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**Public Switched Telephone Network (PSTN);
Category II specification for 1 200 bits per second
half duplex and 1 200/75 bits per second asymmetrical
duplex modems standardized for use on the PSTN**

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Foreword

This final draft second edition European Telecommunication Standard (ETS) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Voting phase of the ETSI standards approval procedure.

This ETS contains the technical characteristics required for end-to-end interworking over the Public Switched Telephone Network (PSTN) for 1 200 bit/s half duplex and 1 200/75 bit/s asymmetrical duplex modems standardized for use over the PSTN.

These requirements are based upon, and do not conflict with, CCITT Recommendation V.23 [3] except in the case of subclause 5.3.1 where the frequency tolerances specified are tighter than those given. Additionally, requirements are included relating to end-to-end inter-operability over PSTN connections. Such requirements are in excess of the CCITT/ITU-T Recommendations.

Except where otherwise stated, a modem which complies with CCITT Recommendation V.23 [3] should always meet the requirements of this ETS which relate to parameters specified in that CCITT Recommendation.

Clause 4 of this ETS references the requirements common to both Category I and II modems, which are contained in final draft prETS 300 114 [1], clause 4.

Clause 5 of this ETS contains Category II requirements specific to 1 200 bits per second half duplex and 1 200/75 asymmetrical duplex modems. In the case of certain functions common to a number of different types of modem (e.g. Auto-answering sequence) reference is made to clause 5 of final draft prETS 300 114 [1] which contains the relevant requirements.

Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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1 Scope

This ETS contains the technical characteristics required for end-to-end interworking over the Public Switched Telephone Network (PSTN) of modems supporting:

- half duplex operation over the PSTN at 1 200 bit/s; and/or
- asymmetrical duplex operation over the PSTN at 1 200/75 bit/s

standardized for use over the PSTN, in accordance with CCITT Recommendation V.23 [3].

The term "modem" in the context of this ETS includes all physical implementation practices for a voice band modem, which is conductively connected to the PSTN.

This ETS specifies up to four modes of operation/use (see subclause 5.2).

This ETS also contains descriptions of the tests to be performed in order to confirm compliance with the functional requirements contained herein. A general description of the test conditions and test requirements is given in annex A (normative).

NOTE: To aid reading, the term "forward channel" is sometimes used to describe the channel capable of transmitting up to 1 200 bit/s, and the term "backward channel" is similarly used to describe the channel capable of transmitting up to 75 bit/s.

2 Normative references

This ETS incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] Final draft prETS 300 114 (1996): "Public Switched Telephone Network (PSTN); Basic Category I and Category II specification for modems standardized for use on the PSTN".
- [2] ETS 300 001: "Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".
- [3] CCITT Recommendation V.23 (1984): "600/1200-baud modem standardized for use in the general switched telephone network".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETS, the definitions contained in final draft prETS 300 114 [1] apply, together with the following:

degree of start-stop distortion: In start-stop transmission the ratio of the maximum measured difference, irrespective of sign, between the actual and theoretical intervals separating any significant instant from the significant instant of the start element immediately preceding it, to the unit interval. The highest absolute value of degrees of individual distortion of the significant instants of a start-stop signal is reached within a specific time interval. The degree of distortion of start-stop modulation, restitution or signal is expressed as a percentage. The result of measurement is completed by an indication of the period of the observation. The start-stop distortion is positive when the significant instant occurs after the ideal instant and conversely, negative when it occurs before.

degree of synchronous start-stop distortion: Determined when the assumed unit interval is that appropriate to the actual modulation rate. The degree of synchronous start-stop distortion is measured by adjusting the scanning rate of the distortion measuring set. The start-stop distortion is positive when the significant instant occurs after the ideal instant and conversely, negative when it occurs before. For the determination of the actual mean modulation rate, account is only taken of those significant instants of modulation (or restitution) that correspond to a change on the same sense as that occurring at the beginning of the start element.

3.2 Abbreviations

For the purposes of this ETS, the abbreviations given in final draft prETS 300 114 [1] apply:

RFS	Ready For Sending
TE	Terminal Equipment

4 General requirements

4.1 References to other ETSS

The modem shall comply with final draft prETS 300 114 [1], clause 4.

NOTE: Final draft prETS 300 114 [1] in turn refers to ETS 300 001 [2] for the majority, if not all, of its requirements.

4.2 Information to be provided by the applicant

4.2.1 Information required for testing purposes

The applicant shall declare for which of the modes of operation/use identified in this ETS, the modem is supposed to undergo tests.

Compliance will be considered to have been accomplished by provision of the relevant information.

NOTE: This may be carried out by completion of forms such as those provided in annex B.

4.2.2 Instructions for use

Instructions for use shall be made available with the apparatus. The instructions for use shall include:

- a) the apparatus or types of apparatus to which the instructions apply;
- b) any information specifically indicated in this ETS for inclusion in the "Instructions for use"; and
- c) any national restrictions on the use of the apparatus.

For the purpose of compliance with this ETS, any additional information shall be disregarded unless it is subject of another ETS.

Compliance shall be checked by inspection.

5 Functional requirements specific to Category II modems

5.1 General requirements

To comply with the requirements of this ETS, it shall be necessary that the modem provide:

- half-duplex mode with switched carrier or asymmetrical duplex mode of operation/use with continuous carriers, as specified in CCITT Recommendation V.23 [3];
- frequency shift binary modulation with synchronous or asynchronous mode of use;
- signalling rates of up to 1 200 bit/s in the forward channel and, optionally, of up to 75 bit/s in the backward channel.

NOTE 1: In the following, references are made to interchange circuits between the modem and the DTE, as defined in CCITT Recommendation V.24. DTEs using certain customised modems will generally not provide an interface with such interchange circuits. For these cases the references to V.24 type interchange circuits indicate equivalent functionality of a DTE and a modem.

NOTE 2: With asymmetrical duplex modems providing a CCITT Recommendation V.24 interface, it is common practice to provide the interchange circuit for the 75 bit/s channel on the relevant pin for the 1 200 bit/s channel.

5.2 Modes of operation/use

It shall be possible to configure the modem to operate in at least one of the following modes of operation/use:

- a) 1 200/1 200 bit/s half duplex asynchronous;
- b) 1 200/75 bit/s asymmetrical duplex asynchronous;
- c) 75/1 200 bit/s asymmetrical duplex asynchronous;
- d) 1 200/1 200 bit/s half duplex synchronous.

It is the applicant's responsibility to specify for which of these modes of operation/use the modem is supposed to undergo tests.

NOTE 1: In the above representation, the first number indicates the rate at which data is received, and the second number indicates the rate at which data is transmitted.

NOTE 2: In this ETS, a clear distinction cannot be made between mode of operation and mode of use, and therefore no attempt has been made to separate the above list into these categories.

5.3 Line signals

The channels defined are within the telephone bandwidth.

NOTE: The allocation of channels is described in subclause 5.5.

5.3.1 Carrier frequencies

The nominal characteristic frequencies are listed in table 1:

Table 1: Frequency allocation

	Binary 0 (Fa)	Binary 1 (Fz)
1 200 bit/s chl	2 100 Hz	1 300 Hz
75 bit/s chl	450 Hz	390 Hz

For modes a), c) and d), as defined in subclause 5.2, the characteristic frequencies Fa and Fz as measured at the line terminals of the modem shall not deviate by more than ± 3 Hz for the 1 200 bit/s channel; and for mode b) ± 2 Hz for the 75 bit/s channel (if provided in the modem) from those given in table 1.

NOTE: These frequency tolerances are tighter than those specified by CCITT Recommendation V.23 [3].

Compliance shall be checked by the method described in annex A, clause A.2.

5.3.2 Spectral power

The national network dependent spectral power limits are given in final draft prETS 300 114 [1], clause 4.

NOTE: This refers in turn to ETS 300 001 [2].

5.4 Line signalling rates

Where the modem provides the relevant mode(s) of operation, it shall be capable of transmitting and/or receiving data at line signalling rates of:

- up to 1 200 bit/s in modes a), b) and c);
- up to 75 bit/s in modes b) and c); and
- 1 200 bit/s in mode d).

Compliance shall be checked during the tests given in subclause 5.11.

5.5 Channel allocation

A modem operating in mode b) (1 200/75 bit/s - asymmetrical duplex modem), shall be capable of responding to signals received in the 1 200 bit/s channel and transmitting signals in the 75 bit/s channel.

A modem operating in mode c) (75/1 200 bit/s - asymmetrical duplex modem), shall be capable of responding to signals received in the 75 bit/s channel and transmitting signals in the 1 200 bit/s channel.

For modems capable of operating in both modes b) and c), at least one of following techniques of channel selection shall be provided:

- a) manual selection of the channel using facilities provided on the modem;
- b) selection of the channel by the DTE, whilst in the on-line state. Two methods are recognised, either:
 - b.1) using a common control signal (equivalent: Using CcT 105):
when the DTE indicates that its wishes to transmit on the 1 200 bit/s channel, the modem shall enable transmission on the 1 200 bit/s channel (equivalent: turning OFF CcT 105); and
when the DTE indicates that it no longer wishes to transmit on the 1 200 bit/s channel (equivalent: turning OFF CcT 105), the modem shall enable transmission on the 75 bit/s channel;

- b.2) using separate control signals (CcT 105 and CcT 120):
 when the DTE indicates that it wishes to transmit on the 1 200 bit/s channel (equivalent: turning ON CcT 105), the modem shall enable transmission on the 1 200 bit/s channel; and when the DTE indicates that it no longer wishes to transmit on the 1 200 bit/s channel (equivalent: turning OFF CcT 105), the modem shall disable transmission on 1 200 bit/s channel;

when the DTE indicates that it wishes to transmit on the 75 bit/s channel (equivalent: turning ON CcT 120), the modem shall enable transmission on the 75 bit/s channel; and when the DTE indicates that it no longer wishes to transmit on the 75 bit/s channel (equivalent: turning OFF CcT 120), the modem shall disable transmission on the 75 bit/s channel.

Compliance shall be checked by the method described in annex A, clause A.3.

5.6 Response times

5.6.1 Response times of the forward channel and backward channel received line signal detectors

The response times of the 1 200 bit/s channel and the 75 bit/s channel received line signal detectors are the times that elapse between:

- for the OFF to ON transition: the application of a tone corresponding to binary 1 at a level higher than - 43 dBm to the line terminals of the modem and an indication being given to the DTE that a carrier signal has been detected (equivalent: turning ON CcT 109).
- for the ON to OFF transition: removal of a tone corresponding to binary 1 from, or the level falling instantaneously to below - 48 dBm, at the line terminals of the modem and an indication being given to the DTE that a carrier signal is no longer being detected (equivalent: turning OFF CcT 109).

The response times of the detector shall be within the limits stated in table 2.

Compliance shall be checked by the method described in annex A, subclause A.4.1.

Table 2: Received line signal detector response times

Data Channel	OFF to ON	300 ms to 2 000 ms 10 ms to 20 ms (see note 1 below)
Signal Detector	ON to OFF	5 ms to 15 ms
Backward Channel Signal Detector	OFF to ON	< 80 ms
	ON to OFF	15 ms to 120 ms (see note 2 below)
NOTE 1:	The longer range of response times is only to be used during call establishment in association with automatic calling and answering.	
NOTE 2:	CCITT Recommendation V.23 [3] suggests a value of 15 ms to 80 ms.	

5.6.2 Response times of the forward channel ready for sending indicator

The applicant shall state whether the ready for sending delay is either a) or b) or both of table 3, and that information shall be included in the instruction for use.

The response times of the 1 200 bit/s channel ready for sending indicator are those given in subclauses 5.6.2.1 to 5.6.2.3.

5.6.2.1 For modems with DTE control

The response times of the 1 200 bit/s channel ready for sending indicator are the times that elapse between:

- a) for the OFF to ON transition: a DTE indicating that it wishes to transmit in the 1 200 bit/s channel (equivalent: turning ON CcT 105) and an indication being given to the DTE that the 1 200 bit/s channel is ready (equivalent: turning ON CcT 106), for modes a), c) and d);
- b) for the ON to OFF transition: a DTE indicating that it no longer wishes to transmit in the 1 200 bit/s channel (equivalent: turning OFF CcT 105) and an indication being given to the DTE that the 1 200 bit/s channel is no longer ready (equivalent: turning OFF CcT 106), for modes a), c) and d).

Compliance shall be checked by the method described in annex A, subclause A.4.2.1.

5.6.2.2 For modems with control derived from the backward channel

For a modem in which control of the transmitted carrier in the 1 200 bit/s channel is controlled by the reception of signals from the remote modem in the 75 bit/s channel, the response times of the 1 200 bit/s channel ready for sending indicator are the times that elapse between:

- a) for the OFF to ON transition: an indication to the DTE that a carrier signal has been received in the 75 bit/s channel (equivalent: turning ON CcT 122) and an indication being given to the DTE that the 1 200 bit/s channel is ready (equivalent: turning ON CcT 106);
- b) for the ON to OFF transition; an indication to the DTE that a carrier signal is no longer being received in the 75 bit/s channel (equivalent: turning OFF CcT 122) and an indication being given to the DTE that the 1 200 bit/s channel is no longer ready (equivalent: turning OFF CcT 106).

Compliance shall be checked by the method described in annex A, subclause A.4.2.2.

5.6.2.3 For modems which transmit carrier constantly when in the on-line state

The response times of the 1 200 bit/s channel ready for sending indicator are the times that elapse between:

- a) for the OFF to ON transition; an indication being given to the DTE that the modem is ready to operate (equivalent: turning ON CcT 107) and an indication being given to the DTE that it is able to transmit on the 1 200 bit/s channel (equivalent: turning ON CcT 106);
- b) for the ON to OFF transition; an indication being given to the DTE that the modem is no longer ready to operate (equivalent: turning OFF CcT 107) and an indication being given to the DTE that the 1 200 bit/s channel is no longer ready (equivalent: turning OFF CcT 106).

The response times of the indicator shall be within the limits stated in table 3.

Compliance shall be checked by the method described in annex A, subclause A.4.2.3.

5.6.3 Response times of the backward channel ready for sending indicator

The applicant shall state whether the ready for sending delay is either a) or b) or both in table 3, and that information shall be included in the instruction for use.

The response times of the backward channel ready for sending indicator shall be those given in subclauses 5.6.3.1 and 5.6.3.2.

5.6.3.1 For modems with DTE control

The response times of the backward channel ready for sending indicator shall be the times that elapse between:

- a) for the OFF to ON transition: a DTE indicating that it wishes to transmit in the 75 bit/s channel (equivalent: turning ON CcT 120) and an indication being given to the DTE that the 75 bit/s channel is ready (equivalent: turning ON CcT 121);
- b) for the ON to OFF transition: a DTE indicating that it no longer wishes to transmit in the 75 bit/s channel (equivalent: turning OFF CcT 120) and an indication being given to the DTE that the 75 bit/s channel is no longer ready (equivalent: turning OFF CcT 121).

Compliance shall be checked by the method described in annex A, subclause A.4.3.2.

5.6.3.2 For modems with control derived from the forward channel

For a modem in which control of the transmitted carrier in the 75 bit/s channel is controlled by the reception of signals from the remote modem in the 1 200 bit/s channel, the response times of the backward channel ready for sending indicator are the times that elapse between:

- a) for the OFF to ON transition: an indication to the DTE that a carrier signal has been received on the 1 200 bit/s channel (equivalent: turning ON CcT 109) and an indication being given to the DTE that the 75 bit/s channel is ready (equivalent: turning ON CcT 121);
- b) for the ON to OFF transition: an indication to the DTE that a carrier signal is no longer being received on the 1 200 bit/s channel (equivalent: turning OFF CcT 109) and an indication being given to the DTE that the 75 bit/s channel is no longer ready (equivalent: turning OFF CcT 121).

The response times of the detector shall be within the limits stated in table 3.

Compliance shall be checked by the method described in annex A, subclause A.4.3.2.

Table 3: Ready for sending response times

Data Channel Ready for	OFF to ON	750 ms to 1 400 ms (note 1)	a) 20 ms to 40 ms b) 200 ms to 275 ms
Sending Indicator	ON to OFF	(note 2)	
Backward Channel Signal Detector	OFF to ON	80 ms to 160 ms	
	ON to OFF	(note 2)	
NOTE 1:	The longer range of response times is only to be used during call establishment in association with automatic calling and answering.		
NOTE 2:	The Ready for Sending ON to OFF delay has no effect upon the inter-operability between two modems. Therefore, no requirement exists.		

5.7 Synchronous mode of use

Where the modem provides timing signals to facilitate synchronous transmission, it shall generate a synchronization pattern to aid synchronization of the remote modem as follows.

A pattern of alternating binary 1 and binary 0 shall be transmitted throughout the period from the DTE, indicating that it wishes to send data (equivalent: turning ON CcT 105), and the modem indicating that it is ready to accept data from the DTE (equivalent: turning ON CcT 106).

Compliance shall be checked by the method described in annex A, clause A.5.

NOTE: Part of this synchronization pattern may appear as received data at the remote modem (equivalent: data on CcT 104) after this modem has indicated to the DTE that a carrier signal is being detected (equivalent: turning ON CcT 109). It will be necessary for a DTE to make provision for differentiating between these signals and genuine data signals.

5.8 Thresholds of received line signal detectors

The modem shall comply with the requirements of final draft prETS 300 114 [1], subclause 5.4, when receiving a data signal of 1 300 Hz for a modem capable of receiving at up to 1 200 bit/s and 390 Hz for a modem capable of receiving at up to 75 bit/s.

5.9 Auto-calling and auto-answering procedures

5.9.1 Auto-calling - calling tone

The provision of the calling tone defined in CCITT Recommendation V.25 is not required by this ETS.

5.9.2 Auto-calling- recognition of answering tone

For asymmetrical duplex (i.e. modes b) and c) of subclause 5.2) modems to be used for automatically originated calls, the modem, or its associated call establishment equipment, shall comply with the requirements for answering tone detection given in final draft prETS 300 114 [1], subclause 5.2.1.

5.9.3 Auto-answering - answer tone

For asymmetrical duplex (i.e. modes b) and c) of subclause 5.2) modems to be used for automatically answered calls, the modem, or its associated call answering equipment, shall comply with the requirements for answering tone generation given in final draft prETS 300 114 [1], subclause 5.2.2.

5.10 Provision of test looping facilities

This ETS does not require the provision of the test looping facilities such as those defined in CCITT Recommendation V.54. However, the provision of such facilities does not preclude the modem from assessment of conformance to Category II.

5.11 Performance

Since CCITT Recommendation V.23 [3] does not define performance criteria, the requirements of this subclause are additional to the CCITT Recommendation.

5.11.1 Distortion

For an asynchronous modem, in each of the modes of operation for which assessment of conformance as a Category II modem is sought, the following applies:

When two modems of the same type are interconnected via:

- a) Test Line 3 (see final draft prETS 300 114 [1], annex C, clause C.5), the degree of synchronous start-stop distortion measured at the received data output (equivalent: CcT 104 for the forward channel, or 119 for the backward channel) of the modem under test, shall not be greater than 15 % at 1 200 bit/s in the 1 200 bit/s channel and 15 % at 75 bit/s in the 75 bit/s channel (if provided).

Compliance shall be checked by the method described in annex A, subclause A.6.1.

- b) Test Line 1, without frequency offset and the transient impairments, the degree of synchronous start-stop distortion measured at the received data output (equivalent: CcT 104 for the data channel, or 119 for the backward channel) of the modem under test shall not be greater than 35 % at 1 200 bit/s in the 1 200 bit/s channel and 35 % at 75 bit/s in the 75 bit/s channel (if provided).

Compliance shall be checked by the method described in annex A, subclause A.6.2.

- c) Test Line 1, without the transient impairments, but with a frequency shift of ± 4 Hz applied to the signals received by the modem under test, the degree of synchronous start-stop distortion measured at the received data output (equivalent: CcT 104 for data channel, or 119 for backward channel) of the modem under test shall not be greater than 35 % at 1 200 bit/s in the 1 200 bit/s channel and 35 % at 75 bit/s in the 75 bit/s channel (if provided).

Compliance shall be checked by the method described in annex A, subclause A.6.3.

NOTE: Two modems of the "same type" is intended to convey that they are not only both V.23 modems but also from the same applicant/supplier. Where it is necessary to distinguish between the two modems, the one being tested is referred to as the "modem under test" and the other as the "modem used for reference".

When a non-reversible asymmetrical duplex modem (i.e. a modem handling only modes b) or c)) is to be tested, this shall be done against a modem used for reference. The modem used for reference may, on the choice of the applicant, be provided by the testing authority or by himself.

If serial binary data at the line signalling rate is not accessible at a digital interface of the modem under test, means shall be provided by the applicant to enable the testing authority to verify that data characters are correctly received by the modem under test.

5.11.2 Receiver performance

When tested as described in final draft prETS 300 114 [1], subclause 5.6, the modem shall accumulate not less than 85 % error free seconds during each of the performance testing periods.

NOTE: The figure of 85 % is provisional, and is based upon reasoned estimations.

Annex A (normative): Testing methods

A.1 General testing conditions

The general conditions for test shall apply, as described in final draft prETS 300 114 [1], annex B.

For the testing of the modem it will generally be necessary to simulate the PSTN in the test set-up in order for the modem to remain in an on-line state. Unless otherwise indicated, Test Line 3 (see final draft prETS 300 114 [1], annex C, clause C.5) should be used to connect the modem under test and the test apparatus.

A.2 Test for subclause 5.3.1 (Carrier frequencies)

The modem under test is caused to assume the on-line state and to transmit the frequencies associated with binary 1 and binary 0.

For those modems which are capable of transmitting at 75 bit/s:

- the frequency associated with binary 1, which shall be not less than 388 Hz and not greater than 392 Hz; and
- the frequency associated with binary 0, which shall be not less than 448 Hz and not greater than 452 Hz.

For those modems which are capable of transmitting at 1 200 bit/s:

- the frequency associated with binary 1, which shall be not less than 1 287 Hz and not greater than 1 303 Hz; and
- the frequency associated with binary 0, which shall be not less than 2 097 Hz and not greater than 2 103 Hz.

A.3 Test for subclause 5.5 (Channel allocation)

For the purpose of the tests in this clause, a signal shall be present when the total signal power within the specified band exceeds a level of - 30 dBm.

For each of the tests in this clause, the modem under test shall be connected to the Modem Conformance Tester (MCT) via Test Line 3.

Tests shall be performed for each combination of mode of operation (subclause 5.2, modes b) and c)) and method of channel selection (subclause 5.5 a), b1) and b2)), that the applicant has identified.

The modem is caused to enter the on-line state.

Whenever the modem is supposed to be transmitting on the 1 200 bit/s channel, the spectrum of the signal transmitted by the modem under test shall be checked to verify that transmitted signal power is present in the range 1 300 Hz to 2 100 Hz, but not in the range 390 Hz to 450 Hz.

Whenever the modem is supposed to be transmitting on the 75 bit/s channel, the spectrum of the signal transmitted by the modem under test shall be checked to verify that transmitted signal power is present in the range 390 Hz to 450 Hz, but not in the range 1 300 Hz to 2 100 Hz.

A.4 Test for subclause 5.6 (Response times)

The modem under test shall be connected to Test Line 3 (see final draft prETS 300 114 [1], annex C, clause C.5) used during test A.3.1.

NOTE 1: The tolerance of $\pm 3,0$ dB on the signal levels given are to accommodate the differences between the insertion loss frequency response including the tolerances of the test line, and small differences in the transmit level.

NOTE 2: The tests for subclauses 5.6.1 and 5.6.2 could be performed together.

A.4.1 Test for subclause 5.6.1

1 200 bit/s

For a modem which is capable of receiving at 1 200 bit/s, the modem under test is caused to enter the on-line state, a tone shall be transmitted at 1 300 Hz to arrive at the line terminals of the modem under test at a level of $-20 \text{ dBm} \pm 3,0 \text{ dB}$. The time shall be measured from the moment of application of the signal until the modem indicates that a carrier signal has been detected.

The signal shall then be removed and the time measured between the instant of removal and the modem under test indicating that it is no longer detecting a carrier signal.

75 bit/s

For a modem which is capable of receiving at 75 bit/s, the modem under test is caused to enter the on-line state, a tone shall be transmitted at 390 Hz to arrive at the line terminals of the modem under test at a level of $-20 \text{ dBm} \pm 3,0 \text{ dB}$. The time shall be measured from the moment of application of the signal until the modem under test indicates that a carrier signal has been detected.

The signal shall then be removed and the time measured between the instant of removal and the modem under test indicating that it is no longer detecting a carrier signal.

A.4.2 Test for subclause 5.6.2 (Data channel Ready For Sending (RFS) response times)

A.4.2.1 Test for subclause 5.6.2.1

For a modem which is capable of transmitting at 1 200 bit/s, the modem under test is caused to enter the on-line state.

OFF to ON

The DTE is caused to indicate that it wishes to transmit (equivalent: turning ON CcT 105). The time shall be measured between the DTE indicating that it wishes to transmit and the modem under test indicating to the DTE that the 1 200 bit/s data channel is ready (equivalent: turning ON CcT 106). When a call is not automatically established, the time measured shall not be less than 20 ms and not more than 40 ms in case a) of table 3, and not less than 200 ms and not more than 275 ms in case b) of table 3. When a call is automatically established, the time shall not be less than 750 ms and not more than 1 400 ms following the first indication that the DTE wishes to transmit data (equivalent: turning ON CcT 105) occurring after an indication has been given to the DTE that the modem is ready to operate (equivalent: turning ON CcT 107).

A.4.2.2 Test for subclause 5.6.2.2

For a modem which is capable of transmitting at 1 200 bit/s, the modem under test is caused to enter the on-line state.

OFF to ON

A tone shall be transmitted at 390 Hz to arrive at the line terminals of the modem under test at a level of $-20 \text{ dBm} \pm 3,0 \text{ dB}$. The time shall be measured from the moment the modem under test indicates that a carrier signal has been detected (equivalent: turning ON CcT 122) and the modem under test indicating to the DTE that the 1 200 bit/s data channel is ready (equivalent: turning ON CcT 106). When a call is not automatically established, the time measured shall not be less than 20 ms and not more than 40 ms in case a) of table 3, and not less than 200 ms and not more than 275 ms in case b) of table 3. When a call is automatically established, the time shall be not less than 750 ms and not more than 1 400 ms following the first indication that the DTE wishes to transmit data (equivalent: turning ON CcT 105) occurring after an indication has been given to the DTE that the modem is ready to operate (equivalent: turning ON CcT 107).

A.4.2.3 Test for subclause 5.6.2.3

For a modem which is capable of transmitting at 1 200 bit/s, the modem under test is caused to enter the on-line state.

OFF to ON

The DTE is caused to indicate that it wishes the modem to assume an on-line state (equivalent: turning ON CcT 108), or the modem is caused to assume the on-line state by the method indicated by the applicant. The time shall be measured between the modem under test indicating that it is ready to operate (equivalent: turning ON CcT 107) and the modem under test indicating to the DTE that the 1 200 bit/s data channel is ready (equivalent: turning ON CcT 106). When a call is not automatically established, the time measured shall not be less than 20 ms and not more than 40 ms in case a) of table 3, and not less than 200 ms and not more than 275 ms in case b) of table 3. When a call is automatically established, the time shall be not less than 750 ms and not more than 1 400 ms following the first indication that the DTE wishes to transmit data (equivalent: turning ON CcT 105) occurring after an indication has been given to the DTE that the modem is ready to operate (equivalent: turning ON CcT 107).

A.4.3 Test for subclause 5.6.3 (Backward channel RFS response times)

A.4.3.1 Test for subclause 5.6.3.1

For a modem which is capable of transmitting at 75 bit/s, the modem under test is caused to enter the on-line state.

OFF to ON

The DTE is caused to indicate that it wishes to transmit (equivalent: turning ON CcT 120). The time shall be measured between the DTE indicating that it wishes to transmit and the modem under test indicating to the DTE that the 75 bit/s data channel is ready (equivalent: turning ON CcT 121). The time measured shall be not less than 80 ms.

A.4.3.2 Test for subclause 5.6.3.2

For a modem which is capable of transmitting at 75 bit/s, the modem under test is caused to enter the on-line state.

OFF to ON

A tone shall be transmitted at 1 300 Hz to arrive at the line terminals of the modem under test at a level of - 20 dBm \pm 3,0 dB. The time shall be measured from the moment the modem under test indicates that a carrier signal has been detected (equivalent: turning ON CcT 122) and the modem under test indicating to the DTE that the 75 bit/s data channel is ready (equivalent: turning ON CcT 121). The time measured shall be not less than 80 ms.

A.5 Test for subclause 5.7 (Synchronous mode of use)

For a modem which is capable of transmitting at 1 200 bit/s in the synchronous mode of use, the modem under test is connected to the modem used for reference via Test Line 3 (see final draft prETS 300 114 [1], annex C, clause C.5). After the modem used for reference having given an indication that it has detected a line signal in the forward channel (equivalent: turning ON CcT 109), an indication shall be given from the DTE connected to the modem under test that it wishes to transmit data. During the time until the modem under test indicates to the DTE that it is ready to accept data from the DTE (equivalent: turning ON CcT 106), alternating binary 1 and binary 0 shall be output at the received data lead of the modem used for reference (equivalent: CcT 104).

A.6 Test for subclause 5.11.1 (Distortion)

The following test pattern is specified for the tests described in subclauses A.6.1, A.6.2 and A.6.3:

A cyclic string of discrete test characters (DTCs) consisting of:

DTC N° 2 + DTC N° 3 + DTC N° 2 + DTC N° 1 + DTC N° 2 +

as specified in final draft prETS 300 114 [1], annex B, subclause B.5.1.3 for the 10 bit character length.

The test period for the tests described in subclauses A.6.1, A.6.2 and A.6.3 shall be one minute.

A.6.1 Test for subclause 5.11.1 (a)

The modem under test shall be connected to the modem used for reference via Test Line 3 (see final draft prETS 300 114 [1], annex C, clause C.5). The modem used for reference is caused to transmit the test pattern to the modem under test at rate equal to the maximum bit rate for the channel under test, i.e. 1 200 bit/s or 75 bit/s. The degree of synchronous start-stop distortion of the received data output (equivalent: CcT 104 for the data channel, or CcT 119 for backward channel) of the modem under test shall not be greater than 15 %.

A.6.2 Test for subclause 5.11.1 (b)

The modem under test shall be connected to the modem used for reference via Test Line 1 without frequency offset (see final draft prETS 300 114 [1], annex B, subclause B.6.4 and annex C, clause C.3) and transient impairments. The modem used for reference is caused to transmit the test pattern to the modem under test at rate equal to the maximum bit rate for the channel under test, i.e. 1 200 bit/s or 75 bit/s. The degree of synchronous start-stop distortion of the received data output (equivalent: CcT 104 for the data channel, or CcT 119 for backward channel) of the modem under test shall not be greater than 35 %.

A.6.3 Test for subclause 5.11.1 (c)

This test shall be performed twice once with a frequency offset of + 4 Hz and then with a frequency offset of - 4 Hz.

The modem under test shall be connected to the modem used for reference via Test Line 1 without transient impairments (see final draft prETS 300 114 [1], annex B, subclause B.6.4 and annex C, clause C.3). The modem used for reference is caused to transmit the test pattern to the modem under test at rate equal to the maximum bit rate for the channel under test, i.e. 1 200 bit/s or 75 bit/s. The degree of synchronous start-stop distortion of the received data output (equivalent: CcT 104 for the data channel, or CcT 119 for backward channel) of the modem under test shall not be greater than 35 %.

Annex B (informative): Proforma declaration of modes of operation/use

Declaration of modes of operation/use for 1 200 bit/s half duplex and 1 200/75 bit/s asymmetrical duplex modems based on CCITT Recommendation V.23 [3].

The modem submitted for assessment of conformance is capable of operating in the modes indicated in the tables below.

Table B.1: Proforma for declaring modes of use

1 200 bit/s half duplex	
a)	Asynchronous.
b)	Synchronous.
asymmetrical duplex	
c)	1 200/75 bit/s asymmetrical duplex.
d)	75/1 200 bit/s asymmetrical duplex.

Table B.2: Proforma for declaring modes of operation/use

Auto calling or answering	
a)	Auto calling.
b)	Auto answering.

Table B.3: Proforma for declaring modes of operation/use

1 200 bit/s channel ready for sending indicator	
a)	DTE control.
b)	Control derived from the 1 200 bit/s channel.
c)	Neither of the above methods.

Table B.4: Proforma for declaring modes of operation/use

75 bit/s channel ready for sending indicator	
a)	DTE control.
b)	Control derived from the 75 bit/s channel.

Table B.5: Proforma for declaring modes of operation/use

Ready for sending response times	
a)	750 ms to 1 400 ms for initial attempt.
b)	20 ms to 40 ms.
c)	200 ms to 275 ms.

Table B.6: Proforma for declaring modes of operation/use

Channel allocation for asymmetrical duplex modems	
a)	Transmit on backward channel when forward channel is off.
b)	Separate control of the forward and backward channels by the DTE.

Annex C (informative): Bibliography

For the purposes of this ETS, the following documents have been referenced for information:

- CCITT Recommendation V.24 (1988): "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".
- CCITT Recommendation V.25 (1988): "Automatic answering equipment and/or parallel automatic calling equipment on the general switched telephone network including procedures for the disabling of echo control devices for both manually and automatically established calls".
- CCITT Recommendation V.54 (1988): "Loop test devices for modems".

History

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