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Digital Video Subcommittee

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**Next Generation Audio Carriage Constraints For Cable
Systems: Part 2 – AC-4 Audio Carriage Constraints**

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Note: Standards that are released multiple times in the same year use: a, b, c, etc. to indicate normative balloted updates and/or r1, r2, r3, etc. to indicate editorial changes to a released document after the year.

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1. Introduction

1.1. Executive Summary

This standard is part of a suite documenting carriage constraints of Next Generation Audio (NGA) codecs in MPEG-2 transport systems and in MPEG DASH. It is intended to be used in conjunction with the specific audio technologies described in subsequent Parts of this standard (see [SCTE 243-1]).

1.2. Scope

This document is part of a three-part standard that specifies carriage constraints of Next Generation Audio (NGA) codecs in MPEG-2 transport systems and in MPEG DASH. In conjunction with [SCTE 243-1] this document defines the carriage of AC-4 audio in MPEG-2 transport systems and MPEG DASH.

1.3. Benefits

The Next Generation Audio (NGA) system audio system provides immersive and personalizable sound for television. AC-4 supports the generation of coded audio frames that represent the same time interval as the associated video frame. With this frame alignment, audio can be passed transparently through a cable, satellite, or Internet Protocol Television (IPTV) turnaround facility, eliminating the need to decode and re-encode audio to correct time-base differences or to perform switching/splicing. All common integer and fractional video frame rates are supported.

To select the correct frame rate and time-align the audio frame boundaries to video, the AC-4 encoder is provided with reference timing information. There is a direct whole-frame relationship between video and audio frames from a reference time, such as at the start of a coded video sequence or at a random access point (RAP).

Note that NGA is not compatible with the audio system used in [SCTE 54-era service].

2. Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this document. The editions indicated were valid at the time of subcommittee approval. All documents are subject to revision and, while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

- [SCTE 242-2] SCTE 242-2 202x, Next Generation Audio Coding Constraints for Cable Systems: Part 2 – AC-4 Audio Coding Constraints
- [SCTE 243-1] SCTE 243-1 202x, “Next Generation Audio Carriage Constraints for Cable Systems: Part 1 – Common Transport Signaling”

2.2. Standards from Other Organizations

- [A342-2] ATSC A/342:2021 Part 2, AC-4 System

- [TS 101 154] ETSI TS 101 154 V2.6.1 (2019-09), Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG 2 Transport Stream
- [TS 103 190-1] ETSI TS 103 190-1 V1.3.1 (2018-02), Digital Audio Compression (AC-4) Standard; Part 1: Channel based coding
- [TS 103 190-2] ETSI TS 103 190-2 V1.2.1 (2018-02), Digital Audio Compression (AC-4) Standard; Part 2: Immersive and personalized audio
- [EN 300 468] ETSI EN 300 468 v1.16.1 (2019-08), Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems.
- [ISO 14496-12] ISO/IEC 14496-12:2015, Information technology -- Coding of audio-visual objects -- Part 12: ISO base media file format

2.3. Other Published Materials

No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. SCTE References

- [SCTE 54] ANSI/SCTE 54 2020, Digital Video Service Multiplex and Transport Subsystem Standard for Cable Television

3.2. Standards from Other Organizations

No informative references are applicable.

3.3. Other Published Materials

No informative references are applicable.

4. Compliance Notation

<i>shall</i>	This word or the adjective “ <i>required</i> ” means that the item is an absolute requirement of this document.
<i>shall not</i>	This phrase means that the item is an absolute prohibition of this document.
<i>forbidden</i>	This word means the value specified <i>shall</i> never be used.
<i>should</i>	This word or the adjective “ <i>recommended</i> ” means that there <i>may</i> exist valid reasons in particular circumstances to ignore this item, but the full implications <i>should</i> be understood and the case carefully weighed before choosing a different course.
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5. Abbreviations and Definitions

5.1. Abbreviations

AP	access point
DASH	MPEG Dynamic Adaptive Streaming over HTTP (ISO/IEC 23009-1)
ES	elementary stream
IPTV	Internet Protocol Television
NGA	Next generation audio
PES	packetized elementary stream
RAP	random access point
SCTE	Society of Cable Telecommunications Engineers
TS	transport stream

6. AC-4 Compressed Audio Transport

This section describes the carriage of AC-4 audio elementary streams, as defined in [SCTE 242-2], in MPEG-2 transport systems and MPEG DASH.

6.1. Carriage in MPEG-2 Transport Streams

This section outlines the constraints and signaling for AC-4 compressed audio carried in MPEG-2 Transport Streams.

6.1.1. Audio Elementary Stream Format

When AC-4 is multiplexed into an MPEG-2 Transport Stream, the AC-4 audio elementary stream *shall* be formatted using the AC-4 sync frame format as specified in ETSI [TS 103 190-2], Annex C.

6.1.2. PES Packaging

Placement of raw AC-4 frames of an AC-4 Elementary Stream (ES) into Packetized Elementary Stream (PES) and thence into Transport Stream (TS) packets *shall* be done in accordance with ETSI [TS 101 154], Section 6.6.2.

6.1.3. Audio/Video Synchronization

AC-4 can encode audio at the same frame rate as the accompanying video to facilitate keeping audio and video in sync throughout the distribution chain. When this feature is enabled, the AC-4 audio elementary stream *shall* comply with the constraints defined in ETSI [TS 101 154], Section 6.6.6.

6.2. ISOBMFF Packaging for Carriage in MPEG DASH

This section describes the packaging rules for AC-4 compressed audio carried in the ISO Base Media File Format (ISOBMFF) for transport in MPEG DASH.

6.2.1. Packaging of AC-4 Bitstreams into ISOBMFF Segments

Each raw AC-4 frame *shall* be packaged as an ISO Base Media File Format sample. For more information, refer to ETSI [TS 103 190-2], Annex E.3. AC-4 sync frames as described in ETSI [TS 103 190-2], Annex C, *shall not* be packetized directly into ISO Base Media File Format.

6.2.2. Additional Constraints on AC-4 Elementary Streams

ETSI [TS 103 190-2], Annex E, describes the constraints that *shall* be applied to the AC-4 bitstream for storage within the ISO base media file format. For the use of DASH with the ISO base media file format, the additional constraints listed in ATSC [A342-2], Section 5.6.2 *shall* apply when packaging AC-4 audio into DASH Representations.

6.2.3. Random Access Point and Stream Access Point

To facilitate random access and seamless switches, the constraints defined in ATSC [A342-2], Section 5.6.4 *shall* apply.

6.2.4. Packaging of Individual Audio Elements

In scenarios where AC-4 DASH Representations from different Adaptation Sets form an AC-4 presentation, the constraints listed in ATSC [A342-2], Section 5.6.5 *shall* apply.

7. Service Information Signaling

7.1. Signaling of an AC-4 Bitstream in MPEG-2 Transport Streams

7.1.1. AC-4_descriptor

The **AC-4_descriptor** syntax provides information about individual AC-4 elementary streams within a Transport Stream that are to be identified in the PSI PMT sections. The **AC-4_descriptor** is defined in ETSI [EN 300 468], and located in the PMT of the SI Tables that are also defined in ETSI [EN 300 468].

The **AC-4_descriptor** shall be included in a program map section at most once in each relevant ES_info descriptor loop which describes an elementary stream carrying an AC-4 audio stream, coded in accordance with ETSI [TS 103 190-1] or ETSI [TS 103 190-2], that is included in a Transport Stream.

7.1.2. audio_preselection_descriptor

The **audio_preselection_descriptor**, specified in [EN 300 468], provides information about the available Audio Preselections for one Audio Program contained in one or more AC-4 Audio associated elementary streams within a Transport Stream that are to be identified in the PSI PMT sections.

The contents of the **audio_preselection_descriptor** and the information carried in the AC-4 Audio elementary stream *should* match as shown in ETSI [EN 300 468], table M.1.

7.2. Signaling of an AC-4 Bitstream in ISOBMFF

The basic structures defined within [ISO 14496-12] to identify audio tracks *shall* be used with specific extensions to provide detailed information on the characteristics of an AC-4 stream.

The AC-4SampleEntry Box *shall* be included in the Sample Description Box according to ETSI [TS 103 190-2] Annex E. The box type of the AC4SampleEntry Box *shall* be 'ac-4'.