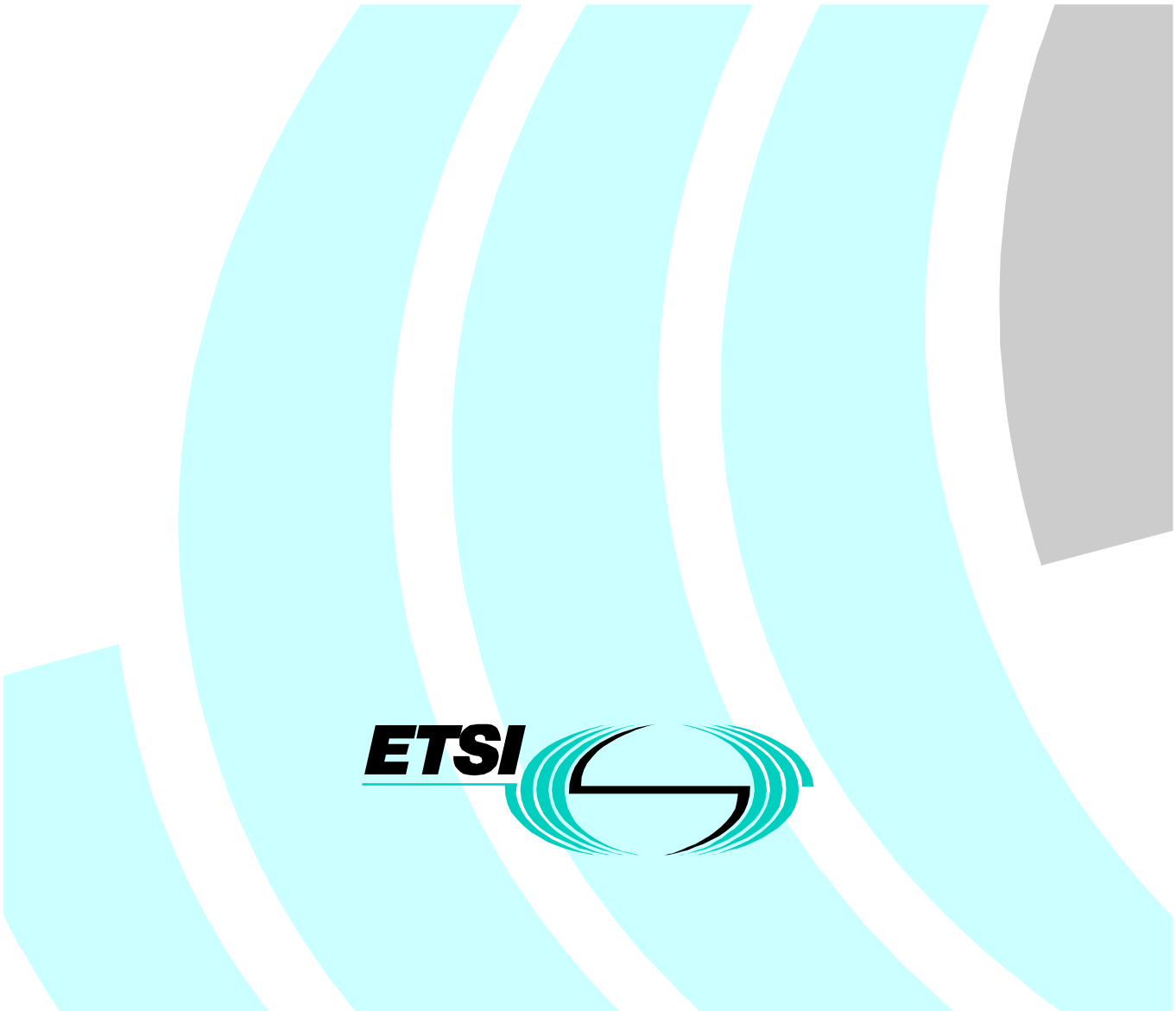
ETSI EN 300 290 V1.2.1 (2001-07)

European Standard (Telecommunications series)

Access and Terminals (AT);
64 kbit/s digital unrestricted leased line
with octet integrity (D64U);
Terminal equipment interface



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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Access and Terminals (AT).

The present document results from a mandate from the Commission of the European Community (CEC) to provide standards for the support of the Directive on Open Network Provision (ONP) of leased lines (92/44/EEC).

There are two other standards directly related to the present document:

- EN 300 288: "Access and Terminals (AT); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Network interface presentation";
- EN 300 289: "Access and Terminals (AT); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Connection characteristics".

The present document is based on information from ITU-T Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

National transposition dates	
Date of adoption of this EN:	29 June 2001
Date of latest announcement of this EN (doa):	30 September 2001
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 March 2002
Date of withdrawal of any conflicting National Standard (dow):	31 March 2002

Introduction

The Council Directive on the application of Open Network Provision (ONP) to leased lines (92/44/EEC) concerns the harmonization of conditions for open and efficient access to, and use of, the leased lines provided over public telecommunications networks and the availability throughout the Community (EEC) of a minimum set of leased lines with harmonized technical characteristics.

The consequence of the Directive is that Telecommunications Organizations within the EEC shall make available a set of leased lines between points in these countries with specified connection characteristics and specified interfaces.

Two categories (voluntary and regulatory) of standard were used for the interfaces of terminal equipment designed for connection to the ONP leased lines. Technical Basis for Regulations (TBRs) gave the earlier essential requirements under the Directive 91/263/EEC, later replaced by 98/13/EC, for attachment to the leased lines, whereas other voluntary standards (ETSs or ENs) gave the full technical specifications for these interfaces. The present document, which is based on an earlier ETS, belongs to the second category.

The requirements of TBR 14 are a subset of the present document.

The present version of the present document has been produced to introduce some necessary changes.

ETS 300 166 and ITU-T Recommendation G.703 [1] were used as the basis for the terminal interface.

1 Scope

The present document specifies the physical and electrical characteristics (except safety, overvoltage and EMC aspects) and corresponding test principles for a terminal equipment interface for connection to the network termination points of ONP 64 kbit/s digital unrestricted leased lines with octet integrity.

The present document is to ensure that the interface of the terminal equipment is compatible with the ONP 64 kbit/s digital unrestricted leased line with octet integrity. It is applicable to all interfaces designed for connection to the leased line, however in the cases of apparatus that carries a particular service, of complex apparatus and of apparatus in private networks, other requirements may apply in addition to the present document.

Customer premises wiring and installation between the terminal equipment and the Network Termination Point (NTP) are outside the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ITU-T Recommendation G.703 (1998): "Physical/electrical characteristics of hierarchical digital interfaces".

[2] ITU-T Recommendation O.152 (1992): "Error performance measuring equipment for bit rates of 64 kbit/s and N x 64 kbit/s".

3 Definitions

For the purposes of the present document, the following definitions apply:

leased lines: telecommunications facilities provided by a public telecommunications network that provide defined transmission characteristics between network termination points and that do not include switching functions that the user can control, (e.g. on-demand switching)

Network Termination Point (NTP): all physical connections and their technical access specifications which form part of the public telecommunications network and are necessary for access to and efficient communication through that public network

Terminal Equipment (TE): equipment intended to be connected to the public telecommunications network, i.e.:

a) to be connected directly to the termination of a public telecommunication network; or

b) to interwork with a public telecommunications network being connected directly or indirectly to the termination of a public telecommunications network;

in order to send, process, or receive information.

4 Abbreviations

For the purposes of the present document, the following abbreviations apply:

D64U	64 kbit/s digital unrestricted ONP leased line with octet integrity
dc	direct current
EMC	Electro-Magnetic Compatibility
NTP	Network Termination Point
ONP	Open Network Provision
ppm	parts per million
PRBS(2^{11}-1)	Pseudo Random Bit Sequence (as defined in clause 2.1 of ITU-T Recommendation O.152 [2])
rms	root mean square
RX	Receive (a signal input at either the leased line interface or the test equipment, see figure 1)
TE	Terminal Equipment
TX	Transmit (a signal output at either the leased line interface or the test equipment, see figure 1)
UI	Unit Interval

5 Requirements

The terminal equipment interface is for use with 64 kbit/s unrestricted leased lines with octet integrity, which provide bidirectional, point-to-point digital connections with a usable bit rate of 64 kbit/s where the leased line output timing is provided from the network. The interface timing arrangements are codirectional.

5.1 Physical characteristics

Currently no standardized connector is readily available. Consequently, the only method of connection that can be specified in the present document is the use of solid conductors of 0,4 mm to 0,6 mm. The present document requires the TE to be capable of presenting either a point for the attachment of unterminated solid conductors, or solid conductors themselves (see clause 5.1.1). It is a requirement that such a connection method be available to be provided for use with the TE if necessary.

In order to allow connection to be made using other methods (e.g. connectors), the TE is permitted to be supplied with a connection method suitable for use with those methods (see clause 5.1.2).

NOTE 1: The following are examples of arrangements that comply with the requirements. The list below should not be regarded as an exhaustive list of all permitted arrangements:

a) a cord, permanently connected to the terminal equipment at one end and unterminated at the other end, with wires that are solid conductors with diameters in the range 0,4 mm to 0,6 mm;

b) a cord, connected via a plug and socket to the terminal equipment at one end and unterminated at the other end, with wires that are solid conductors with diameters in the range 0,4 mm to 0,6 mm;

c) an insulation displacement connector, designed to accept wires with solid conductors with diameters in the range 0,4 mm to 0,6 mm, but with no cord;

d) a screw connector, designed to accept wires with solid conductors with diameters in the range 0,4 mm to 0,6 mm, but with no cord;

e) the arrangement in b) plus one or more additional alternative cords with the same plug or socket arrangement at the terminal end and any plug or socket at the other end;

f) the arrangement in c) or d) plus one or more cords suitable for connection to the terminal equipment at one end and any plug or socket at the other end.

The transmit pair is the output from the terminal equipment interface. The receive pair is the input to the terminal equipment interface, as shown in figure 1. Where the terms "output" and "input" are used without qualification in the present document, they refer to the terminal equipment interface.

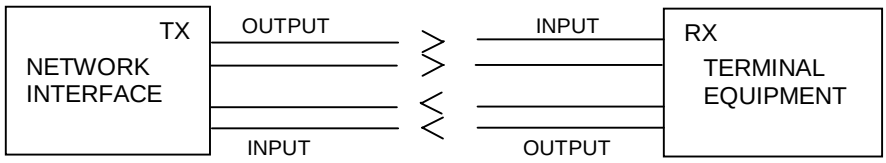


Figure 1

NOTE 2: The use of a shielded cord or cable may be necessary to meet radiation and immunity requirements defined in Electro-Magnetic Compatibility (EMC) standards.

5.1.1 Hardwired connection

Requirement: The terminal equipment shall provide:

a) a set of connection contacts (e.g. an insulation displacement connector or a screw terminal block) to which solid wire conductors with diameters in the range 0,4 mm to 0,6 mm may be connected; or

b) a wiring arrangement connected by any means to the terminal equipment, with unterminated solid wire conductors with diameters in the range 0,4 mm to 0,6 mm at the end distant from the terminal equipment.

Test: There is no test. All subsequent tests are carried out via the specified connection method.

5.1.2 Alternative means of connection

Any alternative means of connection may be provided in addition to the connection arrangements under clause 5.1.1.

5.2 Electrical characteristics

5.2.1 Output port

5.2.1.1 Signal coding

Requirement: The signal transmitted at the output port shall comply with the encoding rules given in annex B.

Test: The test shall be conducted according to annex A, clause A.2.1.

5.2.1.2 Waveform shape

Requirement: The pulse at the output port shall comply with the requirements given in table 2 and figures 2 and 3, taken from ITU-T Recommendation G.703 [1].

Table 2: Waveform shape at output port

Pulse shape (nominally rectangular)	All pulses of a valid signal shall conform with the masks (see figures 2 and 3) irrespective of the polarity.
Test load impedance Nominal peak voltage V of a mark (pulse) Peak voltage of a space (no pulse)	120 Ω non-reactive 1 V 0 V ± 0,1 V
Nominal pulse width	3,9 µs for a single pulse 7,8 µs for a double pulse
Ratio of the amplitudes of positive and negative pulses at the centre of the pulse interval	0,95 to 1,05
Ratio of the widths of positive and negative pulses at the nominal half amplitude	0,95 to 1,05

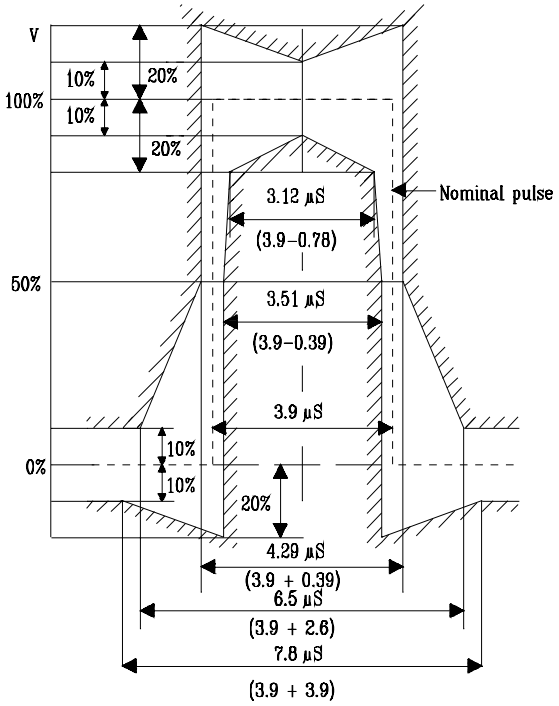


Figure 2: Pulse mask for single pulse

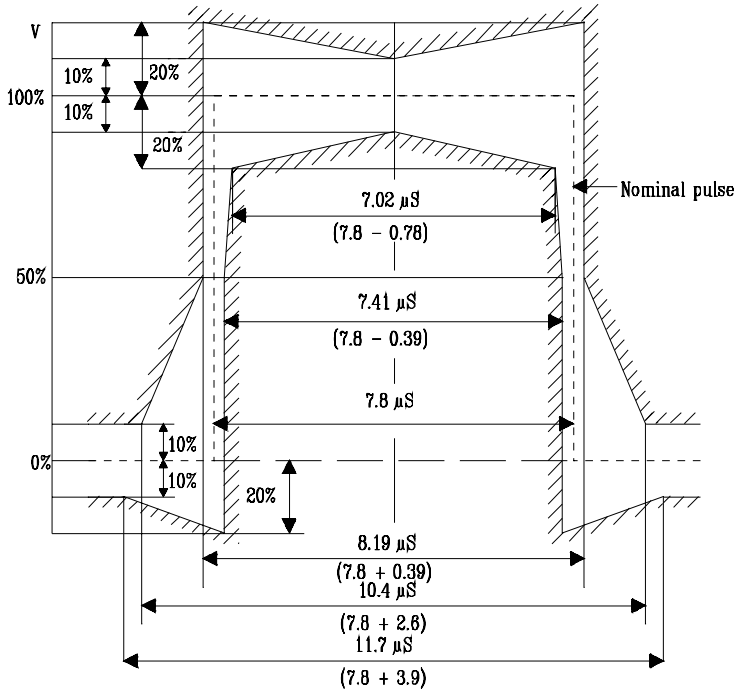


Figure 3: Pulse mask for double pulse

Test: The test shall be according to annex A, clause A.2.2.

5.2.1.3 Output timing

Requirement: The terminal equipment shall be capable of:

a) synchronizing the output timing to the timing received at the receive side of the interface; or

b) synchronizing the output timing to an external reference (plesiochronous working).

NOTE: Additional sources of timing, e.g. an internal clock, are not precluded by the above requirement.

Test: The test for the synchronization of the output timing is covered by the test of annex A, clause A.2.5.

5.2.1.4 Output jitter

This requirement applies when the terminal equipment is producing the timing from an internal clock source or when the terminal equipment is deriving the output timing from an external source (including derivation from the input signal).

Requirement: The peak-to-peak output jitter shall not exceed the limits of table 3 when measured with first order linear filters with the defined cut-off frequencies. For the purpose of testing, any signal input from which the output timing is derived shall be provided with the maximum tolerable input jitter and with the maximum tolerable input frequency deviation as specified by the manufacturer.

NOTE: This requirement differs from that in ETR 005 which defines maximum output jitter in terms of intrinsic jitter and a jitter transfer characteristic. Intrinsic jitter is limited to 0,05 UI from 20 Hz to 20 kHz. The jitter transfer characteristic is limited to 0,5 dB from 20 Hz to 3 kHz, decreasing to -16 dB at 20 kHz.

Where the output timing of the terminal equipment is taken from the leased line, the input to the terminal equipment shall be provided with components of sinusoidal jitter at points on the curve of figure 4 and table 5.

Table 3: Maximum output jitter

Measurement filter bandwidth		Output jitter
Lower cut-off (high pass)	Upper cut-off (low pass)	UI peak-to-peak (maximum)
20 Hz	20 kHz	0,25 UI
3 kHz	20 kHz	0,05 UI

Test: The test shall be conducted according to annex A, clause A.2.5.

5.2.1.5 Output return loss

There are no requirements for output return loss under the present document.

NOTE: A requirement for output return loss may be added to the present document when appropriate specifications become available.

5.2.1.6 Impedance towards ground

Requirement: Where the terminal equipment has a ground, the impedance towards ground of the output port shall be greater than 1 000 Ω for frequencies in the range from 10 Hz to 1 MHz when measured with a sinusoidal test voltage of 2 V rms. For the purpose of this requirement, ground shall be the terminal equipment common reference point or test reference point.

NOTE: This requirement is included to allow transformerless implementations.

Test: The test shall be according to annex A, clause A.2.7.

5.2.1.7 Longitudinal conversion loss

Requirement: Where the terminal equipment has a ground, the longitudinal conversion loss of the terminal output port shall be greater than or equal to the figures given in table 4. For the purpose of this requirement, ground shall be the terminal equipment common reference point or test reference point.

NOTE: This requirement is included to allow transformerless implementations.

Table 4: Output port longitudinal conversion loss

Frequency	Longitudinal conversion loss
3,4 kHz	40 dB
3,4 kHz to 34 kHz	decreasing 20 dB/decade from 40 dB to 20 dB
34 kHz to 256 kHz	20 dB

Test: The test shall be conducted according to annex A, clause A.2.6.

5.2.2 Input port

5.2.2.1 Signal coding

Requirement: The input port shall decode without errors signals encoded in accordance with encoding rules of annex B.

NOTE: When there is no input signal or octet timing is not present at the leased line distant input or when there is a failure in the leased line connection, the octet timing at the leased line output will not be meaningful.

Test: The test shall be according to annex A, clause A.2.3.

5.2.2.2 Input clock tolerance

Requirement: The terminal equipment shall operate without errors with signals encoded as in annex B over the frequency range 64 kbit/s ± 100 ppm.

Test: By declaration.

5.2.2.3 Input jitter tolerance

Requirement: The terminal equipment shall function as specified without errors with the maximum sinusoidal input jitter as shown in figure 4 and table 5.

NOTE: This requirement differs from that in ETR 005 which specifies an input jitter tolerance below 20 Hz (i.e. wander tolerance). The requirement is for 1,15 UI at 1,2 x 10^{-5} Hz, decreasing to 0,25 UI at 20 Hz.

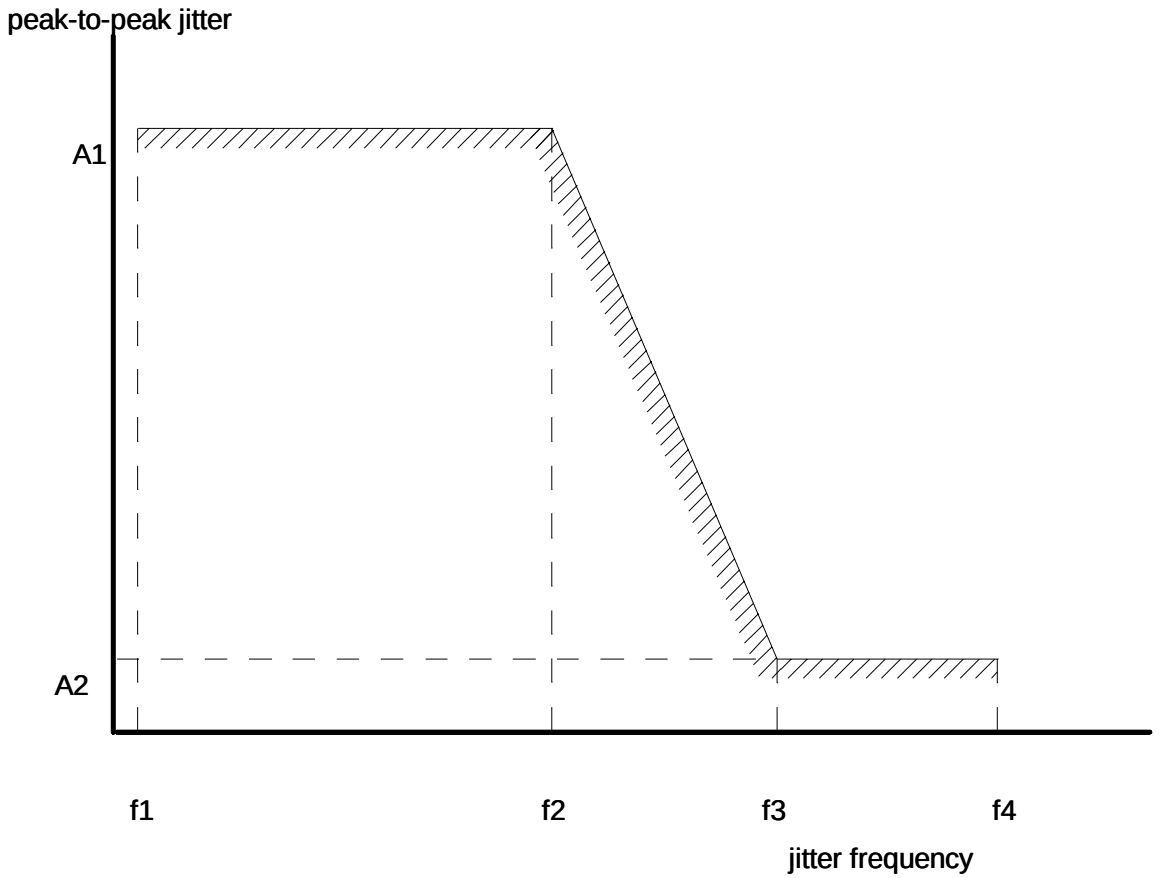


Figure 4: Input jitter tolerance

Table 5: Input jitter tolerance

Peak-to-peak amplitude (UI)		Frequency (Hz)			
A1	A2	f1	f2	f3	f4
0,25	0,05	20	600	3 000	20 000
NOTE: 0,25 UI = 3,9 µs; 0,05 UI = 0,78 µs.					

Test: The test shall be according to annex A, clause A.2.5.

5.2.2.4 Input return loss

Requirement: The input return loss with respect to 120 Ω at the interface shall be greater than or equal to the values given in table 6 taken from ITU-T Recommendation G.703 [1].

Table 6: Input port minimum return loss

Frequency range	Return loss
4 kHz to 13 kHz	12 dB
13 kHz to 256 kHz	18 dB
256 kHz to 384 kHz	14 dB

Test: The test shall be according to annex A, clause A.2.4.

5.2.2.5 Input loss tolerance

Requirement: The input port shall correctly interpret a 64 kbit/s signal as defined in clauses 5.2.1.1 and 5.2.1.2 above but modified by an intervening pair with the following characteristics:

a) attenuation that follows a ´f law with values throughout the range from 0 dB to 3 dB at 128 kHz; and

b) characteristic impedance of 120 Ω with a tolerance of ± 20 % in the frequency range from 200 kHz to 1 MHz, and ±10 % at 1 MHz.

Test: The test shall be according to annex A, clause A.2.3.

5.2.2.6 Immunity against reflections

Requirement: When a signal comprising a combination of a normal signal and an interfering signal is applied to the input port, via an artificial cable with a loss in the range from 0 dB to 3 dB at 128 kHz, no errors shall result due to the interfering signal.

The normal signal shall be a signal encoded according to annex B, shaped according to the masks of figures 2 and 3, with a binary content in accordance with a Pseudo Random Bit Sequence as defined in clause 2.1 of ITU-T Recommendation O.152 [2] (PRBS(2^{11}-1)).

The interfering signal shall be the same as the normal signal except that the level shall be attenuated by 20 dB, the bit rate shall be within 64 kbit/s ± 100 ppm, and the timing shall not be synchronized to the normal signal.

Test: The test shall be according to annex A, clause A.2.3.

5.2.2.7 Impedance towards ground

Requirement: Where the terminal equipment has a ground, the impedance towards ground of the input port shall be greater than 1 000 Ω for frequencies in the range from 10 Hz to 1 MHz when measured with a sinusoidal test voltage of 2 V rms. For the purpose of this requirement, ground shall be the terminal equipment common reference point or test reference point.

NOTE: This requirement is included to allow transformerless implementations.

Test: The test shall be according to annex A, clause A.2.7.

5.2.2.8 Longitudinal conversion loss

Requirement: Where the terminal equipment has a ground, the longitudinal conversion loss of the terminal input port shall be greater than or equal to the figures given in table 7. For the purpose of this requirement, ground shall be the terminal equipment common reference point or test reference point.

NOTE: This requirement is included to allow transformerless implementations.

Table 7: Input port longitudinal conversion loss

Frequency	Longitudinal conversion loss
3,4 kHz	40 dB
3,4 kHz to 34 kHz	decreasing 20 dB/decade from 40 dB to 20 dB
34 kHz to 256 kHz	20 dB

Test: The test shall be conducted according to annex A, clause A.2.6.

5.3 Safety

Requirements for safety are outside the scope of the present document.

Safety standards are published by CENELEC.

NOTE 1: An example of such a CENELEC product safety standard is EN 60950 (see annex C).

NOTE 2: For safety categories of interfaces, see EG 201 212, this document is also available from CENELEC as ROBT-002.

NOTE 3: Designers should take into account the minimum impedance towards ground specified in the present document.

5.4 Overvoltage

Overvoltage aspects are outside of the scope of the present document.

5.5 Electro-magnetic compatibility

EMC requirements are outside the scope of the present document.

Annex A (normative): Test methods

A.1 General

This annex describes the test principles to determine the compliance of a terminal equipment against the requirements of the present document.

It is outside the scope of the present document to identify the specific details of the implementation of the tests.

A terminal equipment may be designed for through-connecting and may fulfil the electrical requirements only if through-connected. In these cases the requirements of the present document are valid and the tests are carried out with the through-connection terminated as defined by the equipment supplier.

Details of test equipment accuracy and the specification tolerance of the test devices are not included in all cases. Where such details are provided they shall be complied with, but the way they are expressed shall not constrain the method of implementing the test.

NOTE: Attention is drawn to the issue of measurement uncertainty which may be addressed in future documents. Not all the required test results make allowance for spurious events during testing (e.g. errors due to EMC effects), which may make it necessary to repeat a test.

The test configurations given do not imply a specific realization of the test equipment or test arrangement, or the use of specific test devices. However any test configuration used shall provide those test conditions specified under "interface state", "stimulus" and "monitor" for each individual test.

The test equipment shall be a device, or a group of devices, that is capable of generating a stimulus signal conforming to the present document and capable of monitoring the signal received from the interface.

A.1.1 Additional information to support the test

The following facilities shall be provided by the terminal equipment interface under test:

a) an ability to configure the terminal equipment such that it provides a transparent loopback of the input to the output; and

b) an ability to transmit a given bit pattern, e.g. PRBS(2^{11}-1);

or

c) where a) or b) cannot be provided, an alternative means of performing the test.

A.1.2 Equipment connection

The tests in the present document shall be carried out using the connection method suitable for use with unterminated solid conductors as defined in clause 5.1.1. However, in the case of the tests specified in clauses A.2.2, A.2.4 and A.2.7, an alternative method of connection may be provided by the terminal equipment supplier for test purposes. In this case, this method of connection shall be used for these tests because the requirements do not make allowances for the electrical characteristics of any cord.

NOTE: This alternative method of connection is for test purposes only and has been introduced because the characteristics in clauses A.2.2, A.2.4 and A.2.7 are based on ITU-T Recommendation G.703 [1] which makes no allowance for additional wiring. This alternative method may not be the same as the alternative method of connection referred to in clause 5.1.2 which is for operational use.

A.2 Test methods

One test may cover more than one requirement. The scope of each test is defined under the heading "purpose".

A.2.1 Signal coding at output port

Purpose: To test the correct signal coding at the terminal equipment output port.

Test configuration: Figure A.1.

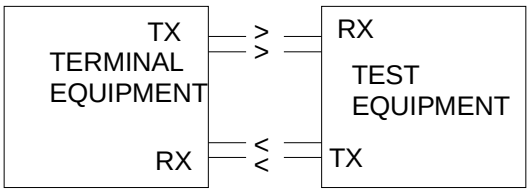


Figure A.1: Signal coding at output port

Interface state: Powered.

Stimulus: The terminal shall transmit a bit stream including both binary ONEs and binary ZEROs, for example a PRBS(2^{11}-1).

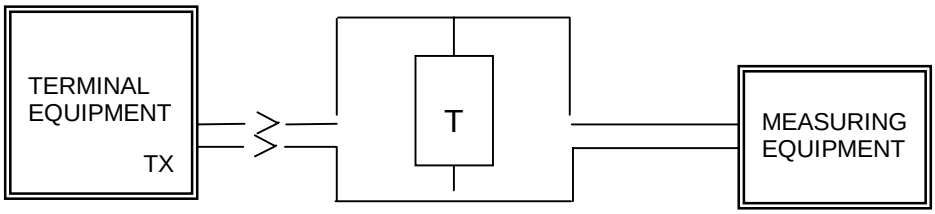
Monitor: The output bit stream.

Results: Within a test duration of up to 5 minutes there shall be at least one period of one minute during which there are no errors in the decoded bit stream.

A.2.2 Waveform shape at output port

Purpose: To verify the output waveform for both single and double pulses.

Test configuration: Figure A.2.



T = TERMINATING RESISTOR
120 Ω ± 0,25 %

Figure A.2: Waveform shape at output port

Interface state: Powered.

Stimulus: Undefined.

Monitor: Marks and spaces transmitted by the terminal equipment, measuring the amplitude and shape of positive and negative pulses (measured at the centre of the pulse interval) and the time duration of positive and negative pulses (measured at the nominal half of the pulse amplitude, i.e. 0,5 V).

The overall measurement accuracy shall be better than 30 mV. All the measurements shall be performed using measuring equipment capable of recording dc. A bandwidth of 200 MHz or greater shall be used to ensure the capture of overshoot or undershoot of the pulse.

Results: Both positive and negative pulses shall be within the masks of figures 2 and 3 as appropriate where V = 100 % shall be 1 V.

The bit interval corresponding to a space shall not present voltages higher than ±0,1 V.

The ratio between the amplitude of positive and negative pulses shall be contained in the range from 0,95 to 1,05.

The ratio between the pulse widths of positive and negative pulses shall be in the range from 0,95 to 1,05.

A.2.3 Input coding, loss tolerance and immunity against reflections

Purpose: To check the input port coding, input loss with a cable attenuation of maximum 3 dB and immunity against an interfering signal combined with the input signal.

Test configuration: Figure A.3.

The output signals of the test equipment and the pattern generator shall be encoded as in clause 4.2.1.1 of ITU-T Recommendation G.703 [1] and conform to a pulse shape as defined in table 1/G.703 and figure 5/G.703 of ITU-T Recommendation G.703 [1]. The binary content shall be a PRBS(2^{11}-1). The bit rates shall be within the limits 64 kbit/s ± 100 ppm and the output signal of the pattern generator shall not be synchronized to the output signal of the test equipment.

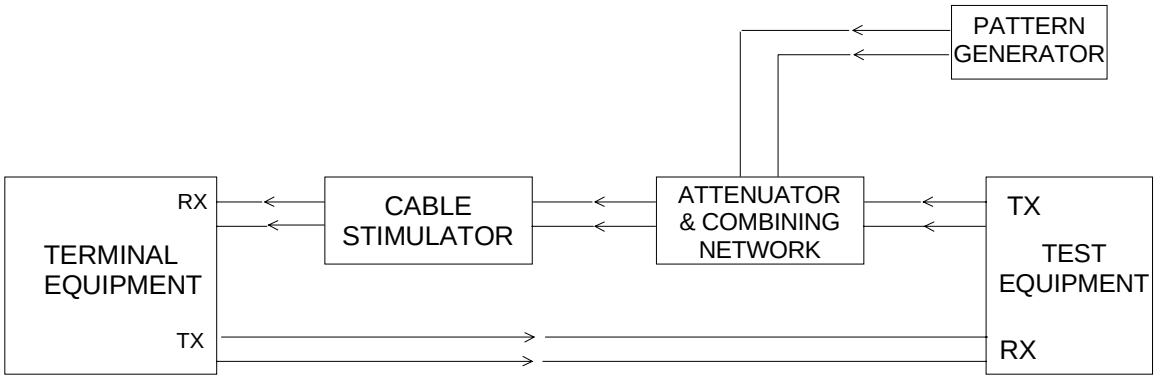


Figure A.3: Immunity against reflections

The interfering signal shall be combined with the main signal in a combining network of impedance 120 Ω, with 0 dB loss in the main path and an attenuation in the interference path of 20 dB.

The cable simulator shall have an attenuation of 3 dB measured at 128 kHz and an attenuation characteristic that follows a ´f law.

The conformance of the interface shall be verified in the following test conditions:

a) without cable simulator and without interfering tone, with the test equipment generating a PRBS; and

b) with cable simulator and without interfering tone; and

c) without cable simulator and with interfering tone; and

d) with cable simulator and with interfering tone.

The test shall be repeated with the wires at the terminal equipment interface reversed.

Interface state: Powered, with received data looped back to the output port.

Stimulus: A PRBS(2^{11}-1) bit stream.

Monitor: Data at output port.

Results: Within a test duration of up to 5 minutes there shall be at least one period of one minute during which the data received from the equipment under test is identical with the generated sequence.

NOTE: The ´f law of the cable simulator shall apply over the frequency range from 100 kHz to 1 MHz.

A.2.4 Return loss at input port

Purpose: To measure the return loss with respect to 120 Ω of the receive pair of the terminal equipment interface.

Test configuration: Figure A.4.

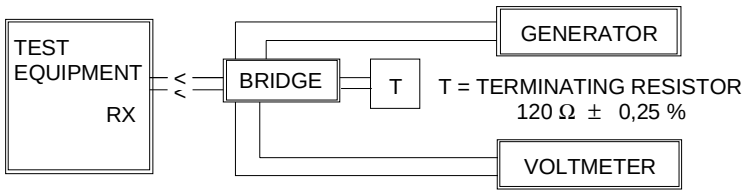


Figure A.4: Return loss at input port

Interface state: Powered.

Stimulus: Sinusoidal signal of 1 V peak at the input port of the terminal equipment with a frequency variable between 4 kHz and 384 kHz.

Monitor: Voltage measured across the bridge, representing a terminating resistor of 120 Ω, using a selective voltmeter with a bandwidth of less than 1 kHz.

Results: The measured return loss shall be greater than or equal to the values in table 6 (clause 5.2.2.4).

NOTE: The characteristics of the generator and of the voltmeter may be different depending on the implementation of the bridge however the total error of the test set-up should be less than 0,5 dB in the range between 10 dB and 20 dB. When connected to a 120 Ω ± 0,25 % resistor, the measured return loss of the bridge should be 20 dB higher than the limits specified for the interface.

A.2.5 Input and output jitter

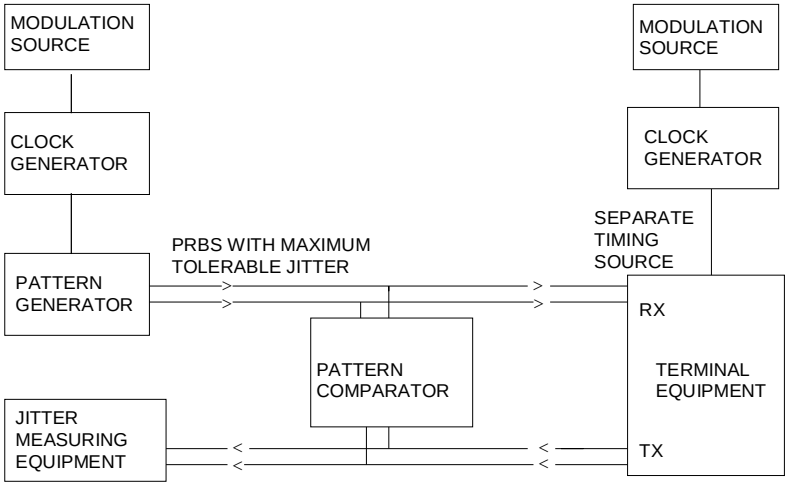
Purpose: This test is used to measure tolerance to input jitter and maximum output jitter.

Test configuration: Figure A.5.

The terminal equipment shall be configured (where these modes of operation are supported):

a) with output timing referenced to the internal clock; and

b) with output timing referenced to any external clock source from which timing can be derived.



NOTE: The modulation source may be included in the clock generator and/or the pattern generator, or it may be provided separately.

Figure A.5: Jitter measurement

Interface state: Powered.

Stimulus: The output signal of the pattern generator shall be encoded as in clause 4.2.1.1 of ITU-T Recommendation G.703 [1] and conform to a pulse shape as defined in table 1/G.703 and figure 5/G.703 of ITU-T Recommendation G.703 [1]. The binary content shall be a PRBS(2^{11}-1). If this signal causes the equipment to operate in such a manner that the test is not valid, the supplier shall declare how a suitable test signal shall be applied.

Measurements shall be made at the nominal digital rate of 64 kbit/s.

It may be necessary to synchronize the pattern generator:

a) to the output of the terminal equipment when the terminal equipment is running from its own internal clock; or

b) to the external clock source when the terminal equipment is running from this clock source;

in order to avoid a high occurrence of slips.

The modulation source for the terminal equipment signal input shall generate individual components of sinusoidal jitter at points on the curve of figure 4 and table 5 of the present document.

The modulation source for the external timing (if needed) shall be independent from that for the input signal and shall generate the maximum tolerable jitter defined by the manufacturer of the terminal equipment.

Monitor: a) The signal transmitted by the terminal equipment; and

b) the jitter extracted from this signal.

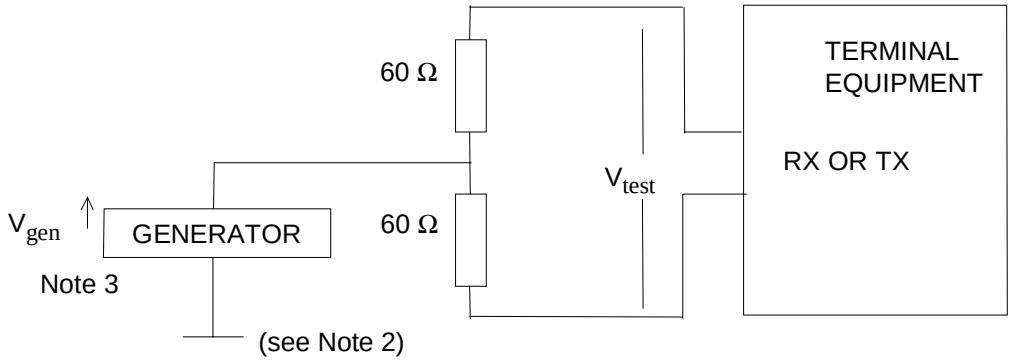
Results: a) There shall be no bit errors reported by the test equipment within the period of the test; and

b) the peak-to-peak jitter shall comply with table 3 (clause 5.2.1.4) when measured with first order linear filters with the defined cut-off frequencies.

A.2.6 Longitudinal conversion loss

Purpose: To measure the longitudinal conversion loss of the input and output ports.

Test configuration: Figure A.6.



NOTE 1: The 60 Ω resistors shall be within 1 % and matched to better than 0,1 %.
NOTE 2: This point is connected to the terminal equipment common reference point or test reference point.
NOTE 3: The impedance of the generator shall be 120 Ω.

Figure A.6: Longitudinal conversion loss

Interface state: Powered.

Stimulus: Generator output (V_{gen}) 1 V rms ± 10 mV shall be applied at any frequency in the range from 3,4 kHz to 256 kHz.

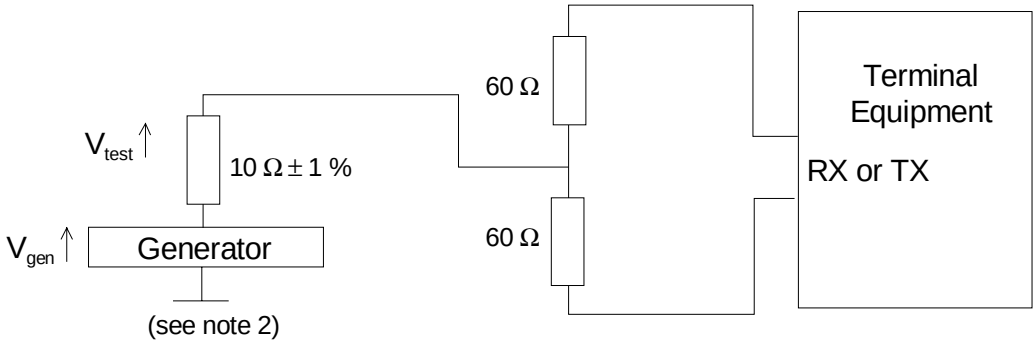
Monitor: Voltages V_{gen} and V_{test}.

Results: The longitudinal conversion loss $20 \log_{10} (|V_{gen}/V_{test}|)$ shall be greater than or equal to the values given in table 4 (clause 5.2.1.7) or table 7 (clause 5.2.2.8) as applicable.

A.2.7 Impedance towards ground

Purpose: To check the terminal equipment interface input and output ports impedance towards ground.

Test configuration: Figure A.7.



NOTE 1: The 60 Ω resistors shall be within 1 % and matched to better than 0,1 %.
NOTE 2: This point is connected to the terminal equipment common reference point or to the equipment test reference point.

Figure A.7: Impedance towards ground

Interface state: Powered.

Stimulus: Sinusoidal test signal (V_{gen}) of 2 V rms ± 20 mV applied over the frequency range from 10 Hz to 1 MHz.

Monitor: Voltage of V_{test}.

Results: Voltage V_{test} shall be less than 19,2 mV rms.

Annex B (normative): Code conversion rules

This annex specifies the code conversion rules for the 64 kbit/s codirectional interface, defined in clause 4.2.1.1 of ITU-T Recommendation G.703 [1].

Step 1: A 64 kbit/s bit period is divided into four unit intervals.

Step 2: A binary 1 is encoded as a block of the following four bits:

1 1 0 0

Step 3: A binary 0 is encoded as a block of the following four bits:

1 0 1 0

Step 4: The binary signal is converted into a three-level signal by alternating the polarity of consecutive blocks.

Step 5: The alteration in polarity of the blocks is violated every 8th block. The violation marks the last bit in an octet.

These conversion rules are illustrated in figure B.1.

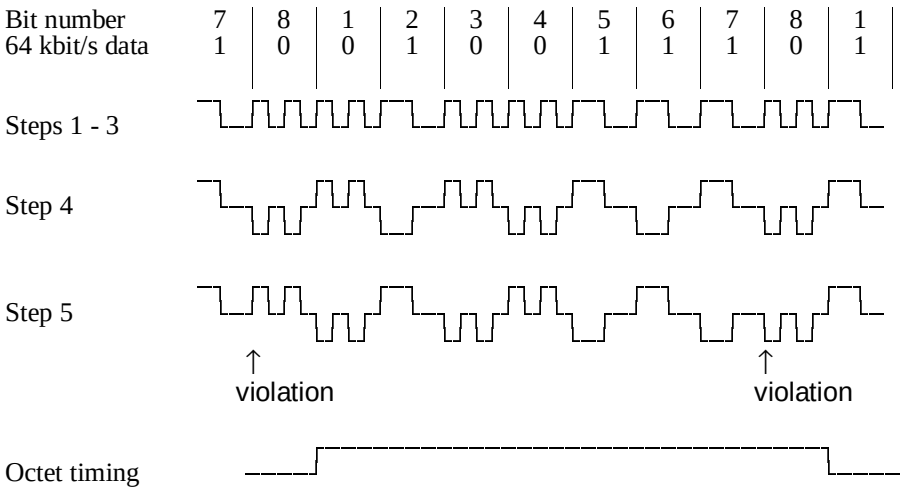


Figure B.1: 64 kbit/s code conversion

Annex C (informative): Bibliography

Council Directive 91/263/EEC of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity.

Council Directive 92/44/EEC of 5 June 1992 on the application of open network provision to leased lines.

Directive 98/13/EC of the European Parliament and of the Council of 12 February 1998 relating to telecommunications terminal equipment and satellite earth station equipment, including the mutual recognition of their conformity.

ETSI ETR 005 (1990): "Terminal Equipment (TE); Technical requirements for data terminal equipment for connection to high speed digital fixed-connection services".

ETSI ETS 300 166 (1993): "Transmission and Multiplexing (TM); Physical and electrical characteristics of hierarchical digital interfaces for equipment using the 2 048 kbit/s - based plesiochronous or synchronous digital hierarchies".

CENELEC EN 60 950: "Safety of information technology equipment"

ETSI EN 300 288: "Access and Terminals (AT); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Network interface presentation";

ETSI EN 300 289: "Access and Terminals (AT); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Connection characteristics".

ETSI EG 201 212: "Electrical safety; Classification of interfaces for equipment to be connected to telecommunication networks". This document is also available from CENELEC as ROBT-002.

History

Document history		
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