

SMPTE STANDARD

Format for Non-PCM Audio and Data in AES3 — AC-4 Data Type



Page 1 of 16 pages

Table of Contents	Page
Foreword	2
Intellectual Property	2
1 Scope	3
2 Conformance Notation	3
3 Normative References	3
4 Definitions and Acronyms	4
4.1 Definitions	4
4.2 Acronyms	5
5 AC-4	5
5.1 Overview	5
5.2 burst_preamble	6
5.3 AC-4 Burst Payload.....	8
5.4 AES3 Frame Rate (Sampling Frequency)	8
5.5 AC-4 Reference Point	9
5.6 AC-4 Standard Repetition Rate	9
5.7 AC-4 Standard Decode Latency	10
5.8 AC-4 Reference Position.....	10
5.9 AC-4 Guard Band.....	12
5.10 Burst Payload Timing	13
5.11 Use of Pause Data Bursts Between AC-4 Data Bursts	13
Annex A AC-4 Sync Frame	14
Annex B Bibliography (Informative)	16

Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Standards Operating Manual.

SMPTE ST 2021 was prepared by Technology Committee 32NF.

Intellectual Property

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

1 Scope

This standard describes how AC-4 data rate reduced (non PCM) audio streams conforming to ETSI TS 103 190 are packed into an AES3 data stream, following the methods described by SMPTE ST 337. The AC-4 data type is identified by a data type number listed in SMPTE ST 338 and carried in the burst information word of the data burst preamble.

2 Conformance Notation

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

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

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

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

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

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

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

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

3 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 274:2008) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 274M-2008). Documents with the same root number (e.g. 274) and publication year (e.g. 2008) are functionally identical.

The following standards contain provisions that, through reference in this text, constitute provisions of this recommended practice. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this recommended practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ETSI TS 103 190 v.1.1.1 (2014-04), Digital Audio Compression (AC-4) Standard

SMPTE RP 168:2009, Definition of Vertical Interval Switching Point for Synchronous Video Switching

SMPTE ST 274:2008, Television — 1920 × 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates

SMPTE ST 296:2012, 1280 × 720 Progressive Image 4:2:2 and 4:4:4 Sample Structure — Analog and Digital Representation and Analog Interface

SMPTE ST 337:2015, Format for Non-PCM Audio and Data in an AES3 Serial Digital Audio Interface

SMPTE ST 339:2015, Format for Non-PCM Audio and Data in AES3 — Generic Data Types

SMPTE ST 2036-1:2014, Ultra High Definition Television — Image Parameter Values for Program Production

4 Definitions and Acronyms

4.1 Definitions

4.1.1 AC-4 frame

An AC-4 sync frame, as specified in Annex A.

4.1.2 AC-4 I-frame

An independently decodable AC-4 frame, as specified in ETSI TS 103 190.

4.1.3 Audio Frame Rate

The number of AC-4 audio frames per second, indicated by the value of the frame_rate_index bitstream parameter as specified in ETSI TS 103 190.

4.1.4 Base sampling frequency

The sampling frequency of the AC-4 bitstream, indicated by the value of the fs_index bitstream parameter as specified in ETSI TS 103 190.

4.1.5 Fractional frame rates

AC-4 supports a number of fractional audio frame rates. These frame rates are written in shorthand notation, as specified in Table 1.

Table 1 – Shorthand notation for fractional frame rates

Fractional AC-4 audio frame rate (fps)	Shorthand version
$24 \times 1\,000 / 1\,001$	23.976
$30 \times 1\,000 / 1\,001$	29.97
$48 \times 1\,000 / 1\,001$	47.952
$60 \times 1\,000 / 1\,001$	59.94
$120 \times 1\,000 / 1\,001$	119.88
12 000 / 512	23.438
11 025 / 512	21.533

4.1.6 Latency

Delay time of an external audio decoder to decode an AC-4 data burst, defined as the sum of two values; the receiving delay time and the decoding delay time.

4.2 Acronyms

4.2.1 ETSI

European Telecommunication Standards Institute

4.2.2 fps

frames per second

4.2.3 UIMSBF

Unsigned integer, most significant bit first

5 AC-4

5.1 Overview

AC-4 coded audio shall be transported in an AES3 data stream as a series of Data Bursts. Each Data Burst shall start with a Burst Preamble as defined by SMPTE ST 337, containing information about the Burst Payload, which shall follow the Burst Preamble. The Burst Payload shall consist of an AC-4 Frame. The Burst Payload shall be followed by enough zero padding words to make the resulting Data Burst duration exactly match the duration in samples of baseband (PCM) audio that the AC-4 coded audio represents.

The resulting Data Bursts shall be placed in the audio sample word/aux data fields of AES3 subframes at regular intervals in either the frame or subframe mode (see SMPTE ST 337, Section 5). Data Bursts shall be placed in the AES3 transport, using either 16, 20, or 24 bits of the available data space. While the 24-bit mode allows more efficient use of the AES3 capacity, the 16- and 20-bit modes allow use with existing equipment limited to 16- or 20-bit operation.

A single AC-4 Frame shall form the Burst Payload, as shown in Figure 1. As specified by ETSI TS 103 190 and Annex A of this document, each AC-4 Frame begins with a sync word and a frame size field that indicates the size of the following raw AC-4 frame. If the value of the sync word is AC41h, the raw AC-4 frame is followed by an error check (crc_word) word.