

INTERNATIONAL STANDARD

Digital audio – Interface for non-linear PCM encoded audio bitstreams applying
IEC 60958 –
Part 15: Non-linear PCM bit streams according to Auro-Cx format

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIGITAL AUDIO – INTERFACE FOR NON-LINEAR PCM
ENCODED AUDIO BITSTREAMS APPLYING IEC 60958 –****Part 15: Non-linear PCM bit streams according to Auro-Cx format**

FOREWORD

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The text of this International Standard is based on the following documents:

Draft	Report on voting
100/3462/CDV	100/3536/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available

at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all 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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
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- replaced by a revised edition, or
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INTRODUCTION

The Auro-3D®¹ format has brought immersive 3D audio to the digital cinema and consumer electronics markets since 2011, and started a revolution in the audio industry, bringing the next generation audio experience to the user.

To accommodate the shift towards the use of streaming using set-top boxes, smart TVs and other connected devices, a new audio codec was developed: Auro-Cx®².

To be able to pass the Auro-Cx bit stream from said connected devices to an AV-receiver for decoding via the IEC 60958 interface, the IEC 61937 series must support the Auro-Cx format.

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¹ Auro-3D is a trademark owned by Auro Technologies NV. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

² Auro-Cx is the trademark of a product supplied by Auro Technologies NV. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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

Part 15: Non-linear PCM bit streams according to Auro-Cx format

1 Scope

This part of IEC 61937 describes the method to convey non-linear PCM bit streams in accordance with the Auro-Cx format.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61937-1:2021, *Digital audio interface for non-linear PCM encoded audio bitstreams applying IEC 60958 – Part 1: General*

IEC 61937-2:2021, *Digital audio interface for non-linear PCM encoded audio bitstreams applying IEC 60958 – Part 2: Burst Information*

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3 Terms, definitions and abbreviated terms

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Terms and definitions

3.1.1

Auro-Cx block

block containing all Auro-Cx audio data and metadata, formatted in accordance with the Auro-Cx Bit Stream format

3.1.2

block size

number of samples represented by an Auro-Cx block, indicated by the value of the BlockSize Auro-Cx bit stream parameter

3.1.3

latency

delay time introduced by an external Auro-Cx decoder while decoding an Auro-Cx data block, defined as the sum of the receiving delay time and the decoding delay time

3.1.4

sample rate

sampling frequency³ of the linear PCM samples represented in the Auro-Cx bit stream, as indicated by the value of the acxSampleRateIdx Auro-Cx bit stream parameter

3.1.5

Auro-Cx audio frame rate

number of Auro-Cx blocks per second

3.1.6

fractional frame rate

audio frame rates with non-integer values, which are written in shorthand notation as shown in Table 1

Table 1 – Fractional frame rates

Fractional Auro-Cx frame rate in fps	Shorthand notation
$24 \times 1000 / 1001$	23,976
$30 \times 1000 / 1001$	29,97
$48 \times 1000 / 1001$	47,972
$60 \times 1000 / 1001$	59,94
$120 \times 1000 / 1001$	119,88

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3.2 Abbreviated terms

ACX	Auro-Cx	IEC 61937-15:2021
fps	frames per second	311505317391/iec-61937-15-2021
fs	sampling frequency	
HBR	high bit rate	
spb	samples per block	

4 Mapping of the audio bit stream on to IEC 61937-1

4.1 General

The coding of the bit stream and data-burst is in accordance with IEC 61937-1 and IEC 61937-2.

4.2 Auro-Cx burst-info

The 16-bit burst-info contains information about the data that will be found in the data-burst (see Table 2).

³ Auro-Cx supports sample rates up to 96 kHz.

Table 2 – Burst-info for Auro-Cx data-type and subdata-types

Bits of Pc	Data type value (bits 0–4)	Subdata-type value (bits 5–6)	Contents	Reference point R	Repetition period of data-burst in IEC 60958 frames
0–6	0–25	According to IEC 61937-2			
	26	0	ACX	bit 0 of Pa	See Table 7
		1	ACX HBR2	bit 0 of Pa	See Table 12
		2	ACX HBR4	bit 0 of Pa	See Table 17
		3	ACX HBR8	bit 0 of Pa	See Table 22
27–31	According to IEC 61937-2				
7–15	According to IEC 61937-1				

The burst-info (Pc) bits 0-4 signal the data-type used for the transmission. For Auro-Cx, the data-type is set to 26.

Pc bits 5-6 indicate the Auro-Cx bit stream mode. The repetition periods of data-bursts in IEC 60958 frames shall be derived from the data-type-dependent information specified in Table 4, Table 9, Table 14 and Table 19.

5 Format of Auro-Cx data-bursts

5.1 General

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

To establish synchronisation between the picture and decoded audio, the transmitter should use the latency indicated for the data-type to schedule data-bursts as necessary.

5.2 Pause data-burst

The Pause data-burst for Auro-Cx is given in Table 3.

Table 3 – Repetition period of the Pause data-bursts

Data-type of audio data-burst	Repetition period of Pause data-burst	
	Mandatory	Recommended
ACX	-	3
ACX HBR2	-	5
ACX HBR4	-	5
ACX HBR8	-	5

If regular audio data-bursts are not being transmitted because of a pause condition, for example, it is recommended that Pause data-bursts are used to fill the stream gaps in the ACX bit stream, as described in IEC 61937-1. The Pause data-bursts should be transmitted with a repetition rate period in accordance with Table 3, except when other repetition periods are necessary to fill the precise stream gap length, which may not be a multiple of 3 IEC 60958 frames, or to meet the requirement on burst spacing (refer to IEC 61937-1).

When a stream gap in an ACX stream is filled by a sequence of Pause data-bursts, the Pa of the first Pause data-burst shall be located one data-burst repetition period following the Pa of

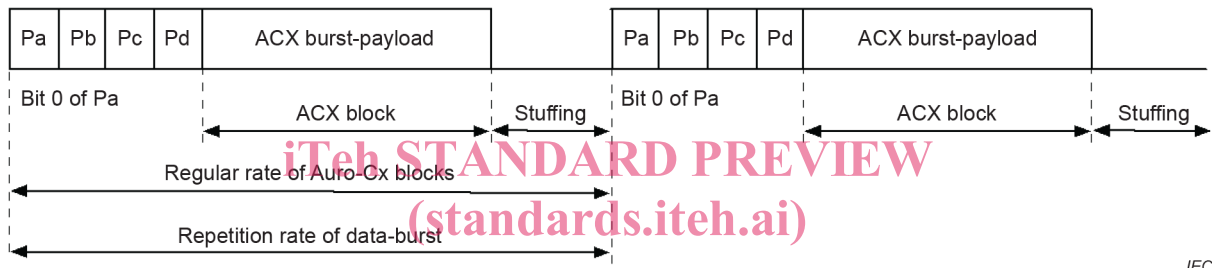
the previous Auro-Cx block. It is recommended that the sequence(s) of Pause data-bursts, which fill the stream gap, should continue from this point up to (as close as possible considering the total IEC 60958 frame length of the Pause data-burst) the Pa of the first ACX data-burst that follows the stream gap.

The gap length parameter contained in the Pause data-burst is intended to be interpreted by the Auro-Cx decoder as an indication of the number of decoded PCM samples that are missing (due to the resulting audio gap).

5.3 Audio data-bursts

5.3.1 ACX data-burst

An ACX bit stream consists of a sequence of Auro-Cx blocks. The ACX data-burst is headed with a burst-preamble, followed by the burst-payload and stuffing. The structure of the ACX data-burst is shown in Figure 1. The data-type of an ACX data-burst is 26 and the subdata-type is 0. When transmitting Auro-Cx data, the transmitter needs to set both the data-type and subdata-type correctly. The receiving device shall then use both values to make sure that the content of the data-burst is identified as Auro-Cx.



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Figure 1 – ACX data-burst

The data-type dependent information for Auro-Cx is specified in Table 4.

Table 4 – Data-type-dependent information for ACX

Bits of Pc LSB..MSB	Value	Meaning
8–12	See Table 5.	Repetition period of the data-burst in IEC 60958 frames

The ACX burst-payload always contains a single Auro-Cx block. The transmitter shall therefore make sure that the ACX burst-payload is constructed from a single Auro-Cx block only. It is not allowed to transmit a single Auro-Cx block using multiple data-bursts. The length of the Auro-Cx data-burst will depend on the encoded block size.

The reference point R of an Auro-Cx data-burst is bit 0 of Pa. The block size of the Auro-Cx bit stream defines the repetition period of the Auro-Cx data-burst. The IEC 60958 frame rate shall be equal to the sample rate of the ACX bit stream. Because Auro-Cx supports multiple block sizes that match commonly used video frame rates, the transmitter shall ensure that the selected ACX data-burst repetition rate is equal to the block size, as specified in Table 5.