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SERIES V: DATA COMMUNICATION OVER THE TELEPHONE NETWORK

Interfaces and voiceband modems

Operational and interworking requirements for DCEs operating in the text telephone mode

ITU-T Recommendation V.18

Superseded by a more recent version

(Previously CCITT Recommendation)

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ITU-T V-SERIES RECOMMENDATIONS

DATA COMMUNICATION OVER THE TELEPHONE NETWORK

1 – General
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For further details, please refer to ITU-T List of Recommendations.

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FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation V.18 was revised by ITU-T Study Group 14 (1993-1996) and was approved by the WTSC (Geneva, October 9-18, 1996).

NOTES

1. In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

2. The status of annexes and appendices attached to the Series V Recommendations should be interpreted as follows:

- an *annex* to a Recommendation forms an integral part of the Recommendation;
- an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

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Recommendation V.18

OPERATIONAL AND INTERWORKING REQUIREMENTS FOR DCEs OPERATING IN THE TEXT TELEPHONE MODE

(revised 1996)

Background

The ITU-T,

considering

(a) that text telephones place special operational needs on the use of DCEs;

(b) that for historical reasons, many existing text telephones do not use V-Series modulation;

(c) that there is a desire to have all future GSTN text telephones employ V-Series modulation;

(d) that to provide a migration path from the diverse installed base, it will be necessary to provide interworking with existing text telephones;

(e) that to provide for interworking, the DCE will need to convert the 5-bit character code or Recommendation Q.23 (DTMF) character set used by some existing text telephones into the 7-bit code set as given in Recommendation T.50;

(f) that such character conversion in the DCE be undertaken solely to enable interworking with existing text telephones and to impose no constraints on character sets used in future text telephones;

(g) that new technology is being developed that could be used to provide additional text telephone modes,

recommends the procedure below:

1 Scope

This Recommendation specifies features to be incorporated in DCEs intended for use in, or communicating with, text telephones primarily used by the deaf and hard of hearing. One of the goals of this Recommendation is to provide a platform on which a future universal text telephone could be built. To accommodate this goal, procedures for interworking with identified existing text telephones are provided in clause 5. In addition, this Recommendation has the goal of identifying ways in which the multimedia Recommendations could be used to support new modes of operation or create new multimode text telephone devices. To accommodate this additional goal, clause 6 identifies some possible uses of this new technology to support text telephony and additionally specifies requirements for multimode text telephone devices.

To provide for maximum flexibility, it is envisaged that any of the text telephone modes of operation specified in this Recommendation will be invoked on an as required basis using the commands specified in Recommendation V.25 *ter* or some equivalent mechanism.

It provides for:

- calling identification signals;
- no DCE initiated disconnect;
- procedures for call establishment;
- procedures for interoperation with existing text telephones;
- specification of requirements for the use of text telephones in a multimedia environment.

2 References

The following Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent editions of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- CCITT Recommendation Q.23 (1988), *Technical features of push-button telephone sets.*
- CCITT Recommendation T.50 (1992), *International Reference Alphabet (IRA) (formerly International Alphabet No. 5 or IA5) – Information technology – 7-bit coded character set for information interchange.*
- ITU-T Recommendation V.8 (1994), *Procedures for starting sessions of data transmission over the general switched telephone network.*
- ITU-T Recommendation V.8 *bis* (1996), *Procedures for the identification and selection of common modes of operation between Data Circuit-terminating Equipments (DCEs) and between Data Terminal Equipments (DTEs) over the general switched telephone network and on leased point-to-point telephone-type circuits.*
- CCITT Recommendation V.21 (1984), *300 bits per second duplex modem standardized for use in the general switched telephone network.*
- CCITT Recommendation V.23 (1988), *600/1200-band modem standardized for use in the general switched telephone network.*
- ITU-T Recommendation V.25 (1996), *Automatic answering equipment and general procedures for automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls.*
- ITU-T Recommendation V.25 *ter* (1995), *Serial asynchronous automatic dialling and control.*
- ITU-T Recommendation V.61 (1996), *A simultaneous voice plus data modem, operating at a voice plus data signalling rate of 4800 bit/s, with optional automatic switching to data-only signalling rates of up to 14 400 bit/s, for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits.*
- ISO/IEC 10646-1:1993, *Information Technology – Universal Multiple-Octet Coded Character Set (UCS) – Part 1: Architecture and Base Multilingual Plane.*
- ISO/IEC 6429:1992, *Information Technology – Control functions for coded character sets.*

3 Definitions

For the purposes of this Recommendation, the following definitions apply.

3.1 carrierless mode: A mode for communication, where signals are only present on the connection when data is being exchanged (e.g. in response to the pressing of a key on a keyboard).

3.2 carrier mode: A mode for communication, where continuous signals (i.e. carriers) are present on the connection irrespective of whether data is being exchanged or not.

3.3 CI: A signal transmitted from the call DCE to indicate the general communications function, consisting of a repetitive sequence of bits at 300 bit/s, modulating Recommendation V.21(1), the low-band channel defined in Recommendation V.21. The cadence of this shall be bursts of 4 CI sequences separated by 2 s of silence. The CI sequence shall be coded in octets as defined below. The 30-bit CI sequence in left-to-right order of transmission is given by:

(1 1111 1111 1) (0) 0000 0000 (1) (0) 1000 0010 (1) where brackets enclose start and stop bits.

3.4 master mode: The mode used by the device, in an asymmetric connection, that normally is assumed to have initiated the connection. In the Annex E case, this role is usually assigned to the terminal that sends in 75 bits/s and receives in 1200 bit/s.

3.5 **multi-mode text telephone**: A device which incorporates simultaneous voice and data in addition to conforming to clauses 4 and 5.

3.6 **slave mode**: The mode used by the device, in an asymmetric connection, that it is usually assumed to have answered a call. In the Annex E case, this role is usually assigned to the terminal that sends in 1200 bits/s and receives in 75 bit/s.

3.7 **text telephone**: A device incorporating text telephony functions.

3.8 **text telephone mode**: The operational mode when two devices are interconnected to provide text telephone communications.

3.9 **text telephony**: A telecommunications capability which supports real-time text conversation on communication networks.

3.10 **TXP**: A signal transmitted to allow early termination of answer tone, and also to confirm V.18 capability in the answering device. It consists of a repetitive sequence of bits at 300 bit/s modulating V.21(1) if transmitted from the call DCE, or modulating V.21(2) if transmitted from the answer DCE. The 40-bit TXP sequence in left-to-right order of transmission is given by:

(1 1111 1111 1) (0) 0010 1011 (1) (0) 0001 1011 (1) (0) 0000 1010 (1) where brackets enclose start and stop bits.

3.11 **V.18 mode**: The operational mode when two devices conforming to this Recommendation are interconnected to provide text telephone capability. Except as specified in 6.1 below, the modulation in this mode shall be in accordance with Recommendation V.21.

3.12 **V.18 text telephone**: A communications device conforming to the requirements of this Recommendation.

4 Operational requirements

The DCE, when configured to support text telephone mode shall:

1) not initiate a disconnect;

2) have the optional capability to be configured to automatically reassume the initial interworking state, (e.g. reinitiate the calling id signal and activate the appropriate detectors) whenever transmission has ceased for a period of 2 s (e.g. a call transfer);

3) implement the CI signal coded as specified in this Recommendation. The use of CI is required by the calling DCE except where it is known *a priori* that the called terminal supports Recommendation V.8 *bis* (see 6.1);

4) provide call progress indications to the DTE. These signals shall include, but not be limited to: BUSY, RINGING, CARRIER, LOSS OF CARRIER and CONNECT(x) where x indicates the mode of connection (e.g. V.18, EDT, etc.);

5) implement circuit 135 – Received energy present (or its equivalent) (see Note).

NOTE – Because of the subjective nature of this indication, the operational thresholds of this circuit are left to the discretion of the implementors; however, means should be provided to prevent the presence of CI signal specified in this Recommendation from interfering with the indication of call progress signals.

5 Connecting in text telephone mode including procedures for interworking with the installed base of existing text telephones

This clause specifies procedures for connecting in text telephone mode. This includes procedures for establishing communications between two V.18 text telephones as well as procedures for establishing communications between a V.18 text telephone and the pre-existing text telephone devices specified in Annexes A through F. Although it is envisaged that for most connections the user will have *a priori* knowledge of the type of device being called and will preset the DCE to the correct mode, automatic procedures are provided for both originating and answering. These procedures provided for automoding and, where required for interworking, modulation and protocol conversion.

5.1 Automoding originating

These procedures are based on the assumption that the DCE has been placed in the V.18 mode with the CI specified in this Recommendation and the called party is known to be equipped with a text telephone. The procedure is defined below, and represented in Figure 1.

5.1.1 After connecting to line, the DCE shall transmit no signal for 1 s, and then transmit the CI signal as specified in this Recommendation with the ON/OFF cadence defined in clause 3. Detection of incoming signals shall take place during OFF periods in the signal CI, as indicated in Figure 1. After transmitting four of the CI sequences defined in this Recommendation (see clause 3), the DCE shall condition its receivers to detect the following signals during the 2 s OFF period in signal CI (see Figure 1):

- 2100 Hz (ANS);
- 2025 Hz;
- 1300 Hz;
- 1650 or 1850 Hz;
- 1400 or 1800 Hz;
- DTMF tones;
- 980 or 1180 Hz (see Note);
- 390 Hz or 450 Hz.

NOTE – Care should be taken in the design of 980 and 1180 Hz detectors to prevent incorrect triggering by echoes of transmitted CI signals.

If any of the above signals are detected, the DCE shall stop transmitting CI. No disconnect timers shall be started.

5.1.2 If ANS is detected, the DCE shall stop transmitting the CI signal, transmit no signal for 0.5 s, and then initiate the transmission of signal TXP in V.21(1) mode. The DCE shall then monitor for 900 Hz, 1650 Hz, 1850 Hz, 1300 Hz, 390 Hz, 450 Hz and loss of ANS.

5.1.2.1 When the DCE detects the absence of ANS, it shall stop transmission of signal TXP after completion of the current TXP sequence and continue to monitor for 1650 Hz, 1850 Hz, 1300 Hz, 390 Hz and 450 Hz.

5.1.2.2 If the DCE detects TXP, it shall connect as V.18, i.e. Recommendation V.21 with the operational characteristics given in clause 4.

5.1.2.3 If the DCE detects 1650 Hz or 1850 Hz for ≥ 0.2 s, it shall connect as per Annex F.

5.1.2.4 If the DCE detects 1300 Hz for 1.7 s, it shall connect as per Annex E in master mode. If 390 Hz is detected for 3 s, then the DCE shall connect as per Annex E in slave mode (i.e. transmit on the higher speed channel).

5.1.3 If the DCE detects 2025 Hz for 0.5 s, it shall connect as Annex D.

5.1.4 If 1650 Hz or 1850 Hz for 0.2 s are detected, the DCE shall connect as per Annex F.

5.1.5 If 1300 Hz is detected for 1.7 s, the DCE shall connect as per Annex E in master mode (i.e. transmitting on the 75 bit/s channel).

5.1.6 If 390 Hz or 450 Hz is detected for 3 s, the DCE shall initiate a connection as per Annex E in slave mode.

5.1.7 If a sequence of 1400 Hz or 1800 Hz FSK signals (i.e. valid 5-bit characters) are detected, the DCE shall analyse the bit duration and connect in the appropriate signalling rate as per Annex A.

5.1.8 If Dual Tone Multi-Frequency (DTMF) signals are detected, the DCE shall connect in the DTMF mode using the character conversion and the operational characteristics specified in Annex B.

5.1.9 If 980 Hz or 1180 Hz signals are detected, the DCE shall start a 2-sec timer (Tr) and attempt to determine the data signalling rate of the sequence.

5.1.9.1 If the data signalling rate is 110 bit/s, the DCE shall connect as per Annex C.

5.1.9.2 If timer Tr expires, the DCE shall connect as per Annex F in answer mode.

5.1.9.3 If the signal ceases for 0.4 s, the DCE shall return to monitoring, as specified in 5.1.1.

5.2 Automoding answering

5.2.1 When in the answer mode, the DCE shall connect to the line and condition its receiver to detect:

- 390 Hz or 450 Hz;
- 1300 Hz;
- 1400 Hz or 1800 Hz;
- DTMF tones;
- 980 Hz or 1180 Hz;
- signal CI;
- 2100 Hz;
- 1070 Hz or 1270 Hz;
- 2025 Hz or 2225 Hz.

The 3 s timer Ta shall be started. No disconnect timers shall be started. The procedures are defined below, and are provided in Figures 2a and 2b as an aid to the reader.

5.2.2 If signal CI coded for text telephone is detected, the DCE shall initiate transmission answer tone ANS as defined in Recommendation V.25, monitor for signal TXP and start a 3 s timer (Tt).

5.2.2.1 If signal TXP is detected, the DCE shall transmit no signal for 75 ± 5 ms, transmit 3 TXP sequences in V.21(2) mode, and then proceed as V.18 (i.e. Recommendation V.21 with the operational requirements specified in clause 4).

5.2.2.2 If Tt expires, the DCE shall return to monitoring, as specified in 5.2.1.

5.2.3 If 2100 Hz is detected, the DCE shall continue to monitor for 980 Hz, 1300 Hz or 1650 Hz.

5.2.3.1 If 980 Hz is detected for 0.4 s, the DCE shall connect as per Annex F in answer mode.

5.2.3.2 If 1300 Hz is detected for 1.7 s, the DCE shall connect as per Annex E in master mode.

5.2.3.3 If 1650 Hz is detected for 0.4 s, the DCE shall connect as per Annex F in the calling mode.

5.2.4 If 980 Hz is detected for 5 ms, the DCE shall start a 2.7 s timer Te and monitor for 1650 Hz and 1180 Hz.

5.2.4.1 If 1650 Hz is detected for 0.4 s, the DCE shall connect as per Annex F in the calling mode.

5.2.4.2 If, after > 0.5 s of 980 Hz signal, 1 s of no signal is detected, the DCE shall connect as per Annex C.

5.2.4.3 If either 1180 Hz is detected for 5 ms or timer Te expires, the DCE shall start 2 s timer Tr and attempt to determine the data signalling rate of the data sequence.

5.2.4.3.1 If the data signalling rate is 110 bit/s, the DCE shall connect as per Annex C.

5.2.4.3.2 If the data signalling rate is 300 bit/s or timer Tr expires, the DCE shall connect as per Annex F.

5.2.5 If a sequence of 1400 Hz and 1800 Hz FSK signals (i.e. valid 5-bit characters) are detected, the DCE shall analyse the bit duration and connect in the appropriate signalling rate as per Annex A.

5.2.6 If Dual Tone Multi-Frequency (DTMF) signals are detected, the DCE shall connect in the DTMF mode using the character conversion and the operational characteristics specified in Annex B.

5.2.7 If 1070 Hz or 1270 Hz is detected for 0.4 s, the DCE shall connect as per Annex D in answer mode.

5.2.8 If 2025 Hz or 2225 Hz is detected for 1 s, the DCE shall connect as per Annex D in the calling mode.

5.2.9 If Ta expires, the DCE shall enter probing state, sending signals intended to stimulate the calling text telephone or its user to respond. The DCE shall start a 1 s timer and send an initial probing sequence that shall consist of transmission of carrierless mode sequence consisting of the character "-" sent in 5-bit mode with 47.6 bit/s, in EDT mode and in DTMF mode in rapid sequence and continue to monitor . If the timer expires, the DCE shall proceed either per 5.2.9.1 or per 5.2.9.2 depending on the most likely scenario preset by the user (see Appendix I).

5.2.9.1 The DCE shall transmit a buffered message and start variable timer Tm (default 3 sec) to allow for a response from the caller. If Tm expires and no response is received, the DCE shall proceed to the next appropriate probe (e.g. ANS, carrier or the next carrierless mode).

NOTE – The DCE shall have a stored, user changeable, default answer message (e.g. Hello, GA). Although the primary use of this stored message is to stimulate a response from a carrierless text telephone, it may also be optionally sent after a connection is established with a continuous carrier-based text telephone.

5.2.9.2 The DCE shall transmit ANS, for 0.5 s, then remain silent for 75 ± 5 ms and then transmit, for the duration of variable timer Tc (default 6 secs) depending on the user setting, 1300 Hz carrier, 1650 Hz or 2025 Hz. The DCE shall monitor for all appropriate signals while transmitting one of the above carriers.

5.2.9.2.1 If 980 Hz is detected for 300 ms, the DCE shall connect as Annex F.

5.2.9.2.2 If 1070 Hz is detected for 300 ms, the DCE shall connect as Annex D.

5.2.9.2.3 If 390 Hz is detected for 3 s, the DCE shall connect as per Annex E in the slave mode.

5.2.9.2.4 When any other valid signal as defined in 5.2.1 is detected, the DCE shall act according to the specification in 5.2.2 to 5.2.8.

5.2.9.2.5 If Tc expires, the DCE shall proceed to the next appropriate probe (e.g. next carrier mode or next carrierless mode).

6 Multimode text telephony

The capability for Simultaneous Voice and Data (SVD) provided by Recommendations H.324, V.61 and V.70 can be used to support expanded modes of text telephone without need of any special modifications. When this capability is added to a device that supports the provisions of clauses 4 and 5, the device shall be considered a V.18 multimode text telephone device. In this case, V.8 *bis* procedures shall be used, whenever possible, for the exchange and negotiation of capabilities as well as to provide the means for switching between supported text telephone modes and between text telephone mode and voice.

6.1 Simultaneous voice and text telephony (SVT)

When SVD capability is added to a basic V.18 text telephone, connections between hearing people and oral deaf or hard-of-hearing people are facilitated. In these cases, after the SVD capability is established, the deaf or hard-of-hearing user communicates orally over the audio channel and the hearing user responds using text telephony over the data channel.

6.2 Simultaneous data and text telephony

The audio channel provided by Quadrature Audio Data Modulation (QADM) SVD DCEs (e.g. V.61) can, in many cases, support V.18 text telephony. In this case, the V.18 devices could be connected to the audio input of such devices and the text telephone connection would be established, in accordance with the provisions of clause 5, after the SVD connection is established. In this case, however, the SVD devices are not considered to be text telephone devices and therefore would not need to conform to the provisions of this Recommendation.

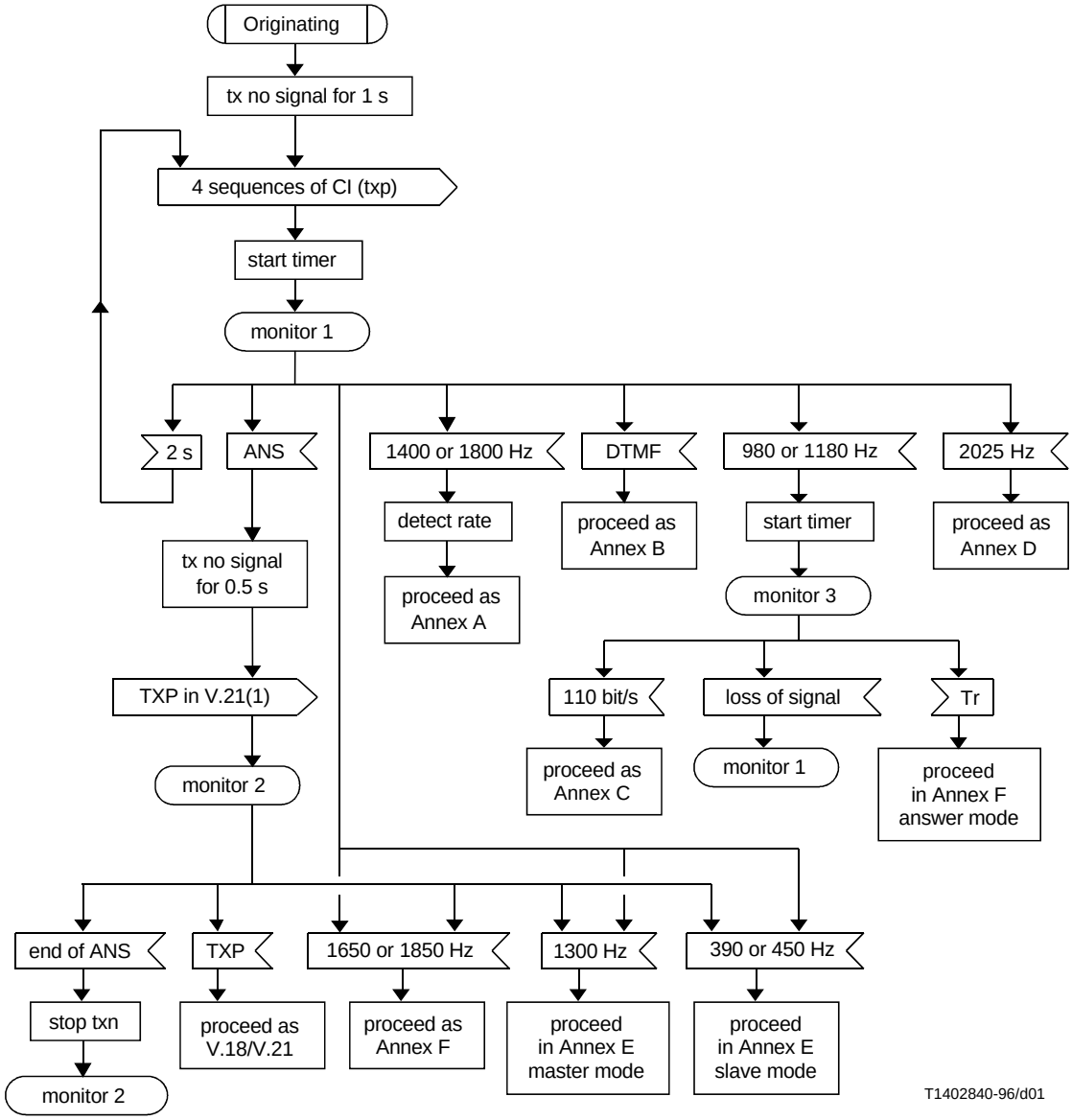
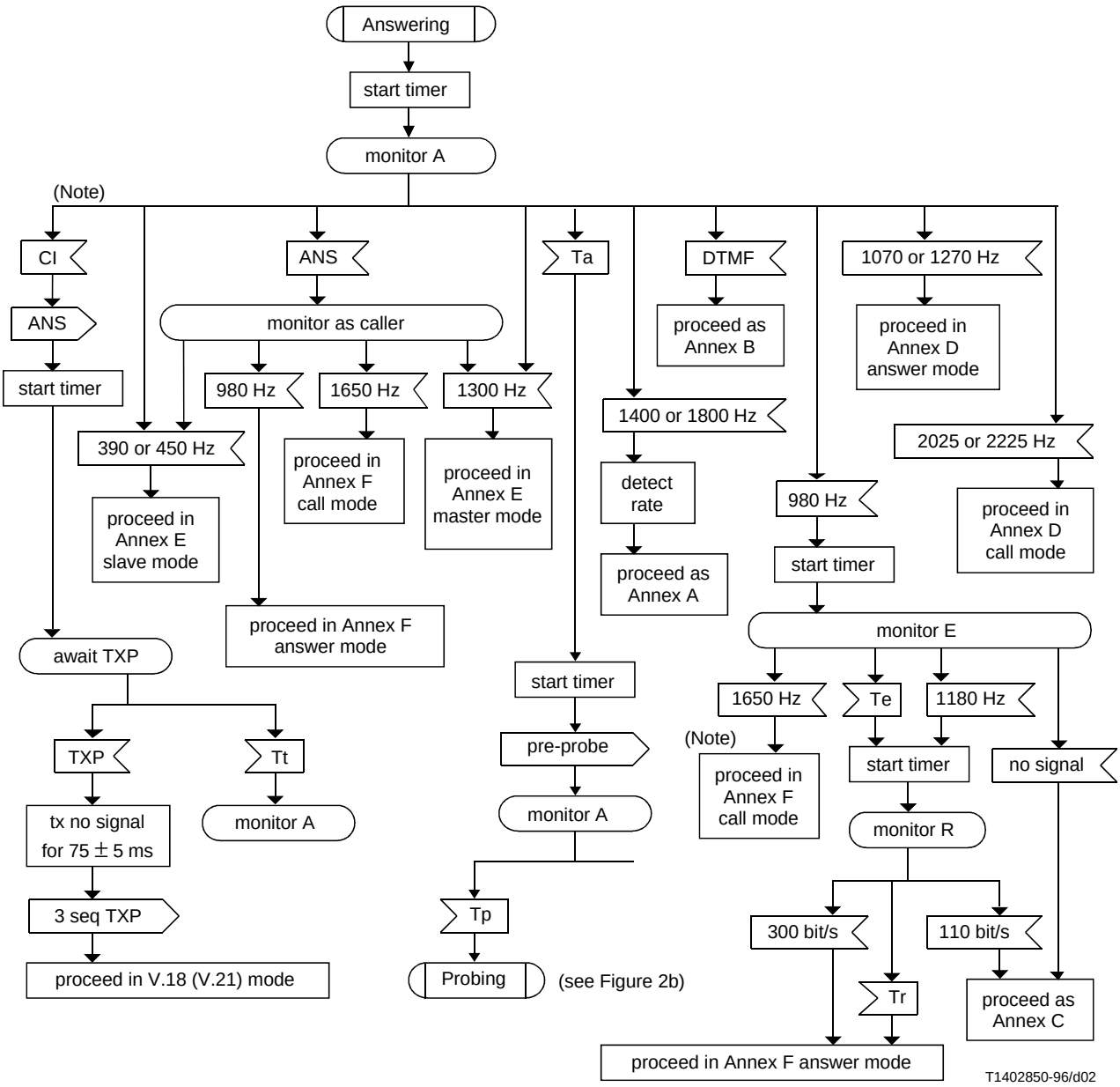


FIGURE 1/V.18

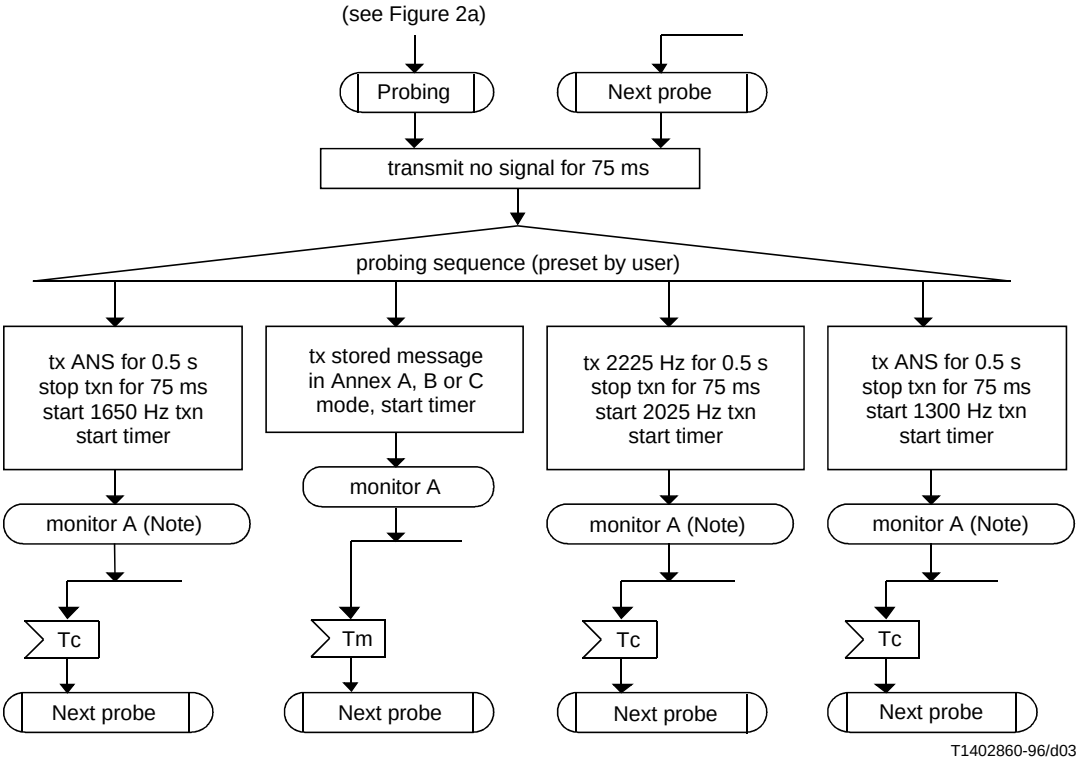
Start-up procedure in the originating V.18 DCE with automoding to existing types of text telephone



NOTE – The detection of CI may be integrated with the detection of other V.21(1) signals.

FIGURE 2a/V.18

Start-up procedure in the answering V.18 DCE showing automoding



NOTE – Excluding detection of the tone currently being transmitted.

FIGURE 2b/V.18

Automode probing

Annex A

5-bit operational mode

A.1 Mode of operation

The communication channel is half-duplex with no channel turnaround. The carrier is transmitted 10 ms before the first character is transmitted. The receiver shall be disabled for 300 ms when a character is transmitted to mitigate false detection of echoes (in non-V.18 devices, the carrier is 1 s after the last character to provide this same function).

A.2 Modulation

The modulation is frequency shift-keyed modulation (i.e. no carrier is present when a character is not being transmitted) using 1400 Hz (± 56 Hz) for a binary 1 and 1800 Hz (± 72 Hz) for a binary 0. A bit duration of either 20 or 22.00 ± 0.40 ms is used providing either a nominal data signalling rate of 50 or 45.45 bits/s respectively.

A.3 Probe

The probe in answer mode shall be at a 47.6 bit/s data signalling rate.

A.4 Character conversion

The initial condition of the converter shall be the letters (LTRS) mode, therefore the DCE shall send the LTRS character (11111) to the line prior to transmitting the first translated character. The receiver decoding shall also start up in the LTRS mode. Additionally, the DCE shall send the appropriate mode character (i.e. LTRS or FIGS) every 72 characters.

The 5-bit codes supported are given in Tables A.1 and A.2. Each character shall consist of the 5-bit sequence given in the tables preceded by a one start bit and followed by a minimum of one and one-half stop bits.

The DCE shall convert the 5-bit coded characters received from the line to the appropriate 7-bit coded characters and transfer them to the DTE on circuit 104 (or its equivalent).

The DCE shall convert the 7-bit coded characters received from the DTE on circuit 103 (or its equivalent) to the appropriate 5-bit coded characters (see Annex A) and transmit to the line.

TABLE A.1/V.18

Line-to-DTE code conversion (5-bit to 7-bit)

5-bit code	LTRS	7-bit T.50 code	5-bit code	FIGS	7-bit T.50 code
00000	(BACKSP)	000 1000	*00000*	(BACKSP)	000 1000
00001	E	100 0101	*00001*	3	011 0011
00010	LF	000 1010	*00010*	LF	000 1010
00011	A	100 0001	*00011*	-	010 1101
00100	SPACE	010 0000	*00100*	SPACE	010 0000
00101	S	101 0011	*00101*	-	000 0000
00110	I	100 1001	*00110*	8	011 1000
00111	U	101 0101	*00111*	7	011 0111
01000	CR	000 1101	*01000*	CR	000 1101
01001	D	100 0100	*01001*	$	010 0100
01010	R	101 0010	*01010*	4	011 0100
01011	J	100 1010	*01011*	’	010 0111
01100	N	100 1110	*01100*	,	010 1100
01101	F	100 0110	*01101*	!	010 0001
01110	C	100 0011	*01110*	:	010 1010
01111	K	100 1011	*01111*	(	010 1000
10000	T	101 0100	*10000*	5	011 0101
10001	Z	101 1010	*10001*	"	010 0010
10010	L	100 1100	*10010*	)	010 1001
10011	W	101 0111	*10011*	2	011 0010
10100	H	100 1000	*10100*	=	011 1101
10101	Y	101 1001	*10101*	6	011 0110
10110	P	101 0000	*10110*	0	011 0000
10111	Q	101 0001	*10111*	1	011 0001
11000	O	100 1111	*11000*	9	011 1001
11001	B	100 0010	*11001*	?	011 1111
11010	G	100 0111	*11010*	+	010 1011
11011	FIGS	(Note)	11011	FIGS	(Note)
11100	M	100 1101	*11100*	.	010 1110
11101	X	101 1000	*11101*	/	010 1111
11110	V	101 0110	*11110*	;	011 1011
11111	LTRS	(Note)	11111	LTRS	(Note)

NOTE – The translator must keep track of (e.g. toggle a memory location) the mode (i.e. LTRS, FIGS). The default should be the LTRS mode. The 7-bit T.50 character DEL (111 1111) sent from the keyboard shall force the receiving translator to the LTRS mode (see Table A.2).

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TABLE A.2/V.18

DTE-to-line code conversion (7-bit to 5-bit)

7-bit code	T.50 character	5-bit code	7-bit code	T.50 character	5-bit code
000 0000	NULL	NULL	100 0000	@ >> X	11101
000 0001	SOH	NULL	100 0001	A	00011
000 0010	STX	NULL	100 0010	B	11001
000 0011	ETX	NULL	100 0011	C	01110
000 0100	EOT	NULL	100 0100	D	01001
000 0101	ENQ	NULL	100 0101	E	01001
000 0110	ACK	NULL	100 0110	F	01101
000 0111	BEL	NULL	100 0111	G	11010
000 1000	BACKSPACE	*00000*	100 1000	H	10100
000 1001	HT >> SPACE	*00100*	100 1001	I	00110
000 1010	LF	*00010*	100 1010	J	01011
000 1011	VT >> LF	*00010*	100 1011	K	01111
000 1100	FF >> LF	*00010*	100 1100	L	10010
000 1101	CR	01000	100 1101	M	11100
000 1110	SO	NULL	100 1110	N	01100
000 1111	SI	NULL	100 1111	O	11000
001 0000	DLE	NULL	101 0000	P	10110
001 0001	DC1	NULL	101 0001	Q	10111
001 0010	DC2	NULL	101 0010	R	01010
001 0011	DC3	NULL	101 0011	S	00101
001 0100	DC4	NULL	101 0100	T	10000
001 0101	NAK	NULL	101 0101	U	00111
001 0110	SYN	NULL	101 0110	V	11110
001 0111	ETB	NULL	101 0111	W	10011
001 1000	CAN	NULL	101 1000	X	11101
001 1001	EM	NULL	101 1001	Y	10101
001 1010	SUB >> ?	11001	101 1010	Z	10001
001 1011	ESC	NULL	101 1011	[>> (	*01111*
001 1100	IS4 >> LF	*00010*	101 1100	\ >> /	*11101*
001 1101	IS3 >> LF	*00010*	101 1101	] >>)	*10010*
001 1110	IS2 >> LF	*00010*	101 1110	^ >> ’	*01011*
001 1111	IS1 >> SPACE	*00100*	101 1111	_ >> SPACE	*00100*
010 0000	SPACE	*00100*	110 0000	’	*00101*
010 0001	!	*01101*	110 0001	a	00011
010 0010	"	*10001*	110 0010	b	11001
010 0011	# >> $	*01001*	110 0011	c	01110
010 0100	$	*01001*	110 0100	d	01001
010 0101	% >> /	*11101*	110 0101	e	01001
010 0110	& >> +	*11010*	110 1110	f	01101
010 0111	’	*00101*	110 0111	g	11010
010 1000	(	*01111*	110 1000	h	10100

TABLE A.2/V.18 (*concluded*)

DTE-to-line code conversion (7-bit to 5-bit)

7-bit code	T.50 character	5-bit code	7-bit code	T.50 character	5-bit code
010 1001	)	*10010*	110 1001	i	00110
010 1010	_ >> .	*11100*	110 1010	j	01011
010 1011	+	*11010*	110 1011	k	01111
010 1100	,	*01100*	110 1100	l	10010
010 1101	-	*00011*	110 1101	m	11100
010 1110	.	*11100*	110 1110	n	01100
010 1111	/	*11101*	110 1111	o	11000
011 0000	0	*10110*	111 0000	p	10110
011 0001	1	*10111*	111 0001	q	10111
011 0010	2	*10011*	111 0010	r	01010
011 0011	3	*00010*	111 0011	s	00101
011 0100	4	*01010*	111 0100	t	10000
011 0101	5	*10000*	111 0101	u	00111
011 0110	6	*10101*	111 0110	v	11110
011 0111	7	*00111*	111 0111	w	10011
011 1000	8	*00110*	111 1000	x	11101
011 1001	9	*11000*	111 1001	y	10101
011 1010	:	*01110*	111 1010	z	10001
011 1011	;	*11110*	111 1011	{ >> (	*01111*
011 1100	< >> (	*01111*	111 1100	| >> !	*01101*
011 1101	=	*10100*	111 1101	} >>)	*10010*
011 1110	> >>)	*10010*	111 1110	~ >> SPACE	*00100*
011 1111	?	*11001*	111 1111	DEL	NULL (Note)

NOTE – Whenever the mode changes (e.g. an alphabet character is followed by a number), the translator must insert the appropriate mode code (i.e. 11011 or 11111) before transmitting the next 5-bit character code (see Table A.1). The 7-bit T.50 character DEL (111 1111) sent from the keyboard shall force the receiving translator to the LTRS mode.

Annex B

DTMF operational mode

B.1 Mode of operation

The communications channel is half-duplex. The receiver is disabled for 300 ms when a character is transmitted to mitigate false detection of echoes.

B.2 Character conversion

The Q.23 (DTMF) characters supported are given in Tables B.1 and B.2. Each character shall consist of the appropriate code sequence given in the table.

The DCE shall convert the DTMF characters received from the line to their equivalent T.50-coded characters and transfer them to the DTE on circuit 104 (or its equivalent) as per Table B.1.

The DCE shall convert the T.50-coded characters received from the DTE on circuit 103 (or its equivalent) to the appropriate DTMF characters and transmit to the line as per Table B.2.

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TABLE B.1/V.18

Line-to-DTE code conversion (DTMF to 7-bit)

DTMF codes	T.50 character	7-bit code	DTMF codes	T.50 character	7-bit code
1	b	110 0010	**4	:	011 1010
2	e	110 0101	**5	%	010 0101
3	h	110 1000	**6	(	010 1000
4	k	110 1011	**7	)	011 1110
5	n	110 1110	**8	,	010 1100
6	q	111 0001	**9	LF	000 1010
7	t	111 0100	**0	NULL	NULL
8	w	111 0111	#*1	æ (Note 1)	111 1011
9	z	111 1010	#*2	ø (Note 1)	111 1100
0	SPACE	101 1110	#*3	å (Note 1)	111 1101
**1*	a	110 0001	#*4	Æ (Note 1)	101 1011
**2*	d	110 0100	#*5	Ø (Note 1)	101 1100
**3*	g	110 0111	#*6	Å (Note 1)	101 1101
**4*	j	110 1010	##*1	A	100 0001
**5*	m	110 1101	##*2	D	100 0100
**6*	p	111 0000	##*3	G	100 0111
**7*	s	111 0011	##*4	J	100 1010
**8*	v	111 0110	##*5	M	100 1101
**9*	y	111 1001	##*6	P	101 0000
**0*	BACK SPACE	000 1000	##*7	S	101 0011
#1	c	110 0011	##*8	V	101 0110
#2	f	110 1110	##*9	Y	101 1001
#3	i	110 1001	##*0	NULL	NULL
#4	l	110 1100	##1	B	100 0010
#5	o	110 1111	##2	E	100 0101
#6	r	111 0010	##3	H	100 1000
#7	u	111 0101	##4	K	100 1011
#8	x	111 1000	##5	N	100 1110
#9	.	010 1110	##6	Q	101 0001
#0	?	011 1111	##7	T	101 0100
**#1*	1	011 0001	##8	W	101 0111
**#2*	2	011 0010	##9	Z	101 1010
**#3*	3	011 0011	##0	SPACE	101 1111
**#4*	4	011 0100	###1	C	100 0011
**#5*	5	011 0101	###2	F	100 0110
**#6*	6	011 0110	###3	I	100 1001
**#7*	7	011 0111	###4	L	100 1100
**#8*	8	011 1000	###5	O	100 1111
**#9*	9	011 1001	###6	R	101 0010
**#0*	0	011 0000	###7	U	101 0101
**1	+	010 0110	###8	X	101 1000
**2	-	010 1101	###9	;	011 1011
**3	=	011 1101	###0	!	010 0001

NOTES

1 – National option.

2 – Codes preceded by **# or *** are reserved for preprogrammed sentences and should not be translated character-by-character to the corresponding T.50 codes.

TABLE B.2/V.18

DTE-to-line code conversion (7-bit to DTMF)

7-bit code	T.50 character	DTMF	7-bit code	T.50 character	DTMF
000 0000	NULL	NULL	100 0000	@ >> X	###8
000 0001	SOH	NULL	100 0001	A	##*1
000 0010	STX	NULL	100 0010	B	##1
000 0011	ETX	NULL	100 0011	C	###1
000 0100	EOT	NULL	100 0100	D	##*2
000 0101	ENQ	NULL	100 0101	E	##2
000 0110	ACK	NULL	100 0110	F	###2
000 0111	BEL	NULL	100 0111	G	##*3
000 1000	BACKSPACE	*0	100 1000	H	##3
000 1001	HT >> SPACE	0	100 1001	I	###3
000 1010	LF	**9	100 1010	J	##*4
000 1011	VT >> LF	**9	100 1011	K	##4
000 1100	FF >> LF	**9	100 1100	L	###4
000 1101	CR	NULL	100 1101	M	##*5
000 1110	SO	NULL	100 1110	N	##5
000 1111	SI	NULL	100 1111	O	###5
001 0000	DLE	NULL	101 0000	P	##*6
001 0001	DC1	NULL	101 0001	Q	##6
001 0010	DC2	NULL	101 0010	R	###6
001 0011	DC3	NULL	101 0011	S	##*7
001 0100	DC4	NULL	101 0100	T	##7
001 0101	NAK	NULL	101 0101	U	### 7
001 0110	SYN	NULL	101 0110	V	##* 8
001 0111	ETB	NULL	101 0111	W	##8
001 1000	CAN	NULL	101 1000	X	### 8
001 1001	EM	NULL	101 1001	Y	##*9
001 1010	SUB >> ?	#0	101 1010	Z	## 9
001 1011	ESC	NULL	101 1011	Æ (Note)	#*4
001 1100	IS4 >> LF	**9	101 1100	Ø (Note)	#*5
001 1101	IS3 >> LF	**9	101 1101	Å (Note)	#*6
001 1110	IS2 >> LF	**9	101 1110	^ >> '	NULL
001 1111	IS1 >> SPACE	0	101 1111	_ >> SPACE	0
010 0000	SPACE	0	110 0000	'	NULL
010 0001	!	###0	110 0001	a	*1
010 0010	"	NULL	110 0010	b	1
010 0011	# >> $	NULL	110 0011	c	#1
010 0100	$	NULL	110 0100	d	*2
010 0101	% >> /	**5	110 0101	e	2
010 0110	& >> +	**1	110 1110	f	#2
010 0111	'	NULL	110 0111	g	*3
010 1000	(	**6	110 1000	h	3

TABLE B.2/V.18 (*concluded*)

DTE-to-line code conversion (7-bit to DTMF)

7-bit code	T.50 character	DTMF	7-bit code	T.50 character	DTMF
010 1001	)	**7	110 1001	i	#3
010 1010	_ >> .	#9	110 1010	j	*4
010 1011	+	**1	110 1011	k	4
010 1100	,	**8	110 1100	l	#4
010 1101	-	**2	110 1101	m	*5
010 1110	.	#9	110 1110	n	5
010 1111	/	NULL	110 1111	o	#5
011 0000	0	*#0	111 0000	p	*6
011 0001	1	*#1	111 0001	q	6
011 0010	2	*#2	111 0010	r	#6
011 0011	3	*#3	111 0011	s	*7
011 0100	4	*#4	111 0100	t	7
011 0101	5	*#5	111 0101	u	#7
011 0110	6	*#6	111 0110	v	*8
011 0111	7	*#7	111 0111	w	8
011 1000	8	*#8	111 1000	x	#8
011 1001	9	*#9	111 1001	y	*9
011 1010	:	**4	111 1010	z	9
011 1011	;	###9	111 1011	æ (Note)	#*1
011 1100	< >> (	**6	111 1100	ø (Note)	#*2
011 1101	=	**3	111 1101	å (Note)	#*3
011 1110	> >>)	**7	111 1110	~ >> SPACE	0
011 1111	?	#0	111 1111	DEL	*0

NOTE – National option.

Annex C

EDT operational mode

C.1 Mode of operation

The communications channel is half-duplex. The carrier is transmitted 10 ms before the first character is transmitted. The receiver shall be disabled for 300 ms when a character is transmitted to mitigate false detection of echoes (in non-V.18 devices, the carrier is 1 s after the last character to provide this same function).

C.2 Modulation

The modulation is frequency shift-keyed modulation using V.21(1) frequencies. The data signalling rate is 110 bits/s.

C.3 Characters in the EDT mode

The EDT must use the following character structure. The 7-bit T.50-coded character shall be preceded by one (1) START bit and shall be followed by one EVEN PARITY bit, and 2 STOP bits.

Annex D

Bell 103 mode

D.1 Mode of operation

The communication circuit for data transmission is a duplex circuit whereby data transmission in both directions simultaneously is possible at 300 bit/s or less. The frequency of the ANS used by this DCE is 2225 Hz.

D.2 Modulation

The modulation is a binary modulation obtained by frequency shift, resulting in a modulation rate being equal to the data signalling rate.

For channel No. 1, the nominal mean frequency is 1170 Hz, for channel No. 2, it is 2125 Hz.

The frequency deviation is ± 100 Hz. In each channel, the higher characteristic frequency (FA) corresponds to a binary 1 [i.e. channel No. 1 (FA = 1270 Hz and Fz = 1070 Hz); channel No. 2 (FA = 2225 Hz and Fz = 2025 Hz)].

Annex E

Minitel mode

E.1 Mode of operation

The modulation is asymmetric duplex conforming to Recommendation V.23 with a 1200 bit/s forward channel and the 75 bit/s backward channel active. Minitels intended for text telephone use can act as either master or slave, with role selection automatically being done at connection establishment. The carrier connection procedure assigns the role of “master mode” to the DCE which transmits at the 75 bit/s data signalling rate and the role of “slave mode” to the DCE that transmits at the 1200 bit/s data signalling rate. In Minitel operation the slave echoes received characters and uses local echo to view transmitted characters.

Any implementation of the Minitel must follow the profile 2 of the CEPT Videotext Recommendation.

E.2 Character code and framing

When used in text telephone mode, the basic C0, G0 and G2 character sets shall be supported. The characters are sent in asynchronous mode, 7-bit characters framed by one even parity bit, one start bit and one stop bit (receive parity is ignored).

E.3 Control

A repertoire of control sequences is defined for Minitel in accordance with Profile 2 of the CEPT Videotex protocol. A subset is required for text telephone usage. After connection, the slave takes the initiative to set the terminals in a mode suitable for text telephony by the following control sequences.

Slave sends	**Master responds**
Reset (1B, 39, 7F)	Initialization (13, 5E)
Request scroll up mode (1B, 3A, 69, 43)	Acknowledge scroll mode (1B, 3A, 73, 46)
Clear screen (0C)	

E.4 Error control

The slave can request initiation of error control procedure (1B, 3A, 69, 44) to which the master responds with acknowledge error control (1B, 3A, 73, 44). The slave does not initiate any other transmission while waiting for the acknowledge error control message. When the error control procedure is active, and the master detects errors, it can request retransmission. When in error control mode, the slave sends characters blocked in groups of 15 characters followed by a CRC character and a validation character with all bits set to 0. Erroneous blocks are discarded. Partially filled blocks are filled with NUL characters if no characters are entered for 16 ms. The slave can also request deactivation of the error control procedure.

E.5 Interworking with normal (non-text telephone) Minitels

Connection to a Minitel not intended for text telephone use requires manual intervention on the part of the user. In this scenario, the calling V.18 device must be configured to connect in the answer (slave) mode.

Annex F

V.21 text telephone mode

F.1 Mode of operation

The communication connection is 300 bit/s duplex.

F.2 Modulation

The modulation is frequency shift-keyed modulation using continuous carriers according to V.21 frequencies.

F.3 Channel selection

Existing text telephone devices use several different ways to select the mode of operation (i.e. originate or answer). The following is a list of known methods used for resolution of mode assignments:

1) The DCE starts in answer mode and then toggles at random intervals (0.6-2.4 s) between the originate and answer modes until a carrier connection is established.

2) The DCE uses stored information and chooses its mode of operation depending on whether the device has most recently dialled or detected a ring.

In other cases, where no form of resolution is provided, the assignment of the mode of operation relies on the users selecting different modes at each end by prior agreement.

F.4 Character code and framing

Characters shall be coded in 7-bit national character sets according to Recommendation T.50. Characters are framed by one start bit, 7-bit data, with one parity bit and one stop bit. Devices should be designed to accept one or two stop bits.

F.5 Presentation control

Transmitted characters are viewed through the use of local echo. Erasure of the last character is requested by BS (0/7). New line is requested by CR LF. Local word wrapping is used at the end of line, and does not cause CR LF to be sent to the line.

F.6 Usage conventions

Most existing devices have only one common window for display of both directions of transmission, therefore an indicator is used to indicate when a user is through typing. The most commonly used indicators for this purpose are the “*” (e.g. in the Nordic countries) and the character string “GA” (e.g. in the United Kingdom).

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Appendix I

Representative ordering of automoding

The following orderings of automoding are suggested starting points for development of probing sequences for the specified countries:

Australia, Ireland

send 5-bit code buffered message
send V.21 carrier
send V.23 carrier
send EDT code buffered message
send DTMF buffered message
send Annex D carrier

UK

send V.21 carrier
send 5-bit code buffered message
send V.23 carrier
send EDT code buffered message
send DTMF buffered message
send Annex D carrier

Germany, Switzerland, Italy

send EDT code buffered message
send V.21 carrier
send V.23 carrier
send 5-bit code buffered message
send DTMF buffered message
send Annex D carrier

USA

send 5-bit code buffered message
send Annex D carrier
send V.21 carrier
send V.23 carrier
send EDT code buffered message
send DTMF buffered message

Netherlands

send DTMF buffered message
send V.21 carrier
send V.23 carrier
send 5-bit code buffered message
send EDT buffered message
send Annex D carrier

Scandinavian countries

send V.21 carrier
send DTMF buffered message
send 5-bit code buffered message
send EDT code buffered message
send V.23 carrier
send Annex D carrier

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Appendix II

Guidelines for software designers and device manufacturers

Character set and control

Characters shall be sent in asynchronous mode, with 8 bits of data, 1 start bit and 1 stop bit with no parity bit. Characters shall not be echoed by the receiving device. The sending device shall provide for display of transmitted characters. The default character set shall conform to the two-octet version, level 1 of ISO/IEC 10646-1. Devices shall support procedures for negotiation of other character sets. The following basic set of presentation control functions from ISO/IEC 6429 shall be supported:

CR - Carriage return

BS - Back space

SPD- Select presentation direction (used to request a change in presentation direction)

MW- Message waiting (used to trigger a steady alerting state)

DSR- Device status report (used to request a status report)

LF- Line feed [used in conjunction with CR (CR+LF) for new line]

INT- Interrupt (used to initiate mode negotiation procedure)

ESC- Escape to ISO 2022 control

DCH- Delete character [used in conjunction with BS (BS+DCH) to erase the last character]

BEL Bell

The escape sequence to designate a character set shall follow the ISO international register of coded character sets to be used with escape sequences. ESC 2/5 2/15 4/0 shall be the code used to enter UCS-2 level 1.

When the 16-bit UCS character set is being used, ISO/IEC 6429 control functions shall be padded with 00 characters as specified in ISO/IEC 10646-1.

Visual presentation

It is recommended that sent and received characters be presented in separate areas of the display or at a minimum be assigned distinctive fonts to allow for easy determination of the conversation flow by the user.

Line status display

Visual indications on the status of the connection should be visually presented, including call progress information as well as the status of circuit 135, line energy present.

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