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SERIES V: DATA COMMUNICATION OVER THE
TELEPHONE NETWORK

Interfaces and voiceband modems

**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

(Previously CCITT Recommendation)

ITU-T V-SERIES RECOMMENDATIONS
DATA COMMUNICATION OVER THE TELEPHONE NETWORK

- 1 – General
- 2 – **Interfaces and voiceband modems**
- 3 – Wideband modems
- 4 – Error control
- 5 – Transmission quality and maintenance
- 6 – Interworking with other networks

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

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.25, 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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CONTENTS

	<i>Page</i>
1 Scope	1
2 Abbreviations and definitions	2
3 Interface procedures at call-originating data station	3
4 Interface procedure at answering data station	6
5 Proposed line procedures	6
6 Manually controlled modem calling automatically controlled modem.....	7
7 Automatically controlled calling modem calling manually controlled modem.....	7
8 Disabling of echo suppressors in the case of manually operated data stations	8
9 Notification to ordinary telephone users	8
10 Manual selection of automatic answering, data mode and voice mode	8
11 2100 Hz tone recognition	8
References	9

**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**

*(Mar del Plata, 1968; amended at Geneva, 1972 and 1976;
revised at Malaga-Torremolinos in 1984 and at Geneva in 1996)*

1 Scope

1.1 This Recommendation is concerned with the setting-up of a data connection when Data Circuit-terminating Equipment (DCE) comprising automatic answering equipment is used over international circuits. Automatic calling procedures are defined in Recommendations V.25 *bis* and V.25 *ter*.

NOTE – Up to and including the 1988 (*Blue Book*) version, this Recommendation, in addition to what is outlined herein, specified parallel automatic calling equipment using the 200-Series interchange circuits defined in Recommendation V.24, and an associated automatic call set-up protocol. It is the opinion of the ITU-T that both this type of equipment and the associated protocol are out of date, and that more modern techniques and protocols are specified in Recommendations V.25 *bis* and V.25 *ter*. It is therefore not recommended to use this technique for new designs.

Automatic answering equipment used within any single Member's area or between two Members by bilateral agreement is not necessarily constrained by the procedures specified herein. In particular, the use of the 2100 Hz answering tone, as described in this Recommendation, could be substituted by another tone when the equipment is used over circuits not equipped with echo control devices. Similarly, the calling tone could be omitted by bilateral agreements, but attention is drawn to clauses 7 and 8 below.

In addition, the provisions for echo canceller disabling and for a "calling station response" prior to the termination of the answer tone are optional and only applicable to Data Circuit-terminating Equipment (DCE) for which the relevant V-Series Recommendation specifically calls for such provision(s).

1.2 This Recommendation describes the sequence of events involved in establishing a connection between an automatic calling data station¹⁾ and an automatic answering data station for V-Series Recommendations modems specified for general switched telephone network operations.

Consideration is given only to:

- a) the events which affect the interfaces between the data terminal equipment and the data circuit-terminating equipment at the answering data station; and
- b) the events on the line during establishment of a data call.

Interactions within the data circuit-terminating equipment are not considered, since such consideration is unnecessary for purposes of international standardization.

1.3 The proposed procedures are intended to be suitable for four types of calls, namely:

- a) automatic calling data station to automatic answering data station;
- b) manual calling data station to automatic answering data station;
- c) automatic calling data station to manual answering data station;
- d) disabling of echo suppressors in the case of manual calling data stations.

¹⁾ In this Recommendation, the term "data station" is synonymous with the term "terminal installation for data transmission" [1].

- 1.4** The data terminal equipment is responsible for:
- a) during call establishment:
 - i) ensuring that the data circuit-terminating equipment is available for operation;
 - ii) providing the telephone number;
 - iii) deciding to abandon the call if it is unsuccessfully completed;
 - b) after call is established:
 - i) establishing identities;
 - ii) exchanging such traffic as is appropriate;
 - iii) initiating disconnect at calling and answering station.

2 Abbreviations and definitions

The following abbreviations are used in this Recommendation:

DCE Data Circuit-terminating Equipment
DTE Data Terminal Equipment

The following definitions apply to this Recommendation:

2.1 calling tone: The tone transmitted from the calling end. The calling tone consists of a series of interrupted 1300 Hz \pm 15 Hz signals (bursts). ON for a duration of not less than 0.5 s and not more than 0.7 s and OFF for a duration of not less than 1.5 s and not more than 2.0 s.^{2) 3)}

2.2 answering tone: The tone transmitted from the called end.

NOTES

1 – The answering tone is an uninterrupted 2100 \pm 15 Hz tone with a duration, except when truncated as described in 4.3, of 3.3 \pm 0.7 s.

2 – Recommendation V.8 specifies, for the purpose of starting sessions of data transmission, an amplitude modulated answering tone, ANSam.

2.3 phase reversals: Reversals (180°) in the phase of the answering tone at intervals of 425 to 475 ms. The reversal in phase shall be accomplished such that the phase is within 180 \pm 10 degrees in 1 ms, and that the amplitude of the answering tone is not more than 3 dB below its steady state value for more than 400 μ s.

2.4 starting signal: Binary 1, synchronizing signal or equalizer training signal, as specified in the relevant V-Series Recommendation.⁴⁾

2.5 calling station response: A tone or signal transmitted from the calling DCE in response to its detection, as defined in this Recommendation, of answering tone.^{4), 5), 6)}

2.6 automatic calling: A procedure by which a DTE, by use of V.24 interchange circuits, may instruct a DCE to perform the call establishment function. The transmission, from DTE to DCE, of each digit to be dialled is achieved on interchange circuit 103 (see Recommendations V.25 *bis* and V.25 *ter*).

²⁾ The calling tone and calling station response should not contain power in the band 2100 \pm 250 Hz.

³⁾ The power levels of the signals specified in this Recommendation shall conform to the levels specified in Recommendation V.2.

⁴⁾ The calling tone and calling station response should not contain power in the band 2100 \pm 250 Hz.

⁵⁾ The power levels of the signals specified in this Recommendation shall conform to the levels specified in Recommendation V.2.

⁶⁾ The specification of the calling station response and the timing of its transmission are the subject of the individual V-Series Recommendation for the DCE involved. The specifications in this Recommendation cover only limitations on its transmission during call establishment.

3 Interface procedures at call-originating data station

The description of the complete interface procedures for call initiation at a call-originating data station is not part of this Recommendation. Details may be found in Recommendations V.25 *bis* and V.25 *ter*.

Event

- 3.1 The DTE instructs the DCE to establish a call, and specifies the number to be dialled. Subsequently, circuit 108/2 is in the ON condition (circuit 108/2 may be turned in the ON condition at any time up to and including event 3.6).
- 3.2 For half-duplex modems, DTE puts circuit 105 ON if the calling end wishes to transmit first. Circuit 105 can be placed ON at any time up to and including event 3.10.
- 3.3 The DCE goes “off-hook”.
- 3.4 The telephone system puts dial tone on line.⁷⁾
- 3.5 The DCE dials the wanted telephone number.
- 3.6 The DTE turns circuit 108/2 ON, if not previously ON.
- 3.7 If implemented, the DCE transmits the interrupted calling tone to line, as shown in Figures 1, 2 and 3.

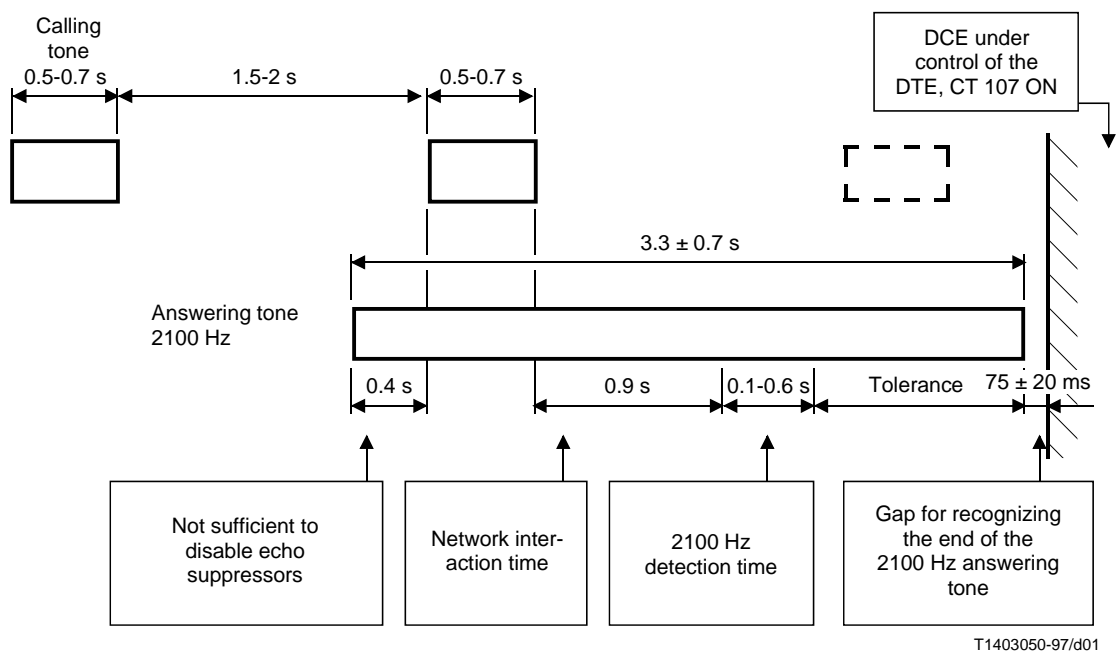
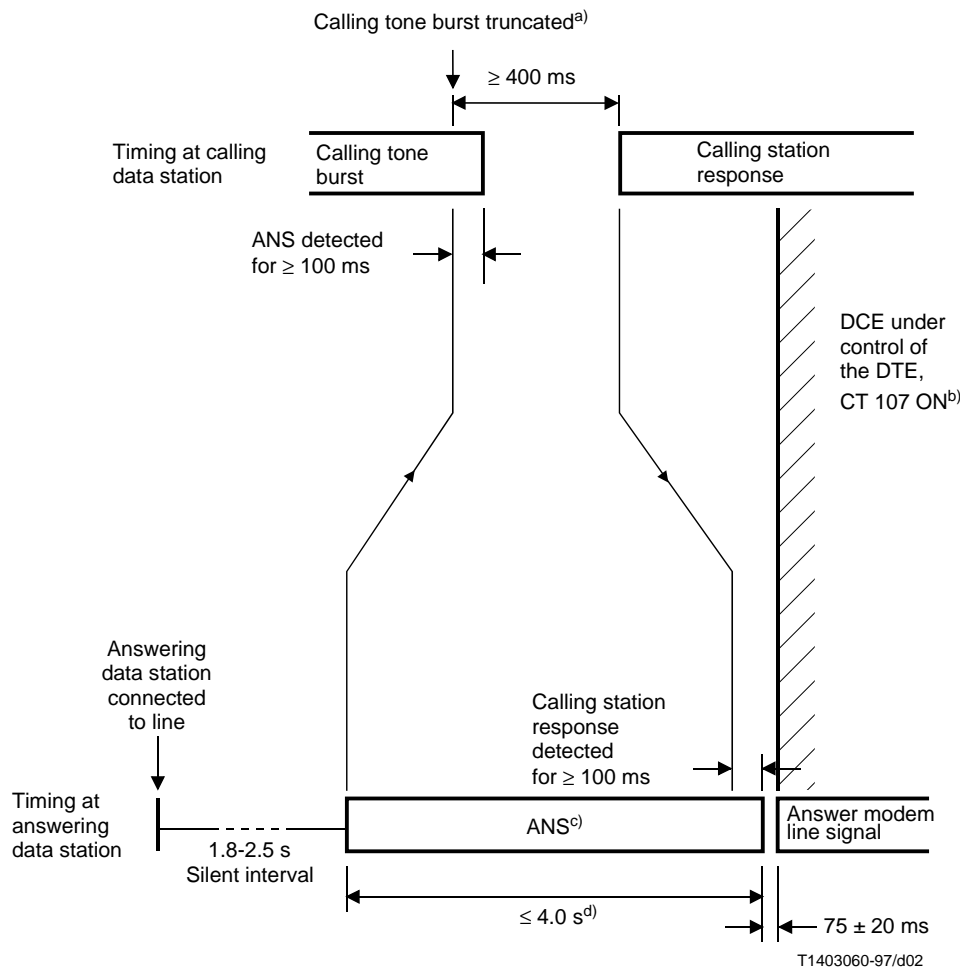


FIGURE 1/V.25
Timing of line signals

⁷⁾ Some countries apply the second dial tone to the line after the initial digit is transferred.



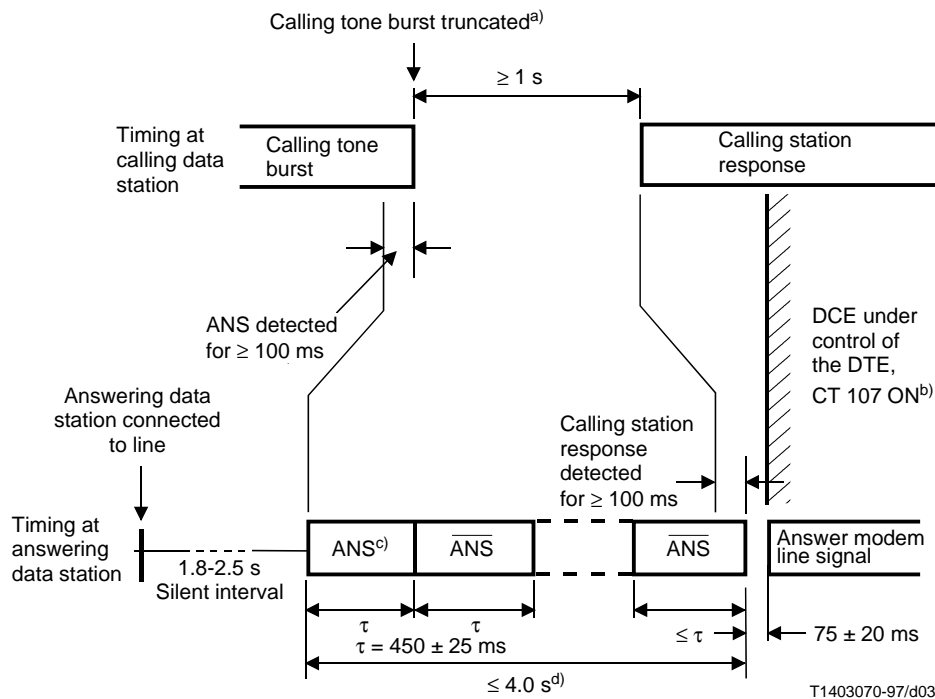
- a) If ANS is detected during a calling tone burst, the burst may be truncated. If it is not truncated, the calling station response must be delayed until at least 400 ms after the end of the burst.
- b) See 3.10 for exception.
- c) ANS denotes the answer tone.
- d) If a calling station response is not received, the answer tone shall continue for 3.3 ± 0.7 seconds.

FIGURE 2/V.25

Timing of line signals – Optional calling station response

- 3.8**
- a) If the call is answered by a data station, then the answering tone is received by the calling DCE. Echo suppressors and echo cancellers are disabled during coincidence of a silent period in the interrupted calling tone (event 3.7) with the answering tone. The answering tone shall not activate circuits 104 and 109.
- b) The subsequent action of the DCE and the DTE if no answering tone is detected is beyond the scope of this Recommendation. Details may be found in Recommendations V.25 *bis* and V.25 *ter*.

3.9 When an answering tone has been received by the DCE for a period of 100 to 600 ms, the interrupted calling tone is discontinued by the DCE as shown in Figures 1, 2 and 3. The DCE transfers control of the connection to circuit 108/2.



- a) If ANS is detected during a calling tone burst, the burst may be truncated. If it is not truncated, the calling station response must be delayed until at least 1 second after the end of the burst.
- b) See 3.10 for exception.
- c) ANS denotes the answer tone. $\overline{\text{ANS}}$ denotes the answer tone with its phase reversed.
- d) The answer tone duration must be at least 2.6 seconds if a calling station response is not received.

FIGURE 3/V.25

Timing of line signals, optional provision for echo canceller disabling and for calling station response

The DCE may, as shown in Figures 2 and 3, transmit the calling station response following the detection of a continuation of the answering tone for a period of at least 400 ms after the transmission of the calling tone is terminated. As indicated in Figure 3, the required duration (≥ 1 s) of the continuous 2100 Hz period, which must follow the termination of the calling tone, is longer if the answering tone includes phase reversals to disable echo cancellers.

3.10 The DCE examines the line to determine the end of the answering tone. The DCE detects an absence of the answering tone for 75 ± 20 ms, and then turns circuit 107 ON:⁸⁾

- i) If circuit 105 is ON, the starting signal is put on the line. After its delay as specified in the appropriate V-Series Recommendation, circuit 106 comes ON, and the DTE can then transmit data.
- ii) If circuit 105 is OFF, the incoming starting signal is recognized, and after its delay as specified in the appropriate V-Series Recommendation, the DCE turns circuit 109 ON to allow the examination of circuit 104 by the DTE.
- iii) For the duplex modem case, where circuit 105 is not used, the starting signal is put on the line after circuit 107 has been turned ON. The DCE then turns circuits 109 and 106 ON after a delay as specified in the appropriate V-Series Recommendation.

⁸⁾ For some DCEs requiring extended training sequences, the associated V-Series Recommendation may specify that circuit 107 be turned ON at some later time, during the handshake sequence, which is more consistent with the specification in Recommendation V.24 of circuit 107.

3.11 The signalling between DTE and DCE to disconnect the call is outside the scope of this Recommendation. Details may be found in Recommendations V.25 *bis* and V.25 *ter*.

NOTE – Where circuit 105 or circuit 120 is not implemented, the timing of circuit 106 or circuit 121 shall be related to circuit 107 and circuit 109 respectively.

4 Interface procedure at answering data station

Event

4.1 Ringing received on line. The DCE puts circuit 125 ON.

4.2 a) If circuit 108/2 is ON, the DCE goes “off-hook”.
b) If circuit 108/1 or circuit 108/2 is OFF, the DCE waits for circuit 108/1 or circuit 108/2 to come ON, and then goes “off-hook”. If circuit 108/1 or circuit 108/2 is not turned ON by the DTE, then the call is not answered.

4.3 The DCE goes “off-hook”, maintains silence on the line for a period between 1.8 and 2.5 s, then transmits the answering tone for a certain period of time, as shown in Figures 1 and 2.

Where it is intended to disable network echo cancellers [3] as well as echo suppressors [2], phase reversals shall be introduced, as indicated in Figure 3.

The answering tone, with continued reversals in its phase, shall continue for 3.3 ± 0.7 s unless a calling station response is received, in which case the answering tone may be discontinued after detection of the response for 100 ms.

For the very special application in which an automatically answering modem is permanently dedicated to receive calls only from acoustically coupled originating stations, the modem may, optionally, extend the duration of the answering tone to ten seconds to compensate for operator reaction time in placing the handset on the acoustic coupler. All other timeouts remain the same, and the protocol is as defined in clause 6. Use of the extended answering tone is restricted expressly to this unique application.

4.4 At the end of the transmission of the answering tone, the DCE shall provide a silent period for 75 ± 20 ms. The DCE puts circuit 107 ON after this silent period.⁹⁾

5 Proposed line procedures

The line procedures outlined are applicable to both duplex and half-duplex modems.

Systems which operate in the half-duplex mode and which employ automatic calling equipment shall determine by pre-arrangement which of the two data stations – calling or answering – shall first transmit to the other upon establishment of the data connection. As indicated in clause 3 above, the DTE at the data station which is to transmit first shall put circuit 105 ON, at the appropriate point in the call establishment sequence. For correct operation, it is necessary that the longer response times of circuits 106 and 109 as specified in the appropriate V-Series Recommendation are used during call establishment.

Figures 1, 2 and 3 show the timing of line signals when automatic calling and automatic answering are employed. The sequence of operation is as follows:

On completion of dialling as specified in the appropriate V-Series Recommendation or, where possible, the other end going off-hook, the DCE sends the calling tone to the answering data station.

⁹⁾ For some DCEs requiring extended training sequences, the associated V-Series Recommendation may specify that circuit 107 be turned ON at some later time, during the handshake sequence, which is more consistent with the specification in Recommendation V.24 of circuit 107.

1.8 to 2.5 s after the answering modem is connected to the line (i.e. circuits 125 and 108 are ON), it sends a continuous answering tone for a duration of not more than 4.0 s. If it is intended to disable network echo cancellers as well as echo suppressors, the answering modem shall transmit phase reversals (see Figure 3).

The answering tone propagates towards the calling data station and, during the course of one or two interruptions between bursts of calling tone, causes any echo suppressors in the circuit to disable. If the phase reversals are included in the signal, any echo cancellers in the circuit are also disabled.

The answering tone is recognized by the calling modem 100 ms to 600 ms after its arrival. The calling modem discontinues the calling tone and may transmit a calling station response.

The answering modem, after detecting the calling station response, shall discontinue transmission of the answering tone and shall provide a silent interval of 75 ± 20 ms in its transmitted output following the discontinuance of the answering tone and shall then turn circuit 107 ON.¹⁰⁾

The calling modem recognizes the end of the answering tone for a period of 75 ± 20 ms. At the end of this interval, the calling modem shall turn circuit 107 ON.

To keep the echo suppressor disabled, it is necessary to ensure that following the 75 ± 20 ms silent period after the transmission of the answering tone from the answering modem, which serves to disable the echo suppressor or echo canceller during the silent period in the calling tone, energy is maintained as specified in Recommendation G.164 [2].

During the automatic calling and answering procedures, the echo suppressors will be disabled, and the echo cancellers will be disabled if the required sequence is transmitted. If signal gaps, at the echo suppressor or canceller, exceed 100 ms at any time, e.g. during modem turn-around, they may become re-enabled. This requires that, to maintain the disabled state of echo control devices on circuits with satellite links, the answering modem resumes transmission after the 75 ± 20 ms silent period unless a calling station response is received prior to the silent interval and appropriately continued.

6 Manually controlled modem calling automatically controlled modem

The procedure for establishing a call from a manually controlled modem to a modem comprising automatic answering equipment is similar to that from an automatically calling modem, except that no tone is transmitted from the calling modem until the answering modem has answered. The operator dials the required number, hears 2100 Hz returned from the answering modem and then, during the period that 2100 Hz is being received, depresses his data button to connect the modem to line. Circuit 107 comes ON at the time specified in event 3.10.

Where the calling modem is acoustically coupled to the line, placement of the telephone handset on the acoustic coupler is logically equivalent to pressing a “data” button on a permanently installed modem.

Satisfactory disabling of echo suppressors and echo cancellers by the answering tone, however, will require that no speech signals from the microphone at the calling data station enter the telecommunication circuit for a period of at least 1 s during the receipt of the answering tone. This may be accomplished by a handset switch or other appropriate means.

7 Automatically controlled calling modem calling manually controlled modem

An operator answering a call from a modem comprising automatic calling equipment hears the interrupted calling tone of 0.5 to 0.7 s ON and 1.5 to 2.0 s OFF. The data button must be depressed to connect the modem to line. A period of up to 4.0 s of the answering tone is transmitted to the calling modem to disable echo suppressors and/or echo cancellers and to notify the calling modem that the connection is being established. This sequence is followed by data transmission, as required.

¹⁰⁾ For some DCEs requiring extended training sequences, the associated V-Series Recommendation may specify that circuit 107 be put ON at some later time, during the handshake sequence, which is more consistent with the specification in Recommendation V.24 of circuit 107.

8 Disabling of echo suppressors in the case of manually operated data stations

The procedures as described in clauses 6 and 7 above with regard to the manually operated data stations can obviously be used for disabling echo suppressors and echo cancellers when manual switching from voice conversation to data is required, which is the preferred principle of operation. Considering the type of DCE designed to be used in conjunction with manual connection set-up, it will be necessary to equip the DCE with an answering tone generator. To avoid modifying existing equipment at the data station which receives the answering tone, the following procedure may replace the operation principle of clause 6 above. The operator depresses his data button after the end of the answering tone. The modem which is to transmit the answering tone is to be agreed between the operators while still in the voice mode.

Care must be exercised in cases of half-duplex modems where transmission of data is started from the data station which transmits the answering tone, to avoid mutilation of the initial data.

NOTE – Where, in the half-duplex modem case, disabling of echo suppressors is not required, the answering tone need not be transmitted. However, the delay between circuit 105 and circuit 106 ON conditions should be longer than 100 ms in consideration of the echo suppressor suppression hangover time.

9 Notification to ordinary telephone users

As both automatic calling and automatic answering data stations transmit tones to line during call establishment, a normal telephone user who becomes inadvertently connected to one will receive tone signals for a sufficient duration to indicate clearly to him that he is incorrectly connected.

10 Manual selection of automatic answering, data mode and voice mode

It is recognized that, at the data station, means should be provided to allow the operator to select between automatic and manual answering of calls. If a call is manually answered, voice mode shall be established. Subsequent switching to the data mode shall be performed by the procedure as specified in clause 7 above.

Selection of manual or automatic answering of subsequent calls shall be possible after entering the data mode. As an option, automatic answering may be arranged for all subsequent incoming calls. In this case, manual answering may still be achieved by keeping circuit 108/2 OFF to cause an audible signal to occur at the telephone instrument.

The DCE shall be disconnected from the line whenever circuit 108/1 or circuit 108/2 is turned OFF by the DTE, irrespective of the means employed in establishing the connection.

Procedures for switching to the voice mode between data transmission within the same call shall ensure that circuit 107 is turned OFF while in the voice mode.

11 2100 Hz tone recognition

To protect the 2100 Hz tone detector against faulty operation resulting from interference generated by the interrupted calling tone, the detector may be inhibited during the ON periods of the calling tone.

Additionally, in cases where data circuit-terminating equipment comprising automatic calling equipment is used to set up the call, the 2100 Hz detector must not respond to spurious tones which may arise from speech or service signals during call establishment. It is suggested that the answering tone detection be prevented when the 2100 Hz signal is accompanied by any other signal of comparable level within the ranges 350 Hz to 1800 Hz and 2500 Hz to 3400 Hz.

NOTE – The relative inhibiting signal levels recommended for the echo suppressor disabling tone detector of Recommendation G.164 [2] are a useful guide for 2100 Hz tone detector inhibiting levels.

References

- [1] CCITT Definition: “Terminal installation for data transmission” in *Terms and Definitions*, Geneva 1988.
- [2] CCITT Recommendation G.164 (1988), *Echo suppressors*.
- [3] ITU-T Recommendation G.165 (1993), *Echo cancellers*.
- [4] ITU-T Recommendation V.24 (1996), *List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE)*.
- [5] ITU-T Recommendation V.25 bis (1996), *Synchronous and asynchronous automatic dialling procedures on switched networks*.
- [6] ITU-T Recommendation V.25 ter (1995), *Serial asynchronous automatic dialling and control*.

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