SMPTE STANDARD

for Television — Format for Non-PCM Audio and Data in AES3 — ATSC A/52 (AC-3) Data Type

1 Scope

This standard specifies data type specific format requirements for AC-3 data bursts carried within an AES3 interface according to SMPTE 337M.

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.

ATSC A/52, Digital Audio Compression (AC-3) Standard

SMPTE 337M-2000, Television — Format for Non-PCM Audio and Data in an AES3 Serial Digital Audio Interface

SMPTE 338M-2000, Television — Format for Non-PCM Audio and Data in AES3 — Data Types

SMPTE 339M-2000, Television — Format for Non-PCM Audio and Data in AES3 — Generic Data Types

3 burst_preamble

The AC-3 data type is used to convey non-PCM audio streams encoded according to ATSC A/52 (ITU-R BS.1196).

3.1 data_type

The data_type shall have a value of 1.

3.2 data_type_dependent

The burst_preamble for an AC-3 data burst shall include a data_type_dependent field encoded as shown in table 1.

rep_rate_flag — The repetition rate flag shall be set to 0 if the AC3 data burst is placed in the AES3 interface such that the reference point of the data burst (as defined in 4.3) occurs at the AC-3 standard repetition rate (as defined in 4.4). The flag shall be set to 1 if the reference point does not occur at the AC-3 standard repetition rate. This flag is intended to be set to the same state for all data bursts of a given AC-3 data stream to indicate whether data bursts for the stream occur at the standard repetition.

Table 1 – Values of data_type_dependent field for AC-3 data type

data_type_dependent bit number	Meaning
0–2	Reserved, should be set to 000
3	Repetition rate flag (rep_rate_flag)
4	Not full service flag (not_full_svc)

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not_full_svc — This is a 1-bit field which indicates whether or not this audio service is a full service suitable for presentation, or whether this audio service is only a partial service which should be combined with another audio service before presentation. This bit shall be set to a 0 if this audio service is sufficiently complete to be presented to the listener without being combined with another audio service (for example, a visually impaired service which contains all elements of the program; music, effects, dialog, and the visual content descriptive narrative). This bit shall be set to a 1 if the service is not sufficiently complete to be presented without being combined with another audio service (e.g., a visually impaired service which only contains a narrative description of the visual program content and which needs to be combined with another audio service which contains music, effects, and dialog).

data_stream_number — The data_stream_number shall be set to any valid number other than 0×7.

4 burst_payload

4.1 AC-3 burst_payload

The AC-3 data stream consists of a sequence of AC-3 sync frames as defined in ATSC A/52. Each AC-3 sync frame represents 1536 encoded audio samples. AC-3 sync frame boundaries naturally occur at a frequency of exactly once every 1536 AES3 frames. The burst_payload of each AC-3 data burst shall contain one complete AC-3 sync frame. The length of the AC-3 burst_payload will depend on the encoded bit rate (which determines the AC-3 sync frame length).

4.2 AC-3 sampling frequency

When AC-3 data are conveyed by the AES3 interface, the AES3 frame frequency shall be equal to the sampling frequency of the AC-3 encoded audio. When more than one coded AC-3 bit stream is transmitted through the same interface, the audio sampling frequencies shall be identical. Bits 24-27 of the channel status word shall indicate the sampling frequency.

4.3 AC-3 reference point

The reference point of an AC-3 data burst is defined as bit 0 of the burst_payload; i.e., the first bit of the encoded AC-3 frame contained within the data burst.

4.4 AC-3 standard repetition rate

The AC-3 standard repetition rate is defined as 1536 AES3 frames. Data bursts for an AC-3 bit stream shall be considered as occurring at the standard repetition rate if the reference points for consecutive data bursts (of the same data stream number) are spaced 1536 AES3 frames apart.

4.5 AC-3 standard decode latency (professional)

The AC-3 reference decode latency for professional applications is defined as the time equivalent to 1536 AES3 frames at the current AES3 frame frequency (e.g., 32 ms at 48-kHz frame frequency). This means that a reference decoder would output the first PCM sample encoded in an AC-3 frame exactly 1536 sample times after the first bit of the frame is received by the decoder.

4.6 AC-3 reference position

AC-3 data bursts may occupy a reference position within an AES3 signal that is associated with a companion video signal. An AC-3 burst shall be defined as occupying the reference position if the reference point of the AC-3 burst is located in the AES3 interface such that the AC-3 stream can be decoded by a reference decoder and be presented at the intended time (e.g., in lip sync) with the associated video signal.

AC-3 bursts may have associated time stamp information in time stamp data bursts preceding the AC-3 data burst in the AES3 bit stream. These time stamps may include an optional delay value. For AC-3 data bursts that occupy a reference position, the delay shall be defined as 0. For AC-3 data bursts that do not occupy a reference position, the delay shall indicate the offset of the data burst (in AES3 frames) from the reference position.

4.7 AC-3 data burst synchronization

AC-3 data streams that include data bursts occurring at the standard repetition rate and reference position may be decoded by a decoder with minimal buffering and synchronization capabilities. However, in some cases, it may not be possible or desirable to include data bursts at the standard repetition rate.

For instance, when multiple AC-3 streams are carried within the AES-3 interface, conflicts between data burst spacing may exist when one or more data bursts attempt to occupy the same reference positions. The

combination of the rep_rate_flag and the delay field within time stamp bursts may be used to allow data bursts to be freely moved in the AES-3 interface when such conflicts exist. For AC-3 data streams with the rep_rate_flag set to 1, data burst spacing may vary dynamically between data bursts for that stream. The delay field in the time stamp burst is one method that may be used to indicate the offset for each data burst. SMPTE 12M time code information with an audio sample number is another method of specifying the absolute time of the audio encoded within the AC-3 frames.

The delay field may also be used to indicate data bursts that have been delayed due to equipment processing. For instance, an AC-3 bit stream produced by an encoder may contain data bursts occurring at the standard repetition rate, but still contain time stamp data bursts with constant delay value indicating the delay incurred by the encoding process. This delay value may be used, e.g., by MPEG-2 multiplexing equipment, to determine the audio delay of a companion AC-3 encoder.

Annex A (informative)
Bibliography

AES3-1992, Digital Audio Engineering — Serial Transmission Format for Two-Channel Linearly Represented Digital Audio Data

SMPTE 12M-1999, Television, Audio and Film — Time and Control Code

ITU-R BS.1196 (10/95), Audio Coding for Digital Terrestrial Television Broadcasting