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DATA COMMUNICATION OVER THE TELEPHONE NETWORK

PROCEDURES FOR STARTING SESSIONS OF DATA TRANSMISSION OVER THE GENERAL SWITCHED TELEPHONE NETWORK

ITU-T Recommendation V.8

(Previously "CCITT Recommendation")

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.8 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.

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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.8

PROCEDURES FOR STARTING SESSIONS OF DATA TRANSMISSION OVER THE GENERAL SWITCHED TELEPHONE NETWORK

(Geneva, 1994)

The ITU-T,

considering

(a)   that many DCEs can provide operation according to a number of different V-Series modem Recommendations, and a means is needed to determine automatically, prior to initiation of modem handshake, the best available operational mode between two DCEs connected via the GSTN;

(b)   that circuit multiplication equipments (CMEs) in the GSTN will increasingly need to deploy demodulation/remodulation in order to maintain and improve data signalling rates, and therefore need timely information on the V-Series modulation to be employed in any new session of data transmission;

(c)   that there is increasing demand for the means to enable a GSTN call to be passed on automatically to an appropriate DCE;

(d)   that a new start-up procedure should have the minimum potential for adversely affecting existing DCEs;

(e)   that the procedure must continue to provide signals for interacting with GSTN echo-control equipment, as provided for in Recommendation V.25;

recommends

the procedures defined below.

1   Scope

This Recommendation defines signals to be exchanged between DCEs over the GSTN when a session of data transmission needs to be established, but before signals are exchanged which are specific to a particular modem Recommendation.

2   References

–   ITU-T Recommendation V.2

–   ITU-T Recommendation V.17

–   ITU-T Recommendation V.18 (1994)

–   ITU-T Recommendation V.21

–   ITU-T Recommendation V.22

–   ITU-T Recommendation V.22 *bis*

–   ITU-T Recommendation V.23

–   ITU-T Recommendation V.25

–   ITU-T Recommendation V.26 *bis*

–   ITU-T Recommendation V.26 *ter*

–   ITU-T Recommendation V.27 *ter*

–   ITU-T Recommendation V.29 (with GSTN usage defined in a T-Series Recommendation)

–   ITU-T Recommendation V.32

–   ITU-T Recommendation V.32 *bis*

–   ITU-T Recommendation V.34 (1994)

–   ITU-T Recommendation V.42

–   ITU-T Recommendation T.30

3   Definitions

call indicator signal (CI): A signal transmitted from the call DCE to indicate the general communication function. CI is transmitted with an ON/OFF cadence defined in 7.1. The ON periods consist of a repetitive sequence of bits at 300 bit/s, modulating V.21(L), the low-band channel defined in Recommendation V.21.

signal CNG: The call tone defined in Recommendation T.30.

signal CT: Any call tone allowed for in Recommendation V.25.

call menu signal (CM): A signal (see 7.3) transmitted from the call DCE primarily to indicate modulation modes available in the call DCE. CM consists of a repetitive sequence of bits at 300 bit/s, modulating V.21(L), the low-band channel defined in Recommendation V.21.

CM terminator (CJ): A signal which acknowledges the detection of a JM signal and indicates the end of a CM signal. CJ consists of three consecutive octets of all ZEROs with start and stop bits, modulating V.21(L) at 300 bit/s.

joint menu signal (JM): A signal (see 7.4) transmitted from the answer DCE primarily to indicate modulation modes available jointly in the call and answer DCEs. JM consists of a repetitive sequence of bits at 300 bit/s, modulating V.21(H), the high-band channel defined in Recommendation V.21.

ANS: Answer tone as defined in Recommendation V.25.

ANSam: A sinewave signal at 2100 Hz, amplitude-modulated, as defined in 7.2.

sigC: A signal transmitted by a call DCE specific to a V-Series modem Recommendation.

sigA: A signal transmitted by an answer DCE specific to a V-Series modem Recommendation.

4   Overview of the Recommendation

4.1   Call indication

The V.8 alternative to call tone (CT), signal CI, carries information to permit the selection of call functions, eg. facsimile or data. The subsequent CM/JM exchange also provides for this function as well as other functions outlined in 4.2.

4.2   Modulation mode selection

The exchange of call menu and joint menu signals, CM and JM, enables DCEs to choose, for a forthcoming data session on the GSTN, the best V-Series modulation mode from those available in both the call and answer DCEs.

The CM/JM exchange also provides for protocol selection and GSTN access indication.

JM signals also provide information in a form suitable for GSTN circuit multiplication equipment (CME) prior to the onset of modem training.

5   Coding format

Signals CI, CM and JM use a common coding format. Each of these signals consists of a repeated sequence of bits. A sequence consists of 10 ONEs followed by 10 bits for synchronization and then information-bearing octets, each octet being preceded by a start-bit (ZERO), and followed by a stop-bit (ONE).

To avoid confusion of signal JM with Recommendation T.30 signals which also use V.21(H) modulation, a coding constraint is maintained which ensures that HDLC flags (01111110) cannot appear in the bit stream.

Each octet lies within one "information category". The coding format allows information categories to be expanded for special applications, while keeping signals brief for the majority of applications.

The first information category in a sequence shall be the call function. No particular ordering is required for subsequent information categories. All information within one category shall be carried in one octet or, when necessary, in an ordered sequence of octets.

5.1   Category octets

Category octets are those which occur first in any new information category, and include a 4-bit code identifying the information category. The format is shown below with bits listed from left to right in order of transmission:

start-bit (0)   b0   b1   b2   b3   0   b5   b6   b7   stop-bit (1)

Bits b0-b3 make up the category tag with b0 the least-significant bit, b4 is set to ZERO to prevent flag simulation, and bits b5-b7 are "option bits" relevant to the information category.

5.2   Extension octets

When 3 option bits are inadequate for a particular category, any number of extension octets may follow directly after a category octet. The format for an extension octet is shown below:

start-bit (0)   b0   b1   b2   0   1   0   b6   b7   stop-bit (1)

Bits b0-b2, b6 and b7 provide five additional option bits in the current category. Bit b4 is set to ONE in order to distinguish an extension octet from a category octet, and bits b3 and b5 are set to ZERO to prevent flag simulation.

6   Code tables

Information categories and extension octets beyond those specified in the tables below are all reserved for future definition by the ITU-T. To be compatible with future versions of Recommendation V.8, a receiver shall ignore all bits, codes and octets reserved for such future definition.

Table 1 shows the preamble to each signal sequence. This consists of ten ONEs followed by ten bits for synchronization.

TABLE 1/V.8

Preamble

1	1	1	1	1	1	1	1	1	1	Ten ONEs preceding each information sequence
0	0	0	0	0	0	0	0	0	1	Synchronization for CI sequences
0	0	0	0	0	0	1	1	1	1	Synchronization for CM and JM sequences

Table 2 lists the information categories, identified by a 4-bit category tag b0-b3.

TABLE 2/V.8

Information categories

Start	b0	b1	b2	b3	b4	b5	b6	b7	Stop	Category octets (b4 = 0) with category given by tag b0-b3
0	1	0	0	0	0	x	x	x	1	Call function
0	1	0	1	0	0	x	x	x	1	Modulation modes
0	0	1	0	1	0	x	x	x	1	Protocols
0	1	0	1	1	0	x	x	x	1	GSTN access

6.1   Call functions

Table 3 shows how the 3 option bits in a call-function octet are used to identify particular call functions:

TABLE 3/V.8

The call function category

Start	b0	b1	b2	b3	b4	b5	b6	b7	Stop	Octet – 'callf0'
0	1	0	0	0						Tag b0-b3 indicating the call function category
					0					Indicates a category octet
						0	0	0		To be determined by the ITU-T
						1	0	0		To be determined by the ITU-T
						0	1	0		Textphone according to Recommendation V.18
						1	1	0		To be determined by the ITU-T
						0	0	1		To be determined by the ITU-T
						1	0	1		To be determined by the ITU-T
						0	1	1		Transmit and receive data
						1	1	1		Call function as indicated in an extension octet
									1	Stop bit

6.2 Modulation modes

Table 4 shows the coding over 3 octets to indicate availability of GSTN V-Series modulation modes. Availability shall be shown only if the modulation mode can be used with the indicated call function, and if it is desired to convey that capability to the remote DCE.

TABLE 4/V.8

Modulation modes

Start	b0	b1	b2	b3	b4	b5	b6	b7	Stop	Octet – 'modn0'	Item
0	1	0	1	0						Tag b0-b3 indicating the modulation modes category	
					0					Indicates a category octet	
						0				Reserved for future definition by the ITU-T	0
							x			1 denotes V.34 duplex availability	1
								x		1 denotes V.34 half-duplex availability	2
									1	Stop bit	
0										Octet – 'modn1'	
	x									1 denotes V.32 *bis*/V.32 availability	3
		x								1 denotes V.22 *bis*/V.22 availability	4
			x							1 denotes V.17 availability	5
				0	1	0				Indicates an extension octet	
							x			1 denotes V.29 half-duplex availability (as used in T.30, etc.	6
								x		1 denotes V.27 *ter* availability	7
									1	Stop bit	
0										Octet – 'modn2'	
	x									1 denotes V.26 *ter* availability	8
		x								1 denotes V.26 *bis* availability	9
			x							1 denotes V.23 duplex availability	10
				0	1	0				Indicates an extension octet	
							x			1 denotes V.23 half-duplex availability	11
								x		1 denotes V.21 availability	12
									1	Stop bit	

6.3 Protocols

Table 5 lists codes within the protocol category.

If the LAPM protocol code is indicated in CM and the answer DCE wishes to use LAPM, a protocol octet is also transmitted in JM indicating LAPM.

TABLE 5/V.8

The protocol category

Start	b0	b1	b2	b3	b4	b5	b6	b7	Stop	Octet – 'prot0'
0	0	1	0	1						Tag b0-b3 indicates the protocol category
					0					Indicates a category octet
						1	0	0		Calls for LAPM protocol according to V.42
						1	1	1		Calls for protocol as indicated in an extension octet
									1	Stop bit
NOTE – Absence of this octet does not preclude alternative means of protocol negotiation.										

6.4 GSTN access

Table 6 provides codes for indicating cellular access to the GSTN connection.

TABLE 6/V.8

GSTN access category

Start	b0	b1	b2	b3	b4	b5	b6	b7	Stop	Octet – 'access0'
0	1	0	1	1						Tag b0-b3 indicates the GSTN access category
					0					Indicates a category octet
						x				1 denotes that the call DCE is on a cellular connection
							x			1 denotes that the answer DCE is on a cellular connection
								0		Reserved for future definition by the ITU-T
									1	Stop bit
NOTE – Absence of this octet conveys no information about the type of GSTN access.										

7 Descriptions of signals

7.1 Function indicator signal CI

To initiate a session of data transmission on the GSTN, a DCE transmits either CI, CT, CNG or no signal. Signal CI is a V.8 alternative to call tone CT, and is coded to indicate a call function. The term "call signal" is used hereinafter to refer to CI, CT or CNG.

CI is transmitted from the call DCE with a regular ON/OFF cadence. The ON periods shall be not less than 3 periods of the CI sequence, and not greater than 2.0 s in duration; the OFF periods shall be not less than 0.4 s and not greater than 2.0s in duration.

A CI sequence consists of 10 ONEs followed by 10 synchronization bits and the call function octet.

The transmission and detection of CI is optional in most DCE Recommendations. Whether or not this option is used, DCEs conforming with Recommendation V.8 should not malfunction if CI is received.

7.2   Modified Answer Tone ANSam

Modified answer tone ANSam consists of a sinewave signal at 2100 ± 1Hz with phase reversals at an interval of 450 ± 25 ms, amplitude-modulated by a sinewave at 15 ± 0.1 Hz. The modulated envelope shall range in amplitude between (0.8 ± 0.01) and (1.2 ± 0.01) times its average amplitude. The average transmitted power shall be in accordance with Recommendation V.2.

The average power outside the band 2100 ± 200 Hz produced by using an approximation to the 15 Hz sinewave envelope shall be at least 24 dB below the average power within that band.

When network echo canceller disabling is not required, phase reversals shall not be imparted to the ANSam signal.

A call DCE shall not transmit a signal CM unless ANSam has been detected.

> NOTE – The call DCE needs to distinguish ANSam from ANS. Detector design needs to allow for transient variations in the received answer-tone amplitude and phase that may be generated occasionally by network equipment.

7.3   The Call Menu signal CM

Signal CM initiates the process of modulation-mode selection.

A CM sequence starts with 10 ONEs followed by 10 synchronization bits as given in Table 1.

The first information category in CM indicates the required call function in accordance with Table 3. CM shall also include one or more octets indicating available modulation modes in accordance with Table 4.

The protocol category may be included in order to negotiate LAPM without requiring the ODP/ADP exchange (see 7.2.1/V.42) (see Table 5).

The GSTN access category is included if the call DCE wishes to indicate cellular access (see Table 6). In this case bit b5 is set to ONE and bit b6 is set to ZERO.

A CM signal is terminated (after JM detection) by the transmission of a CJ signal.

7.4   The Joint Menu signal JM

A signal JM is transmitted from an answer DCE only in response to a detected CM signal. JM shall be transmitted after a minimum of two identical CM sequences have been received.

A JM sequence starts with 10 ONEs followed by 10 synchronization bits as given in Table 1.

The first information category in JM indicates the same call function as in the received CM or, if the call function is not available in the answer DCE, JM may indicate a different call function (see 8.2.3).

If there are modulation modes in common between the call and answer DCEs, JM shall include the octets necessary to indicate all modulation modes that are both indicated in CM and available in the answer DCE for use with the call function indicated in CM. Additional modulation mode octets that are in CM may also be included. The indicated modulation mode with the lowest item number (see Table 4) shall be used in the subsequent data session.

If there are no modulation modes in common between the call and answer DCEs, the JM sequence shall include the same number of modulation-mode octets as CM, and show zeros for all modulation modes.

If the LAPM protocol code is indicated in CM, the protocol octet may be included in JM in order to complete the negotiation of LAPM (see Table 5).

The GSTN access category is included if the answer DCE wishes to indicate cellular access, or if this category is present in the received CM (see Table 6). If the answer DCE wishes to indicate cellular access, bit b6 is set to ONE. Bit b5 is set to ONE if and only if the corresponding bit (b5) is set to ONE in the received CM.

8 Data session start-up procedure

Figure 1 shows the signal interaction diagram with CI, ANSam and CM/JM signals. T_e is the silent period allowed for disabling of network echo-control equipment.
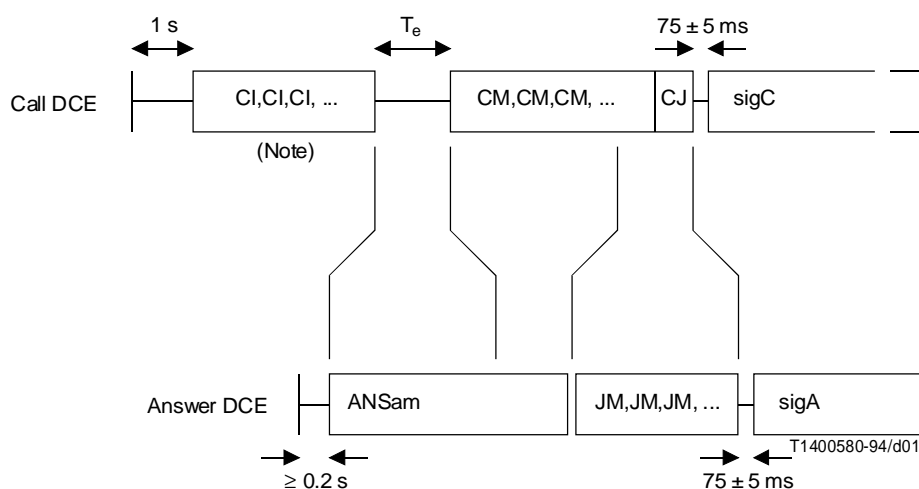
NOTE – Use of CI as a call signal is optional. Compatibility with existing answer terminals will sometimes mandate the use of CNG or CT.

FIGURE 1/V.8

Use of the CI call signal and exchange of CM/JM menu signals

8.1 Start-up procedure in the call DCE

8.1.1 Call signal transmission

After transmitting no signal for 1 s, the DCE shall initiate transmission of CI, CT or CNG, or continue transmission of no signal.

The DCE shall then seek to detect ANS, ANSam, or a sigA that is characteristic of an acceptable mode of modulation.

NOTE – The transmission of a V.21(H) signal before the transmission of answer tone is being studied by the ITU-T for some facsimile applications. A call DCE conforming with Recommendation V.8 should not malfunction if such a signal is received.

If a suitable sigA is detected, then the call modem shall proceed in accordance with the modulation mode indicated by sigA. Such procedure is outside the scope of this Recommendation.

After detection of ANS or ANSam, the call signal shall be stopped. However the call DCE may choose to ensure that CI has been transmitted for a minimum of 3 full sequences.

If ANSam (rather than ANS) is detected, the DCE shall transmit no signal for a period T_e prior to transmitting signal CM. The silent period T_e begins after the termination of the call signal or, in the absence of a call signal, after the detection of ANSam. The minimum value for T_e shall be 0.5 s. However, if it is desired to allow for network echo canceller disabling in the manner defined in Recommendation V.25, T_e shall be set to a value $\geq 1s$. The procedure shall continue in accordance with 8.1.2.

If ANS (rather than ANSam) is detected, the DCE shall proceed in accordance with Annex A/V.32 *bis*, Recommendation T.30, or other appropriate Recommendation.

8.1.2 Call menu transmission

When interval T_e has elapsed, the call DCE shall initiate transmission of signal CM and condition its receiver to detect signal JM.

After a minimum of 2 identical JM sequences have been received, the call DCE shall complete the current octet and associated start and stop bits and then signal CJ shall be transmitted. Following CJ, the call DCE shall transmit no signal for a period of 75 ± 5 ms, transmit sigC and proceed in accordance with the selected V-Series modulation mode.

If JM showed zeros for all modulation modes, the call DCE may disconnect after transmission of CJ.

8.2 Start-up procedure in the answer DCE

For a period of at least 0.2 s after connection to line, the answer DCE shall transmit no signal.

Some Recommendations require that the answer DCE shall delay the transmission of answer tone unless or until some signal is detected from the call DCE. In these cases, upon detection of CI, CT or CNG as appropriate, the DCE shall proceed in accordance with 8.2.1 or 8.2.2.

Other Recommendations require that answer tone shall be transmitted without waiting for call signals. Such DCEs shall proceed directly in accordance with 8.2.1 or 8.2.2.

8.2.1 ANS transmission

Some Recommendations require the transmission of unmodulated answer tone (ANS) and do not allow for CM/JM exchanges. The procedure following the transmission of ANS is outside the scope of this Recommendation.

8.2.2 ANSam transmission

If the answer DCE supports CM/JM exchanges, ANSam shall be transmitted.

Upon receiving a minimum of 2 identical CM sequences, the DCE shall transmit JM and proceed in accordance with 8.2.3.

If a suitable sigC is detected during ANSam transmission, the DCE shall transmit no signal for 75 ± 5 ms, transmit the appropriate sigA and continue in accordance with the relevant modem Recommendation.

If neither CM nor a suitable sigC is detected during ANSam transmission, the DCE shall transmit no signal for 75 ± 5 ms and then continue in accordance with Annex A/V.32 *bis*, or Recommendation T.30 or other appropriate Recommendation. If not terminated by the receipt of CM or a suitable sigC, ANSam shall be transmitted for a period of 5 ± 1 s.

8.2.3 JM transmission

If the call function is available, JM shall be coded to indicate the same call function as CM, and to indicate the modulation modes jointly available in call and answer DCEs.

If the call function is not available, the answer DCE may indicate an available call function different from CM. If JM is sent, it shall include the same number of modulation mode octets as CM and show zeros for all modulation modes.

JM transmission shall continue until signal CJ is detected and all 3 octets of CJ have been received. In the case that CJ is not correctly received, other criteria may be used to terminate transmission of JM, such as detection of sigC corresponding to the selected modulation mode, or the absence of CM for a suitably long period of time.

JM shall be terminated without any requirement to complete a current JM sequence. No signal shall be transmitted for a period 75 ± 5 ms, followed by sigA corresponding to the selected modulation mode. SigA and subsequent responses shall be as defined in the relevant V-Series modem Recommendation.

If JM shows zeros for all modulation modes, the answer DCE may disconnect on reception of CJ.

9   DTE-DCE interchange circuits

During the V.8 procedure, there is no requirement for DTE-DCE communication, and the Recommendation does not provide for any such communication. The states of interchange circuits may therefore be determined by the procedures before and after the V.8 procedure.