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Videotelephone systems and terminal equipment operating
on one or two 64 kbit/s channels

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Contents

Foreword

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

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1 Scope

This ETS specifies the system requirements for a videotelephone using one or two B-channels, when connected to the S point or coincident S and T reference point of the pan-European Integrated Services Digital Network (ISDN). These requirements ensure end-to-end compatibility of terminals supporting the videotelephony teleservice to ETS 300 264 [9].

Conformance to this ETS allows interworking with terminals supporting telephony 3,1 kHz teleservice to ETS 300 111 [3], telephony 7 kHz teleservice to ETS 300 263 [8], terminals to CCITT Recommendation G.725 [13], and Public Switched Telephone Network (PSTN) telephony. Interworking with other audio-visual terminals can take place if their operation on one or two B-channels is according to this ETS.

This ETS is applicable to terminal equipment and other equipment supporting the videotelephony service, such as multipoint conference units.

Interworking with terminals not connected to an ISDN may be possible if one or two 64 kbit/s (unrestricted or restricted) digital channels can be established between the two terminals.

The inband signalling procedures are described in ETS 300 143 [6], and the syntax for these procedures is defined in ETS 300 144 [7]. The video coding algorithm is described in ITU-T Recommendation H.261 [5].

> NOTE: Interworking with terminals to CCITT Recommendation G.725 [13] may be restricted to mode 0.

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]   ETS 300 012 (1991): "Integrated Services Digital Network (ISDN; Basic user-network interface, Layer 1 specification and test principles".

[2]   ETS 300 102-1: "Integrated Services Digital Network (ISDN); User-network interface, layer 3, Specifications for basic call control".

[3]   ETS 300 111 (1992): "Integrated Services Digital Network (ISDN); Telephony 3,1 kHz teleservice, Service description".

[4]   ETS 300 125 (1991): "Integrated Services Digital Network (ISDN); User-network interface data link layer specification, Application of CCITT Recommendations Q. 920/I. 440 and Q. 921/I. 441".

[5]   ITU-T Recommendation H.261 (1993): "Video codec for audiovisual services at p x 64 Kbit/s".

[6]   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".

[7]   ETS 300 144: "Integrated Services Digital Network (ISDN): Audiovisual services; Frame structure for a 64 to 1 920 kbit/s channel and associated syntax for inband signalling".

[8]   ETS 300 263: "Integrated Services Digital Network (ISDN): Telephony 7 kHz teleservice, Service description".

[9]   ETS 300 264: "Integrated Services Digital Network (ISDN): Videotelephony teleservice; Service description".

[10]   ETS 300 267: "Integrated Services Digital Network (ISDN); Telephony 7 kHz and videotelephony teleservices, Digital Subscriber Signalling System No. one (DSS1)".

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

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

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

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

[15]   CCITT Recommendation H.100 (1984): "Visual telephone systems".

[16]   CCITT Recommendation H.233 (1992): "Confidentiality system for audiovisual services".

3   Definitions

For the purposes of this ETS the definitions given in Clause 3 of both ETS 300 143 [6] and ETS 300 144 [7] apply along with the following.

Additional channel: one of the channels between two users, which is not the I-channel (see ETS 300 144 [7]).

Audio mute: muting the loudspeaker of a terminal.

Channel: a unidirectional link between two users.

Connection: a bi-directional link between two users: it carries both (unidirectional) channels.

Control and Indication (C&I): end-to-end signalling between terminals, consisting of Control, which causes a state change in the receiver, and Indication which provides for information as to the state or functioning of the system (see also ETS 300 144 [7] for additional information and abbreviations).

Data: refer to any of these: Low Speed Data (LSD), High Speed Data (HSD), Multi Layer Protocol (MLP), High Speed Multi Layer Protocol (H-MLP) as defined in ETS 300 144 [7].

I-channel: the initial or only B-channel as defined in ETS 300 144 [7].

In-band signalling: signalling via the Bit-rate Allocation Signal (BAS) of the frame structure, as defined in ETS 300 144 [7].

Lip synchronisation: operation to provide the feeling that speaking motion of the displayed person is synchronised with his speech.

Man-machine interface: interface between human user and terminal/system, consisting of a physical section (electro-acoustic, electro-optic transducer, keys, etc.) and a logical section dealing with functional operation states.

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
CCITT	The International Telegraph and Telephone Consultative Committee
CONNECT	D-channel message (as in ETS 300 102-1 [2])
ECS	Encryption Control Signal
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FAS	Frame Alignment Signal
H-MLP	High Speed Multi Layer Protocol
HOLD	Supplementary service
HSD	High Speed Data
ISDN	Integrated Services Digital Network
ITU-TS	International Telecommunications - Telecommunications Standardization Sector
LSD	Low Speed Data
MCU	Multipoint Control Unit
MLP	Multi Layer Protocol
MSB	Most Significant Bit
PSTN	Public Switched Telephone Network
SC	Service Channel
TEA	Terminal Equipment Alarm
TERM1, TERM2, TERM3	Terminals

5 System description

For a videotelephone as described in this ETS, at most, 2 B-channels are available at a time, because it has to be connected to an ISDN basic access conforming to ETS 300 012 [1], ETS 300 102-1 [2] and ETS 300 125 [4].

5.1 Block diagram and identification of elements (informative)

A generic videotelephony system is shown in figure 1. It consists of the videotelephone terminal, network, Multipoint Control Unit (MCU) and other system operation entities.

A configuration of a complete videotelephone consisting of several functional units is also shown in figure 1.

- Video I/O equipment includes camera(s) and monitor(s), and video processing units to provide functions such as split-screen scheme.

- Audio I/O equipment includes the handset and/or microphone(s), loud-speaker(s) and/or earphone(s), and audio processing units to provide such functions as acoustic echo cancellation.

- Telematic equipment includes visual aids such as an electronic blackboard and a still picture transceiver to enhance basic videotelephone communication as defined in CCITT T.120 series of Recommendations: these are optional.

- The system control unit carries out such functions as network access through end-to-network signalling, end-to-end C&I to establish a suitable mode of operation and signalling for proper operation of the terminal through end-to-end and end-to-network signalling.

- The video codec carries out redundancy reduction coding and decoding for video signals: the algorithm is defined in ITU-T Recommendation H.261 [5].
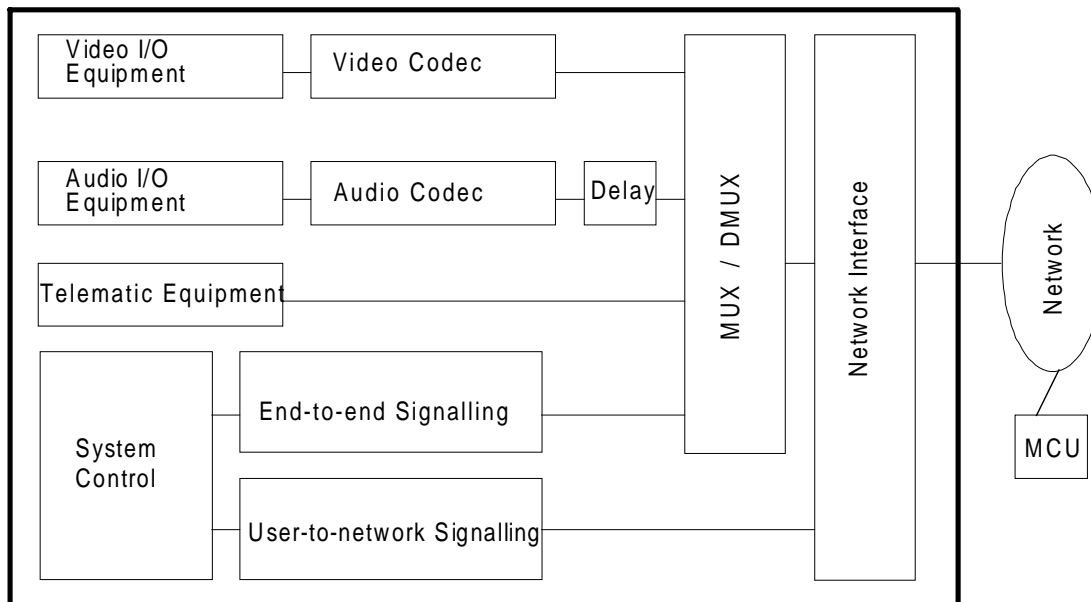
Figure 1: Visual telephone system

- The audio codec carries out redundancy reduction coding and decoding for audio signals: the algorithms are defined in CCITT Recommendations G.711 [11], G.722 [12] and G.728 [14]. The audio characteristics are defined in I-ETS 300 302 Parts 1 to 6.

  NOTE 1:   Parts 2 to 6 of this prI-ETS are still under study.

- Delay may be introduced into the audio path equal to the video codec delay, to maintain lip synchronisation.

  NOTE 2:   The effect of lip synchronisation on the overall quality of a videotelephony communication is under study.

- The Mux/dmux unit multiplexes transmitting video, audio, data and control signals into a single bit stream and demultiplexes a received bit stream into constituent multimedia signals, as defined in ETS 300 144 [7].

- The network interface makes the necessary adaptation between the network and the terminal according to the user-network interface requirements, as defined in ETS 300 012 [1], ETS 300 102-1 [2] and ETS 300 125 [4].

- End-to-end signalling is defined in ETS 300 143 [6] and ETS 300 144 [7].

- User-to-network signalling is defined in ETS 300 102-1 [2], ETS 300 125 [4], ETS 300 267 [10], Clause 7.

5.2   Videotelephone terminal types

Table 1 lists terminal types of videotelephone. The terminal type is categorised according to the audio communication modes and the number of B-channels with which the terminal can communicate (see subclause 5.3.4).

For 2B categories, the terminal shall be able to operate in 1B and 2B modes. The type of remote terminal is identified through the capability exchange defined in ETS 300 143 [6].

Table 1: Videotelephone terminal type

Mode	transfer rate	Type: audio coding	1B Xa G.728 G.711	2B Xb1 G.728 G.711	Xb2/3 G.728 G.722 G.711	Xb4 G.711	Xb5 G.722 G.711
a0	1B	G.711	♦	♦	♦	♦	♦
a1	1B	G.728	♦	♦	♦		
b1	2B	G.711		♦	♦	♦	♦
b2	2B	G.722			♦		♦
b3	2B	G.728		♦	♦		
NOTE: "♦" indicates operable mode.							

5.3 Signal structure and procedures

5.3.1 Frame structure

The terminal shall conform to ETS 300 144 [7].

5.3.2 Control and Indication (C&I)

C&I shall be chosen from the general audiovisual set contained in ETS 300 144 [7]. For videotelephone systems, relevant values are listed in table 2 giving their source, sink, synchronisation with picture, transmission channel and reference for code word definition. They are mandatory where so indicated.

All videotelephone terminals have a video source providing a picture of participants, and some terminals may have optional additional video sources: the participant-picture source is designated #1, having the associated symbol VIA. When incoming video is ON (BAS command (010)[1] or (010)[2]) and VIA, VIA2, VIA3 have not been transmitted, source #1 is assumed.

Table 2: C&I signals for videotelephone

	C&I signal	C/I	Source	Sink	Sync. with picture	Transmission channel	Code word definition	Mandat-ory (see NOTES)	
								RX (1)	TX (1)
Video	Picture format	I	decoder	coder	no	BAS	ETS 300 144		M
	Picture format	C	coder	decoder	yes	embedded in video	ITU-T Recom-mendation H.261	M	M
	minimum decodable picture interval	I	decoder	coder	no	BAS	ETS 300 144		M
	freeze picture request control, VCF	C	coder or MCU	decoder	no	BAS	ETS 300 144	M	
	fast update request control, VCU	C	decoder or MCU	coder	no	BAS	ETS 300 144	M	M (3)
	freeze picture release control	C	coder	decoder	yes	embedded in video	ITU-T Recom-mendation H.261	M	
	MCU related message	C	terminal or MCU	terminal or MCU	no	MLP	CCITT T.120 series		
MCU	multipoint command conference/cancel, MCC/cancel-MCC	C	MCU, etc.	terminal	no	BAS	ETS 300 144	M	
	multipoint command symmetrical data transmission, MCS, and MCN	C	MCU	terminal	no	BAS	ETS 300 144	M (4)	
	MIZ and MIS	C	MCU	terminal	no	BAS	ETS 300 144	M	
Mainte-nance	audio loop request control, LCA	C	terminal (1)	terminal	no	BAS	ETS 300 144		
	video loop request control, LCV	C	terminal (1)	terminal	no	BAS	ETS 300 144		
	digital loop request control, LCD	C	terminal (1)	terminal	no	BAS	ETS 300 144		M (2)
	loop off request, LCO	C	terminal (1)	terminal	no	BAS	ETS 300 144		M (2)
Confe-rence	split-screen indication	I	sending terminal	receiving terminal	yes	embedded in video	ITU-T Recom-mendation H.261		M (5)

Table 2: C&I signals for videotelephone (concluded)

C&I signal			Source	Sink	Sync. with picture	Transmission channel	Code word definition	Mandat-ory (see NOTES)	
		C/I						RX (1)	TX (1)
Termi-nal	document camera indication	I	sending terminal	receiving terminal	yes	embedded in video	ITU-T Recom-mendation H.261		M (6)
	audio active/muted indication, AIA/AIM	I	sending terminal	receiving terminal	no	BAS	ETS 300 144	M (7)	M (7)
	video active /suppressed indication VIA, VIA2, VIA3, VIS	I	sending terminal	receiving terminal	no	BAS	ETS 300 144	M (7)	M (7)
	video ready to activate indication, VIR	I	sending terminal	receiving terminal	no	BAS	ETS 300 144	M (8)	M (8)

NOTE 1:   RX - mandatory (or conditionally mandatory - see following NOTES) to recognise and act upon: TX - mandatory to send when/if relevant conditions occur.
NOTE 2:   Maintenance terminals only.
NOTE 3:   Mandatory if the terminal cannot decode high or low video rates - see subclause 6.2.4.1.
NOTE 4:   Mandatory for a terminal which can transmit LSD, MLP, HSD or H-MLP. Terminals not obeying MCS shall not be able to exchange video in a multipoint call when other terminals are using their data capability.
NOTE 5:   Mandatory for a terminal which can transmit a split-screen picture to CCITT Recommendation H.100 [15].
NOTE 6:   Mandatory for a terminal which has a document camera.
NOTE 7:   Mandatory for a terminal which has user controls to mute audio or cut the video without also switching off the audio/video channel within the transmitted frame.
NOTE 8:   Mandatory if the terminal itself does not turn video on until it receives this code from the remote terminal. See subclause 6.2.4.2.

5.3.3   Inband signalling procedures

The terminal shall conform to ETS 300 143 [6] for point-to-point communications.

5.3.4   Communication modes of videotelephones

Communication modes of a videotelephone for the ISDN basic access are defined according to their channel configuration and coding. All videotelephones to this ETS shall be capable of operation in mode A O one or more of the modes a1, b1, b2, b3.

The following modes of operation are defined for an ISDN basic interface (see also table 3):

Mode a_0:   Mode 0U: 64 kbit/s audio to CCITT Recommendation G.711 [11], A or μ-law.

Mode 0F: 56 kbit/s audio to CCITT Recommendation G.711 [11], A or μ-law: 6,4 kbit/s video to ITU-T Recommendation H.261 [5] may, or may not, be activated.

Mode a_1:   16 kbit/s audio to CCITT Recommendation G.728 [14] and 46,4 kbit/s video to ITU-T Recommendation H.261 [5].

Mode b_1:   56 kbit/s audio to CCITT Recommendation G.711 [11] A or μ- law and 68,8 kbit/s video to ITU-T Recommendation H.261 [5].

Mode b_2:   48 or 56 kbit/s audio to CCITT Recommendation G.722 [12] and 76,8 kbit/s or 68,8 kbit/s video to ITU-T Recommendation H.261 [5].

Mode b$_3$:   16 kbit/s audio to CCITT Recommendation G.728 [14] and 108,8 kbit/s video to ITU-T Recommendation H.261 [5].

Table 3: Communication modes of videotelephone

Videotelephone mode	Channel rate	ISDN channel	Audio coding	Video to ITU-T Recommendation H.261
a0	64 kbit/s	B	G.711	optional, on/off
a1			G.728	
b1			G.711	ON
b2	128 kbit/s	2B (NOTE)	G.722	
b3			G.728	
NOTE: In the case of two B-channels, the channels shall be synchronised according to ETS 300 143 [6].				

6   Terminal procedures

The provision of the communication is made in the following steps:

-        phase A: call set-up of initial channel, D-channel signalling (subclause 6.1.1);

-        phase B: mode initialisation on initial channel, inband signalling (subclause 6.1.2);

-        phase CA if relevant: call set-up of additional channel (subclause 6.1.3);

-        phase CB if relevant: initialisation on additional channel (subclause 6.1.4);

-        phase C: videotelephone communication (subclauses 6.2 and 6.3);

-        phase D/E: call clearing, inband and D-channel signalling (subclause 6.4).

6.1   Call establishment and mode initialisation

To establish intercommunication between various audiovisual terminals, in-band procedures according to ETS 300 143 [6] and D-channel procedures according to ETS 300 267 [10], Clause 7 shall be carried out.

6.1.1   Phase A - Call set-up for the initial channel

The calling terminal shall request the initial channel using D-channel signalling according to ETS 300 267 [10], Clause 7.

The called terminal shall send an ALERTING message according to ETS 300 267 [10], Clause 7 or another message appropriate to this call state. When the called user answers, it sends the CONNECT message to the network.

Before the terminals receive the CONNECT, respectively the CONNECT ACKNOWLEDGE message, the allowed transmission from each terminal is one of the following:

1)   unframed all-ones;
2)   Mode-0U;
3)   Mode-0F with full capability sets according to ETS 300 143 [6] in the BAS position;
4)   Mode-0F with audio commands (000) [18] and optionally (001) [0].

If 1) or 2) is used there shall be a change to 3) or 4) at, or before, receipt of the CONNECT message at the calling terminal, and at, or before, receipt of the CONNECT ACKNOWLEDGE message at the called terminal. The moment of receipt of CONNECT or CONNECT ACKNOWLEDGE message defines the initialize of timer T1=0 in the phase B procedure which follows.

If the called terminal is not a videotelephone, then the D-channel procedures described in ETS 300 267 [10], Clause 7 shall apply for the cases given below:

- fallback not allowed;
- fallback allowed to a 3,1 kHz telephone;
- fallback allowed to a 7 kHz telephone;
- fallback allowed to a PSTN telephone.

6.1.2   Phase B - mode initialisation

Using the procedures provided in ETS 300 143 [6], framed PCM audio is transmitted in both directions. After frame and, in the 2B case, multiframe alignment has been gained, terminal capabilities are exchanged. During this phase, a detection of A/µ-law shall be performed. Multiframe alignment shall be performed, if a 2B transfer rate capability has been declared.

If frame alignment cannot be gained, an indication shall be given to the user, to the effect that the call results in an audio communication.

If the restricted capability BAS code has been received at the local terminal, and if the local terminal is unable to work in a restricted mode, the call shall be released according to phase D/E and an indication shall be given to the human user to inhibit the re-establishing of a call that cannot be successful.

If 2B capability is received at the calling terminal then it may initiate a request for a second B-channel. Alternatively, this action may be suspended until the user at the calling terminal has given the go-ahead. If the user at either terminal does not wish the call to proceed to two channels, even though his terminal has this capability, he shall set the terminal such that only single-channel capability is declared during the capability exchange.

When the terminal capabilities have been exchanged using the procedure given in ETS 300 143 [6], the most appropriate transmission mode shall be determined. This should normally be the highest mode (see table 4), but a lower compatible mode may be chosen instead. In the case that both terminals have announced the capability to work on 2 B-channels, the calling terminal may initiate the request for the additional call set-up.

Table 4: Appropriate mode (default) for communication between different types of videotelephones using 1B or 2B channel

Xa	Xb1	Xb2/3	Xb4	Xb5	Terminal type
a1	a1	a1	a0	a0	Xa
	b3	b3	b1	b1	Xb1
		b2/b3 (NOTE)	b1	b2	Xb2/3
			b1	b1	Xb4
				b2	Xb5

NOTE 1:   "b2/b3" indicates that either of b2 or b3 can be transmitted; b2 gives better audio, while b3 gives better video.

To ensure that the picture builds up quickly when the video transmission first begins, the encoder shall transmit in INTRA mode to ITU-T Recommendation H.261 [5].

The video transmission can start at any time after the completion of the initial capability exchange. During the establishment of any additional channels, the video data may be introduced, using a data rate up to the maximum common transfer rate indicated in the capability sets.

If the remote terminal's decoder is unable to decode the video information at the start of a video transmission, it shall miss the INTRA pictures. In this case, it shall issue a VCU command after the transmission rate has changed so that it can decode the video data (see ETS 300 144 [7]).

If the communication is to remain on 1 B-channel only, a mode switch for a suitable 1B mode shall be performed; this includes changing the transmitter from A- to µ-law, if necessary; it shall be mandatory to send information about the used law (A or µ), using the appropriate command. If an additional channel is

going to be established immediately, mode switching to a mode including video may optionally be deferred until the second channel has been established. In any case, the mode adopted here may be regarded as an interim state. The transmission of a video signal, as in ITU-T Recommendation H.261 [5], is not precluded: this may be at 46,4 kbit/s (less 800 bit/s if ECS is also on) with audio to CCITT Recommendation G.728 [14], or at 6,4 kbit/s if a 56 kbit/s audio mode is in use (see ETS 300 143 [6], subclause 6.2.2.2).

> NOTE 2: If the terminals have not both adopted the same mode, an asymmetric communication will result.

6.1.3 Phase CA - call set-up for the additional channel

Following phase B, the communication phase C proceeds on that channel (see subclause 6.2). If an additional channel has been requested this is again in phase A (hence the nomenclature "phase CA"), as in phase A above, additional call set-up being requested by the calling terminal using D-channel signalling according to ETS 300 267 [10], Clause 7. A terminal having answered an incoming call shall not make a request for a connection back to the calling terminal.

The moment of the receipt of CONNECT respectively CONNECT ACKNOWLEDGE message for the additional channel defines the end of phase CA and phase CB procedure follows.

If the additional connection cannot be established, the communication remains in phase C.

6.1.4 Phase CB - mode initialisation on the additional channel

Framing according to ETS 300 144 [7] is transmitted by both terminals. Using the procedure provided in ETS 300 143 [6], frame and multiframe alignment are gained.

Synchronisation of the two channels is achieved.

The most appropriate transmission mode has been determined in phase B. See table 4 for the case using 2 B-channels. A lower compatible mode may be chosen instead.

A mode switch for a suitable 2B mode, as identified in phase B, shall be performed using the procedure defined in ETS 300 143 [6].

> NOTE: If the terminals have not both adopted the same mode, an asymmetric communication will result.

6.2 Phase C - videotelephone communication

In the case where more than one channel is used, there shall be intermediate phases CA and CB as described above. Likewise, if additional channels are dropped during the call there shall be intermediate phases (see subclause 6.4). The provisions of this subclause apply to any channel, initial or additional, for which phase B has been completed and phase D/E has not yet started.

> NOTE: Changes of communication here do not involve D-channel signalling. Changes of communication also involving D-channel signalling are described in subclause 6.3.

6.2.1 Mode switching

According to action by either user (for example, starting a facsimile machine) a different mode from the initially selected mode may become more appropriate. Switching to this mode is made according to the procedure of ETS 300 143 [6].

A switch to a mode which is unframed in the I-channel shall only be done if:

- the remote terminal is put on hold (e.g. prior to call transfer, see subclause 6.3); or

- the call is going to be cleared (see subclause 6.4).

This is to avoid an unexpected loss of frame alignment.

The use of modes having no framing in the additional channel is not precluded.

If the remote terminal's decoder is unable to decode the video information at the start of a video transmission (e.g. after a mode switch), it shall miss the INTRA pictures. In this case, it shall issue a VCU command according to ETS 300 144 [7] after the transmission rate has changed so that it can decode the video data.

6.2.2 Capability change

The user may change the capability of his terminal during the call (for example, by connecting or switching-on auxiliary telematic equipment); the terminal shall then perform a capability exchange according to the procedure defined in ETS 300 143 [6].

6.2.3 Loopbacks for maintenance purposes (optional)

Some loopback functions are defined in ETS 300 144 [7] to allow verification of some functional aspects of the terminal, to ensure correct operation of the system and satisfactory quality of the service to the remote party.

a)   Loop at terminal-network interface (towards network). Upon receiving the LCD command as defined in ETS 300 144 [7], loopback shall be activated at the digital interface of the terminal toward the network side. In case of a multiple B-channel arrangement, loopback is activated in each connection.

b)   Loop at analogue I/O interface (optional): Upon receiving the LCV or LCA command as defined in ETS 300 144 [7], loopback should, where possible, be activated at the analogue interface of the video/audio codec towards the video/audio codec.
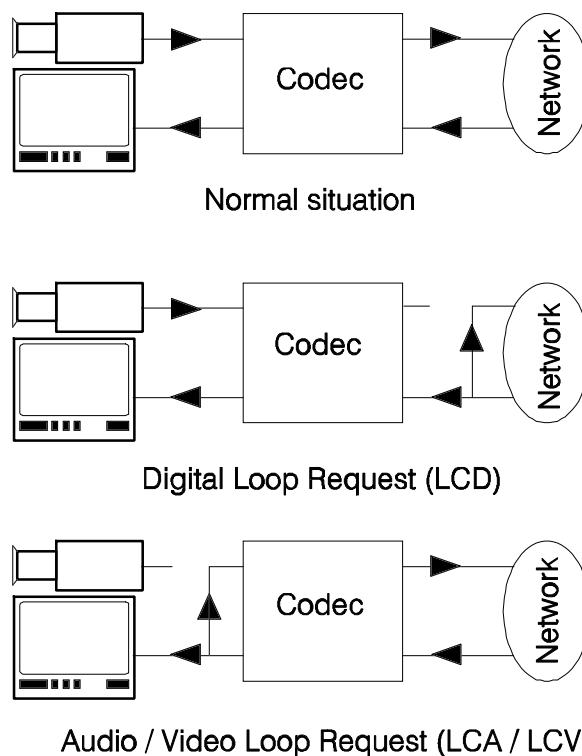

Figure 2: Loopback

6.2.4 Terminal arrangements

6.2.4.1 Video

When only the initial channel is present and the audio is at 56 kbit/s, "Video On" results in a video rate of 4,8 kbit/s (4,0 kbit/s if Encryption Control Signal (ECS) channel is also on). A terminal which is not capable of decoding such a low rate video stream shall disable its decoder. When, subsequently, the video rate is increased sufficiently that decoding becomes possible, then the decoder shall be re-enabled and a command VCU shall be transmitted (see ETS 300 144 [7]).

When two B-channels are present and the audio is switched off, "Video On" results in a video rate of 124,8 kbit/s (124,0 kbit/s if ECS channel is also on). A terminal which is not capable of decoding such a high rate video stream shall disable its decoder. When, subsequently, the video rate is decreased sufficiently that decoding becomes possible, then the decoder shall be re-enabled and a command VCU shall be transmitted (see ETS 300 144 [7]).

6.2.4.2 Exchange of video by mutual agreement (optional)

The symbol VIR, "Video Indicate Ready-to-activate", is defined in ETS 300 144 [7]. Its use is optional, but when used the procedure shall be as follows.

Terminal X has been set so that video is not transmitted unless, and until, the remote terminal has also indicated readiness to transmit video. Terminal X shall send the indication VIR when the initial capability exchange has been completed, but shall not transmit a video signal until it has received either VIR or the video-ON command.

A terminal which has not been set in this optional way is not obliged to wait until receipt of VIR or video-ON before initiating its video transmission.

6.2.4.3 Delay compensation (optional)

Video codecs, as in ITU-T Recommendation H.261 [5], require some processing delay, while the audio codecs to CCITT Recommendations G.711 [11], G.722 [12] and G.728 [14] involve much less delay. Lip synchronisation shall not be mandatory, but where it is to be maintained, the video processing delay shall be compensated in the audio path. Since video coder and decoder delays may vary according to implementation, delay compensation shall be carried out individually at the coder and decoder. A reference measurement method of video coder and decoder delays is defined in ITU-T Recommendation H.261 [5].

> NOTE: The effect of lip synchronisation on the overall quality of a videotelephony communication is under study.

6.3 Changes of communication involving D-channel and in-band signalling

This subclause also applies to the period after completion of phase B, and before starting phase D/E.

6.3.1 Supplementary services (optional)

This subclause describes procedures for the use of the supplementary services:

- Call Hold;

- Terminal Portability;

- Call Transfer.

Related D-channel procedures are specified in other ETSs.

If one of these supplementary services is invoked, attention shall be paid to the fact that the B-channel(s) shall be interrupted. Therefore, framing shall be lost in the receiving parts of the terminals. The procedure described in this subclause is needed to distinguish this specific loss of framing from an (erroneous) unexpected loss of framing and to avoid the activation of a fault recovery procedure.

Procedure P (preparation for the above supplementary services):

1)   TERM1 discontinues encryption, if in use, and by successive BAS commands changes its transmission mode to: audio mode 0F(A), video-OFF, data-OFF, ECS-OFF, transfer rate 64 kbit/s.

2)   TERM1 then forces TERM2 to transmit in mode 0F by using the mode-0 forcing procedure (see ETS 300 143 [6]); if possible, TERM2 should be forced to mode 0F(A), otherwise to mode 0F(μ).

3)   TERM1 then switches its transmitter to mode 0U(A); TERM2 is now receiving unframed, and so does not enter a fault procedure (due to "unexpected loss of frame alignment") when put on hold.

6.3.1.1   HOLD

6.3.1.1.1   Invocation procedure

Initial situation: TERM1 is connected to TERM2. Either TERM1 or TERM2 had established the call.
Requirement: TERM1 wishes to put TERM2 on HOLD.

a)   Procedure P is carried out.
b)   D-channel signalling for the supplementary service is carried out, requesting the network to put TERM2 on HOLD; if two connections are on HOLD, the supplementary service applies for each connection separately.

6.3.1.1.2   Retrieval after invocation of HOLD

Initial situation: TERM1 has TERM2 on hold. TERM1 has now "forgotten" the capabilities of TERM2.
Requirement: TERM1 wishes to retrieve the call with TERM2.

a)   D-channel signalling is applied to retrieve both connections separately in the 2B case.
b)   Upon receipt of the RETRIEVE ACKNOWLEDGE message from the network for the initial channel, TERM1 initiates phase B; in the case of a 2B call, phase CB is started when phase B has been completed and the RETRIEVE ACKNOWLEDGE message has been received from the network for the additional channel.

6.3.1.2   Terminal Portability

6.3.1.2.1   Invocation procedure

Initial situation: TERM1 is connected to TERM2. Either TERM1 or TERM2 had established the call.
Requirement: TERM1 wishes to suspend the connection(s).

a)   Procedure P is carried out.
b)   D-channel signalling for the supplementary service is carried out. If two connections are involved, the supplementary service applies for each connection separately.

6.3.1.2.2   Resumption after invocation of Terminal Portability

Initial situation: TERM1 was connected to TERM2. TERM1 had suspended the connection(s). TERM1 has now "forgotten" the capabilities of TERM2.
Requirement: TERM1 now wishes to resume the connection(s).

a)   D-channel signalling is applied, resuming both connections separately in the 2B case.
b)   Upon receipt of RESUME ACKNOWLEDGE message from the network acknowledging resumption of the initial channel, TERM1 initiates phase B; in the case of a 2B call, phase CB is started when phase B has been completed and the RESUME ACKNOWLEDGE message has been received from the network for the additional channel.

6.3.1.3 Explicit Call Transfer, invocation procedure

Initial situation: TERM1 was connected to TERM2. Either TERM1 or TERM2 had established the call.

Requirement 1: TERM1 wishes to put TERM2 on Hold, make a call to TERM3 and then connect TERM2 to TERM3.

Requirement 2: TERM1 wishes to put TERM2 on Hold, accept a call from TERM3 and then connect TERM2 to TERM3.

a) Procedure P is carried out on the TERM1-TERM2 connection.

b) D-channel signalling for the supplementary service is carried out, first putting TERM2 on Hold and establishing the call to/from TERM3:

Case 1: TERM1 and TERM2 are both 2B types and the initial situation was a 2B call:
- both connections to TERM2 are initially put on Hold;
- TERM1 is connected to TERM3 by an initial channel only, and phase B is carried out;
- if TERM3 declares ≥2B capability, then an additional channel is requested to TERM3 and this communication proceeds via phases CA and CB to phase C; the additional channel to TERM2 remains on Hold; however, if TERM3 does not declare ≥2B capability then TERM1 requests disconnection of the additional channel to TERM2.

Case 2: the initial situation was a 1B call:
- the one connection to TERM2 is put on Hold;
- TERM1 is connected to TERM3 by an initial channel only, and phase B is carried out.

c) Communication proceeds in phase C until the users are ready to effect the transfer.

d) Procedure P is carried out on the TERM1-TERM3 connection.

e) D-channel signalling continues, now requesting the network to transfer the call such that TERM2 and TERM3 are connected.

f) On receipt of network message confirming the transfer of the initial channel, both terminals enter phase B; in the case that two connections have been transferred, phase CB follows when phase B is completed and the network message has been received confirming the transfer of the additional channel; in the case that only one connection has been transferred, and the capability exchange in the subsequent phase B includes ≥2B from both TERM2 and TERM3, then further considerations apply to the establishment of an additional channel at this stage.

Case 1: originally, TERM1 called TERM2 and TERM3; in this case, neither TERM2 nor TERM3 is the calling terminal, and so an additional channel cannot be requested.

Case 2: TERM1 called either TERM2 or TERM3, but not both; in this case, the terminal which originally called TERM1 still has "calling terminal" status, and may request an additional channel.

Case 3: both TERM2 and TERM3 called TERM1; in this case, both may request an additional channel.

6.3.2 Change of connection arrangements

6.3.2.1 Expanding a 1B call to a 2B call

If, for example, a higher picture quality is desired, the communication mode can be changed, by the calling terminal only, from a 1B call to a 2B call. This can be done for example, if two Xb2/3 terminals are connected. The procedure to be used is as follows:

Initial situation: TERM1 is the calling terminal, and it is connected to TERM2 in a 1B connection.

Requirement: TERM1 wants to change the connection arrangement from 1B to 2B.

- Inband signalling: TERM1 signals TERM2 a 2B capability within a valid capability set.

    a)   Outcome: TERM2 signals a 2B (or higher) capability; continue with D-channel signalling.
    b)   Outcome: TERM2 signals a 1B capability; 2B operation not possible - not proceed.

- D-channel signalling: TERM1 connects an additional channel according to phase CA.

    a)   Outcome: the connection is established; proceed with inband signalling.
    b)   Outcome: the connection is not established; continue in 1B operation. If desired by the human user, try again.

- Inband signalling: continue according to phase CB.

6.3.2.2   Reducing a 2B call to a 1B call

This functionality may be invoked to reduce the call costs, or to free the second channel on a basic access for other purposes (e.g. for facsimile applications during the session). The procedure to be used is as follows:

Initial situation: TERM1 is connected to TERM2 in a 2B connection.
Requirement: TERM1 wants to change the connection arrangement from 2B to 1B.

- Inband signalling, initial channel:

    a)   TERM1 switches its transmitter to a mode in which the additional channel is vacant, if necessary stopping transmission of video, data, etc.
    b)   TERM1 switches to 1B transfer rate.
    c)   TERM1 then forces TERM2 to a mode in which the additional channel is vacant by sending 1B transfer-rate capability within a valid capability set, using the mode-forcing procedure given in ETS 300 143 [6].

- D-channel signalling: TERM1 disconnects the additional channel according to ETS 300 267 [10], Clause 7.

6.4   Phase D/E - call clearing

The procedure described in this subclause ensures that:

- the distant terminal (either a videotelephone or a 7 kHz telephone) does not erroneously invoke an error recovery procedure due to a loss of frame alignment;

- the human user gets the right indications via tones and announcements from the network exchange;

- according messages can be displayed for the human user by the terminal.

It is assumed that the terminals receive in a framed mode according to ETS 300 144 [7] prior to the procedure described. Otherwise an inband signalling is not necessary, e.g. in a communication with a telephone.

6.4.1   Clearing terminal

The clearing terminal shall:

a)   discontinue encryption and, by successive BAS commands, change its transmission mode to: audio mode 0F(A), video-OFF, data-OFF, ECS-OFF, transfer rate 64 kbit/s;

b)   switch audio off, using the command Au-off, U;

c)   disconnect all connections according to ETS 300 267 [10], Clause 7.

6.4.2 Cleared terminal

When receiving from the network a disconnection message for the additional channel, it shall release this channel at once.

When a disconnection message includes information about the availability of tones and announcements provided by the network (see ETS 300 102-1 [2]), the audio decoder shall be restarted in A-law to be able to decode them properly. Otherwise, the cleared terminal shall release the I-channel at once from the network to make it available immediately for another connection.

7 Optional enhancements

7.1 Data ports

Data ports are physical I/O ports of the terminal for telematic and other equipment. They are activated and deactivated by BAS commands. Depending on the transmission capability of a connection, e.g. 1B or 2B, various bit rates are available at these ports. Allocation of bit streams to the port(s) is performed by inband signalling procedures according to ETS 300 143 [6]. Data conveyed at the port(s) is transparent, data rates being listed in ETS 300 144 [7].

7.2 Encryption

Communication between two terminals may be encrypted if both are equipped with the same algorithm. The ECS channel shall be opened according to ETS 300 143 [6], and the encryption process carried out according to CCITT Recommendation H.233 [16]. Encryption may be activated at any time after Phase B. When the encryption is turned on, all the user information is encrypted. Once outgoing encryption has been activated, it shall not be deactivated as a result of any change in the incoming signals (for example, an incoming capability set with ECS-capability omitted), but only upon local action by the user.

8 Fault indication

If a system fault is detected, the procedures in ETS 300 143 [6] shall be followed.

If there is a temporary loss of service or significant reduction of quality (such as loss of picture or speech path) while automatic procedures are in progress to recover from the fault, then a message or other indication shall be displayed to the user, making it clear that no action by the user is needed at this point.

If such procedures result in a loss of service to the user which can only be recovered by user action, an indication concerning this fault and the action to be taken shall be displayed.

Annex A (informative): Bibliography

I-ETS 300 302   "Videotelephony audio aspects, Parts 1 to 6:

Part 1   PCM A-law handset.

Part 2   PCM A-law loudspeaking and handsfree.

Part 3   Wideband handset.

Part 4   Wideband coding and loudspeaking or handsfree function.

Part 5   Application of 3,1 kHz bandwidth 16 kbit/s speech coding algorithm.

Part 6   Application of low bit-rate (below 32 kbit/s speech coding algorithm)".

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