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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

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1 Scope

This 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 synchronisation 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 synchronised multiconnection structure in the case of multimedia services, such as videoconference.

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

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

A separate ETS is under preparation (DE/TE-04120) 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 (1993): "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 H.200 (1988): "Framework for recommendations for audiovisual services".

[9] CCITT Recommendation T.50 (1992): "International Alphabet No. 5".

[10] ITU-T Recommendation T.81 (1993): "Information technology - Digital compression and coding of continuous-tone still images - Requirements and guidelines".

[11] CCITT Recommendation H.221 (1992): "Frame structure for a 64 to 1 920 kbit/s channel in audiovisual teleservices".

[12] CCITT Recommendation H.243 (1992): "Procedures for establishing communication between three or more audiovisual terminals using digital channels up to 2 Mbit/s".

[13] 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".

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

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: 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.

Control and indication: End-to-end signalling between terminals consisting of control which causes a state change in the receiver and indication which provides information as to the functioning of the system.

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 m–law unless this law is also specified in brackets thus: Mode-0U(A), Mode-0U(u).

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

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

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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.

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 Symbols and abbreviations

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

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 Multi Layer Protocol **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
LCA	Loopback Command "Audio loop request"
LCD	Loopback Command "Digital loop request"
LCO	Loopback Command "Loop Off request"
LCV	Loopback Command "Video loop request"
LSB	Least Significant Bit
LSD	Low Speed Data
MBE	Multiple Byte Extension
MCU	Multipoint Control Unit
MLP	Multi Layer Protocol **5)**
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
VCF	Video Command "Freeze-picture request"
VCU	Video Command "fast-Update request"

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4) MLP protocols are under discussion in the ITU-TS.

5) MLP protocols are under discussion in the CCITT.

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 over/from 1 to 6 B-connections, from 1 to 5 H0-connections, or an H11 or H12 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"; it is possible to fix the transfer rate 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.

An H0, H11 or H12 channel may be regarded as consisting of a number of 64 kbit/s Time Slots (TS) (see table 2). The lowest numbered time-slot 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 synchronisation, 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
							BAS	9 : 16
							ECS	17 : 24
							Sub-channel # 8	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 1-8 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.

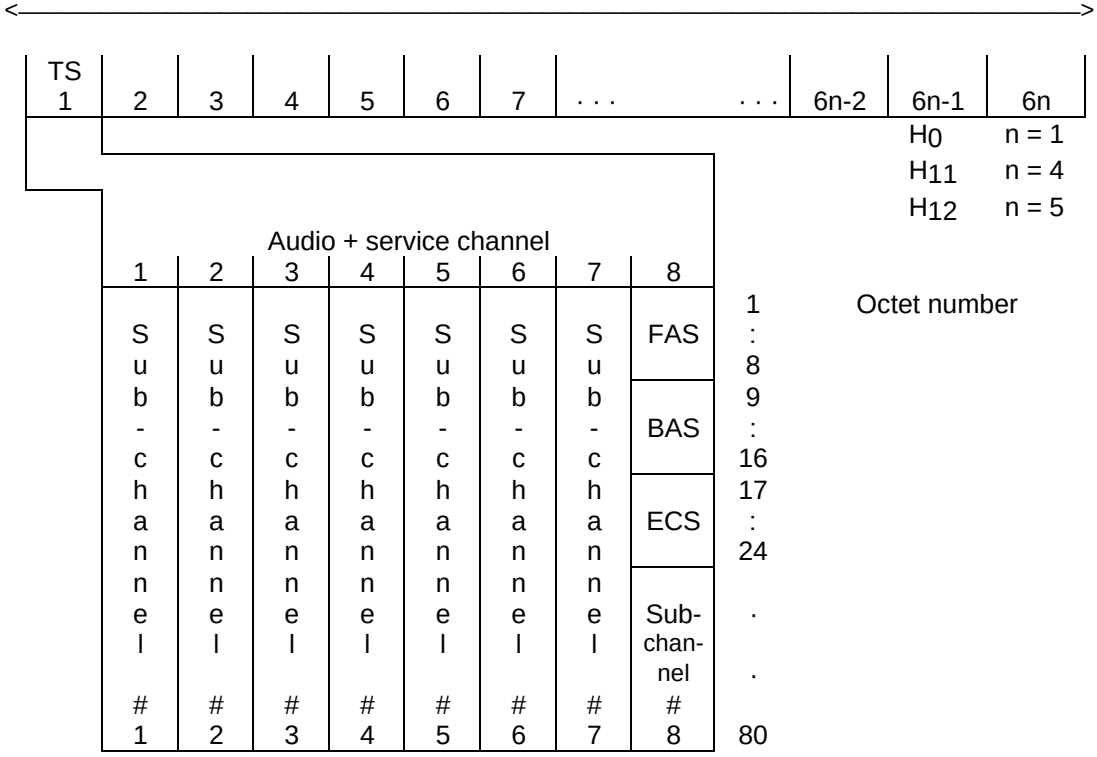
The bits are transmitted to line in order, bit 1 first and Octet 1 first.

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.

In 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



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 synchronised 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 the 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 within the framework of a multimedia service, under the control of the BAS. It is carried in bits 1 to 8 of each octet in the case of a single 64 kbit/s connection, and it includes the rest of the SC. 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 synchronise 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 synchronisation 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

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

Multiframe Number	**N4**	**N3**	**N2**	**N1**	
0	0	0	0	0	(or numbering inactive)
1	0	0	0	1	
2	0	0	1	0	
. .	. .	. .	. .	. .	
15	1	1	1	1	

6.3 Gain, loss and recovery of frame alignment

Frame alignment is defined as being gained when the following sequence is detected:

- for the first time, the presence of the correct first seven bits of the FAW;
- the eighth bit of the FAW in the following frame is detected by verifying that bit 2 is a 1;
- for the second time, the presence of the correct first seven bits of the FAW in the next frame.

Frame alignment is defined to have been lost when three consecutive FAWs have been received with an error.

Frame alignment is defined to have been recovered when the same sequence as described above is detected.

When the frame alignment is lost, the A-bit of the next odd frame is set to 1 in the transmit direction.

6.4 Gain, loss and recovery of multiframe alignment

Multiframe alignment is needed to number and synchronise two or more channels. Terminals such as those having only single-channel capabilities which have no use for the multiframe structure shall transmit the multiframe structure, but need not check for multiframe alignment on the incoming signal: they may transmit outgoing A = 0 when frame alignment is recovered.

NOTE: Such a terminal cannot recognise TEA (see table 4a).

Multiframe alignment is defined to have been gained when the multiframe alignment signal is consistent over 16 consecutive frames.

After multiframe alignment has been validated, the other functions represented by bit 1 of the SC can be used. When multiframe alignment of the distant terminal has been signalled (A=0 received), the distant terminal is expected to have validated BAS codes and to be able to interpret BAS codes.

Multiframe alignment is defined to have been lost when three consecutive multiframe alignment signals have been received with an error. It is defined to have been recovered when the multiframe alignment signal has been received with no error in the next multiframe. When multiframe alignment is required and has been lost, even when an unframed mode is received, the A-bit of the next odd frame is set to 1 in the transmit direction, and is reset to 0 when multiframe alignment is regained. It is reset in additional channels when multiframe alignment and synchronism with the initial channel is regained.

6.5 Procedure to recover octet timing from frame alignment

The terminal shall recover octet timing in the receive direction from bit timing and from the frame alignment.

6.5.1 General rule

The receive octet timing is normally determined from the FAS position. At the start of the call and before the frame alignment is gained, the receive octet timing may be taken to be the same as the internal transmit octet timing. As soon as a first frame alignment is gained, the receive octet timing is initialised at the new bit position, but it is not yet validated. It shall be validated only when frame alignment is not lost during the next 16 frames.

6.5.2 Particular cases

a) When, at the initiation of a call, the terminal is in a forced reception mode (i.e. searching for frame alignment), or when the frame alignment has not yet been gained, the terminal may temporarily use the transmit octet timing.
b) When frame alignment is lost after being gained, the receive timing shall not be changed until frame alignment is recovered.
c) As soon as frame and, if necessary, multiframe alignment have been gained once, the octet timing shall be considered as valid for the rest of the call, unless frame alignment is lost and a new frame alignment is gained at another bit position.

d) When the terminal switches from a framed mode to an unframed mode (by means of the BAS), the octet timing previously gained shall be kept.

e) When a new frame alignment is gained on a new position, different from that previously validated, the receive octet timing is re-initialised to the new position but not yet validated and the previous bit position is stored. If no loss of frame alignment occurs in the next 16 frames, the new position shall be validated, otherwise the stored old bit position is ritualised.

6.5.3 Search for Frame Alignment Signal (FAS)

Two methods may be used: sequential or parallel. In the sequential method, each of the eight possible bit positions for the FAS is tried. When FAS is lost after being validated, the search shall resume starting from the previously validated bit position. In the parallel method, a sliding window, shifting one bit for each bit period, may be used. In that case, when frame alignment is lost, the search shall resume starting from the bit position next to the previously validated one.

6.6 Frame structure for interworking between a 64 kbit/s terminal and a 56 kbit/s terminal (optional)

The ability to interwork with restricted networks is not a mandatory requirement.

The sub-channel arrangement for this frame structure is given in tables 5a and 5b.

Table 5a: Transmitter of the 64 kbit/s terminal

Bit number									
1	**2**	**3**	**4**	**5**	**6**	**7(SC)**	**8**		
							1	1	**Octet number**
S	S	S	S	S	S	FAS	1	:	
u	u	u	u	u	u		1	8	
b	b	b	b	b	b		1	9	
-	-	-	-	-	-	BAS	1	:	
c	c	c	c	c	c		1	16	
h	h	h	h	h	h		1	17	
a	a	a	a	a	a	(ECS)	1	:	
n	n	n	n	n	n		1	24	
n	n	n	n	n	n	Sub-	1	25	
e	e	e	e	e	e	chan-	1	·	
l	l	l	l	l	l	nel	1	·	
#	#	#	#	#	#	#	1	·	
1	2	3	4	5	6	7	1	80	

Table 5b: Receiver of the 64 kbit/s terminal

Bit number, synchronised with the octet timing of the network

1	2	3	4	5	6	7	8
							1
							1
Sub-channel #3	Sub-channel #4	Sub-channel #5	Sub-channel #6	FAS*	Sub-channel #1	Sub-channel #2	1
				BAS			1
				(ECS)			1
				Sub-channel #7			1
							1
							1
							1
							1
							1
							1
							1
							1

Frame structured by the 56 kbit/s terminal

*FAS may appear at any of Bits 1 to 7

6.6.1 Operation of the 64 kbit/s terminal

The transmitter fills the eighth sub-channel with "1", while the receiver searches FAS at every sub-channel. It should be noted that at the receiver side stuffing bits "1" appear always at Bit number 8, but FAS and BAS appear at any of Bit numbers 1 to 7.

6.6.2 Restriction against some communication modes

Since the interworking bit rate becomes 56 kbit/s, the transmission modes using more than 56 kbit/s are forbidden (receivers ignore these command BAS codes). Facilities using the original seventh sub-channel move to the sixth sub-channel. See subclause 10.1.1.2.

7 Multiple connections

Some audiovisual terminals shall be able to communicate over multiple B or H0 connections (see NOTE). In this case, a single B or H0 initial connection is established, the possibility for more connections is determined from the transfer rate capability BAS of Clause 10 and the additional connections are then established and synchronised by the terminal using the multiframe structure.

NOTE: A connection is a physical path between the terminals. A channel is the transmission in one direction over the connection.

7.1 Multiple B-connections

FAS and BAS are transmitted in each B-channel.

The actual bit-rates allowed by this ETS for audio codings within a 64 kbit/s I-channel are 64 kbit/s and 56 kbit/s, commands (000)[4/5 and 18/19] respectively. Thus, in a 2B audiovisual call, it shall not be permitted to transmit framed audio, coded according to CCITT Recommendation G.711 [4] in the I-channel and video only in the additional channel. The two channels shall be synchronised, the audio shall be set to 56 kbit/s, and, when the video is ON, it shall occupy the remaining 68,8 kbit/s.

FAS operation is as follows:

- multiframe numbering is used to determine relative transmission delay between B-channels as described in Subclause 6.2;
- the channel numbers are transmitted, as described in subclause 6.2, with the channel of the initial connection being numbered 1 and there being up to five additional connections;
- the outgoing A-bit is set to 1 in the additional B-channel of the same connection whenever the received additional channel is not synchronised to the initial channel;
- when receive synchronisation is achieved between the initial and additional channels by introducing delay to align their respective multiframe signals, the transmitted A-bit is set to 0;
- the E-bit for each additional B-channel is transmitted in the additional B-channel in the same connection, because it relates to a physical condition of the transmission path.

The BAS operation in additional connections is restricted to the transmission of the additional channel number (thus the channel numbering of any additional connection shall be sent both in BAS according to Clause 10 and in the FAS, as in subclause 6.2), while channel numbering of the initial channel is sent only in FAS.

The distant terminal, upon receiving the A-bit set to "0" with respect to sequentially numbered channels, can add their capacity to the initial connection by sending the appropriate transfer rate BAS in Clause 10. The order of the bits transmitted in the channels is in accordance with the examples given in tables 14 to 21.

7.2 Multiple H0-connections

FAS and BAS are transmitted in the first time-slot of each H0.

FAS operation is as stated in subclause 7.1 except that the channel number is used to order the six octets received each 125 microseconds with respect to the six octet groups received in other channels.

The BAS operation in additional channels is as specified in subclause 7.1.

8 Introduction to BAS

8.1 Encoding of the BAS

The Bit-rate Allocation Signal (BAS) occupies the bits 9 to 16 of the SC in every frame. An eight bit BAS code (b_0, b_1, b_2, b_3, b_4, b_5, b_6, b_7) is complemented by eight error correction bits (p_0, p_1, p_2, p_3, p_4, p_5, p_6, p_7) to implement a (16,8) double error correcting code. This error correcting code is obtained by shortening the (17,9) cyclic code with generator polynomial:

$$g(x) = x^8 + x^7 + x^6 + x^4 + x^2 + x + 1$$

The error correction bits are calculated as coefficients of the remainder polynomial in the following equation:

$$p_0x^7 + p_1x^6 = p_2x^5 + p_3x^4 + p_4x^3 + p_5x^2 + p_6x + p_7$$

$$= RES_{g(x)} [b_0x^{15} + b_1x^{14} + b_2x^{13} + b_3x^{12} + b_4x^{11} + b_5x^{10} + b_6x^9 + b_7x^8]$$

where $RES_{g(x)}[f(x)]$ represents the residue obtained by dividing f(x) by g(x).

The BAS code is sent in the even-numbered frame, while the associated error correction bits are sent in the subsequent odd-numbered frame. The bits of the BAS code or the error correction are transmitted in the order shown in table 6 to avoid emulation of the FAW.

Table 6

Bit position	Even frame	Odd frame
9	b_0	p_2
10	b_3	p_1
11	b_2	p_0
12	b_1	p_4
13	b_5	p_3
14	b_4	p_5
15	b_6	p_6
16	b_7	p_7

The decoded BAS value is valid if:

- the receiver is in frame alignment, and
- the FAW, in the same sub-multiframe, was received with two or fewer bits in error.

Otherwise the decoded BAS value is ignored.

8.2 Values of the BAS

The encoding of BAS is made according to an attribute method. This consists of attribute (8 attributes) and value (32 values). The first three bits of a BAS represent the attribute, describing the general command or capability, and the other five bits identify the "value" - the specific command or capability (see table 7).

Table 7

Attribute	Significance
000	Audio coding command
001	Transfer rate command
010	Video, encryption, loops and other command
011	LSD/MLP commands
100	Audio / Transfer Rate capabilities
101	Video, MBE, encryption and LSD/MLP capabilities
110	Reserved
111	Escape codes

The values of these attributes are listed and defined in Clause 10. They provide for the following facilities:

- transmission at various total rates and on single and multiple channels, on clear channels and on networks subject to restrictions to 56 kbit/s and its multiples;
- audio transmission, digitally encoded to various recommended algorithms, e.g.:
  - voice encoded at 56 kbit/s using a truncated form of PCM of CCITT Recommendation G.711 [4] (A-law or μ- law);
  - voice encoded at 16 kbit/s and video at 46,4 kbit/s;
  - voice encoded at 56 kbit/s with a bandwidth 50 Hz to 7 000 Hz (sub-band ADPCM according to CCITT Recommendation G.722 [5]); the coding algorithm is also able to work at 48 kbit/s - data can then be dynamically inserted at up to 14,4 kbit/s;
- video transmission, digitally encoded to a recommended algorithm, with provision for future recommended improvement;
- still pictures;
- Low Speed Data (LSD) within the I-channel, or TS1 of a higher rate initial channel, e.g. data at 56 kbit/s inside an audiovisual session for, inter alia, file transfer for communicating between personal computers;
- High Speed data (HSD) in the highest-numbered 64 kbit/s channel or Time Slots;
- data transmission within a multilayer protocol, either in the I-channel Multi Layer Protocol (MLP [6)]) or in capacity other than the I-channel High speed Multi Layer Protocol (H-MLP);

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6) MLP protocols are under discussion in the ITU-TS.

- an encryption control signal;
- loopback towards the network for maintenance purposes;
- signalling for control and indications;
- a message system for, inter alia, conveying information concerning equipment manufacturer and type.

8.2.1 Single octet BAS

The command BAS attributes have the following significance: on receipt of a BAS command code in one (even) frame and its error-correcting code in the next (odd), the receiver prepares to accept the stated mode (or mode change) beginning from the subsequent (even) frame; thus a mode change can be effected in 20 milliseconds. The command remains in force until countermanded (see ETS 300 143 [2]). The bit positions occupied as a result of combinations of BAS commands are exemplified in Clause 10, tables 14 to 21.

The capability BAS attributes have the following significance: they indicate the ability of a terminal to receive and properly treat the various types of signal. It follows that having received a set of capability values from the remote terminal Y, terminal X shall not transmit signals lying outside that declared range.

The value (111)[24] is the capability marker which is followed by normal BAS codes, not by any escape values (see ETS 300 143 [2]).

8.2.2 Two-octet BAS

The attribute (111) provides means for extension of the use of the BAS position in the subsequent sub-multiframe(s) for other purposes.

Values [16] - [23] of the attribute (111) are temporary escape BAS codes of Single Byte Extension (SBE). The last three bits of the temporary escape BAS form a pointer to one of eight possible escape BAS tables of 224 entries each (codes beginning with 111 are not used in the escape BAS tables). Then the next received BAS indicates the specific entry in the escape BAS table.

Value [18] gives access to a table of values specifying applications of a data channel (LSD or HSD).

8.2.3 Multi-octet BAS (optional)

NOTE: The ability to work with multi-octet BAS is not a mandatory requirement.

The last seven attribute values [25] to [31] of the attribute (111) are of Multiple Byte Extension (MBE) and are used to send messages as specified in Clause 10.

9 Connection quality monitoring (optional)

NOTE: The use of the connection quality monitoring procedure is not a mandatory requirement.

To provide an end-to-end quality monitoring of the connection, a 4-bit Cyclic Redundancy Check (CRC4) procedure may be used and the four bits C1, C2, C3 and C4 computed at the source location are inserted in bit positions 5 to 8 of the odd frames. In addition, bit 4 of the odd frames, the E-bit, is used to transmit an indication whether the most recent CRC block, received in the incoming direction, contained errors or not.

When the optional CRC4 procedure 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. The receiver may disable the reporting of CRC errors after receiving eight consecutive CRCs set to all 1s, and it may enable reporting of CRC errors after receiving two consecutive CRCs each containing a 0 bit.

9.1 Computation of the CRC4 bits

The CRC4 bits C1, C2, C3 and C4 are computed for each B/H0/H11/H12 channel [7)] , for a block made of two frames: one even frame (containing the first seven bits of FAW) followed by one odd frame (containing the eighth bit of FAW). The CRC4 block size is then 160/960/3 840/4 800 octets for a B/H0/H11/H12 channel [8)] and 320/480/640/1 280/1 920/2 880/3 680 octets for a 128/192/256/512/768/1 152/1 472 kbit/s channel and the computation is performed 50 times per second.

This is still valid for the case of H0/H11 or 128/192/256/512/768/1 152/1 472 kbit/s transfer rate in restricted networks. When interworking with restricted networks on a B-channel, the CRC4 bits C1, C2, C3 and C4 in the FAS are computed for the 160 septets, or 1 120 bits.

9.1.1 Multiplication-division process

A given C1 to C4 word located in block J is the remainder after multiplication by x^4 and then division (modulo 2) by the generator polynomial $x^4 + x + 1$ of the polynomial representation of block (J - 1).

When representing contents of a block as a polynomial, the first bit in the block shall be taken as being the Most Significant Bit. Similarly, C1 is defined to be the MSB of the remainder and C4 the Least Significant Bit (LSB) of the remainder.

9.1.2 Encoding procedure

a) The CRC bit positions in the odd frame are initially set at zero, i.e. C1 = C2 = C3 = C4 = 0.
b) The block is then acted upon by the multiplication-division process referred to above in subclause 9.1.1.
c) The remainder resulting from the multiplication-division process is stored, ready for insertion into the respective CRC locations of the next odd frame.

NOTE: These CRC bits do not affect the computation of the CRC bits of the next block, since the corresponding locations are set at zero before the computation.

9.1.3 Decoding procedure (optional)

The decoding is optional, even if the encoding is done. If the decoding is performed, the following procedure shall be performed:

a) a received block is acted upon by the multiplication-division process, referred to above in subclause 9.1.1, after having its CRC bits extracted and replaced by zeros;
b) the remainder, resulting from this multiplication-division process, is then stored and subsequently compared on a bit-by-bit basis with the CRC bits received in the next block;
c) if the decoded calculated remainder exactly corresponds to the CRC bits sent from the encoder, it shall be assumed that the checked block is error-free.

9.2 Consequent actions

9.2.1 Action on the E-bit

The E-Bit of block J is set to "1" in the transmitting direction if bits C1 to C4 detected in the most recent block in the opposite direction have been found in error (at least one bit in error). In the opposite case it is set to "0".

If the CRC is not in use, the E-bit is set to "0".

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7) If the transfer rate is such that a part of any H0/H11/H12 channel is unoccupied, then the computation is made only for that part covered by the transfer rate.

8) If the transfer rate is such that a part of any H0/H11/H12 channel is unoccupied, then the computation is made only for that part covered by the transfer rate.

9.2.2 Additional monitoring for incorrect frame alignment (optional)

The monitoring for incorrect frame alignment is optional, even if the encoding is done. If the monitoring for incorrect frame alignment is performed, the following procedure shall be performed:

In the case of a long simulation of the FAW, the CRC4 information can be used to re-invite a search for frame alignment. For such a purpose, it is possible to count the number of CRC blocks in error within two seconds (100 blocks) and to compare this number with 89. If the number of CRC blocks in error is greater than or equal to 89, a search for frame alignment should be reinitiated.

These values 100 and 89 have been chosen in order that:

- for a random transmission error rate of 10^{-3}, the probability of incorrectly reinitiating a search for frame alignment, because of 89 or more blocks in error, should be less than 10^{-4};
- in case of simulation of frame alignment, the probability of not reinitiating a search of frame alignment after a two-second period should be less than 2,5%.

NOTE: Values in this and the next subclause exemplify the case of a 64 kbit/s channel. For H0, H11 or H12 channels the details differ but the principles are still applicable.

9.2.3 Monitoring for error performance (optional)

The monitoring for error performance is optional, even if the encoding is done.

The quality of the 64 kbit/s connection is monitored by counting the number of CRC blocks in error within a defined period of time.

The detailed process is outside the scope of this ETS.

By counting the received E-bits, it is possible to monitor the quality of the connection in the opposite direction.

10 Definitions and tables of BAS values

10.1 Single/first octet BAS values

For bit numbering and positions see tables 14 to 21.

The definitions of BAS values are given below, and the corresponding numerical values are listed in table 8.

10.1.1 Audio command values (000)

For bit position illustrations see tables 14 to 21.

10.1.1.1 Unrestricted case

Neutral — Neutralised I-channel, containing only FAS and BAS; all other bits are to be ignored at the receiver **9)** .

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9) It is interpreted as a command to shut off all the output of the I-channel demultiplexer except FAS, BAS and ECS (if relevant). Audio is muted accordingly. Release of this shut off is activated by a fixed rate command (namely by a command other than Var-LSD, Var-MLP). Channels other than I-channel (such as additional channel for 2B communications, or the 2nd through 6th timeslot for H0 communications) remain unchanged.
If video or HSD was set on before this Neutral BAS command is issued, it continues to be on. For example, if video has been on in a 2B communication, and Neutral BAS command is issued, the video is transmitted only in the additional channel. If a fixed rate command for I-channel is then issued, the video also occupies all bit positions of I-channel other than those designated by the fixed rate command, and FAS and BAS positions. In case of 1B communication, video is completely excluded by this Neutral BAS command, but it shall recover by e.g. next 16 kbit/s audio command.
It is noted that no procedures for the use of neutral BAS command have been adopted.

Au-off, U	No audio signal, no frame; all the I-channel is available for use under other commands [10].
Au-off, F	No audio signal, FAS and BAS in use; 62,4 kbit/s available for use under other commands.
A-law, 0U	Audio according to CCITT Recommendation G.711 [4] at 64 kbit/s, A-law, no framing (mode 0U).
A-law, 0F	Audio according to CCITT Recommendation G.711 [4] at 56 kbit/s, A-law, truncated to 7 bits in bits 1 to 7, with FAS and BAS in bit 8; bit 8 is set to zero at the PCM audio decoder (mode 0F).
µ-law, 0U	Audio according to CCITT Recommendation G.711 [4] at 64 kbit/s, µ-law, no framing (mode 0U).
µ-law, 0F	Audio according to CCITT Recommendation G.711 [4] at 56 kbit/s, µ-law, truncated to 7 bits in bits 1 to 7, with FAS and BAS in bit 8; bit 8 is set to zero at the PCM audio decoder (mode 0F).
G.722, m1	7 kHz audio at 64 kbit/s according to CCITT Recommendation G.722 [5], no framing.
G.722, m2	7 kHz audio at 56 kbit/s according to CCITT Recommendation G.722 [5], in bits 1 to 7.
G.722, m3	7 kHz audio at 48 kbit/s according to CCITT Recommendation G.722 [5], in bits 1 to 6.
Au-40k	Reserved.
Au-32k	Reserved.
Au-24k	Reserved.
Au-16k	Audio at 16 kbit/s according to CCITT Recommendation G.728 [7] in bits 1 and 2.
Au-<16k	Reserved.
Au-ISO-64/128/192/256	Audio to ISO/IEC 11172 [13] at 64/128/192/256 kbit/s, in the lowest-numbered time-slots (other than TS1) of an H0 or greater channel.
Au-ISO-384	Audio to ISO/IEC 11172 [13] at 384 kbit/s in time-slots 2 to 7 of a channel greater than H0.

10.1.1.2 Restricted case

Neutral	Neutralised I-channel, containing only FAS and BAS; all other bits are to be ignored at the receiver.
Au-off, U	No audio signal, no framing; bits 1 to 7 of the I-channel are available.
Au-off, F	No audio signal, FAS and BAS in use; 54,4 kbit/s available for use under other commands.
A-law, U7	Audio according to CCITT Recommendation G.711 [4] at 56 bit/s, A-law truncated to 7 bits, no framing (mode 0U).

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10) These attribute values designate unframed modes. In the receive direction reverting to a framed mode can only be achieved by recovering frame and multiframe alignment which might take up to two multiframes (320 ms).

A-law, F6	Audio according to CCITT Recommendation G.711 [4] at 48 kbit/s, A-law truncated to 6 bits, with FAS and BAS in bit 7.
µ-law, U7	Audio according to CCITT Recommendation G.711 [4] at 56 kbit/s, µ-law truncated to 7 bits, no framing (mode 0U).
µ-law, F6	Audio according to CCITT Recommendation G.711 [4] at 48 kbit/s, µ-law truncated to 6 bits, with FAS and BAS in bit 7.
G.722, U8	Not possible to transmit 8 bits per octet (according to CCITT Recommendation G.722 [5]).
G.722, U7	7 kHz audio in bits 1 to 7, 56 kbit/s according to CCITT Recommendation G.722 [5] (unframed).
G.722, F6	7 kHz audio at 48 kbit/s according to CCITT Recommendation G.722 [5], in bits 1 to 6.
Au-16k	Audio at 16 kbit/s according to CCITT Recommendation G.728 [7] in bits 1,2.
[Other]	All other values reserved.

Table 8 includes the values that are assigned maintaining the same number of audio bits per octet between the 64 kbit/s and 56 kbit/s environments.

10.1.2 Transfer-rate command values (001)

NOTE: If the transfer-rate command is less than the available connected capacity, the information occupies the lowest-numbered channel(s)/time-slot(s).

64	Signal occupies one 64 kbit/s channel.
2*64	Signal occupies two 64 kbit/s channels, with FAS and BAS in each.
3 to 6*64	Signal occupies three to six 64 kbit/s channels, with FAS and BAS in each.
384	Signal occupies 384 kbit/s, with FAS and BAS in the first 64 kbit/s time-slot; the effective channel may be the whole of an H0 channel or the lowest numbered time-slots of an H11 or H12 channel.
2*384	Signal occupies two channels of 384 kbit/s, with FAS and BAS in each.
3 to 5*384	Signal occupies three to five 384 kbit/s channels, with FAS and BAS in each.
1 536	Signal occupies 1 536 kbit/s, with FAS and BAS in the first 64 kbit/s time-slot. The effective channel occupies the whole of an H11 channel or the lowest numbered time-slots of an H12 channel.
1 920	Signal occupies 1 920 kbit/s, with FAS and BAS in the first 64 kbit/s time-slot. The effective channel occupies the whole of an H12 channel.
128/192/256/320	Signal occupies 128/192/256/320 kbit/s, with FAS and BAS in the first 64 kbit/s time-slot. The effective channel occupies the lowest numbered time-slots of an H0 or a channel with corresponding or higher capacity.
512/768/1 152/1 472	Signal occupies 512/768/1 152/1 472 kbit/s, with FAS and BAS in the first 64 kbit/s time-slot. The effective channel occupies the lowest numbered time-slots of an H11 or H12 channel or a channel with corresponding or higher capacity.
Loss-i.c.	Designated "Initial channel", used following loss of the channel previously so designated (see ETS 300 143 [2]).

Channel No. 2-6 Numbering of additional channels (see subclause 7.1).

10.1.3 Video, encryption, loopback and other commands (010)

NOTE 1: In three-letter-codes, the first letter of the alphabetic code-name indicates the type; the second is C for command, I for indication; the third is for the specific function.

Some Control and Indication (C&I) functions are defined such that, under various appropriate circumstances, the audiovisual system shall operate in a fault-free manner and also such that sympathetic presentation to users is possible. Some functions shall therefore be mandatory, others optional. Table 9 clarifies the circumstances under which C&I functions are mandatory.

Video-off No video; video switched off.

H.261 Video on, according to ITU-T Recommendation H.261 [1]: video occupies all capacity not otherwise allocated by other commands. The video rate in the initial B-channel (framed) or TS1 is:

62,4 kbit/s - audio rate - {800 bit/s if ECS is ON} - {MLP rate if ON} - {LSD rate if ON}

Video cannot be inserted in the I-channel when var-LSD or var-MLP is in force. The bit allocation for 76,8 kbit/s video and 48 kbit/s audio is given in table 19.

Vid-imp.(R) Reserved for video on, to improved recommended algorithm.

Video-ISO Video on, to ISO/IEC 11172 [13]: video occupies the same capacity as stipulated above for the case of video according to ITU-T Recommendation H.261 [1].

AV-ISO Composite audio/video to ISO/IEC 11172 [13]: the composite signal occupies the same capacity as stipulated above for the case of video according to ITU-T Recommendation H.261 [1].

VCF Video Command "Freeze-Picture request": this symbol may be transmitted prior to the "video-off" mode switch, to prepare the video decoder for this event (see NOTE 2). This symbol is also transmitted by a Multipoint Control Unit (MCU) prior to video switching (see CCITT Recommendation H.243 [12]). On receipt, a terminal video decoder shall complete updating of the current video frame but subsequently display the frozen picture until receipt of the freeze-picture release control which is embedded in the video.

NOTE 2: If a decoder according to ITU-T Recommendation H.261 [1] receives "VCF," it freezes pictures until a "Freeze Picture Release" signal **11)** is received or a timeout period of at least six seconds has expired. If a terminal wishes to continue the freezing of the picture at the remote end more than six seconds, it sends VCF repeatedly with an appropriate period (see ITU-T Recommendation H.261 [1]).

VCU Video Command "Fast-Update request": this symbol is transmitted by an MCU after performing a video switch. It may also be transmitted by a terminal at the start of communication when the video decoder is first ready to receive. On receipt, the terminal video encoder shall enter the fast-update mode at its earliest opportunity. This code is also intended for procedures for use in multipoint calls according to CCITT Recommendation H.243 [12].

NOTE 3: After a multipoint switch the video encoder which has received the "Fast update request" sends "Freeze Picture Release" in the video bit stream in accordance with to ITU-T Recommendation H.261 [1].

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11) Defined in ETS 300 142.

NOTE 4: After a call handling (e.g. call transfer) followed by "Fast-Update request", the encoder uses the INTRA mode for the first (and only the first) video frame.

Encryp-on — ECS Channel active.

NOTE 5: When encryption is active, it does not apply to the bits 1 to 24 of the SC in the I-channel nor to the FAS and BAS positions of the other channels.

Encryp-off — ECS channel off.

LCA — Loopback Command, "Audio Loop Request": on receipt of this symbol, the terminal, where possible, shall connect the output of the audio decoder to the input of the audio encoder.

LCV — Loopback Command "Video loop request": on receipt of this symbol, a terminal, where possible, shall connect the output of the video decoder to the input of the video encoder.

LCD — Loopback Command, "Digital Loop Request": on receipt of this symbol, the terminal shall disconnect the output of the multiplexer from the outgoing path, replacing it with the input to the demultiplexer. In the case of multiple B or H0 connections, loopback is activated in each connection.

If this digital loop back command is issued, it would come back from the remote terminal. Then the original terminal would respond to this loopback command making a complete loop of the transmission path. Maintenance terminals should avoid this situation by sending the command only once, or by ignoring the received loopback command.

LCO — Loopback Command "Loop off request": on receipt of this symbol, the terminal shall disconnect all loops and restore audio and data paths to their normal condition.

NOTE 6: Loopback requests are intended for use by maintenance staff.

NOTE 7: No standardised procedures are defined.

N*64 compatible — When this command is received by a terminal that has declared the "N*64 compatible" capability, and the terminal is operating at one of the declared single-channel transfer rates in both directions, the terminal shall ignore the unused bits defined in the "N*64 compatible" capability in the receive direction, and set these bits to "1" in the transmit direction. For use by MCUs, gateways and aggregators to provide compatible operation between terminals connected using multiple channels and terminals connected using a single higher rate channel.

Not-N*64 compatible — Negates the command "N*64 compatible". This is used, for example, in testing.

Restrict — To provide for operation on a restricted network, and for interconnection between a terminal on restricted and unrestricted networks: on receipt of this code, a terminal shall treat the SC as being in bit 7 of the I-channel, and discard bit 8 of every other channel and/or time-slot; in the outgoing direction these bits are set to "1".

Derestrict — On receipt of this code, a terminal shall revert to "unrestricted network" operation, treating the SC as being in bit 8 of the I-channel.

10.1.4 LSD/MLP commands (011) [12)]

For bit position illustrations see tables 14 to 21.

Special symbol:

#	These LSD rates are not allowed if ECS channel is in use.
LSD off	LSD switched off.
300	Low-Speed Data at 300 bit/s in SC, octets 38 to 40.
1 200	Low-Speed Data at 1 200 bit/s in SC, octets 29 to 40.
4 800	Low-Speed Data at 4 800 bit/s in SC, octets 33 to 80.
6 400	Low-Speed Data at 6 400 bit/s in SC, octets 17 to 80#.
8 000	Low-Speed Data at 8 000 bit/s in bit 7 (in restricted case: in bit 6).
9 600	Low-Speed Data at 9 600 bit/s in bit 7 (in restricted case: in bit 6) and octets 25 to 40 of SC.
14 400	Low-Speed Data at 14 400 bit/s in bit 7 (in restricted case: in bit 6) and octets 17 to 80 of SC#.
16k	Low-Speed Data at 16 kbit/s in bit 6 and bit 7 (in restricted case: in bit 5 and bit 6).
24k	Low-Speed Data at 24 kbit/s in bits 5, 6 and 7 (in restricted case: in bits 4, 5 and 6).
32k	Low-Speed Data at 32 kbit/s in bits 4 to 7 (in restricted case: in bits 3 to 6).
40k	Low-Speed Data at 40 kbit/s in bits 3 to 7 (in restricted case: in bits 2 to 6).
48k	Low-Speed Data at 48 kbit/s in bits 2 to 7 (in restricted case: in bits 1 to 6).
56k	Low-Speed Data at 56 kbit/s in bits 1 to 7 (no framing in restricted case).
62,4k	Low-Speed Data at 62,4 kbit/s in bits 1 to 7 and octets 17 to 80 of SC. If ECS channel is in use, the data rate is reduced to 61,6 kbit/s, but returns to 62,4 kbit/s if ECS channel is closed.
64k	Low-Speed Data at 64 kbit/s in bits 1 to 8, no framing.
Var-LSD	Low-Speed Data occupying all I-channel capacity not allocated under other fixed-rate commands; cannot be invoked when other LSD is on, or when variable-MLP is on. Exact var-LSD rate: 62,4 kbit/s - audio rate - {800 bit/s if ECS in ON} - {fixed-MLP if ON}.
DTI-1, -2, -3(R)	Three codes reserved for communicating the status of the data terminal equipment interfaces.
MLP-off	MLP off in all channels.
MLP-4k	MLP on at 4 kbit/s in octets 41 to 80 of SC.

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12) MLP protocols are under discussion in ITU-T.

MLP-6,4k — MLP on at 6,4 kbit/s in octets 17 to 80 of SC; if ECS channel is in use, the data rate is reduced to 5,6 kbit/s in octets 25 to 80, but returns to 6,4 kbit/s if ECS channel is closed.

Var-MLP — MLP occupying all I-channel capacity not allocated under other fixed-rate commands: cannot be invoked when other MLP is on, or when variable-LSD is on. Exact var-MLP rate:

62,4 kbit/s - audio rate - {800 bit/s if ECS is ON} - {fixed-LSD if ON}.

10.1.5 Audio capabilities (100)

Neutral — Neutral capability: no change in the current capabilities of the terminal.

A-law — Capable of decoding audio according to CCITT Recommendation G.711 [4], A-law.

μ-law — Capable of decoding audio according to CCITT Recommendation G.711 [4], μ-law.

G.722-64 — Capable of decoding audio according to CCITT Recommendation G.722 [5] (64 kbit/s) and CCITT Recommendation G.711 [4].

G.722-48 — Capable of decoding audio according to CCITT Recommendation G.722 [5] (64 kbit/s, 56 kbit/s, 48 kbit/s) and CCITT Recommendation G.711 [4].

Au-16k — Capable of decoding audio, according to both CCITT Recommendation G.728 [7] and CCITT Recommendation G.711 [4].

Au-ISO — Capable of decoding audio to ISO/IEC 11172 [13] at all rates up to 384 kbit/s.

10.1.6 Transfer-rate capabilities (100)

1B, H0 — Can accept signals on only one 64 kbit/s channel, one 384 kbit/s channel.

2B — Can accept signals on one or two 64 kbit/s channels, and synchronise them.

... — ...

6B — Can accept signals on one to six 64 kbit/s channels, and synchronise them.

2H0 — Can accept signals on one or two 384 kbit/s channels, and synchronise them.

... — ...

5H0 — Can accept signals on one to five 384 kbit/s channels, and synchronise them.

H11, H12 — Can accept signals on a H11 channel, a H12 channel.

Restrict — Can work only at p*56 kbit/s, rate-adapted to p*64 kbit/s by moving the SC to bit position 7 and setting bit 8 to "one" in every channel or time-slot; a constant "one", however, may be set in bit 8 if it is known by out-of-band signalling prior to the connection that the restriction exists; this code has the effect of forcing the remote terminal to work in the p 56 kbit/s mode (see subclause 6.6).

N*64 compatible — This capability shall be declared along with one or more single-channel transfer rate capabilities greater than 64 kbit/s (128, 192, 256, etc.). It indicates the ability to operate at all the declared single-channel transfer rates where the Least Significant Bits of the first 16 octets of all time slots except TS1 are not used (TS1 contains FAS and BAS).

128/192/256/320 — Capable of accepting the transfer rate specified by the corresponding command.

512/768/1 152/1 472 Capable of accepting the transfer rate specified by the corresponding command.

10.1.7 Video, MBE and encryption capabilities (101)

QCIF — Can decode video to QCIF picture format, but not CIF (see ITU-T Recommendation H.261 [1]) - this code shall be followed by one of the four Minimum Picture Interval (MPI) values below.

CIF — Can decode video to CIF and QCIF formats (see ITU-T Recommendation H.261 [1]) - this code shall be followed by two MPI values, the first applicable to QCIF and the other to CIF format.

MPI codes are as follows:

1/29.97 — Can decode video, having a minimum picture interval of 1/29,97 seconds, according to ITU-T Recommendation H.261 [1].

2/29.97 — Can decode video, having a minimum picture interval of 2/29,97 seconds, according to ITU-T Recommendation H.261 [1].

3/29.97 — Can decode video, having a minimum picture interval of 3/29,97 seconds, according to ITU-T Recommendation H.261 [1].

4/29.97 — Can decode video, having a minimum picture interval of 4/29,97 seconds, according to ITU-T Recommendation H.261 [1].

Vid-imp(R) — Reserved for future improved recommended video algorithm.

Video-ISO — Can decode video to ISO/IEC 11172 [13].

AV-ISO — Can decode composite audio/video signal to ISO/IEC 11172 [13].

MBE-cap — Can handle multiple-byte extension messages in the BAS position, those beginning with codes in the range (111)[25-31], in addition to other values.

Esc-CF(R) — Reserved for capability to accept non-zero class/family escape codes (see CCITT Recommendation H.221 [11]).

Encryp — Capable of handling signals on the ECS channel.

10.1.8 LSD/MLP capabilities (101) [13)]

300 — Can accept LSD at 300 bit/s in the bit positions specified against the corresponding commands.

... — ...

64 — Can accept LSD at 64 kbit/s in the bit positions specified against the corresponding commands.

Var-LSD — Can accept LSD variable rate in the bit positions specified against the corresponding command.

MLP-4k — Can accept MLP at 4 kbit/s in the bit positions specified against the corresponding command.

MLP-6,4k — Can accept MLP at 6,4 kbit/s in the bit positions specified against the corresponding command and at 4 kbit/s as for MLP-4k.

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13) MLP protocols are under discussion in ITU-T.

Var-MLP — Can accept MLP at up to 64 kbit/s in the I-channel.

10.1.9 Escape table values (111)

HSD — High-Speed Data: a table containing capabilities and commands for High Speed Data and MLP.

C&I — Control and Indications: tables with definitions for Controls and Indications, SBE Numbers and SBE Characters.

Data-apps — Applications within LSD/HSD channels: see table 12.

(R-SBE) — Three codes reserved for future application.

Cap-mark — Capability marker - the first item in a capability set - see ETS 300 143 [2].

Start-MBE — First byte of (N+2) octet BAS message; the message format is:start-MBE//value of N (max=255)//N bytes.

NS-cap — First byte of non-CCITT capabilities message; the message format is: NS-cap//value of N (max=223)//country code //manufacturer code*//(N - 4) bytes. Country code consists of two bytes, the first being according to CCITT Recommendation T.35 [14]; the second byte and the terminal manufacturer code of two bytes are assigned nationally.

NOTE 1: The value of N is coded by its binary representation.

NOTE 2: The Most Significant Bit of each MBE message byte is transmitted as the b0 bit of BAS.

NS-comm — First byte of non-CCITT command message; the message format is: NS-comm//value of N (max=223)//country code //manufacturer code*//(N-4) bytes. Country code consists of two bytes, the first being according to CCITT Recommendation T.35 [14]; the second byte and the terminal manufacturer code of two bytes are assigned nationally.

NOTE 3: The value of N is coded by its binary representation.

NOTE 4: The Most Significant Bit of each MBE message byte is transmitted as the b0 bit of BAS.

Table 8: BAS numerical values

	(000) Audio coding command subclause 10.1.1.1	(000) for restricted case subclause 10.1.1.2	(001) Transfer rate command subclause 10.1.2	(010) Video, encryption, loops and other command subclause 10.1.3	(011) LSD/MLP command subclause 10.1.4	(100) Audio/ transfer rate capability subclause 10.1.5 subclause 10.1.6	(101) Data/video capability subclause 10.1.7 subclause 10.1.8	(111) Escape subclause 10.1.9
[0]	neutral	neutral	64	video off	LSD off	neutral	var-LSD	
[1]			2 * 64	H.261	300	A-law	300	
[2]			3 * 64	vid-imp(R)	1 200	µ-law	1 200	
[3]			4 * 64	video-ISO	4 800	G.722-64	4 800	
[4]	A-law, 0U		5 * 64	AV-ISO	6 400	G.722-48	6 400	
[5]	µ-law, 0U		6 * 64		8 000	Au-16 k	8 000	
[6]	G.722, m1	not possible	384	encryp-on	9 600	Au-ISO	9 600	
[7]	Au-off, U	Au-off, U	2 * 384	encryp-off	14 400		14 400	
[8]	NOTE 1		3 * 384		16k	128	16k	
[9]	NOTE 1		4 * 384		24k	192	24k	
[10]			5 * 384		32k	256	32k	
[11]			1536		40k	320	40k	
[12]			1 920		48k	512	48k	
[13]	Au-ISO-64		128		56k	768	56k	
[14]	Au-ISO-128		192		62,4k		62,4k	
[15]	Au-ISO-192		256		64k	1 152	64k	
[16]	Au-ISO-256		320	VCF	MLP-off	1B	MLP-4k	HSD
[17]	Au-ISO-384		loss i.c.	VCU	MLP-4k	2B	MLP-6,4k	C&I
[18]	A-law, 0F	A-law, U7	ch#2	LCA	MLP-6,4k	3B	var-MLP	Data-apps.
[19]	µ-law, 0F	µ-law, U7	ch#3	LCV	Var-MLP	4B		C&I
[20]		A-law, F6	ch#4	LCD		5B	QCIF	C&I
[21]		µ-law, F6	ch#5	LCO	(DTI-1)	6B	CIF	(R-SBE)
[22]			ch#6		(DTI-2)	restrict	1/29,97	(R-SBE)
[23]			512		(DTI-3)	N*64 comp	2/29,97	(R-SBE)
[24]	G.722, m2 (NOTE 2)	G.722, U7	768			H_0	3/29,97	cap-mark
[25]	G.722, m3 (NOTE 2)	G.722, F6		N*64 comp		$2H_0$	4/29,97	start-MBE
[26]	(Au-40k)		1 152	Not-N*64 comp		$3H_0$	V-imp(R)	
[27]	(Au-32k)			restrict		$4H_0$	Video-ISO	
[28]	(Au-24k)			derestrict		$5H_0$	AV-ISO	
[29]	Au-16k	Au-16k	1 472			1 472	esc-CF (R)	
[30]	(Au-<16k)					H_{11}	encryp.	NS-cap
[31]	Au-off, F	Au-off,F			var-LSD	H_{12}	MBE-cap	NS-com

NOTE 1: These codes are listed in CCITT Recommendation G.725 [6] with reference to an “application channel”; such a channel has not been defined, the concept having been superseded by that of LSD/MLP; therefore these codes should not be used.

NOTE 2: These codes are listed in CCITT Recommendation G.725 [6] with reference to “data”; however, the nature of such data (video, LSD, MLP, ECS) shall be specified by further commands (001), (010), (011).

- The column header gives the attribute designation as bits (b_0, b_1, b_2); the left-hand column gives the decimal value of bits [b_3, b_4, b_5, b_6, b_7]; for example, “ch#6” has the value (001) [10110]. All unassigned values are reserved, as are values in brackets.

Table 9

abbreviation	TRANSMIT terminal	TRANSMIT MCU	RECEIVE terminal	RECEIVE MCU
VCF	X	M	M	M
VCU	X	M	M	M
LCV	NA	NA	CM	NA
LCA	NA	NA	X	X
LCD	NA	NA	X	
LCO	NA	X	CM	

CM denotes "conditionally mandatory": if the terminal (or MCU) is capable of entering the given state, then it shall transmit the given code and, when leaving that state, the complementary code. If it has no such capability it can ignore both.
M denotes "mandatory" for all equipments of either terminal or MCU type.
X denotes "non-mandatory": on receipt of such a code, it may be unrecognised, or recognised but not acted upon, or recognised and acted upon, entirely at the discretion of the manufacturer or user, or as specified in other ETSs.
NA denotes that the code is not applicable in that case.

10.2 Second octet ("escaped") BAS values

10.2.1 HSD/H-MLP (High speed Multi layer Protocol) (111)[16]

This table is reached by the escape BAS (111)[16]. It defines the second BAS code of a SBE sequence (see table 10).

NOTE: In the cases of multiple channels, the term "highest-numbered time-slot" refers to the highest-numbered channel.

10.2.1.1 Capabilities (111)[16]-(101)

64k to 384k — Can accept HSD at the specified rate in the bit positions specified against the corresponding commands.

512k to 1 536k — Reserved for other HSD rates.

Var-HSD — Can accept HSD variable rate in the bit positions specified against the corresponding command.

H-MLP-62,4k — Can accept MLP at 62,4 kbit/s in the bit positions specified against the corresponding command.

H-MLP-r — Can accept MLP at r = 64/128/192/256/320/384 kbit/s in the bit positions specified against the corresponding command.

Var-H-MLP — Reserved for capability to accept H-MLP variable rate in the bit positions specified against the corresponding command.

10.2.1.2 Commands (111)[16]-(011)

NOTE: When the "restrict" command is in force the least significant bit of all octets covered by the HSD and H-MLP commands is set to "1", so the effective data rate is less than that indicated by the command.

HSD-off — HSD switched off; FAS and BAS restored in additional channels.

64k — HSD on, in highest numbered channel/time-slot; FAS and BAS are removed in the case of multiple B-channels.

128/192/256k — HSD on in highest-numbered time-slots of an H0 or greater channel.

320k — HSD on in highest-numbered time-slots of an H0 or greater channel.

384k — HSD on in highest-numbered H0 channel, or highest-numbered time-slots of a greater channel; FAS and BAS are removed in the case of multiple-H0 channels.

512,768,1 152,1 536 — Reserved for other HSD rates.

Var-HSD — Reserved for high-speed data occupying all capacity, other than in the I-channel, not allocated under other commands: cannot be invoked when other HSD is on, or when var-H-MLP is on (may also be impractical when video is on, the latter then being confined to the I-channel).

H-MLP-off — H-MLP switched off (this does not affect I-channel MLP).

H-MLP-62,4 — H-MLP on at 62,4 kbit/s, occupying second 64 kbit/s channel except FAS and BAS positions.

H-MLP-r — H-MLP on at r = 64/128/192/256/320 kbit/s in the lowest-numbered time-slots (other than TSI) of an H0 or greater channel.

H-MLP-384k — H-MLP on at 384 kbit/s in time-slots 2 to 7 of a greater channel than H0.

Var-H-MLP — Reserved for MLP occupying all capacity, other than in the I-channel, not allocated under other commands: cannot be invoked when other MLP is on, or when var-HSD is on.

Table 10: HSD/H-MLP numerical values, reached by BAS (111)[16]

	Capabilities (101)	**Commands (011)**
[0]		HSD-off
[1]	var-HSD(R)	var-HSD(R)
[2]	H-MLP-62,4	H-MLP-62,4
[3]	H-MLP-64	H-MLP-64
[4]	H-MLP-128	H-MLP-128
[5]	H-MLP-192	H-MLP-192
[6]	H-MLP-256	H-MLP-256
[7]	H-MLP-320	H-MLP-320
[8]	H-MLP-384	H-MLP-384
[9] - [12]		
[13]	var-H-MLP(R)	var-H-MLP(R)
[14]		H-MLP-off
[15] - [16]		
[17]	64k	64k
[18]	128k	128k
[19]	192k	192k
[20]	256k	256k
[21]	320k	320k
[22]	384k	384k
[23]	512k(R)	512k(R)
[24]	768k(R)	768k(R)
[25]	1 152k(R)	1 152k(R)
[26]	1 536k(R)	1 536k(R)
[27] - [31]		

NOTE: The column header gives the attribute designation as bits (b_0, b_1, b_2); the left-hand column gives the decimal value of bits [b_3, b_4, b_5, b_6, b_7]. All assigned values are reserved, as are values marked (R).

10.2.2 Control and Indication (C&I) - (111)[17]

The C&I may be categorised into two groups:

a) transmission frame-synchronous, or otherwise requiring rapid response;
b) conference, data, and telematic control not requiring frame synchronism, governed by the MLP of CCITT Recommendation H.200 [8], H.200/AV.270.

This ETS concerns only those C&I coming under category a). This includes a simplified set of conference C&I for multipoint connections of simple terminals.

All the following frame-synchronous C&I codes are transmitted by a sequence involving the BAS positions in two consecutive sub-multiframes. In the first, the code (111)[17] is transmitted (escape code). In the second, the code defined in table 11 is transmitted.

NOTE: Only one symbol is transmitted by this method - the code in the subsequent sub-multiframe is again treated as a normal BAS code.

The full definitions of these symbols are set out below and the code values in table 11. In these three-letter-codes, the first letter of the alphabetic code-name indicates the type; the second is C for command, I for indication; the third is for the specific function.

The C&I functions are defined such that, under various appropriate circumstances, the audiovisual system shall operate in a fault-free manner and also such that sympathetic presentation to users is possible. Some functions shall therefore be mandatory, others optional. This subclause, together with the categorisation in table 11, clarifies the circumstances under which C&I functions are mandatory.

There are only a few mandatory requirements on most terminals. All audiovisual terminals shall recognise and obey the command to make or break the digital loopback, and video loopback if they have video capability. All terminals having a video capability shall also obey VCU, VCF, and MCS/MCN, otherwise there will be system misoperation on a multipoint call. See also table 9.

10.2.2.1 C&I related to video (111)[17]-(000)

VIS — Video Indicate Suppressed: this symbol is used to indicate that the content of the video channel does not represent a normal camera image. The video encoder may be without video input or an electronically-generated pattern may have been substituted.

VIA — Video Indicate Active: Complementary to VIS. The video source is the only one, or, in the case that more video sources are to be distinguished, it is that designated "video No. 1".

VIA2 — Equivalent to VIA, but designating "video No. 2" as the source.

VIA3 — Equivalent to VIA, but designating "video No. 3" as the source.

VIR — Video Indicate Ready-to-Activate: this symbol is transmitted by a terminal whose user has decided not to send video unless he will also receive video from the other end.

10.2.2.2 C&I related to audio (111)[17]-(000)

AIM — Audio Indicate Muted: this symbol is used to indicate that the content of the audio channel does not represent a normal audio signal. The audio encoder may be without audio input or an electronically-generated tone may have been substituted.

AIA — Audio Indicate Active: complementary to AIM.

10.2.2.3 C&I related to simple multipoint conferences not using MLP (111)[17]-(001)

NOTE 1: Some of the following codes may be cancelled by transmission of appropriate codes, as listed in table 11, but not separately defined here.

MCV — Multipoint Command Visualisation-Forcing: transmitted by a terminal to force an associated MCU to broadcast its video signal. (Used to transmit the picture of a chairman or VIP, alternatively to hold a picture source during the transmission of graphics).

MIV — Multipoint Indication Visualisation: transmitted by an MCU to indicate to a terminal that its video signal is being seen by other terminals (otherwise known as "On-air" indication).

MCC — Multipoint Command Conference: transmitted by an MCU to a terminal. The terminal receiving MCC shall make its outgoing transfer rate equal to its incoming transfer rate, and its outgoing audio rate equal to its incoming audio rate.

NOTE 2: The command could also be used to invoke an on-screen user indication.

MCS — Multipoint Command Symmetrical Data-transmission: transmitted by an MCU when setting up data broadcasting. On receipt, a terminal shall prepare itself for data reception and ensure, by mode change if necessary, that its outgoing data channel occupies the same capacity as its incoming data channel. A terminal in receipt of MCS cannot initiate data broadcasting

MCN — Multipoint Command Negating MCS: transmitted by an MCU at the completion of data broadcasting. On receipt, a terminal shall close any outgoing data channel which it has opened as a result of the previous reception of MCS. Following the end of data reception and the receipt of MCN, a terminal is permitted to initiate data broadcasting.

MIZ — Multipoint Indication Zero-communication: transmitted by an MCU to a terminal for information, with the meaning that no other terminals are yet connected to the MCU.

MIS — Multipoint Indication Secondary-status: transmitted by an MCU to a terminal for information, with the meaning that since other terminals of higher capability are participating in the conference-call, this terminal does not necessarily receive all the signals that are sent to those other terminals (see CCITT Recommendation H.243 [12]).

10.2.2.4 SBE symbols used in multipoint working (111)[17]-(000), (001), (010), (011)

NOTE: See also CCITT Recommendation H.243 [12].

Any of the symbols prescribed here may be repeated without ill effect: they are part of a set currently in force. An MCU shall expect propagation and processing delays to slow responses from terminals and other MCUs; terminals may repeat a request that an MCU has already satisfied. It is important that terminals receiving SBE symbols which they do not recognise, or cannot use, shall ignore these and not enter any fault recovery process.

The asterisks ("*") identify symbols which shall be followed (always) by at least one SBE number or SBE character (see subclauses 10.2.4 and 10.2.5).

A "double symbol" consists of two SBE code-pairs, the second immediately following the first. The first is one of the symbols listed as having an associated SBE number or SBE character parameter to be conveyed by the second. Thus a double symbol occupies four successive BAS positions, and takes 80 ms to transmit.

A "triple symbol" similarly consists of three SBE code-pairs in succession; the first is one of the symbols listed as having an associated numerical or character parameter to be conveyed by the second and third. Thus a triple symbol occupies six successive BAS positions, and takes 120 ms to transmit.

In the case of TII*, it may be double or triple, or longer, but the succession of symbols shall end with the symbol TIS.

Terminal numbers (see CCITT Recommendation H.243 [12]) are of the form <M><T>, where <M> and <T> are each SBE numbers.

MIM	Multipoint Indicate Master-MCU: transmitted by an MCU which has claimed the master-MCU role.
MIL*	Multipoint Indication Loop: see CCITT Recommendation H.243 [12], section 10; shall be followed by an SBE number.
RAN*	RAndom Number: shall be followed by a random SBE number in the range 0 to 223.
TIA*	Terminal Indicate Assignment: used by an MCU to transmit the assigned terminal number to another MCU or to a terminal; shall be followed by <M><T>.
TIN*	Terminal Indicate Number: used to pass information concerning terminal number assignments made; shall be followed by <M><T>.
TID*	Terminal Indicate Dropped: used to pass information concerning any terminal number no longer effective; shall be followed by <M><T>.
TCU	Terminal Command Update: transmitted by a terminal or MCU to an MCU to request an updated list of terminals connected.
TIF*	Terminal Indicate Floor-request: transmitted by a terminal to its MCU; shall be followed by <M><T> when forwarded from one MCU to another <T> is that of the terminal requesting the floor; when transmitted by the terminal itself <0><0> shall follow.
TCI	Terminal Command Identify: sent by an MCU to a directly-connected terminal or vice versa in order to request identification by means of a symbol TII*.

TCS-n	Terminal Command String: sent by an MCU to a directly-connected terminal or vice versa in order to request information in the form of a symbol IIS [14]; the meaning according to the different values of n is thus:
	
	n=0: reserved;
	
	n=1: password;
	
	n=2: identity (person or terminal);
	
	n=3: conference identity;
	
	n=4 to 31: reserved.

TII*	Terminal Indicate Identity: sent in response to TCI; shall be followed by an SBE alphanumeric character, the content being prescribed by the MCU service provider.
TIS	Terminal Indicate identity-Stop: end-marker to indicate the end of a sequence of TII symbols.

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14) See "Multiple-Byte Extension BAS values".

TIC	Terminal Indicate Capability: included in the initial capset of a terminal to tell an MCU that it can recognise TIA and return TIX in the additional channels; included in the capset of an MCU to say that it can accept additional calls to the same access number and correctly associate additional channels according to the procedure described in CCITT Recommendation H.243 [12].
TIX*	Terminal Indicate additional-channel-X: sent by a terminal having capability TIC in response to TIA; shall be followed by <M><T>.
VIN*	Video Indicate Number: transmitted by an MCU to indicate the source (terminal identity number) of the video in the signal; shall be followed by <M><T>.
VCB*	Video Command Broadcast: transmitted by a chair-control terminal or an MCU to an MCU to cause broadcasting of the video from the terminal whose identity number follows VCB.
VCE	Video Command End-broadcasting: returns the conference to voice-activated video switching.
VCS*	Video Command Select: transmitted by a terminal to an MCU to cause transmission to itself of the video from the terminal whose identity number follows VCS, if this requirement does not conflict with a VCB requirement.
Cancel-VCS	Transmitted by a terminal to return to automatic video switching at the MCU.
VCR	Transmitted by an MCU when it cannot comply with the commands VCB or VCS, for whatever reason.
CIC	Chair-control Indicate Capability: included in the capset of an MCU to show that it can properly process the codes (CCA, CIT, CCR, CCS, CCD, CIR, CCK), (TIA, TIN, TID, TIL [15)] , TCU, TIF), (VCB, VIN, VCR, VCE).
CCD*	Chair Command Disconnect: transmitted by a chair-control terminal to an MCU to cause dropping of the terminal whose identity number follows.
CIR	Chair Indicate Release/Refuse: transmitted by an MCU when it cannot comply with the command CCD.
CCK	Chair Command Kill: transmitted by a chair-control terminal to drop all terminals from the conference.
CCA	Chair Command Acquire: transmitted by a terminal or MCU to claim a chair-control token.
DCA-L*/DCA-H*	LSD/HSD Command Acquire-token: transmitted by a terminal or MCU to claim an LSD/HSD token; shall be followed by an SBE number indicating the data rate requested (see CCITT Recommendation H.243 [12], table 2/3).
CIT	Chair Indicate Token: used by an MCU to pass the chair-control token.
DIT-L	LSD Indicate Token: used by an MCU to pass the LSD token.
DIT-H	HSD Indicate Token: used by an MCU to pass the HSD token.
CCR	Chair Command Release/Refuse: used by an MCU to withdraw/refuse assignment of chair-control token.

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15) See "Multiple-Byte Extension BAS values".

DCR-L/DCR-H — LSD/HSD Command Release/Refuse: used by an MCU to withdraw/refuse assignment of LSD token, or by the chair-control terminal to cause this withdrawal.

CIS — Chair Indicate Stopped-using-token: transmitted by a terminal holding the chair token to release it.

DIS-L — LSD Indicate Stopped-using-token: transmitted by a terminal holding the LSD token to release it.

DIS-H — HSD Indicate Stopped-using-token: transmitted by a terminal holding the HSD token to release it.

DCC-L / DCC-H — LSD/HSD Command Close: transmitted by a terminal holding the LSD/HSD token to release it and close the LSD/HSD channel.

Table 11: Numerical values for C&I, reached by BAS (111)[17]

			TRANSMIT		RECEIVE		
attribute	**value**	**abbreviation**	**terminal**	**MCU**	**terminal**	**MCU**	**reference for procedures**
(000)	[0,1]	reserved for audio-related symbols					
	[2]	AIM	CM	CM	X	X	subclause 10.2.2.2
	[3]	AIA	CM	CM	X	X	subclause 10.2.2.2
	[4]-[7]	reserved for audio-related symbols					
	[8]	TCI	#	#	#	#	CCITT Recommendation H.243 [12]
	[9]	TII*	#	#	#	#	CCITT Recommendation H.243 [12]
	[10]	TIS	#	#	#	#	CCITT Recommendation H.243 [12]
	[11]-[15]	reserved					
	[16]	VIS	CM	CM	X	X	subclause 10.2.2.1
	[17]	VIA	CM	CM	X	X	subclause 10.2.2.1
	[18]	VIA2	X	NA	X	X	see ETS 300 145 [3]
	[19]	VIA3	X	NA	X	X	see ETS 300 145 [3]
	[20]-[30]	reserved for video-related symbols					
	[31]	VIR	X	NA	X	NA	see ETS 300 145 [3]
(001)	[0]	MCC	NA	M	M	M	CCITT Recommendation H.243 [12]
	[1]	cancel-MCC	NA	M	M	M	CCITT Recommendation H.243 [12]
	[2]	MIZ	NA	M	M	M	CCITT Recommendation H.243 [12]
	[3]	cancel-MIZ	NA	M	M	M	CCITT Recommendation H.243 [12]
	[4]	MIS	NA	M	M	M	CCITT Recommendation H.243 [12]
	[5]	cancel-MIS	NA	M	M	M	CCITT Recommendation H.243 [12]
	[6]	MIM		#		#	CCITT Recommendation H.243 [12]
	[7]	TIC	#	#	#	#	CCITT Recommendation H.243 [12]
	[8]	TIX	#		#	#	
	[9]	RAN		#		#	
	[10]	reserved					
	[11]	TIA*		#	#	#	CCITT Recommendation H.243 [12]
	[12]	TIN*		#	#	#	CCITT Recommendation H.243 [12]
	[13]	TID*		#	#	#	CCITT Recommendation H.243 [12]
	[14]	TCU	#	#		#	CCITT Recommendation H.243 [12]
	[15]	reserved					CCITT Recommendation H.243 [12]
	[16]	MCV	X	NA	NA	M	CCITT Recommendation H.243 [12]
	[17]	cancel-MCV	X	NA	NA	M	CCITT Recommendation H.243 [12]
	[18]	MIV	NA	M	X	NA	CCITT Recommendation H.243 [12]
	[19]	cancel-MIV	NA	M	X	NA	CCITT Recommendation H.243 [12]
	[20]	MCS	NA	CM	CM	CM	CCITT Recommendation H.243 [12]
	[21]	MCN	NA	CM	CM	CM	CCITT Recommendation H.243 [12]
	[22]	VIN*		#	#	#	CCITT Recommendation H.243 [12]
	[23]	VCB*	#	#		#	CCITT Recommendation H.243 [12]
	[24]	VCE	#	#		#	CCITT Recommendation H.243 [12]
	[25]	VCS*	#	#		#	CCITT Recommendation H.243 [12]
	[26]	cancel-VCS	#	#		#	CCITT Recommendation H.243 [12]
	[[27]	VCR		#	#	#	CCITT Recommendation H.243 [12]
	[28]-[30]	reserved					
	[31]	MIL*		#		#	CCITT Recommendation H.243 [12]

Table 11: Numerical values for C&I, reached by BAS (111)[17] (concluded)

attribute	value	abbreviation	TRANSMIT terminal	TRANSMIT MCU	RECEIVE terminal	RECEIVE MCU	reference for procedures
(010)	[0]	CIC		#	#		CCITT Recommendation H.243 [12]
	[1]	CCD*	#	#		#	CCITT Recommendation H.243 [12]
	[2]	CIR		#	#	#	CCITT Recommendation H.243 [12]
	[3]	CCK	#	#		#	CCITT Recommendation H.243 [12]
	[4]	CCA	#	#		#	CCITT Recommendation H.243 [12]
	[5]	CIT		#	#	#	CCITT Recommendation H.243 [12]
	[6]	CCR		#	#	#	CCITT Recommendation H.243 [12]
	[7]	CIS	#	#		#	CCITT Recommendation H.243 [12]
	[8]	TIF*	#	#		#	CCITT Recommendation H.243 [12]
	[9]-[15]	reserved					
	[16]	DCA-L	#	#		#	CCITT Recommendation H.243 [12]
	[17]	DIT-L		#	#	#	CCITT Recommendation H.243 [12]
	[18]	DCR-L		#	#	#	CCITT Recommendation H.243 [12]
	[19]	DIS-L	#	#		#	CCITT Recommendation H.243 [12]
	[20]	DCC-L	#	#		#	CCITT Recommendation H.243 [12]
	[21]-[23]	reserved					
	[24]	DCA-H	#	#		#	CCITT Recommendation H.243 [12]
	[25]	DIT-H		#	#	#	CCITT Recommendation H.243 [12]
	[26]	DCR-H		#	#	#	CCITT Recommendation H.243 [12]
	[27]	DIS-H	#	#		#	CCITT Recommendation H.243 [12]
	[28]	DCC-H	#	#		#	CCITT Recommendation H.243 [12]
	[29]-[31]	reserved					
(011)	[0]	TCS-0	#	#	#	#	CCITT Recommendation H.243 [12]
	[1]	TCS-1	#	#	#	#	CCITT Recommendation H.243 [12]
	[2]	TCS-2	#	#	#	#	CCITT Recommendation H.243 [12]
	[3]	TCS-3	#	#	#	#	CCITT Recommendation H.243 [12]
	[4]-[31]	reserved					

CM denotes "conditionally mandatory": if the terminal (or MCU) is capable of entering the given state, then it shall transmit the given code and, when leaving that state, the complementary code.

M denotes "mandatory" for all equipments of either terminal or MCU type.

X denotes "non-mandatory": on receipt of such a code, it may be unrecognised, or recognised but not acted upon, or recognised and acted upon, entirely at the discretion of the manufacturer or user, or as specified in other ETS.

NA denotes that the code is not applicable in that case.

# denotes only directivity of the C&I signal; see CCITT Recommendation H.243 [12] for whether it is mandatory or optional to the terminal or MCU.

10.2.3 Applications within LSD/HSD channels (111)[18]

This table is reached by the escape BAS (111)[18]. It defines the second BAS code of a SBE sequence (see table 12).

10.2.3.1 Capabilities (111)[18]-(101)

ISO-SP baseline on LSD Can accept ISO-still picture (SP) baseline mode on specified LSD rate to ISO\IEC 11172 [13].

JPEG baseline on HSD Can accept ISO-still picture baseline mode on specified HSD rate to ISO\IEC 11172 [13].

JPEG spatial Can accept ISO-still picture baseline and spatial modes to ISO\IEC 11172 [13].

JPEG progressive Can accept ISO-still picture baseline and progressive modes to ISO\IEC 11172 [13].

JPEG arithmetic Can accept ISO-still picture baseline and arithmetic modes to ISO\IEC 11172 [13].

Still image Can accept still images encoded by the method defined in ITU-T Recommendation H.261 [1].

NOTE 1: Administrations may use this optional procedure as a simple and inexpensive method to transmit still images. However, ITU-T Recommendation T.81 (JPEG) [10] is preferred when the procedures for using ITU-T Recommendation T.81 [10] within audiovisual systems are standardized.

NOTE 2: ITU-T SG15 will define BAS values which indicate the set of JPEG formats a terminal can handle.

Graphics cursor — Can handle graphics cursor data.

Group 3 Facsimile — Can accept group 3 Facsimile.

Group 4 Facsimile — Can accept group 4 Facsimile.

V.120 LSD — Can accept V.120 terminal adaptation within an LSD channel.

V.120 HSD — Can accept V.120 terminal adaptation within an HSD channel.

10.2.3.2 Commands (111)[18]-(011)

This table is reached by the escape BAS (111)[18]. It defines the second BAS code of a SBE sequence (see table 12).

JPEG on in LSD — ISO-still picture switched on in specified LSD to ISO\IEC 11172 [13].

JPEG on in HSD — ISO-still picture switched on in specified HSD to ISO\IEC 11172 [13].

Cursor data on in LSD — Cursor data switched on in specified LSD.

Facsimile on in LSD — Facsimile switched on in specified LSD.

Facsimile on in HSD — Facsimile switched on in specified HSD.

V.120 LSD — V.120 switched on in specified LSD.

V.120 HSD — V.120 switched on in specified HSD.

Table 12: Numerical values for applications in LSD/HSD channels, reached by BAS (111)[18]

	Capabilities (101)	**Commands (011)**
[0]	JPEG baseline on LSD	JPEG on in LSD
[1]	JPEG baseline on HSD	JPEG on in HSD
[2]	JPEG spatial	
[3]	JPEG progressive	
[4]	JPEG arithmetic	
[5] - [8]		
[9]	Still image	
[10]	Graphics cursor	Cursor data on in LSD
[11] - [15]		
[16]	Group 3 Facsimile	Facsimile on in LSD
[17]	Group 4 Facsimile	Facsimile on in HSD
[18] - [19]		
[20]	V.120 LSD	V.120 LSD
[21]	V.120 HSD	V.120 HSD
[22] - [31]		
NOTE:	The column header gives the attribute designation as bits (b_0, b_1, b_2); the left-hand column gives the decimal value of bits [b_3, b_4, b_5, b_6, b_7]. All assigned values are reserved, as are values marked (R).	

10.2.4 General purpose SBE symbols: SBE numbers reached by (111)[19]

The escape code (111)[19] gives access to a table of SBE numbers having the values 0 to 223 according to the 8-bit binary code. These SBE values are referred to as "SBE numbers". One SBE number or a string of such numbers is normally preceded by another SBE symbol indicating the purpose for which the number is being sent.

10.2.5 General purpose SBE symbols: SBE characters reached by (111)[20]

The escape code (111)[20] gives access to a table of SBE characters coded as International Alphabet No. 5 as defined in CCITT Recommendation T.50 [9], with bit 8 set to zero. A character or string of characters is normally preceded by another SBE symbol indicating the purpose for which they are being sent.

10.3 Multiple-byte extension BAS values

TIL — Terminal Indicate List: MBE message used to transmit list of terminals currently added into the conference; the message has the form {start-MBE//N/<til>/<M>//(N-2) values of <T>}, where <til> has the value given in table 13, <M> is a one-byte number assigned to an MCU, and each value of <T> is a one-byte value assigned to a terminal by its local MCU (see CCITT Recommendation H.243 [12]).

IIS — Information Indicate String: an MBE message sent in response to TCS-n; the message has the form {start-MBE//N/<iis>/<n>/(N-2) characters}, where <iis> has the value given in table 13, where n corresponds to the value of n in TCS-n; characters are as defined in subclause 10.2.4.

Table 13: Values assigned to Type identification bytes in MBE messages

0000 0000	reserved
0000 0001	reserved
0000 0010	<til>
0000 0011	<iis>
0000 0100 to 1111 1111	reserved

10.4 Bit positions occupied by combinations of BAS commands

Table 14: Bit numbering and position for 14,4 kbit/s LSD

Bit number 7	Bit number 8	Octet number
1		1
2		2
:	FAS	:
8		8
9		9
:	BAS	:
16		16
17	18	17
19	20	18
:	:	:
143	144	80

Table 15: 56 kbit/s LSD

Bit number								Octet number
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1	2	3	4	5	6	7	FAS	1
:	:	:	:	:	:	:		2
:	:	:	:	:	:	:		:
50	51	52	53	54	55	56		8
57	58	59	60	61	62	63	BAS	9
:	:	:	:	:	:	:		:
:	:	:	:	:	:	:		:
106	107	108	109	110	111	112		16
113	114	115	116	117	118	119	Sub-channel 8	17
120	121	122	123	124	125	126		18
:	:	:	:	:	:	:		:
:	:	:	:	:	:	:		:
554	555	556	557	558	559	560		80

Table 16: 62,4 kbit/s LSD

Bit number								Octet number
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1	2	3	4	5	6	7	FAS	1
:	:	:	:	:	:	:		2
:	:	:	:	:	:	:		:
50	51	52	53	54	55	56		8
57	58	59	60	61	62	63	BAS	9
:	:	:	:	:	:	:		:
:	:	:	:	:	:	:		:
106	107	108	109	110	111	112		16
113	114	115	116	117	118	119	120	17
121	122	123	124	125	126	127	128	18
:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:
617	618	619	620	621	622	623	624	80

Table 17: Bit positions for audio

Audio bit rate	Bit number							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
According to CCITT Recommendation G.711 [4].	MSB	. . .	. . .	. . .	. . .	. . .	. . .	LSB
According to CCITT Recommendation G.722 [5], 64 kbit/s.	H	H	L	L	L	L	L	L
According to CCITT Recommendation G.722 [5], 56 kbit/s.	H	H	L	L	L	L	L	
According to CCITT Recommendation G.722 [5], 48 kbit/s.	H	H	L	L	L	L	–	–
16 kbit/s.	A1	A2	–	–	–	–	–	–

A Audio bits, see table 18;
H High-band audio;
L Low-band audio.

Table 18 shows the 16 kbit/s speech coder bit-assignment. The LD-CELP 2,5 ms frame consists of the following 40 numbered bits:

Codeword 0, bit 9 (MSB) to bit 0 (LSB): 09, 08, 07, 06, 05, 04, 03, 02, 01, 00
Codeword 1, bit 9 (MSB) to bit 0 (LSB): 19, 18, 17, 16, 15, 14, 13, 12, 11, 10
Codeword 2, bit 9 (MSB) to bit 0 (LSB): 29, 28, 27, 26, 25, 24, 23, 22, 21, 20
Codeword 3, bit 9 (MSB) to bit 0 (LSB): 39, 38, 37, 36, 35, 34, 33, 32, 31, 30

These are inserted into two 8 kbit/s sub-channels with minimum delay by putting odd numbered bits in the first channel and even numbered bits in the second. This structure is repeated four times in each 10 ms frame as shown below. The first codeword in each frame is then always the first codeword in the speech coder frame also. The speech coder synchronisation at the receiver shall be derived from the FAS.

Table 18: Bit positions for 16 kbit/s audio

Bit number	1	2	3	4	5	6	7	8	Octet number
Speech coder frame 0	09	08						F	1
	07	06						A	2
	05	04						S	3
	03	02							4
	01	00							5
	19	18							6
	17	16							7
	15	14							8
	13	12						B	9
	11	10						A	10
	29	28						S	11
	...	...							...
	21	20							15
	39	38							16
	...	...						E	...
	31	30						C	20
Speech coder frame 1	09	08						S	21
	07	06							22
	...	...							...
	33	32							39
	31	30							40
Speech coder frame 2	09	08							41
	07	06							42
	...	...							...
	33	32							59
	31	30							60

Table 18: Bit positions for 16 kbit/s audio (concluded)

Speech coder frame 3	09	08							61
	07	06							62
	...	...							...
	33	32							79
	31	30							80

Table 19: Bit positions for video plus 48 kbit/s audio in two B-channels

Initial channel								**Additional channel**							
Bit 1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
A1	A2	A3	A4	A5	A6	V1		V2	V3	V4	V5	V6	V7	V8	
A	. .			. .	A	V9	FAS	V10						V16	FAS
.					.										
.					.										
							BAS								BAS
						V121		V122						V128	
						V129	V130	V131						V137	V138
						V139									V148
.					.	.									.
.					.	.									.
.					.	.									.
A	. .			. .	A	V759	. .							. .	V768

Table 20: 128 kbit/s HSD in H_0 channel

TS1								**TS2**	**TS3**	**TS4**	**TS5**	**TS6**
A	A	A	A	A	A	A	F	V1 V8	V9 V16	V17 V24	D1 D8	D9 D16
							A	V25		V48	D17	D32
							S					
							B					
							A					
							S	V361		V384	D241	D256
							V	V386		V409	D257	
							V	V411				
							.	.				
							.	.				
							.	.		.	.	.
							.	.		.	.	.
							V	V1961 . .		V1984	D1265	D1280

Table 21: 64 kbit/s HSD in 6*64 kbit/s channels

Initial B-channel								2nd channel			3rd channel			4th channel			5th channel			6th channel	
A	A	A	A	A	A	A	F	V1	V7	F	V8	V14	F	V15	V21	F	V22	V28	F	D1	D8
							A	V29		A			A		V42	A		V56	A	D9	D16
							S			S			S			S			S		
							B			B			B			B			B		
							A			A			A			A			A		
							S	V421		S			S			S		V448	S	D121	D128
							V	V450											V481	D129	D136
							V	V483											V514	D137	D144
							.	.													
							.	.													
							.	.							.			.			.
							.	.							.			.			.
							V	V2529 · ·										. . V2560			D633 . . D640

Annex A (informative): Bibliography

DE/TE-04120: "Integrated Services Digital Network (ISDN); Videotelephony teleservice, Abstract Test Suite for inband signalling procedures".

ETS 300 142: "Integrated Services Digital Network (ISDN) and other digital telecommunications network - Audiovisual teleservices".

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