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DATA COMMUNICATION OVER THE TELEPHONE NETWORK

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

ITU-T Recommendation V.18

(Previously “CCITT Recommendation”)

FOREWORD

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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 prepared by ITU-T Study Group 14 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 20th of September 1994.

NOTE

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

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Recommendation V.18

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

(Geneva, 1994)

Background

The ITU-T,

considering

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

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

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

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

(e) 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,

recommends

the procedure below.

1 Scope

This Recommendation defines features to be incorporated in modems intended for use in, or communicating with, text telephones primarily used by the deaf or hard of hearing. It is the goal of this Recommendation to provide a platform on which a future universal text telephone could be built. To accommodate this, procedures for interworking with most existing text telephones are provided in this Recommendation.

To provide for maximum flexibility it is envisaged that text telephone mode of operation will be invoked on an as required basis in response to commands issued by the DTE.

It provides for:

- Calling identification signals using the procedures specified in Recommendation V.8.
- No disconnection on loss of carrier.
- Procedures for interoperation with:
    1) existing text telephones using a 5-bit code;
    2) existing text telephones that use V-Series modulation modes;
    3) existing DTMF-based text telephones;
    4) existing European Deaf Telephone (EDT) text telephones; and
    5) others as identified.

2 References

The following ITU-T 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 referenced Standards 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 currently valid ITU-T Recommendations is regularly published.

- ITU-T(CCITT) Recommendation Q.23 (1988), *Technical features of push-button telephone sets*.
- ITU-T(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(CCITT) Recommendation V.21 (1988), *300 bits per second duplex modem standardized for use in the general switched telephone network*.
- ITU-T(CCITT) Recommendation V.23 (1988), *600/1200 bauds modem standardized for use in the general switched telephone network*.
- ITU-T(CCITT) Recommendation V.8 (1994), *Procedures for starting sessions of data transmission over the general switched telephone network*.

3 Definitions

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

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), which is the low-band channel defined in Recommendation V.21. The cadence of this signal when used in this Recommendation shall be bursts of 4 CI sequences separated by 2 seconds of silence. The CI sequence when used with this Recommendation shall be coded in octets as defined in Tables 1/V.8, 2/V.8 and 3/V.8. CI shall be coded to indicate the function "text telephone". 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.

TXP: A signal transmitted to allow early termination of answer tone, and also to confirm V.18 capability. 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.

4 Operational requirements

4.1 To allow for easy movement between data and voice modes, the modem shall not initiate a disconnect.

4.2 To facilitate transfers, on a established connection, between text telephones using different modes of operation (i.e. 5-bit, T.50 CODE, DTMF), the modem shall have the capability to be configured by the user such that whenever transmission has ceased for 2 seconds (e.g. a call transfer) the modem shall re-assume the initial interworking state, re-initiate the calling id signal and activate the appropriate detectors (see clause 5).

4.3 The modem shall implement the CI signal coded as specified in Recommendation V.8 for text telephones.

4.4 The modem shall 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.).

4.5 The modem shall implement Circuit 135 – *Received energy present* (or its equivalent). Because of the subjective nature of this indication the operational thresholds of this circuit are left to the discretion of the implementors. To prevent confusion with call progress tones during call establishment, the modem shall provide filtering of the signals specified in Recommendation V.8 to the detector associated with this circuit.

5 Interworking

This clause provides procedures for interworking with equipment operating in accordance with Recommendations V.18, V.21, V.23, EDT, 5-bit or DTMF based text telephones. Although it is envisaged that for most connections the user will have a priori knowledge of the type of terminal being called and will preset the modem 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 modem has been placed in the V.18 mode with the CI specified in V.8 for text telephones 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 and dialing the number, the modem shall transmit no signal for 1 second, and then transmit the CI signal as specified in V.8 for text telephones 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 4 of the CI sequences defined in Recommendation V.8 for text telephones (see clause 3), the modem shall condition its receivers to detect the following signals during the 2-second OFF period in signal CI (see Figure 1):

- TXP;
- 2100 Hz (ANS);
- 2225 Hz;
- 1300 Hz;
- 1650/1850 Hz;
- 1400/1800 Hz;
- DTMF tones;
- 980/1180 Hz (see Note);
- 390 Hz.

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

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

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

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

5.1.2.2. If the modem detects TXP, it shall connect as indicated in this Recommendation, i.e. Recommendation V.21 with the operational characteristics given in clause 3.

5.1.2.3 If the modem detects 1650/1850 Hz for ≥ 0.2 second, it shall connect as per Recommendation V.21.

5.1.2.4 If the modem detects 1300/2100 Hz for 1 second, it shall connect as per Recommendation V.23. If 390 Hz is detected for 1 second, then the modem shall connect as per Recommendation V.23 reverse mode (i.e. transmit on the higher speed channel).

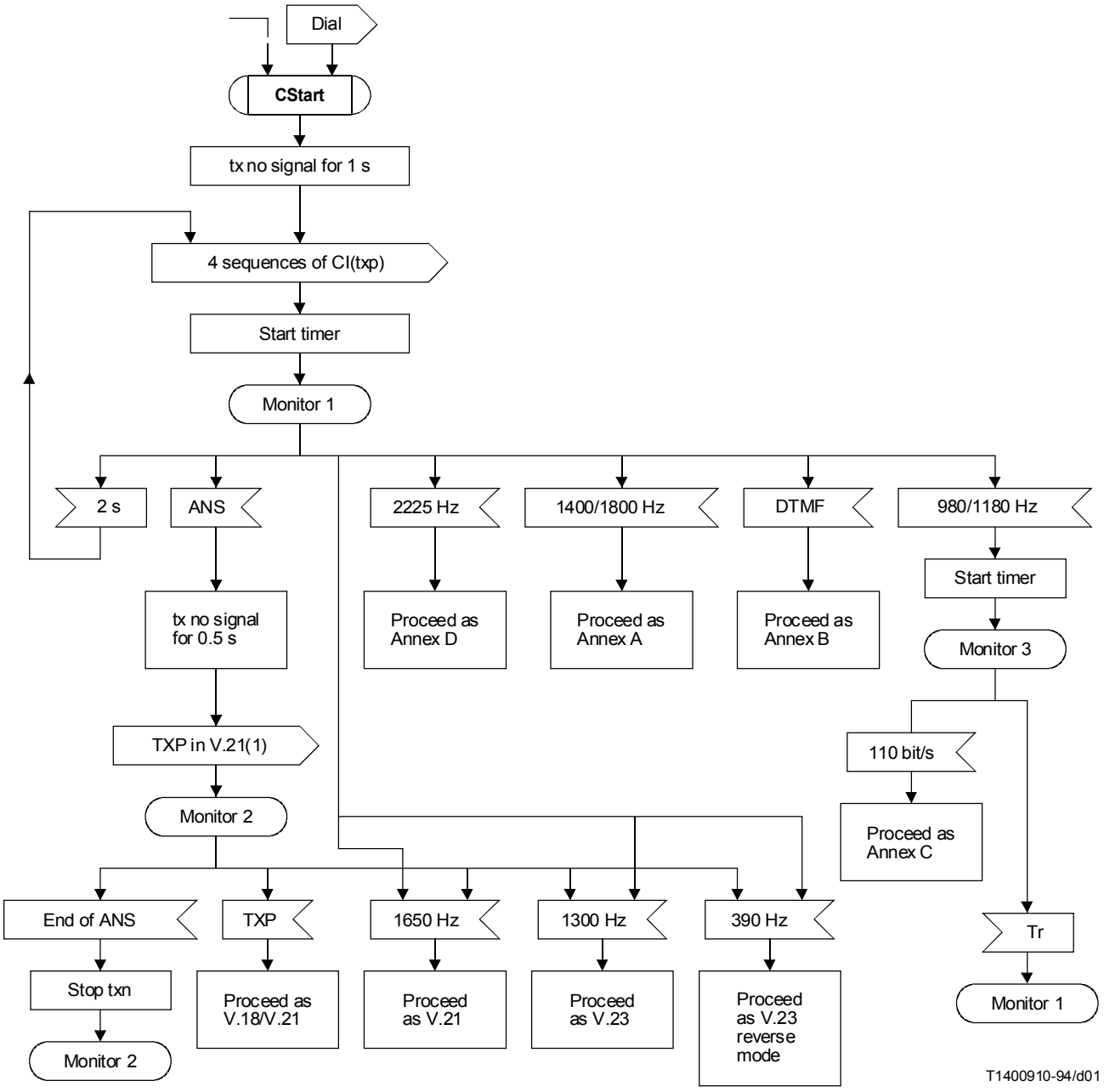

FIGURE 1/V.18

Start-up procedures for the originating text telephone showing automoding

5.1.3 If the modem detects 2225 Hz, it shall connect as Annex D.

5.1.4 If 1650/1850 Hz for 0.2 second are detected, the modem shall connect as per Recommendation V.21.

5.1.5 If 1300 Hz is detected for 1 second, the modem connect as per Recommendation V.23.

5.1.6 If a sequence of 1400 Hz and 1800 Hz FSK signals (i.e. valid 5-bit characters) are detected, the modem shall connect in the 5-bit mode using the character conversion specified in 5.2 and the operational characteristics specified in Annex A.

5.1.7 If Dual Tone Multi-Frequency (DTMF) signals are detected, the modem shall connect in the DTMF mode using the character conversion specified in 5.4 and the operational characteristics specified in Annex B.

5.1.8 If 980 /1180 Hz signals are detected, the modem shall start a 2-second timer Tr and attempt to determine the data signalling rate of the sequence.

5.1.8.1 If the data signalling rate is 110 bit/s, the modem shall connect in the EDT mode using the operational characteristics specified in Annex C.

5.1.8.2 If the timer expires, the modem shall return to the monitor A state.

5.2 Automoding Answering

5.2.1 When in the automatic answer mode the modem shall answer the incoming call, and condition its receiver to detect :

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

The 3-second timer Ta shall be started. No disconnect timers shall be started. The procedures are defined below, and represented in Figures 2a and 2b. The order of the procedures given below, following the detection period for CI, is given for illustration only as the automoding should be ordered by the user on the basis of a "most likely to occur" scenario (see Appendix I).

5.2.2 If signal CI coded for text telephone is detected, the modem shall transmit answer tone ANS as defined in Recommendation V.25, and monitor for signal TXP.

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

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

5.2.3.1 If 980 Hz is detected, the modem shall connect as per Recommendation V.21.

5.2.3.2 If 1300 Hz is detected, the modem shall connect as per Recommendation V.23.

5.2.3.3 If 1650 Hz is detected, the modem shall connect as per Recommendation V.21 reversed (in the calling mode).

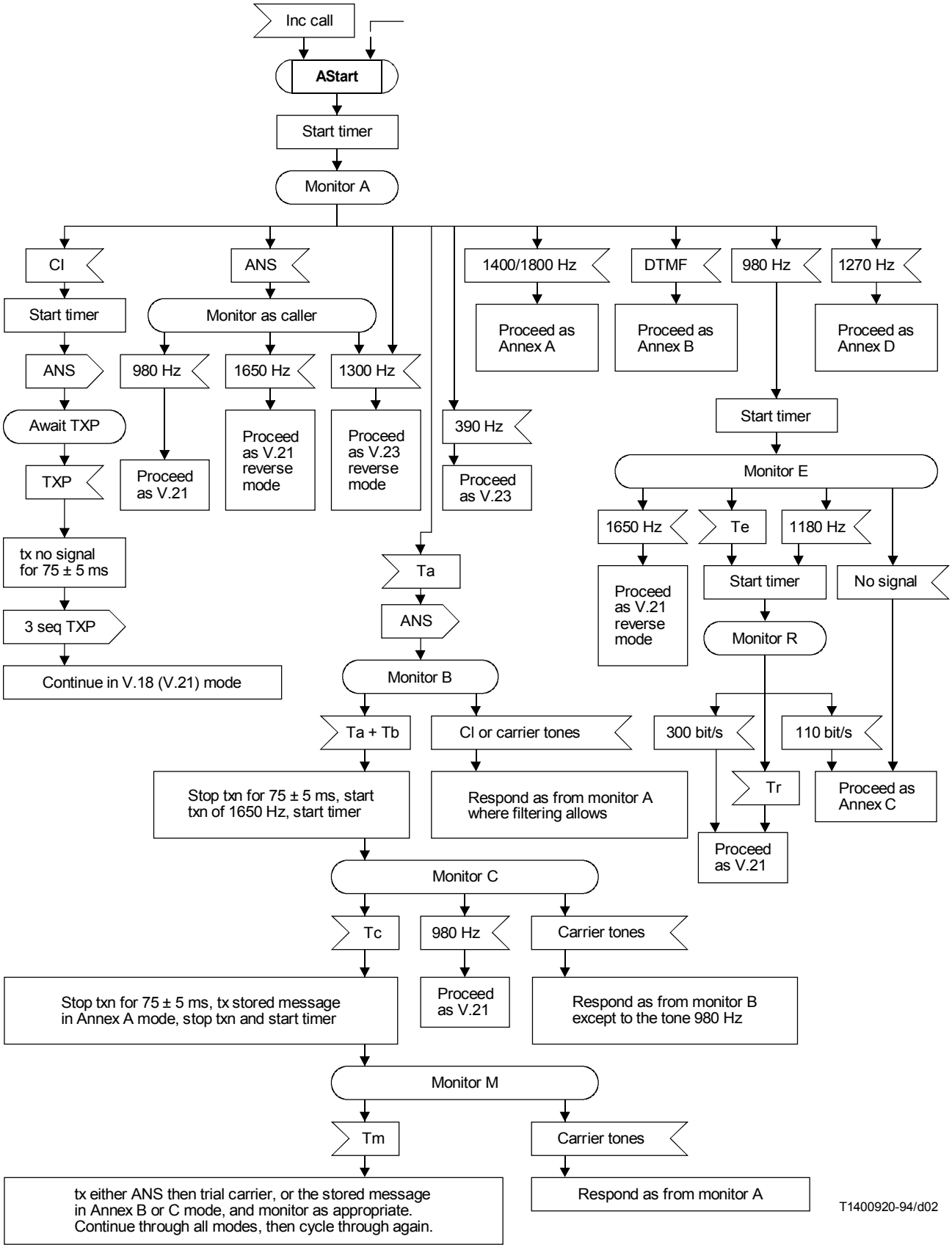

FIGURE 2a/V.18

Start-up procedure in answering V.18 modem showing automoding and carrier mode stimulus

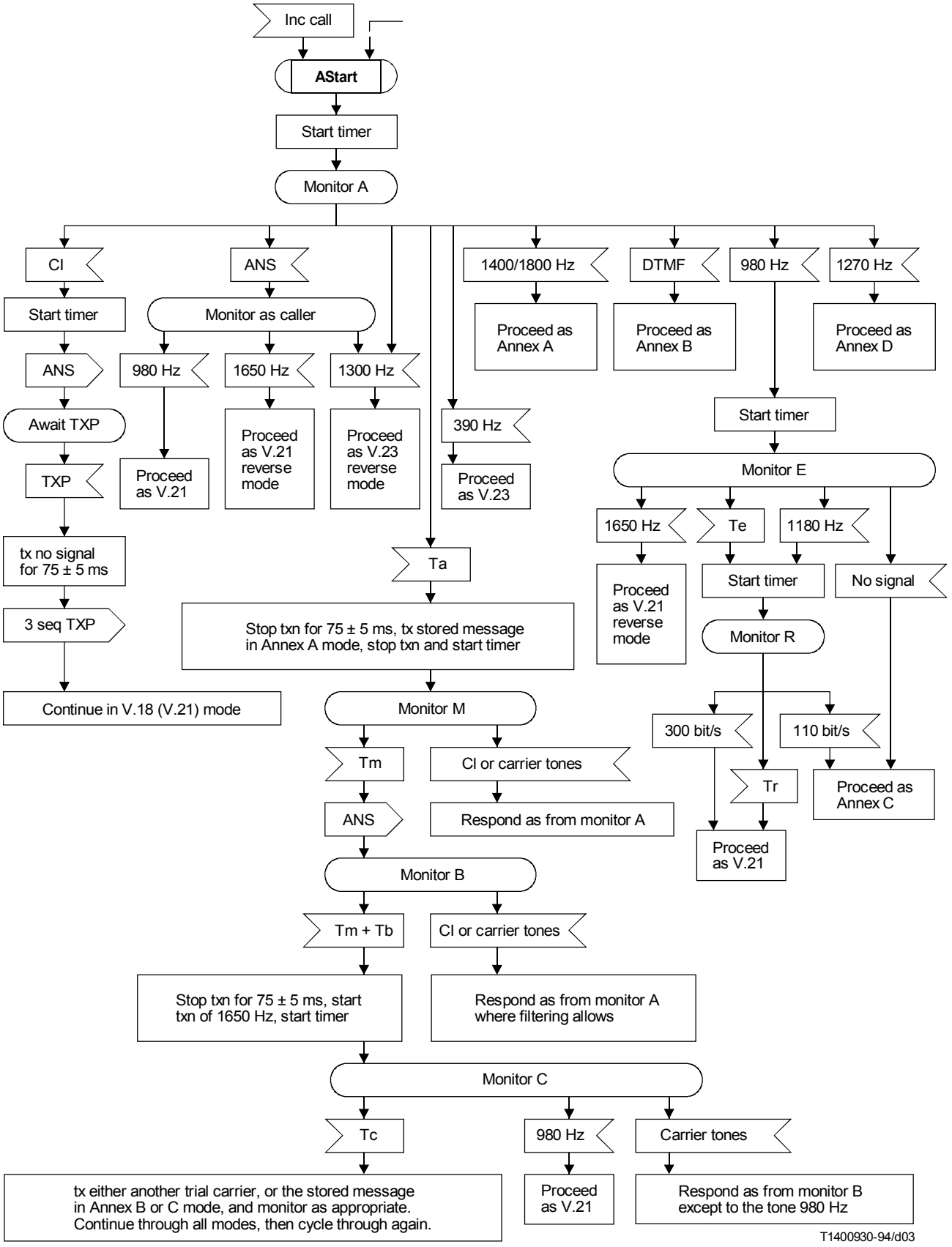

FIGURE 2b/V.18

Start-up procedure in answering V.18 modem showing automoding and carrierless mode stimulus

5.2.4 If 980 Hz is detected, the modem shall start 2.7-second timer Te and monitor for 1650 Hz and 1180 Hz.

5.2.4.1 If 1650 Hz is detected, the modem shall connect as per Recommendation V.21 reversed (in the calling mode).

5.2.4.2 If 1second of no signal is detected, the modem shall connect as per Annex C.

5.2.4.3 If either 1180 Hz is detected or timer Te expires, the modem shall start 1-second 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 modem shall connect in the EDT mode using the operational characteristics specified in Annex C.

5.2.4.3.2 If the data signalling rate is 300 bit/s or timer Tr expires, the modem shall continue as per Recommendation V.21.

5.2.5 If a sequence of 1400/1800 Hz FSK signals (i.e. valid 5-bit characters) are detected, the modem shall connect in the 5-bit mode using the character conversion specified in 5.3 and the operational characteristics specified in Annex A.

5.2.6 If Dual Tone Multi-Frequency (DTMF) signals are detected, the modem shall connect in the DTMF mode using the character conversion specified in 5.4 and the operational characteristics specified in Annex B.

5.2.7 If 1070/1270 Hz is detected, the modem shall connect as per Annex D.

5.2.8 If Ta expires, the modem shall proceed either per 5.2.8.1 or per 5.2.8.2, depending on the most likely scenario determined by the user.

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

NOTE – The modem 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.

5.2.8.2 The modem shall transmit ANS, set 2-second timer Tb and monitor the line for 980 Hz, 1270 Hz and 1300 Hz.

5.2.8.2.1 If 980 Hz is detected, the modem shall connect as per Recommendation V.21.

5.2.8.2.2 If 1270 Hz is detected, the modem shall connect as Annex D.

5.2.8.2.3 If 1300 Hz is detected, the modem shall connect as per Recommendation V.23.

5.2.9 If timer Tb expires, the modem shall remain silent for 75 ± 5 ms then transmit, for the duration of variable timer Tc (default 2 seconds) depending on the user setting 1300 Hz carrier , 1650 Hz or 2125 Hz. The modem shall monitor for the appropriate response while transmitting any of the above carriers.

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

5.3 Character conversion in 5-bit mode

The initial condition of the converter shall be the Letters (LTRS) mode, therefore the modem 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 modem shall send the appropriate mode character (i.e. LTRS or FIGS) every 72 characters.

5.3.1 The 5-bit codes supported are given in Tables B.1 and B.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.

5.3.2 The modem 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).

5.3.3 The modem 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.

5.4 Character conversion in DTMF mode

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

5.4.2 The modem 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) per Table C.1.

5.4.3 The modem shall convert the Recommendation T.50 coded characters received from the DTE on Circuit 103 (or its equivalent) to the appropriate DTMF characters and transmit to the line per Table C.2.

5.5 Character conversion in the EDT mode

Although no character conversion is required, the EDT must use the following character structure. The 7-bit T.50 coded character shall be proceeded by one (1) START bit and shall be followed by one EVEN PARITY bit, and 2 STOP bits.

Annex A

5-bit Operational Mode

(This annex forms an integral part of this Recommendation)

A.1 Mode of operation

The communications channel is half-duplex with no channel turnaround. The receiver shall be disabled for 300 ms when a character is transmitted.

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 for a binary 1 and 1800 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 bit/s respectively.

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	000 1010	*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 trnslator to the LTRS mode (see Table A.2).

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

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

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 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
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

(This annex forms an integral part of this Recommendation)

B.1 Mode of operation

The communications channel is half-duplex.

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 (Note1)	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*	BACKSPACE	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

TABLE B.1/V.18 (*end*)

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
#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.

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 (*end)*

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

(This annex forms an integral part of this Recommendation)

C.1 Mode of operation

The communications channel is half-duplex with no channel turnaround. The receiver is disabled for 300 ms when a character is transmitted.

C.2 Modulation

The modulation is frequency shift keyed modulation (i.e. carrier is 10 ms before a character is transmitted and removed 1 second after the last character) using Recommendation V.21(1) frequencies. The data signalling rate is 110 bit/s.

Annex D

Bell 103 mode

(This annex forms an integral part of this Recommendation)

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 modem 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)].

Appendix I

Representative ordering of automoding

(This appendix does not form an integral part of this Recommendation)

The following orderings of automoding are suggested for the specified countries:

USA

CI detection period

Send 5-bit code buffered message

Send ANS

Send Annex D carrier

Send V.21 carrier

Send V.23 carrier

Send EDT code buffered message

Send DTMF buffered message

UK/Scandinavian Countries

CI detection period

Send ANS

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

Australia, Ireland

CI detection period

Send 5-bit code buffered message

Send ANS

Send V.21 carrier

Send V.23 carrier

Send EDT code buffered message

Send DTMF buffered message

Send Annex D carrier

Germany, Switzerland

CI detection period

Send EDT code buffered message

Send ANS

Send V.21 carrier

Send V.23 carrier

Send 5-bit code buffered message

Send DTMF buffered message

Send Annex D carrier

Netherlands

CI detection period

Send DTMF buffered message,

Send ANS

Send V.21 carrier

Send V.23 carrier

Send 5-bit code buffered message

Send EDT buffered message

Send Annex D carrier

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