

INTERNATIONAL STANDARD

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Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 –

Part 10: Non-linear PCM bitstreams according to the MPEG-4 audio lossless coding (ALS) format

Audionumérique – Interface pour les flux de bits audio à codage MIC non linéaire conformément à la CEI 60958 –

Partie 10: Flux de bits à codage MIC non-linéaire selon le format MPEG-4 Audio sans perte (Audio Lossless Coding – ALS)



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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**DIGITAL AUDIO –
INTERFACE FOR NON-LINEAR PCM ENCODED
AUDIO BITSTREAMS APPLYING IEC 60958 –**

**Part 10: Non-linear PCM bitstreams according
to the MPEG-4 audio lossless coding (ALS) format**

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The text of this standard is based on the following documents:

CDV	Report on voting
100/1733/CDV	100/1808/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 61937 series, published under the general title *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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DIGITAL AUDIO – INTERFACE FOR NON-LINEAR PCM ENCODED AUDIO BITSTREAMS APPLYING IEC 60958 –

Part 10: Non-linear PCM bitstreams according to the MPEG-4 audio lossless coding (ALS) format

1 Scope

This part of IEC 61937 specifies the method for IEC 60958 to convey non-linear PCM bitstreams encoded in accordance with the MPEG-4 audio lossless coding (ALS) format.

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.

IEC 60958 (all parts), *Digital audio interface*

IEC 61937 (all parts), *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958*

IEC 61937-1, *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 – Part 1: General*

IEC 61937-2, *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 – Part 2: Burst-Info*

ISO/IEC 14496-3:2009, *Information technology – Coding of audio-visual objects – Part 3: Audio*

Amendment 2:2010, *ALS Simple Profile and Transport of SAOC*

3 Terms, definitions, abbreviations and conventions

For the purposes of this document, the following terms and definitions, abbreviations and presentation conventions apply.

3.1 Terms and definitions

3.1.1

sub data-type

reference to the type of payload of the data-burst defined for use with the specified data-type

3.1.2

latency

delay time of an external audio decoder to decode a MPEG-4 ALS data-burst, defined as the sum of the receiving delay time and the decoding delay time

3.1.2

length code

code indicating the length of the data-burst-payload in 8-byte units according to this standard

3.1.4

als_id

ALS identifier in ALSSpecificConfig

3.1.5

samp_freq

sampling frequency of the audio samples contained in the MPEG-4 ALS burst payload

3.1.6

samples

number of audio samples per channel contained in the MPEG-4 ALS burst payload

NOTE In contrast to the ALS specification, each data-burst provides its own ALSSpecificConfig. Thus the 'samples' value refers to the total number of samples (per channel) of that data-burst.

3.1.7

channels

number of channels-1, 'channels', contained in the MPEG-4 ALS burst payload

3.1.8

resolution

bit depth of the audio samples contained in the MPEG-4 ALS burst payload

3.1.9

aux_size

size of the auxiliary data field in bytes for MPEG-4 ALS

3.1.10

aux_data

auxiliary data contained in the MPEG-4 ALS burst payload

NOTE Not required for decoding audio samples.

3.2 Abbreviations

ALS	Audio Lossless Coding
PCM	Pulse-Code Modulation

3.3 Presentation convention

01₂ Value "01" in binary format

4 Mapping of the audio bitstream onto IEC 61937

4.1 General

The coding of the bitstream and data-burst is in accordance with the IEC 61937 series of standards.

4.2 MPEG-4 ALS burst-info

The 16-bit burst-info contains information about the data that will be found in the data-burst in accordance with Table 1.

Table 1 – Fields of burst-info (data-type=23, sub-data-type=0)

Bits of Pc	Value	Contents	Reference point R	Repetition period of data-burst in IEC 60958 frames
0 to 4		data-type		
	0-22	In accordance with IEC 61937-2		
	23	MPEG-4 ALS or other applications according to IEC 61937-2, depending on sub-data-type	Bit 0 of Pa	See 5.2.1
	24-31	In accordance with IEC 61937-2		
5, 6		sub data-type		
	0 1-3	MPEG-4 ALS In accordance with IEC 61937-2		See 5.2.1
7	0	Error-flag indicating a valid burst-payload		
	1	Burst may contain errors		
8 to 12		Data-type and sub-data-type dependent information for MPEG-4 ALS		
8		Multiplier		
	0 1	[IEC 60958 frame rate] = audio sampling rate × 2 [IEC 60958 frame rate] = audio sampling rate × 8		
9 to 12	0000	No indication		
	0001	ALS Simple Profile Level 1		
	0010- 1111	Reserved for future Profile or Level		
		In accordance with IEC 61937-1 and IEC 61937-2		

5 Format of MPEG-4 ALS data-bursts

5.1 General

This clause specifies the audio data-burst MPEG-4 ALS. Specific properties, such as reference points, repetition period, the method of filling stream gaps, and decoding latency, are specified for each data-type.

The decoding latency (or delay), indicated for the data-types, should be used by the transmitter to schedule data-bursts, as necessary, to establish synchronisation between video and decoded audio.

5.2 Audio data-bursts

5.2.1 Data-burst for MPEG-4 ALS

Figure 1 shows the detailed description of the MPEG-4 ALS data-burst. The stream of the data-bursts for MPEG-4 ALS consists of sequences of MPEG-4 ALS bitstreams. The data-type of a MPEG-4 ALS data-burst is 23. The sub data-type is 0. The data-burst is headed with a burst-preamble, followed by the burst-payload, and stuffed with stuffing bits. The burst-payload of each data-burst of MPEG-4 ALS data shall contain an ALSspecificConfig header, and one or more ALS random access units. Each data-burst constitutes a self-contained ALS bitstream, whose number of samples (per channel) is given in the field 'samples' of (the corresponding) ALSspecificConfig. The units of length-code (burst_length) shall be in 8-bytes.

Note that if the actual data size of the data-burst is not a multiple of 8 bytes, 1 to 7 stuffing bytes are included in the burst_length.

The number of samples for each encoded channel contained in the data-burst are indicated in the encoded ALS bitstream. The length of the MPEG-4 ALS data-burst depends on the encoded bit rate (which determines the MPEG-4 ALS frame length). For details, see Annex B.

The reference to the specification for the MPEG-4 ALS bitstream, representing the number of samples of encoded audio per frame, may be found in ISO/IEC 14496-3, subpart 11.

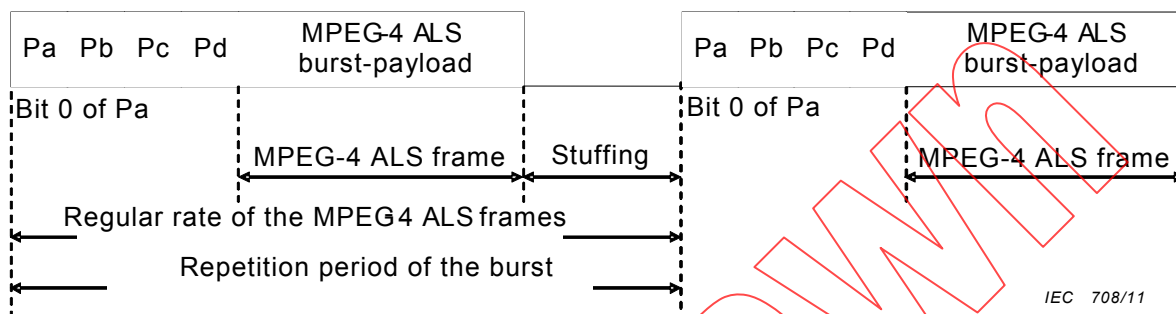


Figure 1 – MPEG-4 ALS data-burst

The regular rate of the MPEG-4 ALS frames and the repetition period of the data burst can be calculated as

'[samples] × [IEC 60958 frame rate]/[sampling frequency of the encoded audio samples (samp_freq)]'.

The value of the 'samples' field is stored in the 9th to 12th bytes of the MPEG-4 ALS burst-payload. The value represents the number of samples contained in the MPEG-4 ALS burst-payload. The IEC 60958 frame rate is defined by the audio sampling rate and a value of the multiplier (see Table.2).

The reference point of a MPEG-4 ALS data-burst is bit 0 of Pa and occurs exactly once every predefined number of IEC 60958 frames. The data-burst containing MPEG-4 ALS frames shall occur at a regular rate, with the reference point of each MPEG-4 ALS data-burst beginning after the number of IEC 60958 frames in the previous MPEG-4 ALS data-burst from the reference point of the preceding MPEG-4 ALS data-burst (of the same bit-stream-number).

It is recommended that pause data-bursts be used to fill stream gaps in the MPEG-4 ALS bit stream as described in the IEC 61937-1, and that pause data-bursts be transmitted with a repetition period of 32 IEC 60958 frames, except when other repetition periods are necessary to fill the precise stream gap length (which may not be a multiple of 32 IEC 60958 frames), or to meet the requirement on burst spacing (see IEC 61937-1).

When a stream gap in an MPEG-4 ALS stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall be located after a number of sampling periods represented by the 'samples' field of the ALSSpecificConfig header in the previous MEG-4 ALS data-burst from the Pa of the previous MPEG-4 ALS frame. It is also recommended that the sequence(s) of pause data-bursts that fill the stream gap should continue from this point up to (as close as possible, considering the 32 IEC 60958 frame length of the pause data-burst) the Pa of the first MPEG-4 ALS data-burst that follows the stream gap. The MPEG-4 ALS decoder can detect the number of decoded PCM samples by using the value set in the 'samples' field of ALSSpecificConfig.

Table 2 shows the relation between the sample rate of MPEG-4 ALS encoded audio and the IEC 60958 frame rate used to deliver MPEG-4 ALS encoded audio via the IEC 61937-10 interface.

Table 2 – Sample rate and number of channels of MPEG-4 ALS encoded audio, multiplier, and IEC 60958 frame rate

Audio sampling rate kHz	Number of channels	Multiplier	IEC 60958 frame rate kHz
48	1, 2	0 (×2)	96
	3 to 8	1 (×8)	384
96	1, 2	0 (×2)	192
	3 to 8	1 (×8)	768
192	1, 2	0 (×2)	384
	3 to 8	1 (×8)	1 536
44,1	1, 2	0 (×2)	88,2
	3 to 8	1 (×8)	352,8

5.2.2 Latency of MPEG-4 ALS decoding

The latency of an external audio decoder to decode MPEG-4 ALS is defined as the sum of the receiving delay time and the decoding delay time as shown in Figure 2.

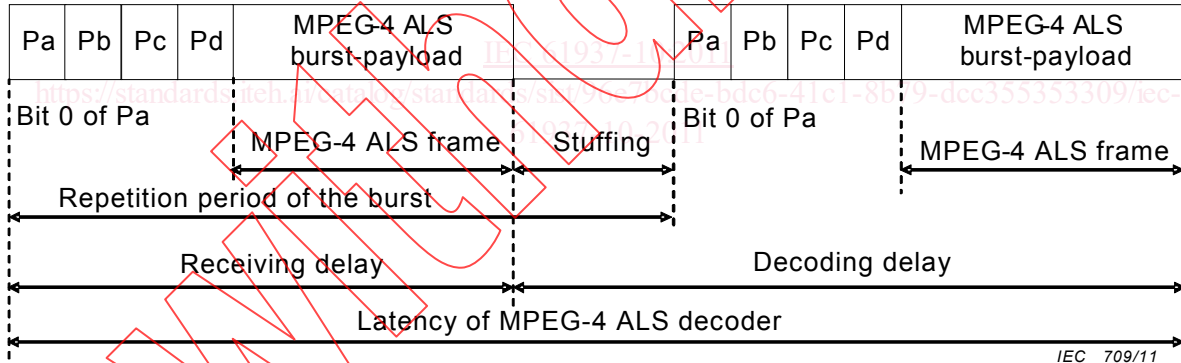


Figure 2 – Latency of MPEG-4 ALS decoding

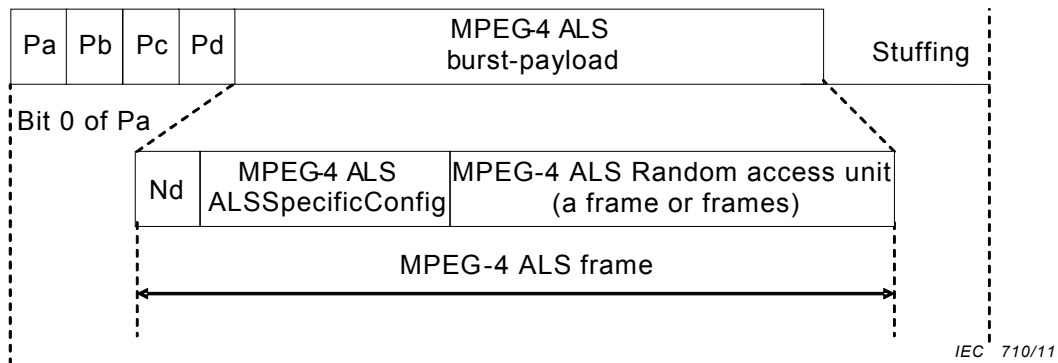


Figure 3 – The MPEG-4 ALS burst-payload

The receiving delay time to receive a whole data-burst is calculated by using the length of the burst-payload, Nd, which is shown in Figure 3. The length of preamble is 8 bytes. Since an IEC 60958 frame can contain 4 bytes, the receiving delay of an MPEG-4 ALS data-burst should be as follows:

$$\text{Receiving delay} = (N_d + 8 \text{ bytes}) / ([\text{IEC 60958 frame rate}] \times 4 \text{ bytes})$$

The maximum receiving delay time is related to the number of samples contained in the data-burst and the IEC 60958 frame rate. The number of samples, 'samples', is stored in the 9th to 12th bytes of the ALSSpecificConfig header of the MPEG-4 ALS burst-payload (13th to 16th bytes of the MPEG-4 ALS burst-payload) as shown in Figure 3. The maximum decoding delay time can be regarded as being the same as the maximum receiving delay time.

Note that the encoded size never exceeds the rate given by the IEC 60958 frame rate in theory except when the Aux data in burst is too large. The Aux size shall be small enough to ensure that the total size of the burst complies with following formula:

$$P_d \leq ((([\text{samples}] / [\text{samp_freq}]) \times [\text{IEC 60958 frame rate}] \times 4 \text{ bytes}) - 8 \text{ bytes}) / 8$$

EXAMPLE The maximum size of the MPEG-4 ALS burst-payload shall be equal to or less than the size calculated by the frame repetition period and the IEC 60958 frame rate. When the values of 'samp_freq', 'samples', 'channels', and 'resolution' are 48 000, 2 048, 1, and 1 respectively, the sampling rate of the audio signal is 48 kHz, the number of samples contained in the MPEG-4 ALS burst-payload is 2 048 samples, the number of channels is 2 (= 'channels'+1), and the number of bits per an audio sample is 16 bits. With these values, the IEC 60958 frame rate is 96 kHz as shown in Table 2. Though the receiving delay time varies depending on the compressed size of the MPEG-4 ALS burst-payload, the maximum receiving delay time can be calculated by using 'samples' and 'samp_freq'. In this example case, it should be 42,67 ms (2 048/48 000 = 0.042 67). The maximum decoding delay time should be 42,67 ms because it can be regarded as being the same as the maximum receiving delay time. The total latency of MPEG-4 ALS decoding is approximately 85,34 ms.

