SLOVENSKI STANDARD
SIST ETS 300 144 E2:2003

01-december-2003

Digitalno omrežje z integriranimi storitvami (ISDN) - Avdiovizualne storitve - Struktura okvirov za kanale s hitrostmi od 64 kbit/s do 1 920 kbit/s in pripadajoča skladnja za znotrajpasovno krmiljenje

Integrated Services Digital Network (ISDN); Audiovisual services; Frame structure for a 64 kbit/s to 1 920 kbit/s channel and associated syntax for inband signalling

Ta slovenski standard je istoveten z: **ETS 300 144 Edition 2**

ICS:

33.080	Digitalno omrežje z integriranimi storitvami (ISDN)	Integrated Services Digital Network (ISDN)

SIST ETS 300 144 E2:2003 **en**

EUROPEAN TELECOMMUNICATION STANDARD

ETS 300 144

January 1996

Second Edition

Source: ETSI TC-TE

Reference: RE/TE-04037

ICS: 33.080

Key words: ISDN, audiovisual services, inband signalling

Integrated Services Digital Network (ISDN); Audiovisual services; Frame structure for a 64 kbit/s to 1 920 kbit/s channel and associated syntax for inband signalling

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Foreword

This second edition European Telecommunication Standard (ETS) was produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

The attention of the user of this ETS is drawn to the possibility that compliance may require the use of technology covered by patent or similar rights.

Transposition dates	
Date of adoption of this ETS:	31 January 1996
Date of latest announcement of this ETS (doa):	30 April 1996
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 October 1996
Date of withdrawal of any conflicting National Standard (dow):	31 October 1996

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1 Scope

This second edition ETS specifies the frame structure and the syntax for end-to-end inband signalling for audiovisual services and end-to-end data communication between equipment using single or multiple digital channels (B, H0, H11 or H12) up to 1 920 kbit/s when connected by the pan-European Integrated Services Digital Network (ISDN). Digital audiovisual services are provided by a transmission system in which the relevant signals are multiplexed onto a digital path. This frame structure allows the best use of the total transmission capacity for the various data flows as audio, video, user data, telematic information and special applications. Additionally, signals for the proper functioning of the system are included.

This ETS allows the synchronization of multiple 64 kbit/s or 384 kbit/s connections and the control of the multiplexing of audio, video, data and other signals within the synchronized multiconnection structure in the case of multimedia services, such as videoconferencing.

It provides the means to transmit end-to-end inband signalling according to the procedures described in ETS 300 143 [2].

NOTE 1: Terminals conforming to this ETS and ETS 300 143 [2] are compatible with terminals according to ITU-T Recommendations H.221 [9] and H.242.

This ETS is applicable to terminals or other equipment (e.g. Multipoint Control Units) supporting audiovisual applications.

NOTE 2: A separate Interim European Telecommunication Standard (I-ETS) is under preparation (DI/TE-04120, Parts 1 to 3) which specifies the method of testing required to identify conformance to this ETS.

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 apply.

[1] ITU-T Recommendation H.261: "Video codec for audiovisual services at p x 64 kbit/s".

[2] ETS 300 143: "Integrated Services Digital Network (ISDN): Audiovisual services, Inband signalling procedures for audiovisual terminals using digital channels up to 2 048 kbit/s".

[3] ETS 300 145: "Integrated Services Digital Network (ISDN): Audiovisual Services; Videotelephone Systems and Terminal Equipment Operating on one or Two 64 kbit/s Channels".

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

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

[6] CCITT Recommendation G.725 (1988): "System aspects for the use of the 7 kHz audio codec within 64 kbit/s".

[7] CCITT Recommendation G.728 (1992): "Coding of speech at 16 kbit/s using low-delay code-excited linear prediction".

[8] CCITT Recommendation T.61 (1992): "International Alphabet No. 5".

[9] ITU-T Recommendation H.221 (1993): "Frame structure for a 64 to 1 920 kbit/s channel in audiovisual teleservices".

[10] ITU-T Recommendation H.243 (1993): "Procedures for establishing communication between three or more audiovisual terminals using digital channels up to 2 Mbit/s".

[11] ISO/IEC 11172 (1993): "Information technology - Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s".

[12] CCITT Recommendation T.35 (1991): "Procedure for the allocation of ITU-T defined codes for non-standard facilities".

[13] ITU-T Recommendation H.244 (1995): "Synchronized Aggregation of ISDN Channels".

3 Definitions

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

A-bit: Indicates the loss of frame or multiframe alignment.

Bit-rate Allocation Signal (BAS): Bit position within the frame structure to transmit, e.g. commands, control and indication signals, capabilities.

capability marker: The first code in a capability set.

capability set: A sequence of capability codes started by the capability marker code.

channel: The signal structure used to transmit the information over a connection.

connection: A physical path between the end-points.

Control and Indication (C&I): End-to-end signalling between terminals consisting of Control which causes a state change in the receiver and Indication which provides information as to system functioning.

E-bit: Indication as to whether the most recent Cyclic Redundancy Check (CRC) block, received in the incoming direction, contained errors or not.

ECS-channel: Optional 800 bit/s channel for use in encryption.

I-channel: The initial or only B channel, or TS1 of initial or only H0 channel, or TS1 of H11, H12 channels.

mode: A term used to denote transmission of user information signals with a particular set of parameters.

Mode 0F: Applies only to the initial channel: there is frame structure in the Service Channel (SC), and audio is confined to the sub-channels 1 to 7 **1)**; the audio is encoded in the same way as in CCITT Recommendation G.711 [4] either in A-law or µ-law unless this law is also specified in brackets thus: Mode-0F(A), Mode-0F(µ), except that the Least Significant Bit (LSB) **2)** is not transmitted.

Mode 0U: Applies only to the initial channel; there is no frame structure, and audio is encoded according to CCITT Recommendation G.711 [4] **3)**, either in A-law or µ-law unless this law is also specified in brackets thus: Mode-0U(A), Mode-0U(u).

Multipoint Conference Unit (MCU): A piece of equipment located in a node of the network or in a terminal which connects several terminals and, according to certain criterions, processes audiovisual signals and distributes them to the connected terminals.

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1) When in "restricted network" operation the number of bits per audio sample is reduced by one.
2) When in "restricted network" operation, the LSB is not the bit 8, but the bit 7.
3) When in "restricted network" operation the number of bits per audio sample is reduced by one.

Service Channel (SC): The eighth sub-channel of a 64 kbit/s channel, or the seventh sub-channel when communicating in restricted mode.

restricted network: A network consisting of multiples of 64 kbit/s links, but where only multiples of 56 kbit/s are usable for the terminals.

4 Abbreviations

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

NOTE: Numerous other specific C&I codepoint abbreviations are listed in subclause 10.1.3 and subclause 10.2.2.

BAS	Bit-rate Allocation Signal
C&I	Control and Indication
cap-mark	capability marker
cap-set	capability set
CIF	Common Intermediate Format (picture format defined in ITU-T Recommendation H.261 [1])
CRC4	Cyclic Redundancy Check 4-bit
ECS	Encryption Control Signal
FAS	Frame Alignment Signal
FAW	Frame Alignment Word
H-MLP	High speed MLP logical subchannel [4)]
H0	384 kbit/s channel
H11	1 536 kbit/s channel
H12	1 920 kbit/s channel
HSD	High Speed Data
ISDN	Integrated Services Digital Network
ITU-TS	International Telecommunications Union - Telecommunication Standardization Sector
LSB	Least Significant Bit
LSD	Low Speed Data
MBE	Multiple Byte Extension
MCU	Multipoint Control Unit
MLP	Logical data subchannel named "MLP" [4)]
MSB	Most Significant Bit
QCIF	Quarter Common Intermediate Format (picture format defined in ITU-T Recommendation H.261 [1])
SBE	Single Byte Extension
SC	Service Channel
SMF	Sub-Multiframe
TEA	Terminal Equipment Alarm
TS	Time Slot
TS1	Time Slot 1

4) MLP previously referred to the ITU-T Recommendation T.120 Multilayer Protocol, but now is just a name for the logical subchannel which may contain T.120 or H.224 protocol, or Dummy data - see ETS 300 143 [2].

5 Description

This ETS provides for dynamically subdividing an overall transmission channel of 64 kbit/s to 1 920 kbit/s into lower rates suitable for audio, video, data and telematic purposes. The overall transmission channel is derived by synchronising and ordering transmissions in 1 to 24 B-connections, or 1 to 5 H0-connections, or a 1 536 kbit/s or 2 048 kbit/s connection. The first connection established is the initial connection and carries the initial channel in each direction. The additional connections carry additional channels.

The total rate of transmitted information is called the "transfer rate"; the transfer rate can be fixed at less than the capacity of the overall transmission channel (values listed in clause 10).

A single 64 kbit/s channel is structured into octets transmitted at 8 kHz. Each bit position of the octets may be regarded as a sub-channel of 8 kbit/s (see table 1). The eighth sub-channel is called the Service Channel (SC), consisting of several parts as described in subclauses 5.1 to 5.4 below.

A 384 kbit/s (H0), 1 536 kbit/s (H11) or 1 920 kbit/s (H12) channel may be regarded as consisting of a number of 64 kbit/s Time Slots (TS) (see table 2). The lowest numbered TS is structured exactly as described for a single 64 kbit/s channel, while the other TS have no such structure. In the case of multiple B or H0 channels, all channels have a frame structure; that in the initial channel controls most functions across the overall transmission, while the frame structure in the additional channels is used for synchronization, channel numbering and related controls.

The term "I-channel" is applied to the initial or only B-channel, to TS1 of initial or only H0 channel, and to TS1 of H11, H12 channels.

Table 1: Frame structure of a single 64 kbit/s channel (B-channel)

Bit number								
1	2	3	4	5	6	7	8 (SC)	Octet number
Sub-channel #1	Sub-channel #2	Sub-channel #3	Sub-channel #4	Sub-channel #5	Sub-channel #6	Sub-channel #7	FAS	1
								:
								8
								9
							BAS	:
								16
								17
							ECS	:
								24
							Sub-channel #	25
								·
								·
								·
								80

5.1 Frame Alignment Signal (FAS)

This signal structures the I-channel and other framed 64 kbit/s channels into frames of 80 octets each and multiframes of 16 frames each. Each multiframe is divided into eight 2-frame sub-multiframes. The term "Frame Alignment Signal" (FAS) refers to the bits 1 to 8 of the SC in each frame. In addition to framing and multiframing information, control and alarm information may be inserted in the FAS, as well as error check information to monitor end-to-end error performance and to check frame alignment validity. Other time-slots in H0, H11 or H12 connections are aligned to the first.

The bits are transmitted to line in order, bit 1 first and Octet 1 first.

FAS shall be transmitted in the Least Significant Bit (LSB) of the octet (called "bit 8") within each 125 microsecond, e.g. in an ISDN basic or primary rate interface (see also tables 1 and 2 and subclause 6.6). It should be noted that, where interworking between the audiovisual terminal and the telephone is required, transmission using the network timing is essential; a transmitting terminal shall always use octet timing, if this can be obtained from the network.

At the receiver side, FAS shall be sought in all bit positions. If the received FAS position conflicts with the network octet timing, the FAS position is given priority. This may happen when the receiver utilises network octet timing while the transmitter does not, as in a terminal using codecs with separate ISDN terminal adaptor, or when interworking between 64 kbit/s and 56 kbit/s terminals takes place.

Table 2: Frame structure of higher-rate single channels (H_0, H_{11}, H_{12} channels)

125 microseconds

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TS 1	2	3	4	5	6	7	. . .	. . .	6n-2	6n-1	6n
										H_0	n = 1
										H_{11}	n = 4
										H_{12}	n = 5

Audio + service channel

1	2	3	4	5	6	7	8	
Sub-channel # 1	Sub-channel # 2	Sub-channel # 3	Sub-channel # 4	Sub-channel # 5	Sub-channel # 6	Sub-channel # 7	FAS	1 : 8
							BAS	9 : 16
							ECS	17 : 24
							Sub-channel # 8	. . 80

Octet number

5.2 Bit-rate Allocation Signal (BAS)

Bits 9 to 16 of the SC in each frame are referred to as the BAS. This signal allows the transmission of codewords to describe the capability of a terminal to structure the capacity of the channel or synchronized multiple channels in various ways, and to command a receiver to demultiplex and make use of the constituent signals in such structures. This signal is also used for Controls and Indications.

NOTE: For some countries having 56 kbit/s channels, the net available bit rates are 8 kbit/s fewer. Interworking between a 64 kbit/s terminal and a 56 kbit/s terminal is established according to the frame structure in subclause 6.6.

5.3 Encryption Control Signal (ECS) channel (optional)

The ECS channel is optional and can be used in single B or H0 channels as well as H11 and H12 channels, or in the initial channel of multiple-channel calls.

When switched on, the ECS channel occupies bits 17 to 24 of the SC, a rate of 800 bit/s, and any video or variable data channel which would otherwise occupy these bits is accordingly reduced in rate by 800 bit/s.

5.4 Remaining capacity

The remaining capacity may convey a variety of signals multiplexed in a way which is defined by the BAS commands; each command defined in clause 10 specifies the explicit bit occupancy, but, additionally certain procedural rules stated in ETS 300 143 [2], subclause 5.2 shall be obeyed. The facilities provided can be found in the list given in subclause 8.2.

6 Frame structure

6.1 General

An 80-octet frame length produces 80 bits in the SC. These 80 bits are numbered 1 to 80. Bits 1 to 8 of the SC in every frame constitute the FAS (see table 3), whose content is as follows:

- multiframe structure (see subclause 6.2 and table 4a);
- Frame Alignment Word (FAW);
- A-bit;
- E-bit and C-bits (see clause 9).

The first seven bits of the Frame Alignment Word (FAW) are formed by bits 2 to 8 of the FAS in the even frames of a sub-multiframe. Their value is "0011011". They are complemented by a "1" in bit 2 of the succeeding odd frame. This eighth bit of the FAW is necessary in order to avoid simulation of the FAW by a frame-repetitive pattern elsewhere in a frame.

The A-bit of the I-channel indicates the loss of frame- or multiframe alignment. It is set to "0" whenever frame- and multiframe is aligned (if multiframe alignment is evaluated, see subclause 6.4, otherwise only if it is frame aligned), and is set to "1" otherwise (see subclause 6.3; for additional channels, see subclause 7.1).

When the optional Cyclic Redundancy Check 4-bit (CRC4) procedure, as defined in clause 9, is not used, the E-bit shall be set to 0, and bits C1, C2, C3 and C4 shall be set to 1 by the transmitter.

Table 3: Assignment of bits 1 to 8 of the service channel in each frame

Bit number **Successive frames**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Even frames	See subclause 6.2	0	0	1	1	0	1	1
Odd frames	See subclause 6.2	1	A	E	C1	C2	C3	C4
		FAW						

6.2 Multiframe structure

The multiframe structure is shown in table 4a.

Each multiframe contains 16 consecutive frames numbered 0 to 15 divided into eight sub-multiframes of two frames each. The multiframe alignment signal is located in bit 1 of frames 1-3-5-7-9-11 and has the form 001011.

Bit 1 of frame 15 remains reserved ("R") for future use. The value is fixed at 0.

Bit 1 of frames 0-2-4-6 (N1 - N4) may be used for a modulo 16 counter to number multiframes in descending order. The LSB is transmitted in frame 0, and the Most Significant Bit (MSB) in frame 6. The receiver uses the multiframe numbering to share out the differential delay of separate connections, and to synchronize the received signals.

The multiframe numbering shall be mandatory in both the initial and additional channels for multiple B or multiple H0 communications, but it may or may not be inserted for single B or single H0 or H11/H12 or other communications where synchronization between multiple channels is not required. In this case, N1 to N4 are set to "0".

Bit 1 of frame 8 (N5) indicates whether multiframe numbering is active or inactive. It is set to 1 when multiframes are numbered and is set to 0 when they are not.

Bit 1 of frames 10-12-13 (L1 - L3) form the channel number; the LSB is L1. This number shall be used to number each channel in a multiconnection structure so that the distant receiver can place the octets received in each 125 microseconds in the correct order.

The bits N1 - N5 and L1 - L3 in the multiframe shall be considered valid, as long as they are received consistently in three consecutive multiframes.

Bit 1 of frame 14, the Terminal Equipment Alarm (TEA) may be set to 1 in the outgoing signal, when one or more of the following conditions holds:

- an internal terminal equipment fault exists such that it cannot receive and act on the incoming signal;

- an internal terminal equipment fault exists such that it can no longer transmit user information in the form previously transmitted.

Otherwise it is set to 0.

For a description of the A-bit see subclause 6.1; the use of the bits C1 to C4 and of the E-bit is described in clause 9.

Table 4a: Assignment of bits 1 to 8 of the SC in each frame in a multiframe

	Sub-multiframe (SMF)	Frame	Bits 1 to 8 of the service channel in every frame							
			1	2	3	4	5	6	7	8
Multi-frame		0	N1	0	0	1	1	0	1	1
	SMF1	1	0	1	A	E	C1	C2	C3	C4
		2	N2	0	0	1	1	0	1	1
	SMF2	3	0	1	A	E	C1	C2	C3	C4
		4	N3	0	0	1	1	0	1	1
	SMF3	5	1	1	A	E	C1	C2	C3	C4
		6	N4	0	0	1	1	0	1	1
	SMF4	7	0	1	A	E	C1	C2	C3	C4
		8	N5	0	0	1	1	0	1	1
	SMF5	9	1	1	A	E	C1	C2	C3	C4
		10	L1	0	0	1	1	0	1	1
	SMF6	11	1	1	A	E	C1	C2	C3	C4
		12	L2	0	0	1	1	0	1	1
	SMF7	13	L3	1	A	E	C1	C2	C3	C4
		14	TEA	0	0	1	1	0	1	1
	SMF8	15	R	1	A	E	C1	C2	C3	C4

Table 4b: Channel numbering with bits L3, L2, L1

Channel	L3	L2	L1
Initial	0	0	1
Second	0	1	0
Third	0	1	1
. . .	. .	. .	. .
Sixth	1	1	0
Seventh and higher	1	1	1

Table 4c: Multiframe numbering with bits N4, N3, N2, N1

Multiframe Number	N4	N3	N2	N1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
. .	. .	. .	. .	. .
15	1	1	1	1

(or numbering inactive)