

for Television — Serial Interface for Multiplexing Eight AES3 Data Streams



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1 Scope

1.1 This standard defines a method of mapping up to eight synchronous streams of AES3-compliant data into a self-clocking serial interface. When used for PCM digital audio, the interface can carry up to 16 channels of linearly encoded audio and auxiliary data. Alternatively or concurrently (within the eight stream limit), the interface may be used to carry streams of compressed audio or other data that is packaged into an AES3-compliant stream. The interface is transparent to any data type that is packaged in an AES3-compliant stream that is synchronous with the multiplex.

1.2 PCM audio sampled at 48 kHz and clock-locked to video is the preferred linear baseband audio representation for studio applications and should be used whenever baseband audio is associated with video that is running at standard frame rates. However, this interface supports any frequency of operation supported by AES3, provided that all of the audio channels and/or all the non-audio (see 3.15) data streams are synchronized to a common clock. Ideally all the audio channels should be audio-synchronous (see 3.5) for guaranteed audio phase coherence.

1.3 This standard is intended to provide a reliable method of distributing multiple co-phased channels of digital audio around a studio without losing the initial relative sample-phase relationship. A mechanism is provided to allow multiple 16-channel streams to be re-aligned after a relative misalignment of up to ± 8 samples.

1.4 This interface is intended to be compatible with the complete range of digital television scanning standards and standard film rates.

2 Normative references

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

AES3-2003, Digital Audio Engineering — Serial Transmission Format for Two-Channel Linearly Represented Digital Audio Data

AES-3id-2001, AES Information Document for Digital Audio Engineering — Transmission of AES3 Formatted Data by Unbalanced Coaxial Cable

AES11-2003, Digital Audio Engineering — Synchronization of Digital Audio Equipment in Studio Operations

ANSI/SMPTE 276M-1995, Television — Transmission of AES/EBU Digital Audio Signals Over Coaxial Cable.

IEC 60169-8, Radio-Frequency Connectors. Part 8: R.F. Coaxial Connectors with Inner Diameter of Outer Conductor 6.5 mm (0.256 in) with Bayonet Lock — Characteristic Impedance 50 ohms (Type BNC)

3 Definition of terms

3.1 AES audio: All of the data, audio and auxiliary, associated with one AES digital stream as defined in AES3.

3.2 AES frame: Two AES subframes, one with audio data for channel a (subframe 1) followed by one with audio data for channel b (subframe 2).

3.3 AES subframe: All data associated with one AES audio sample for one channel in a channel pair .

3.4 audio data: 28 bits: 24 bits of audio associated with one audio sample plus the following 4 bits: sample validity (V bit), channel status (C bit), user data (U bit), and parity (P bit). Alternatively, there may be 20 bits of audio, 4 auxiliary bits, and the V, C, U, and P bits per the AES3 standard.

3.5 audio synchronous: One audio channel is defined as being synchronous with another when the two channels are running from the same clock and the analog inputs are concurrently sampled as described in AES11.

3.6 auxiliary data: Four bits of AES audio associated with one sample defined as auxiliary data by AES3. The four bits may be used to extend the resolution of the audio sample.

3.7 carrier data: Available data bits in the header data that may be used for metadata transmission or other user applications.

3.8 carrier data block start bit (CB bit): An optional bit provided to allow the formation of a carrier data block that spans multiple AES frames.

3.9 channel pair: Two digital audio channels derived from the same AES audio source.

3.10 header data: All the data in the multiplex header.

3.11 multichannel phasing flag (MC bit): A dedicated bit that identifies the start of a 16 frame period with a 1 state. This bit immediately precedes the A1 bit and has a 1 state in the first frame following the frame containing the Z preamble in the AES11 timing reference.

3.12 multiplex frame: All the data associated with each sample of audio in each AES frame for each of 8 AES inputs and the multiplex header associated with that sample period.

3.13 multiplex frame sync: A bi-phase code violation at the beginning of the multiplex header that identifies the start of each multiplex frame

3.14 multiplex header: A 64-bit data packet at the start of each frame that includes a bi-phase code violation for synchronization, 32 bits of carrier data, an optional carrier block flag (CB bit), a parity bit for carrier data (CP bit), a multi-channel phasing flag (MC bit), sixteen channel active bits (A bits), eight AES block start bits (Z bits), and a parity bit for the MC, A, and Z bits (HP bit).

3.15 non-audio data: Any data payload in an AES3 stream that requires byte 0, bit 1 of the channel status data to be set to 1 per the AES3 standard. This encompasses any data that is not linearly coded PCM audio, so “non-audio data” may actually be compressed audio or non-linearly coded audio as well as metadata, compressed video, or other data that is truly not audio.

3.16 video synchronous: Audio is defined as being clock-synchronous with video if the sampling rate of the audio is such that the number of audio samples occurring within an integer number of video frames is itself a constant integer number.

4 Overview

Audio data derived from eight synchronous AES frames are multiplexed together in a single, bi-phase-mark-encoded serial data stream at exactly eight times the bit rate of each incoming AES signal. Each AES subframe is organized in time sequence in the multiplexed frame. All the data in each AES subframe is included with the exception of the preamble. The four bit-times from each preamble are moved to the front of the multiplexed word to produce a 64-bit header. Four of the header bits are used for a code violation that provides frame synchronization. One bit is used for a sixteen frame flag that allows multiple streams that have been subjected to differential delay to be re-phased with minimum latency. Sixteen A bits are used to identify active channels. Eight bits are assigned as Z bits to identify the block start frame for each of the eight AES channel pairs. One bit is assigned to a parity bit that covers the MC bit and the Z bits. Thirty-two bits are allocated to carrier data. One bit is reserved for an optional block start reference for carrier data. The last bit is used to ensure even parity across carrier data bits, the carrier block bit and the reserved bits.

5 Multiplex carrier channel-coding

The data in the multiplex carrier is coded bi-phase mark. Data zeroes are identified by a transition only at the beginning of the bit period. Data ones are identified by transitions at the beginning and at the middle of the bit period as shown in figure 1. The receiver shall be able to detect the bi-phase mark data in either normal or reverse polarity so that it can operate correctly if the data has passed through an odd number of inversions.