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Contents

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Foreword

This European Telecommunication Standard (ETS) has been prepared by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This ETS is part of a series of standards which describe the Videotex data syntax and is consistent with the work being carried out by CCITT Study Group VIII on Question 14. It also specifies a common data syntax for transmitting sound to be used by Videotex terminal equipment.

This ETS defines a data syntax for conveying audio data in a Videotex environment. In this data syntax a variety of audio encoding techniques are embedded in one general structure. No algorithms or specific sound encodings are specified. It allows for the embedding of both waveform and phonemic encodings.

This ETS closely follows the concepts and coding techniques as defined in ISO/IEC 9281 [1] for the identification of pictorial information and for switching between picture encoding environments and coding systems according to ISO 2022 [2].

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1 Scope

This standard specifies the data syntax to be used by Videotex services for conveying sound information.

This standard is applicable to terminals connected to public data networks. Typically, these should be terminals, supporting Integrated Services Digital Network (ISDN) syntax-based Videotex, to be attached at either side of a T reference point or coincident S and T reference points of a public ISDN.

2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ISO 9281: "Information technology - Picture coding methods".

[2] ISO 2022: "Information Processing - ISO 7-bit and 8-bit coded character sets - Code extension techniques".

[3] ETS 300 072 (1990): "Terminal Equipment (TE); Videotex presentation layer protocol, Videotex presentation layer data syntax".

[4] ETS 300 073 (1990): "Videotex presentation layer data syntax : Geometric display (CEPT Recommendation T/TE 06-03, Edinburgh 1988)".

[5] ETS 300 074 (1990): "Videotex presentation layer data syntax : Transparent data (CEPT Recommendation T/TE 06-03, Edinburgh 1988)".

[6] ETS 300 075 "1990": "Terminal Equipment (TE); Videotex processable data".

[7] ETS 300 076 (1990): "Terminal Equipment (TE); Videotex, Terminal Facility Identifier (TFI)".

[8] CCITT Recommendation T.101 (1988): "International Interworking for Videotex".

[9] ISO 646: "Information processing - ISO 7-bit coded character set for information exchange".

[10] CCITT Recommendation G.711 (1988): "Pulse code modulation of voice frequencies".

[11] CCITT Recommendation G.721 (1988): "32 kbit/s adaptive differential pulse code modulation.

[12] CCITT Recommendation G.723 (1988): "Extensions of Recommendation G.721 ADPCM to 24 and 40 kbit/s for DCME application".

[13] CCITT Recommendation G.722 (1988): "7 kHz audio-coding within 64 kbit/s".

[14] GSM Specification 06.10: "GSM Full-rate speech transcoding".

[15] CCITT Recommendation J.41: "Characteristics of equipment for the coding of analogue high quality sound programme signals for transmission on 384 kbit/s channels".

[16] CCITT Recommendation J.42: "Characteristics of equipment for the coding of analogue medium quality sound programme signals for transmission on 384 kbit/s channels".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of this ETS, the following definitions apply:

Audio bit rate: the bit rate required to convey data which is coded according to a specific encoding in real time.

Data Syntax: data syntax I, II or III.

Data Syntax I: data syntax used in the CAPTAIN system.

Data Syntax II: European data syntax (ETSs 300 072 to 300 076 [3] to [7]).

Data Syntax III: data syntax used in the NAPLPS system.

NOTE : The three data syntaxes above are described in CCITT Recommendation T.101 [8].

Encoding: coding method of audio data according to a specific algorithm and coding convention.

Recording level: the mean level of the sound signal as it was recorded.

Sampling rate: aspect of a sound encoding defining the amount of samples encoded per time unit.

Synchronisation mode: attribute of an encoding defining the synchronisation to be applied to the audio data.

Transfer rate: the effective amount of data bits which can be exchanged between communicating entities.

Translation mode: attribute of an encoding defining the method of packing data into octets in order to achieve transparency.

3.2 Symbols and abbreviations

For the purposes of this ETS the following abbreviations apply:

ADPCM	Adaptive Differential Pulse Code Modulation
AM	Alphamosaic
CMI	Coding Method Identifier
GSM	Special Mobile Group
LI	Length Indicator
MI	Method Identifier
P	Profile in Data syntax II
PCD	Picture Coding Delimiter
PCE	Picture Control Entity
PCM	Pulse Code Modulation
PDE	Picture Data Entity
PE	Picture Entity
PI	Picture Identifier

PM	Picture Mode
RPE-LTP	Residual Pulse Excitation - Long Term Predictive
VPCE	Videotex Presentation Control Element

4 Overview

The audio data syntax allows for the embedding of a variety of different audio-coding techniques in one single overall structure. Each information element is tagged with an introducer indicating:

- the coding technique being used;
- the audio bit rate of the coding.

The audio bit rate indicates the bit rate with which the used encoding can be conveyed in real time. The audio bit rate is strongly related to the sampling rate and may be different from the actual transfer rate of the protocol being used for data exchange.

The audio data syntax provides for block-wise transmission of audio data, thus avoiding the need for terminals to scan through streams of audio data for delimiter sequences.

To increase the actual data throughput, the audio data syntax provides for transparent data transport, thereby surpassing the coding convention, that data representing information is coded in columns 2 - 7 (and 10 - 15 in a 8-bit environment).

5 Introducer

The introducer for sound shall be in accordance with ISO/IEC 9281 [1] and has the following coding: ESC 7/0 2/4 where 2/4 identifies audio-coding.

The return from the sound environment may be done by using ESC 2/5 4/0 (return to default ISO 2022 [2] environment) or by switching explicitly to an identified environment using another ESC 2/5 x/y sequence, or by the end of an ISO/IEC 9281 [1] picture element, at which time the current ISO 2022 [2] coding environment (i.e. the base Videotex data syntax) takes effect.

6 ISO/IEC 9281 syntax and switching structure

In some Videotex systems, in a situation where an interruption of the audio data flow is required (caused probably by user interaction) the following may occur. The Picture Entity (PE) being sent to the terminal is completely sent. The next PE sent to the terminal can have the Picture Data Entity (PDE) value set to 04/02 to indicate the end of the data, the PDE will contain only byte (Length Indicator = 1).

If possible, the speed of the network should be taken into account when defining the number of bytes in a PDE with the aim of tolerable interaction response time. As a rough guide, a block length that does not result in a response time exceeding 200 ms - 500 ms may by used.

6.1 Overall switching of coding environment

ISO/IEC 9281 [1] describes a technique for identifying coding methods. The Videotex photographic audio mode is one of the coding methods identified by ISO/IEC 9281 [1]. The diagram in figure 1 gives an overview of the relationship between the Videotex data syntaxes and ISO/IEC 9281 [1] coding environments.

A Videotex data syntax can be explicitly entered using an ESC 2/5 F code, this is also the mechanism for entering an ISO/IEC 9281 [1] environment. The Videotex data syntaxes can therefore be regarded as being ISO/IEC 9281 [1] environments.

A Videotex terminal should usually begin operation, by default, in one of the data syntaxes. It shall not be mandatory to first send an ESC 2/5 F code. The diagram shows how these codes can be used to switch a terminal supporting more than one data syntax from one data syntax to another.

NOTE: It is advisable that the Videotex service explicitly switches the terminal into the required data syntax by sending an ESC 2/5 F sequence to the terminals at connect time.

6.2 Switching into the audio mode

A Videotex terminal operating within one of the data syntaxes can enter the audio mode with the code ESC 7/0 Coding Method Identifier (CMI), as defined in ISO/IEC 9281 [1]. The CMI is used to distinguish between coding methods. In the case of Videotex this shall be, for example, a distinction between audio and photographic data.

An alternative mechanism is defined by ISO/IEC 9281 [1] for entering a coding environment. A unique ESC 2/5 F code is registered for the purpose of switching directly into this coding environment. This implies that a non-Videotex terminal can enter the Videotex audio mode. A Videotex terminal can also use an ESC 2/5 F code to enter a particular environment, in this situation the terminal operation is not defined by a data syntax and no assumptions can be made about the terminal model (see ETS 300 076 [7]).

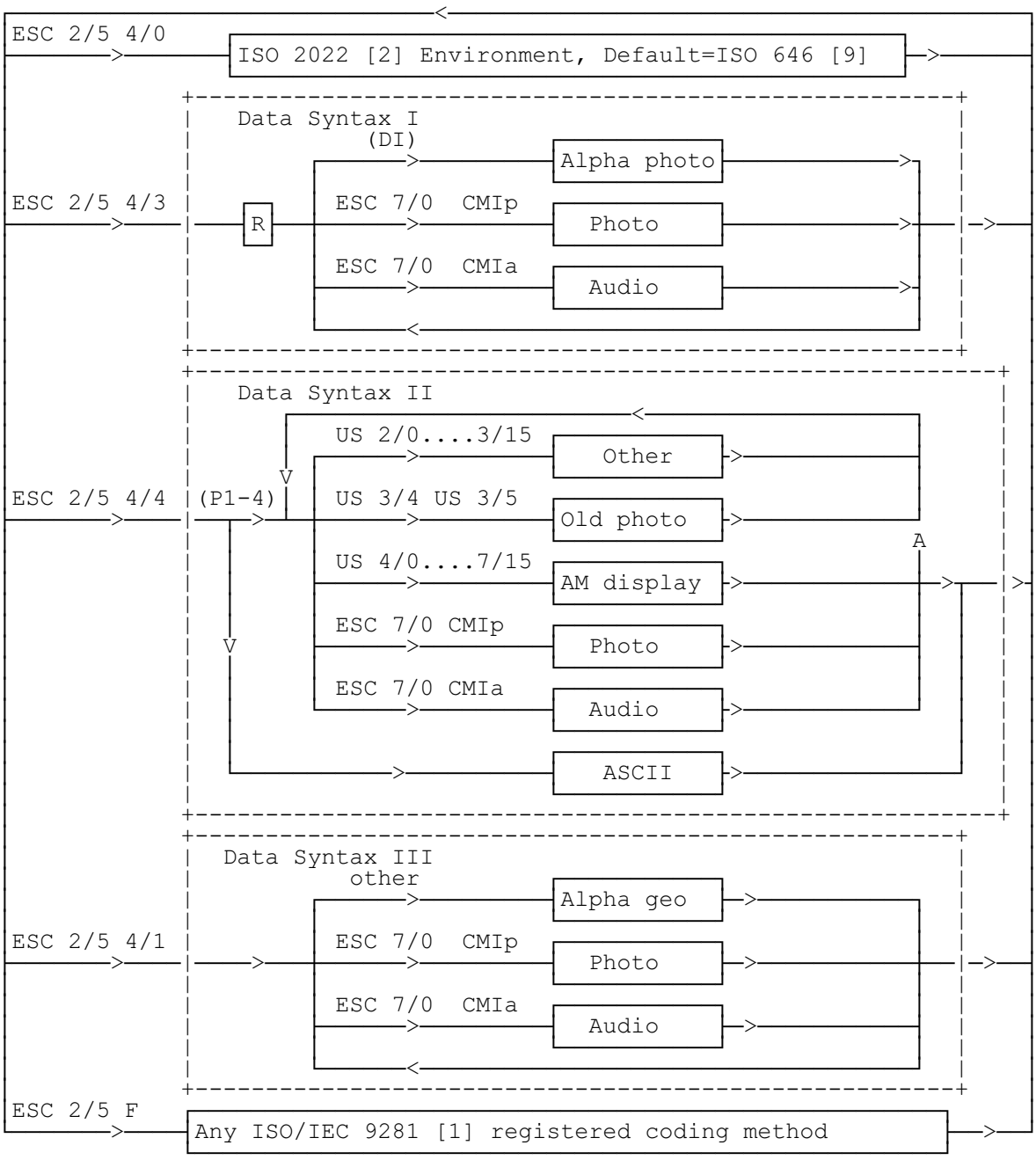

Figure 1: Global switching mechanism

Key to figure 1:

(DI)	Data Syntax I
AM	AM display
R	Rank in Data Syntax I
P	Profile in Data Syntax II
F	Final code
CMIa	Any CMI for Videotex audio data
CMIp	Any CMI for Videotex photographic data

6.3 ISO/IEC 9281 syntax structure

The high level format of the syntax shall be as defined in ISO/IEC 9281 [1]. The structure of the coding shall be as follows:

NOTE: As ISO/IEC 9281 [1] was developed especially for the identification of picture coding in ISO 2022 [2] environments, the word "picture" is often used in the definitions, even when applicable to "audio". ISO has already accepted to make use of ISO/IEC 9281 [1] for non-pictorial information as audio data.

PE ::= PCE PDE

PCE ::= PCD CMI LI

PCD ::= 1/11 7/0

CMI ::= PM PI

PM ::= 2/4

PI ::= <4/0 - 7/15>

LI ::= 1111 1111 <byte1> <byte2>....<byten>

<bytek> ::= x10D DDDD (k=n)
| x11D DDDD (1 µ k < n)

x indicates "don't care".
D indicates "binary number 0 or 1".

Each piece of information shall be coded as one or more Picture Entities (PEs), which consists of a Picture Control Entity (PCE), followed by the actual data, packed in a Picture Data Entity (PDE).

The PCE consists of a Picture Coding Delimiter (PCD), Coding Method Identifier (CMI), followed by a length indicator (LI).

The PCD is a fixed sequence of 2 octets: 1/11 7/0.

The CMI consists of a Picture Mode (PM) octet, followed by a Picture Identifier (PI) octet .

The PM octet specifies the specific mode (in this case audio waveform coding) has the value 02/04.

The PI octet has the value 04/00.

The first octet, after the LI identifies the type of information to be carried, may take the following values:

- sound header information: 4/0;
- sound data with more data to follow: 4/1;
- last block of sound data: 4/2.

The LI follows the conventions of ISO 9281 [1] Part 1, and consists of a series of 1 or more octets, which contain 6 bits per octet to encode the length. All but the last octet have bit 6 set to 1. The most significant bit (bit 7) is reserved for parity.

The PDE contains, depending on the PI value, either header information or audio data coded according to one of the techniques as defined in Clause 9.

7 Sound header

7.1 Introduction

The sound header indicates the following attributes of subsequent sound blocks:

- the encoding;
- the bitrate used to encode the sound information;
- the recording level;
- the translation mode;
- the synchronisation mode.

The coding structure allows for the omission of any of these attributes in a particular sound header. When omitted, an attribute shall take the value of the last appearance in a sound header or when never defined by a default value.

7.2 Header structure

7.2.1 Concepts

The coding structure, allocated columns 2 - 6 of the code table to the attributes mentioned above in subclause 7.1, provides the possibility of omitting particular attributes in a sound header, as defined in table 1 below:

Table 1: Code table mapping

encoding	column 2
bitrate	column 3
recording level	column 4
translation mode	column 5
synchronisation mode	column 6

NOTE: The use of column 7 is for further study. Any octets in the sound header out of columns 2 - 6 shall be ignored.

7.2.2 Encoding

The encoding parameter shall take one of the following values:

- 2/0: PCM A-Law (CCITT Recommendation G.711 [10]);
- 2/1: PCM mu Law (CCITT Recommendation G.711 [10]);
- 2/2: ADPCM (CCITT Recommendations G.721 [11]/G.723 [12]);
- 2/3: Sub-band ADPCM (CCITT Recommendation G.722 [13]);
- 2/4: RPE-LTP coding method (final draft prI-ETS 300 036 [14]);
- 2/5: Near instantaneous (CCITT Recommendation J.41 [15]);
- 2/6: Sub-band ADPCM (CCITT Recommendation J.42 [16]).

The values 2/7 until 2/14 are reserved and shall be ignored when received. Value 2/15 is reserved for future extension mechanisms and shall be ignored when received.

7.2.3 Bitrate

The bitrate parameter shall take one of the following values:

- 3/0: 8 kbit/s;
- 3/1: 16 kbit/s;
- 3/2: 24 kbit/s;
- 3/3: 32 kbit/s;
- 3/4: 40 kbit/s;
- 3/5: 48 kbit/s;
- 3/6: 56 kbit/s;
- 3/7: 64 kbit/s;
- 3/8: 13 kbit/s (GSM encoding);
- 3/9: 2,4 kbit/s (provisional);
- 3/10: 4,8 kbit/s (provisional);
- 3/11: 128 kbit/s (provisional);
- 3/12: 192 kbit/s (provisional);
- 3/13: 384 kbit/s (provisional).

The value 3/14 is reserved and shall be ignored when received. Value 3/15 is reserved for future extension mechanisms and shall be ignored when received.

7.2.4 Recording level

The recording level parameter shall take one of the following values:

- 4/0: recording level not defined by the source; the terminal may adapt the output level by itself.

The values from 4/1 until 4/14 are reserved and shall be ignored when received. Value 4/15 is reserved for future extension mechanisms and shall be ignored when received.

7.2.5 Translation mode

The translation mode parameter shall take one of the following values:

- 5/4: Mode 0: Translation mode 0 (no translation);
- 5/3: Mode 1: Translation mode 1 (no translation, except for US character);
- 5/2: Mode 2: Translation mode 2 (3 in 4 encoding);
- 5/1: Mode 3: Translation mode 3 (shift 8 bits);
- 5/0: Mode 4: Translation mode 4 (shift 7 bits).

For a description of translation modes 1 until 4 refer to Annex A (normative).

The values 5/5 until 5/14 are reserved and shall be ignored when received. Value 5/15 is reserved for future extension mechanisms and shall be ignored when received.

7.2.6 Synchronisation mode

The synchronisation mode parameter shall take one of the following values:

- 6/0: output audio as soon as possible.

The values 6/1 until 6/14 are reserved and shall be ignored when received. Value 6/15 is reserved for future extension mechanisms and shall be ignored when received.

7.3 Default values

The default values of the parameters are given in table 2 below:

Table 2: Default values

encoding	2/2 (ADPCM)
bitrate	3/3 (32 kbit/s)
recording level	4/0 (not defined by the source)
translation mode	5/4 (no translation)
synchronisation mode	6/0 (output audio as soon as possible)

8 Sound block

A sound block conforms to the encoding specified in the previous sound header or, if absent, conforms to the default algorithm.

Several CCITT Recommendations (e.g. CCITT Recommendation G.721 [11] and G.722 [13]) define both a framing structure and a sound encoding. This framing structure specifies the multiplexing of sound data with other data (e.g. control or display).

A sound block shall only use the encoding of sound data specified in these CCITT Recommendations. If sound samples are encoded using less than 8 bits, then the data bits shall be concatenated according to the following structure to obtain the data stream (prior to applying the transparency mechanism) as shown in figure 2 below:

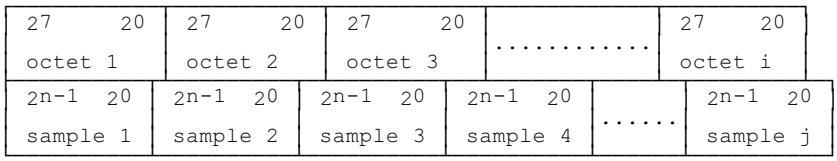

Figure 2: Sampling in less than 8 bits (n ≤ 7)

For CCITT Recommendation G.721 [11] sound, the sample is as in CCITT Recommendation G.721 [11]: 2^{n-1} is I_1 and 2^0 is I_4.

For CCITT Recommendation G.722 [13] sound at 56 kbit/s, the sample is as in CCITT Recommendation G.722 [13]: 2^{n-1} is I_{H1} and 2^0 is I_{L5}.

For CCITT Recommendation G.722 [13] sound at 48 kbit/s, the sample is as in CCITT Recommendation G.722 [13]: 2^{n-1} is I_{H1} and 2^0 is I_{L4}.

NOTE: I_1 and I_4 are defined in CCITT Recommendation G.721 [11].

I_{H1}, I_{L4} and I_{L5} are defined in CCITT Recommendation G.722 [13].

9 Application rules for ISDN syntax-based Videotex

9.1 Encoding/bitrate combinations

The algorithms which are applicable to ISDN syntax-based Videotex are given in table 3 below which also indicates whether the support for them shall be mandatory or not:

Table 3: Applicable algorithms

Encoding	Bitrate
ADPCM	24 kbit/s (optional)
ADPCM	32 kbit/s (mandatory)
ADPCM	40 kbit/s (optional)
sub-band ADPCM	48 kbit/s (optional)
sub-band ADPCM	56 kbit/s (optional)
RPE-LTP coding	13 kbit/s (optional)

9.2 Translation mechanisms

The following translation mechanism shall be used in the case of ISDN syntax-based Videotex:

- Mode 0 (Mandatory) : no translation.

Annex A (normative): Translation modes

A.1 Mode 0

No translation is performed.

A.2 Mode 1 (no translation except US)

Under this scheme, no translation of data shall be performed, except that all US (1/15) characters in the sound block data are represented by two contiguous US characters in the transmitted data stream.

A.3 Mode 2 (3-in-4 coding)

Each group of three bytes in the sound block data shall be mapped into four bytes for transmission, as shown in table A.1. Any remaining group of one or two bytes at the end of a block of data is mapped into two or three bytes respectively, with undefined bits set to zero.

Table A.1: 3-in-4 coding scheme

Block sound	3 bytes	3 bytes	... 1, 2 or 3 bytes
Transmitted	4 bytes	4 bytes	... 2, 3 or 4 bytes

Within each group, the bits shall be mapped as follows, where "bxy" denotes bit y of byte x in the user data. Bit 7 is not taken into account by this scheme, but may be determined by characteristics of the transmission path in use (for example, if parity is required).

a) Three bytes of block sound data

Transmitted	b7	b6	b5	b4	b3	b2	b1	b0
1st byte	X	1	b17	b16	b27	b26	b37	b36
2nd byte	X	1	b15	b14	b13	b12	b11	b10
3rd byte	X	1	b25	b24	b23	b22	b21	b20
4th byte	X	1	b35	b34	b33	b32	b31	b30

b) Two bytes of block sound data at end of sequence

Transmitted	b7	b6	b5	b4	b3	b2	b1	b0
1st byte	X	1	b17	b16	b27	b26	0	0
2nd byte	X	1	b15	b14	b13	b12	b11	b10
3rd byte	X	1	b25	b24	b23	b22	b21	b20

c) One byte of block sound data at end of sequence

Transmitted	b7	b6	b5	b4	b3	b2	b1	b0
1st byte	X	1	b17	b16	0	0	0	0
2nd byte	X	1	b15	b14	b13	b12	b11	b10

A.4 Mode 3 (shift scheme - 8-bits)

In this scheme, bytes of sound block data are each mapped into one of two bytes of transmitted data, as shown in table A.2. In mode 3, the most significant bit of each transmitted byte is taken into account.

NOTE: Most of the conversions are optional.

Either entity shall be prepared to accept any mixture of converted or unconverted data in these cases.

Table A.2: Code conversion for 8 bits shift scheme (mode 3)

Sound block	Conversion	O/M	Transmitted
0/0-0/12	7/14 x+5/0	O	7/14,5/0-5/12
0/13	7/14 x+5/0	M	7/14,5/13
0/14-01/14	7/14 x+5/0	O	7/14,5/14-6/14
1/15	7/14 x+5/0	M	7/14,6/15
2/0	7/13	O	7/13
2/1-7/10	none		2/1 -7/10
7/11	7/11 x-5/8	M	7/11, 2/3
7/12, 7/13	7/11 x-5/8	M	7/11, 2/4-2/5
7/14	7/11 x-5/8	M	7/11, 2/6
7/15	7/11 x-5/8	M	7/11, 2/7
8/0-13/0	7/11 x-5/8	O	7/11, 2/8-7/8
13/1-15/15	7/14 x-5/0	O	7/14, 2/1-4/15

Key:

O Optional
M Mandatory

A.5 Mode 4 (shift scheme - 7-bits)

In this scheme, bytes of sound block data shall each be mapped into one or two bytes of transmitted data, as shown in table A.3. In mode 4, the most significant bit of each transmitted byte is not taken into account.

NOTE: Most of the conversions are optional.

Either entity shall be prepared to accept any mixture of converted or unconverted data in these cases.

Table A.3: Code conversion for 7 bits shift scheme (mode 4)

Sound block	Conversion	O/M	Transmitted
0/0-1/14	7/14,x+80 (X+50hex)	O	7/14, 5/0-6/14
1/15	7/14, 6/15	M	7/14, 6/15
2/0	7/13	O	7/13
2/1-7/10	none	-	2/1-7/10
7/11-7/15	7/11,x-88 (X-58hex)	M	7/11, 2/3-2/7
8/0-13/0	7/11,x-88 (X-58hex)	M	7/11, 2/8-7/8
13/1-15/15	7/14,x+80 (X-50hex)	M	7/14, 2/1-4/15

Key:

"-" Irrelevant
"O" Optional
"M" Mandatory

NOTE: In mode 4, the transmitted bytes may have lost the most significant bit set.

History

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