



**E**UROPEAN  
**T**ELECOMMUNICATION  
**S**TANDARD

**ETS 300 115**

September 1997

Second Edition

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Source: ATA

Reference: RE/ATA-005069

ICS: 33.020

**Key words:** Modems, PSTN, testing

**Public Switched Telephone Network (PSTN);  
Category II specification for 300 bit/s duplex modems  
standardized for use on the PSTN**

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## Foreword

This second edition European Telecommunication Standard (ETS) has been produced by ETSI Project Analogue Terminals and Access.

The objective of this ETS, the application of which is entirely voluntary, is to provide users with an added degree of assurance that modems in compliance with this ETS can interwork with each other, under most network conditions.

This ETS contains the technical requirements required for end-to-end interworking over the Public Switched Telephone Network (PSTN), 300 bits per second duplex modems standardized for use over the PSTN.

These requirements are based upon, and do not conflict with, CCITT Recommendation V.21 [4] except in the cases of subclause 5.3.1 where the frequency tolerances specified are tighter than those given; subclause 5.5.1 (Response times of the received line signal detector) and subclause 5.5.2 (Response times of the ready for sending indicator) where a restricted range of values has been inserted to assist inter-operability. Additionally, requirements are included which relate to end-to-end interoperability over PSTN connections. These requirements are in excess of the CCITT Recommendations.

Except where otherwise stated, a modem which complies with CCITT Recommendation V.21 [4] should always meet the requirements of this ETS which relate to parameters specified in that CCITT Recommendation except in the case of some of the intentional deviations identified above.

Clause 4 of this ETS references the requirements which are common to both Category I and Category II modems, which are contained in clause 4 of ETS 300 114 [2]. The definition of Category I and Category II modems can be found in the foreword of ETS 300 114 [2].

Clause 5 of this ETS contains Category II requirements specific to 300 bits per second 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 ETS 300 114 [2] which contains the relevant requirements.

<b>Transposition dates</b>	
Date of adoption:	19 September 1997
Date of latest announcement of this ETS (doa):	31 December 1997
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	30 June 1998
Date of withdrawal of any conflicting National Standard (dow):	30 June 1998

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## 1 Scope

This second edition European Telecommunication Standard (ETS) contains the technical characteristics required for end-to-end interworking over the Public Switched Telephone Network (PSTN) of 300 bits per second (bit/s) duplex modems standardized for use over the PSTN, in accordance with CCITT Recommendation V.21 [4].

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 two modes of operation: answer mode and call mode.

NOTE: Modems can provide either simply one of the above modes or provide both modes together with facilities for selecting either of the two modes.

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.

## 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] ETS 300 001: "Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN".
- [2] ETS 300 114 (1990): "Attachments to the Public Switched Telephone Network (PSTN); Basic attachment requirements for modems standardized for use on the PSTN".
- [3] CCITT Recommendation S.33 (1984): "Standardization of an international text for the measurement of the margin of start-stop machines using International Alphabet No 5".
- [4] CCITT Recommendation V.21 (1984): "300 bits per second duplex modem standardized for use on the General Switched Telephone Network".
- [5] CCITT Recommendation V.24 (1984): "List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE)".
- [6] CCITT Recommendation V.25 (1984): "Automatic answering equipment and/or parallel automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls".
- [7] CCITT Recommendation V.54 (1984): "Loop Test devices for modems".

### 3 Definitions and abbreviations

For the purposes of this ETS, the definitions and abbreviations of ETS 300 114 [2] apply, together with the following:

#### 3.1 Definitions

**answer mode:** When calls are established with automatic facilities, a standard answer mode shall be used by the modem at the answering station. This mode consists of conventional characteristics (e.g. use of high channel carrier frequency or particular scrambler generating polynomial) complementary to those used in the standard call mode by the modem at the calling station, in order to ensure proper connection and interworking.

If calls are established on the PSTN by operators, or for leased line operation, bilateral agreement on the use of call mode and answer mode shall be necessary.

**call mode:** When calls are established with automatic facilities, a standard call mode shall be used by the modem at the calling station. This mode consists of conventional characteristics (e.g. use of low channel carrier frequency or particular scrambler generating polynomial) complementary to those used in the standard answer mode by the modem at the answering station, in order to ensure proper connection and interworking.

If calls are established on the PSTN by operators, or for leased line operation, bilateral agreement on the use of call mode and answer mode shall be necessary.

**Data Terminal Equipment (DTE):** This term is used to define the origin and destination of signals present at the digital interface of a modem. This expression does not require that a "commercial data terminal" be present to receive or generate such signals; a tester or any other suitable device may monitor or generate such signals.

**degree of start-stop distortion:** In start-stop transmission it is 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 stop-start signal is reached within a specific time interval.

The degree of distortion of start-stop modulation, restitution or signal shall be expressed as a percentage.

The result of measurement shall be completed by an indication of the period of the observation. The start-stop distortion shall be considered positive when the significant instant occurs after the ideal instant and conversely, negative when it occurs before.

**degree of synchronous start-stop distortion:** The degree of start-stop distortion determined when the assumed unit interval is that appropriate to the actual modulation rate.

The degree of synchronous start-stop distortion shall be measured by adjusting the scanning rate of the distortion measuring set.

The start-stop distortion shall be considered 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 shall only be 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.

**initial carrier mode:** A mode in which the Answer Mode Modem (AMM) transmits its carrier signal immediately after the end of the auto answer sequence, and the Call Mode Modem (CMM) remains silent until it receives a carrier signal from the AMM.



**modem:** A functional unit that modulates and de-modulates signals in order to enable digital data to be transmitted over analogue transmission facilities.

**modem used for reference:** A modem used for some of the tests specified herein or in another modem specific ETS. A modem used for reference may, at the discretion of the applicant, be provided by the testing authority or by the applicant. It shall be designed:

- to meet the requirements of the same Recommendation(s) of the CCITT as the modem under test, to the extent necessary for performing the tests;
- to provide the functionalities for a modem used for reference that are specified in the relevant testing clauses; and
- to provide an interface which is accessible and of a type suitable for use in the tests (e.g. CCITT Recommendation V.24 [5]).

Where the applicant has provided the modem used for reference and the test fails, the testing authority may not be in a position to determine the precise reason for failure.

**modes of operation:** Modes specified in this modem specific ETS, that have an influence upon line signals present at the PSTN interface.

**modes of use:** Modes specified in this modem specific ETS, that have an influence upon conditions present at a digital interface e.g. a "conventional" CCITT Recommendation V.24 [5] interface or a PC bus interface in the case of an integral modem.

**on-line state:** An electrical condition into which, when connected to the network, a modem is placed such that it draws enough current to be capable of activating the exchange.

NOTE: Usually, a modem in the on-line state is potentially capable of sending or receiving speech-band information to or from the network.

### 3.2 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

AMM	Answer Mode Modem
Cct	Circuit
CMM	Call Mode Modem
DCE	Data Circuit-Terminating Equipment
DTE	Data Terminal Equipment
PSTN	Public Switched Telephone Network
RFS	Ready For Sending

## 4 General requirements

### 4.1 References to other ETSS

The modem shall comply with ETS 300 114 [2], clause 4.

NOTE: ETS 300 114 [2] in turn refers to ETS 300 001 [1] 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 required to undergo tests.

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

NOTE: This could be accomplished by completion of a form such as the one provided in annex B (informative).

#### **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.

Any additional information that has been included shall be disregarded unless it is the 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, the modem shall provide:

- duplex mode of operation with continuous carrier, as specified in CCITT Recommendation V.21 [4];
- channel separation by frequency division;
- frequency shift binary modulation;
- line signalling rates of up to 300 bit/s;
- initial carrier mode (see subclause 3.1);
- where a modem is capable of transmitting on either of the two channels, means by which the channels may be selected either manually and/or automatically.

In the following, references are made to interchange circuits between the modem and the DTE, as defined in CCITT Recommendation V.24 [5]. DTEs using certain customized modems should not generally provide an interface with such interchange circuits. For these cases the references to CCITT Recommendation V.24 [5] type interchange circuits indicate equivalent functionality of a DTE and a modem.

### **5.2 Modes**

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

- provision for transmission in the answer mode;
- provision for transmission in the call mode.

It shall be the applicant's responsibility to specify for which of these modes of operation, testing for conformance to this ETS is required. An example of a proforma which requests the relevant information is shown in annex B (informative).

### **5.3 Line signals**

The modem transmits on the low channel when receiving on the high channel, and vice versa, according to the channel allocation requirements defined in subclause 5.4.

NOTE: The channels are referred to in CCITT Recommendation V.21 [4] as channel 1 and channel 2. In order to retain a common presentation within this series of ETSs, this ETS refers to channel 1 as the low channel and channel 2 as the high channel.

### 5.3.1 Carrier frequencies

The characteristic frequencies  $F_a$  and  $F_z$  as measured at the line terminals of the modem, shall not deviate by more than  $\pm 2$  Hz from those given in table 1.

Table 1: Frequency Allocation

	Binary 0 ( $F_a$ )	Binary 1 ( $F_z$ )
Low Channel	1 180 Hz	980 Hz
High Channel	1 850 Hz	1 650 Hz

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

NOTE: The frequency tolerance is tighter than that specified by CCITT Recommendation V.21 [4].

### 5.3.2 Spectral power

The national network dependent spectral power limits are given in ETS 300 114 [2], clause 4.

NOTE: This in turn refers to ETS 300 001 [1].

## 5.4 Channel allocation

A Call Mode Modem (CMM) shall be capable of transmitting signals on the low channel and responding to signals received on the high channel. An Answer Mode Modem (AMM) shall be capable of transmitting signals on the high channel and responding to signals received on the low channel.

Compliance shall be checked while performing the tests for subclauses 5.3.1 and 5.6.

### 5.4.1 Channel selection

Modems which are capable of being both a CMM and an AMM shall provide facilities for at least one of the following techniques of channel selection:

- a) manual selection of the channels using facilities provided by the modem;
- b) selection of channels by the DTE (equivalent: Circuit (Cct) 126 control);
- c) automatic selection of channel allocation as specified in subclause 5.4.2.

NOTE: Other means of channel selection may also be provided, but verification of the correct functioning of such facilities is not a requirement of this ETS.

For techniques a) and b), compliance shall be checked by the method described in annex A, subclause A.3.1.

### 5.4.2 Automatic channel selection

A modem providing this facility shall, in the absence of manual intervention or a contrary command e.g. via a digital interface (equivalent: Cct 126), be automatically configured as:

- a) a CMM when exchanging data on-line to another compatible modem and when the modem has entered the on-line state other than in response to an incoming PSTN call;
- b) an AMM when exchanging data on-line to another compatible modem and when the modem has entered the on-line state in response to an incoming PSTN call.

Compliance shall be checked by the method described in annex A, subclause A.3.2.

## 5.5 Response times

NOTE 1: The range of response times available in CCITT Recommendation V.21 [4] has been reduced in order to avoid potential incompatibility between different V.21 modems. The constraint is applied in order to prevent loss of data on call establishment.

NOTE 2: CCITT Recommendation V.21 [4] does not require a modem for use on the PSTN to detect an indication from a DTE that it wishes to transmit data (equivalent: turning ON Cct 105). This mode of operation is therefore outside the scope of this ETS.

### 5.5.1 Response times of the received line signal detector

The response times for received line signal detector are defined as the times that elapse between:

- a) 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);
- b) for the ON to OFF transition: removal of a tone corresponding to binary 1, 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.

**Table 2: Received line signal detector response times**

Received Line Signal Detector	OFF to ON	300 ms to 400 ms
	ON TO OFF	20 ms to 80 ms

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

### 5.5.2 Response times of the Ready For Sending indicator

The response times of the Ready For Sending (RFS) indicator are defined as the times that elapse between:

- a) for the OFF to ON transition: an indication being given to the DTE that a carrier signal has been detected (equivalent: turning ON Cct 109) and an indication being given to the DTE that the modem is ready to transmit data (equivalent: turning ON Cct 106);
- b) for the ON to OFF transition: an indication being given to the DTE that a carrier signal is no longer being detected (equivalent: turning OFF Cct 109) and an indication to the DTE that the modem is no longer ready to transmit data (equivalent: turning OFF Cct 106).

The response time of the RFS OFF to ON transition shall be within the limits stated in table 3.

**Table 3: RFS indicator response times**

Ready for Sending	OFF to ON	400 ms to 1 000 ms
	ON TO OFF	(note)
NOTE: The RFS ON to OFF delay has no effect upon the interoperability between two modems. Therefore, no requirement exists.		

Compliance shall be checked by the method described in annex A, subclause A.4.2.

## 5.6 Threshold of the received line signal detector

The requirements of subclause 5.4 shall apply.

Compliance shall be checked as described in annex A, clause A.5.

## 5.7 Provision of auto-calling and/or answering facilities (hand-shaking facilities)

### 5.7.1 Auto-calling - calling tone

This ETS does not require the provision of a calling tone, including that defined in CCITT Recommendation V.25 [6].

### 5.7.2 Auto-calling - recognition of answering tone

For 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 ETS 300 114 [2], subclause 5.2.1.

### 5.7.3 Auto-answering

For 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 ETS 300 114 [2], subclause 5.2.2.

## 5.8 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 [7]. However, the provision of such facilities does not preclude the modem from assessment of conformance to Category II.

## 5.9 Performance

NOTE: Since CCITT Recommendation V.21 [4] does not define performance criteria, the requirements of this subclause are additional to the CCITT Recommendation.

### 5.9.1 Distortion

For 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 a compatible type are interconnected via:

- a) Test Line 2 (see ETS 300 114 [2], subclause B.6.4 and clause C.4) without transient impairments, the degree of synchronous start-stop distortion measured at the received data output (equivalent: Cct 104) of the modem, shall not be greater than 25 % at a line signalling rate of 300 bit/s.

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

- b) Test Line 1 (see ETS 300 114 [2], subclause B.6.4 and clause C.3) without frequency offset and transient impairments, the degree of synchronous start-stop distortion measured at the received data output (equivalent: Cct 104) of the modem, shall not be greater than 25 % at a line signalling rate of 300 bit/s.

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

- c) Test Line 1 (see ETS 300 114 [2], subclause B.6.4 and clause C.3) without transient impairments but with a frequency offset of  $\pm 4$  Hz applied to the signals received by the modem, the degree of synchronous start-stop distortion measured at the received data output (equivalent: Cct 104) of the modem, shall not be greater than 30 % at a line signalling rate of 300 bit/s.

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

NOTE: "Two modems of a compatible type" is intended to convey that they are not only both V.21 but also from the same supplier. Where it is necessary to distinguish between the two modems, the one being approved is referred to as the "modem under test" and the other as the "modem used for reference".

When an answer mode only modem or a call mode only modem is to be tested, it shall be tested against a reference modem. The reference modem may, on the choice of the applicant, be provided by the testing authority or by the applicant.

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

#### **5.9.2 Receiver performance**

When tested as described in ETS 300 114 [2], subclause 5.6, the modem shall accumulate not less than 90 % error free seconds during each of the performance testing periods.

NOTE: The figure of 90 % is a provisional value and based on reasoned estimations.

## **Annex A (normative): Testing methods**

### **A.1 General testing conditions**

The general conditions for test apply, as described in ETS 300 114 [2], annex B.

For the testing of the modem it shall 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 ETS 300 114 [2], 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)**

For modems that are capable of operation as both a CMM and AMM, these tests are performed in conjunction with the tests for subclause 5.4.1. The modem is caused to assume the appropriate mode of operation by one of the methods described in the tests contained in subclause 5.4.1.

For those modems which are capable of functioning as a CMM, a tone of 1 650 Hz at a level of -30 dBm is applied to the modem under test. The frequencies transmitted by the modem are measured when the modem is caused to transmit:

- the frequency associated with binary 1, which shall be not less than 978 Hz and not greater than 982 Hz; and
- the frequency associated with binary 0, which shall be not less than 1 178 Hz and not greater than 1 182 Hz.

For those modems which are capable of functioning as an AMM, the frequencies transmitted by the modem are measured when the modem is caused to transmit:

- the frequency associated with binary 1, which shall be not less than 1 648 Hz and not greater than 1 652 Hz; and
- the frequency associated with binary 0, which shall be not less than 1 848 Hz and not greater than 1 852 Hz.

### **A.3 Test for subclause 5.4 (channel allocation)**

The modem is connected to Test Line 3 (as described in ETS 300 114 [2], clause C.5) and the output level adjusted as described in the instructions for use, to an indicated power level of -7 dBm. The test signals described in CCITT Recommendation S.33 [3] shall be used as a data source for the purpose of this clause. For the purpose of the tests in this clause, a signal is present when total signal power within the specified band exceeds a level of -30 dBm.

#### **A.3.1 Test for subclause 5.4.1 (channel selection)**

The following tests shall be performed for each of the modes of operation which the applicant has identified:

- for modems providing mode of operation a), using the means of manual selection the modem shall be caused to transmit a signal as a CMM and then as an AMM. When configured as a CMM, the spectrum of the signal transmitted by the modem under test shall be checked to verify that it contains signal power within the permitted range of 975 Hz to 1 185 Hz, but not in the range 1 645 Hz to 1 855 Hz. When configured as an AMM, the spectrum of the signal transmitted by the modem under test shall be checked to verify that it contains signal power within the permitted range of 1 645 Hz to 1 855 Hz, but not in the range 975 Hz to 1 185 Hz;

- for modems providing mode of operation b), using the information supplied by the applicant the modem shall be caused to transmit a signal as a CMM and then as an AMM. When configured as a CMM, the spectrum of the signal transmitted by the modem under test shall be checked to verify that it contains signal power within the permitted range of 975 Hz to 1 185 Hz, but not in the range 1 645 Hz to 1 855 Hz. When configured as an AMM, the spectrum of the signal transmitted by the modem under test shall be checked to verify that it contains signal power within the permitted range of 1 645 Hz to 1 855 Hz, but not in the range 975 Hz to 1 185 Hz;
- for modems providing mode of operation c), compliance shall be checked by the method described in the tests for subclause 5.4.2.

During any one of the above tests, the checks of the frequencies required by the test of subclause 5.3.1 shall be performed.

### **A.3.2 Test for subclause 5.4.2 (automatic channel selection)**

#### **Calling Mode Modem**

The PSTN simulator shall be conditioned to provide the modem with appropriate dial tone and DC conditions. An outgoing call attempt shall be made by the modem under test. After the completion of the CCITT Recommendation V.25 [6] calling tone for automatic terminals or after assuming the on-line state for manual terminals the spectrum of the signal transmitted shall be checked to verify that it contains signal power within the permitted range of 975 Hz to 1 185 Hz, but not in the range 1 645 Hz to 1 855 Hz.

#### **Answer Mode Modem**

The PSTN simulator shall be conditioned to provide the modem with appropriate ringing signals and when answered, to supply the DC conditions to the modem under test. The modem under test shall be caused to answer the call. Once the modem is on line, and following, if present, the CCITT Recommendation V.25 [6] answering tone, the spectrum of the signal transmitted shall be checked to verify that it contains signal power within the permitted range of 1 645 Hz to 1 855 Hz, but not in the range 975 Hz to 1 185 Hz.

### **A.4 Compliance with subclause 5.5 (response times)**

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

NOTE 2: The tests for subclauses 5.5.1 and 5.5.2 can be performed together.

The modem shall be connected to Test Line 2 (see ETS 300 114 [2], clause C.5) used during test A.6.1.

#### **A.4.1 Compliance with subclause 5.5.1 (Received Line Signal Detector)**

##### **Calling Mode Modem**

For a modem which is capable of operation as a CMM, the modem shall be caused to enter the on-line state, a tone is transmitted at 1 650 Hz to arrive at the line terminals of the modem under test at a level in the range  $-20$  dBm  $\pm 3,0$  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 indicating that it is no longer detecting a carrier signal.



### **Answer Mode Modem**

For a modem which is capable of operation as an AMM, the modem shall be caused to enter the on-line state, a tone shall be transmitted at 980 Hz to arrive at the line terminals of the modem under test at a level in the range  $-20 \text{ dBm} \pm 3,0 \text{ dB}$ . 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 indicating that it is no longer detecting a carrier signal.

#### **A.4.2 Compliance with subclause 5.5.2 (RFS Indicator)**

### **Calling Mode Modem**

For a modem which is capable of operation as a CMM, the modem shall be caused to enter the on-line state, a tone shall be transmitted at 1 650 Hz to arrive at the line terminals of the modem under test at a level in the range  $-20 \text{ dBm} \pm 3,0 \text{ dB}$ . The time shall be measured from the moment at which the modem indicates that a carrier signal has been detected until the modem indicates that it is ready to transmit data.

### **Answer Mode Modem**

For a modem which is capable of operation as an AMM, the modem shall be caused to enter the on-line state, a tone shall be transmitted at 980 Hz to arrive at the line terminals of the modem under test at a level in the range  $-20 \text{ dBm} \pm 3,0 \text{ dB}$ . The time shall be measured from the moment at which the modem indicates that a carrier signal has been detected until the modem indicates that it is ready to transmit data.

## **A.5 Test for subclause 5.6 (Threshold of received line signal detector)**

The test shall be performed as described in ETS 300 114 [2], annex B, clause B.4. The modem under test shall consecutively be configured to operate as an AMM and as a CMM (if applicable).

The signals to be applied to the modem under test are  $974 \text{ Hz} \pm 0,1 \text{ Hz}$  when the modem is configured to operate as an AMM, and  $1\,644 \text{ Hz} \pm 0,1 \text{ Hz}$  when the modem is configured to operate as a CMM.

## **A.6 Test for subclause 5.9.1 (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 ETS 300 114 [2], 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 Compliance with subclause 5.9.1 a)**

The modem under test shall be connected to the modem used for reference via Test Line 2 without transient impairments (see ETS 300 114 [2], subclause B.6.4 and clause C.4). The modem used for reference shall be caused to transmit the test pattern at 300 bit/s and the degree of synchronous start-stop distortion of the data received at the modem under test shall be measured. The maximum indicated level of synchronous start-stop distortion shall not be greater than 25 %.

For modems which provide both the CMM and AMM mode of operation, the test shall be carried out in both modes.

**A.6.2 Compliance with subclause 5.9.1 b)**

The modem is first connected to one end of Test Line 1 (see ETS 300 114 [2], subclause B.6.4 and clause C.3) without the addition of frequency offset. The modem used for reference shall be connected to the other end. A connection is established between them. The modem used for reference shall be caused to transmit the test pattern at 300 bits per second and the degree of synchronous start-stop distortion of the data received at the modem under test shall be measured. The maximum indicated level of synchronous start-stop distortion shall not be greater than 25 %.

For modems which provide both the CMM and AMM mode of operation the test shall be carried out in both modes.

**A.6.3 Compliance with subclause 5.9.1 c)**

The modem is first connected to one end of Test Line 1 (see ETS 300 114 [2], subclause B.6.4 and clause C.3). The modem used for reference is connected to the other end. A connection shall be established between them. The modem used for reference shall be caused to transmit the test pattern at 300 bits per second and the degree of synchronous start-stop distortion of the data received at the modem under test shall be measured first for a frequency offset of +4 Hz then for a frequency offset of -4 Hz. The maximum indicated level of synchronous start-stop distortion shall not be greater than 30 %.

For modems which provide both the CMM and AMM mode of operation the test shall be carried out in both modes.

**Annex B (informative): 300 bits per second modem based on CCITT Recommendation V.21**

Declaration of modes of operation/use.

The modem submitted for assessment of conformance is capable of operating in the modes indicated in table B.1.

**Table B.1: Channel selection**

a) Call mode	
b) Answer mode	
Where the answer to both a) and b) is YES, the method or methods of mode selection are as required by subclause 3.4	
c) Automatic selection by detection of the line signals	
d) Selection by an associated data terminal	
e) Manual selection using means provided on the modem	

**Table B.2: Auto-calling and/or auto answer**

<b>Auto calling or answering</b>	
a) Auto calling	
b) Auto answering	

## History

Document history			
June 1991	First Edition		
January 1997	Public Enquiry	PE 9722:	1997-01-31 to 1997-05-30
July 1997	Vote	V 9737:	1997-07-15 to 1997-09-12
September 1997	Second Edition		