metadata set for *MPEG-H 3D Audio* which includes, for instance, elements for indication of the applicable *MPEG-H ADM Profile profileID* and *levelID*.

7.1 Definition of the audioFormatCustom element

This clause defines the *audioFormatCustom* element and its requirements for the *MPEG-H ADM Profile*.

7.1.1 General

The *audioFormatCustom* element shall be a sub-element of the *format* or *frame* element as defined in Subclause 5.12 and 6.2, respectively.

The *audioFormatCustom* element shall include at least one *audioFormatCustomSet* sub-element which is configured according to Subclause 7.3.

7.1.2 Configuration

Table 48 — audioFormatCustom sub-elements

Sub-element	Description	Quantity
<i>audioFormatCustomSet</i>	Description of a custom set of metadata (see Subclause 7.2).	1 ... *

7.2 Definition of the audioFormatCustomSet element

This clause defines the *audioFormatCustomSet* element.

7.2.1 General

The *audioFormatCustomSet* element may be used for the definition of application-specific metadata sets beyond the scope of ITU-R BS.2076-2 and ITU-R BS.2125-0. Those metadata sets may, e.g. be used as backwards-compatible extensions in applications that require support of additional metadata types. Applications may ignore present *audioFormatCustomSet* elements dependent on their specific capability. In that sense, the *audioFormatExtended* element should always describe a valid ADM configuration, which is independent of the *audioFormatCustom* element.

7.2.2 Configuration

Table 49 — audioFormatCustomSet attributes

Attribute	Requirements	Required
<i>audioFormatCustomSetID</i>	ID for the custom set of metadata of the form 'AFC_XXXX'	Yes

	with unique hex digits xxxx.	
<i>audioFormatCustomSetName</i>	Name for the custom set of metadata.	Yes
<i>audioFormatCustomSetType</i>	Unique type for the custom set of metadata.	Yes
<i>audioFormatCustomSetVersion</i>	Version for the custom set of metadata.	No

Table 50 — *audioFormatCustomSet* sub-elements

Sub-element	Description	Quantity
<unknown>	Arbitrary number of XML sub-elements for the definition of application-specific metadata sets dependent on the <i>audioFormatCustomType</i> attribute.	0 ... *

7.3 *audioFormatCustomSet* for MPEG-H 3D Audio

This clause specifies requirements for the attributes and sub-elements of the *audioFormatCustomSet* element for *MPEG-H 3D Audio*. The defined *audioFormatCustomSet* element is used for control of advanced NGA production and distributions systems for *MPEG-H 3D Audio* as defined in ISO/IEC 23008-3.

7.3.1 General

There are no general requirements on the *audioFormatCustomSet* element for *MPEG-H 3D Audio*.

7.3.2 Configuration

Table 51 — *audioFormatCustomSet* attribute requirements

Attribute	Requirements	Required
<i>audioFormatCustomSetID</i>	Shall be set as follows: 'AFC_xxxx' with unique hex digits xxxx in the range '1001' to 'FFFF'.	Yes
<i>audioFormatCustomSetName</i>	Shall be set to 'MPEG-H 3D Audio'.	Yes
<i>audioFormatCustomSetType</i>	Shall be set to 'CUSTOM_SET_TYPE_MPEGH3DA'.	Yes
<i>audioFormatCustomSetVersion</i>	Shall be set to 'x.y.z' with decimal digit x set to '1', decimal digit y set to '0' and decimal digit z set to '0'. All other values are reserved. The number of digits may increase in the future. The <i>audioFormatCustomSet</i> element should be ignored if the value of x is larger than the supported one.	Yes

Table 52 — *audioFormatCustomSet* sub-element requirements

Sub-element	Requirements	Quantity
<i>admInformation</i>	Shall be present and set according to Table 53.	1
<unknown>	Unknown XML sub-elements should be ignored.	0 ... *

Table 53 — *admInformation* sub-element requirements

Sub-element	Requirements	Quantity
<i>profile</i>	See Table 54.	1 ... *
<i>content</i>	See Table 55.	0 or 1

<unknown>	Unknown XML sub-elements should be ignored.	0 ... *
-----------	---	---------

Table 54 — profile attribute requirements for admInformation

Attribute	Requirements	Required
<i>profileID</i>	Shall be set according to the MPEG-H ADM Profile.	Yes
<i>levelID</i>	Shall be set according to the MPEG-H ADM Profile.	Yes
<i>profileName</i>	Shall be set to 'MPEG-H ADM Profile'.	Yes
<i>profileVersion</i>	Shall be set to the version of the MPEG-H ADM Profile.	Yes

Table 55 — content attribute requirements for admInformation

Attribute	Requirements	Required
<i>contentID</i>	Shall be set to a string of at least 1 and up to 16 bytes. Each byte shall be represented by two hexadecimal digits.	Yes
<i>contentType</i>	Shall be set to '0'. All other values are reserved.	Yes

Table 56 — audioFormatCustomSet for the MPEG-H ADM Profile

```

<?xml version="1.0" encoding="UTF-8"?>
<format>
  <audioFormatExtended version="ITU-R_BS.2076-2">

    <!-- ##### -->
    <!-- compliant to the MPEG-H ADM Profile -->
    <!-- ##### -->

  </audioFormatExtended>

  <audioFormatCustom>
    <audioFormatCustomSet audioFormatCustomSetID="AFC_1001"
      audioFormatCustomSetName="MPEG-H 3D Audio"
      audioFormatCustomSetType="CUSTOM_SET_TYPE_MPEGH3DA"
      audioFormatCustomSetVersion="1.0.0">

      <admInformation>

        <profile profileID="1" levelID="3" profileName="MPEG-H ADM Profile" profileVersion="1.0.0"/>

        <content contentID="636a080e75724c4b" contentType="0"/>

        <!-- placeholder element -->
        <unknown>
          <parameter>0123</parameter>
        </unknown>

      </admInformation>

      <!-- ##### -->
      <!-- other custom metadata, e.g. DRC metadata as defined in ISO/IEC 23008-3 -->
      <!-- ##### -->

      <!-- placeholder element -->
      <unknown>
        <parameter>4567</parameter>
      </unknown>

    </audioFormatCustomSet>
  </audioFormatCustom>
</format>

```

8 Determining the maximum number of simultaneously active audio tracks

The maximum number of simultaneously active audio tracks may be different from the number of *audioTrackUID* elements defined in the *audioFormatExtended* element or in the <chna> chunk of a BWF-

compatible file. The number of active audio tracks depends on the selected *audioObject* elements from sets of complementary *audioObject* elements.

An algorithm for determining the maximum number of simultaneously active audio tracks may be implemented as follows:

1. Determine all groups of complementary *audioObject* elements.
2. For each group of complementary *audioObject* elements, determine the number of referenced *audioTrackUID* elements (directly or indirectly) by each of the complementary *audioObject* elements and accumulate the maximum number to the number of simultaneously active audio tracks.
3. Determine all top-level *audioObject* elements that do not belong to a group of complementary *audioObject* elements.
4. For each non-complementary top-level *audioObject* element, accumulate the number of (directly or indirectly) referenced *audioTrackUID* elements to the number of simultaneously active audio tracks.
5. Evaluate the number of simultaneously active audio tracks with respect to the requirements given in Table 1.

See Figure 2 for an example configuration with a maximum of six simultaneously active audio tracks.

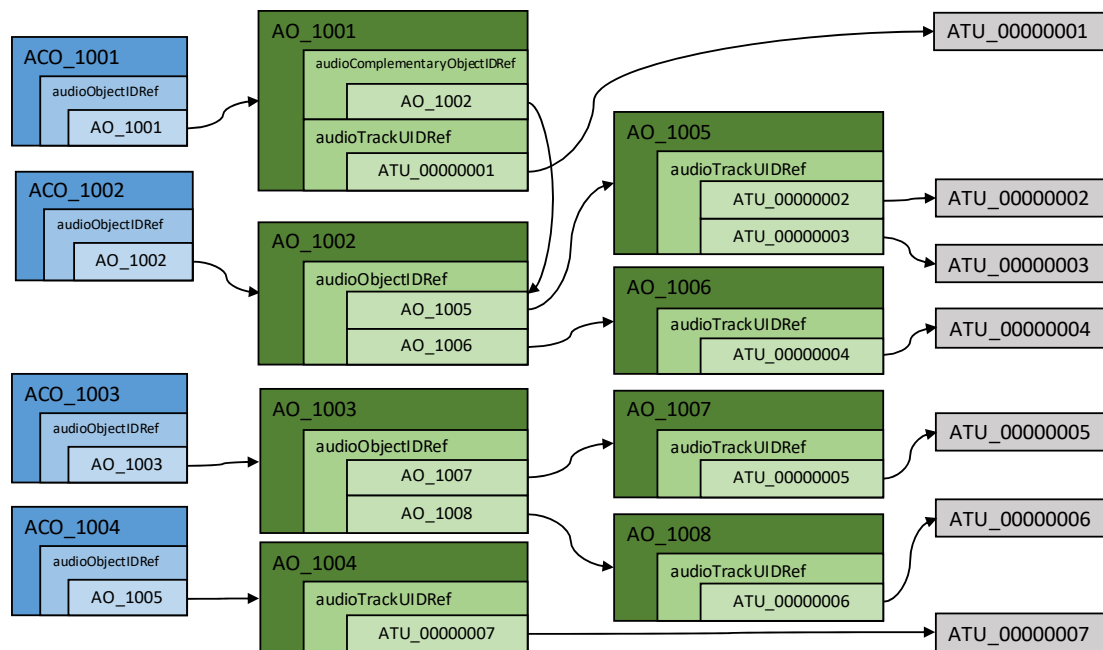


Figure 2 — Example configuration with a maximum of six simultaneously active audio tracks

9 Conversion of MPEG-H 3D Audio to the ADM

9.1 Metadata Structure of MPEG-H 3D Audio

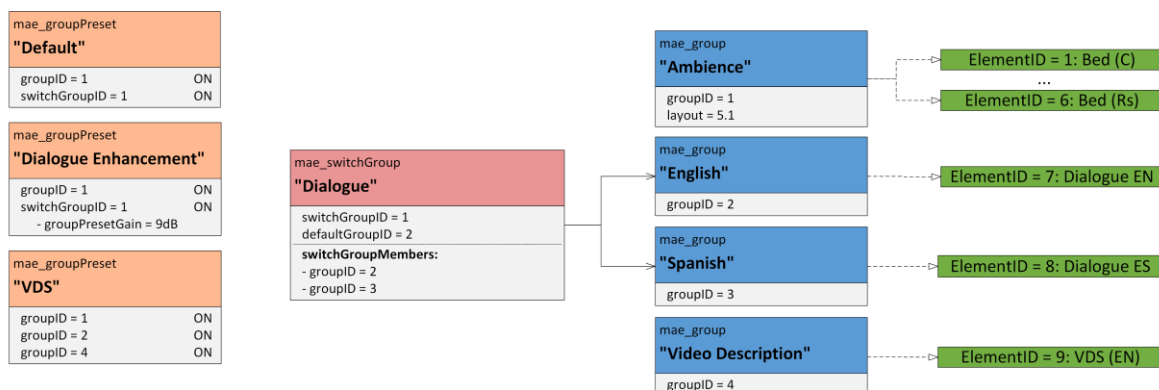
In *MPEG-H 3D Audio*, the audio tracks of an audio scene are structured using three different concepts: *Groups* combine audio elements of the same signal type (e.g. *typeDefinition*="DirectSpeakers") and associate them with additional information like content type, language, text labels and other metadata. *Switch-Groups* define a set of *Groups* which are mutually exclusive, i.e. during playback only one member of a *Switch-Group*

can be active at the same time. *Presets* define different mixes of the same audio content by selecting and balancing *Groups* and *Switch-Groups*. During playback, *Presets* can be selected manually or automatically dependent on the specific user preference. *MPEG-H 3D Audio* also provides various metadata for personalization of an audio scene, such as restrictions on the allowed gain interaction range for selected elements of a *Preset*. During content production, the complete set of *MPEG-H Metadata* can be controlled in a flexible way to serve various NGA use cases in live- and post-productions workflows.

Table 57 gives an overview on the main correspondences of *MPEG-H and ADM Metadata*. An example of an audio scene for *MPEG-H 3D Audio* described with both metadata schemes is depicted in Figure 3.

Table 57 — Correspondences of MPEG-H and ADM Metadata

MPEG-H Metadata	ADM Metadata
<i>Preset</i> (mae_GroupPresetData)	<i>audioProgramme</i>
<i>Group</i> (mae_GroupDefinition)	<i>audioObject</i> , <i>audioContent</i>
<i>Switch-Group</i> (mae_SwitchGroupDefinition)	<i>audioComplementaryObject</i>
<i>Element</i> (mae_metaDataElementID)	<i>audioTrackUID</i>



MPEG-H Metadata

ADM Metadata

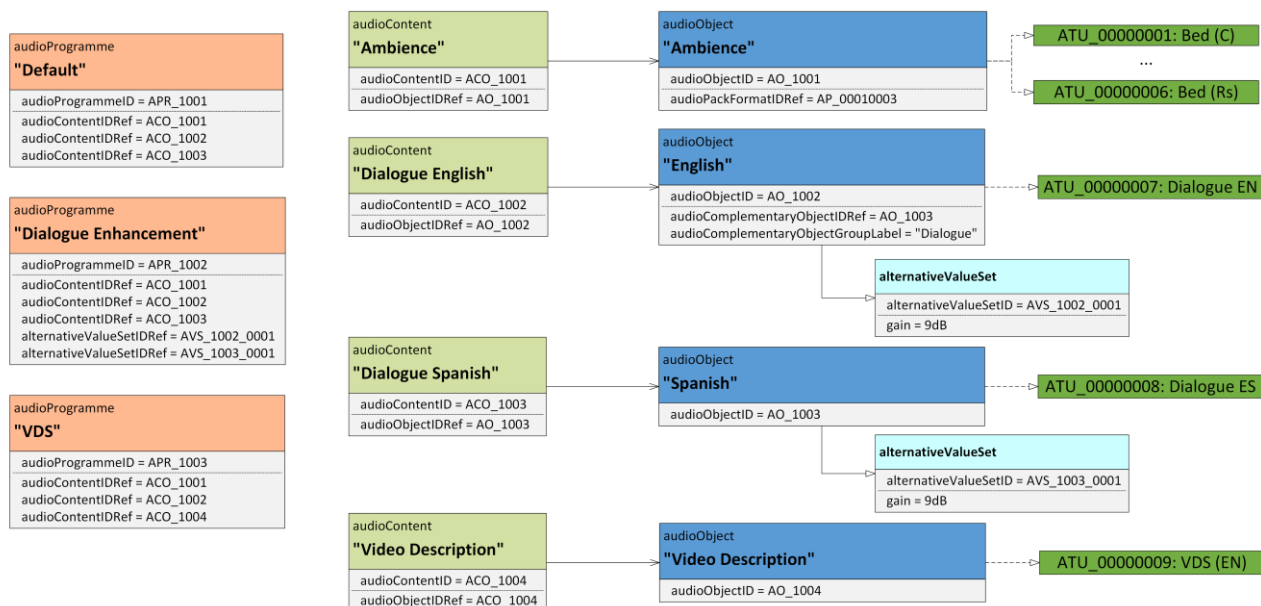


Figure 3 — Example of an audio scene for MPEG-H 3D Audio

9.2 Mapping of MPEG Coding-independent Code Points (CICP) to the ADM

In *MPEG-H 3D Audio*, typical loudspeaker configurations are defined by the *ChannelConfiguration* index according to ISO/IEC 23091-3. For the ADM, typical loudspeaker configurations are defined by common *audioPackFormat* elements according to ITU-R BS.2094-1.

Table 58 defines a mapping of the *ChannelConfiguration* index according to ISO/IEC 23091-3 to *audioPackFormat* elements according to ITU-R BS.2076-2 and ITU-R BS.2094-1.

Table 58 — Mapping of ChannelConfiguration to audioPackFormatID

ChannelConfiguration (ISO/IEC 23091-3)	audioPackFormatID (ITU-R BS.2076-2)
1	AP_00010001 ^(a)
2	AP_00010002 ^(a)
3	AP_0001000a ^(a)
4	AP_0001000b ^(a)
5	AP_0001000c ^(a)
6	AP_00010003 ^(a)
7	AP_00011007 ^(b)
8	-
9	AP_00011009 ^(b)
10	AP_0001100a ^(b)
11	AP_0001000d ^(a)
12	AP_0001100c ^(b)
13	AP_00010009 ^(a)
14	AP_00010004 ^(a)
15	AP_00010007 ^(a)
16	AP_00010005 ^(a)
17	AP_00011011 ^(b)
18	AP_00011012 ^(b)
19	AP_00011013 ^(b)
20	AP_00011014 ^(b)
^(a) Common definition <i>audioPackFormat</i> element as defined in ITU-R BS.2094-1. ^(b) Custom <i>audioPackFormat</i> element as defined in Table 59. The <i>audioPackFormatID</i> and <i>audioPackFormatName</i> attributes may be different from the definition in Table 59.	

Table 59 — Custom audioPackFormat elements for MPEG-H 3D Audio

```

<!-- ##### -->
<!-- ChannelConfiguration 7 (ISO/IEC 23091-3) -->
<!-- ##### -->

<audioPackFormat audioPackFormatID="AP_00011007" audioPackFormatName="audioPackFormat_7"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010003</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010004</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010005</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010006</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010018</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010019</audioChannelFormatIDRef>

```

```

</audioPackFormat>

<!-- ##### -->
<!-- ChannelConfiguration 9 (ISO/IEC 23091-3) -->
<!-- ##### -->

<audioPackFormat audioPackFormatID="AP_00011009" audioPackFormatName="audioPackFormat_9"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010009</audioChannelFormatIDRef>
</audioPackFormat>

<!-- ##### -->
<!-- ChannelConfiguration 10 (ISO/IEC 23091-3) -->
<!-- ##### -->

<audioPackFormat audioPackFormatID="AP_0001100a" audioPackFormatName="audioPackFormat_10"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010005</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010006</audioChannelFormatIDRef>
</audioPackFormat>

<!-- ##### -->
<!-- ChannelConfiguration 12 (ISO/IEC 23091-3) -->
<!-- ##### -->

<audioPackFormat audioPackFormatID="AP_0001100c" audioPackFormatName="audioPackFormat_12"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010003</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010004</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010005</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010006</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001c</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001d</audioChannelFormatIDRef>
</audioPackFormat>

<!-- ##### -->
<!-- ChannelConfiguration 17 (ISO/IEC 23091-3) -->
<!-- ##### -->

<audioPackFormat audioPackFormatID="AP_00011011" audioPackFormatName="audioPackFormat_17"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010003</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010004</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010005</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010006</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000d</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000f</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000e</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010010</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010012</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000c</audioChannelFormatIDRef>
</audioPackFormat>

<!-- ##### -->
<!-- ChannelConfiguration 18 (ISO/IEC 23091-3) -->
<!-- ##### -->

<audioChannelFormat audioChannelFormatID="AC_00011001" audioChannelFormatName="Left back surround"
typeLabel="0001" typeDefinition="DirectSpeakers">
  <audioBlockFormat audioBlockFormatID="AB_00011001_00000001">
    <speakerLabel>CH_M_L150</speakerLabel>
    <position coordinate="azimuth">150.0</position>
    <position coordinate="elevation">0.0</position>
    <position coordinate="distance">1.0</position>
  </audioBlockFormat>

```

```

</audioChannelFormat>

<audioChannelFormat audioChannelFormatID="AC_00011002" audioChannelFormatName="Right back surround"
typeLabel="0001" typeDefinition="DirectSpeakers">
  <audioBlockFormat audioBlockFormatID="AB_00011002_00000001">
    <speakerLabel>CH_M_R150</speakerLabel>
    <position coordinate="azimuth">-150.0</position>
    <position coordinate="elevation">0.0</position>
    <position coordinate="distance">1.0</position>
  </audioBlockFormat>
</audioChannelFormat>

<audioPackFormat audioPackFormatID="AP_00011012" audioPackFormatName="audioPackFormat_18"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010003</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010004</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010005</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010006</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00011001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00011002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000d</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000f</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000e</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010010</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010012</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000c</audioChannelFormatIDRef>
</audioPackFormat>

<!-- ##### -->
<!-- ChannelConfiguration 19 (ISO/IEC 23091-3) -->
<!-- ##### -->

<audioPackFormat audioPackFormatID="AP_00011013" audioPackFormatName="audioPackFormat_19"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010003</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010004</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001c</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001d</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000a</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000b</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000d</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000f</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001e</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001f</audioChannelFormatIDRef>
</audioPackFormat>

<!-- ##### -->
<!-- ChannelConfiguration 20 (ISO/IEC 23091-3) -->
<!-- ##### -->

<audioPackFormat audioPackFormatID="AP_00011014" audioPackFormatName="audioPackFormat_20"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010003</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010004</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001c</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001d</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000a</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000b</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010022</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010023</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001e</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001f</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010024</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010025</audioChannelFormatIDRef>
</audioPackFormat>

```

9.3 Downmix Matrices in MPEG-H 3D Audio

In *MPEG-H 3D Audio*, downmix matrices represent side information which is only applied under certain conditions. Let's assume an MPEG-H audio scene includes a *Group* of type '0001' (*DirectSpeakers*) with channel layout A (e.g. 5.1). An MPEG-H playback device which renders the audio scene to channel layout B (e.g. 2.0) will search the *MPEG-H Metadata* for a matching downmix matrix from channel layout A to channel layout B. If a matching downmix matrix is found, the playback device will apply it to the corresponding group of channels (see Figure 4). If no matching downmix matrix is found, the playback device will apply a default downmix matrix as defined in ISO/IEC 23008-3.

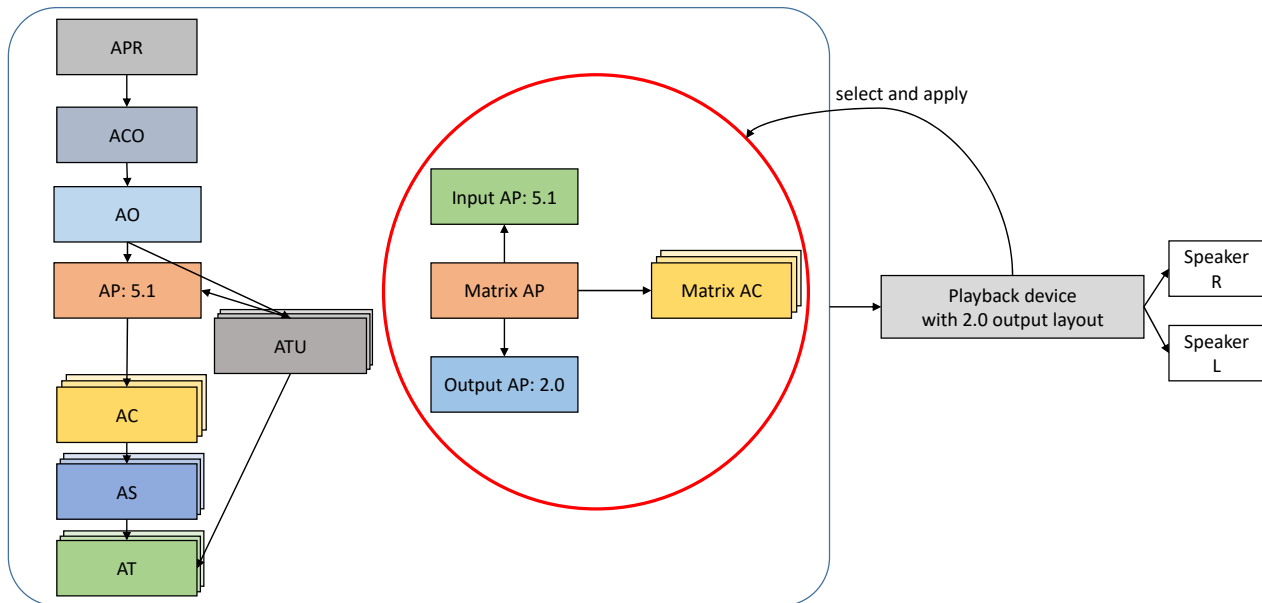


Figure 4 — Application of a downmix matrix in an MPEG-H playback device

In the ADM, downmix matrices can be specified using *audioPackFormat* elements and *audioChannelFormat* elements of type '0002' (*Matrix*) (see Subclause 5.6 and Subclause 5.4, respectively). According to the constraints of the *MPEG-H ADM Profile*, *audioPackFormat* elements of type '0002' are not referenced by *audioObject* elements or *audioTrackUID* elements and *audioChannelFormat* elements of type '0002' are not referenced by *audioStreamFormat* elements or *audioTrackUID* elements. In this way and similar to *MPEG-H Metadata*, the definition of downmix matrices takes the role of side information which is essentially decoupled from the rest of the audio scene configuration as illustrated in Figure 5.

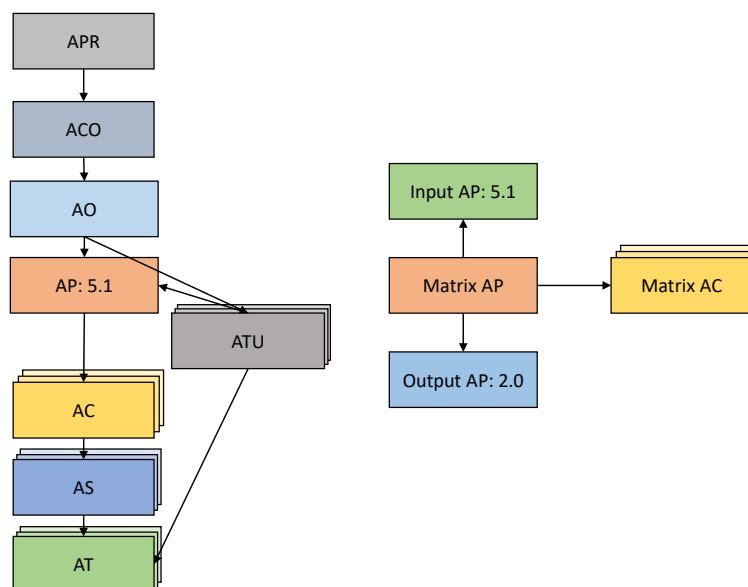


Figure 5 — Audio scene configuration including definition of a downmix matrix

10 Determining configuration changes between S-ADM frames

The metadata carried by the MPEG-H 3DA bitstream describes the structure and properties of the transmitted audio content and controls essentially all processing stages of an MPEG-H decoder. Metadata will change from time to time, e.g. at the transition from the stereo audio content of an advert to the immersive audio content of a movie with a 7.1.4 channel bed and several objects. When an MPEG-H decoder detects a configuration change, it will adapt its processing stages to account for the new metadata.

There are three categories of configuration changes supported by an MPEG-H decoder:

- **Label change:** Text labels are used to tag the components of an NGA audio scene in interactive user interfaces. If a label change occurs, the MPEG-H decoder will forward the updated labels to the user interfaces.
- **Loudness metadata change:** In real-time production scenarios, long-term loudness measurements might need to be updated over time. If a loudness metadata change occurs, the MPEG-H decoder will only adapt the processing in the loudness normalization stage.
- **Static configuration change:** In case of configuration metadata changes that go beyond label and loudness metadata changes, the MPEG-H decoder will adapt all processing stages to the new configuration.

In the following, a method is described for determining the type of configuration change that will be triggered in an MPEG-H decoder if metadata changes between consecutive S-ADM frames:

Apply the following modifications to the previous and the current *frame* element:

1. Determine whether configuration changes will be triggered by changing metadata in any known *audioFormatCustomSet* elements, then remove all *audioFormatCustomSet* elements. Determining configuration changes based on *audioFormatCustomSet* elements is beyond the scope of this document.
2. Remove all sub-elements and attributes that change dynamically within the same configuration:
 - a. Remove the *frameFormatID* attribute, the *start* attribute, the *duration* attribute and the *type* attribute from the *frameFormat* element.

- b. Remove the *start* attribute and the *end* attribute from all *audioProgramme* elements.
 - c. Remove all *audioBlockFormat* sub-elements from all *audioChannelFormat* elements of type '0003'.
3. Establish a canonical form by bringing all different types of attributes and sub-elements of all elements into a consistent order.
4. Denote the resulting ADM XML code for the previous frame as **A** and the resulting ADM XML code for the current frame as **A'**.

If there are any differences between **A** and **A'**, the following steps will determine which type(s) of configuration change(s) will be triggered in an MPEG-H decoder:

1. In **A** and **A'**, remove all *audioProgrammeLabel* sub-elements, all *audioContentLabel* sub-elements and all *audioComplementaryObjectGroupLabel* sub-elements as well as all *audioProgrammeName* attributes and all *audioContentName* attributes from their respective parent elements. Denote the resulting XML code as **B** and **B'**, respectively.
2. In **A** and **A'**, remove all *loudnessMetadata* sub-elements from their respective parent elements. Denote the resulting XML code as **C** and **C'**, respectively.
3. In **B** and **B'**, remove all *loudnessMetadata* sub-elements from their respective parent elements. Denote the resulting XML code as **D** and **D'**, respectively.

If there are any differences between **D** and **D'**, a static configuration change will be triggered. This includes potential label and loudness metadata changes. Otherwise, if there are any differences between **C** and **C'**, a label change will be triggered and if there are any differences between **B** and **B'**, a loudness metadata change will be triggered.

11 Transport Layers for ADM and S-ADM XML Code

11.1 Broadcast Wave Format (BWF)

ADM XML code shall be transported in the *<axml>*, *<bxml>* and *<chna>* chunks of the Broadcast Wave 64Bit (*BW64*) audio file format according to ITU-R BS.2088-1. The *<axml>*, *<bxml>* and *<chna>* chunks may also be transported in the BWF-compatible *RF64* audio file format (EBU Tech 3306).

S-ADM XML code shall be transported in the *<sxm>* chunk of the *BW64* audio file format according to ITU-R BS.2088-1. The *<sxm>* chunk may also be transported in the BWF-compatible *RF64* audio file format (EBU Tech 3306).

11.2 Material Exchange Format (MXF)

ADM and S-ADM XML code may be transported in the Material Exchange Format (*MXF*, SMPTE ST 377-1). Further technical details on *MXF* will be added in future revisions of this document.

11.3 AES3 Digital Audio Interface

S-ADM XML code shall be transported over the AES3 digital audio interface according to SMPTE ST 2116 with the following parameterization:

- data burst format: subframe mode with six subframe preamble (SMPTE ST 337)
- burst spacing: aligned to video frame rate
- data_type: 31 (extended_data_type)

- data_mode: 2 (24 bit)
- error_flag: 0 or 1
- changedMetadata_flag: 0 or 1
- assemble_flag: 0
- format_flag: 1
- multiple_chunk_flag: 0
- data_stream_number: 0
- extended_data_type: 1
- format_type: 1 (gzip)

11.4 Professional IP Networks

S-ADM XML code may be delivered over professional IP networks along audio data transported according to AES67 and the family of SMPTE ST 2110 standards. Further technical details on IP based S-ADM delivery will be added in future revisions of this document.

Annex A (normative)

Illustrations

A.1 Element Referencing

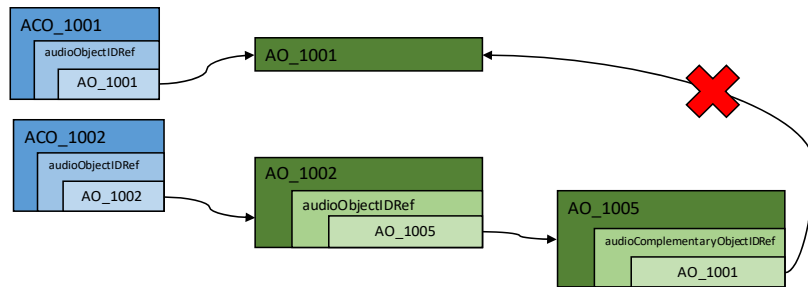


Figure A.1 — Invalid use of audioComplementaryObjectIDRef sub-element in non-top-level audioObject element

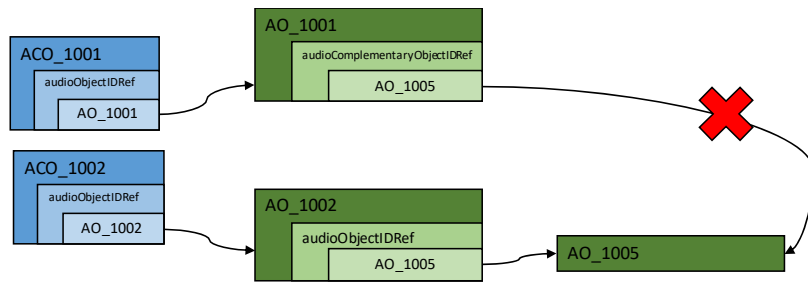


Figure A.2 — Invalid reference to non-top-level audioObject element by audioComplementaryObjectIDRef element

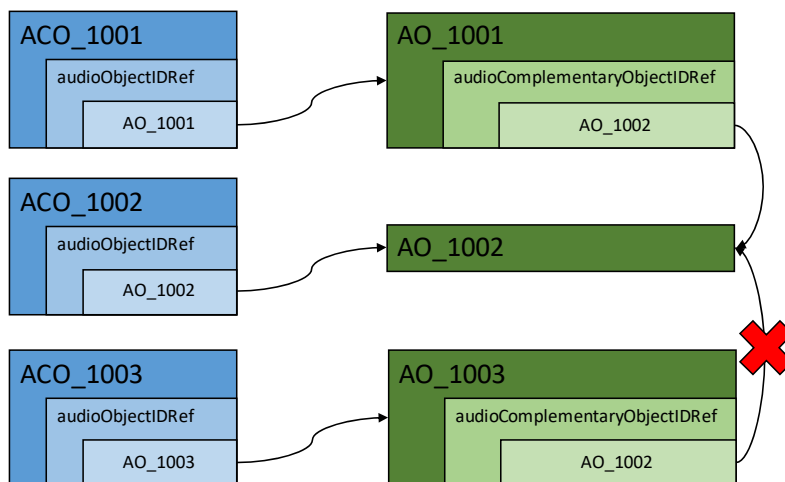


Figure A.3 — Invalid references to audioObject element by multiple audioComplementaryObjectIDRef elements

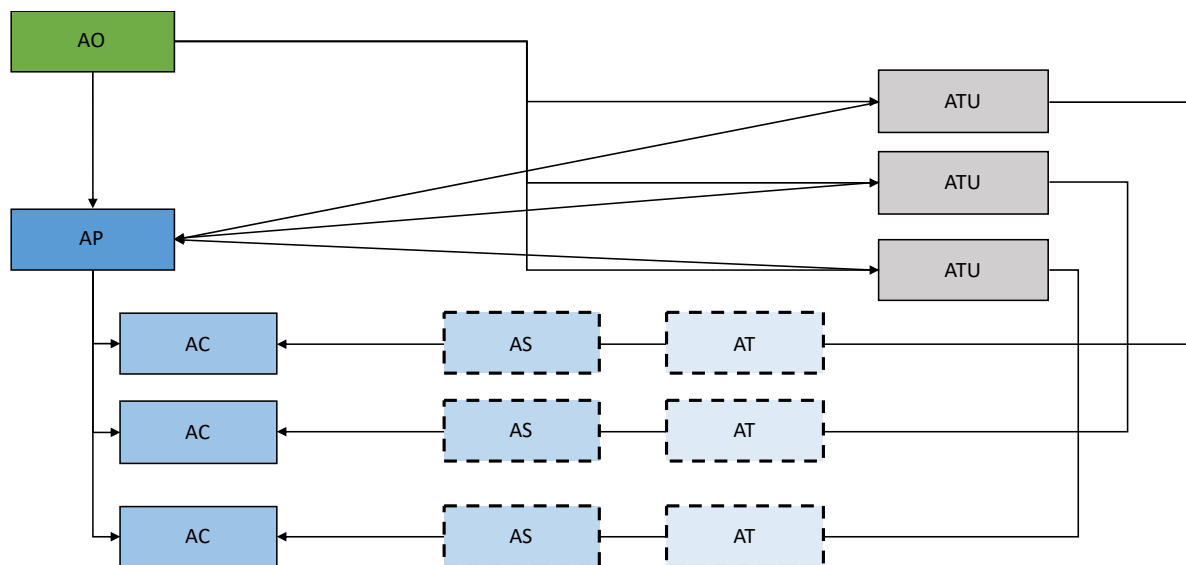


Figure A.4 —Illustration on audioPackFormat element and audioTrackUID element referencing

Annex B (informative)

Examples

B.1 ADM XML Code Example

Table B.1 — ADM XML Code Example

```
<?xml version='1.0' encoding='UTF-8'?>
<format>
  <audioFormatExtended version="ITU-R_BS.2076-2">

    <!-- ##### -->
    <!-- PROGRAMMES -->
    <!-- ##### -->

    <audioProgramme audioProgrammeID="APR_1001" audioProgrammeName="audioProgramme_1" start="00:00:00.00000"
end="00:00:06.00000">
      <audioProgrammeLabel language="eng">Background</audioProgrammeLabel>
      <audioProgrammeLabel language="ger">Hintergrund</audioProgrammeLabel>
      <audioProgrammeLabel language="jpn">背景</audioProgrammeLabel>
      <audioContentIDRef>ACO_1001</audioContentIDRef>
      <audioContentIDRef>ACO_1002</audioContentIDRef>
      <audioContentIDRef>ACO_1003</audioContentIDRef>
      <audioContentIDRef>ACO_1004</audioContentIDRef>
      <audioContentIDRef>ACO_1005</audioContentIDRef>
      <loudnessMetadata>
        <dialogueLoudness>-27.0</dialogueLoudness>
        <integratedLoudness>-24.0</integratedLoudness>
      </loudnessMetadata>
      <authoringInformation>
        <referenceLayout>
          <audioPackFormatIDRef>AP_00011013</audioPackFormatIDRef>
        </referenceLayout>
        <renderer name="renderer_1" uri="urn:renderer_1">
          <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
          <audioPackFormatIDRef>AP_00010003</audioPackFormatIDRef>
          <audioPackFormatIDRef>AP_00011013</audioPackFormatIDRef>
        </renderer>
      </authoringInformation>
    </audioProgramme>

    <audioProgramme audioProgrammeID="APR_1002" audioProgrammeName="audioProgramme_2" start="00:00:00.00000"
end="00:00:06.00000">
      <audioProgrammeLabel language="eng">Background</audioProgrammeLabel>
      <audioProgrammeLabel language="ger">Hintergrund</audioProgrammeLabel>
      <audioProgrammeLabel language="jpn">背景</audioProgrammeLabel>
      <audioContentIDRef>ACO_1001</audioContentIDRef>
      <loudnessMetadata>
        <integratedLoudness>-24.0</integratedLoudness>
      </loudnessMetadata>
    </audioProgramme>

    <audioProgramme audioProgrammeID="APR_1003" audioProgrammeName="audioProgramme_3" start="00:00:00.00000"
end="00:00:06.00000">
      <audioProgrammeLabel language="eng">Dialogue</audioProgrammeLabel>
      <audioProgrammeLabel language="ger">Dialog</audioProgrammeLabel>
      <audioProgrammeLabel language="jpn">ダイアログ</audioProgrammeLabel>
      <audioContentIDRef>ACO_1001</audioContentIDRef>
      <audioContentIDRef>ACO_1002</audioContentIDRef>
      <audioContentIDRef>ACO_1003</audioContentIDRef>
      <audioContentIDRef>ACO_1004</audioContentIDRef>
      <audioContentIDRef>ACO_1005</audioContentIDRef>
      <alternativeValueSetIDRef>AVS_1002_0002</alternativeValueSetIDRef>
      <alternativeValueSetIDRef>AVS_1003_0001</alternativeValueSetIDRef>
    </audioProgramme>
  </audioFormatExtended>
</format>
```

```

<alternativeValueSetIDRef>AVS_1004_0001</alternativeValueSetIDRef>
<alternativeValueSetIDRef>AVS_1005_0001</alternativeValueSetIDRef>
<loudnessMetadata>
  <dialogueLoudness>-21.0</dialogueLoudness>
  <integratedLoudness>-24.0</integratedLoudness>
</loudnessMetadata>
</audioProgramme>

<audioProgramme audioProgrammeID="APR_1004" audioProgrammeName="audioProgramme_4" start="00:00:00.00000"
end="00:00:06.00000">
  <audioProgrammeLabel language="eng">Effect</audioProgrammeLabel>
  <audioProgrammeLabel language="ger">Effekt</audioProgrammeLabel>
  <audioProgrammeLabel language="jpn">効果</audioProgrammeLabel>
  <audioContentIDRef>ACO_1001</audioContentIDRef>
  <audioContentIDRef>ACO_1002</audioContentIDRef>
  <audioContentIDRef>ACO_1003</audioContentIDRef>
  <audioContentIDRef>ACO_1004</audioContentIDRef>
  <audioContentIDRef>ACO_1005</audioContentIDRef>
  <alternativeValueSetIDRef>AVS_1002_0001</alternativeValueSetIDRef>
  <loudnessMetadata>
    <dialogueLoudness>-27.0</dialogueLoudness>
    <integratedLoudness>-24.0</integratedLoudness>
  </loudnessMetadata>
</audioProgramme>

<audioProgramme audioProgrammeID="APR_1005" audioProgrammeName="audioProgramme_5" start="00:00:00.00000"
end="00:00:06.00000">
  <audioProgrammeLabel language="eng">Japanese</audioProgrammeLabel>
  <audioProgrammeLabel language="ger">Japanisch</audioProgrammeLabel>
  <audioProgrammeLabel language="jpn">日語</audioProgrammeLabel>
  <audioContentIDRef>ACO_1001</audioContentIDRef>
  <audioContentIDRef>ACO_1002</audioContentIDRef>
  <audioContentIDRef>ACO_1005</audioContentIDRef>
  <loudnessMetadata>
    <dialogueLoudness>-27.0</dialogueLoudness>
    <integratedLoudness>-24.0</integratedLoudness>
  </loudnessMetadata>
</audioProgramme>

<!-- ##### -->
<!-- CONTENTS -->
<!-- ##### -->

<audioContent audioContentID="ACO_1001" audioContentName="audioContent_1">
  <audioContentLabel language="eng">Background</audioContentLabel>
  <audioContentLabel language="ger">Hintergrund</audioContentLabel>
  <audioContentLabel language="jpn">背景</audioContentLabel>
  <dialogue nonDialogueContentKind="0">0</dialogue>
  <audioObjectIDRef>AO_1001</audioObjectIDRef>
  <loudnessMetadata>
    <integratedLoudness>-24.0</integratedLoudness>
  </loudnessMetadata>
</audioContent>

<audioContent audioContentID="ACO_1002" audioContentName="audioContent_2">
  <audioContentLabel language="eng">Effect</audioContentLabel>
  <audioContentLabel language="ger">Effekt</audioContentLabel>
  <audioContentLabel language="jpn">効果</audioContentLabel>
  <dialogue nonDialogueContentKind="2">0</dialogue>
  <audioObjectIDRef>AO_1002</audioObjectIDRef>
  <loudnessMetadata>
    <integratedLoudness>-24.0</integratedLoudness>
  </loudnessMetadata>
</audioContent>

<audioContent audioContentID="ACO_1003" audioContentName="audioContent_3" audioContentLanguage="eng">
  <audioContentLabel language="eng">Dialog English</audioContentLabel>
  <audioContentLabel language="ger">Dialog Englisch</audioContentLabel>
  <audioContentLabel language="jpn">対話英語</audioContentLabel>
  <dialogue dialogueContentKind="5">1</dialogue>
  <audioObjectIDRef>AO_1003</audioObjectIDRef>

```

```

<loudnessMetadata>
  <integratedLoudness>-24.0</integratedLoudness>
</loudnessMetadata>
</audioContent>

<audioContent audioContentID="ACO_1004" audioContentName="audioContent_4" audioContentLanguage="ger">
  <audioContentLabel language="eng">Dialog German</audioContentLabel>
  <audioContentLabel language="ger">Dialog Deutsch</audioContentLabel>
  <audioContentLabel language="jpn">対話ドイツ語</audioContentLabel>
  <dialogue dialogueContentKind="5">1</dialogue>
  <audioObjectIDRef>AO_1004</audioObjectIDRef>
  <loudnessMetadata>
    <integratedLoudness>-24.0</integratedLoudness>
  </loudnessMetadata>
</audioContent>

<audioContent audioContentID="ACO_1005" audioContentName="audioContent_5" audioContentLanguage="jpn">
  <audioContentLabel language="eng">Dialog Japanese</audioContentLabel>
  <audioContentLabel language="ger">Dialog Japanisch</audioContentLabel>
  <audioContentLabel language="jpn">対話日本語</audioContentLabel>
  <dialogue dialogueContentKind="5">1</dialogue>
  <audioObjectIDRef>AO_1005</audioObjectIDRef>
  <loudnessMetadata>
    <integratedLoudness>-24.0</integratedLoudness>
  </loudnessMetadata>
</audioContent>

<!-- ##### -->
<!-- OBJECTS -->
<!-- ##### -->

<audioObject audioObjectID="AO_1001" audioObjectName="audioObject_1" dialogue="0" start="00:00:00.00000"
duration="00:00:06.00000">
  <audioObjectLabel language="eng">Bed</audioObjectLabel>
  <audioPackFormatIDRef>AP_00011013</audioPackFormatIDRef>
  <audioTrackUIDRef>ATU_00000001</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000002</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000003</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000004</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000005</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000006</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000007</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000008</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000009</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_0000000a</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_0000000b</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_0000000c</audioTrackUIDRef>
</audioObject>

<audioObject audioObjectID="AO_1002" audioObjectName="audioObject_2" interact="1" dialogue="0"
start="00:00:00.00000" duration="00:00:06.00000">
  <audioObjectLabel language="eng">Effect</audioObjectLabel>
  <audioObjectInteraction onOffInteract="0" gainInteract="1" positionInteract="1">
    <gainInteractionRange gainUnit="dB" bound="min">-3.0</gainInteractionRange>
    <gainInteractionRange gainUnit="dB" bound="max">3.0</gainInteractionRange>
    <positionInteractionRange coordinate="azimuth" bound="min">-45.0</positionInteractionRange>
    <positionInteractionRange coordinate="azimuth" bound="max">45.0</positionInteractionRange>
    <positionInteractionRange coordinate="elevation" bound="min">0.0</positionInteractionRange>
    <positionInteractionRange coordinate="elevation" bound="max">30.0</positionInteractionRange>
  </audioObjectInteraction>
  <audioObjectIDRef>AO_1006</audioObjectIDRef>
  <audioObjectIDRef>AO_1007</audioObjectIDRef>
  <gain gainUnit="dB">0.0</gain>
  <positionOffset coordinate="azimuth">-30.0</positionOffset>
  <alternativeValueSet alternativeValueSetID="AVS_1002_0001">
    <gain gainUnit="dB">3.0</gain>
    <positionOffset coordinate="azimuth">45.0</positionOffset>
    <positionOffset coordinate="elevation">30.0</positionOffset>
  </alternativeValueSet>
  <audioObjectInteraction onOffInteract="0" gainInteract="1" positionInteract="0">
    <gainInteractionRange gainUnit="dB" bound="min">-3.0</gainInteractionRange>
    <gainInteractionRange gainUnit="dB" bound="max">3.0</gainInteractionRange>
    <positionInteractionRange coordinate="azimuth" bound="min">-45.0</positionInteractionRange>

```

```

    <positionInteractionRange coordinate="azimuth" bound="max">45.0</positionInteractionRange>
    <positionInteractionRange coordinate="elevation" bound="min">0.0</positionInteractionRange>
    <positionInteractionRange coordinate="elevation" bound="max">30.0</positionInteractionRange>
  </audioObjectInteraction>
  <audioObjectLabel language="eng">Effects</audioObjectLabel>
</alternativeValueSet>
<alternativeValueSet alternativeValueSetID="AVS_1002_0002">
  <gain gainUnit="dB">-3.0</gain>
  <audioObjectInteraction onOffInteract="0" gainInteract="0" positionInteract="1">
    <gainInteractionRange gainUnit="dB" bound="min">-3.0</gainInteractionRange>
    <gainInteractionRange gainUnit="dB" bound="max">3.0</gainInteractionRange>
    <positionInteractionRange coordinate="azimuth" bound="min">-45.0</positionInteractionRange>
    <positionInteractionRange coordinate="azimuth" bound="max">45.0</positionInteractionRange>
    <positionInteractionRange coordinate="elevation" bound="min">0.0</positionInteractionRange>
    <positionInteractionRange coordinate="elevation" bound="max">30.0</positionInteractionRange>
  </audioObjectInteraction>
</alternativeValueSet>
</audioObject>

<audioObject audioObjectID="AO_1003" audioObjectName="audioObject_5" dialogue="1" interact="1"
start="00:00:00.00000" duration="00:00:06.00000">
  <audioObjectLabel language="eng">Dialog English</audioObjectLabel>
  <audioObjectInteraction onOffInteract="0" gainInteract="1">
    <gainInteractionRange gainUnit="dB" bound="min">-6</gainInteractionRange>
    <gainInteractionRange gainUnit="dB" bound="max">6</gainInteractionRange>
  </audioObjectInteraction>
  <alternativeValueSet alternativeValueSetID="AVS_1003_0001">
    <gain gainUnit="dB">6.0</gain>
  </alternativeValueSet>
  <audioObjectIDRef>AO_1008</audioObjectIDRef>
  <audioComplementaryObjectIDRef>AO_1004</audioComplementaryObjectIDRef>
  <audioComplementaryObjectIDRef>AO_1005</audioComplementaryObjectIDRef>
  <audioComplementaryObjectGroupLabel language="eng">Dialogue</audioComplementaryObjectGroupLabel>
  <audioComplementaryObjectGroupLabel language="ger">Dialog</audioComplementaryObjectGroupLabel>
  <audioComplementaryObjectGroupLabel language="jpn">ダイアログ</audioComplementaryObjectGroupLabel>
</audioObject>

<audioObject audioObjectID="AO_1004" audioObjectName="audioObject_6" dialogue="1" interact="1"
start="00:00:00.00000" duration="00:00:06.00000">
  <audioObjectLabel language="eng">Dialog German</audioObjectLabel>
  <audioObjectInteraction onOffInteract="0" gainInteract="1">
    <gainInteractionRange gainUnit="dB" bound="min">-6</gainInteractionRange>
    <gainInteractionRange gainUnit="dB" bound="max">6</gainInteractionRange>
  </audioObjectInteraction>
  <alternativeValueSet alternativeValueSetID="AVS_1004_0001">
    <gain gainUnit="dB">6.0</gain>
  </alternativeValueSet>
  <audioObjectIDRef>AO_1009</audioObjectIDRef>
</audioObject>

<audioObject audioObjectID="AO_1005" audioObjectName="audioObject_7" dialogue="1" interact="1"
start="00:00:00.00000" duration="00:00:06.00000">
  <audioObjectLabel language="eng">Dialog Japanese</audioObjectLabel>
  <audioObjectInteraction onOffInteract="0" gainInteract="1">
    <gainInteractionRange gainUnit="dB" bound="min">-6</gainInteractionRange>
    <gainInteractionRange gainUnit="dB" bound="max">6</gainInteractionRange>
  </audioObjectInteraction>
  <alternativeValueSet alternativeValueSetID="AVS_1005_0001">
    <gain gainUnit="dB">6.0</gain>
  </alternativeValueSet>
  <audioObjectIDRef>AO_100a</audioObjectIDRef>
</audioObject>

<audioObject audioObjectID="AO_1006" audioObjectName="audioObject_3">
  <audioObjectLabel language="eng">Object 1</audioObjectLabel>
  <audioPackFormatIDRef>AP_00031001</audioPackFormatIDRef>
  <audioTrackUIDRef>ATU_0000000d</audioTrackUIDRef>
</audioObject>

<audioObject audioObjectID="AO_1007" audioObjectName="audioObject_4">
  <audioObjectLabel language="eng">Object 2</audioObjectLabel>
  <audioPackFormatIDRef>AP_00031002</audioPackFormatIDRef>
  <audioTrackUIDRef>ATU_0000000e</audioTrackUIDRef>

```

```

</audioObject>

<audioObject audioObjectID="AO_1008" audioObjectName="audioObject_8">
  <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
  <audioTrackUIDRef>ATU_0000000f</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000010</audioTrackUIDRef>
</audioObject>

<audioObject audioObjectID="AO_1009" audioObjectName="audioObject_9">
  <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
  <audioTrackUIDRef>ATU_00000011</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000012</audioTrackUIDRef>
</audioObject>

<audioObject audioObjectID="AO_100a" audioObjectName="audioObject_10">
  <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
  <audioTrackUIDRef>ATU_00000013</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000014</audioTrackUIDRef>
</audioObject>

<!-- ##### -->
<!-- CHANNELS -->
<!-- ##### -->

<audioChannelFormat audioChannelFormatID="AC_00021001" audioChannelFormatName="Matrix Left" typeLabel="0002"
typeDefinition="Matrix">
  <audioBlockFormat audioBlockFormatID="AB_00021001_00000001">
    <outputChannelFormatIDRef>AC_00010001</outputChannelFormatIDRef>
    <matrix>
      <coefficient gain="1.0">AC_00010001</coefficient>
      <coefficient gain="0.0">AC_00010002</coefficient>
      <coefficient gain="0.7">AC_00010003</coefficient>
      <coefficient gain="0.0">AC_00010004</coefficient>
      <coefficient gain="0.7">AC_0001001c</coefficient>
      <coefficient gain="0.0">AC_0001001d</coefficient>
      <coefficient gain="0.7">AC_0001000a</coefficient>
      <coefficient gain="0.0">AC_0001000b</coefficient>
      <coefficient gain="0.5">AC_0001000d</coefficient>
      <coefficient gain="0.0">AC_0001000f</coefficient>
      <coefficient gain="0.5">AC_0001001e</coefficient>
      <coefficient gain="0.0">AC_0001001f</coefficient>
    </matrix>
  </audioBlockFormat>
</audioChannelFormat>

<audioChannelFormat audioChannelFormatID="AC_00021002" audioChannelFormatName="Matrix Right" typeLabel="0002"
typeDefinition="Matrix">
  <audioBlockFormat audioBlockFormatID="AB_00021002_00000001">
    <outputChannelFormatIDRef>AC_00010002</outputChannelFormatIDRef>
    <matrix>
      <coefficient gain="0.0">AC_00010001</coefficient>
      <coefficient gain="1.0">AC_00010002</coefficient>
      <coefficient gain="0.0">AC_00010003</coefficient>
      <coefficient gain="0.7">AC_00010004</coefficient>
      <coefficient gain="0.0">AC_0001001c</coefficient>
      <coefficient gain="0.7">AC_0001001d</coefficient>
      <coefficient gain="0.0">AC_0001000a</coefficient>
      <coefficient gain="0.7">AC_0001000b</coefficient>
      <coefficient gain="0.0">AC_0001000d</coefficient>
      <coefficient gain="0.5">AC_0001000f</coefficient>
      <coefficient gain="0.0">AC_0001001e</coefficient>
      <coefficient gain="0.5">AC_0001001f</coefficient>
    </matrix>
  </audioBlockFormat>
</audioChannelFormat>

<audioChannelFormat audioChannelFormatID="AC_00031001" audioChannelFormatName="Object 1" typeLabel="0003"
typeDefinition="Objects">
  <audioBlockFormat audioBlockFormatID="AB_00031001_00000001" duration="00:00:01.00000" rtime="00:00:00.00000">
    <position coordinate="azimuth">90</position>
    <position coordinate="elevation">0</position>
    <position coordinate="distance">1.0</position>
    <gain>1.000000</gain>
  </audioBlockFormat>
</audioChannelFormat>

```

```

</audioBlockFormat>
<audioBlockFormat audioBlockFormatID="AB_00031001_00000002" duration="00:00:01.00000" rtime="00:00:01.00000">
  <position coordinate="azimuth">87</position>
  <position coordinate="elevation">0</position>
  <position coordinate="distance">1.0</position>
  <gain>0.969765</gain>
</audioBlockFormat>
<audioBlockFormat audioBlockFormatID="AB_00031001_00000003" duration="00:00:01.00000" rtime="00:00:02.00000">
  <position coordinate="azimuth">85</position>
  <position coordinate="elevation">0</position>
  <position coordinate="distance">1.0</position>
  <gain>0.940445</gain>
</audioBlockFormat>
<audioBlockFormat audioBlockFormatID="AB_00031001_00000004" duration="00:00:01.00000" rtime="00:00:03.00000">
  <position coordinate="azimuth">82</position>
  <position coordinate="elevation">0</position>
  <position coordinate="distance">1.0</position>
  <gain>0.912011</gain>
</audioBlockFormat>
<audioBlockFormat audioBlockFormatID="AB_00031001_00000005" duration="00:00:01.00000" rtime="00:00:04.00000">
  <position coordinate="azimuth">80</position>
  <position coordinate="elevation">0</position>
  <position coordinate="distance">1.0</position>
  <gain>0.884437</gain>
</audioBlockFormat>
<audioBlockFormat audioBlockFormatID="AB_00031001_00000006" duration="00:00:01.00000" rtime="00:00:05.00000">
  <position coordinate="azimuth">78</position>
  <position coordinate="elevation">0</position>
  <position coordinate="distance">1.0</position>
  <gain>0.857696</gain>
</audioBlockFormat>
</audioChannelFormat>

<audioChannelFormat audioChannelFormatID="AC_00031002" audioChannelFormatName="Object 2" typeLabel="0003"
typeDefinition="Objects">
  <audioBlockFormat audioBlockFormatID="AB_00031002_00000001" duration="00:00:01.00000" rtime="00:00:00.00000">
    <position coordinate="azimuth">-60</position>
    <position coordinate="elevation">0</position>
    <position coordinate="distance">1.0</position>
    <gain>0.100000</gain>
  </audioBlockFormat>
  <audioBlockFormat audioBlockFormatID="AB_00031002_00000002" duration="00:00:01.00000" rtime="00:00:01.00000">
    <position coordinate="azimuth">-58</position>
    <position coordinate="elevation">0</position>
    <position coordinate="distance">1.0</position>
    <gain>0.103118</gain>
  </audioBlockFormat>
  <audioBlockFormat audioBlockFormatID="AB_00031002_00000003" duration="00:00:01.00000" rtime="00:00:02.00000">
    <position coordinate="azimuth">-56</position>
    <position coordinate="elevation">0</position>
    <position coordinate="distance">1.0</position>
    <gain>0.106333</gain>
  </audioBlockFormat>
  <audioBlockFormat audioBlockFormatID="AB_00031002_00000004" duration="00:00:01.00000" rtime="00:00:03.00000">
    <position coordinate="azimuth">-55</position>
    <position coordinate="elevation">0</position>
    <position coordinate="distance">1.0</position>
    <gain>0.109648</gain>
  </audioBlockFormat>
  <audioBlockFormat audioBlockFormatID="AB_00031002_00000005" duration="00:00:01.00000" rtime="00:00:04.00000">
    <position coordinate="azimuth">-53</position>
    <position coordinate="elevation">0</position>
    <position coordinate="distance">1.0</position>
    <gain>0.113066</gain>
  </audioBlockFormat>
  <audioBlockFormat audioBlockFormatID="AB_00031002_00000006" duration="00:00:01.00000" rtime="00:00:05.00000">
    <position coordinate="azimuth">-52</position>
    <position coordinate="elevation">0</position>
    <position coordinate="distance">1.0</position>
    <gain>0.116591</gain>
  </audioBlockFormat>
</audioChannelFormat>

```

```

<!-- ##### -->
<!-- PACKS -->
<!-- ##### -->

<audioPackFormat audioPackFormatID="AP_00011013" audioPackFormatName="audioPackFormat_19"
typeDefinition="DirectSpeakers" typeLabel="0001">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010003</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00010004</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001c</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001d</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000a</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000b</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000d</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001000f</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001e</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_0001001f</audioChannelFormatIDRef>
</audioPackFormat>

<audioPackFormat audioPackFormatID="AP_00021001" audioPackFormatName="Downmix Matrix 7.1.4 to 2.0"
typeLabel="0002" typeDefinition="Matrix">
  <inputPackFormatIDRef>AP_00011013</inputPackFormatIDRef>
  <outputPackFormatIDRef>AP_00010002</outputPackFormatIDRef>
  <audioChannelFormatIDRef>AC_00021001</audioChannelFormatIDRef>
  <audioChannelFormatIDRef>AC_00021002</audioChannelFormatIDRef>
</audioPackFormat>

<audioPackFormat audioPackFormatID="AP_00031001" audioPackFormatName="Object 1" typeLabel="0003"
typeDefinition="Objects">
  <audioChannelFormatIDRef>AC_00031001</audioChannelFormatIDRef>
</audioPackFormat>

<audioPackFormat audioPackFormatID="AP_00031002" audioPackFormatName="Object 2" typeLabel="0003"
typeDefinition="Objects">
  <audioChannelFormatIDRef>AC_00031002</audioChannelFormatIDRef>
</audioPackFormat>

<!-- ##### -->
<!-- STREAMS -->
<!-- ##### -->

<audioStreamFormat audioStreamFormatID="AS_00031001" audioStreamFormatName="Object 1" formatLabel="0001"
formatDefinition="PCM">
  <audioChannelFormatIDRef>AC_00031001</audioChannelFormatIDRef>
  <audioTrackFormatIDRef>AT_00031001_01</audioTrackFormatIDRef>
</audioStreamFormat>

<audioStreamFormat audioStreamFormatID="AS_00031002" audioStreamFormatName="Object 2" formatLabel="0001"
formatDefinition="PCM">
  <audioChannelFormatIDRef>AC_00031002</audioChannelFormatIDRef>
  <audioTrackFormatIDRef>AT_00031002_01</audioTrackFormatIDRef>
</audioStreamFormat>

<!-- ##### -->
<!-- AUDIO TRACKS -->
<!-- ##### -->

<audioTrackFormat audioTrackFormatID="AT_00031001_01" audioTrackFormatName="Object 1" formatLabel="0001"
formatDefinition="PCM">
  <audioStreamFormatIDRef>AS_00031001</audioStreamFormatIDRef>
</audioTrackFormat>

<audioTrackFormat audioTrackFormatID="AT_00031002_01" audioTrackFormatName="Object 2" formatLabel="0001"
formatDefinition="PCM">
  <audioStreamFormatIDRef>AS_00031002</audioStreamFormatIDRef>
</audioTrackFormat>

<!-- ##### -->
<!-- AUDIO TRACK UIDs -->
<!-- ##### -->

<audioTrackUID UID="ATU_00000001" bitDepth="24" sampleRate="48000">

```

[illegible]

```

<audioTrackUID UID="ATU_00000010" bitDepth="24" sampleRate="48000" >
  <audioTrackFormatIDRef>AT_00010002_01</audioTrackFormatIDRef>
  <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000011" bitDepth="24" sampleRate="48000" >
  <audioTrackFormatIDRef>AT_00010001_01</audioTrackFormatIDRef>
  <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000012" bitDepth="24" sampleRate="48000" >
  <audioTrackFormatIDRef>AT_00010002_01</audioTrackFormatIDRef>
  <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000013" bitDepth="24" sampleRate="48000" >
  <audioTrackFormatIDRef>AT_00010001_01</audioTrackFormatIDRef>
  <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000014" bitDepth="24" sampleRate="48000" >
  <audioTrackFormatIDRef>AT_00010002_01</audioTrackFormatIDRef>
  <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
</audioTrackUID>

</audioFormatExtended>

<audioFormatCustom>
  <audioFormatCustomSet audioFormatCustomSetID="AFC_1001"
    audioFormatCustomSetName="MPEG-H 3D Audio"
    audioFormatCustomSetType="CUSTOM_SET_TYPE_MPEGH3DA"
    audioFormatCustomSetVersion="1.0.0">
    <admlInformation>

      <profile profileID="1" levelID="3" profileName="MPEG-H ADM Profile" profileVersion="1.0.0"/>
      <profile profileID="2" levelID="3" profileName="MPEG-H ADM Profile" profileVersion="1.0.0"/>

      <content contentID="080e636a75724c4b" contentType="0"/>

      <!-- placeholder element -->
      <unknown>
        <parameter>0123</parameter>
      </unknown>

    </admlInformation>

    <!-- ##### -->
    <!-- other custom metadata, e.g. DRC metadata as defined in ISO/IEC 23008-3 -->
    <!-- ##### -->

    <!-- placeholder element -->
    <unknown>
      <parameter>4567</parameter>
    </unknown>

  </audioFormatCustomSet>
</audioFormatCustom>

</format>

```

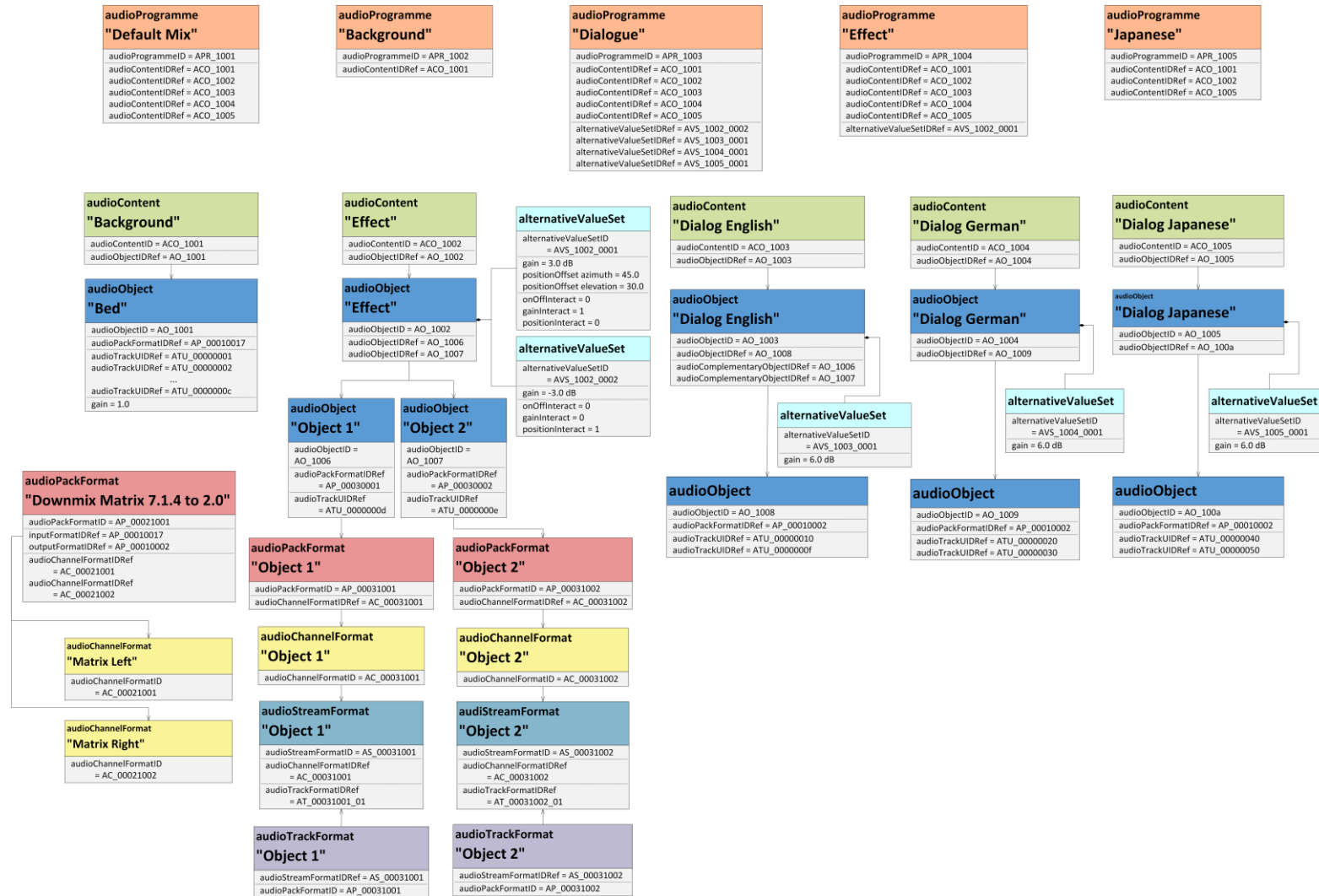


Figure B.1 – Simplified Illustration of Table B.1

B.2 S-ADM XML Code Example

Table B.2 — S-ADM XML Code Example

```
<?xml version='1.0' encoding='UTF-8'?>
<frame>

<!-- ##### -->
<!-- HEADER -->
<!-- ##### -->

<frameHeader>

<!-- ##### -->
<!-- FRAME FORMAT -->
<!-- ##### -->

<frameFormat frameFormatID="FF_00000001" start="0000S48000" duration="1024S48000" type="full" flowID="636a080e-
7572-4c4b-8589-7aaff84a4dbe" timeReference="local">
</frameFormat>

<!-- ##### -->
<!-- TRANSPORT TRACK FORMAT -->
<!-- ##### -->

<transportTrackFormat transportID="TP_0001" transportName="Interface 1" numIDs="8" numTracks="8">
<audioTrack trackID="1">
<audioTrackUIDRef>ATU_00000001</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="2">
<audioTrackUIDRef>ATU_00000002</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="3">
<audioTrackUIDRef>ATU_00000003</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="4">
<audioTrackUIDRef>ATU_00000004</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="5">
<audioTrackUIDRef>ATU_00000005</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="6">
<audioTrackUIDRef>ATU_00000006</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="7">
<audioTrackUIDRef>ATU_00000007</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="8">
<audioTrackUIDRef>ATU_00000008</audioTrackUIDRef>
</audioTrack>
</transportTrackFormat>

<transportTrackFormat transportID="TP_0002" transportName="Interface 2" numIDs="4" numTracks="8">
<audioTrack trackID="1">
<audioTrackUIDRef>ATU_00000009</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="2">
<audioTrackUIDRef>ATU_0000000a</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="3">
<audioTrackUIDRef>ATU_0000000b</audioTrackUIDRef>
</audioTrack>
<audioTrack trackID="4">
<audioTrackUIDRef>ATU_0000000c</audioTrackUIDRef>
</audioTrack>
</transportTrackFormat>
</frameHeader>

<!-- ##### -->
<!-- DATA -->
<!-- ##### -->
```

```

<audioFormatExtended version="ITU-R_BS.2076-2">

<!-- ##### -->
<!-- PROGRAMMES -->
<!-- ##### -->

<audioProgramme audioProgrammeID="APR_1001" audioProgrammeName="Default">
  <audioContentIDRef>ACO_1001</audioContentIDRef>
  <authoringInformation>
    <referenceLayout>
      <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
    </referenceLayout>
  </authoringInformation>
  <loudnessMetadata>
    <integratedLoudness>-24.0</integratedLoudness>
  </loudnessMetadata>
</audioProgramme>

<!-- ##### -->
<!-- CONTENTS -->
<!-- ##### -->

<audioContent audioContentID="ACO_1001" audioContentName="Mix 7.1+4">
  <audioObjectIDRef>AO_1001</audioObjectIDRef>
  <dialogue nonDialogueContentKind="0">0</dialogue>
  <loudnessMetadata>
    <integratedLoudness>-23.0</integratedLoudness>
  </loudnessMetadata>
</audioContent>

<!-- ##### -->
<!-- OBJECTS -->
<!-- ##### -->

<audioObject audioObjectID="AO_1001" audioObjectName="Mix 7.1+4">
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
  <audioTrackUIDRef>ATU_00000001</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000002</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000003</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000004</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000005</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000006</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000007</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000008</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_00000009</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_0000000a</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_0000000b</audioTrackUIDRef>
  <audioTrackUIDRef>ATU_0000000c</audioTrackUIDRef>
</audioObject>

<!-- ##### -->
<!-- AUDIO TRACK UIDs -->
<!-- ##### -->

<audioTrackUID UID="ATU_00000001" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000002" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000003" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_00010003</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000004" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_00010004</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

```

```

<audioTrackUID UID="ATU_00000005" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_0001000a</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000006" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_0001000b</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000007" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_0001001c</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000008" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_0001001d</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_00000009" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_00010022</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_0000000a" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_00010023</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_0000000b" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_0001001e</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

<audioTrackUID UID="ATU_0000000c" bitDepth="24" sampleRate="48000">
  <audioChannelFormatIDRef>AC_0001001f</audioChannelFormatIDRef>
  <audioPackFormatIDRef>AP_00010017</audioPackFormatIDRef>
</audioTrackUID>

</audioFormatExtended>

<audioFormatCustom>
  <audioFormatCustomSet audioFormatCustomSetID="AFC_1001"
    audioFormatCustomSetName="MPEG-H 3D Audio"
    audioFormatCustomSetType="CUSTOM_SET_TYPE_MPEGH3DA"
    audioFormatCustomSetVersion="1.0.0">
    <admInformation>
      <profile profileID="1" levelID="3" profileName="MPEG-H ADM Profile" profileVersion="1.0.0"/>
      <profile profileID="2" levelID="3" profileName="MPEG-H ADM Profile" profileVersion="1.0.0"/>
      <content contentID="4c4b636a080e7572" contentType="0"/>

      <!-- placeholder element -->
      <unknown>
        <parameter>0123</parameter>
      </unknown>

    </admInformation>

    <!-- ##### -->
    <!-- other custom metadata, e.g. DRC metadata as defined in ISO/IEC 23008-3 -->
    <!-- ##### -->

    <!-- placeholder element -->
    <unknown>
      <parameter>4567</parameter>
    </unknown>

  </audioFormatCustomSet>
</audioFormatCustom>
</frame>

```

Bibliography

EBU Tech 3293 — EBU core metadata set (EBUcore)

EBU Tech 3306 — RF64: An extended file format for audio data

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