IEC 61937-5

Edition 2.1   2019-01
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour
inside

Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 –
Part 5: Non-linear PCM bitstreams according to the DTS (Digital Theater Systems) format(s)

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

![IEC logo] **IEC 61937-5**

Edition 2.1   2019-01
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 –
Part 5: Non-linear PCM bitstreams according to the DTS (Digital Theater Systems) format(s)

IEC 61937-5

Edition 2.1   2019-01
CONSOLIDATED VERSION

REDLINE VERSION

Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 –
Part 5: Non-linear PCM bitstreams according to the DTS (Digital Theater Systems) format(s)

IEC 61937-5:2006-01+AMD1:2019-01 CSV(en)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61937-5 edition 2.1 contains the second edition (2006-01) [documents 100/974/CDV and 100/1055/RVC] and its amendment 1 (2019-01) [documents 100/3101/CDV and 100/3163/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61937-5 has been prepared by Technical Area 4: Digital system interfaces and protocols, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition.

a) References to the company name Digital Theater Systems have been changed to DTS which is consistent with the official change of the company name.
b) DTS type IV has been added to Table 1 and 5.3.4 describing type IV has been added.
c) Annex A, which provides examples of the use of the repetition period parameter introduced in subclause 5.3.4, has been added.

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 bitstreams according to the AC-3 format

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

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

Part 6:   Non-linear PCM bitstreams according to the ATRAC, ATRAC2/3 and ATRAC-X formats

Part 8:   Non-linear PCM bitstreams according to the Windows Media Audio Professional[1]

The committee has decided that the contents of the base publication and its amendment 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

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

A bilingual version may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

---

[1] To be published.

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

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

1 Scope

This part of IEC 61937 describes audio bitstreams encoded according to the Digital Theater Systems (DTS) format data-types I, II, III, and IV.

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 60958-1, *Digital audio interface – Part 1: General*

IEC 60958-3, *Digital audio interface – Part 3: Consumer applications*

IEC 60958-4, *Digital audio interface – Part 4: Professional applications*

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 Information*

3 Terms, definitions, abbreviations and presentation convention

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

3.1 Definitions

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

3.2 Abbreviations

IEC   International Electrotechnical Commission

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

3.3 Presentation convention

F872h   Value 'F872' in hexadecimal format

4 Mapping of the audio bitstream on to IEC 61937-1

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

4.1 DTS burst-info

The 16-bit burst-info contains information about the data which will be found in the data-burst.

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 – 10	According to IEC 61937		
	11	DTS type I	bit 0 of Pa	512
	12	DTS type II	bit 0 of Pa	1 024
	13	DTS type III	bit 0 of Pa	2 048
	14 – 16	According to IEC 61937		
	17	DTS type IV		Dependent on bits 8 – 10
	14 – 31	According to IEC 61937	bit 0 of Pa	
5,6		Reserved		
7		According to IEC 61937		
8 – 10		Reserved for DTS Types I, II and III, ~~For the~~ Repetition period for DTS Type IV, see Table 6		
11 – 12	0 – 3	~~Reserved~~ Profile		
13 – 15		According to IEC 61937		

5 Format of DTS data-bursts

This clause specifies the audio data-bursts DTS type I, DTS type II, DTS type III and DTS type IV. Specific properties such as reference points, repetition period, the method of filling stream gaps, and decoding latency are specified for each data-type.

5.1 General

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-burst for DTS type I, DTS type II, DTS type III and DTS type IV is given in Table 2.

Table 2 – Repetition period of the pause data-bursts

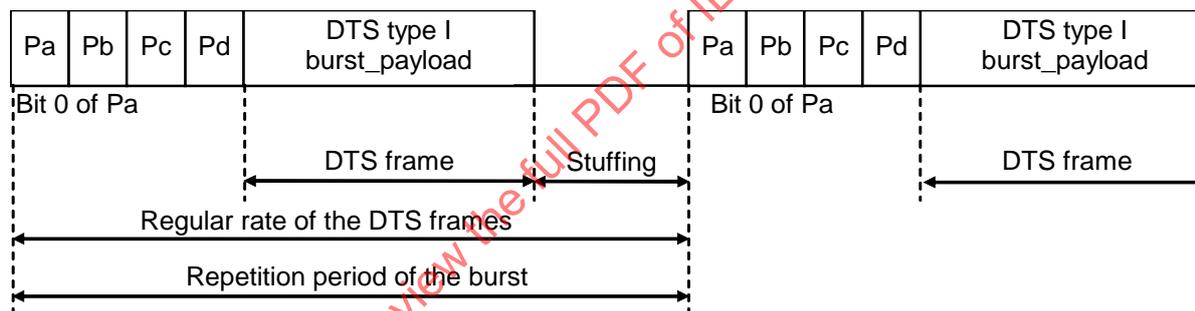| Data-type of audio data-burst	Repetition period of pause data-burst	
	Mandatory	Recommended
DTS type I	-	3 IEC 60958 frames
DTS type II	-	3 IEC 60958 frames
DTS type III	-	3 IEC 60958 frames
DTS type IV	-	3 IEC 60958 frames

5.3 Audio data-bursts

5.3.1 DTS type I

The DTS bitstream consists of sequences of DTS frames. The data-type of a DTS data-burst type I is 0Bh. 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 DTS type I data shall contain one complete DTS-frame and represents 512 samples for each encoded channel.

NOTE 1   The length of the DTS type I data-burst depends on the encoded bit rate (which determines the DTS-frame length).

NOTE 2   The reference to the specification for the DTS bitstream, representing 512 samples of encoded audio per frame, is given in the bibliography.

IEC 2671/05

Figure 1 – DTS type I data-burst

The data-type-dependent information for DTS type I is given in Table 3.

Table 3 – Data-type-dependent when DTS type I

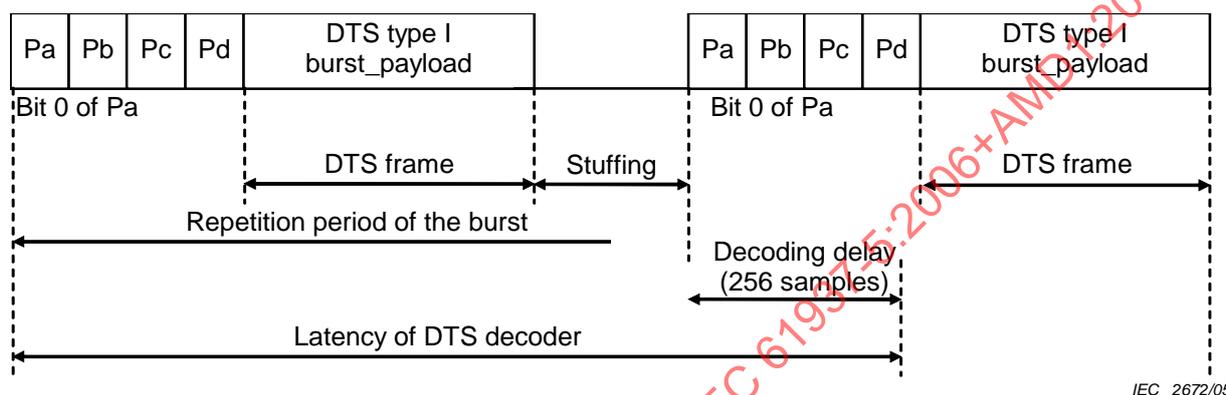| Bits of Pc LSB..MSB	Value	Contents
8-12	00h	Reserved, shall be set to '0'

The reference point of a DTS type I data-burst is bit 0 of Pa and occurs exactly once every 512 sampling periods. The data-burst containing DTS type I frames occurs at a regular rate, with the reference point of each DTS type I data-burst beginning 512 IEC 60958 frames after the reference point of the preceding DTS type I data-burst (of the same bit-stream-number).

It is recommended that pause data-bursts be used to fill stream gaps in the DTS type I bitstream, as described in IEC 61937, and that pause data-bursts be transmitted with a repetition period of 3 IEC 60958 frames, 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 (see IEC 61937).

When a stream gap in a DTS type I stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall be located 512 sampling periods following the Pa of the previous DTS type I frame. 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 3 IEC 60958 frame length of the pause data-burst) the Pa of the first DTS type I data-burst which follows the stream gap.

NOTE 3   The gap-length parameter contained in the pause data-burst is intended to be interpreted by the DTS decoder as an indication of the number of decoded PCM samples which are missing (due to the resulting audio gap).

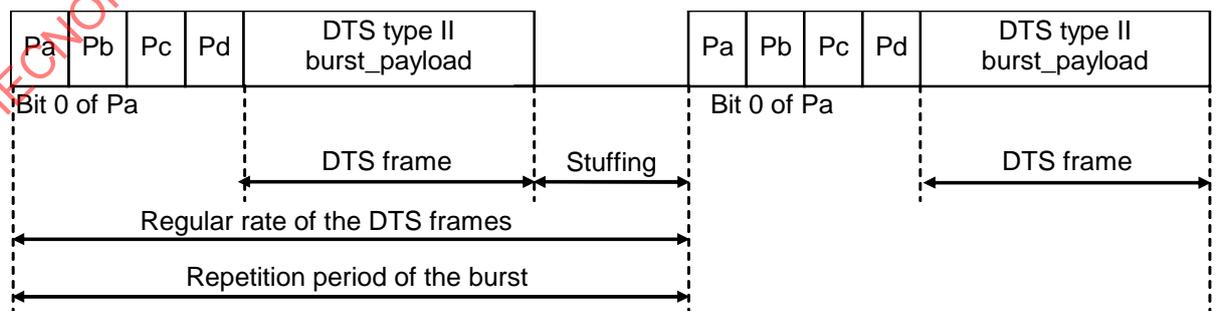**Figure 2 – Latency of DTS type II decoding**

NOTE 4   The latency of a DTS decoder is defined as a delay measured from the reference point and equal to one frame (10,67 ms) plus 5,33 ms (equivalent to 256 samples). This is 768 PCM samples or 16 ms at 48 kHz sampling frequency.

5.3.2   DTS type II

The DTS bitstream consists of sequences of DTS frames. The data-type of a DTS data-burst type II is 0Ch. 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 DTS type II data shall contain one complete DTS-frame and represents 1 024 samples for each encoded channel.

NOTE 1   The length of the DTS type II data-burst depends on the encoded bit rate (which determines the DTS-frame length).

NOTE 2   The reference to the specification for the DTS bitstream, representing 1 024 samples of encoded audio per frame, is given in the bibliography.

Figure 3 – DTS type II data-burst

The data-type-dependent information for DTS type II is given in Table 4.

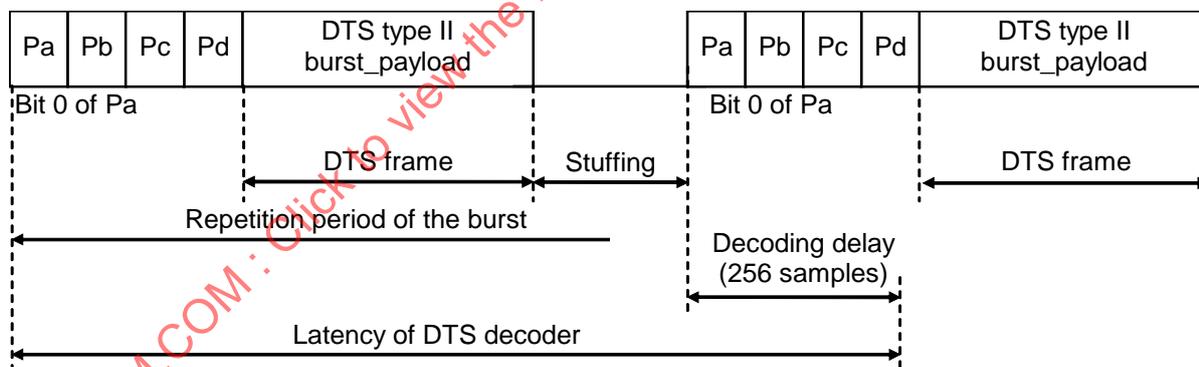**Table 4 – Data-type-dependent when DTS type II**

Bits of Pc LSB..MSB	Value	Contents
8-12	00h	Reserved, shall be set to '0'

The reference point of a DTS type II data-burst is bit 0 of Pa and occurs exactly once every 1 024 sampling periods. The data-burst containing DTS type II frames shall occur at a regular rate, with the reference point of each DTS type II data-burst beginning 1 024 IEC 60958 frames after the reference point of the preceding DTS type II data-burst (of the same bit-stream-number).

It is recommended that pause data-bursts be used to fill stream gaps in the DTS type II bitstream, as described in IEC 61937, and that pause data-bursts be transmitted with a repetition period of 3 IEC 60958 frames, 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 (see IEC 61937).

When a stream gap in a DTS type II stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall be located 1 024 sampling periods following the Pa of the previous DTS type II frame. 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 3 IEC 60958 frame length of the pause data-burst) the Pa of the first DTS type II data-burst which follows the stream gap.

NOTE 3   The gap-length parameter contained in the pause data-burst is intended to be interpreted by the DTS decoder as an indication of the number of decoded PCM samples which are missing (due to the resulting audio gap).

Figure 4 – Latency of DTS type II decoding

NOTE 4   The latency of a DTS decoder is defined as a delay measured from the reference point and equal to one frame (21,34 ms) plus 5.33 ms (equivalent to 256 samples). This is 1 280 PCM samples or 26,67 ms at 48 kHz sampling frequency.

5.3.3   DTS type III

The DTS bitstream consists of sequences of DTS frames. The data-type of a DTS data-burst type III is 0Dh. 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 DTS type III data shall contain one complete DTS-frame and represents 2 048 samples for each encoded channel.

NOTE 1   The length of the DTS type III data-burst depends on the encoded bit rate (which determines the DTS-frame length).

NOTE 2   The reference to the specification for the DTS bitstream, representing 2 048 samples of encoded audio per frame, is given in the bibliography.
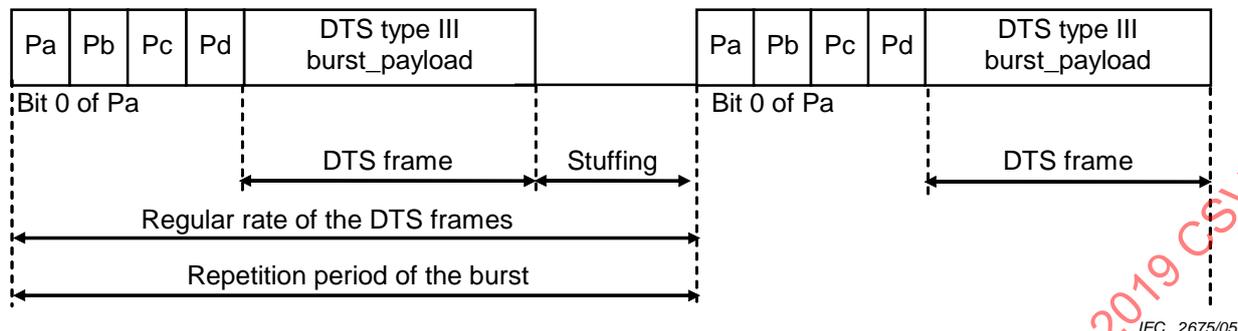

IEC   2675/05

Figure 5 – DTS type III data-burst

The data-type-dependent information for DTS type III is given in Table 5.

Table 5 – Data-type-dependent when DTS type III

Bits of Pc LSB..MSB	Value	Contents
8-12	00h	Reserved, shall be set to '0'

The reference point of a DTS type III data-burst is bit 0 of Pa and occurs exactly once every 2 048 sampling periods. The data-burst containing DTS type III frames shall occur at a regular rate, with the reference point of each DTS type III data-burst beginning 2 048 IEC 60958 frames after the reference point of the preceding DTS type III data-burst (of the same bit-stream-number).

It is recommended that pause data-bursts be used to fill stream gaps in the DTS type III bitstream as described in IEC 61937, and that pause data-bursts be transmitted with a repetition period of 3 IEC 60958 frames, 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 (see IEC 61937).

When a stream gap in a DTS type III stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall be located 2 048 sampling periods following the Pa of the previous DTS type III frame. 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 3 IEC 60958 frame length of the pause data-burst) the Pa of the first DTS type III data-burst which follows the stream gap.

NOTE 3   The gap-length parameter contained in the pause data-burst is intended to be interpreted by the DTS decoder as an indication of the number of decoded PCM samples which are missing (due to the resulting audio gap).
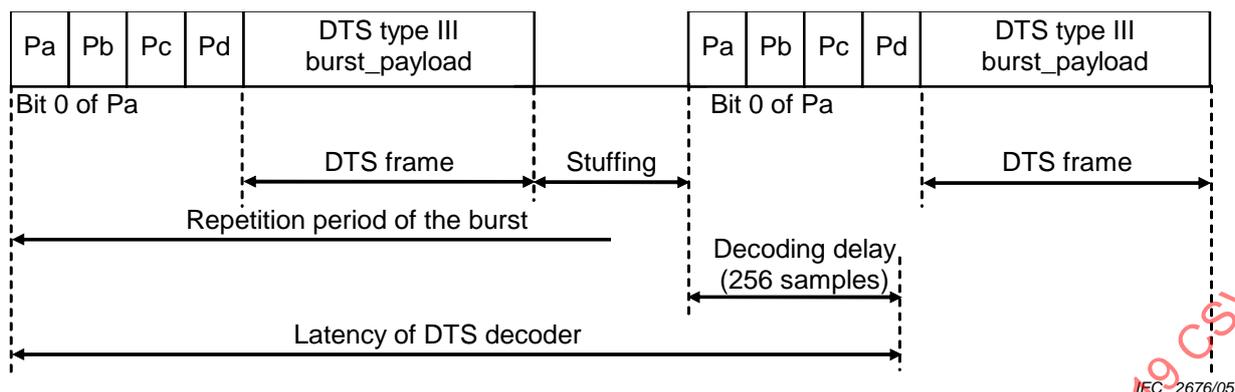
Figure 6 – Latency of DTS type III decoding

NOTE 4   The latency of a DTS decoder is defined as a delay measured from the reference point and equal to one frame (42,67 ms) plus 5,33 ms (equivalent to 256 samples). This is 2 304 PCM samples or 48 ms at 48 kHz sampling frequency.

5.3.4   DTS type IV

The DTS bitstream consists of sequences of DTS frames. The data-type of a DTS data-burst type IV is 11h. The data-burst is headed with a burst-preamble, followed by the burst-payload, and stuffed with stuffing bits. The data-type-dependent information for DTS type IV is given in Table 6.

The frame duration is the period of each complete audio frame and is relative to the base sample rate. In theory, any supported base sample rate may be applied. The burst repetition period is set in bits 8 – 10 of Pc (see Table 6). The IEC 60958 frame rate has an integer relationship to the base sample rate of the compressed audio being delivered. Any supported base sample rate may be applied. The nominal base sample rate for DTS Type IV is 48 kHz.

NOTE 1   The length of the DTS type IV data-burst depends on the encoded bit rate and the duration of the burst.

NOTE 2   The reference to the specification for the DTS-HD bitstream is given in the bibliography.

Bits 11 and 12 are used to indicate a profile of DTS type IV.

The units of **burst_length** shall be in bytes. This means the maximum size of a burst is 65 535 bytes.

The data-type-dependent information for DTS Type IV is given in Table 6.

Table 6 – Data-type-dependent ~~when~~ information for DTS type IV

Bits of Pc	Value	Meaning	
0 – 4	17	DTS type IV	
5,6		Reserved	
7		According to IEC 61937	
8 – 10	0	Repetition period of data burst in IEC 60958 frames	512
	1		1 024
	2		2 048
	3		4 096
	4		8 192
	5		16 384
	6		Reserved
	7		Reserved
11 – 12	0	~~Reserved~~ Type IV profile	Single Burst Mode
	1		Multi-Burst Mode
	2		Profile 2
	3		Profile 3
13 – 15		According to IEC 61937	

The reference point of a DTS type IV data-burst is bit 0 of Pa. The data-burst containing DTS type IV frames shall occur at a regular rate, with the reference point of each DTS type IV data-burst beginning one audio frame period after the reference point of the preceding DTS type IV data-burst.

It is recommended that pause data-bursts be used to fill stream gaps in the DTS type IV bitstream as described in IEC 61937, and that pause data-bursts be transmitted with a repetition period of 3 IEC 60958 frames, 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 (see IEC 61937).

When a stream gap in a DTS type IV stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall be located one audio frame period following the Pa of the previous DTS type IV frame. It is recommended that the sequence(s) of pause data-bursts that fill the stream gap ~~should continue~~ be continued from this point up to (as close as possible considering the 3 IEC 60958-frame length of the pause data-burst) the Pa of the first DTS type IV data-burst that follows the stream gap.

NOTE ~~3~~ The gap-length parameter contained in the pause data-burst is intended to be interpreted by the DTS decoder as an indication of the number of decoded PCM samples that are missing (due to the resulting audio gap).

~~NOTE 4 The latency of a DTS decoder is defined as a delay measured from the reference point and equal to one frame (10,67 ms) plus one subframe (256 samples at 48 kHz or 5,33 ms), equivalent to 16 ms.~~

5.3.5   DTS type IV profile definitions

5.3.5.1   Type IV profile = 0: single burst mode

DTS type IV profile 0 shall deliver a DTS audio frame in a each burst. The burst repetition period, indicated with bits 8 – 10 of Pc, is relative to the period of the IEC 60958 frame. Figure 7 provides a representation of the repetition period of the burst.

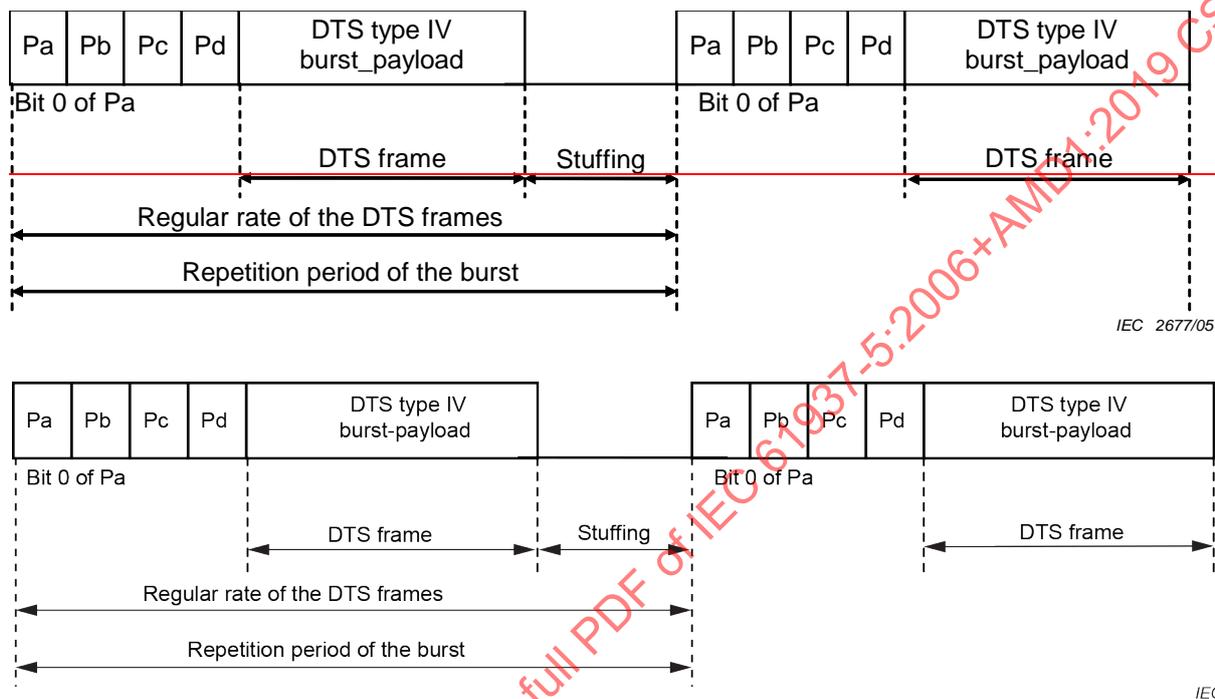NOTE 1   The length of the DTS type IV data-burst depends on the encoded bit rate and duration of the burst.

Figure 7 – DTS type IV single ~~data~~-burst mode

The decoder latency of a DTS stream delivered using DTS type IV single burst mode is shown in Figure 8.
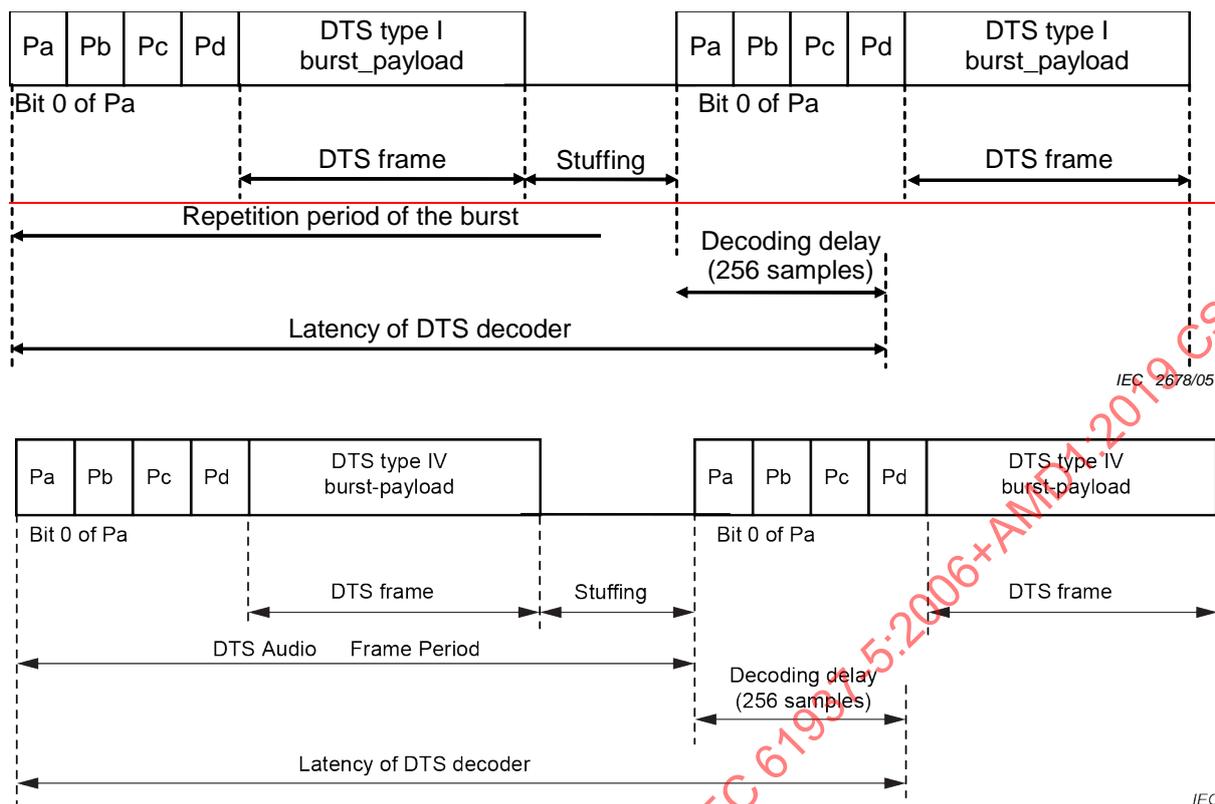
Figure 8 – Decoder latency of DTS type IV ~~decoding~~ single burst mode

NOTE 2   The latency of a DTS decoder is defined as a delay measured from the reference point, and equal to one frame (10,67 ms) plus one subframe (256 samples at 48 kHz, or 5,33 ms), equivalent to 16 ms.

5.3.5.2   Type IV profile = 1: multi-burst mode

DTS type IV profile 1 delivers a DTS audio frame in a multi-burst sequence, which consists of 1, 2, 4, or 8 bursts. The burst repetition period, indicated with bits 8 – 10 of Pc, is relative to the period of the IEC 60958 frame. The repetition period of the multi-burst sequence shall be equal to the DTS audio-frame period.

The first byte of each burst-payload is the multi-burst control byte (MBControl). The multi-burst control byte is defined in Table 7.

Table 7 – Bits of multi-burst control byte

Bits of ControlByte	Coded value	Interpretation	Parameter name
7 (MSB)	0	0	Reserved
6, 5	0	1	MaxBursts
	1	2	
	2	4	
	3	8	
4, 3, 2	0	0	BurstIndex
	1	1	
	2	2	
	3	3	
	4	4	
	5	5	
	6	6	
	7	7	
1, 0	0	8	DelayFactor
	1	4	
	2	2	
	3	1	

A representation of a multi-burst sequence is shown in Figure 9. This representation assumes the case of 2 or more data-bursts per multi-burst sequence, and any data-bursts between the first and last data-burst are represented as data-burst n.
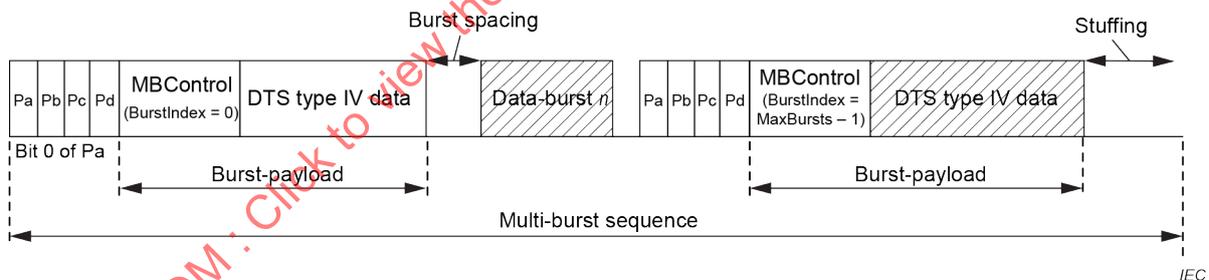

Figure 9 – DTS type IV multi-burst mode

MaxBursts – indicates the number of data-bursts in a multi-burst sequence. The valid values of MaxBursts are 1, 2, 4 or 8 data-bursts per multi-burst sequence. Note that

$$P_{dts} = P_{burst} * MaxBursts$$

where:

P_{dts} is the period of the DTS audio frame, and

P_{burst} is the period of the data burst according to bits 8 – 10 of Pc (see Table 6).

To convert P_{dts} into units of seconds, divide this value by the IEC 60958 frame rate in Hz.

BurstIndex – indicates the index of current burst within the multi-burst sequence. The first data-burst in a multi-burst sequence shall have $BurstIndex = 0$. A multi-burst sequence shall align the DTS audio frame to begin in the first data-burst of the multi-burst sequence. Subsequent bursts in the multi-burst sequence shall have $BurstIndex$ increment monotonically, with the multi-burst sequence terminating when $BurstIndex = (MaxBursts - 1)$.

DelayFactor – This parameter is used to determine the total decoder latency of the transmitted elementary bitstream. Decoder delay is defined as follows:

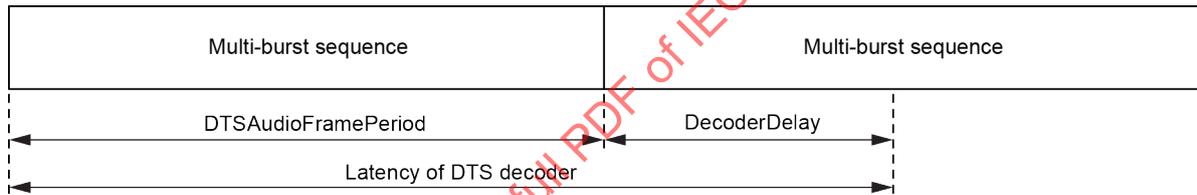$$D_{\text{decoder}} = \frac{P_{\text{dts}}}{DelayFactor}$$

and

$$L_{\text{total}} = P_{\text{dts}} + D_{\text{decoder}}$$

where

D_{decoder} is the delay of the decoder, and

L_{total} is the total latency of the DTS decoder expressed in IEC 60958 frame periods. To convert latency into units of seconds, divide this value by the IEC 60958 frame rate in Hz.

Decoder latency for audio delivered using multi-burst mode is illustrated in Figure 10.

Figure 10 – Decoder latency for DTS type IV multi-burst mode

5.3.5.3   Type IV profile = 2

DTS type IV profile 2 is reserved for future definition.

5.3.5.4   Type IV profile = 3

DTS type IV profile 3 is reserved for future definition.

Annex A
(informative)

**Effect of repetition period of data burst and Fs on frame period
and maximum data rate in DTS type IV**

A.1   Selection of DTS type IV mode

The DTS type IV mode selected will depend on the data rate required by the payload. Table A.1 shows IEC 60958 frame rates and repetition period and payload capacity in Mbps for the symbol rates shown.

Table A.1 – DTS type IV payload and frame repetition: some examples

Frame repetition period	IEC 60958 frame rate Fs	Frame period ms	Maximum data rate
512	48 kHz	10,67	1,524 Mbps
1 024	96 kHz	10,67	3,060 Mbps
2 048	192 kHz	10,67	6,132 Mbps
4 096	384 kHz	10,67	12,276 Mbps
8 192	768 kHz	10,67	24,564 Mbps
16 384	1 536 kHz	10,67	49,140 Mbps
16 384	768 kHz	21,33	24,570 Mbps
16 384	384 kHz	42,67	12,285 Mbps
16 384	192 kHz	85,33	6,1425 Mbps

The maximum data rates in Table A.1 assume a provision for two 60 958 frames for pad between bursts. Specific implementations may have additional restrictions.

Bibliography

The following documents have served as references for the specification of the related data-type.

DTS DTS-HD   *Please contact DTS consumer licensing for the latest specifications for DTS and DTS-HD* [2]

_____

_____

[2]   DTS, Inc. 5171 Clareton Drive, Agoura Hills, CA 91301 email: consumerlicensing@dts.com

IEC 61937-5

FINAL VERSION

colour inside

Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 –
Part 5: Non-linear PCM bitstreams according to the DTS (Digital Theater Systems) format(s)

IEC 61937-5:2006-01+AMD1:2019-01 CSV(en)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION
_____

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

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61937-5 edition 2.1 contains the second edition (2006-01) [documents 100/974/CDV and 100/1055/RVC] and its amendment 1 (2019-01) [documents 100/3101/CDV and 100/3163/RVC].

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 61937-5 has been prepared by Technical Area 4: Digital system interfaces and protocols, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition.

a) References to the company name Digital Theater Systems have been changed to DTS which is consistent with the official change of the company name.

b) DTS type IV has been added to Table 1 and 5.3.4 describing type IV has been added.

c) Annex A, which provides examples of the use of the repetition period parameter introduced in subclause 5.3.4, has been added.

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 bitstreams according to the AC-3 format

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

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

Part 6: Non-linear PCM bitstreams according to the ATRAC, ATRAC2/3 and ATRAC-X formats

Part 8: Non-linear PCM bitstreams according to the Windows Media Audio Professional[1]

The committee has decided that the contents of the base publication and its amendment 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

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

A bilingual version may be issued at a later date.

_____

[1] To be published.

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

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

1 Scope

This part of IEC 61937 describes audio bitstreams encoded according to the Digital Theater Systems (DTS) format data-types I, II, III, and IV.

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 60958-1, *Digital audio interface – Part 1: General*

IEC 60958-3, *Digital audio interface – Part 3: Consumer applications*

IEC 60958-4, *Digital audio interface – Part 4: Professional applications*

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 Information*

3 Terms, definitions, abbreviations and presentation convention

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

3.1 Definitions

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

3.2 Abbreviations

IEC	International Electrotechnical Commission
ISO/IEC MPEG	The Moving Pictures Expert Group, a joint committee of ISO and IEC

3.3   Presentation convention

F872h   Value 'F872' in hexadecimal format

4   Mapping of the audio bitstream on to IEC 61937-1

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

4.1   DTS burst-info

The 16-bit burst-info contains information about the data which will be found in the data-burst.

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 – 10	According to IEC 61937		
	11	DTS type I	bit 0 of Pa	512
	12	DTS type II	bit 0 of Pa	1 024
	13	DTS type III	bit 0 of Pa	2 048
	14 – 16	According to IEC 61937		
	17	DTS type IV		Dependent on bits 8 – 10
	14 – 31	According to IEC 61937	bit 0 of Pa	
5,6		Reserved		
7		According to IEC 61937		
8 – 10		Reserved for DTS Types I, II and III, Repetition period for DTS Type IV, see Table 6		
11 – 12	0 – 3	Profile		
13 – 15		According to IEC 61937		

5   Format of DTS data-bursts

This clause specifies the audio data-bursts DTS type I, DTS type II, DTS type III and DTS type IV. Specific properties such as reference points, repetition period, the method of filling stream gaps, and decoding latency are specified for each data-type.

5.1   General

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-burst for DTS type I, DTS type II, DTS type III and DTS type IV is given in Table 2.

Table 2 – Repetition period of the pause data-bursts

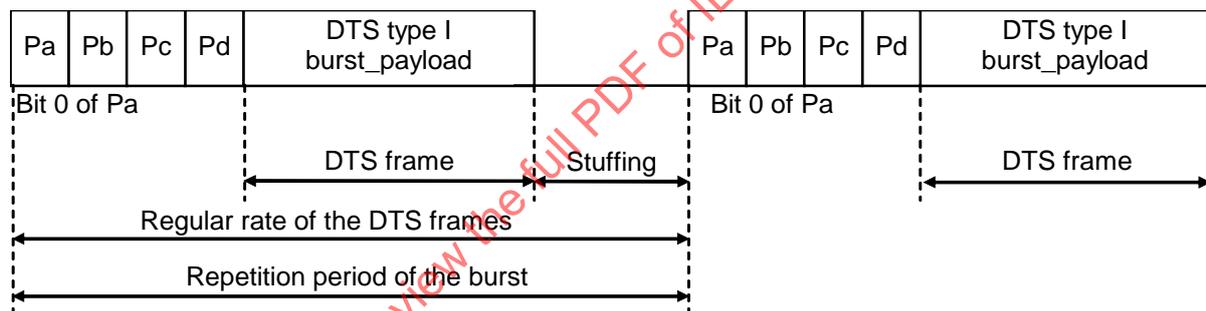| Data-type of audio data-burst	Repetition period of pause data-burst	
	Mandatory	Recommended
DTS type I	-	3 IEC 60958 frames
DTS type II	-	3 IEC 60958 frames
DTS type III	-	3 IEC 60958 frames
DTS type IV	-	3 IEC 60958 frames

5.3 Audio data-bursts

5.3.1 DTS type I

The DTS bitstream consists of sequences of DTS frames. The data-type of a DTS data-burst type I is 0Bh. 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 DTS type I data shall contain one complete DTS-frame and represents 512 samples for each encoded channel.

NOTE 1   The length of the DTS type I data-burst depends on the encoded bit rate (which determines the DTS-frame length).

NOTE 2   The reference to the specification for the DTS bitstream, representing 512 samples of encoded audio per frame, is given in the bibliography.

IEC   2671/05

Figure 1 – DTS type I data-burst

The data-type-dependent information for DTS type I is given in Table 3.

Table 3 – Data-type-dependent when DTS type I

Bits of Pc LSB..MSB	Value	Contents
8-12	00h	Reserved, shall be set to '0'

The reference point of a DTS type I data-burst is bit 0 of Pa and occurs exactly once every 512 sampling periods. The data-burst containing DTS type I frames occurs at a regular rate, with the reference point of each DTS type I data-burst beginning 512 IEC 60958 frames after the reference point of the preceding DTS type I data-burst (of the same bit-stream-number).

It is recommended that pause data-bursts be used to fill stream gaps in the DTS type I bitstream, as described in IEC 61937, and that pause data-bursts be transmitted with a repetition period of 3 IEC 60958 frames, 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 (see IEC 61937).

When a stream gap in a DTS type I stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall be located 512 sampling periods following the Pa of the previous DTS type I frame. 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 3 IEC 60958 frame length of the pause data-burst) the Pa of the first DTS type I data-burst which follows the stream gap.

NOTE 3   The gap-length parameter contained in the pause data-burst is intended to be interpreted by the DTS decoder as an indication of the number of decoded PCM samples which are missing (due to the resulting audio gap).
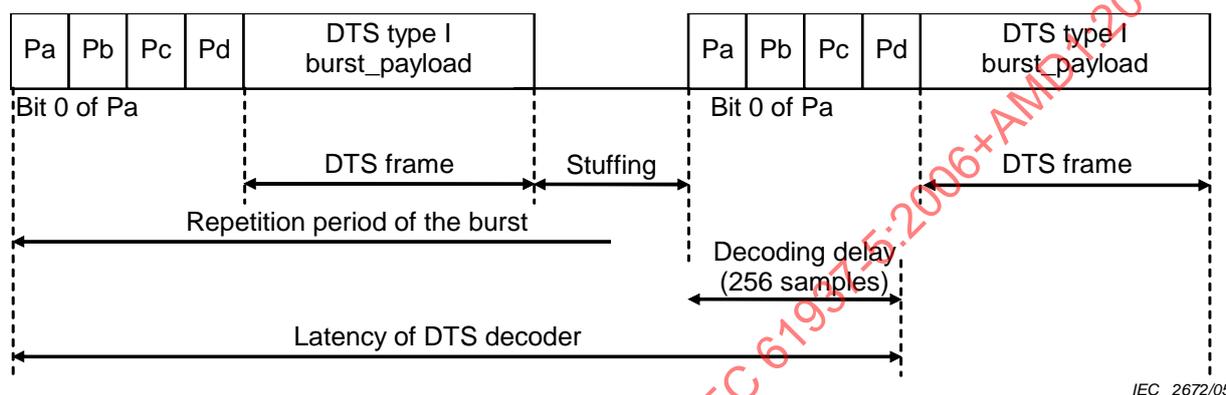

IEC 2672/05

Figure 2 – Latency of DTS type II decoding

NOTE 4   The latency of a DTS decoder is defined as a delay measured from the reference point and equal to one frame (10,67 ms) plus 5,33 ms (equivalent to 256 samples). This is 768 PCM samples or 16 ms at 48 kHz sampling frequency.

5.3.2   DTS type II

The DTS bitstream consists of sequences of DTS frames. The data-type of a DTS data-burst type II is 0Ch. 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 DTS type II data shall contain one complete DTS-frame and represents 1 024 samples for each encoded channel.

NOTE 1   The length of the DTS type II data-burst depends on the encoded bit rate (which determines the DTS-frame length).

NOTE 2   The reference to the specification for the DTS bitstream, representing 1 024 samples of encoded audio per frame, is given in the bibliography.
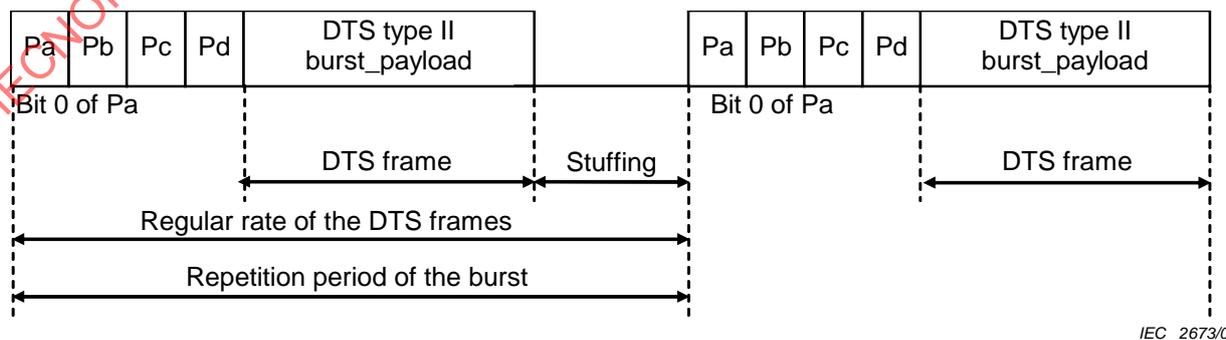

IEC 2673/05

Figure 3 – DTS type II data-burst

The data-type-dependent information for DTS type II is given in Table 4.

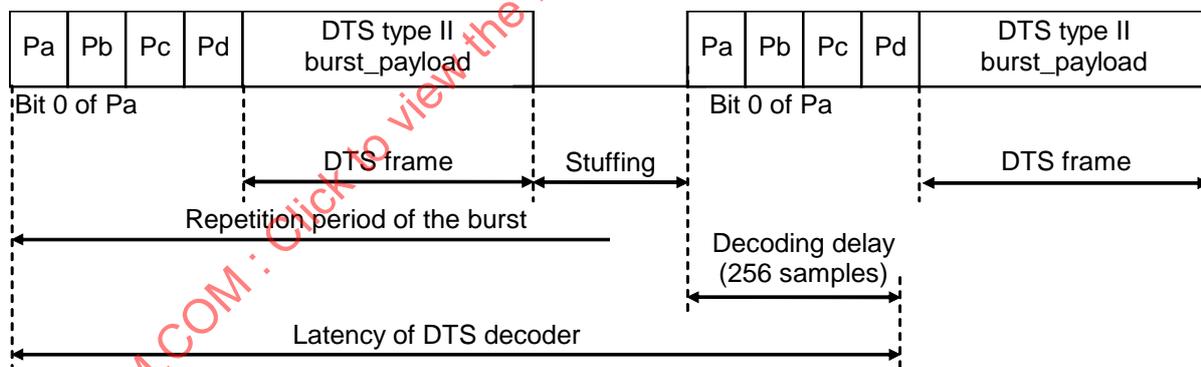**Table 4 – Data-type-dependent when DTS type II**

Bits of Pc LSB..MSB	Value	Contents
8-12	00h	Reserved, shall be set to '0'

The reference point of a DTS type II data-burst is bit 0 of Pa and occurs exactly once every 1 024 sampling periods. The data-burst containing DTS type II frames shall occur at a regular rate, with the reference point of each DTS type II data-burst beginning 1 024 IEC 60958 frames after the reference point of the preceding DTS type II data-burst (of the same bit-stream-number).

It is recommended that pause data-bursts be used to fill stream gaps in the DTS type II bitstream, as described in IEC 61937, and that pause data-bursts be transmitted with a repetition period of 3 IEC 60958 frames, 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 (see IEC 61937).

When a stream gap in a DTS type II stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall be located 1 024 sampling periods following the Pa of the previous DTS type II frame. 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 3 IEC 60958 frame length of the pause data-burst) the Pa of the first DTS type II data-burst which follows the stream gap.

NOTE 3   The gap-length parameter contained in the pause data-burst is intended to be interpreted by the DTS decoder as an indication of the number of decoded PCM samples which are missing (due to the resulting audio gap).

Figure 4 – Latency of DTS type II decoding

NOTE 4   The latency of a DTS decoder is defined as a delay measured from the reference point and equal to one frame (21,34 ms) plus 5.33 ms (equivalent to 256 samples). This is 1 280 PCM samples or 26,67 ms at 48 kHz sampling frequency.

5.3.3   DTS type III

The DTS bitstream consists of sequences of DTS frames. The data-type of a DTS data-burst type III is 0Dh. 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 DTS type III data shall contain one complete DTS-frame and represents 2 048 samples for each encoded channel.

NOTE 1   The length of the DTS type III data-burst depends on the encoded bit rate (which determines the DTS-frame length).

NOTE 2   The reference to the specification for the DTS bitstream, representing 2 048 samples of encoded audio per frame, is given in the bibliography.
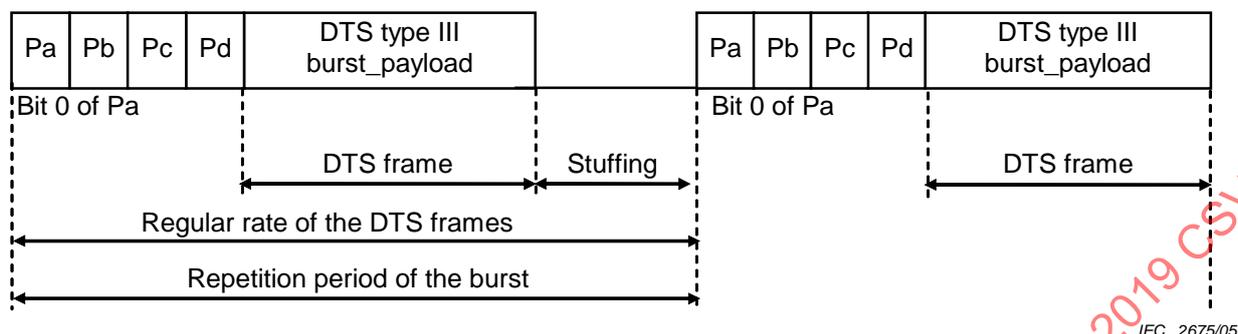

IEC 2675/05

Figure 5 – DTS type III data-burst

The data-type-dependent information for DTS type III is given in Table 5.

Table 5 – Data-type-dependent when DTS type III

Bits of Pc LSB..MSB	Value	Contents
8-12	00h	Reserved, shall be set to '0'

The reference point of a DTS type III data-burst is bit 0 of Pa and occurs exactly once every 2 048 sampling periods. The data-burst containing DTS type III frames shall occur at a regular rate, with the reference point of each DTS type III data-burst beginning 2 048 IEC 60958 frames after the reference point of the preceding DTS type III data-burst (of the same bit-stream-number).

It is recommended that pause data-bursts be used to fill stream gaps in the DTS type III bitstream as described in IEC 61937, and that pause data-bursts be transmitted with a repetition period of 3 IEC 60958 frames, 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 (see IEC 61937).

When a stream gap in a DTS type III stream is filled by a sequence of pause data-bursts, the Pa of the first pause data-burst shall be located 2 048 sampling periods following the Pa of the previous DTS type III frame. 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 3 IEC 60958 frame length of the pause data-burst) the Pa of the first DTS type III data-burst which follows the stream gap.

NOTE 3   The gap-length parameter contained in the pause data-burst is intended to be interpreted by the DTS decoder as an indication of the number of decoded PCM samples which are missing (due to the resulting audio gap).
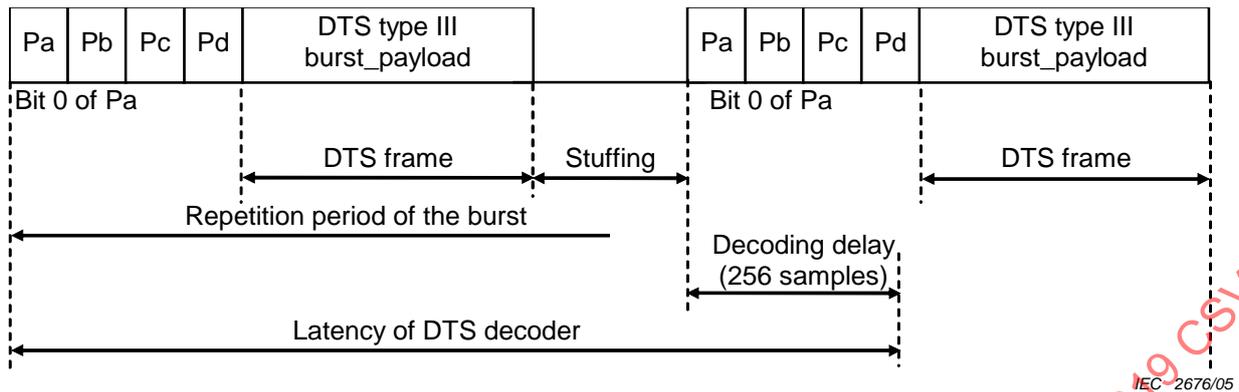
Figure 6 – Latency of DTS type III decoding

NOTE 4   The latency of a DTS decoder is defined as a delay measured from the reference point and equal to one frame (42,67 ms) plus 5,33 ms (equivalent to 256 samples). This is 2 304 PCM samples or 48 ms at 48 kHz sampling frequency.

5.3.4   DTS type IV

The DTS bitstream consists of sequences of DTS frames. The data-type of a DTS data-burst type IV is 11h. The data-burst is headed with a burst-preamble, followed by the burst-payload, and stuffed with stuffing bits. The data-type-dependent information for DTS type IV is given in Table 6.

The burst repetition period is set in bits 8 – 10 of Pc (see Table 6). The IEC 60958 frame rate has an integer relationship to the base sample rate of the compressed audio being delivered. Any supported base sample rate may be applied. The nominal base sample rate for DTS Type IV is 48 kHz.

Bits 11 and 12 are used to indicate a profile of DTS type IV.

The units of **burst_length** shall be in bytes. This means the maximum size of a burst is 65 535 bytes.