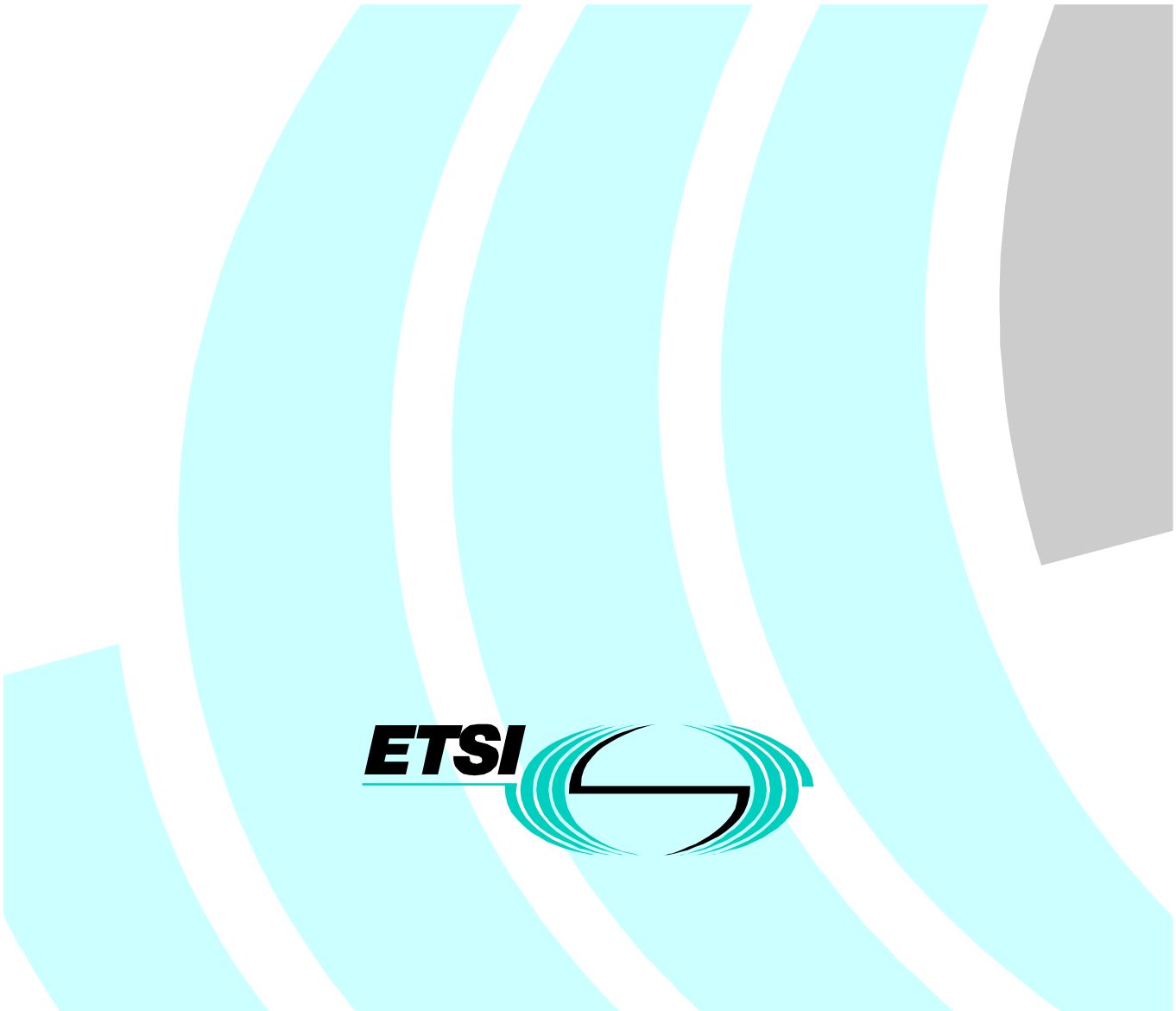
ETSI EN 300 288 V1.2.1 (2001-07)

European Standard (Telecommunications series)

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



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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 resulted 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) (see annex C).

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

- EN 300 289: "Access and Terminals (AT); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Connection characteristics";
- EN 300 290: "Access and Terminals (AT); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Terminal equipment interface".

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) (see annex C) 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.

Other countries outside the EEC may also choose to provide leased lines according to the standards produced to support the Directive (of which the present document is one of the set).

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. Under the Directive 91/263/EEC (see annex C), later replaced by 98/13/EC (see annex C), terminal equipment for connection to these leased lines was required to fulfil certain essential requirements.

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

ETS 300 166 (see annex C) and ITU-T Recommendation G.703 [1] were used as the basis for the interface presentation requirements.

1 Scope

The present document specifies the technical requirements and test principles for the network interface presentations of Open Network Provision (ONP) 64 kbit/s digital unrestricted leased lines with octet integrity. These presentations are codirectional.

A connection is presented via interfaces at Network Termination Points (NTP). The present document defines the network interface presented by the leased line provider and should be used in conjunction with the companion standard, EN 300 289 [3], which specifies the connection characteristics between the NTPs of the leased line. Together, these documents describe the service offered.

The present document is applicable to leased lines, including part time leased lines, whose establishment or release does not require any protocol exchange or other intervention at the NTP.

The present document covers the physical, mechanical and electrical characteristics (except safety, overvoltage and EMC aspects) of the network interface and specifies the conformance tests for equipment of the kind that provides the interface presentation. Some of the tests described in the present document are not designed to be applied to the interface of an installed leased line; such tests may be applied to equipment of the kind used to provide the interface. The present document does not include details concerning the implementation of the tests nor does it include information on any regulations concerning testing. There is no requirement for each leased line to be tested in accordance with the present document before it is brought into, or returned into, service.

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

[4] ETSI EN 300 290: "Access and Terminals (AT); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Terminal equipment interface".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and 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.

3.2 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)

4 Requirements

The 64 kbit/s unrestricted leased line provides a bidirectional, point-to-point digital leased line with a usable bit rate of 64 kbit/s and octet integrity, where the output timing is provided from the network. The interface timing arrangements are codirectional.

NOTE: If equipment providing the interface requires a mains supply, the leased line provider should bring this to the attention of the user so that the user can provide mains supply back-up facilities, if required.

4.1 Physical characteristics

The connection arrangements provided by the leased line interface shall be suitable for hardwired connection (see clause 4.1.1). However, with the agreement of the user, an alternative means of connection, using a socket, may be provided (see clause 4.1.2).

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

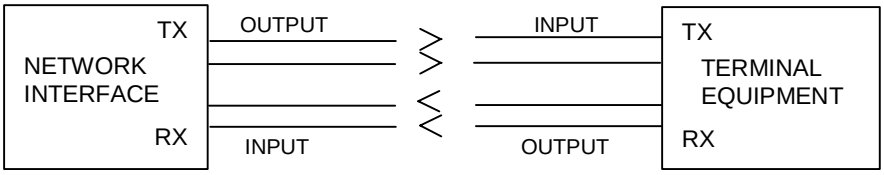


Figure 1

The use on the terminal equipment side of the interface of shielded cables may be necessary to meet radiation and immunity requirements defined in Electro-Magnetic Compatibility (EMC) standards. Therefore the NTP is required to provide a point for connection of the shield (see clause 4.1.3).

4.1.1 Hardwired connection

Requirement: Where the leased line is being presented as a hardwired connection, the leased line interface shall provide a means of terminating wire with solid conductors having diameters in the range 0,4 mm to 0,6 mm. The leased line provider shall provide information on the configuration of the means of connection.

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

4.1.2 Socket specification

There is no constraint on the type of socket that may be used under the present document.

4.1.3 Shield connection point

Requirement: The NTP shall provide a point, or points, to which the shield, or shields, of the cable on the terminal side of the interface can be connected.

NOTE: The purpose of these points is to provide a path from the shield to a common reference. The common reference point does not necessarily have to be earthed.

Test: There shall be a visual inspection that a point, or points, for connection of the shield, or shields, is provided.

4.2 Electrical characteristics

4.2.1 Output port

4.2.1.1 Signal coding

Requirement: The signal transmitted at the output port shall comply with the encoding rules given in 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 clause A.2.1.

4.2.1.2 Waveform shape

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

Table 1: Waveform shape at output port

Pulse shape (nominally rectangular)	All pulses of a valid signal shall conform to the masks (see figures 2 and 3) irrespective of the polarity.
Test load impedance	120 Ω non-reactive
Nominal peak voltage V of a mark (pulse)	1 V
Peak voltage of a space (no pulse)	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

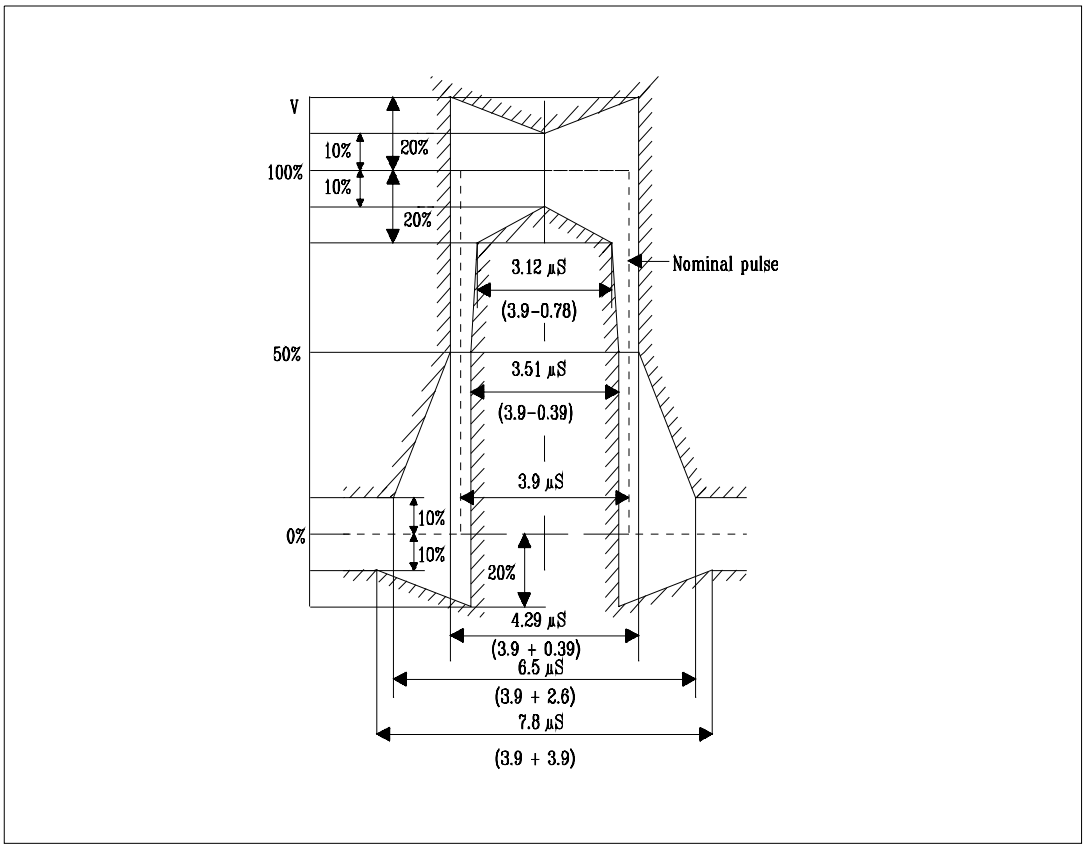


Figure 2: Pulse mask for single pulse

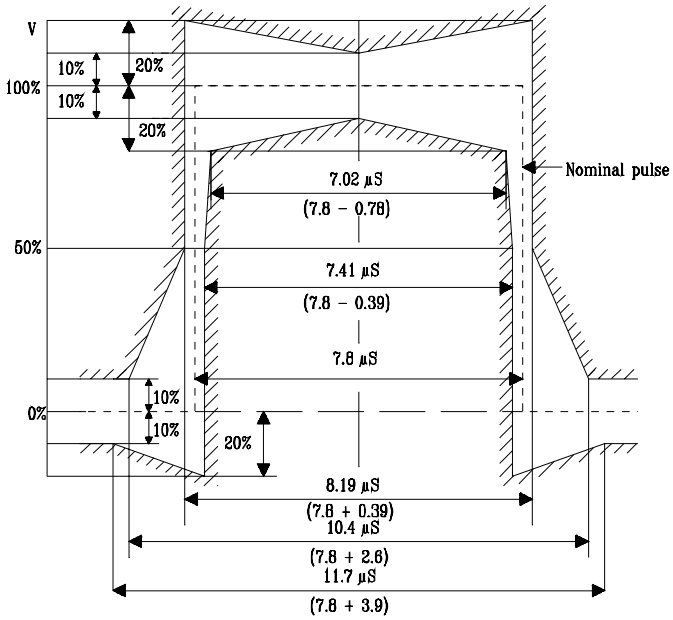


Figure 3: Pulse mask for double pulse

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

4.2.1.3 Output timing

Requirement: Under normal operating conditions, the timing of the output signal shall be network timing.

NOTE: Network timing is timing that is derived from the source or sources of timing that are used for the whole network. Therefore, the timing provided by the leased line will be similar to that provided by other digital services.

Test: By declaration.

4.2.1.4 Output timing under failure conditions

Requirement: When there is a failure within the network and if a signal is presented at the interface output, the timing of the output signal shall be 64 kbit/s ± 100 ppm.

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

4.2.1.5 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.

4.2.1.6 Impedance towards ground

Requirement: The impedance towards ground of the output port shall be greater than 1 000 Ω for frequencies in the range of 10 Hz to 1 MHz when measured with a sinusoidal test voltage of 2 V rms. Ground (in this context) shall be the shield connection point defined in clause 4.1.3.

NOTE: This requirement is included to allow transformerless implementations.

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

4.2.1.7 Longitudinal conversion loss

Requirement: The longitudinal conversion loss of the output port shall be greater than or equal to the figures given in table 2. Ground (in this context) shall be the shield connection point defined in clause 4.1.3.

NOTE: This requirement is included to allow transformerless implementations.

Table 2: 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 clause A.2.6.

4.2.1.8 Output signal balance

There are no requirements for output signal balance under the present document.

NOTE: The effects of the output signal imbalance are covered under the EMC Directive (89/336/EEC) (see annex C).

4.2.2 Input port

4.2.2.1 Signal coding

Requirement: The input port shall accept, without error, signals encoded in accordance with encoding rules of annex B.

NOTE: The output signal is not defined when there is no input signal or octet timing present at the leased line distant input.

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

4.2.2.2 Input timing and jitter tolerance

The requirement for input timing and jitter tolerance is given in the companion standard EN 300 289 [3].

4.2.2.3 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 3 taken from ITU-T Recommendation G.703 [1].

Table 3: 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 clause A.2.5.

4.2.2.4 Input loss tolerance

Requirement: The input port shall correctly operate, without errors, with a 64 kbit/s input signal as defined in clauses 4.2.1.1 and 4.2.1.2 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 clause A.2.4.

4.2.2.5 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(211-1)).

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 clause A.2.4.

4.2.2.6 Impedance towards ground

Requirement: 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. Ground (in this context) shall be the shield connection point defined in clause 4.1.3.

NOTE: This requirement is included to allow transformerless implementations.

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

4.2.2.7 Longitudinal conversion loss

Requirement: The longitudinal conversion loss of the input port shall be greater than or equal to the figures given in table 4. Ground (in this context) shall be the shield connection point defined in clause 4.1.3.

NOTE: This requirement is included to allow transformerless implementations.

Table 4: 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 clause A.2.6.

4.3 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 60 950 (see annex C). The present document is also available from CENELEC as ROBT-002.

NOTE 2: For safety categories of interfaces, see EG 201 212 (see annex C).

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

4.4 Overvoltage

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

4.5 Electromagnetic 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 leased line interface against the requirements of the present document. There is no requirement for each leased line to be tested in accordance with the present document before it is brought into, or returned into, service. The tests in clauses A.2.1, A.2.3, A.2.4, A.2.6 and A.2.7 are not designed for use on installed leased lines. Such tests may be applied to equipment of the kind used to provide the interface.

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

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 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 network interface.

A.1.1 Additional information to support the test

The following facilities shall be provided:

a) an ability to configure the interface 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(211-1); or

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

A.1.2 Equipment connection

Testing shall be performed at the point of connection in accordance with clause 4.1, as this is the point at which compliance with the present document is required.

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 leased line interface output port.

Test configuration: Figure A.1.

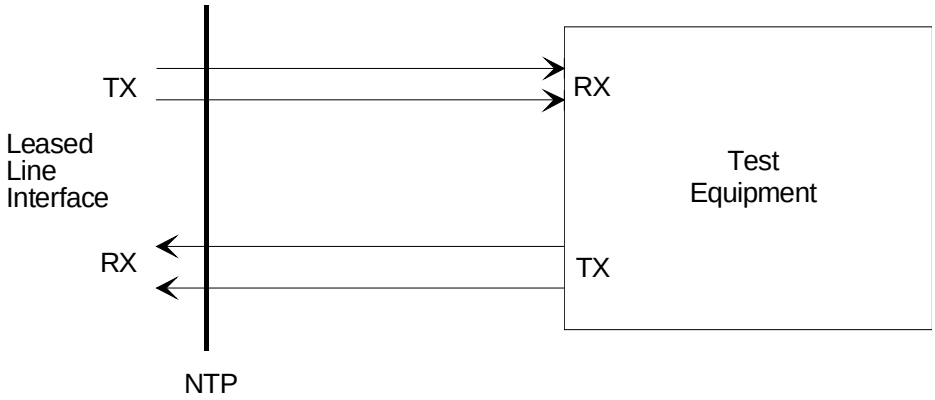


Figure A.1: Signal coding at output port

Interface state: Powered.

Stimulus: The leased line interface shall transmit a bit stream including both binary ONEs and binary ZEROs, for example a PRBS(211-1).

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 encoding.

A.2.2 Waveform shape at output port

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

Test configuration: Figure A.2.

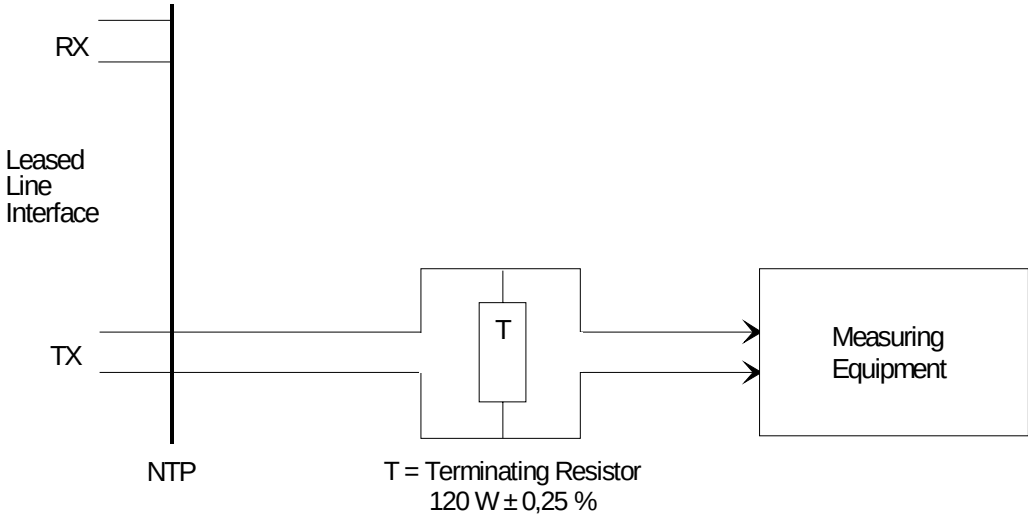


Figure A.2: Waveform shape at output port

Interface state: Powered.

Stimulus: Undefined.

Monitor: Marks and spaces transmitted from the NTP, 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 A.2 and A.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 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 Output timing under failure conditions

Purpose: To measure the output timing if an output signal is present under network failure conditions.

Test configuration: Figure A.3.

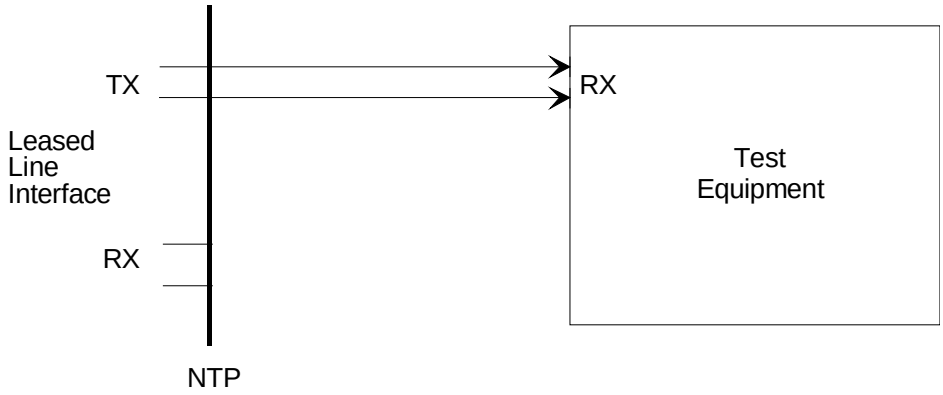


Figure A.3: Output timing under failure conditions

Interface state: Powered.

Stimulus: The interface shall be configured to provide whatever signal is provided under network failure conditions, e.g. all ONEs.

Monitor: The output bit rate from the leased line interface.

Results: The output bit rate shall be within the limits of 64 kbit/s ± 100 ppm.

A.2.4 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.4.

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], which are reproduced in figures 2 and 3 of the present document. The binary content shall be a PRBS(211-1). The output bit rate of the test equipment shall be the bit rate of the leased line (i.e. the timing is looped back). The output bit rate of the pattern generator shall be within the limits 64 kbit/s ± 100 ppm and shall not be synchronized to the output signal of the test equipment or leased line.

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.

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(211-1);

b) with cable simulator and without interfering tone;

c) without cable simulator and with interfering tone;

d) with cable simulator and with interfering tone.

The test shall be repeated with the wires at the network interface input (RX) reversed.

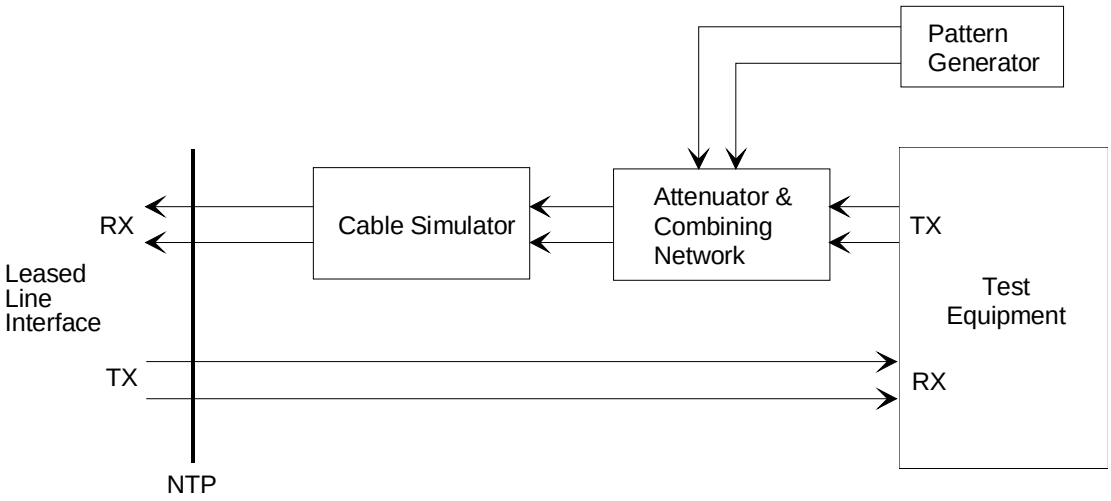


Figure A.4: Immunity against reflections

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

Stimulus: A PRBS(211-1) bit stream, encoded as defined in annex B.

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 there are no bit errors.

A.2.5 Return loss at input port

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

Test configuration: Figure A.5.

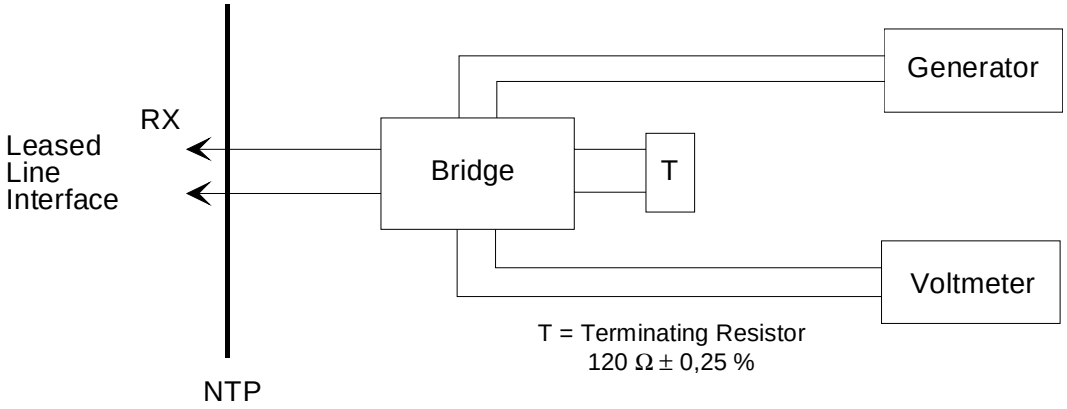


Figure A.5: Return loss at input port

Interface state: Powered.

Stimulus: Sinusoidal signal of 1 V peak at the input to the network interface 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.

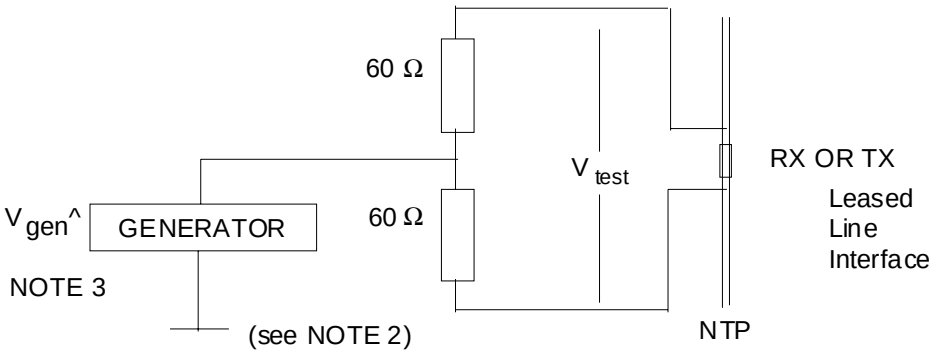
Results: The measured return loss shall be greater than or equal to the values in table 3 (clause 4.2.2.3).

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 shall be 20 dB higher than the limits specified for the interface.

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: Ground (in this context) shall be the shield connection point defined in clause 4.1.3.
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.

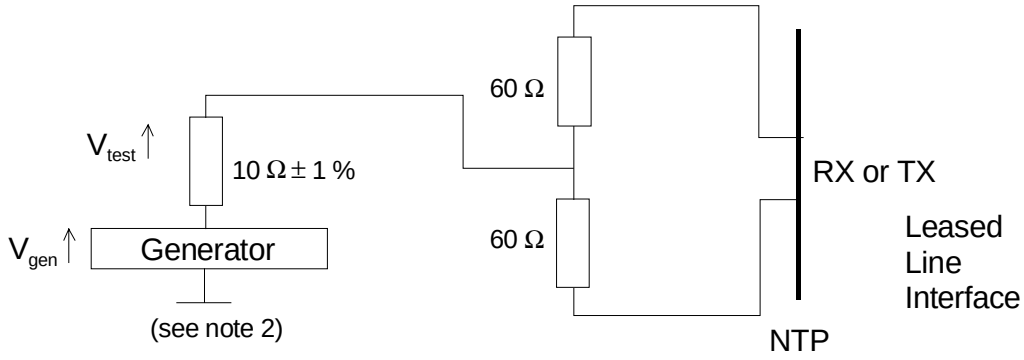
Monitor: Voltages V_{gen} and V_{test}.

Results: The longitudinal conversion loss 20 $\log_{10}$ ($|V_{gen}/V_{test}|$) shall be greater than or equal to the values given in table 2 (clause 4.2.1.7) or table 4 (clause 4.2.2.7) as applicable.

A.2.7 Impedance towards ground

Purpose: To check leased line 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: Ground (in this context) shall be the shield connection point defined in clause 4.1.3.

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.

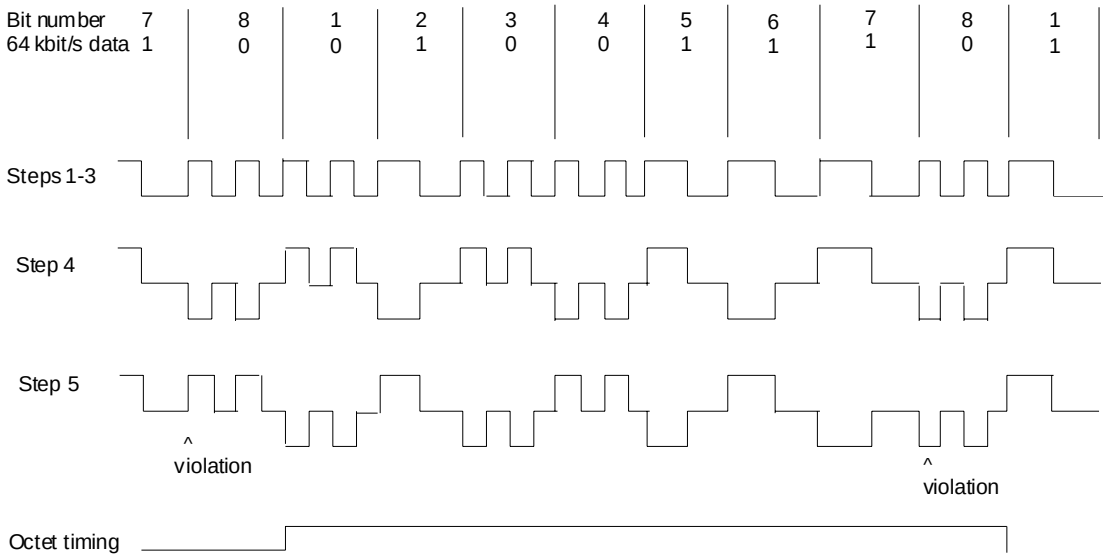


Figure B.1: 64 kbit/s code conversion

Annex C (informative): Bibliography

Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive).

Council Directive 91/263/EEC of 29 April 1991 on the approximation of the laws of 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 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 60950: "Safety of information technology equipment".

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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