IEC

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Edition 1.0 2003-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958
Part 4: Non-linear PCM bitstreams according to the MPEG audio format

Audionumérique – Interface pour les flux de bits audio à codage MIC non linéaire conformément à la CEI 60958 –
Partie 4: Flux de bits MIC non linéaire selon les formats audio MPEG

IEC 61937-4:2003

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FOREWORD

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International Standard IEC 61937-4 has been prepared by technical area 4: Digital system interfaces, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This standard cancels and replaces IEC 61937, published in 2000, which has been divided into four parts (see below). This first edition constitutes a technical revision.

This bilingual version (2012-12) corresponds to the monolingual English version, published in 2003-05.

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

FDIS	Report on voting
100/647/FDIS	100/673/RVD

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

The French version of this standard has not been voted upon.

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

IEC 61937 consists of the following parts under the general title *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958:*

Part 1: General

Part 2: Burst-info

Part 3: Non-linear PCM bistreams according to the AC-3 format

Part 4: Non-linear PCM bitstreams according to the MPEG audio formats

Part 5: Non-linear PCM bitstreams according to the DTS (Digital Theatre Systems) format(s)

Part 6: Non-linear PCM bitstreams according to the MPEG-2 AAC format

Part 7: Non-linear PCM bitstreams according to the ATRAC and ATRAC2/3 formats

The committee has decided that the contents of this publication will remain unchanged until October 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of March 2004 have been included in this copy.

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

Part 4: Non-linear PCM bitstreams according to the MPEG audio formats

1 Scope

This part of IEC 61937 specifies the method for the digital audio interface specified in IEC 60958 to convey non-linear PCM bitstreams encoded in accordance with the MPEG audio.

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

3 Terms and definitions

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

3.1 Definitions

3.1.1
latency
delay time of an external audio decoder to decode an AC-3 data-burst, defined as the sum of two values of the receiving delay time and the decoding delay time

3.2 Abbreviations

3.2.1
ATSC
Advanced Television Systems Committee

3.2.2
MPEG
Moving Pictures Expert Group, a joint committee of ISO and IEC

3.2.3
ITU-R
International Telecommunication Union, Radio Communication Bureau

3.3 Presentation convention

F872h
Value ‘F872’ in hexadecimal format

4 Mapping of the audio bitstream on to IEC 61937

The coding of the bitstream and data-burst is in accordance with IEC 61937-1.

The 16-bit burst-info contains information about the data that will be found in the data-burst (see Table 1).

Table 1 – Fields of burst-info

Bits of Pc	Value	Contents	Reference point R	Repetition period of data-burst in IEC 60958 frames
0 – 4		Data-type		
	0 – 3	According to IEC 61937		
	4	MPEG-1 layer-1 data	Bit 0 of Pa	384
	5	MPEG-1 layer-2 or -3 data, or MPEG-2 without extension	Bit 0 of Pa	1 152
	6	MPEG-2 data with extension	Bit 0 of Pa	1 152
	7	MPEG-2 AAC	Bit 0 of Pa	1 024
	8	MPEG-2 layer-1 low sampling frequency	Bit 0 of Pa	768
	9	MPEG-2 layer-2 low sampling frequency	Bit 0 of Pa	2 304
	10	MPEG-2 layer-3 low sampling frequency	Bit 0 of Pa	1 152
	10 – 31	According to IEC 61937		
5 – 15		According to IEC 61937		

5 Format of MPEG audio data-burst

5.1 General

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

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

5.2 Pause data-burst

Pause data-bursts for MPEG audio are given in Table 2.

Table 2 – Repetition period of pause data-bursts

Data-type of audio data-burst	Repetition period of pause data-burst	
	Mandatory	Recommended
MPEG-1 layer-1 data	32 IEC 60958 frames	
MPEG-1 layer-2 or -3 data, or MPEG-2 without extension	32 IEC 60958 frames	
MPEG-2 data with extension	32 IEC 60958 frames	
MPEG-2 layer-1 low sampling frequency	64 IEC 60958 frames	
MPEG-2 layer-2 low sampling frequency	64 IEC 60958 frames	
MPEG-2 layer-3 low sampling frequency	64 IEC 60958 frames	

5.3 Audio data-types

5.3.1 MPEG-1 layer-1

An MPEG-1 layer-1 MPEG-frame represents 384 samples of each encoded channel and can be transferred using data-type 04h. The data-burst is headed with a burst-preamble, followed by the burst-payload.

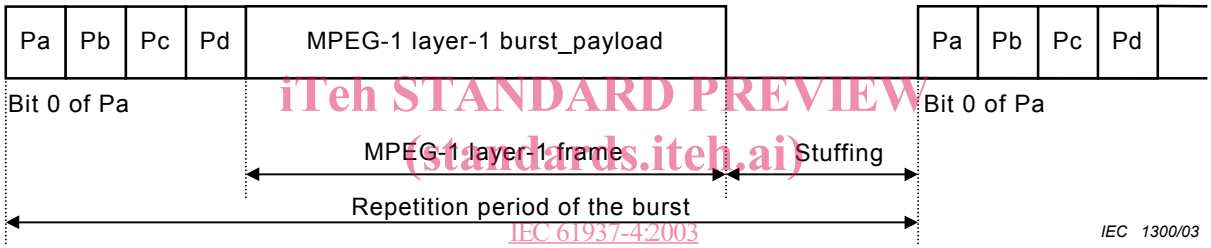

Figure 1 – MPEG-1 Layer-1 data-burst

In the case where pause data-bursts are used to fill stream gaps in the MPEG-1 layer-1 bitstream as described in IEC 61937-1, it is recommended that the pause data-bursts be transmitted with a repetition period of 32 IEC 60958 frames. The total gap length shall be a multiple of 32 IEC 60958 frames.

When a stream gap in an MPEG bitstream is filled by a sequence of pause data-bursts, the Pa of the initial pause data-burst should be located at the 16-bit data word located 384 IEC 60958 frames following the Pa of the previous MPEG data-burst. The sequence(s) of pause data-bursts that fill the stream gap shall continue from this point up to the Pa of the first MPEG data-burst which follows the stream gap. The gap-length parameter contained in the pause data-burst may be used to specify the number of decoded PCM samples that are missing (due to the gap).

The latency of an audio decoder to decode an MPEG-1 layer-1 data-burst is not defined.

5.3.2 MPEG-1 layer-2 or -3, or MPEG-2 without extension

The burst-payload of data type MPEG-1 layer-2 or -3 MPEG-2 without extension represents 1 152 samples of each encoded channel and can be transferred using data-type 05h. The data-burst is headed with a burst-preamble, followed by the burst-payload.

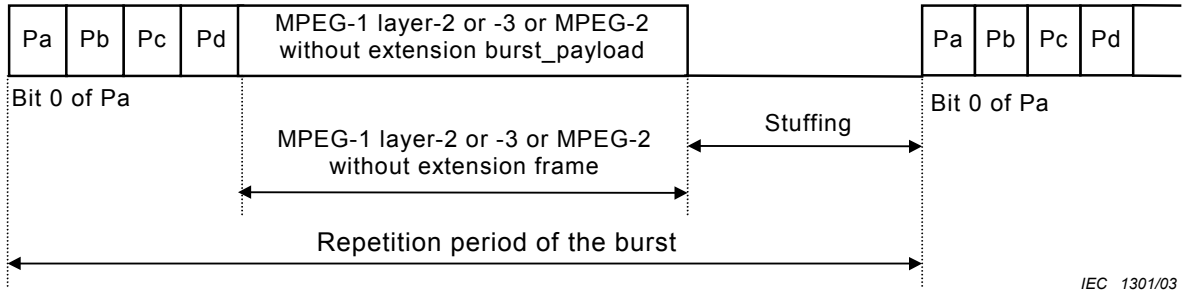

Figure 2 – Data-burst with MPEG-1 layer-2 or -3 or MPEG-2 without extension

NOTE An MPEG-2 layer-1 super-frame contains 3 MPEG-1 layer-1 base-frames and the MPEG-extension-frame. The MPEG layer-1 super-frame contains 3 × 384 = 1 152 samples per channel (see ISO/IEC 13818-3).

The data-type-dependent info for MPEG-1 layer-2 or -3 data or MPEG-2 without extension is given in Table 3.

In the case where pause data-bursts are used to fill stream gaps in the MPEG-1 layer-2 or -3 data or MPEG-2 without extension bitstream as described in IEC 61937-1, it is recommended that the pause data-bursts be transmitted with a repetition period of 32 IEC 60958 frames. The total gap length shall be a multiple of 96 IEC 60958 frames.

When a stream gap in an MPEG bitstream is filled by a sequence of pause data-bursts, the Pa of the initial pause data-burst should be located at the 16-bit data word located 1 152 IEC 60958 frames following the Pa of the previous MPEG data-burst. The sequence(s) of pause data-bursts that fill the stream gap shall continue from this point up to the Pa of the first MPEG data-burst which follows the stream gap. The gap-length parameter contained in the pause data-burst may be used to specify the number of decoded PCM samples that are missing (due to the gap).

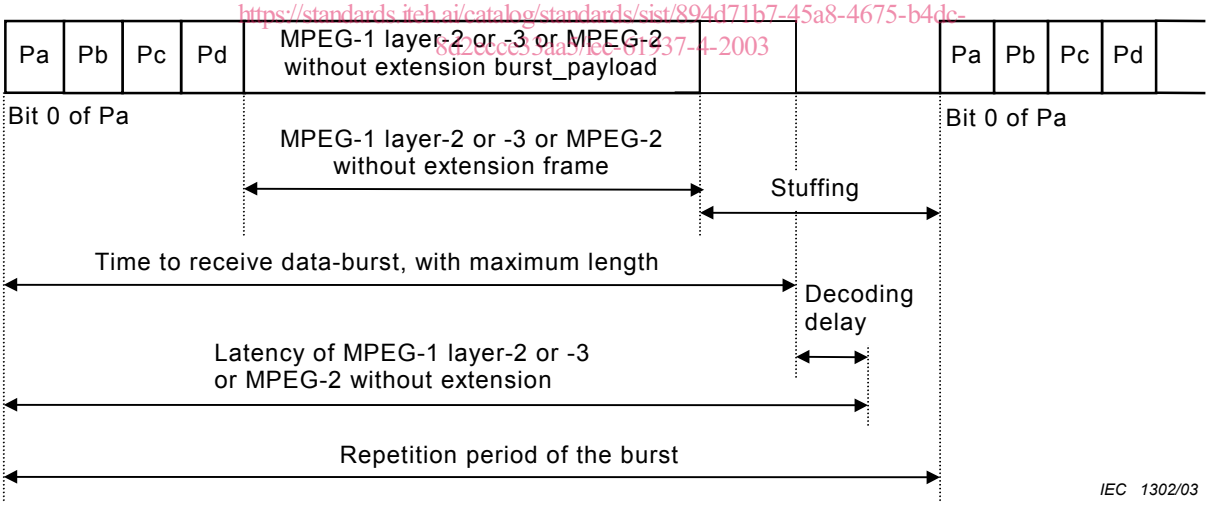

Figure 3 – Latency of MPEG-1 layer-2 or -3 or MPEG-2 without extension

The latency of an audio decoder to decode a MPEG-1 layer-2 or -3 or MPEG-2 without extension data-burst is defined as the time to receive the whole data-burst with maximum length (16,75 ms for fs = 48 kHz), plus the decoding delay, which is the time to output the first linear PCM sample (Figure 3, 4,15 ms for fs = 48 kHz). The latency is defined as a delay of 20,9 ms for fs = 48 kHz, 22,75 ms for fs = 44,1 kHz, and 31,35 ms for fs = 32 kHz.

5.3.3 MPEG-2 with extension

An MPEG-2 frame represents 1 152 samples of each encoded channel. The data type is 06h. The data-burst is headed with a burst-preamble, followed by the burst-payload.

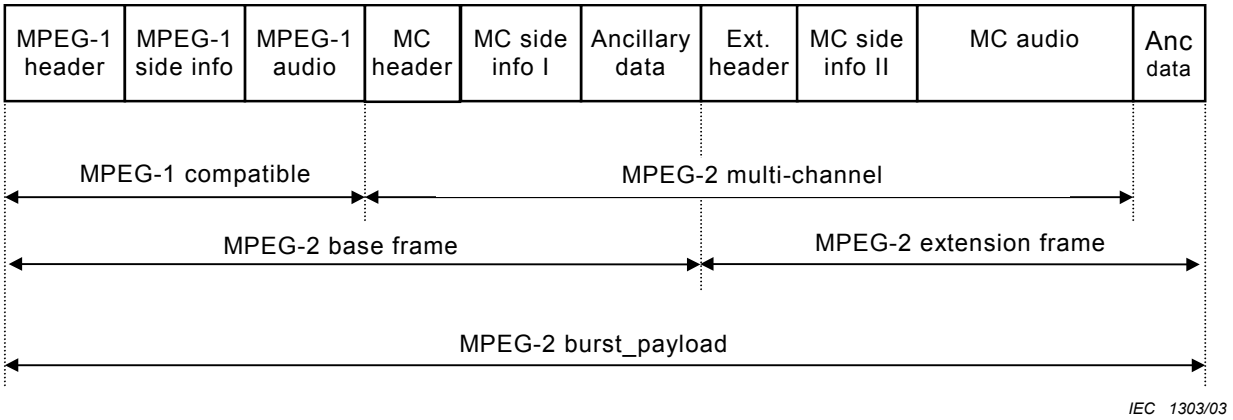

Figure 4 – Format of MPEG-base-frame and MPEG-extension-frame

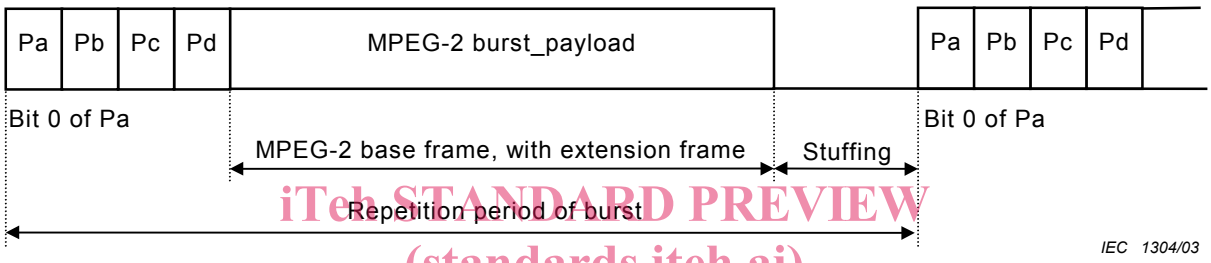

Figure 5 – MPEG 2 with extension data-burst

NOTE An MPEG-2 layer-1 MPEG-super-frame contains 3 layer-1 base frames and the extension frame. The layer-1 MPEG-super-frame contains 3 × 384 = 1152 samples per channel (see ISO/IEC 13818-3).

The data-type-dependent info is given in Table 3.

Table 3 – Data-type-dependent info for data-types 5 and 6

Bits of Pc LSB..MSB	Value LSB..MSB	Contents	Remarks
8	0	Normal mode	Second stereo = second stereo
	1	Karaoke mode	Second stereo = Karaoke
9 – 10	00	Dynamic Range Control does not exist in MPEG audio stream	
	10	Dynamic Range Control exists in MPEG audio stream	
	01	Reserved	
	11	Reserved	
11 – 12	00	Reserved	
	10	Reserved	
	01	Reserved	
	11	Reserved	

In the case where pause data-bursts are used to fill stream gaps in the MPEG-2 with extension bit stream as described in IEC 61937-1, it is recommended that the Pause data-bursts be transmitted with a repetition period of 32 IEC 60958 frames. The total gap length shall be a multiple of IEC 60958 frames. The total gap length shall be a multiple of 96 IEC 60958 frames.

When a stream gap in an MPEG bitstream is filled by a sequence of Pause data-bursts, the Pa of the initial pause data-burst should be located at the 16-bit data word located 1 152 sampling periods following the Pa of the previous MPEG data-burst. The sequence(s) of pause data-bursts that fill the stream gap shall continue from this point up to the Pa of the first MPEG data-burst which follows the gap. The gap-length parameter contained in the pause data-burst may be used to specify the number of decoded PCM samples that are missing (due to the gap).

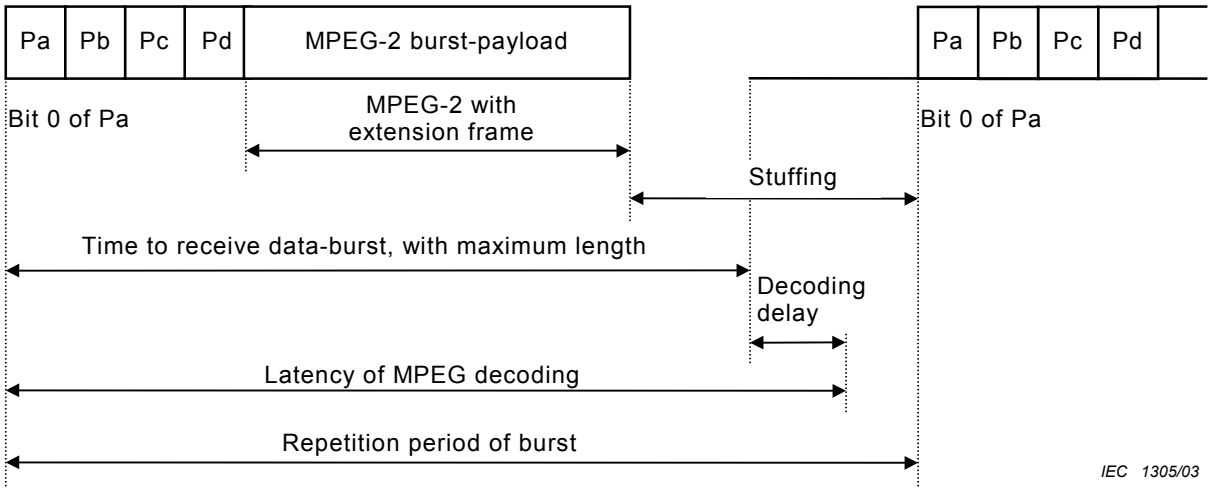

Figure 6 – Latency of MPEG-2 with extension

The latency of an audio decoder to decode an MPEG-2 with extension data-burst is defined as the time to receive the whole data-burst with maximum length (16,75 ms for fs = 48 kHz), plus the decoding delay, which is the time to output the first linear PCM sample (Figure 3, 4,15 ms for fs = 48 kHz). The latency is defined as a delay of 20,9 ms for fs = 48 kHz, 22,75 ms for fs = 44,1 kHz, and 31,35 ms for fs = 32 kHz.

5.3.4 MPEG-2 layer-1 low sampling frequency

An MPEG-2 layer-1 frame with low sampling frequency represents 384 samples of each encoded channel and can be transferred using data-type 08h. The data-burst is headed with a burst-preamble, followed by the burst-payload.

In the case where pause data-bursts are used to fill gaps in the MPEG-2 layer-1 low sampling frequency bitstream as described in IEC 61937-1, it is recommended that the pause data-bursts be transmitted with a repetition period of 64 IEC 60958 frames. The total gap length shall be a multiple of 64 IEC 60958 frames.

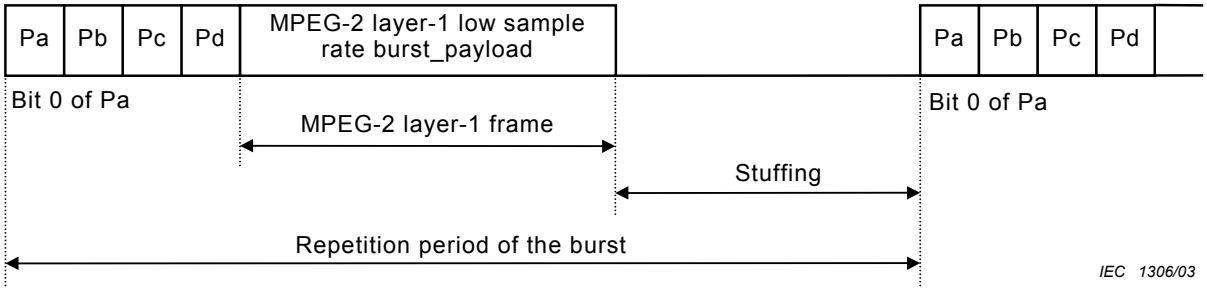

Figure 7 – MPEG-2 layer-1 low sampling frequency data-burst