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Digital audio interface –

Part 3:
Consumer applications

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DIGITAL AUDIO INTERFACE –

Part 3: Consumer applications

FOREWORD

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International Standard IEC 60958-3 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

This third edition of IEC 60958-3 cancels and replaces the second edition published in 2003 and constitutes a technical revision.

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

– Electrical and optical requirements are removed from IEC 60958-3; they should be specified in IEC 60958-1. The third edition of IEC 60958-1 will include these.

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

CDV	Report on voting
100/1009/CDV	100/1070/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.

The list of all the parts of the IEC 60958 series, under the general title *Digital audio interface*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn;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.

DIGITAL AUDIO INTERFACE –

Part 3: Consumer applications

1 Scope

This part of IEC 60958 specifies the consumer application of the interface for the interconnection of digital audio equipment defined in IEC 60958-1.

NOTE When used in a consumer digital processing environment, the interface is primarily intended to carry stereophonic programmes, with a resolution of up to 20 bits per sample, an extension to 24 bits per sample being possible.

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 60841:1988, *Audio recording – PCM encoder/decoder system*

IEC 60908:1999, *Audio recording – Compact disc digital audio system*

IEC 60958-1:2004, *Digital audio interface – Part 1*: *General*

IEC 61119-1:1992, *Digital audio tape cassette system (DAT) – Part 1: Dimensions and characteristics*

IEC 61119-6:1992, *Digital audio tape cassette system (DAT) – Part 6: Serial copy management system*

IEEE 1394:2004, *IEEE standard for high-performance serial bus bridges*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60958-1 apply.

4 Interface format

The interface format as defined in IEC 60958-1 shall be used.

Unless otherwise specified in the annexes, the following specification is applicable.

- Audio sample word has a length of 20 bits/sample. The auxiliary sample bits are an optional expansion of the audio sample, if not used = “0”.
- User data is not used, all bits = “0”.
- Channel status is identical for both subframes of the interface, with the exception of the channel number, if that is not equal to zero.

5 Channel status

5.1 General

For every subframe, the channel status bit provides information related to the audio channel that is carried in that same subframe.

Channel status information is organized in a 192-bit block, subdivided into 24 bytes, numbered 0 to 23 (see Table 1). The first bit of each channel status block is carried in the frame with preamble “B”.

The individual bits of a channel status block are numbered 0 to 191.

The primary application is indicated by channel status bit 0.

As stated in IEC 60958-1, for the consumer digital audio applications described in this standard, this first channel status bit equals “0”.

NOTE As stated in IEC 60958-1, for professional application this first channel status bit equals “1”.

Secondary applications may be defined within the framework of these primary applications.

5.2 Application

5.2.1 Channel status general format

For each channel, the channel status block provides the information described in this clause and summarized in Table1.

Table 1– Channel status general format for consumer use

Byte									
0		a = “0”	b	c	d			Mode	
	bit	0	1	2	3	4	5	6	7
1									
	bit	8	9	10	11	12	13	14	15
2									
	bit	16	17	18	19	20	21	22	23
3									
	bit	24	25	26	27	28	29	30	31
4									
	bit	32	33	34	35	36	37	38	39
5									
	bit	40	41	42	43	44	45	46	47
6									
	bit	48	49	50	51	52	53	54	55
7									
	bit	56	57	58	59	60	61	62	63
8									
	bit	64	65	66	67	68	69	70	71
9									
	bit	72	73	74	75	76	77	78	79
10									
	bit	80	81	82	83	84	85	86	87
11									
	bit	88	89	90	91	92	93	94	95
12									
	bit	96	97	98	99	100	101	102	103
13									
	bit	104	105	106	107	108	109	110	111
14									
	bit	112	113	114	115	116	117	118	119
15									
	bit	120	121	122	123	124	125	126	127
16									
	bit	128	129	130	131	132	133	134	135
17									
	bit	136	137	138	139	140	141	142	143
18									
	bit	144	145	146	147	148	149	150	151
19									
	bit	152	153	154	155	156	157	158	159
20									
	bit	160	161	162	163	164	165	166	167
21									
	Bit	168	169	170	171	172	173	174	175
22									
	Bit	176	177	178	179	180	181	182	183
23									
	Bit	184	185	186	187	188	189	190	191
		a: use of channel status block b: linear PCM identification			c: copyright information d: additional format information				

Byte 0: General control and mode information

Control:

Bit 0	“0”	Consumer use of channel status block (Notes 1 and 2)

NOTE 1 The significance of byte 0, bit 0 is such that transmission from an interface conforming to IEC 60958-4 can be identified.

Bit 1	“0”	Audio sample word represents linear PCM samples (Note 2)
	“1”	Audio sample word used for other purposes

NOTE 2 The functions of channel status bits 0 and 1 are defined in IEC 60958-1.

Bit 2	“0”	Software for which copyright is asserted (Note 3)
	“1”	Software for which no copyright is asserted

NOTE 3 Bit 2 is referred to as the “Cp-bit”. It should indicate whether copyright protection has been asserted.

The copyright status may be unknown for certain applications. The above interpretation is therefore not valid in combination with some category codes (as indicated in the annex associated with the category code). The Cp-bit can alternate between 0 and 1 at a rate between 4 Hz and 10 Hz (see Annex A).

Bits 3 to 5 Additional format information, meaning depends on bit 1.

When bit 1 = “0”, linear PCM audio mode:

Bit	3 4 5	
State	“0 0 0”	2 audio channels without pre-emphasis
	“1 0 0”	2 audio channels with 50 µs /15 µs pre-emphasis
	“0 1 0”	Reserved (for 2 audio channels with pre-emphasis)
	“1 1 0”	Reserved (for 2 audio channels with pre-emphasis)

All other states of bits 3 to 5 are reserved and shall not be used until further defined.

NOTE 4 The single and dual channel operating modes are defined with the frame format in IEC 60958-1.

When bit 1 = “1”, other than linear PCM applications:

Bit	3 4 5	
State	“0 0 0”	Default state for applications other than linear PCM

All other states of bits 3 to 5 are reserved and shall not be used until further defined.

Bits 6 and 7 Channel status mode, indicates one of four possible channel status formats (bytes 1 to 23). There are four possible modes for each of the states of bit 1.

Bit	6 7	
State	“0 0”	Mode 0, refer to 5.2.2

All other states of bits 6 and 7 are reserved and shall not be used until further defined.

The contents of bits 8 to 191 depend on the mode as indicated by bits 6 and 7. If not defined otherwise, the default value is “0”.

5.2.2 Mode 0 channel status format for digital audio equipment for consumer use

When the audio sample word represents linear PCM and the channel status mode is mode 0, the channel status format shown in Table 2 should be applied.

Table 2 – Mode 0 channel status format for consumer use

Byte									
0		a = "0"	b = "0"	c	d			Mode = "0 0"	
	bit	0	1	2	3	4	5	6	7
1		Category code							
	bit	8	9	10	11	12	13	14	15
2		Source number				Channel number			
	bit	16	17	18	19	20	21	22	23
3		Sampling frequency				Clock accuracy			
	bit	24	25	26	27	28	29	30	31
4		Word length				Original sampling frequency			
	bit	32	33	34	35	36	37	38	39
5		CGMS-A							
	bit	40	41	42	43	44	45	46	47
6									
	bit	48	49	50	51	52	53	54	55
7									
	bit	56	57	58	59	60	61	62	63
8									
	bit	64	65	66	67	68	69	70	71
9									
	bit	72	73	74	75	76	77	78	79
10									
	bit	80	81	82	83	84	85	86	87
11									
	bit	88	89	90	91	92	93	94	95
12									
	bit	96	97	98	99	100	101	102	103
13									
	bit	104	105	106	107	108	109	110	111
14									
	bit	112	113	114	115	116	117	118	119
15									
	bit	120	121	122	123	124	125	126	127
16									
	bit	128	129	130	131	132	133	134	135
17									
	bit	136	137	138	139	140	141	142	143
18									
	bit	144	145	146	147	148	149	150	151
19									
	bit	152	153	154	155	156	157	158	159
20									
	bit	160	161	162	163	164	165	166	167
21									
	bit	168	169	170	171	172	173	174	175
22									
	bit	176	177	178	179	180	181	182	183
23									
	bit	184	185	186	187	188	189	190	191
		a: use of channel status block b: linear PCM identification				c: copyright information d: additional format information			

Byte 0 as defined in 5.2.1, with

Bit 1	"0"	Audio sample word represents linear PCM samples
Bits 6 to 7	"0 0"	Mode 0

Byte 1: Category code

The category code indicates the kind of equipment that generates the digital audio interface signal. See the relevant annexes for the assignments. Bit 8 = LSB, bit 15 = MSB.

Byte 2: Source and channel number

Bits 16 to 19	Source number, bit 16 = LSB, bit 19 = MSB	
Bit	16 17 18 19	
State	"0 0 0 0"	Do not take into account
	"1 0 0 0"	1
	"0 1 0 0"	2
	"1 1 0 0"	3
	.....	
	"1 1 1 1"	15

Bits 20 to 23	Channel number (audio channel), bit 20 = LSB, bit 23 = MSB.	
Bit	20 21 22 23	
State	"0 0 0 0"	Do not take into account.
	"1 0 0 0"	(left channel for stereo channel format)
	"0 1 0 0"	(right channel for stereo channel format)
	"1 1 0 0"	
	.....	
	"1 1 1 1"	

NOTE 1 The single and dual channel operating modes are defined with the frame format in IEC 60958-1.

Byte 3: Sampling frequency and clock accuracy

Bits 24 to 27	Sampling frequency	
Bit	24 25 26 27	
State	"0 0 1 0"	22,05 kHz
	"0 0 0 0"	44,1 kHz
	"0 0 0 1"	88,2 kHz
	"0 0 1 1"	176,4 kHz
	"0 1 1 0"	24 kHz
	"0 1 0 0"	48 kHz
	"0 1 0 1"	96 kHz
	"0 1 1 1"	192 kHz
	"1 1 0 0"	32 kHz
	"1 0 0 0"	Sampling frequency not indicated
	"1 0 0 1"	768 kHz

All other combinations are reserved and shall not be used until further defined.

Bits 28 to 29	Clock accuracy.	
Bit	28 29	
State	“0 0”	Level II
	“1 0”	Level I
	“0 1”	Level III
	“1 1”	Interface frame rate not matched to sampling frequency.

NOTE 2 The sampling frequency over 192 kHz is not actual, it is used for high bit-rate transmission using the IEC 60958 protocol. For example, IEC 61883-6 can transmit a high bit rate of IEC 61937 using IEC 60958 comformant data format defined in IEC 61883-6.

Byte 4: Word length and original sampling frequency

Bit 32	“0”	Maximum audio sample word length is 20 bits
	“1”	Maximum audio sample word length is 24 bits

Bits 33 to 35	Sample word length		
Bit	33 34 35	Audio sample word length if maximum length is 24 bits as indicated by bit 32	Audio sample word length if maximum length is 20 bits as indicated by bit 32
State	“0 0 0”	Word length not indicated (default)	Word length not indicated (default)
	“1 0 0”	20 bits	16 bits
	“0 1 0”	22 bits	18 bits
	“0 0 1”	23 bits	19 bits
	“1 0 1”	24 bits	20 bits
	“0 1 1”	21 bits	17 bits
	All other combinations are reserved and shall not be used until further defined.		

NOTE 3 The first edition of IEC 60958 had bits 32 to 35 reserved and set to zero. Therefore, the all zero state for these bits on a received signal may be an indicator that the word length indication has not been implemented.

Bits 36 to 39	Original sampling frequency	
Bit	36 37 38 39	
State	“1 1 1 1”	44,1 kHz
	“1 1 1 0”	88,2 kHz
	“1 1 0 1”	22,05 kHz
	“1 1 0 0”	176,4 kHz
	“1 0 1 1”	48 kHz
	“1 0 1 0”	96 kHz
	“1 0 0 1”	24 kHz
	“1 0 0 0”	192 kHz
	“0 1 1 1”	Reserved
	“0 1 1 0”	8 kHz
	“0 1 0 1”	11,025 kHz
	“0 1 0 0”	12 kHz
	“0 0 1 1”	32 kHz
	“0 0 1 0”	Reserved
	“0 0 0 1”	16 kHz
	“0 0 0 0”	Original sampling frequency not indicated (default)

NOTE 4 The original sampling frequency field may be used to indicate the sampling frequency of a signal prior to sampling frequency conversion in a consumer playback system.

NOTE 5 Many of the values indicated for a frequency in the original sampling frequency field in byte 4 are complementary to the values used for that frequency in the sampling frequency field in byte 3.

Byte 5: CGMS-A

Bits 40 to 41	CGMS-A	
Bit	40 41	
State	“0 0”	Copying is permitted without restriction
	“0 1”	Condition not be used
	“1 0”	One generation of copies may be made
	“1 1”	No copying is permitted

NOTE 6 CGMS-A information from other IEC standards (for example, IEC 61880) can be carried.

5.3 Copyright management guidelines for consumer application of the digital audio interface

5.3.1 General

Category codes are used for all consumer products that are capable of supplying a digital signal to consumer digital audio recorders, except for products that are fully transparent from input to output. A category code of a product is defined as a live function to make a source data. If products have the capability to play plural recorded media that are defined in different categories, the category code of the product should be defined as a playing medium.

These category codes have been grouped by general function of the product. This makes it possible to take into account future digital recording products not yet defined in detail. Such a product then deals with the group code under a general rule. These rules define whether a digital recorder is enabled to record a copyright-protected digital signal.

Unless otherwise specified, any consumer equipment capable of transferring digital audio information from an input terminal to an output terminal, if not fully transparent and regardless of the delay or kind of transformation of the audio content of the signal, shall copy channel status bits 0, 1, 3, 4, 5, 6 and 7 from the source. Bit 2 shall be copied from the source, unless otherwise specified in the annexes.

Bit 15 is referred to as the “L-bit”. It indicates the “generation status” of the digital audio signal.

“Generation status” means:

- whether the signal emanates from a source that has been produced or published or authorized by the rights owner of the material, such as commercially released pre-recorded compact discs or DAT tapes or a digital broadcast (referred to herein as “original”) and for which copyright has been asserted; or
- whether the signal emanates from a recording made from such “original” material (i.e. “a home-copy of generation 1 or higher”).

Generally the L-bit is specified as:

Bit 15	“0”	No indication
	“1”	Commercially released pre-recorded software

For historical reasons, the reverse situation is valid for the signals originating from

- laser optical products (category code “100 XXXXL”);
- broadcast reception (category codes “001 XXXXL” and “011 1XXXL”).

For these category codes the L-bit indicates:

Bit 15	"0"	Commercially released pre-recorded software
	"1"	No indication

The generation status may be unknown for certain applications. The above interpretation is therefore not valid in combination with some category codes such as

- general (category code "000 00000");
- analogue/digital converters for analogue signals without copyright information (category code "011 00XXL").

5.3.2 Category code groups

5.3.2.1 The category code groups are defined in Table 3.

Table 3 – Category code groups

Bits 8 to 15	Category
"000 00000"	General. Used temporarily
"100 XXXXL"	Laser optical products
"010 XXXXL"	Digital/digital converters and signal processing products
"110 XXXXL"	Magnetic tape or disc-based products
"001 XXXXL" and "011 1XXXL"	Broadcast reception of digitally encoded audio signals with or without video signals
"101 XXXXL"	Musical instruments, microphones and other sources without copyright information
"011 00XXL"	Analogue/digital converters for analogue signals without copyright information
"011 01XXL"	Analogue/digital converters for analogue signals which include copyright information in the form of "Cp-bit and L-bit status"
"000 1XXXL"	Solid-state memory-based products
"000 0001L"	Experimental products not for commercial sale
"000 0001L"	Other products of this groups and/or experimental products
"111 XXXXL"	Not defined. Reserved
"000 0XXXL"	Not defined. Reserved, except for "000 00000" and "000 0001L"

5.3.2.2 Within a group a further indication of the kind of source is given.

5.3.2.2.1 For the general category code ("000 00000") the following applies:

– used temporarily;

– applied specifically for digital audio broadcast reception with or without a video signal, for example, digital satellite reception in Japan in the case where no copyright information is transmitted (see also Annex H);

– for the group of laser optical products (category code = "100 XXXXL"), the category codes are defined in Table 4.

Table 4 – Category code groups for laser optical products

Bits 8 to 15	Category
“100 00000”	Compact-disc digital audio signal compatible with IEC 60908 (see Annex A)
“100 1000L”	Laser optical digital audio systems for which no other category code is defined (see Annex D)
“100 1001L”	Mini-disc system (see Annex N)
“100 1100L”	Digital versatile disc (DVD) (see Annex P)
“100 1111L”	Other products of this category
“100 others”	Reserved

5.3.2.2.2 For the group of digital/digital converters and signal-processing products (category code = “010 XXXXL”), the category codes are defined in Table 5.

Table 5 – Category code groups for digital/digital converter and signal-processing products

Bits 8 to 15	Category
“010 0000L”	PCM encoder/decoder (see Annex B)
“010 0100L”	Digital signal mixer (see Annex E)
“010 1100L”	Sampling rate converter (see Annex F)
“010 0010L”	Digital sound sampler (see Annex G)
“010 1010L”	Digital sound processor (see Annex O)
“010 1111L”	Other products of this category
“010 others”	Reserved

5.3.2.2.3 For the group of magnetic tape or magnetic disc based products (category code = “110 XXXXL”), the category codes are defined in Table 6.

Table 6 – Category code groups for magnetic tape or magnetic disc based products

Bits 8 to 15	Category
“110 0000L”	DAT (see annex C)
“110 1000L”	Video tape recorder with digital sound
“110 0001L”	Digital compact cassette (see Annex M)
“110 1100L”	Magnetic disc digital audio system (see Annex R)
“110 1111L”	Other products of this category
“110 others”	Reserved

5.3.2.2.4 For the group of broadcast reception of digitally encoded audio with/without video signals (category code = “001 XXXXL” or “011 1XXXL”), the category codes are defined in Table 7.

Table 7 – Category code groups for broadcast reception of digitally encoded audio with/without video signals

Bits 8 to 15	Category
“001 0000L”	Digital audio broadcast signal with or without a video signal (Japan) (see Annex H)
“001 1000L”	Digital audio broadcast signal with or without a video signal (Europe) (see Annex J)
“001 0011L”	Digital audio broadcast signal with or without a video signal (USA) (see Annex K)
"001 0001L"	Electronic software delivery (see Annex L)
“001 0010L”	Used by another standard (see note)
“001 1111L”	Other products of this category
“001 others”	Reserved
“011 1XXXL”	Reserved
NOTE The code "001 0010L" is under consideration for use in connection with IEC 62105.	

5.3.2.2.5 For the group of musical instruments, microphones and other sources that create original sound (category code = “101 XXXXL”), the category codes are defined in Table 8.

Table 8 – Category code groups for musical instruments, microphones and other sources that create original sound

Bits 8 to 15	Category
“101 0000L”	Synthesizer
“101 1000L”	Microphone
“101 1111L”	Other products of this category
“101 others”	Reserved

5.3.2.2.6 For the group of analogue/digital converters for analogue signals without copyright information (category code = “011 00XXL”), the category codes are defined in Table 9.

Table 9 – Category code groups for A/D converters for analogue signals without copyright information

Bits 8 to 15	Category
“011 0000L”	A/D converter
“011 0011L”	Other products of this category
“011 00 others”	Reserved

5.3.2.2.7 For the group of analogue/digital converters for analogue signals which include copyright information in the form of “Cp-bit and L-bit status” (category code = “011 01XXL”), the category codes are defined in Table 10.

Table 10 – Category code groups for A/D converters for analogue signals with copyright information

Bits 8 to 15	Category
“011 0100L”	A/D converter
“011 0111L”	Other products of this category
“011 01 others	Reserved

5.3.2.2.8 For the group of solid state memory based products (category code = “000 1XXXL”), the category codes are defined in Table 11.

Table 11 – Category code groups for solid state memory based products

Bits 8 to 15	Category
“000 1000L"	Digital audio recorder and player using solid state memory
“000 1111L”	Other products of this category
“000 1 others”	Reserved

5.3.2.2.9 For experimental products not for commercial sale (category code = “000 0001L”), the following definition applies.

New products for which a category code and a category group is not yet defined or for which circuitry to signal the appropriate category is not yet available.

6 User data

6.1 General

The default value of the user bits is logical “0”.

For interchangeability of equipment, it is strongly recommended that the general user data format described below be used for consumer applications of the user data.

6.2 Application

6.2.1 User data bitstream

The user data bits from every subframe in a frame combine so that there is just one user data bitstream for each interface.

6.2.2 User data message structure

A message consists of information units (IUs). An IU consists of one start bit (logical value “1”) followed by seven information bits.

The eight bits of an IU are also referred to as the P, Q, R, S, T, U, V and W bits. IUs in a message are separated by up to and including eight bits with a logical value “0”. The nominal number of bits with logical value “0” between IUs is four. Messages are separated by more than eight bits with a logical value “0”. An example of this structure is shown in Figure 1.

Bit	0	1	2	3	4	5	6	7	8	9	10	11	
0	0	0	1	Q	R	S	T	U	V	W	0	0	A)
+12	0	0	1	Q	R	S	T	U	V	W	0	0	
+24	1	Q	R	S	T	U	V	W	0	0	0	0	B)
+36	0	0	0	0	1	Q	R	S	T	U	V	W	C)
+48	1	Q	R	S	T	U	V	W	0	0	0	0	
+60	1	Q	R	S	T	U	V	W	0	0	0	0	D)
+72	0	0	0	0	0	0	0	1	Q	R	S	T	
+84	U	V	W	0	0	0	0	1	Q	R	S	T	E)
+96	U	V	W	0	0	0	0	0	1	Q	R	S	

Key

0 Bit between IUs with logical value “0”

1 Start bit P, first bit of IU with logical value “1”

Q, R, S, T, U, V, W information bits

A) Example of an IU: start bit plus seven information bits

B) Maximum distance between two IUs of the same message is two bits

C) Minimum distance between two IUs of the same message is zero bits

D) Distance of more than eight bits between IUs indicates start of a new message

E) Nominal distance between two IUs of the same message is four bits

IEC 1743/99

Figure 1 – Example of message structure using information units

6.2.3 Equipment classification

Equipment is divided into three classes, according to the category code of the channel status. See also the relevant annexes.

Future equipment, for which there is no relevant annex, shall be classified as belonging to one of the three classes defined below.

6.2.3.1 Class I: original user data generating equipment

Original user data generating equipment will generate user data bits according to a format that is defined in the standard for that equipment. See the relevant annex.

Any new equipment in this class will carry the general user data format as defined in 6.2.4.1.

6.2.3.2 Class II: user data transparent equipment

The user data transparent equipment shall either provide all “0” user data bits or transfer the user data bits it receives from its input unchanged to its output. If the processing of the audio information causes considerable delay, it is recommended that the user data bits should be equally delayed.

6.2.3.3 Class III: mixed mode user data equipment

This class of equipment shall either operate as class II (user data transparent) equipment or originate a new user data stream according to the general user data format.

The possible user data formats for this class are:

- all “0” bits;
- the complete user data information of the input, or one of the inputs in the case of multiple inputs;
- the general user data format. The information carried in this case may originate from within the equipment itself, or be transcoded from the input source(s).

6.2.4 User data message length and contents

The possible length and contents of the user data messages depends on the category code of the equipment. See the relevant annexes.

For new equipment that is capable of generating original user data contents, the general user data format shall be used.

6.2.4.1 General user data format

According to the general user data format, a message consists of a minimum of 3 and a maximum of 129 information units, except for a length of 96 information units. A total message length of 96 information units is reserved for some specific laser optical products (see 6.2.4.2).

The contents of the first IU are shown in Figure 2.

1 (Start)	1 (Q)	Mode R	Mode S	Mode T	Item U	Item V	Item W

Figure 2 – First UI contents

The bits R, S, T, U, V, W have the following meaning:

Mode	RST	
	000	Not used, reserved for digital compact cassette (DCC)
	100	SMPTE time code
	110	Latency
	other 1XX	May be used for new messages
	X1X	
	XX1	

The mode bits indicate a class of messages, for example text, preset information, etc., and the item bits give a further definition of the type of message.

It is recommended that any new application should conform as much as possible to messages coded according to the general user data format that have been defined for other applications.

The second IU contains a number indicating the following number of IUs as shown in Figure 3.

1 (Start)	IU Count6	IU Count5	IU Count4	IU Count3	IU Count2	IU Count1	IU Count0

Figure 3 – Second UI contents

IU count6 is the most significant bit; IU count0 is the least significant bit. The number is coded as a binary number in the range 1 to 127 (000 0001b to 111 1111b) except that the value 94 is not possible.

The third IU contains the originating category code, without the L-bit, of the equipment that generates the general user data format messages as shown in Figure 4.

1 (Start)	C-Ch bit 8	C-Ch bit 9	C-Ch bit 10	C-Ch bit 11	C-Ch bit 12	C-Ch bit 13	C-Ch bit 14

Figure 4 – Third UI contents

The L-bit (C-channel bit 15) is not carried in this message, as it is not relevant for the decoding of the user data messages. Therefore, any decisions on the copyright status of the audio information shall be based on the category code and Cp-bit as carried in the channel status.

The IUs that follow the third IU contain user information.

User information that originally was organized as bytes is carried as in Figure 5: four successive IUs carry a maximum of three successive bytes (X, Y and Z, 7 = MSB, 0 = LSB) in bits R, S, T, U, V, W of the IUs:

1 (Start)	Q	X7	X6	X5	X4	X3	X2
1 (Start)	Q	X1	X0	Y7	Y6	Y5	Y4
1 (Start)	Q	Y3	Y2	Y1	Y0	Z7	Z6
1 (Start)	Q	Z5	Z4	Z3	Z2	Z1	Z0

Figure 5 – User information

The Q bits can optionally indicate that the remaining six bits of the IU contain an error:

“0” no error detected.

“1” error in bits R, S, T, U, V, W.

If not used, the error flag should be set to a logical “0” value.

If the number of bytes to transfer does not fill a complete quadruplet (i.e. just one or two bytes, not three bytes), the remaining byte(s) shall be coded “0 0 0 0 0 0 0 0”.

6.2.4.2 General user data format for some specific laser optical products

For historical reasons, the laser optical products with category codes “100 0000” (compact disc digital audio, see IEC 60908) and “100 1001L” (mini disc) employ a user data format that differs from the one defined above. In this format no message length specifier is applied. Instead, the length is fixed to 96 IUs. The information in the Q bits of the IUs is considered to be in a separate channel (the Q channel).

Each group of six bits R, S, T, U, V, W of an information unit is called a SYMBOL.

The SYMBOL numbering follows the numbering of the bits in Table A.1.

A group of 24 SYMBOLS is called a PACK:

PACK 1 is formed by symbols 1 to 24;

PACK 2 is formed by symbols 25 to 48;

PACK 3 is formed by symbols 49 to 72;

PACK 4 is formed by symbols 73 to 96.

Information will be carried in the PACKS according to specific formats.

6.3 Information for synchronization

To manage audio data synchronization with other data such as video data, the information for synchronization is applied.

6.3.1 SMPTE time code information

SMPTE time code is aligned to mode bits and item bits as shown in Figure 6.

Mode item	RSTUVW	
	100000	SMPTE time code: LTC
	100001	SMPTE time code: VITC

Figure 6 – SMPTE time code information

The second information unit is settled as follows.

0010001b

The third information units are same as defined in 6.2.4.1.

LTC information is aligned to 16 IUs of user information area as shown in Figure 7.

1 (Start)	Q	Units of frame				1st binary group	
1 (Start)	Q	1st binary group		Tens of frames		Drop fr	Color fr
1 (Start)	Q	2nd binary group				Units of seconds	
1 (Start)	Q	Units of seconds		3rd binary group			
1 (Start)	Q	Tens of seconds			ph color bit	4th binary group	
1 (Start)	Q	4th binary group		Units of minutes			
1 (Start)	Q	5th binary group				Tens of minutes	
1 (Start)	Q	Tens of minutes	Bin G flg	6th binary group			
1 (Start)	Q	Units of hours				7th binary group	
1 (Start)	Q	7th binary group		Tens of hours		Bin G flg	Bin G flg
1 (Start)	Q	8th binary group				Sync word	
1 (Start)	Q	Sync word					
1 (Start)	Q	Sync word					
1 (Start)	Q	Sync word		0	0	0	0
1 (Start)	Q	0	0	0	0	0	0
1 (Start)	Q	0	0	0	0	0	0

Figure 7 – LTC information alignment

VITC information is aligned to 16 IUs of user information area as shown in Figure 8.

1 (Start)	Q	1	0	Units of frame			
1 (Start)	Q	1st binary group				1	0
1 (Start)	Q	Tens of frames		Drop fr	Color fr	2nd binary group	
1 (Start)	Q	2nd binary group		1	0	Units of seconds	
1 (Start)	Q	Units of seconds		3rd binary group			
1 (Start)	Q	1	0	Tens of seconds			Field mark
1 (Start)	Q	4th binary group				1	0
1 (Start)	Q	Units of minutes				5th binary group	
1 (Start)	Q	5th binary group		1	0	Tens of minutes	
1 (Start)	Q	Tens of minutes	Bin G frg	6th binary group			
1 (Start)	Q	1	0	Units of hours			
1 (Start)	Q	7th binary group				1	0
1 (Start)	Q	Tens of hours		Bin G frg	Bin G frg	8th binary group	
1 (Start)	Q	8th binary group		1	0	CRC	
1 (Start)	Q	CRC					
1 (Start)	Q	1	0	0	0	0	0

Figure 8 – VITC information alignment

6.3.2 Latency information

Latency information is aligned to information units as shown in Figure 9.

Mode RSTUVW

110000 Latency

Figure 9 – Latency information

The second information unit is settled as follows.

0001101b

The third information units are the same as defined in 6.2.4.1.

Latency information is aligned to 12 IUs of the user information area as shown in Figure 10.

1 (Start)	Q	Audio latency valid		Audio units type		0	0
1 (Start)	Q	0	0	Audio latency (1)			
1 (Start)	Q	Audio latency (1)				Audio latency (2)	
1 (Start)	Q	Audio latency (2)					
1 (Start)	Q	0	0	0	0	0	0
1 (Start)	Q	0	0	Video latency valid		Video units type	
1 (Start)	Q	0	0	0	0	Total video latency (1)	
1 (Start)	Q	Total video latency (1)					
1 (Start)	Q	Total video latency (2)					
1 (Start)	Q	Total video latency (2)		0	0	0	0
1 (Start)	Q	0	0	0	0	0	0
1 (Start)	Q	0	0	0	0	0	0

Audio latency valid	2 bit	
	00	Invalid
	10	Valid
	Others	Reserved
Audio unit type	2 bit	
	00	millisecond
	01	1/16 millisecond
	Others	
Audio latency	16 bit	Binary (current accumulation of audio latency)
Video latency valid	2 bit	
	00	Invalid
	10	Valid
	Others	Reserved
Video unit type	2 bit	
	00	millisecond
	01	1/16 millisecond
	Others	Reserved
Total video latency	16 bit	Binary (total accumulation of video latency)

Figure 10 – Latency information alignment

Annex A
(normative)

Application of the digital audio interface in the compact disc digital audio system

(See IEC 60908)

This annex applies to equipment having category code “100 00000”.

A.1 General: application-specific details

The audio sample word length is 16 bits.

The auxiliary sample bits are = “0”.

A.2 Channel status: application-specific details

The four CONTROL bits of the Q-channel (subcode) shall be copied to the channel status bits 0 to 3 (part of the CONTROL in the channel status).

Bit 2, the Cp-bit, shall mean:

Bit 2	“0”	Software for which copyright is asserted
	“1”	Software for which no copyright is asserted

The Cp-bit may alternate between 0 and 1 at a rate between 4 Hz and 10 Hz.

Th Cp-bit indicates in the alternating mode that the signal does not emanate from commercially released pre-recorded software, but from a recording made from “original” material, that is, a home copy of generation 1 or higher.

A.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

The user data carries the subcode (see Table A.1).

The U-bits form one subcode block of 1 176 bits (average) multiplexed over the left and the right channel. One compact disc frame consists of one subcoding symbol with 12 audio samples. Ninety-eight subcoding symbols constitute one subcoding block, resulting in 12 times 98 = 1 176 U-bits.

The subcode synchronization word is minimum 16 “0” bits.

Table A.1 – Example of 2-channel compact disc format

No.	Preamble SYNC	AUX	Audio samples				MSB	V	U	C	P
1	B	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C1L	P
2	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C1R	P
3	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C2L	P
4	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C2R	P
5	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C3L	P
6	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C3R	P
7	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C4L	P
8	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C4R	P
9	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C5L	P
10	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C5R	P
11	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C6L	P
12	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C6R	P
13	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C7L	P
14	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C7R	P
15	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C8L	P
16	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C8R	P
17	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C9L	P
18	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C9R	P
19	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C10L	P
20	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C10R	P
21	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C11L	P
22	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C11R	P
23	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C12L	P
24	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C12R	P
25	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	1	C13L	P
26	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	Q1	C13R	P
27	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	R1	C14L	P
28	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	S1	C14R	P
29	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	T1	C15L	P
30	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	U1	C15R	P
31	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	V1	C16L	P
32	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	W1	C16R	P
33	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C17L	P
34	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C17R	P
35	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C18L	P
36	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C18R	P
37	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	1	C19L	P
38	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	Q2	C19R	P
39	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	R2	C20L	P
40	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	S2	C20R	P
41	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	T2	C21L	P
42	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	U2	C21R	P
43	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	V2	C22L	P
44	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	W2	C22R	P
45	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C23L	P
46	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C23R	P
47	M	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C24L	P
48	W	0000	0000	XXXX	XXXX	XXXX	XXXX	0	0	C24R	P

Annex B
(normative)

Application of the digital interface in the 2-channel PCM encoder/decoder

(See IEC 60841)

This annex applies to equipment having category code “010 0000L”.

B.1 General: application-specific details

The audio sample word length is 14 or 16 bits.

The auxiliary sample bits are “0”.

B.2 Channel status: application-specific details

Copy and emphasis bits of the CONTROL bits should be copied from the source (the polarity should be inverted).

B.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

All user data bits are “0”.

Annex C
(normative)

Application of the digital interface in the 2-channel digital audio tape recorder in the consumer mode

(See IEC 61119-1 and IEC 61119-6)

This annex applies to equipment having category code “110 0000L”.

C.1 General: application-specific details

The audio sample word length is 16 bits. The auxiliary sample bits are “0”.

C.2 Channel status: application-specific details

Bits 0 to 4 (“CONTROL”) and bits 24 to 27 (“Fs”) should be copied from the source.

Table C.1 illustrates the use of the Cp-bit, L-bit and category code for DAT.

Table C.1 – Use of Cp-bit, L-bit and category code for DAT

Application or source signal	Input signal to DAT-recorder for consumer audio use of C-channel			On DAT tape	Effect on DAT output
	Cp-bit bit 2	Category code Bits 8 to 14	L-bit Bit 15	ID 6	Cp-bit / L-bit bit 2 / bit 15
	No copyright “1”		Home copy “0”		Recordable
General	“1”	“0000000”	“0”	“11”	Set bit 2 to “0”
Laser optical product	“1”	“100XXXX”	“1”	“00”	
D/D converter	“1”	“010XXXX”	“0”	“00”	
Magnetic product	“1”	“110XXXX”	“0”	“00”	
Broadcast reception	“1”	“001XXXX” and “0111XXX”	“1”	“00”	
Musical instrument	“1”	“101XXXX”	“0”	“00”	
Present A/D converter	“1”	“01100XX”	“0”	“11”	Set bit 2 to “0”
Future A/D converter	“1”	“01101XX”	“0”	“00”	
Solid-state memory	“1”	“0001XXX”	“0”	“00”	
Experimental	“1”	“0000001”	“0”	“00”	
	No copyright “1”		Pre-recorded “1”		Recordable
General	“1”	“0000000”	“1”	“11”	Set bit 2 to “0”
Laser optical product	“1”	“100XXXX”	“0”	“00”	
D/D converter	“1”	“010XXXX”	“1”	“00”	
Magnetic product	“1”	“110XXXX”	“1”	“00”	
Broadcast reception	“1”	“001XXXX” and “0111XXX”	“0”	“00”	
Musical instrument	“1”	“101XXXX”	“1”	“00”	
Present A/D converter	“1”	“01100XX”	“1”	“11”	Set bit 2 to “0”
Future A/D converter	“1”	“01101XX”	“1”	“00”	
Solid-state memory	“1”	“0001XXX”	“1”	“00”	
Experimental	“1”	“0000001”	“1”	“00”	

Table C.1 *(continued)*

Application or source signal	Input signal to DAT-recorder for consumer audio use of C-channel			On DAT tape	Effect on DAT output
	Cp-bit bit 2	Category code Bits 8 to 14	L-bit Bit 15	ID 6	Cp-bit / L-bit bit 2 / bit 15
	With copyright "0"		Home copy "0"		Not recordable
D/D converter	"0"	"010XXXX"	"0"	–	Not recordable
Magnetic product	"0"	"110XXXX"	"0"	–	Not recordable
Musical instrument	"0"	"101XXXX"	"0"	–	Not recordable
Future A/D converter	"0"	"01101XX"	"0"	–	Not recordable
Solid-state memory	"0"	"0001XXX"	"0"	–	Not recordable
Experimental	"0"	"0000001"	"0"	–	Not recordable
Laser optical product	"0"	"100XXXX"	"1"	-	Not recordable
Broadcast reception	"0"	"0111XXX"	"1"	-	Not recordable
Broadcast reception	"0"	"001XXXX"	"1"	-	Not recordable
CD recordable	"Alternating at 4 Hz to 10 Hz"	"1000000"	"0"	-	Not recordable
	With copyright "0"		Pre-recorded "1"		Recordable set bit 15 to "0"
D/D converter	"0"	"010XXXX"	"1"	"10"	Set bit 15 to "0"
Magnetic product	"0"	"110XXXX"	"1"	"10"	Set bit 15 to "0"
Musical instrument	"0"	"101XXXX"	"1"	"10"	Set bit 15 to "0"
Future A/D converter	"0"	"01101XX"	"1"	"10"	Set bit 15 to "0"
Solid-state memory	"0"	"0001XXX"	"1"	"10"	Set bit 15 to "0"
Experimental	"0"	"0000001"	"1"	"10"	Set bit 15 to "0"
Laser optical product	"0"	"100XXXX"	"0"	"10"	Set bit 15 to "0"
Broadcast reception	"0"	"0111XXX"	"0"	"10"	Set bit 15 to "0"
Broadcast reception	"0"	"001XXXX"	"0"	"10"	Set bit 15 to "0"

C.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.32).

The user data carries a message of a single information unit. The Q and R bits will reflect the state of the start-ID and shortening-ID, respectively. This is shown in Table C.2.

The start bit of the information unit is carried in the subframe of the first sampling word (L_0), the Q bit ("start-ID") in the subframe of the second sampling word (R_0) and the R-bit ("shortening-ID") in the subframe of the third sampling word (L_1), of one DAT frame. Other bits are logical zero "0". When the DAT player replays normally, start-ID and shortening-ID should be transmitted whenever it detects them, that is, start-ID: (300 ± 30) frames and shortening-ID: (33 ± 3) frames.

When the player shortens playback, shortening-ID should be transmitted once for the first frame.

Transmission of start-ID and shortening-ID is illustrated by an example in Figure C.1.

Audio sample word/DAT frame:

F_s = 48 kHz:	L_0	R_0	L_1	R_1	L_2	.....	L_{1439}	R_{1439}	2 880 words	
F_s = 44,1 kHz	L_0	R_0	L_1	R_1	L_2	.....	L_{1322}	R_{1322}	2 646 words	
F_s = 32 kHz	L_0	R_0	L_1	R_1	L_2	.....	L_{959}	R_{959}	1 920 words	(32K, 32K 4-channel mode)
F_s = 32 kHz	L_0	R_0	L_1	R_1	L_2	.....	L_{1919}	R_{1919}	3 840 words	(32K LP mode)

Table C.2 – User data application in the DAT system

Word	User data	
L_0	Sync	
R_0	S-ID	
L_1	Sh-ID	
R_1	0	
L_2	0	One DAT frame
R_2	0	
.....	.....	
.....	.....	
.....	.....	
.....	.....	
.....	.....	
L_0	Sync	
R_0	S-ID	
L_1	Sh-ID	
R_1	0	

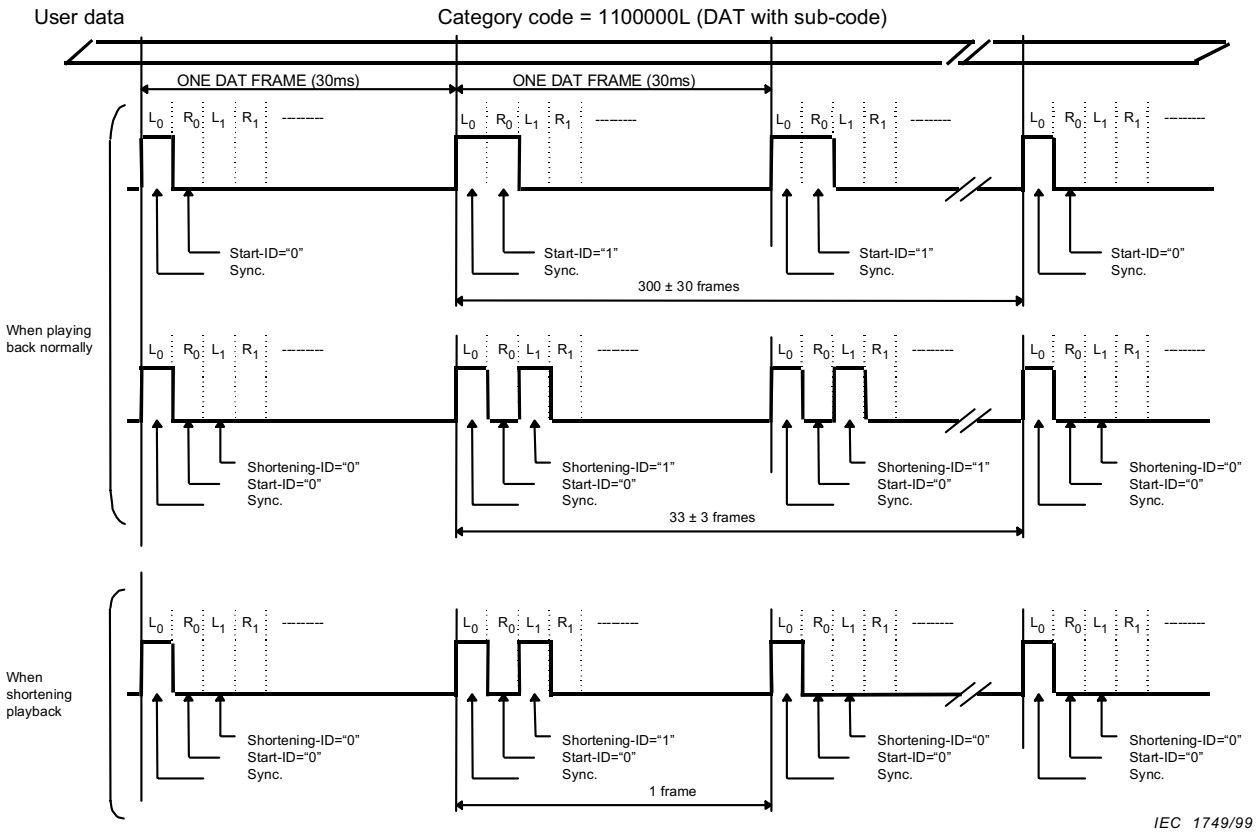

Figure C.1 – Example of different combinations of start-ID and shortening-ID

Annex D
(normative)

Application of the digital interface in laser optical digital audio systems for which no other category code is defined

This annex applies to equipment having category code “100 1000L”.

D.1 General: application-specific details

This category code is for signals from laser optical read-out of discs not compatible with IEC 60908, for example, the magnetic-optical type.

The code “100 10000” shall be used for read-out from pre-recorded discs.

The code “100 10001” shall be used for read-out from home-recorded discs.

The audio sample word length is maximum 24 bits.

D.2 Channel status: application-specific details

Not applicable.

D.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

Annex E
(normative)

Application of the digital interface in a digital audio mixer in the consumer mode

This annex applies to equipment having category code “010 0100L”.

E.1 General: application-specific details

This category code is for signals from products that mix various digital input channels into one or more digital output signals.

E.2 Channel status: application-specific details

This category code shall be used only for products that correctly flag in the output signal the copyright status and the generation status of the input signal(s). Where more than one digital audio input signal is combined into one digital audio output signal, and at least one of the input signals is a first generation or higher copy over which copyright protection has been asserted, then the equipment shall reflect in the L-bit of the digital output signal the generation status for a first generation or higher copy and in the Cp-bit that copyright protection is asserted.

The product shall always apply category code 010 0100L, even when the equipment is adjusted so as not to alter the input signal, i.e. the output signal is identical to the input signal. However, when all input signals originate from an A/D converter and carry category code 011 00XXL, the output signal can also carry category code A/D converter (011 00XXL).

Input signals, of which the copyright status is ambiguous such as with category code “general”, shall result in an output signal with bit 2 = “0” and bit 15 = “1” (copyright protection asserted, original).

E.3 User data: application specific details

Equipment specified in this annex is classified as class III (see 6.2.3).

Annex F
(normative)

Application of the digital interface with a sampling rate converter in the consumer mode

This annex applies to equipment having category code “010 1100L”.

F.1 General: application-specific details

This category code is for signals from products that modify or change the sampling frequency of digital signals.

F.2 Channel status: application-specific details

This category code shall be used only for products that correctly flag in the output signal the copyright status and the generation status of the input signal. Input signals for which copyright protection has been asserted, and which are not “original” shall result in an output signal with bit 2 = “0” and bit 15 = “0”.

The product shall always apply category code 010 1100L, whether the equipment is adjusted so as not to alter the signal (so that the input signal is identical to the output signal), or is adjusted differently. However, when the input signal originates from an A/D converter and carries category code 011 00XXL, the output signal can also carry category code A/D converter (011 00XXL).

Input signals, of which the copyright status is ambiguous such as with category code “general”, shall result in an output signal with bit 2 = “0” and bit 15 = “1” (copyright protection asserted, original).

F.3 User data: application-specific details

Equipment specified in this annex is classified as class III (see 6.2.3).

Annex G
(normative)

Application of the digital interface with a digital sound sampler in the consumer mode

This annex applies to equipment having category code “010 0010L”.

G.1 General: application-specific details

This category code is for signals from products that sample and reassemble digital input signal(s) into one or more digital output signals.

G.2 Channel status: application-specific details

This category code shall only be used for products that correctly flag in the output signal the copyright status and the generation status of the input signal. Input signals for which copyright protection has been asserted, and which are not “original”, and which are used for sampling for more than 1 s, shall result in an output signal with bit 2 = “0” and bit 15 = “0”.

When the input signal originates from an A/D converter and carries category code 011 00XXL, the output signal can also carry category code A/D converter (011 00XXL).

Input signals, of which the copyright status is ambiguous such as with category code “general”, shall result in an output signal with bit 2 = “0” and bit 15 = “1” (copyright protection asserted, original).

G.3 User data: application specific details

Equipment specified in this annex is classified as class III (see 6.2.3).

Annex H
(normative)

Application of the digital interface in a digital broadcast receiver (Japan) in the consumer mode

This annex applies to equipment having category code “001 0000L”.

H.1 General: application-specific details

This category code shall be used for digital audio broadcast reception with or without a video signal (for example, digital satellite reception) in Japan.

The audio sample word length is 14 or 16 bits.

The auxiliary sample bits are “0”.

H.2 Channel status: application-specific details

Bits 0 to 5 (CONTROL) should be copied from the source.

Cp-bit = “0” in the case where copyright information has been transmitted and copyright protection asserted, or no copyright information is transmitted.

Cp-bit = “1” in the case where copyright information has been transmitted and no copyright protection asserted.

H.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

User data bits = “0” (reserved).

Annex J
(normative)

Application of the digital interface in a digital broadcast receiver (Europe) in the consumer mode

This annex applies to equipment having category code “001 1000L”.

J.1 General: application-specific details

This category code shall be used for digital audio broadcast reception with or without a video signal (for example, digital satellite reception) in Europe.

The audio sample word length is 14 or more bits.

J.2 Channel status: application-specific details

Cp-bit = “0” in the case where copyright information has been transmitted and copyright protection asserted or no copyright information is transmitted.

Cp-bit = “1” in the case where copyright information has been transmitted and no copyright protection asserted.

J.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

User data bits = “0” (reserved).

Annex K
(normative)

Application of the digital interface in a digital broadcast receiver (USA) in the consumer mode

This annex applies to equipment having category code “001 0011L”.

K.1 General: application-specific details

This category code shall be used for digital audio broadcast reception with or without a video signal (for example, digital satellite reception) in the USA.

The audio sample word length is 14 bits or more.

K.2 Channel status: application-specific details

Cp-bit = “0” in the case where copyright information has been transmitted and copyright protection asserted or no copyright information is transmitted.

Cp-bit = “1” in the case where copyright information has been transmitted and no copyright protection asserted.

K.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

User data bits = “0” (reserved).

Annex L
(normative)

Application of the digital interface for electronic software delivery in the consumer mode

This annex applies to equipment having category code “001 0001L”.

L.1 General: application-specific details

This category code shall be used for digital audio signals from receivers for which a fee may be charged for the reception of certain software.

L.2 Channel status: application-specific details

Cp-bit = “0” in the case where copyright information has been transmitted and copyright protection asserted, or no copyright information is transmitted.

Cp-bit = “1” in the case where copyright information has been transmitted and no copyright protection asserted.

L.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

Annex M
(normative)

Application of the digital interface in the digital compact cassette system in the consumer mode

This annex applies to equipment having category code “110 0001L”.

M.1 General: application-specific details

This category code shall be used for equipment specified according to the digital compact cassette (DCC) system.

M.2 Channel status: application-specific details

Not applicable.

M.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

Two modes are available, marker mode and extended mode. Both use the same definition of messages. The marker mode is required; the extended mode is optional.

M.3.1 Marker mode

This mode allows just one message that contains the most important information. This message consists of one information unit, which is shown in Figure M.1.

MSB							LSB
1	0	LAB	SH	FAD	MUT	STP	SCM
Start bit	Mode bit						

Figure M.1 – Marker mode

The bits have the following definition.

- The first bit is the start bit and is equal to “1”.
- The second bit is “0” to identify that it is a marker-mode message.
- LAB (LABEL): gives an indication of the position of the start of a track. The following rules apply:

  during play back the equipment should

  a) set the LAB-bit to “1” for 16 frames at the start of a new track;

NOTE The “0” to “1” transition coincides with the track start (a track start is indicated on pre-recorded tapes by the “1” to “0” transition of the L-ID, and on consumer recorded tapes by the “0” to “1” transition of the same bit);

  b) set the LAB-bit to “0” if the SCM-ID (and SCM-bit in the marker mode) is “1”.

  during recording the equipment should

  c) record an L-ID = “1” for 16 frames if it detects an SCM bit “1” to “0” transition;

  d) record an L-ID = “1” for 16 frames if it detects a LAB-bit “0” to “1” transition.

- SH (SHORTENING ID): If this bit is set to “1”, play starts.
- FAD (FADE): If this bit is set to “1”, a gradual reduction of playback level occurs from start of mute, and a gradual increase of playback level occurs from reset of mute. If this bit is set to “0”, start and reset of mute occur in one step.
- MUT (MUTE): If this bit is set to “1”, mute starts and will continue until the bit is reset to “0”.
- STP (STOP): This bit is set to “1” if no audio signal is available due to search actions or when playback is stopped. Otherwise, it is set to “0”.
- SCM (SECTOR MARKER): This bit is set to “1” during detection of a sector marker.

This marker-mode message shall be sent at least once for every DCC tape frame.

It is recommended that the information be sent simultaneously with the audio information.

NOTE L-ID and sector markers are signals recorded in the auxiliary information track of the DCC player, indicating specific portions of the tape.

M.3.2 Extended mode

In this mode several messages are defined. The first IU of a message is as shown in Figure M.2.

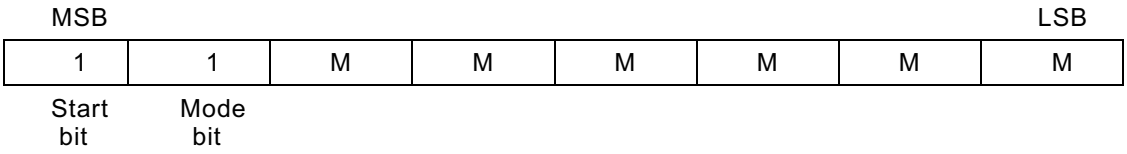

Figure M.2 – Extended mode

- The first bit is the start bit and is equal to “1”.
- The second bit is “1” to identify the extended mode.
- The remaining bits indicate the message number.

M.3.2.1 Message number “000000”: current status

Implementation of this message is optional. If implemented, a message shall be sent at least once in every tape frame.

This message contains information on the current status of the deck. Three bytes of information shall be made available: deck status, track number and index number. The three bytes are carried in four IUs. The layout of the whole message shall be as shown in Table M.1.

Table M.1 – Layout of message number “000000”

1 (Start)	1 (Extended mode)	0	0	0	0	0	0
1 (Start)	Error flag	State $_7$	State $_6$	State $_5$	State $_4$	State $_3$	State $_2$
1 (Start)	Error flag	State $_1$	State $_0$	Track $_7$	Track $_6$	Track $_5$	Track $_4$
1 (Start)	Error flag	Track $_3$	Track $_2$	Track $_1$	Track $_0$	Index $_7$	Index $_6$
1 (Start)	Error flag	Index $_5$	Index $_4$	Index $_3$	Index $_2$	Index $_1$	Index $_0$

The error flag is optional and can be used to indicate whether the information in the IU is possibly in error: “0” = no error, “1” = possible error in the remaining six bits.

The deck status is carried with the MSB first. It is a BCD-coded two-digit message. The codes given in Table M.2 apply.

Table M.2 – Deck status codes

Code	Meaning	Explanation
00	STOP	Deck stopped, no information read from tape
01	PAUSE	Deck in pause mode, no information read from tape
02	EJECT	Cassette ejected, no ITTS and auxiliary information available from tape
11	PLAY-A	Playback of sector A, information read from tape
12	PLAY-B	Playback of sector B, information read from tape
13	PLAY-C	Playback of sector C, information read from tape
14	PLAY-D	Playback of sector D, information read from tape
18	CC-PLAY	A compact cassette is played back, no information from tape
21	WIND	Wind (forward in time), no information read from tape
22	REWIND	Rewind (backwards in time), no information read from tape
23	SEARCH-F	Forward search, track number estimated from markers
24	SEARCH-B	Backward search, track number estimated from markers
30	REC-PAU	Recording + pause mode, no ITTS and auxiliary information available from tape
31	REC	Recording, no ITTS and auxiliary information available from tape

Mode indications 30 and 31 shall be available only during recording from analogue sources. Recording from digital sources implies that the information from the digital source will be copied on the digital output.

The track and index information is copied from the auxiliary data, or may be estimated during search or playback of tapes with track numbering. During playback of tapes without track numbering or compact cassettes, the track and index number is unknown (“00”). Both bytes are BCD-coded with MSB first.

M.3.2.2 Message numbers “000001”, “000010”, “000011”: ITTS packet message

Text information in the form of “ITTS packets” from the DCC tape can optionally be transferred on the digital output. If implemented, the message number “000000” (current status) shall also be implemented. All ITTS packets shall be sent in the same sequence as recorded on the DCC tape.

The message number indicates whether the message contains the start of an ITTS packet, a continuation or the end of a packet.

Message number	Contents
“000001”	ITTS packet start or complete packet
“000010”	ITTS packet continuation
“000011”	ITTS packet continuation and end

The 48 bytes of an ITTS packet shall be coded in a similar way to the method used for coding the three bytes of the current status message, using four IUs for every three bytes, bytes coded with the MSB first. If a message does not contain a multiple of three ITTS bytes, the remaining bits in the IU that contains the last bits of the final ITTS byte shall be padded with "0" bits (for example, for a message of two ITTS bytes, three information units are used, in which the two final bits of the third information unit contain "0"). It is not permitted to add an IU that is fully padded with "0" bits, as this would make the detection of an ITTS byte with all zeroes impossible.

In total, the extended message consists of a maximum of 66 IUs: one IU to indicate extended message, one IU containing message contents identification, and a maximum of 64 IUs for the ITTS packet data, including error flags and start bits.

An example of a complete ITTS packet extended message is shown in Table M.3.

Table M.3 – ITTS packet extended message example

1 (Start)	**1 (Extended mode)**	**0**	**0**	**0**	**0**	**0**	**1**
1(Start)	IU count $_6$	IU count $_5$	IU count $_4$	IU count $_3$	IU count $_2$	IU count $_1$	IU count $_0$
1(Start)	Error flag	Byte 1_6	Byte 1_6	Byte 1_5	Byte 1_4	Byte 1_3	Byte 1_2
1(Start)	Error flag	Byte 1_1	Byte 1_0	Byte 2_7	Byte 2_6	Byte 2_5	Byte 2_4
1(Start)	Error flag	Byte 2_3	Byte 2_2	Byte 2_1	Byte 2_0	Byte 3_7	Byte 3_6
1(Start)	Error flag	Byte 3_5	Byte 3_4	Byte 3_3	Byte 3_2	Byte 3_1	Byte 3_0
…	…	…	…	…	…	…	…
1(Start)	Error flag	Byte 46_7	Byte 46_6	Byte 46_5	Byte 46_4	Byte 46_3	Byte 46_2
1(Start)	Error flag	Byte 46_1	Byte 46_0	Byte 47_7	Byte 47_6	Byte 47_5	Byte 47_4
1(Start)	Error flag	Byte 47_3	Byte 47_2	Byte 47_1	Byte 47_0	Byte 48_7	Byte 48_6
1(Start)	Error flag	Byte 48_5	Byte 48_4	Byte 48_3	Byte 48_2	Byte 48_1	Byte 48_0

The information unit count (IU count $_{6...0}$) indicates how many information units will follow and can range from 0 (no ITTS information available) to 64 (complete ITTS packet).

IU count $_6$ = MSB, IU count $_0$ = LSB, binary coded.

The error flag is optional and can be used to indicate whether the information in the IU is in error: "0" = no error detected, "1" = error in the remaining six bits.

Bytes 46 to 48 represent here the three last character codes in an ITTS packet.

Partial ITTS packets may be sent in similar fashion. The message number may need to be changed according to the contents: start, continuation or end. Several combinations are possible, as shown in M.3.2.3a), b) and c).

It is also allowed to mix ITTS messages with marker-mode and other extended-mode messages, as long as the ITTS packet sequence is maintained, as shown in M.3.2.3d).

M.3.2.3 Examples of ITTS packet transfer

a) Complete ITTS packet transfer

Message number	IU count	Total message length	ITTS bytes
000001 start	64	66	48

b) One ITTS packet in the form of two combined messages

Message number	IU count	Total message length	ITTS bytes
000001 start	32	34	24
000011 end	32	34	24

c) Two examples of one ITTS packet in the form of three combined messages

Example 1

Message number	IU count	Total message length	ITTS bytes
000001 start	11	13	8
000010 continue	43	45	32
000011 end	11	13	8

NOTE The number of ITTS bytes transferred in a message in the examples above may be changed, as long as the total number of ITTS bytes remains below 48 and the IU count is adjusted accordingly.

Example 2

Message number	IU count	Total message length	ITTS bytes
000001 start	12	14	9
000010 continue	40	42	30
000011 end	12	14	9

d) One ITTS packet in the form of eight messages with marker mode and current status

First byte	IU count	Total message length	ITTS bytes
11000001 start	8	10	6
11000010 continue	8	10	6
11000010 continue	8	10	6
11000010 continue	8	10	6
10xxxxxx marker	–	1	–
11000000 current status	–	5	–
11000010 continue	8	10	6
11000010 continue	8	10	6
11000010 continue	8	10	6
11000011 end	8	10	6

Other message numbers are reserved for future use.

Annex N
(normative)

Application of the digital interface in the mini-disc system in the consumer mode

This annex applies to equipment having category code “100 1001L”.

N.1 General: application-specific details

This category code is for signals from products according to the mini-disc system.

N.2 Channel status: application-specific details

Not applicable.

N.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

The format of user data is in accordance with Clause A.3.

Annex O
(normative)

Application of the digital interface in a digital sound processor in the consumer mode

This annex applies to equipment having category code “010 1010L”.

O.1 General: application-specific details

This category code is for signals from products that transform the audio information, such as equalization, echo, delay, surround sound, etc.

O.2 Channel status: application-specific details

Not applicable.

O.3 User data: application-specific details

Equipment specified in this annex is classified as class II (see 6.2.3).

Annex P
(normative)

Application of the digital interface in the digital versatile disc system (DVD) in the consumer mode

This annex applies to equipment having category code “100 1100L”

P.1 General: application-specific details

This category code is for signals from products according to the DVD system.

P.2 Channel status: application-specific details

Not applicable.

P.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

Annex Q
(informative)

Use of original sampling frequency, sampling frequency and clock accuracy

The bit states in the channel status fields for "original sampling frequency", "sampling frequency" and "clock accuracy" can identify the process being executed in a player and interface unit of a transmitter.

For explanation, terms are defined in Table Q.1.

Table Q.1 – Term definitions

Term	Meaning	Explanation
OSF	Original sampling frequency	Sampling frequency recorded on disc, etc. This can be identified by bits 36-39
TSF	Transmitted sampling frequency	The sampling frequency required to present the transmitted audio data at the intended reproduction speed. This can be identified by bits 24-27
IFR	Interface frame rate	Frame rate on interface
N	Up or down sampling ratio	By re-sampling, etc.
M	High-speed transmission ratio	By high-speed revolution of disc, etc.

The player and interface model is described in Figure Q.1.

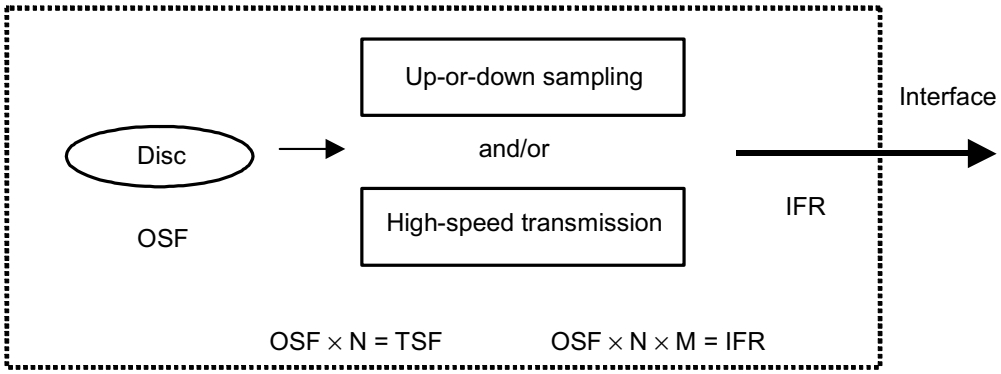

Figure Q.1 – Player and interface model

In this model, cases depend on the state of channel status bits 28 and 29, as described in Table Q.2. With the state “11”, "interface frame rate not matched to sampling frequency", high-speed transmission is used and the interface frame rate (IFR) is scaled up from the transmitted sampling frequency (TSF) by the high-speed transmission ratio (M). For other states of bits 28 and 29 IFR is equal to TSF.

TSF is equal to the original sampling frequency (OSF) except when up-or-down sampling (sample rate conversion) is used. In that case the TSF is scaled from the OSF by the up or down sampling ratio (N).

Table Q.2 – Cases

Bits 28,29	TSF	IFR	Case
11	TSF = N × OSF	IFR = TSF × M	High-speed transmission and up or down sampling
11	TSF = OSF	IFR = TSF × M	High-speed transmission
00, 01, 10	TSF = N × OSF	IFR = TSF	Up or down sampling
00, 01, 10	TSF = OSF	IFR = TSF	Original

In Table Q.3, some examples of cases are described.

Table Q.3 – Example

	Player conditions					Interface coding		
	Sampling frequency recorded in disc	Up or down sampling ratio	Transmitted sampling frequency	High-speed transmission ratio	Interface frame rate	Clock accuracy	Original sampling frequency (OSF)	Sampling frequency (TSF)
	OSF	N	TSF	M	IFR	Bit 28,29	Bits 36-39	Bits 24-27
Formula			OSF x N		OSF x N x M			
Example	44,1 kHz	2	88,2 kHz	1	88,2 kHz	00,01,10	1111	0001
		1	44,1 kHz	1	44,1 kHz	00,01,10		0000
				2	88,2 kHz	11		
				4	176,4 kHz	11		
	96 kHz	1	96 kHz	1	96 kHz	00,01,10	1010	0101
				2	192 kHz	11		
		1/2	48 kHz	1	48 kHz	00,01,10		0100
				2	96 kHz*	11		
				4	192 kHz	11		
	192 kHz	1	192 kHz	1	192 kHz	00,01,10	1000	0111
		1/2	96 kHz	1	96 kHz	00,01,10		0101
				2	192 kHz*	11		
		1/4	48 kHz	1	48 kHz	00,01,10		0100
				2	96 kHz	11		
				4	192 kHz*	11		

NOTE Even if OSF is equal to IFR, there may be a down sampling and high-speed transmission process if TSF is not also equal. See *.

Annex R
(normative)

Application of the digital interface in magnetic disc digital audio systems in the consumer mode

This annex applies to equipment having category code “110 1100L”.

R.1 General: application-specific details

This category code is for signals from magnetic disc, i.e. hard disc drive products.

The code “110 11000” shall be used for read-out from home-recorded discs or no indication.

The code “110 11001” shall be used for read-out from commercially released pre-recorded discs or equivalent contents that is delivered by the other media or system.

The audio sample word length is maximum 24 bits.

R.2 Channel status: application-specific details

Not applicable.

R.3 User data: application-specific details

Equipment specified in this annex is classified as class I (see 6.2.3).

Annex S
(normative)

Explanations of category code implementation

S.1 Multi-media player

When a product can play multiple recorded media, a category code is assigned as a medium that is playing. This rule is compliant with the definition of 5.3.1.

Then a category code may change within a player that can play multi-media (see Figure S.1).

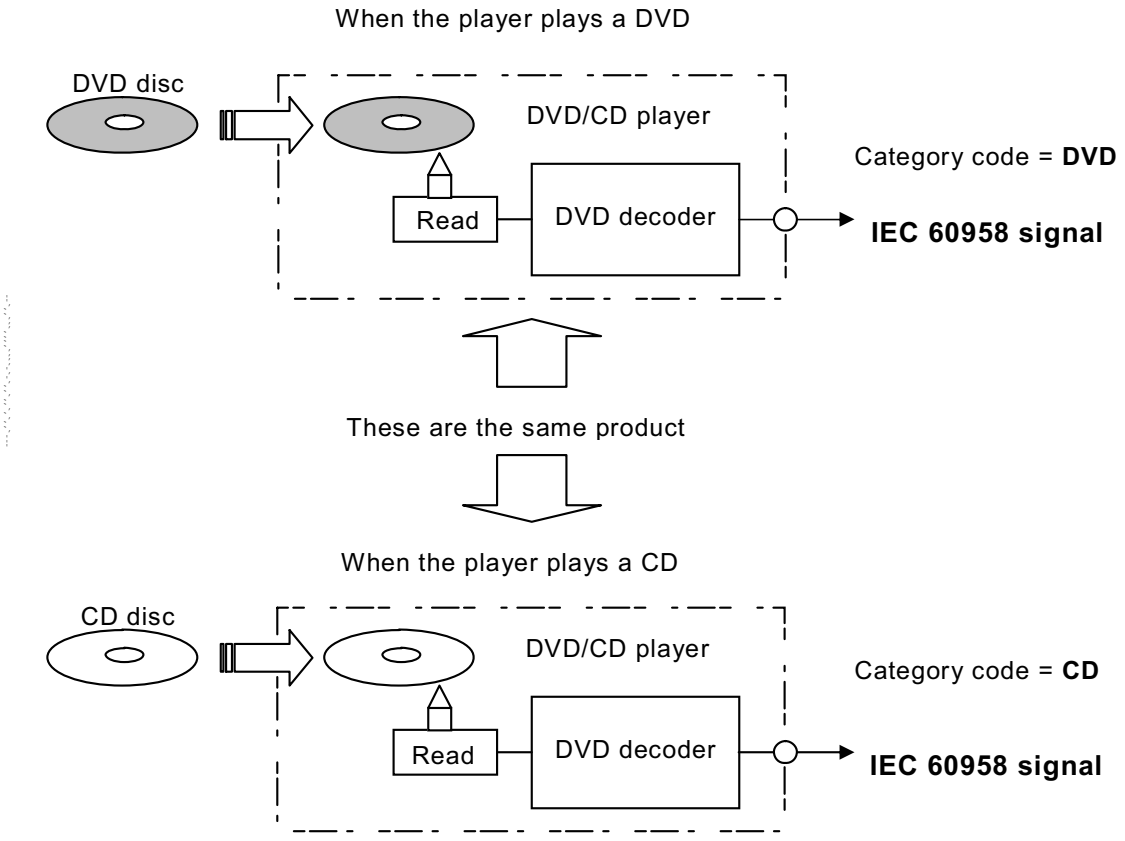

Figure S.1 – Multi-media player

S.2 Home-recorded medium player

A category code from a player is a category code of playing medium.

If a CD recorder records some contents from an IEC 60958 interface that has a category cord, a player that plays the recorded disc does not carry a category code of the original source (see Figure S.2).

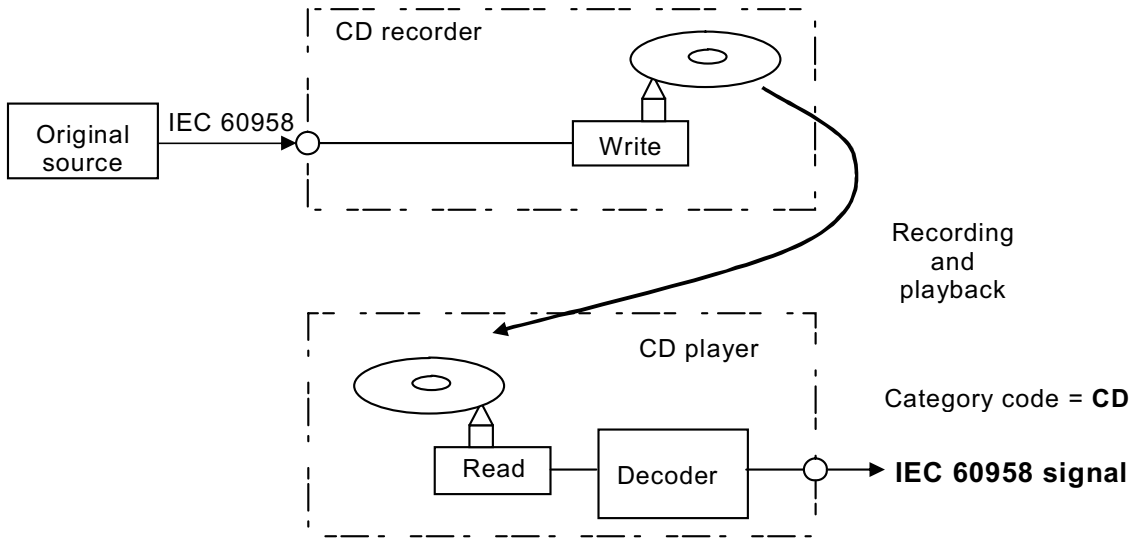

Figure S.2 – Home-recorded medium player

S.3 Monitoring output from a recorder

S.3.1 Real-time monitoring (direct monitoring)

If output data is transmitted direct from an input monitoring terminal, the category code is the same as the input one (see Figure S.3).

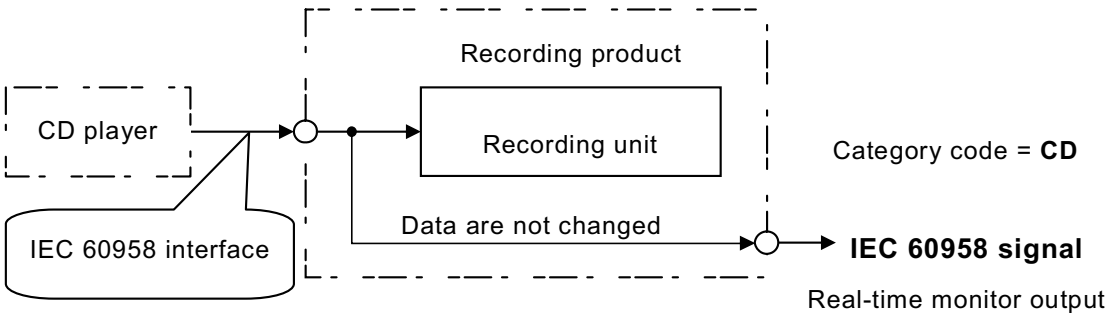

Figure S.3 – Direct monitoring

S.3.2 Monitoring after recording

An output category code is assigned as a reading medium.

Even if writing and reading are done simultaneously, the output category code is one of reading medium (see Figure S.4).

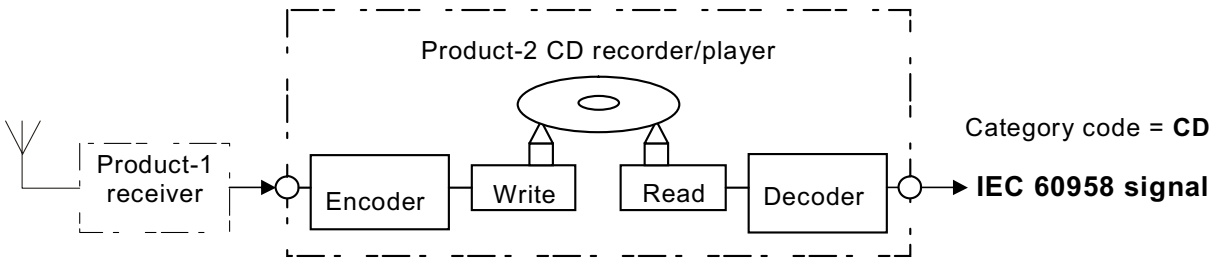

Figure S.4 – Monitoring after recording

S.4 Integrated products

The definition of 5.3.1 defines a category code of a product as an active function to make a source data. In other words, a category code of an integrated product is assigned to the selected unit (see Figure S.5).

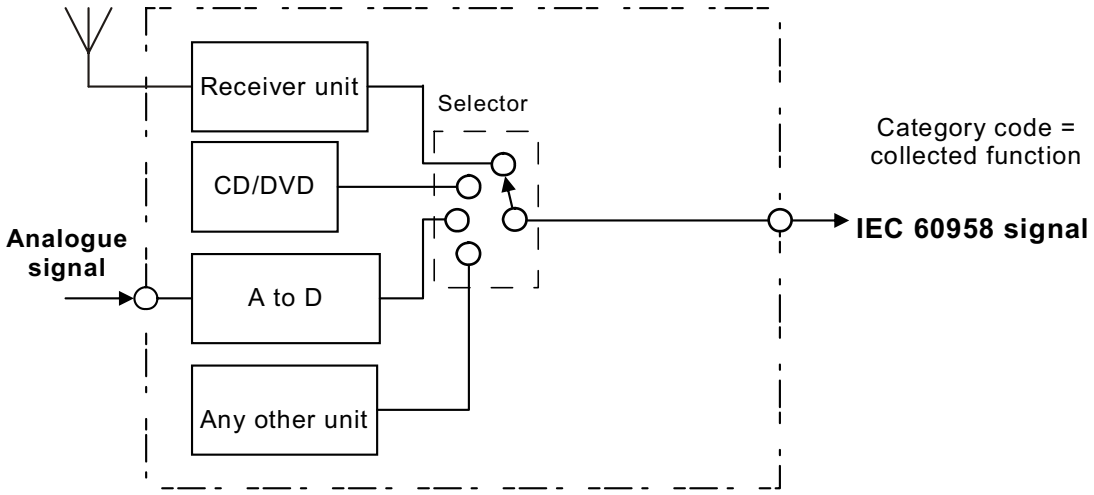

Figure S.5 – Integrated product

S.5 Implementation rule of category code groups for digital/digital converter and signal-processing products

S.5.1 Discrete product worked as a digital/digital converter or a signal processing unit

A category code of an output signal is assigned by Table 5 as 010 XXXXL".

When an input IEC 60958 data is not changed in the product, an output category code of the product takes over from the input category code. Even in this case, a product of this group may use the category code of "digital/digital converter or a signal processing unit". In this case, the setting of output channel status should be equivalent to the source channel status. Discrete product complied with category code groups of digital/digital converter and processing unit (see Figure S.6).

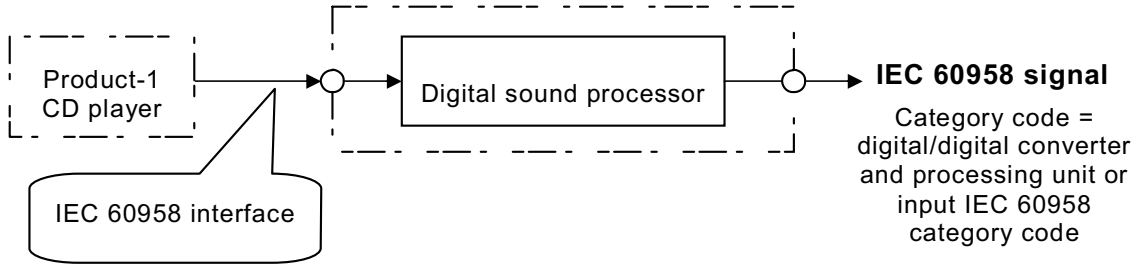

Figure S.6 – Digital/digital converter

S.5.2 Integrated product including a digital/digital converter or a signal processing unit

When the input of a digital/digital converter or a signal processing unit is connected to other units or input terminals in the product as follows, the output category code may be assigned as source unit and also assigned as "digital/digital converter and signal processing products". In this case, the setting of output channel status should be equivalent to source conditions (see Figure S.7)..

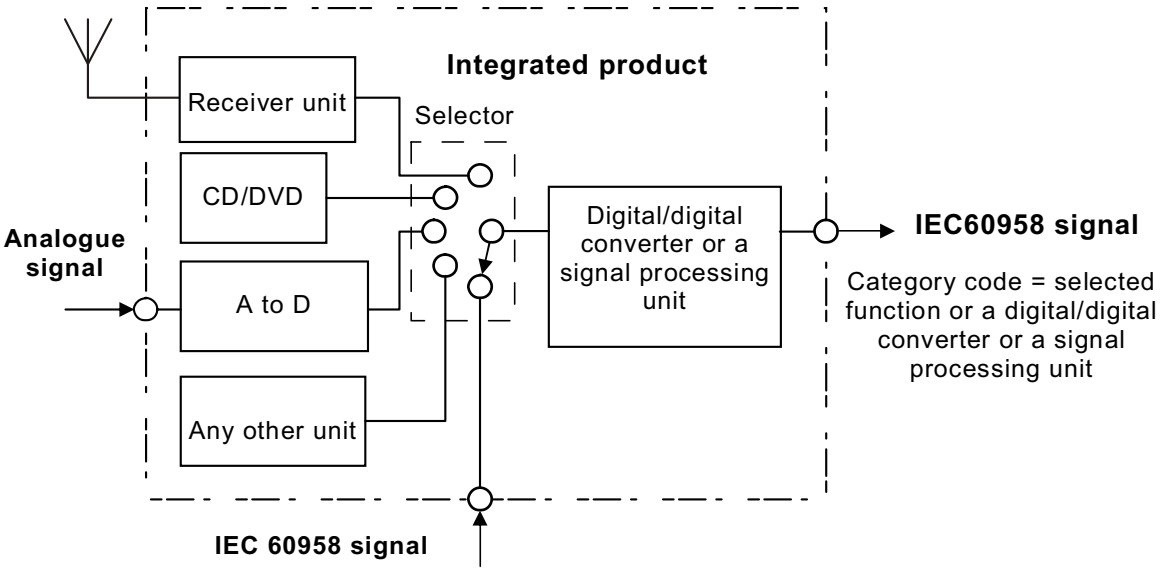

Figure S.7 – Integrated product including digital/digital converter

S.6 Magnetic disc recorder unit inside an integrated product

If an output signal is transmitted from a magnetic disc recorder unit in a playback of a magnetic disc as follows, a category code of a product shall be defined as one of a tape- or disc-based products reception whatever the selector position is (see Figure S.8).

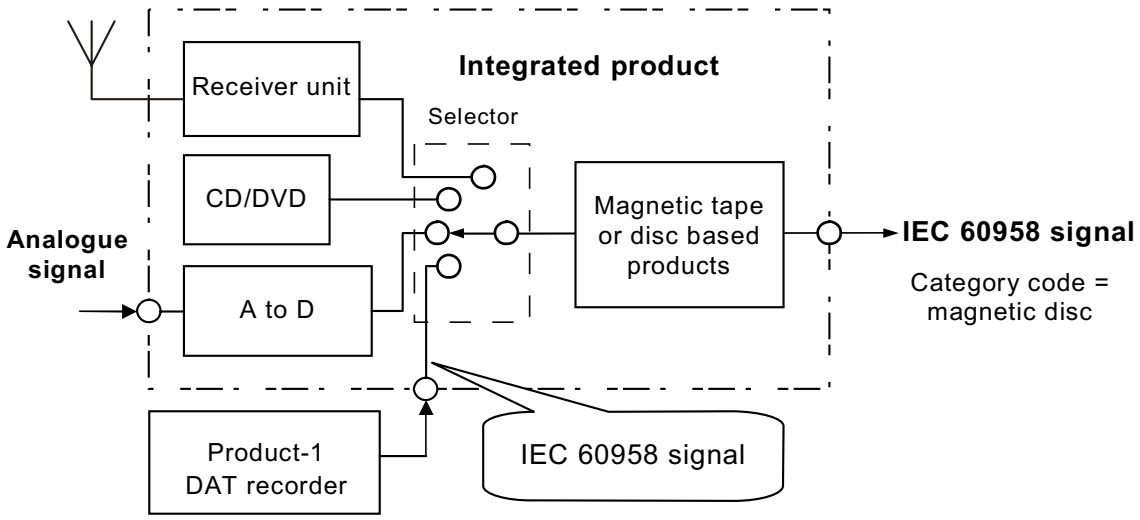

Figure S.8 – Integrated product including magnetic disc recorder

S.7 Category code assignment

S.7.1 No category code in a corresponding category code group

If there is no corresponding category code for the product, it may use a category code of "other products" in the category group.

S.7.2 No category code group for a corresponding product

If there is no corresponding category group for the product, it may use a category code of "other products".

S.8 Other assignment of integrated products

Though a category code of a product is defined as an active function to make a source data, to keep consistency with the previous version of this standard, it is admitted that one category code can be assigned to a product.

In order to apply this method, the category code should not change in any case, and the setting of the output channel status should be equivalent to source conditions.

Annex T
(informative)

Application of the digital audio interface for synchronization of audio, video and multi-media equipments

When reproducing or watching audiovisual content, audio and video presentation time should be assumed to coincide at the source device. However, lip-sync problems may be caused by transmission. It is because of the difference between audio latency and video latency, especially in each individual case of equipment on the paths. In order to solve the problem, this technical specification provides some usages of time-code and latency information onto the digital audio interface.

T.1 Lip-sync system model

The subject is each latency form reproducer to AV presentation (see Figure T.1).

Definitions

Latency: unavoidable delay in a device to propagate and/or processing a data stream from input to output.

Delay: amount of delay intentionally added to a data stream in a device.

TLv: total sum of latencies of video stream.

TLa: total sum of latencies of audio stream.

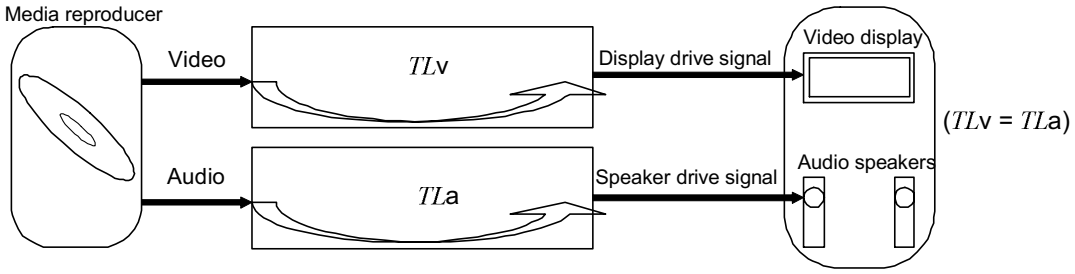

Figure T.1 – Lip-sync system model

T.2 How to compensate lip-sync

The basic way is by adding delay to the equipment on the shorter latency path as well as on others. For that purpose, it is necessary to detect the difference between TLv and Tla. Vice versa extra delay on the video path can be added in principle.

Even if there is not any compensation, it may be negligible because the allowance is high enough in the case where the video presentation is faster than the audio (see Figure T.2).

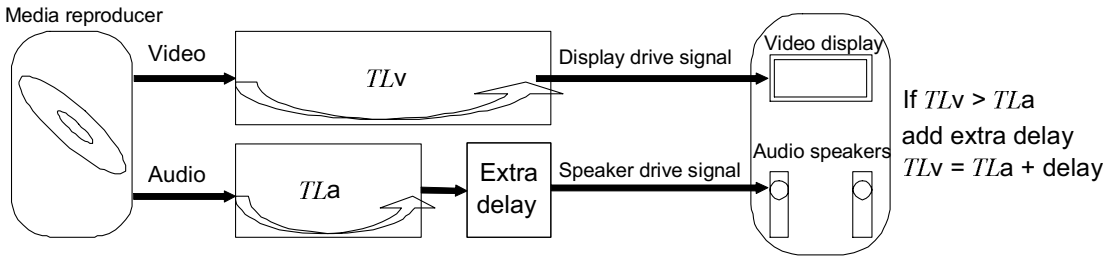

Figure T.2 – Lip-sync compensation

T.2.1 Detection methods

There are two types of method as follows.

T.2.1.1 Time-code transmission method

The source transmits SMPTE time code concurrently with audio and video signals (see Figure T.3). The controller detects the difference between the audio SMPTE output and that of video. Then the controller adds extra delay.

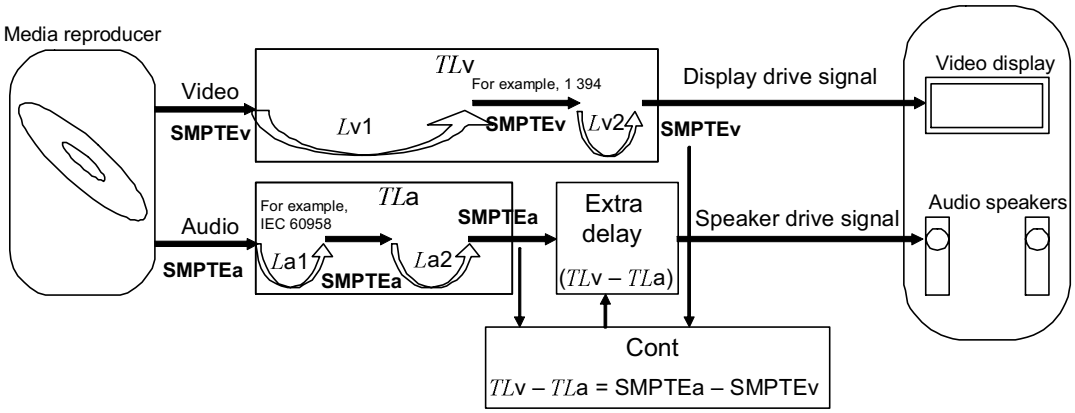

Figure T.3 – Time-code transmission

T.2.1.2 Latency parameter transmission method

All devices transmit accumulative latency parameter. For instance, Video device2 adds $Lv2$ on $ALv1$ and output accumulated value as $ALv2$. Therefore, the final device output total sum of latencies through the path is, for example, TLv or TLa. A controller detects TLv and TLa. Then the controller adds extra delay ($TLv - TLa$) on the device in the audio path if $TLv > TLa$ (see Figure T.4).

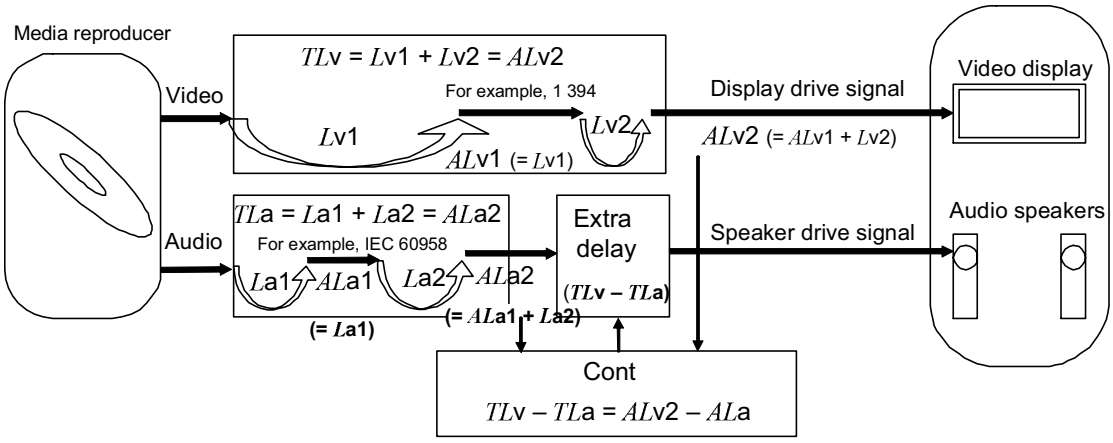

Figure T.4 – Latency parameter transmission

T.2.1.3 Latency parameter transmission method with TLv

When the video path has bi-directional data interface such as IEEE 1394 or HDMI, the source device may inquire the total sum of latencies through the video path by some command sequence in IEEE 1394 or by EDID system in HDMI. If the source gets the *TL*v parameter by means of up-directional way, the *TL*v parameter can be transmitted in the audio interface among others. The audio devices transmit accumulative audio latency parameter with *TL*v parameter. Therefore, the final audio device output total sum of latencies through the audio path as *TL*a with *TL*v. Then the controller detects both *TL*v and *TL*a only from the final audio device. Then the controller adds extra delay (*TL*v – *TL*a) on the device in audio path, if *TL*v > *TL*a (see Figure T.5).

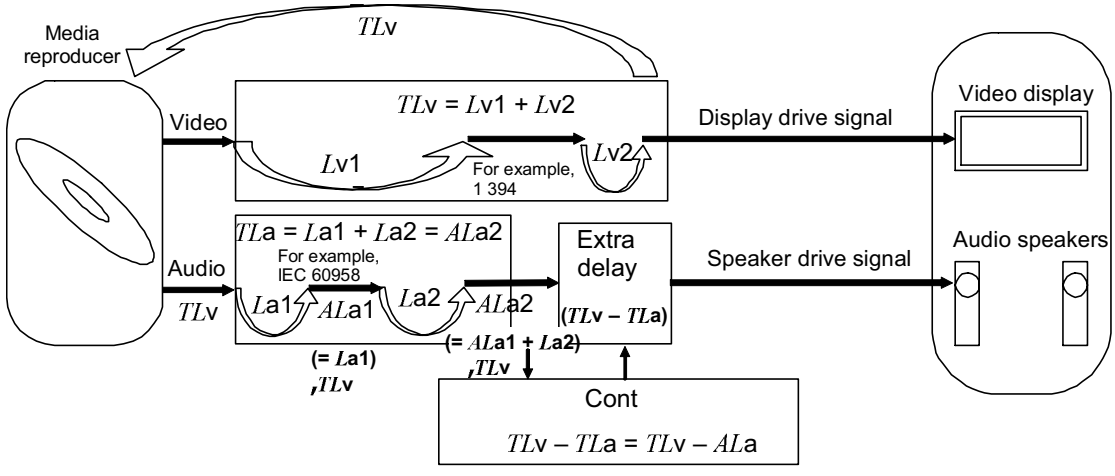

Figure T.5 – Latency parameter transmission with TLv

T.3 Use of time code

When a source transmits the SMPTE LTC time code and/or the SMPTE VITC time code by users bit, the time code transmission timing shall be aligned the first start bit of first IU to the video frame top. Therefore, the source shall transmit time the code frame by frame. If there is no valid time code, the source shall not transmit the SMPTE time code.

When a repeater or an equivalent device transmits the SMPTE LTC time code and/or the SMPTE VITC time code by users bit, the time code transmission timing shall have same delay as audio latency. If there is no valid time code, the repeater shall not transmit the SMPTE time code.

T.4 Use of latency information

When a source transmits audio latency and/or video latency by users bit, the latency information transmission timing shall be transmitted at least every 500 ms. In this case, the audio latency shall be the audio latency of the source itself, and the video latency shall be the TLv parameter that is detected by the up-directional interface in the other video path. If there is no valid information, the source shall set the validity bit to invalid status, or shall not transmit any latency information.

When a repeater or an equivalent device transmits audio latency and/or video latency by users bit, the latency information transmission timing shall be transmitted at least every 500 ms. In this case, the audio latency shall be the added audio latency of the repeater itself on the previous input value accumulatively, and the video latency shall be TLv as transparent value. If there is no valid information, the repeater shall set the validity bit to invalid status, or shall not transmit any latency information.

When a sink device receives the audio latency and/or the video latency by users bit, the audio latency shall be the added audio latency of the sink itself on the previous input value accumulatively. Then the final audio latency shall be TLa. If both audio latency and video latency are valid, the sink device may calculate difference between TLv and TLa. Then the sink device adds extra delay to compensate if capable. If only the audio latency is valid, the sink device cooperates to a device which detects total video latencies (TLv).

T.5 Example of latency parameter transmission method with TLv

T.5.1 An example for solving lip-sync problems

An example for solving lip-sync problems caused primarily by video processing time is shown in Figure T.6.

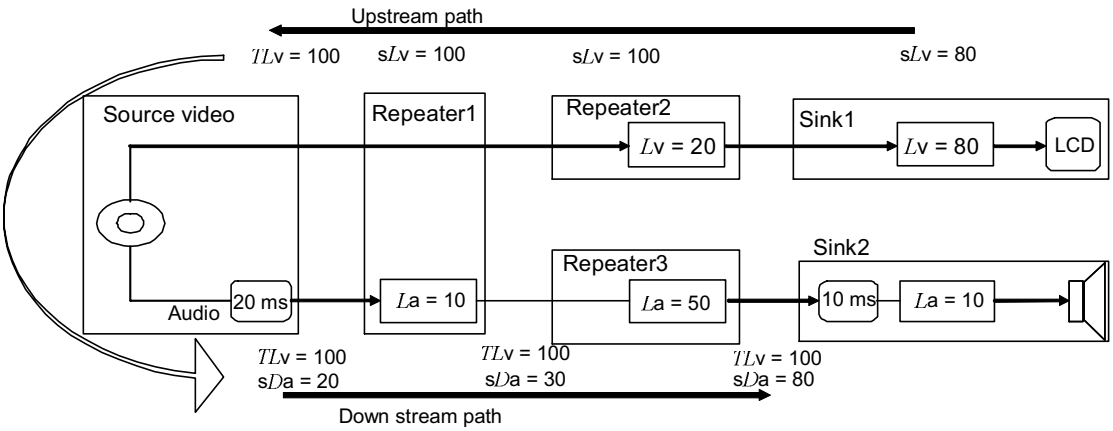

Figure T.6 – Example of latency parameter transmission

In this example, the source device is the DVD player. The source device first enquires the total sum latency of the video path from the source to the sink device by means of HDMI EDID. The latencies of the devices in the video path are as follows.

Repeater2: Lv1 = 20 ms , Sink1: Lv2 = 80 ms

As a result, the total latency of the video is 100 ms; and the source device gets the result parameter TLv (= 100 ms).

The source device transmits both the TLv (= 100 ms) and its own audio latency (La1 = 20 ms) as ALa = 20 ms by using, for example, the u-bit. Repeater1 receives TLv = 100 ms and ALa = 20 ms and transmits TLv = 100 ms and TLa = 30 ms that is accumulated from the source to the point. Repeater2 receives TLv = 100 ms and ALa = 30 ms and transmits TLv = 100 ms and ALa = 80 ms that is accumulated from the source to the point. Sink2 has adjustable audio delay and its own latency of 10 ms. Sink2 receives TLv = 100 ms and ALa = 80 ms and add extra delay of 10 ms for minimizing the difference between the total audio latency and the total video latency. As a result, the total latency of the audio becomes 100 ms. Thus, the audio path and the video path have the same amount of latency and the lip-sync problem can be solved.

T.5.2 Another example for solving lip-sync problems

Another example for solving lip-sync problems caused primarily by video processing time is shown in Figure T.7.

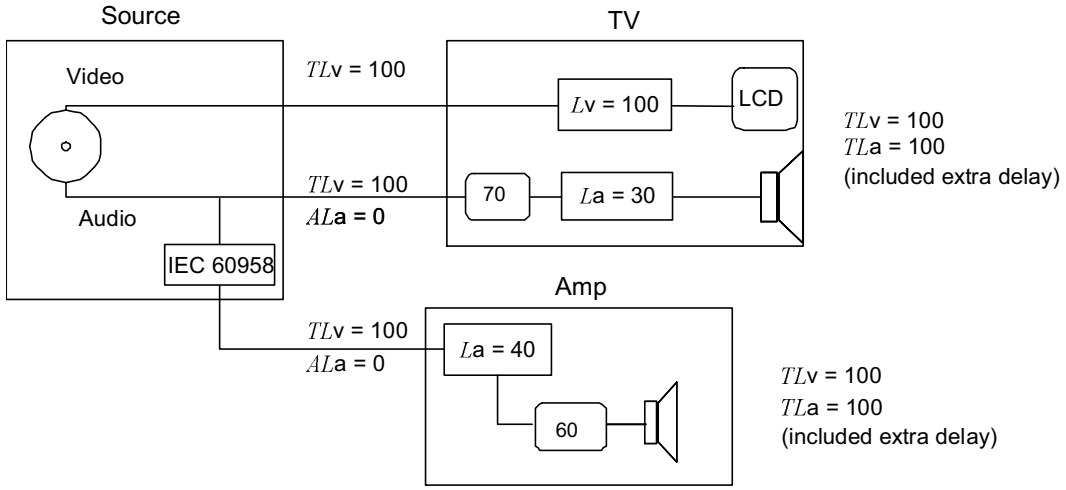

Figure T.7 – Another example for solving lip-sync problems

This example includes some branching audio path. The source device first enquires the total sum latency of the video path from the source to the sink device by means of HDMI EDID. The latencies of the devices in the video path are as follows.

TV: Lv = 100 ms

So the total latency of the video is 100 ms; and the source device gets the result parameter TLv (= 100 ms).

The source device transmits both TLv (=100 ms) and its own audio latency (La = 0 ms) as ALa = 0 ms to TV. TV has adjustable audio delay and its own latency of 30 ms. TV receives TLv = 100 ms and ALa = 0 ms and adds an extra delay of 70 ms. The source device also transmits both TLv (= 100 ms) and its own audio latency (La = 0 ms) as ALa = 0 ms to AMP by using, for example, a u-bit. AMP has adjustable audio delay and its own latency of 40 ms. AMP receives TLv = 100 ms and ALa = 0 ms and adds an extra delay of 60 ms. As a result, the total latency of audio becomes 100 ms at the TV. The total latency of audio also becomes 100 ms at the AMP. Thus, all the latencies of the total audio path are adjusted to the same value of video. The lip-sync problem can be solved in this topology.

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