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Foreword

ETSI Technical Reports (ETRs) are informative documents resulting from ETSI studies which are not appropriate for European Telecommunications Standard (ETS) or Interim-Telecommunications Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

This ETR has been produced by the Business Telecommunications (BT) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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Executive Summary

This European Technical Report has been produced by Project Team 9V of the European Telecommunications Standards Institute (ETSI) in response to the mandate (Work Order No. 45062) given by the European Commission DG XIII.

The object of the mandate is to establish in two phases the set of additional European Standards required to meet the requirements of Open Network Provision (ONP) for leased lines. This report deals with the first phase of the mandate, which concerns an assessment of the current standards situation in relation to ONP leased lines and a proposal for the additional work necessary for the preparation of relevant standards.

From the technical point of view we have concluded that:

a) the currently available standards do not adequately cover the requirements for ONP leased lines;

b) a significant amount of work will be required in order to put in place the appropriate standards e.g.;

- work will be required to supplement CCITT Recommendation G.703, which in itself is not a complete interface specification;

- further discussion of the parameter values in the standards for analogue leased lines will be required in order to reconcile the various national differences resulting from a long period in which analogue technology has developed independently in the member states;

c) it will not be possible for the TOs to supervise, and so guarantee, all aspects of the performance of analogue and unstructured digital connections between NTPs during operation.

We have considered in some depth the content and scopes of the required standards. We have drafted scope statements and preliminary abstracts covering the contents of the standards.

Below, we summarise the recommendations from our work:

Recommendation 1

We recommend that the provision of ONP leased lines is viewed in terms of connections with standardised characteristics and presented to the user with a standardised interface presentation.

Recommendation 2

We recommend that three types of document are required in support of the ONP leased line Directive. These are:

a) ETSs describing the characteristics of ONP leased line connections;

b) ETSs describing the interface presentations for ONP leased lines;

c) ETSs describing the requirements for terminal equipments to be attached to ONP leased lines.

In addition, although not essential, we suggest that an Application Note is produced to provide relevant further information concerning ONP leased lines.

Recommendation 3

We recommend that the CEC gives the earliest and widest possible publicity to the scopes and abstracts of the proposed ETSs for ONP leased lines.

Recommendation 4

We recommend that the interface presentation specifications for the 2048 kbit/s digital leased lines identified in Annex 2 of the Directive should be based upon ETS 300 166, and that additional material should be drawn where appropriate from ETS 300 011.

Recommendation 5

We recommend that the interface presentation specifications for the 64 kbit/s digital leased line identified in Annex 2 of the Directive should be based upon ETS 300 166, and that additional material should be drawn where appropriate from ETS 300 012.

Recommendation 6

We recommend, in the case of 2048 kbit/s digital leased lines, that a 120 ohm balanced symmetric pair be used for the User-Network interface.

In addition to the specification of the leased line types chosen by the European Commission, relevant work on private telecommunication networks is taking place under Bons de Commands 74-77 and ITSTC Memorandum of Information Technology No. 5 (M-IT-05). Additionally, there is increasing investment in I-series interfaces, which would be suitable for digital leased lines and which offer some potential advantages; in particular the I.430 interface would be well suited for use with the 64 kbit/s digital leased line, and a number of 64 kbit/s leased lines to different destinations could share the same 2048 kbit/s interface. The report contains a number of comments and suggestions concerning these and other issues to help the European Commission as it considers the further development of its policy on ONP leased lines. In particular, section 12.2 and Annexes A and E cover the question of how out of band signalling can be conveyed according to ISDN principles.

There are some areas where further guidance is required from the European Commission before detailed drafting of the proposed standards can progress. In particular:

a. on the inclusion (or otherwise) of requirements related to overvoltage protection, and EMC phenomena, other than "conducted emission and immunity";

b. on the question of the specification of a maximum delay value.

1 Introduction

This European Technical Report has been produced in response to the mandate (Work Order No. 45062) given to ETSI by the European Commission DG XIII. The object of the mandate is to establish in two phases the set of additional European Standards required to meet the requirements of Open Network Provision (ONP) for leased lines. The two phases of the mandate are (i) an assessment of the current standards situation in relation to ONP leased lines together with proposals for the additional work necessary, and (ii) preparation of any proposed standards. This report is concerned with the first phase only.

The report has been prepared by Project Team 9V (PT 9V), which was established for the purpose, under the supervision of the ETSI Technical Committee responsible for Business Telecommunications, TC-BT.

The report is based on the approach to the harmonisation of technical specifications, usage conditions, and tariff principles for leased lines described in the proposed Directive on the "Application Of Open Network Provision To Leased Lines", , which is referred to subsequently as "the Directive". The report covers the technical aspects of the "ONP Conditions", and the work which will be required to establish the necessary European Telecommunications Standards (ETS).

The report begins by discussing the application of the Directive. This leads to a model for leased lines and an examination of the use of the CCITT attribute method as an appropriate means of describing ONP Leased Lines. The report then considers the relationships at the Network Termination Point (NTP). The existing standards situation in the fields of private telecommunications networking, "digital", and "analogue" are reviewed. A proposal for the approach to be adopted to the ONP Leased Lines standardisation work is made. This leads to a consideration of the standards required, their scopes, and contents. The report contains a number of Annexes which address issues such as the applications context of leased lines, and the issues arising out of the requirement for transparent unstructured capacity. Some of the technical aspects dealt with may impinge upon the ONP usage conditions. We have indicated where we feel this is the case.

In addition to identifying the standardisation work necessary for the provision of the minimum set of leased lines specified in the Directive, some suggestions are made for consideration by the European Commission on the future development of the ONP leased lines concept in the light of the ongoing standardisation work within Europe.

The objective of liberalizing and harmonizing public telecommunications services as proposed under ONP cannot be viewed in isolation given the interrelationship between the public network and the terminal equipment. In order to achieve this objective, there also needs to be substantial liberalisation and harmonisation of the terminal equipment market; this is being addressed by other European Commission Directives. However, given the extent of the differences in public networks and in the approach to regulation in different countries, harmonisation for ONP will inevitably take some time to achieve. Liberalisation involves a reassignment of responsibility, with users having to accept responsibility for their equipment, and the Telecommunications Organisation (TO) no longer being responsible for end to end performance, but continuing to be responsible for public network performance between the NTPs. Overall performance is now a matter for the regulators. The transition from the scenario where the telecommunications organisation was responsible for everything requires education and reorientation in attitudes.

2 References

This technical report incorporates by dated or undated reference, provisions from other publications. These 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 technical report only when incorporated into it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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[2] 89/336/EEC: "Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility".

[3] 90/387/EEC: "Council Directive of 28 June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision".

[4] 90/388/EEC: "Commission Directive of 28 June 1990 on competition in the markets for telecommunications services".

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[15] CCITT Recommendation G.704 (1988): "Synchronous frame structures used at primary and secondary hierarchical levels".

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[20] CCITT Recommendation G.81s (for jitter and wander).

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[29] CCITT Recommendation I.112 (1988): "Vocabulary of terms for ISDNs".

[30] CCITT Recommendation I.140 (1988): "Attribute technique for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

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[45] CCITT Recommendation M.1040 (1988): "Characteristics of ordinary quality international leased circuits".

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[57] EN 41001: "ISDN connector up to 8 pins and up to 2,048 Mbit/s".

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[66] ETR 010: "ISDN Standards Management (ISM); The ETSI basic guide on The European Integrated Services Digital Network".

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[77] ETS 300 011: "Integrated Services Digital Network (ISDN); Primary rate user-network interface; Layer 1 specification and test principles".

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[80] ETS 300 046: "Integrated Services Digital Network (ISDN); Primary rate access - safety and protection (5 Parts)".

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[89] ETSI DTR/BT-1002 version H: "Business Telecommunications (BT); Provision of connections for interconnecting Private Telecommunications Network Exchanges (PTNX)".

[90] ETSI DE/TM-1003: "Functional requirements of 64 kbit/s DXC equipments (Scope: Draft additions to ETS 300 010-1 to cover additional functionality, Draft new ETS on the management aspects of 64 kbit/s DXCs)".

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[92] ETSI DTR/TM-3002: "ISDN basic access digital system".

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[94] ETSI DTR/TM-5003: "Echo control performance in existing networks".

[95] ETSI/TC-BT1(89)2: "Technical Committee BT (Business Telecommunications) STC BT1 Frame Document May 1989".

[96] IEC 605 to 607: "Compliance test plans for failure rate and mean time between failures, assuming constant failure rate".

[97] ITSTC M-IT-05: "Directory of private telecommunication network standards (And technical reports)".

[98] ISO/IEC 9646: "Information Technology - Open Systems Interconnection - Conformance testing methodology and framework, Parts 1 and 4".

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3 Definitions

To assist the reader, the following definitions of terms which are used throughout this report are relevant. Most of the terms have been originally defined elsewhere; the source of each term is given in italics at the end of its definition.

3.1 Definitions used in the regulatory context

Terminal equipment: Equipment intended to be connected to the public telecommunications network ie:

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. The system of connection may be wire, radio, optical, or other electromagnetic system. *[5]*

Telecommunications Organisations: Public or private bodies, to which a Member State grants special or exclusive rights for the provision of a public telecommunications network and, where applicable, public telecommunications services. *[3]*

Public telecommunications network: The public telecommunications infrastructure which permits the conveyance of signals between defined NTPs by wire, by microwave, by optical means, or by other electromagnetic means. *[3]*

Public telecommunications services: Telecommunications services whose supply Member States have specifically entrusted inter alia to one or more telecommunications organisations. "Telecommunications services" means services whose provision consists wholly or partly in the transmission and routing of signals on a telecommunications network by means of telecommunications processes, with the exception of radio broadcasting and television. *[3]*

Network Termination Point: 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. *[3]*

Essential requirements: The non-economic reasons in the general interest which may cause a Member State to restrict access to the public telecommunications network or public telecommunications services. These reasons are security of network operations, maintenance of network integrity and, in justified cases, inter-operability of services and data protection. *[3]*

Open Network Provision (ONP) Conditions: The conditions, ..., which concern the open and efficient access to public telecommunications networks and, where applicable, public telecommunications services and the efficient use of those networks and services. ....., the open network conditions may include harmonised conditions with regard to:

- technical interfaces, including the definition and implementation of NTPs, where required,
- usage conditions, ... ,
- tariff principles. *[3]*

Leased lines: The telecommunications facilities provided in the context of the establishment, development, and operation of the public telecommunications network, which provide for transmission capacity between NTPs and which do not include on-demand switching (switching functions which the user can control as part of the leased line provision). *[6]*

3.2 Definitions used in the standards context

Public: An attribute indicating that the application of the so qualified item e.g. a network, a unit of equipment, a service, is offered to the general public. The term does not include legal or regulatory aspects, nor does it indicate any aspect of ownership. *[60]*

Private: An attribute indicating that the application of the so qualified item, e.g. a network, a unit of equipment, a service, is offered to or is in the interest of a determined set of users. The term does not include legal or regulatory aspects, nor does it indicate any aspect of ownership. *[60]*

Private Telecommunications Network Exchange (PTNX): A nodal entity in a private telecommunication network which provides autonomous and automatic switching and call handling functions used for the provision of telecommunication services which are based on the definitions of those of the public Integrated Services Digital Network (ISDN).

NOTE 1: If applicable, PTNX provides:

- telecommunication services within its own area and/or
- telecommunication services from the public ISDN and/or
- telecommunications services of other public or private networks and/or
- within the context of a private telecommunication network, telecommunication services from other private telecommunication network exchanges

to users of the same and/or other private telecommunication network exchanges.

NOTE 2: A PTNX may be represented by an Integrated Services Private Branch Exchange (ISPBX), or by equipment which is physically part of the equipment of the public ISDN, e.g. public local exchange. The functions of such equipment are still considered part of the PTN and not part of the public ISDN. *[60]*

Intervening Network (IVN): Any means of providing connections for the purpose of interconnecting terminal equipments. *[This document]*

Connection: A concatenation of transmission channels or telecommunication circuits, switching, and other functional units set up to provide for the transfer of signals between two or more points in a telecommunication network, to support one or more communications. *[This document]*

Circuit; telecommunications circuit: A combination of two transmission channels permitting bidirectional transmission of signals between points, to support a single communication.

NOTE 1: If the telecommunication is by nature unidirectional (for example: long distance television transmission), the term "circuit" is sometimes used to designate the single channel providing the facility.

NOTE 2: In a telecommunication network, the use of the term "circuit" is generally limited to a telecommunication circuit directly connecting two switching devices or exchanges, together with associated terminating equipment.

NOTE 3: A telecommunication circuit may permit transmission in both directions simultaneously (duplex), or not simultaneously (simplex).

NOTE 4: A telecommunication circuit that is used for transmission in one direction only is sometimes referred to as a unidirectional telecommunication circuit. A telecommunication circuit that is used for transmission in both directions (whether simultaneously or not) is sometimes referred to as a bidirectional telecommunications circuit. *[12]*

Circuit mode: A transfer mode in which transmission functions are achieved by the permanent allocation of channels/bandwidth. *[This document]*

4 Symbols and abbreviations

The following abbreviations are used in this document:

A2O: Ordinary quality voice bandwidth 2-wire ONP leased line

A2S: Special quality voice bandwidth 2-wire ONP leased line

A40: Ordinary quality voice bandwidth 4-wire ONP leased line

A4S: Special quality voice bandwidth 4-wire ONP leased line

D64U: 64 kbit/s digital ONP leased line

D2048U: 2048 kbit/s digital unstructured ONP leased line

D2048S: 2048 kbit/s digital structured ONP leased line

ETS: European Telecommunications Standard

NSO: National Standards Organisation

5 The application of the directive

5.1 Introduction

Article 1 of the Directive clearly indicates it is concerned with both *"the harmonization of conditions for open and efficient access to and use of leased lines*" and "*the availability throughout the Community of a set of leased lines with harmonized technical characteristics*". We have identified the standardisation work necessary to meet the requirements of the Directive, but at the same time we have expended some effort to discuss the requirements themselves and to make comments upon them. This discussion can be found in Annexes A, C, and E.

It is apparent from the "Whereas" clauses that the Directive must be interpreted in conjunction with other directives, specifically in conjunction with the so called 'ONP Framework Directive', 90/387/EEC, [3].

5.2 Essential requirements

Article 5(3) of the Directive specifies the essential requirements that ONP leased lines must satisfy. These are:

- security of network operations,
- maintenance of network integrity,
- inter-operability of services, and
- protection of data.

5.2.1 Security of network operation

There are no specific technical characteristics or specifications which will help to ensure security of network operation; this is an operational matter for the TO. Specific technical aspects which are required in order to ensure the security of a TO's staff are covered in the sections on attachment requirements (12.3, 13.5).

5.2.2 Maintenance of network integrity

In general, the Directive requires (in article 5(1)) that the usage conditions for leased lines derived from essential requirements shall be imposed by regulatory means and not through technical restrictions. However, the essential requirement maintenance of network integrity includes a provision that there shall be "*no restrictions on the use of the capacity or the bandwidth of the* (leased line) *service ... and that the user shall be provided with a fully transparent service which he can use in an unstructured manner as he wants eg where no channel allocations are forbidden or prescribed*". This particular requirement has implications which are discussed in Annex H.

5.2.3 Inter-operability of services

Article 5(3)c states that TOs are not expected to impose restrictions on the grounds of the inter-operability of services, except where provided for by article 5(3) of the ONP Framework Directive, . [3]

The technical specifications (standards) to be identified in this report are not expected to restrict the inter-operability of services in any way.

5.2.4 Protection of data

The European Commission has advised that this essential requirement does not have to be considered within this study.

5.3 Provision of a minimum set of leased lines

Article 6(1) of the Directive calls upon "*Member States to ensure that the respective telecommunications organisations ... provide a minimum set of leased lines in accordance with Annex 2*" of the Directive. The European Commission has asked for standards to be prepared for the leased lines identified in table 1.

Table 1: ONP leased line types requested to be studied by the European Commission

ONP Leased Line Type	Interface Specifications	Performance Specifications NOTE 1
Ordinary quality voice bandwidth	2 or 4 wire analogue	M.1040
Special quality voice bandwidth	2 or 4 wire analogue	M.1020/M.1025
64 kbit/s digital	G.703 NOTE 2	Relevant G.800 series Recs.
2048 kbit/s dig. unstructured	G.703	Relevant G.800 series Recs.
2048 kbit/s dig. structured	G.703 and G.704 (excluding sect. 5) NOTE 3	Relevant G.800 Recs. In-service monitoring NOTE 4

NOTE 1: The CCITT recommendations referenced refer to the 1988 version. ETSI has been requested to carry out further work on standards for leased lines.

NOTE 2: The majority of applications are converging towards the G.703 specifications. For an interim period, leased lines may be provided using other interfaces, based on X.21 or X.21 (bis), instead of G.703.

NOTE 3: With cyclic redundancy checking in accordance with CCITT G.706.

NOTE 4: In-service monitoring can facilitate improved maintenance by the telecommunications organisation.

Clarification from the European Commission has confirmed that:

a) there is no requirement for this study to consider standards related to the transitional arrangements referred to in note 2;

b) interface specifications are required for both 2 *and* 4 wire analogue interfaces;

c) ordinary quality analogue leased lines, in addition to being based upon CCITT Recommendation M.1040, [45], should maintain their current capability to convey data.

6 The scope of the directive and the definition of leased lines

6.1 Model of a leased line.

In the context of "ONP leased lines" the apparatus connected at either end can in the widest sense consist of one piece or many pieces of equipment, as well as a variety of different types of equipment. Typical types of equipment include terminals, PABXs, modems, computers, multiplexers, local area networks, automatic call distributors, echo cancellers, signalling converters, and packet switches, and in the future broadband apparatus will also be used. Throughout this report the term "terminal equipment" is used to include all these types of apparatus.

From the application of leased lines described in Annex A two new concepts are introduced; the concept of the *connection through the intervening network (IVN)* and the concept of the *interface.*

In order to establish a common understanding of the ONP leased line configuration, the elements to be looked at, and the necessary definitions and specification work to be carried out, PT 9V has drafted a generic model for leased lines (Figure 1).

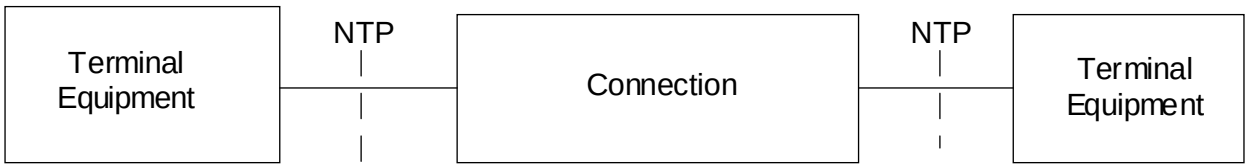

Figure 1: Generic leased line model

The term *Connection* is defined as *"a concatenation of transmission channels or telecommunication circuits, switching, and other functional units set up to provide for the transfer of signals between two or more points in a telecommunication network, to support one or more communications*[1)]".

Connections are considered to be established between points through an underlying subnet. The term which is used to describe this subnet generically is intervening network. A definition of "intervening network" already exists, , but it is specifically in the context of PTNXs. We suggest a modified version of the term which is more generally applicable to ONP leased lines as follows: "Intervening Network (IVN) - Any means of providing connections for the purpose of interconnecting Terminal Equipments."

We have made an assumption that the standards for the ONP leased lines standardisation work will be concerned only with point-to-point leased lines. However, the approach proposed caters for any evolution to multipoint arrangements which may occur in the future.

6.2 General architecture of a leased line connection

Looking in more detail at the general architecture of a leased line connection it is possible to identify some further useful sub-divisions of the model in . These are illustrated in Figure 2.

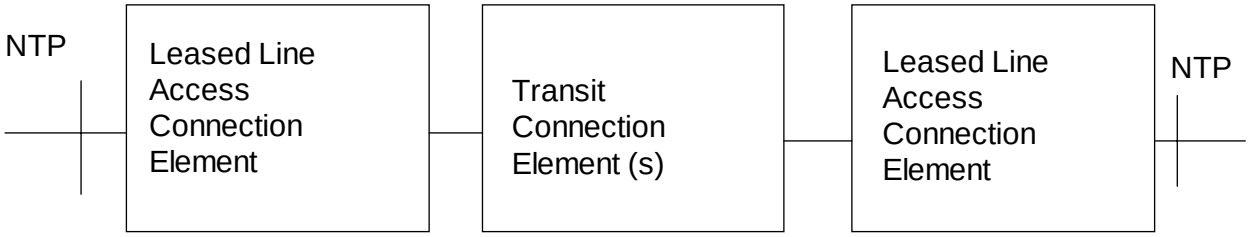

Figure 2: General architecture of a leased line connection

For any leased line there are typically two "*access connection elements*" (between the customer's premises and the local telecommunications organisation's building). They provide at one end the interface at the NTP and at the other side an interface for direct connection with the other access connection element or for connection with further connection elements (usually of the transit or trunk network; the "*transit connection element*"). There may of course be several transit connection elements, corresponding to the individual public telecommunications networks involved in the provision of a leased line. In this case

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1) Although the word "call" is used in the existing ETSI definition we prefer to use the word "Communications" because it less strongly implies any element of switching. "Communication" is used in the original CCITT definition of "connection" and was replaced with "call" by ETSI TC-BT as a result of their private telecommunications networking work.

the access connection elements would occur in different networks. The NTPs shown in figure 2, therefore, are not necessarily provided by the same TO.

6.3 Application of the CCITT attribute technique

CCITT has defined semi-formal methods to assist with the definition of ISDN services and network aspects. One of these methods is known as the *attribute technique* and is described in CCITT Recommendation I.140, [30] , and supplemented by I.340, [31] . The technique describes objects in a structured, simple manner, and highlights the salient features of the object. The salient features are termed *attributes*. Each attribute is independent of the others so that a change in one will not affect the others. Each attribute can take a set of pre-defined *values*.

The technique is applicable to the characterisation of both telecommunication services and connection types within the ISDN context. We believe that the method forms a suitable technique for the characterisation of connection types within the context of ONP.

Using the attribute technique, connection characteristics can be described in a manner which ensures completeness and which allows easy comparison between different types of connection. By studying a connection's attributes a user will be able to clearly understand the extent of the connection capability. In addition to describing connection capabilities, the identification of connection types facilitates the specification of network to network interfaces.

Although there are many attributes, the fundamental divisions of classification are the "Type Of Information[1)]", "Establishment Of Connection", and "Information Transfer Mode" attributes. In section and we attempt to assign values to each of the attributes for each of the connection types of ONP leased lines.

7 The Network Termination Point (NTP)

The ONP Framework Directive (90/387/EEC) defines the NTP as *"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".*

7.1 The relationship between "connection" and "interface"

We have already seen from the generic leased line model illustrated in that a connection has attached to both of it's ends, the user's terminal equipment. The user's application will be based on the connection characteristics and the capabilities of the terminal equipment (end to end protocols), rather than on the interface at each end of the connection. Indeed each end of the connection might have a different interface presentation.

Attachment occurs at a physical interface co-incident with the point at each end of the connection known as the NTP. Viewed another way, each end of a connection is delineated by the NTP, at which there is a defined physical interface to which a user may attach his terminal equipment.

Annex B discusses this subject more fully and leads to the following recommendation:

Recommendation 1

We recommend that the provision of ONP leased lines is viewed in terms of *connections with standardized characteristics* and presented to the user with a *standardized interface presentation.*

1) "Type of information" is a connection attribute originated by ETSI TC-BT in its work on private telecommunications networking. It refers to the type of information conveyed in a connection across an intervening network, and can take the values "signalling" and "user information".

7.2 The interface at the NTP

The definition of "interface" is "*a common point or boundary between two things*" or "*an electrical circuit linking one device with another*". When applied in the context of terminal equipment connected to a leased line two interpretations are possible which have important consequences regarding the specification of the interface presentation and the attachment requirements.

In the first interpretation, illustrated in Figure 3, the interface is considered to be a boundary which is co-

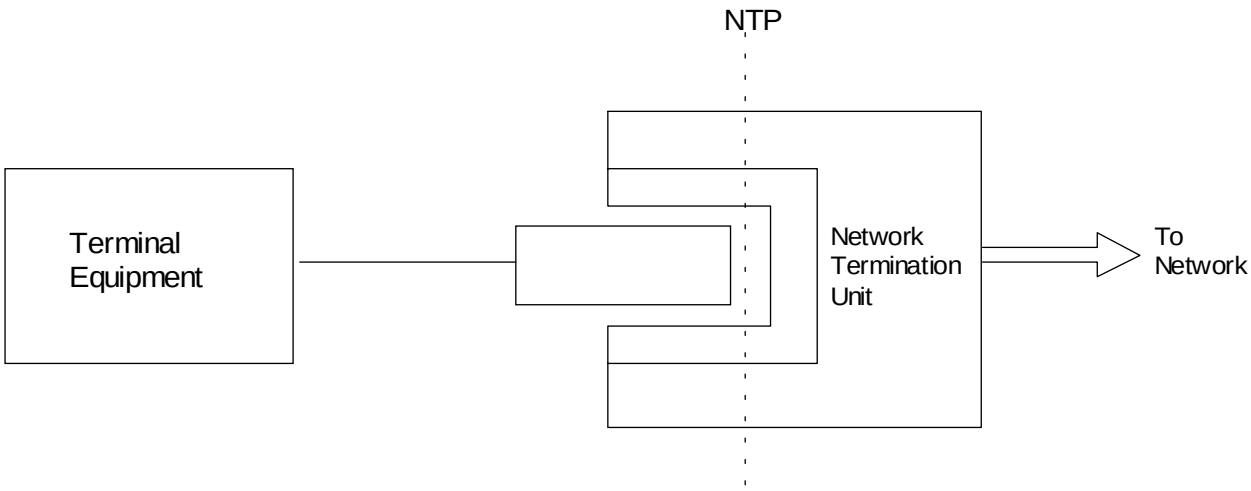

Figure 3: Interface at the NTP

incident with the NTP. In this case, the wiring connecting the terminal equipment to the leased line is considered to be part of the terminal equipment. The wiring is left free from regulation (with the exception of the actual connector specification), and the attachment requirements are specified at the point at which the wiring system actually mates with the leased line ie. at the NTP. It is left to the ingenuity of equipment manufacturers to design equipment which, when used in conjunction with other equipment (e.g. the wiring system), will cause the attachment requirements to be met at the NTP. While simple, this approach is not consistent with the philosophy adopted for the specification of interfaces based on CCITT Recommendation G.703, [14] , (e.g. G.703 itself, ISDN Basic Rate and Primary Rate interfaces).

In the second interpretation, illustrated in Figure 4, an interface is an electrical circuit (the interface wiring)

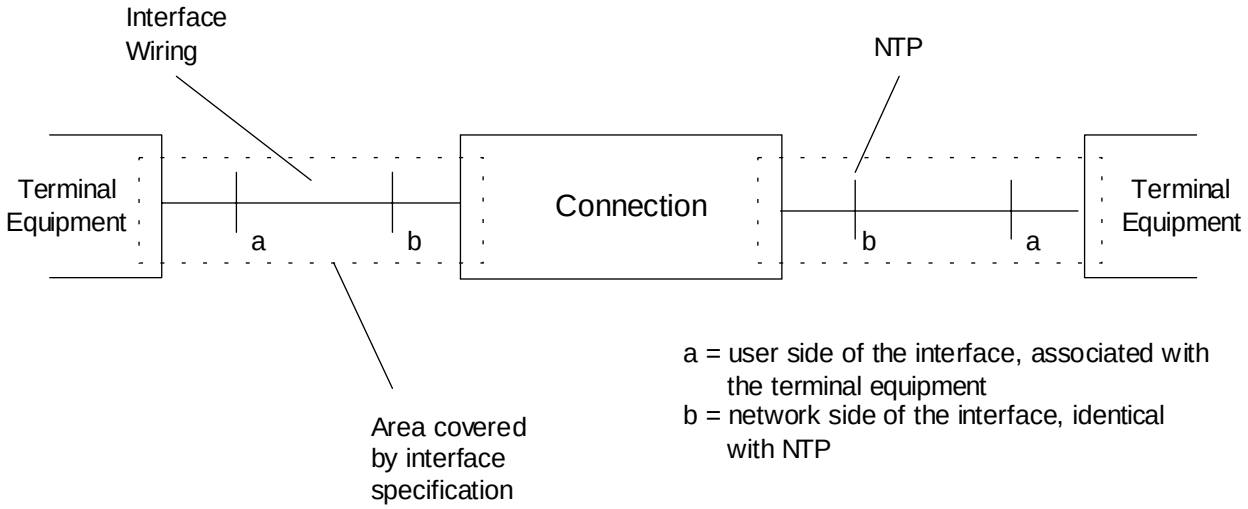

Figure 4: Identification of interface points and NTP

linking terminal equipment to the leased line. The interface has two ends; the network end (which coincides with the NTP in the case of ONP leased lines), and the user end which is part of the terminal equipment[1)].

The characteristics of the electrical wiring need to be defined in order to optimize the interface performance. Attachment requirements cannot be specified as they would appear at the NTP; it is only possible to specify them as they appear at the user end of the interface ie. at the defined output and input *ports* of the terminal equipment. This leaves the effect which different wiring systems might have on the signals between the terminal equipment and the NTP undefined, unless it is tightly specified within the interface presentation standard. This is the approach which is used in current CCITT and ETSI standardisation work.

We suggest a similar approach for the ONP leased lines work. However, rather than tightly specifying the wiring characteristics we believe only those characteristics which affect the interworking performance between the terminal equipment and the NTP of the leased line need to be defined. For this reason we suggest a modified approach in which the two ends of the interface are treated separately. This is illustrated in Figure 4.

The *interface presentation* standard will describe the requirements which apply at the network end or "b" side of the interface when viewed from outside the network. The *attachment requirement* standard will describe the requirements which apply at the user end or "a" side of the interface when viewed from outside the terminal equipment.

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1) In ISDN terminology these two ends are designated "Ib" and "Ia" respectively.

8 Examination of the ONP conditions in the context of the existing situation

The European Commission expects that the basis for ONP standardisation will be those standards which are already agreed in an international standards body such as CCITT, ISO, or ETSI.

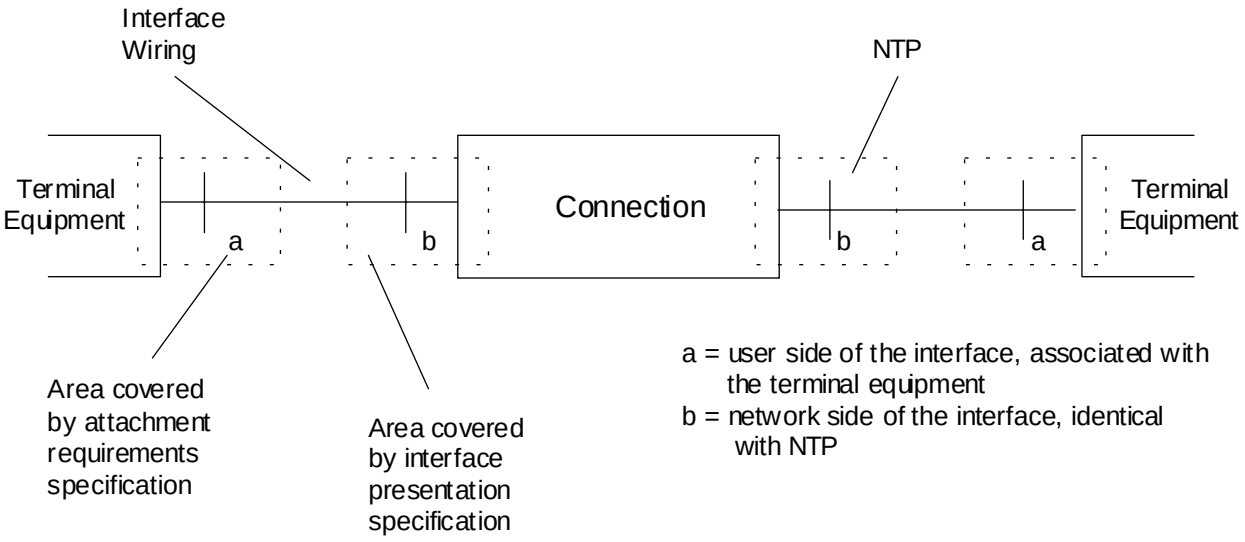

Figure 5: Identification of interface points and NTP

This precludes technical specification based on national, proprietary or non-standardized technologies[1)] . This section of the report examines the current situation with respect to existing standards and current standardisation activities which may have relevance to the work necessary for ONP leased lines. The various sub-sections examine the work in the fields of "private telecommunications networking", "digital", and "analogue" which are considered to be particularly relevant. In each case the current situation is assessed in the context of the requirements of the Directive.

8.1 Private telecommunication networking

8.1.1 M-IT-05 work-programme

A programme of European standardisation work has been under way since the late 1980's in the field of digital private telecommunications networking. This was initiated by the European Commission with the issuance of Bons de Commands 74 - 77 and subsequently evolved into the M-IT-05, [97], work programme supervised by the CEN/CENELEC/ETSI Information Technology Steering Committee (ITSTC). The responsibility for the work under the Bons de Commands is currently (late 1991) being transferred to ETSI. The contents of M-IT-05 are being re-organised and integrated into the overall ETSI work-programme on ISDN. Much of the current direction of this work (in so far as it is relevant to ONP) has resulted from work carried out by ETSI Project Team 7 on ISPBX Interconnection Matters in 1988/89 with subsequent work by TC-BT (and its sub-technical committees).

One part of the M-IT-05 work-programme, [97], concerns the production of interface standards at the T, S and C reference points for layer 1, and layers 2 and 3 of the D-channel protocol control plane.

The standards for the C reference point define the interface characteristics for interconnection of PTNXs via connections according to the interconnection scenarios defined in ENV 41006, [59], which includes leased lines.

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1) However there is no reason why such material cannot be used as source material for the identification of additional areas of specification that may be required.

NOTE: Other parts of the M-IT-05 work programme concern the control plane protocol at the Q reference point (Q-SIG), service specifications for PTNs stages 1 to 3 (basic services and supplementary services), and end to end protocols for teleservices.

One well publicised aspect of the M-IT-05 work-programme is the "Q-SIG" signalling system. This is a signalling system closely aligned to the ISDN standards for public network access but optimised to meet the special needs of linking PTNX systems together. No physical layer standard is specified for Q-SIG as there is no physical interface at the Q reference point; the physical interface at the C reference point depends on the "intervening network" (for example, the leased line network) being used to implement the PTN. Other work items are concerned with studying the various means of providing the intervening network. This has resulted in a concept called the "network scenarios" for the interconnection of terminal equipment, described in ENV 41006, [59] . Some of the scenarios described are relevant to the provision of ONP leased lines. Specific network scenarios are implemented through an intervening network by using particular combinations of different "connection" types. A draft ETR, entitled "Provision Of Connections For Interconnecting Private Telecommunication Network Exchanges", [89] , specifies requirements to be met by TOs wishing to provide such "connections" and requirements to be met by PTNXs wishing to use these "connections". The work does not address how connections should be used; it only addresses requirements covering the establishment and control of such connections.

It is the opinion of this project team that there is much to be gained by utilising the work already carried out in this area as a basis for the ONP leased line standardisation work. With this in mind, the conceptual approach proposed in this report draws on the work which has already been done within TC-BT. In particular we suggest that the ONP leased lines standardisation work should be viewed in the context of network scenarios and should utilise common vocabulary. Some aspects of the terminology are specific to the TC-BT work, so where appropriate we have made suggestions for modification.

The ETSI work covers more complicated scenarios than are currently required under the terms of the Directive. However, the adoption of an approach based upon current ETSI work will be of benefit later on when new types of leased lines, implemented using for example switched ISDN connections, are considered.

8.1.2 Analogue work

ETSI STC-BT2 has recently produced a number of I-ETSs which specify the transmission characteristics at the interfaces between a PABX system and various types of leased lines. In particular,

- I-ETS 300 003, [72], identifies PABX interconnection interfaces M2 and M4 for the interconnection to another PABX via 2 or 4 wire analogue interfaces respectively;

- I-ETS 300 006, [75], identifies ISPBX digital interconnection interfaces MD1 (on the basis of ETS 300 012, [78]), MD2 (as specified in ETS 300 011, [77]) and MD3 (on the basis of CCITT Recommendations G.703, [14], and G.704, [15], and G.706, [16]).

8.2 Digital standards

The following standards and ETSI work items are relevant to the work on ONP digital leased lines. The full titles can be found in the references section of the report, except for ETSI study items (prefixed SI) for which no deliverables are yet identified. Where relevant, information about the current status of the standard is given; this is accurate at the time of writing (February 1992).

8.2.1 Standards relevant to connections

G.801: Digital transmission models, . [19]

I.340: ISDN connection types, . [31]

I.350: General aspects of quality of service and network performance in digital networks, including ISDN, . [32]

G.114: Mean one-way propagation time, . [9]

G.821: Error performance of an international digital connection forming part of an integrated services digital network, . [21]

G.82x: Error performance parameters and objectives for constant bit rate international digital connections at or above the Primary Rate, . [24]

G.822: Controlled slip rate objectives on an international digital connection, . [22]

G.823: The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy, . [23]

G.921: Digital sections based on the 2048 kbit/s hierarchy, . [25]

ETR 003: General aspects of quality of service and network performance in digital networks, including ISDN, . [63]

SI/TM-2101: Revision of existing CCITT Recommendations on jitter issues. Revision of G.823, due 1992.

SI/TM-2102: Development of G.82x - a new error performance Recommendation. Development due throughout 1992.

SI/TM-2103: Derivation of G.821 and G.82x in the development of M.550. Work in progress during 1991/2.

SI/TM-2105: Specification of the availability aspects of digital transmission networks. Generic network model defined 1990, work continuing 1991/2.

M.550: deals with performance limits for bringing into service and maintenance of digital paths, section and line sections. This recommendation has already been issued but is under review, . [38]

M.555: dealing with bringing international digital blocks, paths and sections into service. Again this has already been issued but is under review, . [39]

M.557: the specification of performance filtering storage and reporting is in draft form and will be finalized for review meeting in the Autumn, . [40]

SI/ATM1-3: Developing a framework and methodology for conformance testing of interface and protocols standards. Phase 3 completed 9/91.

8.2.2 Standards relevant to interfaces

G.703: Physical/electrical characteristics of hierarchical digital interfaces, . [14]

ETS 300 166: Transmission and multiplexing, physical and electrical characteristics of digital interfaces using 2048 kbit/s-based plesiochronous or synchronous digital hierarchies, . [87]

G.704: Synchronous frame structures used at primary and secondary hierarchical levels, . [15]

G.706: Frame alignment and Cyclic Redundancy Check (CRC) procedures relating to basic frame structures defined in Recommendation G.704, . [16]

G.823: The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy, . [23]

K.22: Overvoltage resistibility of equipment connected to an ISDN T/S bus, . [37]

ETS 300 167: Transmission and Multiplexing; Functional characteristics of 2 Mbit/s interfaces, [88]

ETR 012: Terminal Equipment (TE); Safety categories and protection levels at various interfaces for telecommunication equipment in customer premises (T/TE 04-25), . [67]

ETSI DI/BT-2006: Synchronisation aspects of digital private networks, [91]

ETS 300 011: ISDN primary rate user-network interface, Layer 1 specification and test principles. Not yet adopted. [77]

ETS 300 046 ISDN primary rate access interface safety and protection. Parts 1-5, . [80]

ETS 300 047: ISDN basic rate access safety and protection. Parts 1-5, . [81]

ATM 1-3: ETSI work items. See above.

ETS 300 012: Completed ETSI standard, includes layer 1 and test principles for ISDN Basic Rate user-network interface. Not yet adopted, . [78]

EN 60950: Safety on Information Technology equipment including electrically operated business machines, . [61]

EN 41003: Particular electrical safety requirements for equipment to be connected to telecommunication networks, . [58]

ENV 28877: Information processing systems - Interface connector and contact assignment for ISDN basic access interface located at reference points S and T, .?

EN 41001: ISDN connector up to 8 pins and up to 2,048 Mbit/s, . [57]

CENELEC TC108 WG CPC: Draft AAA recommendations for the Design and implementation of cabling schemes, . [62]

8.2.3 Standards relevant to attachment requirements

ETS 300 153: Attachment requirements for terminal equipment to attach to an ISDN using basic rate access, . [85]

ETS 300 156: Attachment requirements for terminal equipment to attach to an ISDN using primary rate access, . [86]

8.3 Analogue standards

It is characteristic that most standardisation work of importance for the analogue ONP leased lines are concerned with terminals and terminal characteristics. This is a consequence of the long period in which the local network was just a pair of copper wires with variable length resulting in detailed planning and provisioning rules to establish analogue connections, while the important issue externally was what terminals should do in order to be compatible with the network (and for example, not harm it). The present standardisation work is listed for connections, network interfaces and terminals.

8.3.1 Connection standards

Connections are hardly discussed in papers other than CCITT Recommendations M.1020, [43], M.1025, [44], and M.1040, [45], for leased circuits for other uses than telephony (modems without equalizers), for other uses than telephony (modems with equalizers) and for telephony and similar uses, respectively. The values stated in these recommendations are most stringent in M.1020, and least stringent in M.1040. The recommendations present only requirement values. They do not describe how to measure and control whether the values are adhered to.

The European Technical Report ETR 004, "Overall transmission plan aspects of a private branch network for voice connections with access to the public network", [64]. One of the uses of leased lines is in private branch networks (i.e. between PABXs), and the connection requirements should make such use possible.

8.3.2 User network interface standards

Presently there are no analogue network interface standards completed or in preparation. The only hint at what such a standard should contain can be inferred from the terminal requirements, e.g. when a 2-wire terminal must have a certain input impedance it should normally mean that the balance impedance of the nearest hybrid in the network has the same value. The same is true for the mechanical connection means; the plug required for the terminal should presumably fit into the socket provided by the TO. Not only the values, but also the measurements to control them, can thus be taken as a guideline from the terminal requirements.

8.3.3 Terminal standards

This is where an abundance of material exists which can form a basis for standards for terminal equipment to be connected to analogue leased line offerings under the Directive.

First of all, many countries have liberalized the access to analogue leased lines earlier than they have liberalized the access to the PSTN. Thus, national technical requirements for such access exist in many countries. For example:

- British Standard 6328: Apparatus for connection to private circuits run by certain public telecommunication operators. Part 1: 1985 (with amendments) deals with "Specification for apparatus for connection to speechband circuits", [7];

- Danish TI-publication 12/89 (formerly "circular 12"): Technical regulations for terminal equipment for analogue leased lines, [54].

It has been clearly stated in connection with the implementation of the Directive that national deviations are not acceptable. Thus, these national technical requirements can only be taken as guidelines for the present work, to remind us for example of items which must be included and to suggest possible values for them. Also the measuring configurations for compliance testing can be used in the present work.

European standards in this area and their possible use for ONP work are:

- ETS 300 001 (candidate NET 4), [70], General technical requirements for equipment connected to an analogue subscriber interface in the PSTN.

  This ETS could provide a framework for the build-up of terminal standards under the Directive. Items which are not applicable to leased line offerings (such as dialling and ringing) should be left out. The same applies to national deviations. Several values should be directly applicable for the leased line offerings, such as maximum levels.

We suggest that ETS 300 001 (candidate NET 4) be used as a starting point for the build-up of the standards for terminal equipment intended for attachment to ONP leased lines.

- ETS 300 002 (candidate NET 25), [71], Approval requirements for 9600 or 4800 bits per second duplex modems standardized for use on the PSTN.

  This ETS is concerned with a specific use of the PSTN. It will only be of interest for the present work in so far that the leased lines of ordinary quality should live up to the performance expected by these modems from the PSTN.

- I-ETS 300 004, [73], Transmission characteristics at 2-wire analogue interfaces of a digital PABX.

  The M2-interface of a PABX is intended for connection to a leased line, thus its characteristics have a direct bearing on the present work.

- I-ETS 300 005, [74] , Transmission characteristics at 4-wire analogue interfaces of a digital PABX.

  The M4-interface of a PABX is intended for connection to a leased line, thus its characteristics have a direct bearing on the present work.

- ETS 300 019, [79] , Environmental conditions & environmental tests for telecommunications equipments. Part A: Introduction and terminology. Part B: Classification of environmental conditions.

  The present work should refer to this ETS, which should become applicable to the leased line offerings as it becomes ready.

- ETS 300 114 (text for NET 20), [82], Basic attachment requirements for modems standardized for use on the PSTN.

  The provisions of this ETS have a direct bearing on the present work.

- ETS 300 115, 116, 117, & 118 (texts for NETs 21 to 24), [82] , Category II attachment requirements for .... modems standardized for use on the PSTN.

  The provisions of these ETSs may have a direct bearing on the present work, and they should therefore be consulted.

9 Approach to be taken to ONP standardisation work

9.1 General approach

In an earlier part of this report we have proposed a generic model for a leased line which recognizes three separate entities; connection, terminal equipment, and the interface between them. As illustrated in , the standardisation of ONP leased lines can be sub-divided into three areas based upon this model; these cover the characteristics of the connections themselves, the interfaces at which they are presented, and the requirements which must be met by a terminal equipment wishing to attach at the NTP. This leads to a three step approach to the task of writing the standards:

- first, specify the characteristics of each connection type;
- second, specify the characteristics at the interface at which the connection is presented;
- third, specify the attachment requirements of the terminal equipment.

The advantage of separating the specification of the connection from that of the interface at which it is presented is that it facilitates the provision of a particular connection type over evolving networks (with potentially different network access interfaces).

We propose that a terminal attachment standard be provided for each type of leased line[1)] . Further, for each type of digital leased line separate standards for connection characteristics and interface presentations should be provided. For each type of analogue leased line one standard can be provided which includes both the connection characteristic and interface presentation aspects [2)] . In total 17 ETSs are required. In addition we propose an Application Note which covers for example an explanation of the attributes, transmission plan aspects when leased lines are connected to the Public Telecommunications Network, etc.

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1) It may be the case that the attachment requirements do not vary between some types of ONP leased line eg. ordinary quality voice bandwidth 2-wire leased line and special quality voice bandwidth 2-wire leased line. In these cases it may be possible to reduce the overall number of standards required.

2) This is because of the close relationship between the connection characteristics and whether the leased line has a 2 or 4 wire presentation.

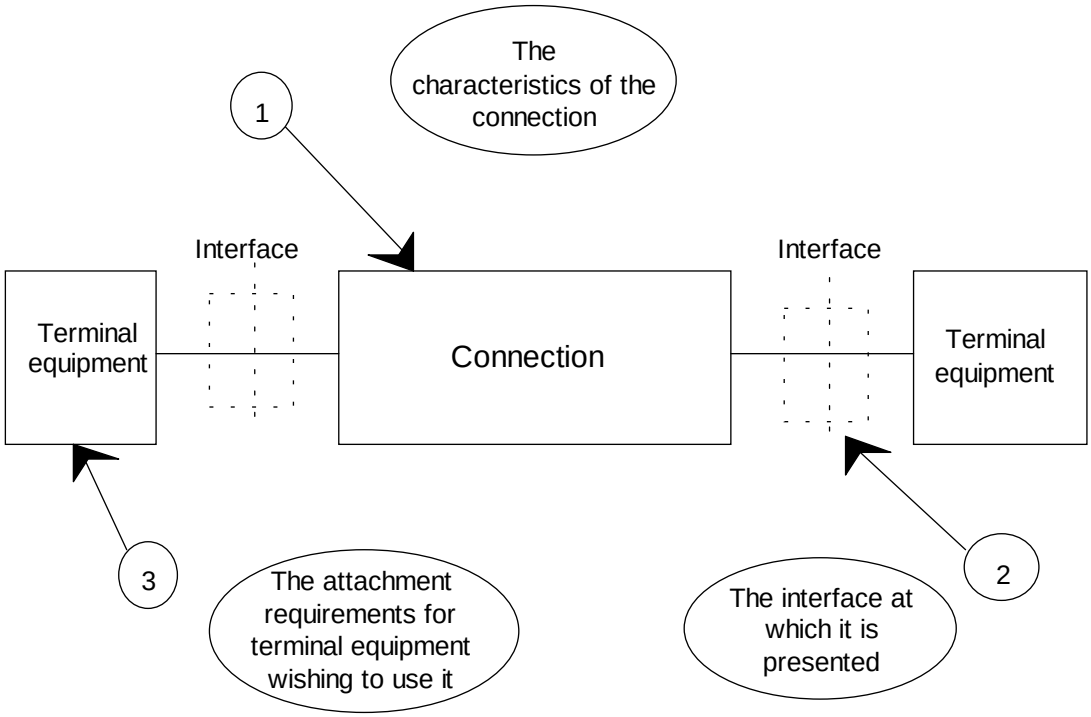

Figure 6: Suggested approach to ONP standardization for leased lines

Recommendation 2

We recommend that three types of document are required in support of the ONP leased line Directive. These are:

- **a) ETSs describing the characteristics of ONP leased line connections;**
- **b) ETSs describing the interface presentations for ONP leased lines;**
- **c) ETSs describing the requirements for terminal equipments to be attached to ONP leased lines**

In addition, although not essential, we suggest that an Application Note is produced to provide relevant further information concerning ONP leased lines

There are diverse opinions on the inclusion of requirements related to safety, overvoltage protection, and Electromagnetic Compatibility (EMC) phenomena, other than "conducted emission and immunity". On the one hand it is thought that these aspects need to be defined fully in the standards to be produced; but on the other hand it is thought that the EMC and Low Voltage Directives, , , adequately address these subjects. The Commission is requested to consider this matter and to indicate the favoured approach to ETSI.

10 Structure of standards for ONP leased lines

In this section we deal with the titles, scopes and contents of these documents in detail.

There is a large amount of new material pertaining to these aspects which we believe it would be advantageous to give publicity to, both within ETSI and to the NSOs of the member states. An objective of obtaining comments as early as possible in the standards drafting process will make things easier during the later stages of the work.

Recommendation 3

We recommend that the CEC gives the earliest and widest possible publicity to the scopes and abstracts of the proposed ETSs for ONP leased lines.

10.1 Titles

In line with ETSI rules, the general format of the titles for the standards required for ONP leased lines will be as follows:

Introductory element

Main element

Complementary element

The introductory element will be "Open Network Provision Technical Requirements".

The main element will indicate the type of leased line with which the standard is concerned together with its abbreviated name e.g. "2048 kbit/s Digital Leased Line (D2048U)".

Abbreviated names, which have been introduced in this report, consist of three parts as shown in Figure 7.

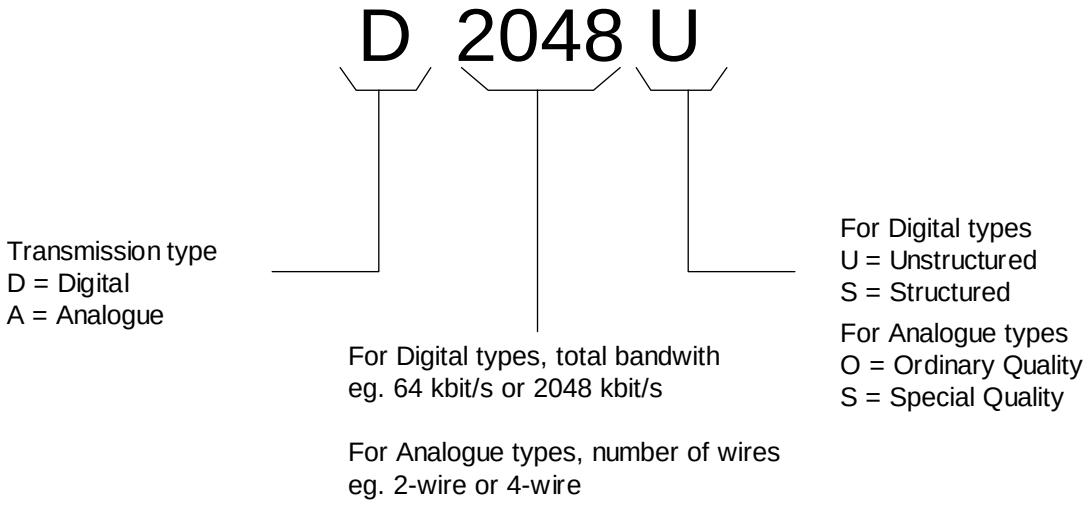

Figure 7: Structure of abbreviated names

The complementary element will describe the particular aspect which is covered by the standard e.g. "Connection Characteristics".

Given the above principles, the titles for the set of standards required will be as shown in Annex I.

10.2 Scopes and contents

Annex J contains draft contents, forewords, introductions, scopes for each of the proposed standards.

10.3 Abstracts

Annex K contains draft abstracts for each of the proposed standards.

10.4 Scope of application note

Annex L contains a draft content, foreword, introduction, and scope for the application note which is proposed to accompany the set of ONP leased line standards.

11 Guidelines to standards writers

Below are a number of guidelines which we believe should be adhered to by those people responsible for writing the standards proposed in this report:

a) every requirement which is written into the standard must have a corresponding test for compliance; where possible the test shall appear in the same sub-clause as the requirement to which it pertains;

b) the standards produced should contain no options;

c) consistency of requirements and tests between all the standards is important;

d) consistency of format and language between all the standards is important;

e) the relevant parts of internationally approved standards or recommendations shall be utilized;

f) where used the relevant parts of other standards should be copied into the new standards as well as being referenced;

g) the standards dealing with interface presentation shall restrict themselves to specifying only the physical interface at the NTP. That is to say they shall only specify the mechanical, electrical, and electromagnetic characteristics of the interface and shall not in any way describe signalling and/or protocols across the interface. This is except for the protocols required by CCITT Recommendations G.704, [15], and G.706, [16] for the 2048 kbit/s structured digital connection;

h) for compatibility, all those involved in writing the standards (ie. PT 22V) should use the same wordprocessing software (the work done so far has been carried out using Wordperfect);

12 Examination of the technical requirements; digital

In this section we examine the technical requirements that need to be standardized for digital ONP leased lines.

12.1 Digital connections

12.1.1 Digital connection attributes

As already described in section , it is proposed that connections are classified according to a number of attributes. Tables D.1, D.2 and D.3 in Annex D propose "first cut" attribute values for the various types of digital connections. Many of the proposed values relate to connection performance, and these should be reviewed in conjunction with the comments made on this topic in the section below.

12.1.2 Digital connection performance

"Performance" is one of the key characteristics which needs to be specified for ONP leased line connections. As far as possible the performance specification for a connection should be network independent. That is to say, the user should not have to be aware of the network implementation in order to determine the expected performance.

The performance objectives must meet the following needs:

a) to give the user of the digital connection an indication of the performance of the connection, PRIOR to handover to the user;

b) to facilitate the user in his task of service planning, and;

c) to assist manufacturers with equipment design.

In the first instance performance objectives represent a compromise between a desire to meet service needs and a need to realize transmission systems taking into account economic and technical constraints. These objectives have been internationally agreed in CCITT Recommendations G.821, [21], G.82x, [24], and G.822, [22], and the TO will carry out measurement of these parameters as part of their normal connection establishment procedures.

As we have indicated in Annex C, some aspects of connection performance cannot be supervised by the TO once the user has taken a connection into service. For example, in an "in service" unstructured connection, the TO is unable to generate overhead algorithms and hence may have no means of checking bitstream integrity within a particular transparent connection between NTPs. It is possible to determine by inference that all is well in the transit connection element by monitoring at the next hierarchical level. However, some other parts of the connection may not be monitored. Parameters affected by this include bit error rate, availability, errored seconds, and severely errored seconds. As a consequence we feel it may be important that TOs should be able, if necessary, to demonstrate that their portion of the digital connection fully meets all the requirements. We suggest that one of the ONP supply and usage conditions should be that TOs should be able, if necessary, to demonstrate that their portion of the digital connection fully meets all the requirements.

12.1.2.1 Specification framework for 64 kbit/s digital connections

The framework for the specification of performance of the 64 kbit/s digital connection is shown in table D.1 in Annex D.

12.1.2.1.1 Error performance parameters

CCITT Recommendation G.821, [21], defines error performance of a 64 kbit/s connection.

The performance objective is stated in terms of Error Performance Parameters each of which is defined as "the percentage of averaging periods each of time interval TΦ during which the Bit Error Ratio (BER) exceeds a threshold value".

At the CCITT WPXVIII/6 meeting in Geneva in June 1991, agreement was reached to remove the Degraded Minutes parameter from G.821; hence it should not be used in the ONP leased line standards and has not been included in table D.1.

The remaining parameter values described in CCITT Recommendation G.821 (Errored Seconds and Severely Errored Seconds) are designed for switched digital connections and should be reviewed to ensure that the values given are suitable for leased lines also.

CCITT Recommendation G.821 objectives are only valid for tests made on a connection whilst out-of-service and require a rather long measurement period. A note in the recommendation indicates that the period of time over which the measurements are conducted may be application dependant and suggests a reference period of 30 days. Further study is required to determine whether this is appropriate for ONP leased lines.

CCITT Recommendations M.550, [38], and M.557, [40], give internationally agreed algorithms for the derivation of Errored-Second (ES) and Severely Errored-Second (SES) parameters plus performance filtering/thresholding/storage/reporting techniques. These Recommendations will need to be studied carefully for their applicability especially to determine if a reduction in the measurement time according to G.821 can be effected.

12.1.2.1.2 Controlled slip parameters

The parameters for Controlled Slip Rate are fully documented in CCITT Recommendation G.822, [22]. Slips occur when clocks of terminal equipments and of a network section begin to drift and are governed by the frame structure, the size of buffer stores, and the accuracies and stabilities of the interconnecting national clocks. As the structure of the user's signals is unknown, and slip has an effect on bit sequence integrity, this parameter cannot be guaranteed unless there is an appropriate synchronisation strategy. See Section 9.1.4.2 of CCITT Recommendation G.822, [22]. The introduction of the Synchronous Digital Hierarchy (SDH) may cause some unexpected problems and the issue must be studied carefully when the requirements in the proposed new standards are drafted.

12.1.2.1.3 Availability parameters

ETSI/TM2/GEP are currently producing a document on availability performance of switched connections. In reality this work is valid for leased lines only, and not for switched connections, because the switches and routing problems are not taken into account. Some definitions of availability performance are available from CCITT SG II and are under consideration at a high level in CCITT, IEC, and ISO. The problem is to decide which measures to use.

The most relevant parameters appear to be MADT (Mean Accumulated Down Time over one year) and MFI (Mean Failure Intensity) leading to Unavailability as a percentage, or as hours per year. This may be the only measure which is understood by the user.

12.1.2.2 Specification framework for 2048 kbit/s digital connections

The framework for the specification of performance of the 2048 kbit/s digital connections is shown in tables D.2 and D.3 in Annex D.

12.1.2.2.1 Error performance parameters

The parameters for network performance are defined based on Errored-Blocks (EB) as defined in CCITT Recommendation G.82x, [24]. An EB is an interval of time containing one or more bit errors; these intervals would normally correspond to the inherent monitoring blocks of the transmission system employed.

Since in table D.2, the connection is unstructured, and the format of the monitoring blocks will be unknown to the TO, network performance by the TO based the Errored-Blocks method is not possible once the connection has been handed over to the user. This area requires further study.

Since the objectives given in the tables refer to a worst case 27 500 km hypothetical reference connection (HRX) as defined in CCITT Recommendation G.801, [19], it is necessary to partition the end to end objectives by network section. CCITT Recommendation G.82x, [24] , refers. The final specification should however reflect the performance objective of the overall connection.

It should be noted that CCITT Recommendations G.821, [21], and G.82x, [24], refer to route length and not geographical distance when considering length dependency.

12.1.2.2.2 Controlled slip parameters

Unlike the case for 64 kbit/s connections, there is some uncertainty about whether it is possible to guarantee the network performance parameter, "slip". It is known that there is a dependency upon frame structure, but at the primary rate of 2048 kbit/s it is difficult to predict whether any slip will occur using the user's protocols. An unstructured connection may require that the connection is taken out of service so that the location and type of fault can be determined.

For the structured 2048 kbit/s frame slip should be required to limit the impact on the connection. In a structured connection where CRC-4 is utilized, in-service tests may be performed on the circuit without interruption to the user signal. This facility is useful for the detection of certain burst errors, such as those which may occur only at certain times of the day/week/month etc., or for the detection of slowly degrading performance leading eventually to the initiation of preventative maintenance. The interaction of terminal equipment, which may be switched on or off or disconnected from the network, with the monitoring and alarm systems of the public telecommunications network needs to be studied further.

12.1.2.2.3 Availability parameters

As described above, ETSI/TM2/GEP are currently producing a document on availability performance of switched connections. This is relevant for the 2048 kbit/s connections also.

12.1.3 Terminal equipment synchronisation in the ONP leased line context.

12.1.3.1 64 kbit/s connections

64 kbit/s connections are always multiplexed inside the network into 2048 kbit/s digital signals. In order to multiplex 64 kbit/s leased lines from different users into one 2048 kbit/s signal all the signals must be synchronized to one clock frequency to control and to meet the slip performance limits. The method is that the 2048 kbit/s digital signals in the network are synchronous to each other ie. all multiplexers use the synchronous network clock for the digital signal processing and multiplexing.

This requires that the terminal equipment generates the output signal with a frequency which is within the tolerance of the network timing. At the input of the terminal equipment the signal received from the network contains the clock frequency of the network which shall then be used by the terminal equipment to generate the output signal. This concept is shown in Figure 8.

This requirement will need to be defined for the 64 kbit/s digital connection as it is not currently covered in CCITT Recommendation G.703, [14]. It may be possible to base it on information contained in ETS 300 012, [78].

12.1.3.2 2048 kbit/s connections

Neither the unstructured nor the structured 2048 kbit/s kbit/s connections have the requirement described for 64 kbit/s connections. The synchronisation concept may therefore depend on the application for which the leased line is used.

If service interworking with the public network is required, then both the unstructured and structured 2048 kbit/s connections need to be synchronized to the network clock. This is also required if service interworking with the public network is not required but operation via a private network node is foreseen which may handle calls via the public network as well. In both cases the network clock is available at the node where the leased line is terminated and shall therefore be used for the generation of the transmit signal.

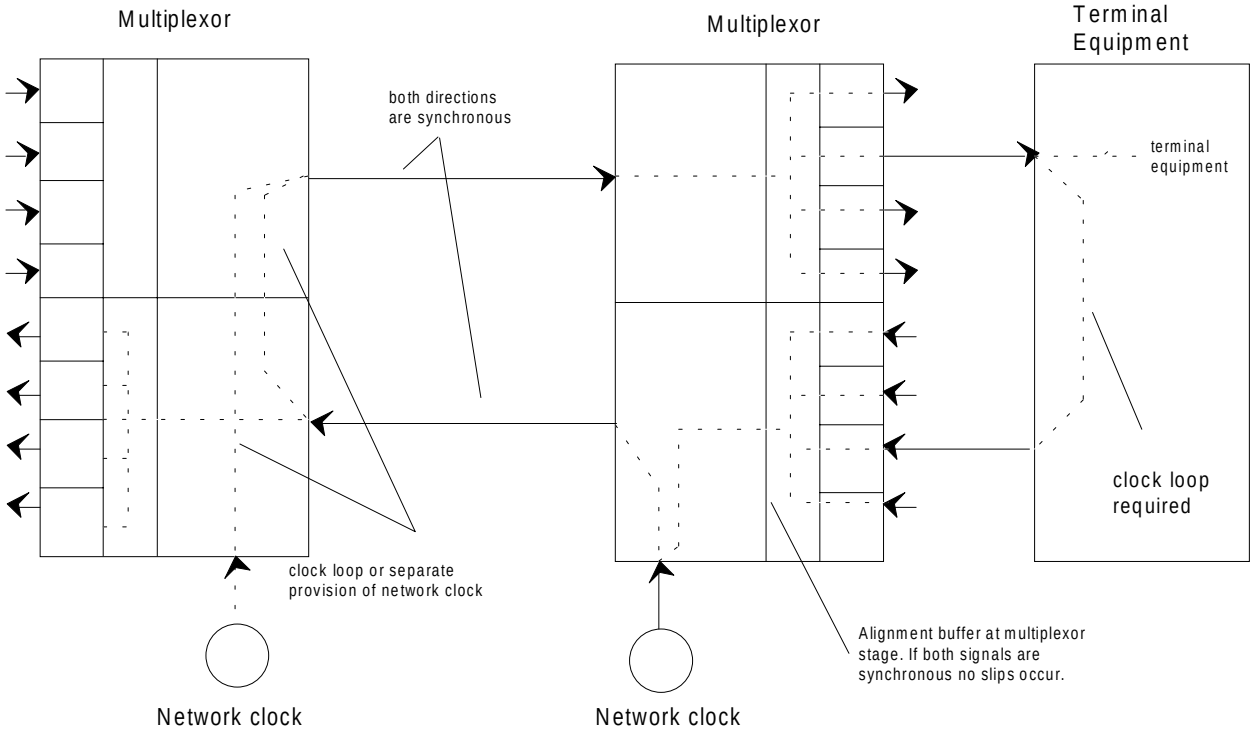

Figure 8: Clock synchronization for 64 kbit/s connections

If a private network node is available at one end of the connection only, the terminal equipment at the other end may use the clock loop method as explained for the 64 kbit/s connection. This however is not covered by the current jitter specification in CCITT Recommendation G.823, [23] , which assumes sufficient jitter reduction due to clock processing in the connected equipment. The jitter specification will have to be enhanced for this case. A possible way to do this is to use the concept in ETS 300 011, [77], table 1, subclause 5.3, especially the values in subclause 5.3.4.2.

Clock synchronisation is further discussed in ETSI DI/BT-2006, , which also defines a clock negotiation protocol.

For all other cases the two terminal equipments shall use their own clock, free running oscillator within the limits defined, for generation of the output signal.

In cases where the terminal equipment is a PTN other timing requirements are defined in ETSI DI/BT-2006, [91].

12.2 Digital interfaces

12.2.1 User network interfaces and network node interfaces

Both ETSI and CCITT distinguish clearly in their standardisation of interfaces between User Network Interfaces (UNI) and Network Node Interfaces (NNI). The reason for the distinction is that the environmental conditions are different in customer premises and in TO buildings.

TO buildings can generally be considered to be controlled environments, where due to the consistent approach to:

- equipotential bonding conditions and arrangements;
- installation and operation practices;
- temperature and humidity control;
- power feeding arrangements and safety precautions, and
- shielding and galvanic separation practices in equipments and installation;

the variation of electromagnetic effects and risks is limited. This has an impact on the depth of specification necessary, as well as on the actual values for safety and protection requirements, for interfaces and equipment for use in TO buildings.

The situation is different in customer premises where consistent environmental conditions do not exist. Specification of user network interfaces therefore requires a more detailed set of characteristics and values which are appropriate for this environment. In particular, this set of characteristics has to cover the essential requirements listed in the Terminal Directive, [5]. Table 2 lists the interface characteristics which are typically specified for the UNI and shows that most are not specified for an NNI. For the case where an NNI specification (e.g. CCITT Recommendation G.703) is adapted for use as a UNI, all these characteristics need to be specified.

Table 2:
Interface characteristics specified at the UNI and the NNI

Interface Characteristics Specified	User Network Interface (UNI)	Network Node Interface (NNI)
Physical characteristics	Yes	Yes
Electrical characteristics	Yes	Yes
Connector requirements	Yes	No NOTE 1
Wiring characteristics	Yes	Yes
Wiring practice	Yes	No NOTE 1
Interface procedure aspects	Yes	No NOTE 2
Power feeding arrangements	(Yes) NOTE 3	No NOTE 4
Safety class of the interface and requirements	Yes	(No)NOTE 5
Additional isolation requirements	Yes	(No)NOTE 5
Overvoltage protection	Yes	(No)NOTE 5
Electromagnetic immunity	Yes	(No)NOTE 5
Radiation limitation	Yes	(No)NOTE 5
Limitation of current or voltage under single fault condition in TE	Yes	No NOTE 6

NOTE 1: The connector (if any) and the wiring practice depends on the TOs specific practice and is not harmonised.

NOTE 2: Networking and terminal equipment synchronisation requirements as well as interface status monitoring and indication are not provided for unstructured NNIs.

NOTE 3: Some UNI provide remote power feeding capabilities for the support of simple terminal equipment without local power feeding from the mains or which require feeding via the interface from the terminal equipment under certain circumstances e.g. if remote power feeding of the network termination cannot be provided through the network (optical fibre or radio transmission).

NOTE 4: Power feeding is not a subject of the interface and is generally regulated by the TOs, but it is not fully harmonised.

NOTE 5: These requirements are generally covered by the installation practice within the TOs building and thus are less stringent and detailed for the interfaces and equipment as explained above for the controlled environment.

NOTE 6: This requirement is not necessary for NNI because both the equipments connected together belong to TOs and therefore they allow testing and failure identification even under specific circumstances.

12.2.2 Extent of standardisation of user network interface

Table 3 provides an indication of the extent to which the standardisation of user network interfaces based on CCITT Recommendation G.703, [14], has already been achieved in Europe. For comparison the extent to which standardisation for ISDN user network interfaces has been achieved is also shown.

Reference is made wherever possible to European standards but corresponding CCITT Recommendations are given for information in square brackets. A reference given in quotation marks indicates a document which may be used as source material for the further specification of this aspect. Entries given in parenthesis are for information only and indicate standards which might possibly cover the interface characteristic in question; however, further clarification and definition of the detailed requirements is needed.

The interfaces considered are:

a) 64 kbit/s "G.703" UNI: a 64 kbit/s co-directional interface according to ETS 300 166, [87], (ie. according to CCITT Recommendation G.703, [14], paras. 1.1.1 to 1.1.4.1 and 1.2.1);

b) 2048 kbit/s "G.703" UNI: an interface at 2048 kbit/s according to ETS 300 166, [87], (ie. according to CCITT Recommendation G.703, [14], paragraph 6, for signals with 2048 kbit/s (with or without structure according to ETS 300 167, [88]);

c) ISDN Basic Rate UNI: ISDN Basic Rate user network interface, layer 1 specification, ETS 300 012, [78], (ie. according to CCITT Recommendation I.430, [34]);

d) ISDN Primary Rate UNI: ISDN Primary Rate user network interface, layer 1 specification, ETS 300 011, [77], (ie. according to CCITT Recommendation I.431, [35]).

It should be noted that ETS 300 011 refers to CCITT G.703, 704 and 706, however options have been removed, the conformance test specification is added and additional maintenance procedures have been specified on the basis of already described functions of the G series Recommendations.

Table 3: The extent to which the standardisation of considered user network interfaces has been achieved

	64 kbit/s "G.703" UNI	2048 kbit/s "G.703" UNI	ISDN Basic Rate UNI	ISDN Primary Rate UNI
Physical/electrical characteristics	covered in ETS 300 166	covered in ETS 300 166	covered in ETS 300 012	covered in ETS 300 011
Connector requirements	EN 28877	EN 41001	covered by EN 28 877 & EN 41 001	no connector specified yet (EN 41 001)
Wiring configurations	not relevant	not relevant	covered in ETS 300 012	not relevant
Wiring characteristics	covered in ETS 300 166	covered in ETS 300 166	covered in ETS 300 012	covered in ETS 300 011
Wiring practice	not specified	not specified	draft standard from CENELEC TC108 WG CPC	draft standard from CENELEC TC108 WG CPC
Interface procedure aspects	not specified NOTE 1	not specified (structured interface covered in ETS 300 167) NOTE 1	covered in ETS 300 012	covered in ETS 300 011
Definition of test loops	not specified	not specified	covered in ETS 300 012	covered in ETS 300 011
Power feeding arrangements	not defined	ETS 300 011	covered in ETS 300 012	covered in ETS 300 011
Safety class of the interface and requirements	not defined, (SELV) "EN 60 950" "EN 41 003" "ETR 12"	not defined, (SELV) "EN 60 950" "EN 41 003" "ETR 12"	covered in ETS 300 047 & ETR 12 (EN 60 950) (EN 41 003)	covered in ETS 300 046 & ETR 12 (EN 60 950) (EN 41 003)
Additional isolation requirements	not defined, ETR 12	not defined, ETR 12	covered in ETS 300 047	??
Overvoltage protection	covered in ETS 300 166 [G.703 Annex B for controlled environment only. NOTE 2	covered in ETS 300 166 [G.703 Annex B for controlled environment only. NOTE 2	covered in ETS 300 047 [CCITT K.22]	covered in ETS 300 046
Electromagnetic immunity	not specified;for controlled environment only	not specified;for controlled environment only	covered in ETS 300 126	covered in ETS 300 126
Radiation limitation	not specified "EN 55 022"	not specified "EN 55 022"	covered in ETS 300 126	covered in ETS 300 126
Limitation of current or voltage under single fault condition in TE	not specified	not specified	covered in ETS 300 047	covered in ETS 300 046
Conformance test specification for all interface requirement	not available	not available	covered in ETS 300 012 ETS 300 047 ETS 300 126	covered in ETS 300 011 ETS 300 046 ETS 300 126
Attachment approval specification	not available	not available	covered in ETS 300 153	covered in ETS 300 156
Access connection element specification	not available	not available	covered in DE/TM-3004 [G.960]	covered in DE/TM-3003 [G.96Y]
Access system specification	not available	(G.921)	covered in DTR/TM-3002 [G.961]	(G.921)
Application in leased line configurations	not defined yet	"ETS 300 011"	not defined yet "ETS 300 011"	covered in ETS 300 011

NOTE 1: Network and terminal equipment synchronisation requirements as well as interface status monitoring and indication are not provided for unstructured NNIs.

NOTE 2: These requirements are generally covered by the installation practice within the TO's building and thus less stringent and detailed for the interfaces and equipment as explained above for the controlled environment.

12.2.3 Interface alternatives

Taking account of the connection types identified in Annex A and the discussion concerning the interface presentation in Annex B, the following alternatives exist for digital interfaces at the NTP:

The 64 kbit/s digital connection may be presented at either:

- an interface according to ETS 300 166, [87], which refers to CCITT Recommendation G.703,[14] , paras 1.1 to 1.1.4.1 and 1.2.1, or

- an interface according to a subset of ETS 300 012, [78], (point-to-point only, and only one B-channel supported).

The 2048 kbit/s digital unstructured connection may be presented at:

- an interface according to ETS 300 166, [87], which refers to CCITT Recommendation G.703, [14], para. 6.

The 2048 kbit/s digital structured connection may be presented at either:

- an interface according to ETS 300 166, [87], (which refers to CCITT Recommendation G.703, [14], para. 6), provided that the terminal equipment structures the signal according to ETS 300 167, [88], (which refers to CCITT Recommendation G.704, [14], para. 2.3) and follows the procedures as defined in CCITT Recommendation G.706, [15] , para. 4.

- an interface according to a subset of ETS 300 011, [77] , (point-to-point only, and without structuring other than TS0).

The list of specifications relevant to digital interfaces is given in and should be used as the basis for the specification of the interfaces required by the Directive.

Recommendation 4

We recommend that the interface presentation specifications for the 2048 kbit/s digital leased lines identified in annex 2 of the Directive should be based upon ETS 300 166, and that additional material should be drawn where appropriate from ETS 300 011.

Recommendation 5

We recommend that the interface presentation specifications for the 64 kbit/s digital leased line identified in annex 2 of the Directive should be based upon ETS 300 166, and that additional material should be drawn where appropriate from ETS 300 012.

12.2.4 Additional technical aspects

12.2.4.1 Coaxial versus symmetrical interface option

In the case of 2048 kbit/s, CCITT Recommendation G.703, [14] section 6 allows the option of either 75 ohm unbalanced coaxial pair or 120 ohm balanced symmetrical pair interface. The question is whether in the context of ONP leased lines to recommend that the two presentations should continue to coexist, or should one be recommended over the other. As well as having impact on physical connectorisation, there are political and economic considerations arising out of this question which we are unable to address. However, ETSI, in the context of ISDN, has provisionally decided upon the 120 ohm balanced presentation for the primary rate interface (ETS 300 011). Provided that this proposal is firmly adopted, we believe that the 2048 kbit/s digital leased lines should also use the same presentation.

Recommendation 6

We recommend, in the case of 2048 kbit/s ONP leased lines, that a 120 ohm balanced symmetric pair be used for the User Network interface.

12.2.4.2 Low Q versus High Q clock recovery

The jitter specification for the 2048 kbit/s interface according to CCITT Recommendation G.703 [14] has two options defined in CCITT Recommendation G.823 [23] which are used in different networks. There are countries using high Q clock recovery in regenerators as well as in line terminations and others using low Q clock recovery. This has an impact on the output jitter value as well as the tolerable input jitter as indicated in Table 1 and 2 of CCITT Recommendation G.823 [23] causing incompatibility of interconnected equipment using different concepts.

The problem is solved in CCITT Recommendation G.823 [23] for interconnection of networks with different Q-factors. Only the low Q values are relevant at the international interconnection point. This does however not solve the problem of terminals ie. for connection to an NTP in all European countries. This problem needs to be resolved.

Current proposals under discussion within CCITT are likely to result in a complete new jitter mask specification in CCITT Recommendation G.823, [23]. This is expected to have been decided by the end of 1991. As a consequence, ETSI standards will require revision.

Another aspect which needs to be considered is the existing terminal equipment which is not capable of selecting a particular recovery strategy. A careful study of the cost/complexity issues is required.

The following two alternatives were looked at:

a) the terminal equipment can be switched to low or high Q as required by the connection, which may cause problems if it is part of a complex private network configuration: or

b) the approach taken by ETS 300 011, [77], is followed which may increase the complexity of the timing recovery in the terminal equipment. The approach is that the input of the terminal tolerates jitter produced by a low Q network but at the output limits the jitter for the satisfaction of the high Q network. This guarantees free connectivity to networks without adaptation.

We suggest that the latter approach is taken.

12.2.4.3 Analogue and digital clock recovery implementations

The current specification of the jitter characteristics in CCITT Recommendation G.823 [23] is based on clock recovery implementations in terminal equipment of the analogue Phase Locked Loop (PLL) type. This is relevant for both the 64 kbit/s as well as the 2048 kbit/s interface.

Modern types of implementations with digital PLL may cause a totally different output jitter characteristic which cannot be measured with the defined measurement equipment using the specification methods. For example the analogue PLL provides a linear transfer of input jitter to the output increased by the jitter transfer characteristic of the PLL. A digital PLL may transfer the frequency spectrum of input jitter into another spectrum or even may produce significant output jitter without input jitter due to frequency adaptation to the input clock.

From the implementation point of view digital PLL are the more advanced ones because they may be implemented in integrated circuits but if the jitter specification and measurement does not take account of the new transfer characteristics interworking problems at the interface may be experienced in future. This

problem needs to be resolved not to restrict advantages of implementations but to avoid interworking problems.

There is no approach available yet for the 64 kbit/s interface. For the 2048 kbit/s interface ETS 300 011, [77] , provides a completely revised jitter specification applicable for both types of PLL implementations including the measurement as well as the conformance testing. It needs to be clarified whether this approach can be adopted for the simple CCITT Recommendation G.703, [14], interface as well.

12.3 Terminal attachment requirements

The existence of diverse opinions on the inclusion of requirements related to safety, overvoltage protection, and EMC phenomena has already been noted in 9. This section is written on the assumption that the standards to be produced will cover these aspects.

The requirements specified in this section are intended to ensure that, when any terminal equipment is attached to an ONP leased line Connection via an NTP, all terminal equipments complying with the requirements, will neither adversely affect the public telecommunication network which has provided the connection nor interfere with the service available to other users. The requirements also include safety parameters for the protection of personnel operating the public telecommunication network.

Table 4 proposes some initial values for various parameters, but it should be noted that no investigative work has been undertaken to justify the values given. They must therefore be assumed to be a "first cut" set of values.

The requirements of Table 4 are based on the assumption that the interface of the TE shall provide operating conditions at the NTP so that the network does not experience a failure at the NTP.

Table 4: Digital interface requirements

Connection type: Interface type:	64 kbit/s G.703	2048 kbit/s G.703	2048 kbit/s G.703,704,706
Connector requirements - integral connector	based on EN 41001	based on EN 41001	based on EN 41001
- non-integral connector	optional	optional	optional
- connection of screen to equipment	yes	yes	yes
Electrical and physical characteristics, conformance testing	note 1	note 2	note 2
- use of transformer	required	required	required
- output - clock tolerance in free running mode	±100 ppm	±32 ppm note 3	±32 ppm note 3
- clock tolerance in operation condition	synchronized to i/p clock	±32 ppm note 3	±32 ppm note 3
- signal coding	G.703 § 1.2.1.1.5, octet structur required	HDB3 G.703 Anx.A	HDB3 G.703 Anx.A
- electrical characteristics	G.703 § 1.2.1.2 & table 1	G.703 § 6.2 & table 6	G.703 § 6.2 & table 6
- jitter characteristics	requires clarification	depends on the synchronis'n concept and requires clarification	depends on the synchronis'n concept and requires clarification
- input	network clock		
- clock tolerance for signal recognition	±100 ppm in fail condition	±50 ppm	±50 ppm
- electrical characteristics	G.703 § 1.2.1.3	G.703 § 6.3	G.703 § 6.3
- jitter characteristics	requires clarification	requires clarification	requires clarification
Safety requirements	note 4	note 4	note 4
Additional isolation reqts.	note 4	note 4	note 4
Conducted immunity	note 4	note 4	note 4
Conducted emission	note 4	note 4	note 4
Limitation of voltage and current under single fault condition	note 4	note 4	note 4
Resistibility to miswiring	note 4	note 4	note 4
Interface procedure, conformance testing	not relevant	not relevant	G.704 § 2.3, G.706 § 4 note 5,note 6

NOTE 1: Conformance testing is not defined in CCITT Recommendation G.703 or ETS 300 166 for this type of interface.

NOTE 2: Conformance testing is not defined in CCITT Recommendation G.703 or ETS 300 166, but ETS 300 011 may be taken as a basis for the specification of attachment requirement tests.

NOTE 3: The value of 50 ppm in CCITT Recommendation G.703 was reduced due to non-applicability of the hypothetical reference concept of CCITT Recommendation G.801 and table 2 of CCITT Recommendation G.921. See also ETS 300 011 Annex A.

NOTE 4: The relevant standards still have to be identified.

NOTE 5: The options and the use/coding of the Sa bits still need to be clarified.

NOTE 6: Conformance testing is not defined in CCITT Recommendations G.704 & G.706 or ETS 300 167, but ETS 300 011 may be taken as a basis for the specification of attachment requirement tests.

13 Examination of the technical requirements; analogue

In ISDN standards there is an important distinction made between *bearer services* and *teleservices*. Although formulated for the ISDN environment this approach has general applicability throughout the telecommunications field.

Bearer services describe the capability offered at a NTP; teleservices describe the capability offered to a user through a combination of network capabilities (ie the appropriate bearer service) and terminal functionality. For example, the telephony teleservice is realized by utilizing the capability of a network to convey speech (the speech bearer service) in conjunction with the functionality of the telephone to encode that speech and to ensure that it is transmitted with the required acoustic performance.

The terminal equipment performs a significant role in implementing the specific performance requirements laid down for voice quality and transmission delay which are contained in the telephony teleservice description. By itself, a network connection cannot cause these requirements to be met; however, its characteristics have a significant impact on the achievability of telephony performance. For example, excessive attenuation through the network connection cannot be compensated for in the terminal equipment. Because of this circuits commonly used for switched telephony applications are engineered to ensure that (on a statistical basis) an agreed level of telephony performance is achieved. This is specified in G.101, [8], and related recommendations.

However, this is generally not the case for analogue leased lines, which are engineered on an individual basis to meet specific user requirements. The primary contributory factors in this regard will be line length versus line characteristics, and whether the interface presentation is 2 or 4 wire. It is therefore not possible to guarantee that all analogue leased lines will necessarily be suitable for supporting the telephony teleservice because they may not exhibit adequate performance characteristics to allow the required level of telephony performance. This can only be achieved if the leased line is engineered according to the performance values allocated to this connection element in the transmission plan.

When deciding therefore on the type of leased line required for a specific application, a user will need to be cognisant of the network planning rules. In particular he will be required to understand the trade-offs between various performance parameters about which he may have no specialist knowledge. This will be particularly true for small and medium sized enterprises. This information should be given to the user as part of the disclosure of information required by article 3(1) of the Directive. Sufficient information must be given to enable the user to satisfy himself that the desired level of performance will be obtainable from the leased line he intends purchasing.

We suggest that some simple guidelines are formulated in order that user's may take decisions about which sort of ONP leased line will be required for a particular application. One approach is exemplified in the table below.

Table 5: Suitability Of ONP Leased Lines For Particular Applications

	2-wire Ordinary Quality	4-wire Ordinary Quality	2-wire Special Quality (NOTE 1)	4-wire Special Quality (NOTE 1)
Telephony Service	Suitable for some applicns. (NOTE 2)	Suitable (NOTE 3)	Suitable for some applicns. (NOTE 2)	Suitable (NOTE 3)
Data Traffic With Equalizers	(NOTE 5)	Suitable	Suitable (NOTE 4)	Suitable
Data Traffic Without Equalizers	(NOTE 5)	Suitable	Suitable (NOTE 4)	Suitable

NOTE 1: CCITT Recommendation M.1020, [43], may not be sufficiently stringent for PTN applications using cascaded leased lines; in this case, the use of M.580, [41], should be considered.

NOTE 2: If loss, echo, noise, quantisation distortion, and delay values are in conformance with the allocated allowance according to the intervening network transmission plan.

NOTE 3: Allowed if 4 wire switching is done at least at one side and the loss, noise, quantisation distortion and delay values are in conformance with the allocated allowance according to the intervening network transmission plan.

NOTE 4: The achievable transfer rate may depend on some length dependant characteristics.

NOTE 5: The suitability and the transfer rate depends on length and intervening network technology (e.g. coding)

Such guidelines might be contained in the proposed application note.

13.1 Conflicting requirements

In the case of analogue leased lines there are two conflicting requirements. On the one hand there is the requirement of the TOs to be able to utilize any technology they choose in the provision of ordinary quality lines, on the basis that these lines are intended for voice use only. On the other hand many ordinary quality lines are capable of being used for other purposes (such as data transmission), and the current view of the European Commission is that this situation should continue in the future.

To enable this the TOs are required to provide all types of analogue leased lines as full-duplex circuits. Measures to cope with echo and stability requirements on 2-wire analogue leased lines must consequently not include echo suppression.

There shall be no restrictions as to the possible coding of the transmitted signals other than that the stated connection performance must be provided.

13.2 Degree of specification required

The characteristics of analogue leased lines will need to be specified in significantly greater detail than has traditionally been the case. This is in order to ensure an adequate specification of the characteristics of the line and the availability to terminal implementors of information essential to ensure proper interworking across the leased line. There is however a difference of opinion over precisely which parameters should be

specified over and above those contained in the base CCITT Recommendations. The proposals contained in the following sections are those of the project team which undertook the study and do not necessarily have the unanimous agreement of all ETSI members. Specific areas where this is an issue are the parameters "maximum delay" and "maximum number of Quantisation Distortion Units (QDUs)".

NOTE 1: Annex F gives tutorial information on the subject of relative power levels which may assist in the understanding of the following text.

NOTE 2: Annex H provides more detailed information concerning relevant clauses from existing standards which may be used in the new ETSs for analogue leased lines.

13.3 Connection characteristics

13.3.1 Attribute values for analogue connections

An attempt has been made to apply the attribute technique of CCITT Recommendation I.140, [30]. These techniques are for ISDN and some attributes and attribute values have therefore been modified to fit with analogue parameters. Annex G contains the complete listing for analogue connections.

13.3.2 2-wire ordinary quality (A2O)

The connection characteristics of this type of leased line should be based on CCITT recommendation M.1040, [45], and should not be more stringent than the requirements of this recommendation.

M.1040 recommends values for loss/frequency distortion and random circuit noise. This is insufficient and we suggest that a number of other parameters need to be specified. These include nominal overall loss, echo and stability, maximum delay, and quantising distortion.

For distortion and noise we suggest the figures from M.1040 should be applied. We observe that as to the latter the longest connection within the EEC will probably not exceed 6000 km, thus random circuit noise due to FDM carrier systems should not exceed -41 dBm0p. Although such systems are on the wane due to digital transmission systems with different noise characteristics, the notion of random circuit noise should be maintained.

In the case of nominal overall loss the recommendation states that "*Because of the differing nominal level at renters' premises due to the various national practices, it is not normally possible to predict the nominal overall loss of the circuit at the reference frequency.*" We find, however, that a nominal overall loss should be specified such that the mean level of a speech signal should not be less than -37 dBm at the receiver. We propose to pattern it on the M.1040 statement for the nominal overall loss on 4-wire leased lines with a maximum mean sending level of -15 dBm0, (averaged over 1 minute), and a requirement that the relative receiving level must not be less than -22 dBr. This will imply that the TO supplying a leased line shall state the sending relative level, in order that the user can exploit the line to its limit. The ranges to be specified for the relative levels are shown in Annex G.

For echo and stability we propose that a TO (in whose interest it is that these items are under control due to their possible influence on other connections in the same transmission system), shall be required to comply with CCITT recommendation G.131 [2] for stability when terminals are connected or not, and for echo when terminals are connected. The use of echo suppressors and cancellers to achieve this will not be allowed.

The project team believes that a maximum value of delay should be specified in order that users receive a guaranteed level of performance. There is however a body of opinion which believes that it is not feasible to provide such a guarantee as some leased line destinations can only be reached via satellite systems.

This is an area where further analysis of the issue of the performance parameter "delay" and its relationship to the provision of ONP leased lines via satellite is required[1)]. It may be for instance that some mechanism for negotiating for the supply of a leased line with specific characteristics is required in order that a specific application can be implemented. Problems may also arise through the involvement of more than one TO. If a maximum value of delay is specified, then it could be done as shown in Annex G.

Delay distortion is of no importance for voice transmission, for which these leased lines are primarily designed. Terminal Equipments for other purposes which wish to make use of A2O leased lines must compensate for possible shortcomings due to delay distortion themselves. Thus, it is proposed that there shall be no requirements for delay distortion.

In order to ensure the possibility of data transmission the maximum number of permitted QDUs should be specified.

In addition, test set-ups are not given in the CCITT recommendations but must be part of the standards for ONP leased lines. New work, perhaps based on an appropriate national specification will be needed here. The major problem seems to be the verification of the stability and echo conditions.

13.3.3 4-wire ordinary quality (A4O)

For these leased lines M.1040, [45], states for the nominal overall loss that the receiving relative level at the renters' premises should not be less than -15 dBr, and that a mean sending signal power of -15 dBm0 can be assumed. The TOs must specify the sending relative level in order for the user to comply with the permitted sending level. It is proposed to specify an averaging time of 1 minute for the measurement of the mean level, and a range of sending and receiving relative levels as suggested in Annex G.

There will be no problems with echo or stability for this type of leased line. Delay should be stated as for a 2-wire leased line. There is no need to specify delay distortion.

In order to ensure the possibility of data transmission the maximum number of permitted QDUs should be specified.

13.3.4 2-wire special quality (A2S)

The connection characteristics of this type of leased line shall be based on CCITT recommendations M.1020, [43], and M.1025, [44], and should not be more stringent than the requirements of these recommendations.

These recommendations deal with leased circuits for uses other than telephony e.g. data transmission. In particular M.1020 circuits are for use with modems without equalizers, whilst M.1025 circuits are for use with modems containing equalizers.

The recommendations state values for nominal overall loss, loss/frequency distortion, delay distortion, variation of overall loss with time, random circuit noise, impulsive noise, phase jitter, total distortion (including quantising distortion), single tone interference, frequency error and harmonic and inter-modulation distortion.

In order to ensure the possibility of data transmission the maximum number of permitted QDUs should be specified.

---

1) The European Commission has stated that satellite systems are considered to be a legitimate means of providing ONP leased lines.

The two recommendations differ in the following requirements:

- loss/frequency distortion; where, for example, between 500 and 2500 Hz deviations from the value at 1020 Hz may be between -1 to +3 dB in M.1020 and between -2 to +8 dB in M.1025.

- delay distortion; where, for example, between 1000 and 2600 Hz M.1020 allows up to 0.5 ms whereas M.1025 allows up to 1.5 ms.

We suggest that the standard for 2-wire analog special quality leased lines should use the figures from M.1020. In addition the proposal in 13.3.2 concerning nominal overall loss should be adopted for this type of leased line too, however with a range of relative levels as seen in Annex G.

Echo and stability must be specified as in Annex G. Echo may be a problem unless the acoustic and electrical feedback to the 4-wire transmit direction in the terminating equipment is specified, possibly together with a minimum overall loss in the connection.

13.3.5 4-wire special quality (A4S)

For this type of leased line the requirements of M.1020 should be adopted. In addition the proposal of 13.3.2 on nominal overall loss should be adopted, with a range of relative levels as seen in Annex I.

In order to ensure the possibility of data transmission the maximum number of permitted QDUs should be specified.

13.3.6 Example of Connection Performance

The Danish TOs have produced a proposal for the intended connection performance of their national analogue leased line offerings and a report on measurements of how far the leased lines made via different access and transit connection elements perform as intended. The proposal is called "circular 12D" and is issued in August 1990. There are six types of leased lines offered, of which four correspond to the four types required by the Directive. The last two are for "local quality", with copper wires such that DC feeding is possible and the frequencies up to 15 kHz may be used. These two offerings are only possible over short distances.

In this section the values for the four offerings in the proposal are listed first. Then the differences between this proposal and the contents of sections 13.3.2 through 13.3.5 are discussed.

Danish proposal for national leased lines connection performance:

Property	A2O	A4O	A2S	A4S
Frequency error	<-------------- +/-2 Hz ---------------->			
Phase hit	<--------------- NOTE 1 ---------------->			
Phase jitter	<-------------- <10° p-p ---------------->			
Harmonic distortion	<--------------- NOTE 2 ---------------->			
Attenuation (800 Hz)	<25.5 dB	<19.0 dB	<25.5 dB	<19.0 dB
Loss/frequency distortion (NOTE 3)	<--- as M.1040 --->		<--- as M.1020 --->	
Attenuation variation	<----------------- 4 dB ----------------->			
Loop resistance	<----------- not applicable ------------>			
Near-end crosstalk att.	n.a.	>50 dB	n.a.	>50 dB
Group delay distortion	<--- as M.1025 --->		<--- as M.1020 --->	
Listener's echo	>12 dB	n.a.	>12 dB	n.a.
Psophometric noise	<-------------- <-60 dBmp -------------->			
Impulsive noise	<-------------- NOTE 4 ----------------->			
Amplitude hits	<-------------- NOTE 5 ----------------->			

NOTE 1: <10 per 15 minutes will be >15° p-p.
NOTE 2: attenuation of harmonics:2nd >26.0 dB;
3rd >29.5 dB.
NOTE 3: No requirement below 300 Hz;
Lower limit above 3000 Hz is -0.5 dB;
Related to value at 800 Hz.
NOTE 4: <18 per 15 minutes will be <11 dB from the signal level.
NOTE 5: <10 per 15 minutes >+/-2 dB.

"Circular 12D" adds the following parameters to what is proposed in subclauses 10.3.2 to 10.3.5:

- Frequency error for A2O and A4O;
- Phase hit for A2O, A4O, A2S and A4S;
- Phase jitter for A2O and A4O;
- Harmonic distortion for A2O and A4O;
- Attenuation variation for A2O and A4O;
- Near-end crosstalk attenuation for A4O and A4S;
- Group delay distortion for A2O and A4O;
- Listeners echo for A2O and A2S;
- Impulsive noise for A2O and A4O;
- Amplitude hits for A2O and A4O.

On the other hand, subclauses 11.3.2 to 11.3.5 also include requirements for:

Stability for A2O and A2S

Maximum delay for A2O, A4O, A2S and A4S

Total distortion for A2S and A4S

Single tone interference for A2S and A4S

Intermodulation distortion for A2S and A4S

What should be the reaction to these differences?

Generally no reaction as it would add unnecessary requirements to the A2O and A4O offerings (which are primarily intended for speech).

Phase hit for A2S and A4S are "under study" re M.1020, and that is why this parameter can not yet be specified.

The requirement to near-end crosstalk attenuation should be added to the A4S performance specification.

The requirement to listeners echo seems less than required according to G.131 [2].

13.4 Interface characteristics

13.4.1 2-wire lines (A2O, A2S)

Electrically the only item to specify is the input impedance. It is suggested that the return loss against 600 ohms, when the other end of the leased line is terminated in 600 ohms, should be larger than 6 dB.

In ETS 300 001 (terminal equipment requirements for terminals to be used with the public switched telephone network, PSTN), [70], 600 ohms is used in the majority of the present EEC countries. The low requirement of minimum 6 dB also ensures that terminal equipment with an input impedance matched to long unloaded cable lengths of any type used in the distribution network of the public telecommunication network will comply.

There is however a considerable body of opinion which believes that a complex impedance is required in order to satisfy the echo requirements (compare with ETS 300 004, [73]). This issue will require further discussion during the standards drafting stage.

13.4.2 4-wire lines (A4O, A4S)

For each pair of wires the same requirement for the return loss shall be fulfilled as outlined for the 2-wire case above.

13.5 Terminal attachment requirements

The existence of diverse opinions on the inclusion of requirements related to safety, overvoltage protection, and EMC phenomena has already been noted in 9. The following sub-sections include discussion of the technical aspects of these areas in the event that ETSI is advised to include these aspects in the standards.

13.5.1 Electrical characteristics

The electrical requirements are based on ETS 300 004, [73], (BT; transmission characteristics for 2-wire analogue interfaces of digital PABX) and ETS 300 005, [74], (idem for 4-wire interfaces). For other items they are based on ETS 300 153, [85], (attachment requirements for TE using basic access).

Terminals shall have the following specified (re ETS 300 004, [73], and ETS 300 005, [74]):

- The input impedance in the speech band (300 to 3400 Hz) should be 600 ohms, tested by its return loss being minimum 6 dB against a test impedance of 600 ohms. If the terminal can connect transparently to another terminal (if it is e.g. an analogue PABX) the test must be carried out with the terminal through-connected to such another terminal.

- The impedance unbalance about earth in the speech band should be specified by its Longitudinal Conversion Loss (LCL) re CCITT recommendation G.117, [10], para 4.1.3, and be at least 40 dB for 300 to 600 Hz and at least 46 dB for 600 to 3400 Hz. Test should be done re CCITT recommendation O.9, [47], paras 2.1 and 3.

- The maximum instantaneous voltage which may be injected between the line connector pins at any frequency should be 3.5 Volts. The supplier should document how this requirement is fulfilled.

- The maximum average sending power (averaged over 1 minute) in the speech band should either be adjustable in the range -8 to -15 dBm or be fixed at -15 dBm, for terminals for both 2- and 4-wire leased lines terminated in 600 ohms. If such an adjustment is possible, it must not be easy to change it after its initial setting. Test should be done according to CCITT recommendation P.56, [48], with the terminal set to send at its highest level.

- The maximum sending power for possible frequency components outside the speech band should be -40 dBm, for terminals for both 2- and 4-wire leased lines terminated in 600 ohms. Test should be done by a selective peak level meter scanning the frequency range from 3400 to 15000 Hz at a rate of one octave per second while the terminal is set to send at its highest level.

13.5.2 Physical characteristics

These need to be covered by the standard. The detailed discussion can be found in 14.

13.5.3 Interface procedure aspects

For these leased lines, which must provide the full bandwidth, there can be no interface procedure aspects at layer 1 (the only layer with which the leased line offerings are concerned). Thus, nothing should be specified.

13.5.4 Power feeding arrangements

It shall not be allowed for a terminal to draw power for its operation from a leased line. The supplier should document how this requirement is fulfilled.

13.5.5 Safety class of the interface and requirements

The terminal should at least fulfil the IEC rules for double isolation, not only towards its external surface but also towards its electrical signalling interfaces and between these (there is no control over what the user might connect to them). ETR 012, , discusses these points. Reference is also made to the SELV rules which are specified for analogue circuits in EN 41003, [58].

The requirements for the attachment interface can be patterned on ETS 300 047-2, [81], (which is for ISDN basic rate access), and shall consequently cover:

- General requirements.
- Leakage current.
- Galvanic isolation between interface and touchable parts.

13.5.6 Additional isolation requirements

If the terminal is declared to be of the extra-strength equipment type, it shall conform to the enhanced requirements in ETS 300 047-2, [81].

13.5.7 Overvoltage protection

Requirements from ETS 300 047-3, [81], shall be used and shall cover:

- Overvoltage surge simulation at interface, common mode test and transverse mode test.
- Mains voltage simulation, common mode test and transverse mode test.
- Impulse transfer, from mains, from auxiliary interface and conversion from common to transverse mode.
- Interface miswiring.
- Electrostatic discharge shall not be specified here, as it is part of the EMC requirements.

For extra-strength equipment the relevant enhanced requirements in ETS 300 047-3 shall be specified.

13.5.8 Electromagnetic immunity

Requirements from ETS 300 126, [84], shall be specified and cover the following characteristics:

- Electrostatic discharge.
- Electrical fast transients.
- Surges.
- Immunity to continuous conducted energy.
- Radiated immunity.

13.5.9 Electromagnetic emission

Requirements from ETS 300 126, [84], shall be specified and cover the following characteristics:

- Conducted emission.
- Radiated emission.

13.5.10 Limitation of current or voltage under single fault conditions

Requirements from ETS 300 047-3, [81], shall be specified to cover this item.

14 Examination of the technical requirements; physical connection arrangements

The physical connection arrangements between the terminal equipment and the leased line have to cater for the connection of a wide variety of apparatus in a number of configurations e.g. single plug and socket arrangement, multiple hardwired arrangement, etc. To cater for all cases the connectorisation arrangements will be specified in such a way that both TOs and suppliers will have to support both hardwired and plug/socket options and the final choice will be left to the user at the time of use.

> For example, for the interface presentation of the leased line, "the physical connection arrangements will consist of:
>
> a) a socket; or
>
> b) a hardwired connection using insulation displacement connections,
>
> and the connection arrangements will be agreed between the user and the TO at the time of provision of the ONP leased line.",
>
> and for the attachment requirements: "The terminal equipment will provide a means of connection which allows the use of:
>
> a) a plug ended cord; or
>
> b) a means of terminating the copper conductors of a cable or wire used as a connecting medium."

The proposed wording covers both the single line arrangement (typically plug and socket) and the case where several leased lines are required to be connected to a terminal equipment via a distribution frames.

For ONP leased lines the interface should be both mechanically and electrically harmonized. It is proposed that the interface socket should be based on the Western Electric (or Bell) type described in EN 41001, [57] and ISO 8877, [56]. The actual plug/socket combination to be used should be specified during the writing of the standards.

We suggest that for ONP digital leased lines the plug/socket should be based on the 8 pin ISDN connector, as specified in EN 41001, [57].

We suggest that for ONP analogue leased lines the plug/socket should be a 4-position plug/socket like the one in the US FCC, part 68, subpart F, section 68.500 rules. This is similar to the 8-position connector of EN 41001. The same type of socket is used for both 2 wire and 4 wire lines. The connector pins 2 and 3 should be used for access to a) 2-wire leased lines or b) the sending side of 4-wire leased lines (information from the terminal), while connector pins 1 and 4 should be used for access to the receiving side of 4-wire leased lines (information to the terminal).

One area which will have to be addressed further is the question of labelling or keying of plugs/sockets in order to prevent connection with an incompatible service/equipment from occurring.

15 Approach to testing

15.1 Purpose of specifying tests

The purpose of specifying tests is to provide a standardised means free of interpretation to enable testing of the capabilities and behaviour of an implementation, in order to allow checking of what is observed against the requirements in the standards.

15.2 Approach to be adopted

In line with our proposed approach to ONP leased line standardisation, testing will focus on the three areas of connection, interface presentation, and the terminal equipment.

A test schedule will be developed within each ETS. For each normative clause or sub-clause there will be a corresponding test specified to determine compliance with that requirement.

The test schedules should be based on an internationally defined and accepted methodology. International Standard ISO/IEC 9646 Parts 1 to 4, [98], defines the framework and procedures of such an approach. This approach is explained in more detail in ETR 021, "Tutorial on Protocol Conformance Testing", [69].

A preliminary examination of the ISO 9646 methodology suggests that it may be appropriate to the specification of tests in the standards for ONP leased lines. We therefore suggest that the methodology as outlined in ISO/IEC 9646-1, [98], should be adopted for the specification of tests in the standards relating to ONP Leased Lines.

15.3 Policy issues related to compliance testing

In considering the standardisation issues concerned with testing we have identified two policy issues which we feel the European Commission may wish to consider further.

15.3.1 Declarations of compliance by TOs

Declaration, by TOs, of compliance to the proposed standards is one aspect of the supply and usage conditions for ONP leased lines.

If such a mechanism were required, then some consideration needs to be given to whether a declaration needs to be made for every leased line installed by a TO, (consider the length dependency of some of the characteristics) or whether it should be done on a "type" basis, covering all leased lines of a particular type likely to be installed by a particular TO. The approach adopted may have some bearing on the setting of performance values for connections; in the latter case, parameter tolerances may have to be relaxed to take account of the variability which might arise by this method. On the other hand, the approach of declaring compliance for every installed leased line leads to a higher administrative overhead, and this may well end up being reflected in the tariffs applied to each offering. It is however likely to provide a greater degree of confidence for the user as far as "getting what he paid for" is concerned. The European Commission may like to give further consideration to the question of how declarations of compliance should be made by the TOs for their ONP leased line offerings.

15.3.2 Mechanism for resolving disputes

The Directive already provides a mechanism for the resolution of disputes. However, there may be a need for a mechanism for undertaking some form of independent testing by a third party in the event of such a dispute arising between the customer and the TO. One suggestion is that the responsibility for third party testing is given to the national regulatory authority or their nominated testing laboratory, and that this is used in conjunction with the mechanism for the resolution of disputes described in article 11 of the Directive.

16 Outstanding questions and issues

16.1 Broadband leased lines

The project team has not considered the issues surrounding the requirement for transparent 34 Mbit/s and 140 Mbit/s ONP leased lines in any detail. A minor amount of work has been done, which is retained in Annex J for future reference.

17 Conclusions

This report has examined the standardisation issues concerned with the application of the Directive on ONP leased lines. This led to the proposal that the standards should be structured into "connection characteristics", "interface presentations" and "attachment requirements".

A survey of existing standards and standardisation work has been presented and the technical requirements have been examined. This has led to proposals for the contents of the leased line standards.

The issue of compliance testing has been briefly discussed.

From the technical point of view we can conclude that:

a) the currently available standards do not adequately cover the requirements for ONP leased lines;

b) a significant amount of work will be required in order to put in place the appropriate standards; e.g.

- work will be required to supplement CCITT Recommendation G.703, which in itself is not a complete interface specification;

- further discussion of the parameter values in the standards for analogue leased lines will be required in order to reconcile the various national differences resulting from a long period in which analogue technology has developed independently in the member states.

c) it will not be possible for the TOs to supervise, and so guarantee, all aspects of the performance of analogue and unstructured digital connections between NTPs during operation.

We have considered in some depth the content and scopes of the required standards. We have drafted scope statements and preliminary abstracts for these.

There are some areas where further guidance is required from the European Commission before detailed drafting of the proposed standards can progress. In particular:

a. on the inclusion (or otherwise) of requirements related to overvoltage protection, and EMC phenomena, other than "conducted emission and immunity";

b. on the degree of specification of analogue leased lines, specifically regarding the parameter "delay".

Annex A: Applications of leased lines

There are a number of different applications of leased lines which can be grouped according to their signalling needs. The Annex deals with applications based on digital leased lines; however, similar principles may be applied when analogue leased lines are used.

A.1 Applications without specific needs

This set of applications are mainly based on data services using protocols providing the signalling capability within the transport protocol.

Under this group fall

- point-to-point applications which are permanently active using a protocol with layer 2 link control facilities;
- multipoint applications using a protocol with layer 3 network control capabilities, like X.25, [50];
- applications with dedicated protocols having in-band signalling capability, like X.21, [49];

which originate out of the data transmission services offered on public data networks (Circuit Switched Public Data Networks (CSPDN) and Packet Switched Public Data Networks (PSPDN)) and within computer networks. Important applications of this group are interconnections of computers, CAD/CAM, point-to-point videoconferencing, Local Area Networks (LANs), Teleaction and remote control applications. Figure A.1 illustrates such a configuration.

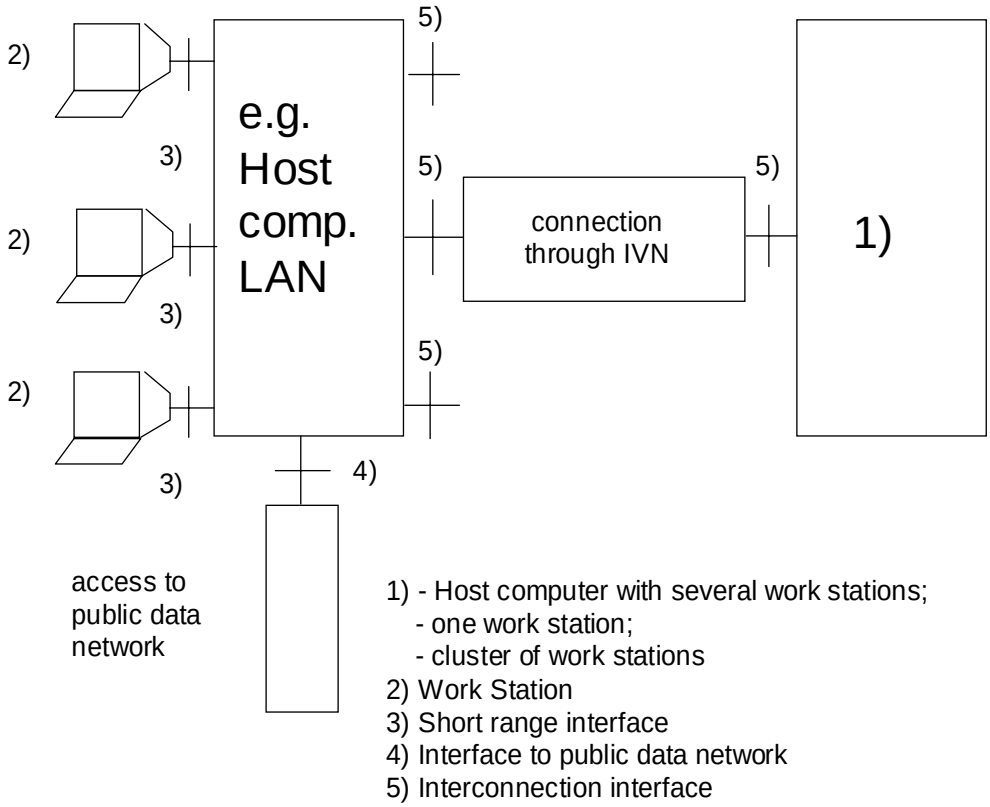

Figure A.1: Data network application

Often such applications use leased lines with data network interfaces (CCITT X or V series type interfaces) and low data rates; however, there are increasing demands for higher bit rate connections. Other interfaces, for instance for LANs, have been specified by IEC, together with the necessary special

communication protocols, running at high bit rates in the LAN but with relatively low throughput rates (a few percent of the bit rate) for the support of (interactive) real time operations. The interconnection of LANs can use either low bitrate connections or high bit rate connections.

From the application point of view of 64 kbit/s and 2048 kbit/s leased lines, the following statements can be made:

- Any need for signalling or network management in these types of applications is taken care of in the protocol specification and does not require any separate signalling capability or channel to be supported by the connection;

- For some multipoint configurations dynamic multiplexing of data frames from different end users is provided by the protocol specification; this does not require any special provision in the connection;

- For some multipoint configurations the multiplexing is carried out in layer 1; this requires structuring of the signal in the pipe to allow identification of the channels at the receiving terminal equipment.

    * For 64 kbit/s cases there are signal structures defined in CCITT Recommendations X.50, [51], X.51, [52], and X.58, [53], for splitting the 64 kbit/s pipe into channels; manufacturer specific mechanisms also exist.

    * For 2048 kbit/s cases there is a signal structure defined in G.704, [15], which may be used to split the remaining transparent connection capacity of 1984 kbit/s easily into channels of multiples of 8 kbit/s. Some bits of timeslot 0 (e.g. Sa4 and Sa8 bits) may be available for use by terminal equipment in the future, e.g. for network management purposes, but this use is not presently specified and is application dependant. There may also be manufacturer specific structures in use.

A.2 Applications with identified signalling needs

This set of applications is mainly based on telecommunication services of the PSTN and ISDN using both in-band and out-band signalling.

One of the best known examples of the use of leased lines is for the construction of PTNs. Figure A.2 illustrates this[1)] and introduces some new concepts resulting from ETSI work in this area.

There are two important examples illustrated in Figure A.2.

- a leased line being used for the interconnection of PTNXs to construct a PTN, which occurs between the two reference points marked "5)";

- a leased line being used to connect off premise extensions to the PTNX (one or a number of terminals, forming a cluster, connected to the PTNX without an additional switching function), which occurs between the two reference points marked "6)" and "4)".

---

1) The terms used in this figure are newly standardised terms arising from ETSI work in the field of PTNs; their definitions are contained in section (3).

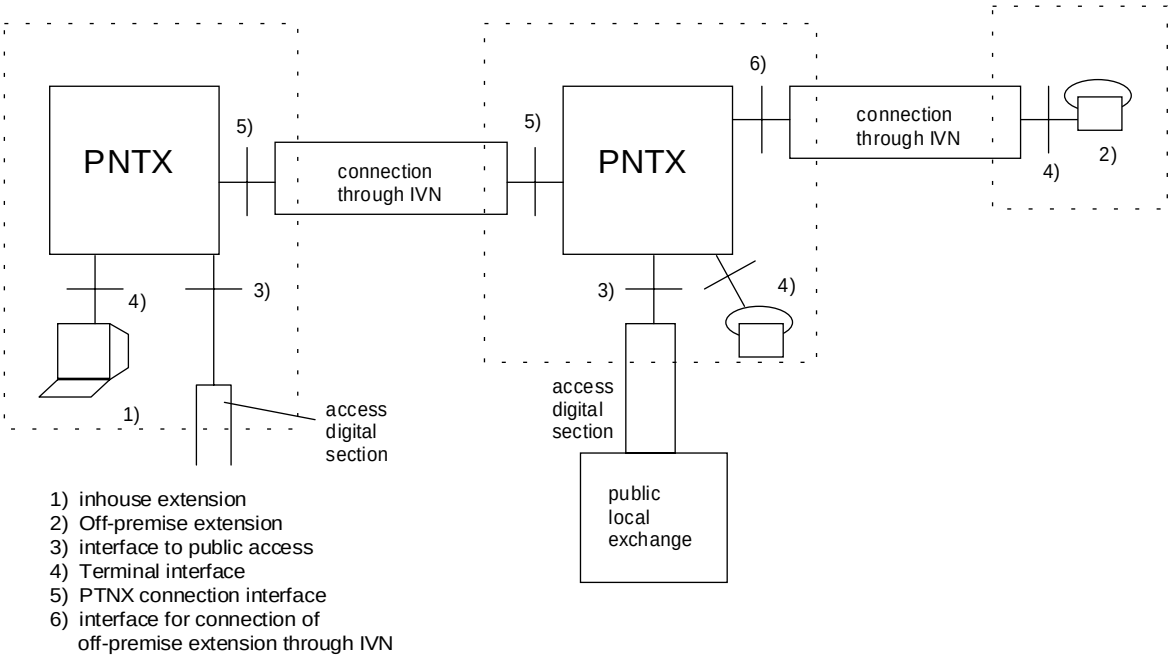

Figure A.2: Example of PTN application

These examples cover most of the possible types of dedicated applications (mainly based on on-demand circuit switched telecommunication services) in PTNs[1] using leased lines for interconnection.

Once a PTN has been created by linking a number of terminal equipments together with *connections through the intervening network (IVN)*, it is possible to create a "higher level" connection between two terminal equipments within the overall PTN; this is called the *PTN* connection. In a PTNX network this PTN connection will typically be established between two extensions during a call attempt to invoke a particular telecommunication service e.g. telephony[2] . There is thus an identified need for signalling between the two terminal equipments to control end to end PTN call establishment which is required for on-demand services within the PTN.

A.3 Differences in signalling requirements

The most important difference between the two groups of applications described is that the first group uses procedures for call control, if required, embedded in the application protocol itself and the other group needs a call control signalling capability which is separate from the application protocol.

The first group of applications often use packet mode type protocols with the signalling capability embedded in the protocol (e.g. X.25). Such mechanisms are also feasible for circuit mode protocols which must coexist with the application protocol used. However protocol restrictions would be required in order to avoid interpretation problems at the receiving side. Since data communication protocols are generally based on message oriented information transfer protocols it is only a matter of protocol definition to provide such in-band capability. An application protocol with packet mode structure can use both unstructured (transparent) and structured connections. The only difference is that throughput is reduced if structured connections are used; (e.g. 64 kbit/s for an unstructured and less than 64 kbit/s (e.g. 62 kbit/s) for a structured connection, or 2048 kbit/s for an unstructured and 1984 kbit/s for a structured connection).

---

1) As well as PABX networks the term "PTN" covers applications of military networks, mobile services networks, data network switching, and transmission node interconnections with common channel signalling according to CCITT X.60 and X.70 series recommendations, as well as other types of signalling.

2) We can differentiate between connections and calls (or communications) which occur over them. A call is a particular invocation, or instance, of a telecommunications service.

The second group of applications is often based on circuit mode information protocols for services requiring real time operation e.g. telephony. These services are sensitive to delays, and also sensitive to short term interruptions which might occur due to incorporated (in-band) signalling during the active phase of a call. Signalling is therefore conveyed outside the information channel if it is required during the active phase. The need for such signalling is increasing in order to provide communication support facilities (e.g. supplementary services). According to ENV 41006, [59], and DTR/BT-1002, [89], there are a number of different network scenarios possible for the implementation of the user information connection and the associated signalling connection. When reviewed in the ONP context this concept appears relevant.

A.4 Use of structured and unstructured connections by circuit mode applications

For a circuit mode application protocol (e.g. telephony) there are a number of factors governing the ability of the application to use structured or unstructured connections. It is necessary to treat 64 kbit/s and the 2048 kbit/s cases separately. Within each of these there is a need to distinguish between applications which need signalling as a part of the bitstream (ie. in-band) and those which make use of a separate signalling channel (ie. outband).

A.4.1 Circuit mode 64 kbit/s

A.4.1.1 Tolerating in-band signalling

For applications which require in-band signalling the situation is the same as for packet mode protocols ie. the bandwidth available to transfer the user's information has to be reduced in order to accommodate the associated signalling. This means that a service requiring unrestricted 64 kbit/s capacity under all conditions cannot use a connection which is structured into an "information" part and a "signalling" part.

This is particularly relevant for the telephony teleservice, which cannot be adapted to a lower bearer rate without significant impact on private and public telephony network planning. It is also relevant for the speech and 3.1 kHz audio bearer services where similar considerations apply (in these cases the performance of encoded modem signals would be impacted).

However, the speech and 3.1 kHz audio bearer services may make use of 64 kbit/s ONP connections if for example the least significant bit of the encoded analogue signal is not transmitted (7 bit encoding which leads to 56 kbit/s information transfer rate and leaves 8 kbit/s for in-band signalling). The consequence of this is that quantisation distortion is increased by 6 dB (2 quantisation distortion units). This, combined with other analogue/digital conversions in connections in a mixed analogue/digital environment results in the accumulation of transmission impairments.

A.4.1.2 Requiring out-band signalling

Out-band signalling is needed in those cases where the full 64 kbit/s is required for the "information part". Thus, an additional connection is required to cater for the "signalling part". This situation is found when (a) there is a leased line from a PTNX to an external extension, or (b) there is a leased line between two PTNXs or (c) there is more than one 64 kbit/s connection in parallel.

In the case of (a) and (b), if part of the available 64 kbit/s bandwidth is utilised for signalling purposes, the speech has to be restricted to the remaining bandwidth. For example, if 8 kbit/s is used for signalling the speech would have to transmitted utilizing a 7-bit PCM encoding scheme.

The incorporation of analogue/digital conversion processes in telephone connections, particularly during the mixed analogue/digital period, can result in an appreciable accumulation of transmission impairments. It is therefore necessary to ensure that this accumulation does not reach a point where it can seriously degrade the overall transmission quality, or even prevent its use for certain services.

In the above example the use of 7-bit PCM encoding would result in 3 units of quantisation distortion, compared with an 8-bit PCM encoding which would introduce only 1 unit of quantisation distortion.

CCITT Recommendation G.113 states that from the point of view of quantisation distortion:-

The number of QDUs in an international telephone connection should not exceed:

5 + 4 + 5 = 14 QDU's.

Under the above rule, each of the two national portions of an international telephone connection are permitted to introduce up to a maximum of 5 QDU's and the international portion up to a maximum of 4 units.

It can be seen that there may be a difficulty interconnecting a leased line which incorporates 7-bit encoding onto the public network or onto another private network, as the quantisation distortion performance objectives may be exceeded, resulting in an unacceptable level of transmission quality.

In the case of data transmission in a 64 kbit/s leased line this problem may not arise, as protocols would allow addressing and signalling as an integral part of the protocol, as appropriate.

The interface specification proposed as the basis for ONP digital leased lines, CCITT Recommendation G.703, [14], does not allow for the presentation of an additional out-band signalling channel to the customer at the interface.

A solution to the problem may be to offer an additional ONP 64 kbit/s digital leased line type which has an associated signalling channel. This new leased line type could be based on the ISDN Basic Rate interface (ie. the user is presented with a "B + D" or "2B + D" configuration) as described in CCITT Recommendation I.430, [34].

By choosing this leased line type, users who wished to utilise a 64 kbit/s digital leased line for telephony would have the full 64 kbit/s available to them on the B-channel and would be able to complete any dependant signalling operations on the D-channel.

Extrapolating this to case (c) above, a 64 kbit/s digital connection with an ISDN Basic Rate interface may then carry the signalling for other leased lines as well. This is allowable within the scenarios described in ENV 41006, [59], and is dealt with in the ETR, [89], on the provision of connections for interconnecting PTNXs. Different implementations are possible:

i) each connection is presented at a separate interface;

ii) several connections are presented combined in one interface.

Case (i) requires dedicated maintenance and network management provisions in the PTN to cope with failures affecting single connections only. The connections are handled individually by the intervening network.

Case (ii) can be implemented with a Basic Rate interface with 2 information channels of 64 kbit/s and a signalling channel of 16 kbit/s.

A.4.2 Circuit mode 2048 kbit/s

If the 2048 kbit/s ONP connection is used as a single end to end connection the same considerations apply as for the 64 kbit/s connection above. There are however no 2048 kbit/s services or protocols specified in international standards. The only indication given about 2048 kbit/s digital paths occurs in CCITT Recommendation G.702, Annex A.2, [13].

If the ONP connection is split in channels (ie. structured for example into timeslot 0 and a number of sub 1984 kbit/s information channels) by the terminal equipment then a mechanism must be used for channel identification. Currently only one structure is defined (CCITT Recommendation G.704, , CCITT Recommendation G.702, [15] Annex A.2, [13]). The requirement for sub-channel identification and the requirements for synchronisation, and some aspects of connection performance monitoring can be met using this standardised structure.

One of the information channels within the 1984 kbit/s may be used for carrying the signalling protocol between the two terminal equipments. The possibility exists to carry private network management information by using one or more of the spare bits in timeslot 0 if required.

A.5 Conclusions and recommendations

The need for end to end signalling exists for some applications involving leased lines. This signalling can be either in-band or out-band signalling.

Four connection types have been identified from the applications point of view as follows:-

a) between two NTPs via an intervening network, at a transparent information transmission rate of 64 kbit/s;

b) between two NTPs via an intervening network, at a transparent information transmission rate of 2048 kbit/s;

c) between two NTPs via an intervening network, at a transparent information transmission rate of 64 kbit/s with an additional transparent channel for out-band signalling information.

d) between two NTPs via an intervening network, at a bit rate of 2048 kbit/s; structured according to CCITT Recommendation G.704, [15], to give a transparent information transmission rate of 1984 kbit/s.

The ONP leased line concept should take account of these requirements, and should provide leased lines both with and without an end to end signalling channel in parallel to the information channel. The 2048 kbit/s case is adequately covered by the incorporation of both unstructured and structured leased lines. However, the case of a 64 kbit/s application requiring out-band signalling (e.g. single digital voice leased line) is not catered for.

We suggest that the European Commission considers the inclusion of a new digital connection type with one or two transparent 64 kbit/s information channel and a transparent (out-band) channel for signalling information.

We suggest that this connection type may be presented at an interface according to ETS 300 012, [78], ie. based on the ISDN Basic Rate interface described in CCITT Recommendation I.430, [34].

As already covered in section 12.1.1, Annex D proposes attribute values for the digital leased lines already covered by the Directive. In Annex E we have taken the opportunity to suggest attribute values for a 64 kbit/s digital leased line based on the ISDN Basic Rate interface.

Annex B: The interface at the NTP

B.1 Effects on the connection

It is intuitive that a connection may have more than one interface presentation depending upon a number of factors. For example, a 2048 kbit/s connection may be presented at an interface utilising either the 75 ohm coaxial presentation or the 120 ohm twisted pair presentation.

The network side of the interface (the means to present the connection to the customer) is generally part of the connection and may therefore have an effect on the connection characteristics. This is true, for example, for analogue leased lines where connection performance is linked to whether it has a 2 or 4 wire presentation.

It is possible to distinguish between positive and negative effects on the connection. A negative effect would be when the interface is the restricting factor for a connection characteristic between NTPs. A positive effect would be when the interface provides defined characteristics at the interface point, perhaps with only a small range of variation, independent of the connection length or other implementation aspects. For digital interfaces typical examples of positive effects may be that:

- the signal representation for interconnection and interaction between the two interface points is provided in a standard format; this gives flexibility for additional wiring within a defined range;

- the jitter and the timing characteristics for synchronisation between the terminal equipment and the connection as well as end to end are well defined; this allows complex customer network configurations;

- other related interface requirements (e.g. safety, protection, EMC) can be based on defined requirements independent from the implementation of the access connection element which is very often specific to the type of local access network (e.g. copper, fibre, radio).

It seems logical to separate the specification of the connection characteristics from the specification of its interface presentation. This allows independent standardisation of each aspect to cater for evolving requirements and technologies.

B.2 Choice of interface presentation

The interface chosen for the presentation of a connection may have greater capabilities than required from the connection characteristics. However, other aspects need to be taken into account in making the choice, including:

- completeness of the specification set required for interfaces in customer premises,

- suitable for use of existing interface wiring

- existence of low cost implementations,

- existence of standard failure indication and localisation capabilities for the interface (from the user as well as the TO point of view),

- supporting the use of standard type of transmission techniques and equipment already implemented in local access networks,

- applicability of standard interface modules independent from the terminal application or service.

Thus, interface presentations which are already defined for other applications than the ONP leased line applications, such as the ISDN Basic and Primary Rate Interface structures, may be suitable.

B.3 Different interfaces at each NTP

There is in principle no technical restriction on having different types of interfaces at the two ends of a connection as long as the two interfaces support the characteristics for the signal transfer of the connection. The interface related characteristics may be different at each end of the connection; in this case some attribute values with only local significance may differ. Scenarios such as this are considered to be beyond the current remit of simple point-to-point leased lines and are not considered any further. However, the approach to ONP standardisation adopted will not preclude this in future.

Annex C: The requirement for transparent transmission capacity

C.1 The term "transparency"

The term "transparency" as applied in digital transmission systems can be defined as "*the ability of a connection to convey a quantity of information corresponding to the full capacity of the path available without alteration or modification of the input signal*". In practice this would mean that:

- the full capacity of the information transfer rate defined for the connection is available to the user end to end;

- the information transfer through the connection is bit sequence independent within the range of tolerable bit rate clock frequency;

- bit sequence integrity is guaranteed within the limits of network slip rates e.g. as defined in CCITT Recommendation G.822, [22];

- no network defined signal structure which could limit the signal transfer rate of the connection is allowed below the service protocol layer. However signal structures required for the interface or required by the service, as an end to end function to be provided by the connection, must be supported (e.g. 8 kHz clock and signal structure to support digitally encoded speech signals.

C.2 Maintenance of connection performance in digital networks

The term performance covers in this context error, slip, jitter and availability performance.

C.2.1 In the switched network

The performance of digital networks is usually based on measurements of a number of digital links followed by calculation of the performance for the total network on a statistical basis. This means that a large number of theoretical connections through the network will meet or better the limits defined in CCITT Recommendation G.821, [21], under normal operating conditions. On the other hand at any one time there will be a number of connections which exhibit poor performance on a temporary basis (or even on a long term basis).

In a switched network those connection elements which demonstrate performance below a defined limit over a minimum period of time will be removed from service automatically. This avoids the possibility of a connection with poor performance or without end to end connectivity being put into the connected state. This is accomplished by exchanges performing a basic connection test during the connection establishment phase for the connection element under its control before through-connecting it.

Together these mechanisms allow a TO to provide a guarantee of the connection performance (e.g. error performance, availability performance) of the whole network on the basis of the mean holding time of switched connections. This, however, neither provides guarantees for any individual connection nor for connections with long durations.

However, once the connection is established there are no longer any means available to control the performance of the end to end connection (transparent information channel). Only hard failures, or unacceptable degradation of system performance (as determined by higher order transmission systems) may be detected and this may lead to call release by the network. Portions of a connection element on the lowest level of the digital hierarchy involved in the connection (e.g. interfaces, distribution frames, parts belonging to a tributary of a multiplexer or switching system) are not monitored in the network during this phase.

C.2.2 In the leased line network

Since many leased lines are not connected through the exchanges of the public telecommunications network, and those that are have long mean holding times, the statistical approach described above does not give an acceptable basis for guaranteeing the connection performance of leased lines from either the user or the TO point of view. Leased line circuits are normally individually engineered to ensure that the desired performance level will be achieved when the circuit is put into service.

In-service performance monitoring, which is the only method to guarantee tolerable performance limits for individual connections with long holding times, can only be carried out when either:

a) the signal at the NTP is structured in a defined way which allows the TO (and the user) to retrieve performance information from the connection by monitoring the structure information at both NTPs; or

b) the TO adds, behind the NTP, additional information to the "transparent" connection which is then transported together with the user information through the network to the other NTP.

Alternative (a) reduces the available net transport capacity through the connection for the user.

Alternative (b) requires restructuring in the network since the additional information together with the net signal rate for the connections under discussion (identical with the channel rates of the network) lead to a gross rate (to be carried through the network) greater than the channel rates currently available. New transmission systems or/and multiplex equipment would have to be developed depending on the required gross channel rate, leading to a separate (overlay) network for leased lines. This means that the economical and flexible use of existing network capacity and resources is then impossible.

Current digital networks designed on the basis of CCITT Recommendations for the plesiochronous digital hierarchy rely on the use of a portion of the total bandwidth within any one level of the hierarchy for the management of that level. At the first level in the hierarchy (2.048 Mbit/s) this is done by reserving 64 kbit/s in Timeslot 0, leaving 1984 kbit/s available for the carriage of end to end user information (which may be sub-divided into further channels or not). The standardised frame overhead which has been specified by CCITT has been designed specifically to consistently deal with practical network effects such as controlled slips in a manner which is as efficient as is reasonably possible. With a proprietary structure transported over an unstructured bit pipe, end-to-end performance is difficult to predict and control since these aspects are partially dependent on the particular frame structure and algorithm used. Current networks do not have any mechanism or method to perform in-service performance measurements for transparent connections according to the definition of transparency given above.

The conclusion therefore is that there is a conflict between the two requirements "connection transparency" and "guarantee of connection performance" if the principles are followed strictly.

Another option is available if interpretation of the requirement **"guarantee of connection performance"** is allowed. The alternatives above are based on the interpretation of the performance requirement to be guaranteed permanently for each individual connection with an impact on charging and billing if the performance level is not met. This interpretation requires permanent supervision of the connection because in the case of a dispute the TO needs the performance information of that time period (in the past) in question.

A freer interpretation of the requirement **"guarantee of connection performance"** may avoid the need for permanent performance measurement, for instance:

- if the TO guarantees the performance when the connection is given to the user, on the basis of measurements carried out beforehand;

- in the case of dispute the TO removes the connection from service and performs measurements (which might take some time);

- if the measurement result does not prove the complaint there will be no effect on the charging and billing of the leased line usage; however, the TO may be justified in charging for time used to investigate the complaint.

The problem becomes worse when more than one TO is involved in providing connections. For these cases it might be impossible to apply the option discussed above since it is impossible to estimate the impact on the user service availability if extensive measurement is required to detect temporary effects.

Advanced future networks using the new transmission technique based on the CCITT Synchronous Digital Hierarchy (SDH) do not have these problems. An overhead usable for performance monitoring of the transparent channel (payload) is already defined and is part of the network channel for the connection, in principle as described in alternative b) above. This means in this new network the channels in the network always have greater capacity then the payload given to the user.

C.3 Conclusions

We talked in the introduction to this report of the liberalisation of telecommunications regimes requiring education and reorientation in attitudes. We mentioned users having to accept responsibility for their equipment, and the telecommunications organisation no longer being responsible for end to end performance. One of the conclusions which can perhaps be drawn from our study of the transparency issue is that this is one area where the comments we made in the introduction hold true.

Considering the connection types identified in Annex B the situation can be summarised as follows:

a) For 64 kbit/s connections the only approach is to use a freer interpretation of the guarantee of connection performance. This is irrespective of the interface presentation used since the impact is on the access connection element;

b) For 2048 kbit/s unstructured connections the only approach is to use a freer interpretation of the guarantee of connection performance. This is irrespective of the interface presentation used since the impact is on the access connection element;

c) For 64 kbit/s connections with associated signalling channel a guarantee of performance may be given, since the TO can use spare capacity in the signalling channel for in-service performance monitoring;

d) For 2048 kbit/s structured connections a guarantee may be given, since the CRC-4 procedure allows an end to end check of the performance. There is an ambiguity with the phrase "end to end" resulting from the choice of interface presentation. In the case of a CCITT Recommendation G.703, [14], based presentation "end to end" means between the two terminal equipments with monitoring by the TO. If the terminal equipment is turned off or disconnected, the capability is lost, but this is unimportant as the terminal equipment does not perform as specified anyway. In the case of an ETS 300 011, [77], based presentation "end to end" means between the NTPs and the dependence on the terminal equipment does not exist.

These consequences are covered by the attributes given for the different connection types in Annexes D and E.

Annex D: Attribute values for ONP connection types according to Annex 2 of the Directive

Table D.1: 64 kbit/s connection with "G.703" interface

Attributes	Connection
	Circuit Mode Permanent
Information Transfer mode	circuit
Information Transfer Rate	64 kbit/s
Tolerance	Synchronized to network clock
Information Transfer Susceptance	unrestricted see G.703 ° 1.1.3
Symmetry	bidirectional
Connection Configuration	point-to-point
Structure	unstructured, 8 kHz structure required at interface (NOTE 1)
Channel Rate	
- Information Channel	64 kbit/s
- Signalling Channel	not applicable
Network Performance	
- General	G.801
- Error (NOTE 2)	G.821 *
- Controlled Slip	G.822 *
- Jitter	G.823 * (NOTE 5)
- Wander (NOTE 3)	G.823
- Long Term Availability	(TM2-5) *
■ Mean Value	
■ 95% Value	
- Transmission Delay (NOTE 4)	G.114
- Conformance Testing	
- all attributes ex performance	needs to be defined
- error perform	(M.550, M.555, M.557)
- slip perform	Design criteria for sync. concept
- jitter perform	Covered by interface spec
- avail perform	To be defined
- trans delay	To be defined

NOTE 1: The 8 kHz (octet) structure shall be maintained through the connection for unrestricted application of services, e.g. digitally encoded speech. There shall be no obligation to the TE above the requirement to group 8 consecutive bits in one octet according to the coding in G.703.

NOTE 2: Degraded Minutes parameter does not apply.

NOTE 3: Relevant for complex TE configurations only.

NOTE 4: Length dependency should be defined.

NOTE 5: The jitter requirement needs further clarification. This is due to the clock loop in the TE and will depend on the jitter transfer characteristics to be defined. Such a concept is currently not taken account of in G.823. Additionally the specification shall cover digital phase locked loop implementation.

An asterisk, "*", identifies performance aspects which cannot be monitored in-service between NTPs by the TOs, and which therefore cannot be guaranteed by the TOs.

Table D.2: 2048 kbit/s unstructured with "G.703" interface

Attributes	Connection
	Circuit Mode Permanent
Information Transfer mode	circuit
Information Transfer Rate	2048 kbit/s
Tolerance	± 32 ppm NOTE 2
Information Transfer Susceptance	unrestricted
Symmetry Connection Configuration	bidirectional point-to-point
Structure	unstructured
Network Performance (NOTE 1)	
- General	G.801
- Errored Seconds	* 5%
- Degraded Seconds	* 0.5%
- Severely Errored Seconds	* 0.1 - 0.2%
- Background Block Error Ratio	* 2 x 10(-4)
- Short Interrptn Interruption Event	* 20/month
- Jitter	* G.823 (NOTE 4)
- Slip	Not defined (NOTE 2)
- Wander	Not defined, relevant for complex TE configurations only
- Long Term Availability	(TM2-5) *
■ Mean Value	
■ 95% Value	
- Transmission Delay	G.114 (NOTE 3)
- Conformance Testing	
- all attributes ex performance	needs to be defined
- error perform	(M.550, M.555, M.557)
- slip perform	Design criteria for sync. concept
- jitter perform	Covered by interface spec
- avail perform	To be defined
- trans delay	To be defined

NOTE 1: These parameters refer to end-to-end error performance objectives for a 27 500 km digital connection at 2048 kbit/s.

NOTE 2: If service interworking with PTN is required, then End System clock must be synchronized to network clock, otherwise slip performance cannot be guaranteed. See I-ETS on PTN synchronization, [91]. This can only occur where the public network clock is available.

NOTE 3: Length dependency should be defined. Further discussion required.

NOTE 4: The jitter requirement needs further clarification. This is due to the clock loop in the TE and will depend on the jitter transfer characteristics to be defined. Such a concept is currently not taken account of in G.823. Additionally the specification shall cover digital phase locked loop implementation. ETS 300 011 may be taken as the basis for the specification.

An asterisk, "*", identifies performance aspects which cannot be monitored in-service between NTPs by the TOs, and which therefore cannot be guaranteed by the TOs.

Table D.3: 2048 kbit/s structure with interface according to G.703, G.704 and G.706

Attributes	Connection
	Circuit Mode Permanent
Transfer mode	Circuit
Transfer Rate	2048 kbit/s
Tolerance	±32 ppm (NOTE 2)
Information Transfer Susceptance	unrestricted
Symmetry	bidirectional
Connection Configuration	point-to-point
Structure	structured
Channel Rate	
- Information Channel Rate	1984 kbit/s
- Information Channel Structure	Unstructured
- Signalling Channel	Not provided (NOTE 4)
Network Performance	(NOTE 1)
- General	G.801
- Errored Seconds	5 %
- Degraded Seconds	0.5 %
- Severely Errored Seconds	0.1 - 0.2 %
- Background Block Error Ratio	2 x 10(-4)
- Short Interrptn Event	20/month
- Jitter	G.823 (NOTE 5)
- Wander	G.823 (NOTE 6)
- Long Term Availability	(TM2-5)
■ Mean Value	
■ 95% Value	
- Transmission Delay	G.114 (NOTE 3)
- Conformance Testing	
- all attributes ex performance	needs to be defined
- error perform	(M.550, M.555, M.557)
- slip perform	Design criteria for sync. concept
- jitter perform	Covered by interface spec
- avail perform	To be defined
- trans delay	To be defined

NOTE 1: Degraded Minutes parameter does not apply.

NOTE 2: If service interworking with PTN is required, then End System clock must be synchronized to network clock, otherwise slip performance cannot be guaranteed. See I-ETS on PTN synchronization, [91].

NOTE 3: Length dependency should be defined. Further discussion required.

NOTE 4: Further clarification is required whether Sa 4 and Sa 8 bits may be available to the TE for information transfer (e.g. management protocols)

NOTE 5: The jitter requirement needs further clarification. This is due to the clock loop in the TE and will depend on the jitter transfer characteristics to be defined. Such a concept is currently not taken account of in G.823. Additionally the specification shall cover digital phase locked loop implementation. ETS 300 011 may be taken as the basis for the specification.

NOTE 6: Relevant for complex TE configurations only.

An asterisk, "*", identifies performance aspects which cannot be monitored in-service between NTPs by the TOs, and which therefore cannot be guaranteed by the TOs.

Annex E: Proposal for presentation via ISDN interfaces

This Annex contains a proposal for attribute values which might be used for the case where a leased line is presented via an ISDN Basic Rate interface. It should be stressed that this is a proposal for the future and is outside the scope of the work currently being carried out by ETSI on behalf of the European Commission.

Table E.1: 64 kbit/s with "ETS 300 012" interface, without out-band signalling

Attributes	Connection
	Circuit Mode Permanent
Information Transfer mode	circuit
Information Transfer Rate	64 kbit/s
Tolerance	Synchronized to network clock
Information Transfer Susceptance	unrestricted
Symmetry	bidirectional
Connection Configuration	point-to-point
Structure	unstructured 8 kHz structure
Channel Rate	
- Information Channel	64 kbit/s
- Signalling Channel	not used
Network Performance	
- General	G.801
- Error (NOTE 1)	G.821 * (NOTE 3)
- Controlled Slip	G.822
- Jitter	I.430
- Wander	G.823 (NOTE 2)
- Long Term Availability	(TM2-5) *
■ Mean Value	
■ 95% Value	
- Outage Density	
- Transmission Delay	G.114
- Conformance Testing	
- all attributes ex performance	needs to be defined
- error perform	(M.550, M.555, M.557)
- slip perform	Design criteria for sync. concept
- jitter perform	Covered by interface spec
- avail perform	To be defined
- trans delay	To be defined

NOTE 1: Degraded Minutes parameter does not apply.

NOTE 2: Relevant for complex TE configurations only.

NOTE 3: Requires further clarification

An asterisk, "*", identifies performance aspects which cannot be monitored in-service between NTPs by the TOs, and which therefore cannot be guaranteed by the TOs.

Table E.2: 64 kbit/s with "ETS 300 012" interface including out-band signalling

Attributes	Connection
	Circuit Mode Permanent
Information Transfer mode	circuit
Information Transfer Rate	64 kbit/s
Tolerance	Synchronized to network clock
Information Transfer Susceptance	unrestricted
Symmetry	bidirectional
Connection Configuration	point-to-point
Structure	unstructured 8 kHz structure (NOTE 1)
Channel Rate	Provided
- Information Channel Rate Structure	64 kbit/s Unstructured
- Signalling Channel Structure	16 kbit/s Unstructured
Network Performance	
- General	G.801
- Error (NOTE 2)	G.821 * (NOTE 5)
- Controlled Slip	G.822
- Jitter	I.430
- Wander	G.823 (NOTE 3)
- Long Term Availability	(TM2-5) *
■ Mean Value	
■ 95% Value	
- Outage Density	
- Transmission Delay	G.114 (NOTE 4)
- Conformance Testing	
- all attributes ex performance	needs to be defined
- error perform	(M.550, M.555, M.557)
- slip perform	Design criteria for sync. concept
- jitter perform	Covered by interface spec
- avail perform	To be defined
- trans delay	To be defined

NOTE 1: The 8 kHz (octet) structure shall be maintained through the connection for unrestricted application of services e.g. digitally encoded speech. There shall be no obligation to the TE above the requirement to group 8 consecutive bits in one octet according to the coding in G.703.

NOTE 2: Degraded Minutes parameter does not apply.

NOTE 3: Relevant for complex TE configurations only.

NOTE 4: Length dependency should be defined.

NOTE 5: Requires further clarification

An asterisk, "*", identifies performance aspects which cannot be monitored in-service between NTPs by the TOs, and which therefore cannot be guaranteed by the TOs.

Table E.3: 1984 kbit/s with interface according to "ETS 300 011" connection

Attributes	Connection
	Circuit Mode Permanent
Information Transfer mode	circuit
Information Transfer Rate	2048 kbit/s
Tolerance	Synchronized to network clock
Information Transfer Susceptance	unrestricted
Symmetry	bidirectional
Connection Configuration	point-to-point
Structure	Structured
Channel Rate	
- Information Channel Rate	1984 kbit/s
- Structure	Unstructured
- Signalling Channel	Not provided (NOTE 3)
Network Performance	
- General	G.801
- Error (NOTE 1)	G.82x
- Controlled Slip	G.822
- Jitter	ETS 300 011
- Wander	ETS 300 011 (NOTE 2)
- Long Term Availability	(TM2-5) *
■ Mean Value	
■ 95% Value	
- Outage Density	
- Transmission Delay	G.114
- Conformance Testing	
- all attributes ex performance	needs to be defined
- error perform	(M.550, M.555, M.557)
- slip perform	Design criteria for sync. concept
- jitter perform	Covered by interface spec
- avail perform	To be defined
- trans delay	To be defined

NOTE 1: Degraded Minutes parameter does not apply.

NOTE 2: Relevant for complex TE configurations only

NOTE 3: Further clarification is required whether Sa 4 and Sa 8 bits may be available to the TE for information transfer (e.g. management protocols)

An asterisk, "*", identifies performance aspects which cannot be monitored in-service between NTPs by the TOs, and which therefore cannot be guaranteed by the TOs.

Annex F: Tutorial on relative levels

CCITT has defined in the introductory pages to the P. recommendations the meaning of dB indications with various postscripts, such as dBr and dBm.

This tutorial gives some background to these definitions, especially seen in conjunction with their use in the standards for analogue leased lines under the ONP-LL directive.

The ratio of two absolute power levels may be stated in dB, which is defined as 10 times the logarithm with base 10 of this ratio. A power of 400 mW (milliWatt) is 6 dB above a power of 100 mW.

An absolute power level may be stated in dBm, which means its ratio in dB to 1 milliWatt. 1 W is equal to +30 dBm.

Power is often measured with an instrument with a dB-scale. It should be emphasized that these instruments are normally voltmeters and will only show the correct value in dB (or rather dBm) when they are used to measure the voltage over a load impedance of 600 ohm resistive value. They show their 0 dB point correspondingly at 0.775 V (0.775 squared and divided by 600 gives 0.001).

Analogue FDM transmission systems comprise amplifiers, attenuators and cables which amplify or attenuate the signals. The levels anywhere in the system may then be given in dBr, i.e. dB relative to the level at a point which is defined to have a relative level of 0 dB. The absolute power level at this point is stated in dBm0, i.e. the power related to 1 mW at a point of 0 dBr. A power level in the system may be given as -5 dBm0. Then at a point of +6 dBr this power will have an absolute value of +1 dBm and similarly for other points with other relative levels.

Such analogue FDM transmission systems may be overloaded and give intermodulation and other disturbances between the transmissions they serve, if continuous input signals of a too high level exist simultaneously on several of their inputs. They must not cause such disturbances if these continuous input levels are each below -10 dBm0. It is up to the supplier to state the relative input level of his system, which makes it comply with this requirement. This relative level will also be the starting point for approval measurements on the system.

The difference in relative levels between an input and an output express the attenuation of the analogue signal from input to output.

Noise in a system can also be conveniently expressed by its value at a point of 0 dBr. If the noise is also weighted psophometrically, i.e. with regard for the sensitivity of the ear for the different frequencies, this noise power is expressed in dBm0p. The actual noise in a circuit will naturally often be an absolute noise power (in dBm) such that a point at a very low relative level can not fulfil the requirement. A noise power of -60 dBm0p at a point of -20 dBr means an absolute noise power of -80 dBmp (absolute level, psophometrically weighted).

For digital PCM transmission systems the situation is different. There is no intermodulation or other disturbance from one channel to the next. Instead a too high input level of a sinusoidal signal to an encoder may cause distortion because several samples are encoded as the same codewords, corresponding respectively to the maximum positive and negative amplitude of the signal. This works as a hard limiter on the output.

CCITT has in recommendation G.711, table 5, specified a codeword pattern which will produce a 1000 Hz sinusoidal signal of 0 dBm0 in a load impedance of 600 ohms. Recommendation O.133 defines an ideal decoder as having an output relative level of 0 dBr and it will therefore deliver 1 mW (0 dBm) when subjected to the said codeword pattern. An ideal encoder is defined as an encoder which will produce this same codeword pattern if its input signal is at a level of 0 dBm and the sampling instants (each 125 micro-second when a new instantaneous value of the signal is encoded) fall correctly.

The standardised codeword pattern is such that if the input signal to the encoder was instead at 3.14 dBm the codewords corresponding to the maximum amplitudes might be generated. That is why, for the masks in the PCM specifications from CCITT there is no requirement to dynamic linearity or signal-to-noise ratio for levels above 3 (or 3.14) dBm0, or for test at levels more than 13 dB above the nominal value of -10 dBm0.

In PCM systems there may also be amplifiers or attenuators between the analogue input/output and the encoder/decoder. Or the encoder might e.g. only reach the maximum codeword when its input is at, say, 4 mW (over 600 ohms). Therefore the input to the encoder chain of components and the output from the decoder chain of components is quoted in dBr. In the example the input of the encoder is such that overload occurs for input levels above 6 dBm (4 mW) and not above 3 (3.14) dBm. The input of this encoder has consequently a level of +3 dBr. Similarly a decoder might deliver an analogue signal of 0.5 mW (-3 dBm) over a load of 600 ohms if it receives the standard pattern, and would then have an output level of -3 dBr.

While one can follow the ups and downs of the relative level through a chain of analogue circuits, this is not the case for a chain of digital circuits. Let us assume a digital circuit with an ideal encoder at its input and an ideal decoder at its output and no change of the digital pattern in between. On either end the relative level will be 0 dBr. Let us now assume the introduction in the digital transmission of digital attenuation, e.g. with a table look-up where each octet is input and the contents in the table is the octet corresponding to the attenuated value of the original signal. One should expect the output relative level to become lower than 0 dBr in this case, but as we still have the ideal decoder in the circuit, the output relative level remains at 0 dBr!

Thus, the attenuation from input to output of a total connection is the difference between input and output relative levels plus the value of possible digital attenuations in the connection.

According to the LL specifications the TOs must deliver analogue leased lines with an input relative level of 0 to +7 dBr. This implies that a TO can not provide an arbitrarily long cable connection between the NTP and the point where the LL enters a transmission system. If this system has an input defined as 0 dBr the TO must limit the attenuation of the cable connection feeding it to 7 dB.

It also implies that a terminal may send its signals at a 7 dB higher level when the LL has a sending relative level of +7 dBr than when the LL has a 0 dBr relative sending level. In the first case an input signal of -3 dBm will be reduced to -10 dBm when it enters the transmission system.

Likewise the LL specifications require the TOs to provide leased lines with a receiving relative level of maximum 0 dBr and a minimum of the following values:

Type of LL	A2O	A4O	A2S	A4S
minimum relative receiving level (dBr)	-22	-15	-20	-13

The TOs are required to state for each LL provided the relative sending and receiving levels. The difference between these two values is identical to the attenuation of the LL as seen by the user (e.g. +3 dBr sending and -10 dBr receiving relative levels mean 13 dB attenuation).

Although ranges of 0 to +7 dBr and 0 to -22 dBr are required from the TOs, this does not mean that a user can demand delivery of leased lines with specified relative levels within these ranges. One consideration is for 2-wire leased lines that a certain attenuation will be required to ensure a proper performance of the LL with regard to echo and stability.

Annex G: Attribute values for analogue connections

G.1 Introduction

An attempt has been made to apply the attribute technique of CCITT Recommendations I.140, [30], and I.340, [31]. These are for ISDN and some attributes and attribute values have therefore been modified to fit with analogue parameters.

G.2 Connection attributes for 2-wire leased lines

	A20	A2S	
Information transfer mode	circuit		
Information transfer bandwidth	voice bandwidth		
Information transfer capability	speech	3.1 kHz audio	
Establishment of communication	permanent		
Symmetry	bidirectional symmetric		
Connection configuration	point-to-point		
Structure	unstructured		
Channel bandwidth	voice bandwidth		
Connection control protocol	not applicable		
Information transfer protocol	unstructured		
Network performance loss			
Relative sending level	0 to +7 dBr		
Relative receiving level	0 to -22 dBr	0 to -20 dBr	
Max average sending level	-15 dBm0		
noise	max random noise -41 dBm0p		
delay	max. 8 ms + 6 ms/1000 km		(NOTE 1)
	min. 3 ms/1000 km		
Network interworking	no CCITT definition		
Operations and management	no CCITT definition		

G.3 Connection attributes for 4-wire leased lines

	A4O	A4S	
Information transfer mode	circuit		
Information transfer bandwidth	voice bandwidth		
Information transfer capability	speech	3.1 kHz audio	
Establishment of communication	permanent		
Symmetry	bidirectional symmetric		
Connection configuration	point-to-point		
Structure	unstructured		
Channel bandwidth	voice bandwidth		
Connection control protocol	not applicable		
Information transfer protocol	unstructured		
Network performance loss			
Relative sending level	0 to +7 dBr		
Relative receiving level	0 to -15 dBr	0 to -13 dBr	
Max. average sending level	-15 dBm0		
noise	max random noise -41 dBm0p		
delay	max 8 ms + 6 ms/1000 km		(NOTE 1)
	min 3 ms/1000 km		
Network interworking	no CCITT definition		
Operations and management	no CCITT definition		

NOTE 1: These figures are initial proposals and need further discussion. See section 13.3.2 where the issue of leased lines via satellite is addressed.

Annex H: Relevant paragraphs in existing standards (analogue)

H.1 General

CCITT Recommendations do not normally include specifications as to how compliance with the recommendations should be measured, while ETSs must include test specifications. However, prI-ETSs or I-ETSs, which are still under way to be approved as full ETSs, may lack some or all test specifications.

Thus, for most of the proposed specifications on the basis of CCITT Recommendations test methods for their verification must be devised.

CCITT Recommendations of the O.-series specify measurement apparatus for various purposes and those of the P.-series specify measurement apparatus for voice measurements. In addition V.2 specifies the permissible maximum level. These Recommendations should be consulted when test methods for the ONP-LL standards are devised.

In addition to the requirements of the ONP-LL standards the "Low Voltage Directive" and the "EMC Directive" are applicable for terminal equipment at the customer premises and the requirements according to these directives shall not be repeated in these standards.

The "Low Voltage Directive" does not cover equipment at the customer premises which is provided by the TO, so applicable requirements must be included in the interface presentation standards. For EMC both the interface presentation standards and the terminal equipment attachment requirements have been extended with requirements for conducted immunity and emission.

H.2 Relevant standards

Item	Requirement	Test
ETS BT-2027, ONP-LL A2O connections and interface		
Connection characteristics		
Nominal overall loss	M.1040; 2.1	None
Loss/frequency distortion	M.1040; 2.2	None
Nominal delay	None	None
Delay distortion	NA	NA
Variation of overall loss with time	NA	NA
Random circuit noise	M.1040; 2.3	None
Impulsive noise	NA	NA
Phase jitter	NA	NA
Total distortion (including quantising distortion)	NA	NA
Maximum QDUs	G.113; 3.5	None
Single tone interference	NA	NA
Frequency error	NA	NA
Harmonic and intermodulation distortion	NA	NA
Echo and stability	G.131; 1, 2.1, 2.3.1	None
Interface presentation		
Connector socket	(ENV 41 001)	None
Multiple presentation	None	None
Input impedance	prETS 300 001; 4.1.2	Idem; A.4.1.2
Transverse leakage current	None	None

Safety		
General requirements	EN 41 003	Idem
Leakage current	EN 41 003	Idem
Galvanic isolation between interface and touchable parts	EN 41 003	Idem
Additional isolation requirements	EN 41 003	Idem
Electromagnetic compatibility		
Immunity for continuous conducted energy	prETS 300 126; 8.5.3	Idem; 8.5.2
Conducted emission	prETS 300 126; 9.2	Idem

ETS BT-2028, ONP-LL A2O TE attachment

Physical characteristics		
Single attachment	(ENV 41 001)	None
Multiple attachment	None	None
Electrical characteristics		
Input impedance	prETS 300 001; 4.1.2	Idem; A.4.1.2
Impedance unbalance	prI-ETS 300 004; 5.1.1.2	Idem
Maximum instantaneous voltage	Danish pub. 12/90; 2.5	None
Maximum sending power in the speech band	Danish pub. 12/90; 2.6.2	None
Maximum sending power outside the speech band	Danish pub. 12/90; 2.6.2	None
Power feeding	None	None
Electromagnetic compatibility		
Immunity for continuous conducted energy	prETS 300 126; 8.5.3	Idem; 8.5.2
Conducted emission	prETS 300 126; 9.2	Idem

ETS BT-2031, ONP-LL A4O connections and interfaces

Connection characteristics		
Nominal overall loss	M.1040; 2.1	None
Loss/frequency distortion	M.1040; 2.2	None
Nominal delay	None	None
Delay distortion	NA	NA
Variation of overall loss with time	NA	NA
Random circuit noise	M.1040; 2.3	None
Impulsive noise	NA	NA
Phase jitter	NA	NA
Total distortion (including quantising distortion)	NA	NA
Maximum QDUs	G.113; 3.5	None
Single tone interference	NA	NA
Frequency error	NA	NA
Harmonic and intermodulation distortion	NA	NA
Near-end crosstalk	None	None
Interface presentation		
Connector socket	(ENV 41 001)	None
Multiple presentation	None	None
Input impedance	prETS 300 001; 4.1.2	Idem; A.4.1.2
Transverse leakage	None	None
Safety		
General requirements	EN 41 003	Idem
Leakage current	EN 41 003	Idem
Galvanic isolation between interface and touchable parts	EN 41 003	Idem
Additional isolation requirements	EN 41 003	Idem
Electromagnetic compatibility		
Immunity for continuous conducted energy	prETS 300 126; 8.5.3	Idem; 8.5.2
Conducted emission	prETS 300 126; 9.2	Idem

ETS BT-2032, ONP-LL A4O TE attachment

Physical characteristics		
Single attachment	(ENV 41 001)	None
Multiple attachment	None	None
Electrical characteristics		
Input impedance	prETS 300 001; 4.1.2	Idem; A.4.1.2
Impedance unbalance	prI-ETS 300 005; 5.1.1.2	Idem
Maximum instantaneous voltage	Danish pub. 12/90; 2.5	None
Maximum sending power in the speech band	Danish pub. 12/90; 2.6.2	None
Maximum sending power outside the speech band	Danish pub. 12/90; 2.6.2	None
Power feeding	None	None
Electromagnetic compatibility		
Immunity for continuous conducted energy	prETS 300 126; 8.5.3	Idem; 8.5.2
Conducted emission	prETS 300 126; 9.2	Idem

ETS BT-2029, ONP-LL A2S connections and interface

Connection characteristics		
Nominal overall loss	M.1020; 2.1	None
Loss/frequency distortion	M.1020; 2.2	None
Nominal delay	None	None
Delay distortion	M.1020; 2.3	None
Variation of overall loss with time	M.1020; 2.4	None
Random circuit noise	M.1020; 2.5	None
Impulsive noise	M.1020; 2.6	None
Phase jitter	M.1020; 2.7	None
Total distortion (including quantising distortion)	M.1020; 2.8	None
Maximum QDUs	G.113; 3.5	None
Single tone interference	M.1020; 2.9	None
Frequency error	M.1020; 2.10	None
Harmonic and intermodulation distortion	M.1020; 2.11	None
Echo and stability	G.131; 1, 2.1, 2.3.1	None

Interface presentation		
Connector socket	(ENV 41 001)	None
Multiple presentation	None	None
Input impedance	prETS 300 001; 4.1.2	Idem; A.4.1.2
Transverse leakage	None	None
Safety		
General requirements	EN 41 003	Idem
Leakage current	EN 41 003	Idem
Galvanic isolation between interface and touchable parts	EN 41 003	Idem
Additional isolation requirements	EN 41 003	Idem
Electromagnetic compatibility		
Immunity for continuous conducted energy	prETS 300 126; 8.5.3	Idem; 8.5.2
Conducted emission	prETS 300 126; 9.2	Idem

ETS BT-2030, ONP-LL A2S TE attachment

Physical characteristics		
Single attachment	(ENV 41 001)	None
Multiple attachment	None	None
Electrical characteristics		
Input impedance	prETS 300 001, 4.1.2	Idem, A.4.1.2
Impedance unbalance	prI-ETS 300 004, 5.1.1.2	Idem
Maximum instantaneous voltage	Danish pub. 12/90, 2.5	None
Maximum sending power in the speech band	Danish pub. 12/90, 2.6.2	None
Maximum sending power outside the speech band	Danish pub. 12/90, 2.6.2	None
Power feeding	None	None
Electromagnetic compatibility		
Immunity for continuous conducted energy	prETS 300 126; 8.5.3	Idem; 8.5.2
Conducted emission	prETS 300 126; 9.2	Idem

ETS BT-2033, ONP-LL A4S connections and interfaces

Connection characteristics		
Nominal overall loss	M.1020; 2.1	None
Loss/frequency distortion	M.1020; 2.2	None
Nominal delay	None	None
Delay distortion	M.1020; 2.3	None
Variation of overall loss with time	M.1020; 2.4	None
Random circuit noise	M.1020; 2.5	None
Impulsive noise	M.1020; 2.6	None
Phase jitter	M.1020; 2.7	None
Total distortion (including quantising distortion)	M.1020; 2.8	None
Maximum QDUs	G.113; 3.5	None
Single tone interference	M.1020; 2.9	None
Frequency error	M.1020; 2.10	None
Harmonic and intermodulation distortion	M.1020; 2.11	None
Near-end crosstalk	None	None

Interface presentation		
Connector socket	(ENV 41 001)	None
Multiple presentation	None	None
Input impedance	prETS 300 001, 4.1.2	Idem, A.4.1.2
Transverse leakage	None	None
Safety		
General requirements	EN 41 003	Idem
Leakage current	EN 41 003	Idem
Galvanic isolation between interface and touchable parts	EN 41 003	Idem
Additional isolation requirements	EN 41 003	Idem
Electromagnetic compatibility		
Immunity for continuous conducted energy	prETS 300 126; 8.5.3	Idem; 8.5.2
Conducted emission	prETS 300 126; 9.2	Idem

ETS BT-2034, ONP-LL A4S TE attachment

Physical characteristics		
Single attachment	(ENV 41 001)	None
Multiple attachment	None	None
Electrical characteristics		
Input impedance	prETS 300 001, 4.1.2	Idem, A.4.1.2
Impedance unbalance	prI-ETS 300 005, 5.1.1.2	Idem
Maximum instantaneous voltage	Danish pub. 12/90, 2.5	None
Maximum sending power in the speech band	Danish pub. 12/90, 2.6.2	None
Maximum sending power outside the speech band	Danish pub. 12/90, 2.6.2	None
Power feeding	None	None
Electromagnetic compatibility		
Immunity for continuous conducted energy	prETS 300 126; 8.5.3	Idem; 8.5.2
Conducted emission	prETS 300 126; 9.2	Idem

H.3 Comments and proposals on missing standards

H.3.1 Requirements for which no prior standards exist

Nominal delay: A proposal for this requirement is found in 13.3 (delay mask).

Near-end crosstalk: A proposal for this requirement is found in 13.3 (from Danish "circular 12D").

Multiple presentation/attachment: A proposal for this requirement is found in 13.3 ("cable conductors suited for fastening to screw, solder or insulation-displacement connectors").

Transversal leakage: A proposal which prevents saturation of a possible transformer in the TE could be that "The maximum DC voltage over a 100 ohm resistor connected over the interface shall be 0.1 V."

Power feeding to terminal equipment: A proposal for this requirement is found in 13.3 ("to be documented by the supplier").

A number of requirements for A2O and A4O are marked NA for "not applicable". These items are not mentioned in M.1040 and should not be specified although they are listed in the contents and the body of the specifications.

H.3.2 Test methods for which no prior standards exist

Nominal overall loss: The value is calculated from the values for sending and receiving level stated by the TO. The test method may be found in the P.-series.

Loss/frequency distortion: P.-series?

Nominal delay: O.-series?

Delay distortion: O.-series?

Variation of overall loss with time: O.-series?

Random circuit noise: P.-series?

Impulsive noise: O.-series?

Phase jitter: O.-series?

Total distortion (including quantising distortion): O.-series?

Maximum number of QDUs: TO declaration?

Single tone interference: O.-series?

Frequency error: O.-series?

Harmonic and intermodulation distortion: O.-series?

Echo and stability: O.-series?

Near-end crosstalk: O.-series?

Connector socket: ?

Multiple presentation/attachment: ?

Transverse leakage current: As required?

Power feeding: documentation?

Single attachment: ?

Maximum instantaneous voltage: documentation?

Maximum sending power in the speech band: P.-series?

Maximum sending power outside the speech band: O.-series?

Annex I: Titles of proposed standards

The titles of the standards to be written are as follows:

ETS BT-2018
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Interface Presentation

ETS BT-2019
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Connection Characteristics

ETS BT-2020
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Terminal Equipment Attachment Requirements

ETS BT-2021
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Interface Presentation

ETS BT-2022
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Connection Characteristics

ETS BT-2023
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Terminal Equipment Attachment Requirements

ETS BT-2024
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Interface Presentation

ETS BT-2025
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Connection Characteristics

ETS BT-2026
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Terminal Equipment Attachment Requirements

ETS BT-2027
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 2-wire Leased Line (A2O);
Connection Characteristics And Interface Presentation

ETS BT-2028
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 2-wire Leased Line (A20);
Terminal Equipment Attachment Requirements

ETS BT-2029
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 2-wire Leased Line (A2S);
Connection Characteristics And Interface Presentation

ETS BT-2030
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 2-wire Leased Line (A2S);
Terminal Equipment Attachment Requirements

ETS BT-2031
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 4-wire Leased Line (A4O);
Connection Characteristics And Interface Presentation

ETS BT-2032
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 4-wire Leased Line (A4O);
Terminal Equipment Attachment Requirements

ETS BT-2033
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 4-wire Leased Line (A4S);
Connection Characteristics And Interface Presentation

ETS BT-2034
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 4-wire Leased Line (A4S);
Terminal Equipment Attachment Requirements

Annex J: Proposed scopes and structure for standards

ETS BT-2018
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Interface Presentation

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There are two ETSs directly connected with this standard:

> ETS BT-2019: Open Network Provision Technical Requirements; 2048 kbit/s Digital Unstructured Leased Line (D2048U); Connection Characteristics
>
> ETS BT-2020: Open Network Provision Technical Requirements; 2048 kbit/s Digital Unstructured Leased Line (D2048U); Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation G.703, section 6, for electrical characteristics of 2048 kbit/s interface, is used as the starting point for the interface presentation.

2) Scope

This ETS specifies the technical requirements for interface presentations of ONP 2048 kbit/s digital unstructured leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). This standard is concerned with the interface as presented by the TO.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

The specification covers the physical, mechanical, electrical and functional characteristics of the interface.

This standard specifies the conformance tests for the interface presentation. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2019
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Connection Characteristics

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There are two ETSs directly connected with this standard:

> ETS BT-2018: Open Network Provision Technical Requirements; 2048 kbit/s Digital Unstructured Leased Line (D2048U); Interface Presentation
>
> ETS BT-2020: Open Network Provision Technical Requirements; 2048 kbit/s Digital Unstructured Leased Line (D2048U); Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendations of the G.82x series, for quality and availability targets for international digital connections, are used as the starting point for the connection characteristics.

2) Scope

This ETS specifies the technical requirements for connection characteristics of ONP 2048 kbit/s digital unstructured leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). Signals between terminal equipments are subject to impairments during their transfer over the leased line from the NTP at one end to the NTP at the other end, and the limits to these impairments are stated in this ETS.

The leased line provides to the user access to the full digital bitrate of 2048 kbit/s with no restrictions on the bit patterns used and with bit sequence integrity.

For certain parameters identified within the body of this standard, the TO providing the connection is required to declare the range within which the performance of the connection lies. This information is needed by the user for network planning.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

This specification is applicable for connections within Europe.

This standard specifies the conformance tests for the connection requirements. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2020
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Terminal Equipment Attachment Requirements.

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Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There are two ETSs directly connected with this standard:

ETS BT-2019: Open Network Provision Technical Requirements; 2048 kbit/s Digital Unstructured Leased Line (D2048U); Connection Characteristics

ETS BT-2018: Open Network Provision Technical Requirements; 2048 kbit/s Digital Unstructured Leased Line (D2048U); Interface Presentation

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation G.703, section 6, for electrical characteristics of 2048 kbit/s interface, is used as the starting point for the attachment requirements.

2) Scope

This ETS specifies the technical requirements for attachment of terminal equipment to network terminating points (NTP) of ONP 2048 kbit/s digital unstructured leased lines.

The term "attachment requirements" in the context of this standard describes the minimum essential requirements for access which have to be fulfilled under the Terminal Directive, 91/263/EEC. Conformance to these requirements does not guarantee end-to-end interoperability.

The specification covers the physical and electrical characteristics of the terminal equipment interface.

Where for the purposes of testing the terminal equipment is provided with a plug suitable for connection at the NTP the requirements of this standard apply at the plug. Where the terminal equipment is not provided with such a plug the requirements of this standard apply at the end of a [2 m] length of cable attached to the terminal equipment for testing purposes.

Wiring practice and installation between the equipment and the NTP are outside the scope of this standard.

Editorial note: The above paragraphs require further study.

ETS BT-2021
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Interface Presentation

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Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There are two ETSs directly connected with this standard:

> ETS BT-2022: Open Network Provision Technical Requirements; 2048 kbit/s Digital Structured Leased Line; Connection Characteristics
>
> ETS BT-2023: Open Network Provision Technical Requirements; 2048 kbit/s Digital Structured Leased Line; Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation G.703, section 6, for electrical characteristics of 2048 kbit/s interface, is used as the starting point for the interface presentation.

2) Scope

This ETS specifies the technical requirements for interface presentations of ONP 2048 kbit/s digital structured leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). This standard is concerned with the interface as presented by the TO.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

The specification covers the physical, mechanical, electrical and functional characteristics of the interface.

This standard specifies the conformance tests for the interface presentation. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2022
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Connection Characteristics

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Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There are two ETSs directly connected with this standard:

> ETS BT-2021: Open Network Provision Technical Requirements; 2048 kbit/s Digital Structured Leased Line; Interface Presentation
>
> ETS BT-2023: Open Network Provision Technical Requirements; 2048 kbit/s Digital Structured Leased Line; Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendations of the G.82x series, for quality and availability targets for international digital connections, are used as the starting point for the connection characteristics.

2) Scope

This ETS specifies the technical requirements for connection characteristics of ONP 2048 kbit/s digital structured leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). Signals between terminal equipments are subject to impairments during their transfer over the leased line from the NTP at one end to the NTP at the other end, and the limits to these impairments are stated in this ETS.

The leased line provides to the user access to 1984 kbit/s of the digital bitrate of 2048 kbit/s on the interface, with no restrictions on the bit patterns used and with bit sequence integrity. The bit pattern in time slot 0 (TS0) is, however, specified in CCITT Recommendations G.704 and G.706. TS0 delineates an 8 kHz framing structure which the user may exploit.

For certain parameters identified within the body of this standard, the TO providing the connection is required to declare the range within which the performance of the connection lies. This information is needed by the user for network planning.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

This specification is applicable for connections within Europe.

This standard specifies the conformance tests for the connection requirements. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2023
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Terminal Equipment Attachment Requirements.

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Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There are two ETSs directly connected with this standard:

ETS BT-2022: Open Network Provision Technical Requirements; 2048 kbit/s Digital Structured Leased Line (D2048S); Connection Characteristics

ETS BT-2021: Open Network Provision Technical Requirements; 2048 kbit/s Digital Structured Leased Line (D2048S); Interface Presentation

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation G.703, section 6, for electrical characteristics of 2048 kbit/s interface, is used as the starting point for the attachment requirements.

2) Scope

This ETS specifies the technical requirements for attachment of terminal equipment to network terminating points (NTP) of ONP 2048 kbit/s digital structured leased lines.

The term "attachment requirements" in the context of this standard describes the minimum essential requirements for access which have to be fulfilled under the Terminal Directive, 91/263/EEC. Conformance to these requirements does not guarantee end-to-end interoperability.

The specification covers the physical and electrical characteristics of the terminal equipment interface.

Where for the purposes of testing the terminal equipment is provided with a plug suitable for connection at the NTP the requirements of this standard apply at the plug. Where the terminal equipment is not provided with such a plug the requirements of this standard apply at the end of a [2 m] length of cable attached to the terminal equipment for testing purposes.

Wiring practice and installation between the equipment and the NTP are outside the scope of this standard.

Editorial note: The above paragraphs require further study.

ETS BT-2024
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Interface Presentation

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Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There are two ETSs (ETS) directly connected with this standard:

> ETS BT-2025: Open Network Provision Technical Requirements; 64 kbit/s Digital Leased Line; Connection Characteristics
>
> ETS BT-2026: Open Network Provision Technical Requirements; 64 kbit/s Digital Leased Line; Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation G.703, for electrical characteristics of 64 kbit/s codirectional interfaces, is used as the starting point for the interface presentation.

2) Scope

This ETS specifies the technical requirements for interface presentations of ONP 64 kbit/s digital leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). This standard is concerned with the interface as presented by the TO.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

The specification covers the physical, mechanical, electrical and functional characteristics of the interface.

This standard specifies the conformance tests for the interface presentation. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2025
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Connection Characteristics

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Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

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There are two ETSs directly connected with this standard:

> ETS BT-2024: Open Network Provision Technical Requirements; 64 kbit/s Digital Leased Line; Interface Presentation
>
> ETS BT-2026: Open Network Provision Technical Requirements; 64 kbit/s Digital Leased Line; Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendations of the G.82x series, for quality and availability targets for international digital connections, are used as the starting point for the connection characteristics.

2) Scope

This ETS specifies the technical requirements for connection characteristics of ONP 64 kbit/s digital leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). Signals between terminal equipments are subject to impairments during their transfer over the leased line from the NTP at one end to the NTP at the other end, and the limits to these impairments are stated in this ETS.

The leased line provides to the user access to the full digital bitrate of 64 kbit/s with no restrictions on the bit patterns used and with bit sequence integrity. The possible octet structure which may be provided from the terminal equipment will be preserved in the connection. There will be no requirement that the octet structure shall be used by the terminal equipment at the other NTP.

For certain parameters identified within the body of this standard, the TO providing the connection is required to declare the range within which the performance of the connection lies. This information is needed by the user for network planning.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

This specification is applicable for connections within Europe.

This standard specifies the conformance tests for the connection requirements. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2026
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Terminal Equipment Attachment Requirements.

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Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There are two ETSs directly connected with this standard:

ETS BT-2025: Open Network Provision Technical Requirements; 64 kbit/s Digital Leased Line (D64U); Connection Characteristics

ETS BT-2024: Open Network Provision Technical Requirements; 64 kbit/s Digital Leased Line (D64U); Interface Presentation

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation G.703, for electrical characteristics of 64 kbit/s codirectional interfaces, is used as the starting point for the attachment requirements.

2) Scope

This ETS specifies the technical requirements for attachment of terminal equipment to network terminating points (NTP) of ONP 64 kbit/s digital leased lines.

The term "attachment requirements" in the context of this standard describes the minimum essential requirements for access which have to be fulfilled under the Terminal Directive, 91/263/EEC. Conformance to these requirements does not guarantee end-to-end interoperability.

The specification covers the physical and electrical characteristics of the terminal equipment interface.

Where for the purposes of testing the terminal equipment is provided with a plug suitable for connection at the NTP the requirements of this standard apply at the plug. Where the terminal equipment is not provided with such a plug the requirements of this standard apply at the end of a [2 m] length of cable attached to the terminal equipment for testing purposes.

Wiring practice and installation between the equipment and the NTP are outside the scope of this standard.

Editorial note: The above paragraphs require further study.

ETS BT-2027
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O);
Connection Characteristics and Interface Presentation

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Foreword

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Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There is an ETS directly connected with this standard:

ETS BT-2028: Open Network Provision Technical Requirements; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O); Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation M.1040, for leased lines for telephony, is used as the starting point for the connection characteristics.

2) Scope

This ETS specifies the technical requirements for connection characteristics and for interface presentations of ONP ordinary quality voice bandwidth 2-wire leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). Signals between terminal equipments are subject to impairments during their transfer over the leased line from the NTP at one end to the NTP at the other end, and the limits to these impairments are stated in this ETS.

The leased line provides to the user access to the full analogue voice bandwidth (300 to 3400 Hz) with no restrictions on the use of the bandwidth.

For certain parameters identified within the body of this standard, the TO providing the connection is required to declare the range within which the performance of the connection lies. This information is needed by the user for network planning.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

This specification is applicable for connections within Europe.

The specification covers the physical, mechanical, electrical and functional characteristics of the interface.

The specification assumes that the wires of the TO access connection element are directly connected to pins of the interface presentation.

This standard specifies the conformance tests for the connection and interface requirements. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2028
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O);
Terminal Equipment Attachment Requirements.

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Foreword

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Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There is a European Telecommunication Standard (ETS) directly connected with this standard:

> ETS BT-2027: Open Network Provision Technical Requirements; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O); Connection Characteristics and Interface Presentation

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

I-ETS 300 004, transmission characteristics at 2-wire analogue interfaces for digital PABXs, is used as the starting point for the attachment requirements.

2) Scope

This ETS specifies the technical requirements for attachment of terminal equipment to network terminating points (NTP) of ONP ordinary quality voice bandwidth 2-wire leased lines.

The term "attachment requirements" in the context of this standard describes the minimum essential requirements for access which have to be fulfilled under the Terminal Directive, 91/263/EEC. Conformance to these requirements does not guarantee end-to-end interoperability.

The specification covers the physical and electrical characteristics of the terminal equipment interface.

A terminal equipment may be designed for through-connecting and may only fulfil the electrical requirements if through-connected. In these cases the requirements of this ETS are valid and the tests are carried out with the through-connection suitably terminated.

> Editorial note: This arrangement requires further study before the scope can be finalised. Reference should be made to ETR 034.

Where for the purposes of testing the terminal equipment is provided with a plug suitable for connection at the NTP the requirements of this standard apply at the plug. Where the terminal equipment is not provided with such a plug the requirements of this standard apply at the end of a [2 m] length of cable attached to the terminal equipment for testing purposes.

Wiring practice and installation between the equipment and the NTP are outside the scope of this standard.

> Editorial note: The above paragraphs require further study.

ETS BT-2029
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 2-Wire Leased Line (A2S);
Connection Characteristics and Interface Presentation

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Foreword

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Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There is an ETS directly connected with this standard:

> ETS BT-2030: Open Network Provision Technical Requirements; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S); Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation M.1020, for leased lines for uses other than telephony, is used as the starting point for the connection characteristics.

2) Scope

This ETS specifies the technical requirements for connection characteristics and for interface presentations of ONP special quality voice bandwidth 2-wire leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). Signals between terminal equipments are subject to impairments during their transfer over the leased line from the NTP at one end to the NTP at the other end, and the limits to these impairments are stated in this ETS.

The leased line provides to the user access to the full analogue voice bandwidth (300 to 3400 Hz) with no restrictions on the use of the bandwidth.

For certain parameters identified within the body of this standard, the TO providing the connection is required to declare the range within which the performance of the connection lies. This information is needed by the user for network planning.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

This specification is applicable for connections within Europe.

The specification covers the physical, mechanical, electrical and functional characteristics of the interface.

The specification assumes that the wires of the TO access connection element are directly connected to pins of the interface presentation.

This standard specifies the conformance tests for the connection and interface requirements. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2030
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 2-Wire Leased Line (A2S);
Terminal Equipment Attachment Requirements.

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There is a European Telecommunications Standard (ETS) directly connected with this standard:

> ETS BT-2029: Open Network Provision Technical Requirements; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S); Connection Characteristics and Interface Presentation

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

I-ETS 300 004, transmission characteristics at 2-wire analogue interfaces for digital PABXs, is used as the starting point for the attachment requirements.

2) Scope

This ETS specifies the technical requirements for attachment of terminal equipment to network terminating points (NTP) of ONP special quality voice bandwidth 2-wire leased lines.

The term "attachment requirements" in the context of this standard describes the minimum essential requirements for access which have to be fulfilled under the Terminal Directive, 91/263/EEC. Conformance to these requirements does not guarantee end-to-end interoperability.

The specification covers the physical and electrical characteristics of the terminal equipment interface.

A terminal equipment may be designed for through-connecting and may only fulfil the electrical requirements if through-connected. In these cases the requirements of this ETS are valid and the tests are carried out with the through-connection suitably terminated.

> Editorial note: This arrangement requires further study before the scope can be finalised. Reference should be made to ETR 034.

Where for the purposes of testing the terminal equipment is provided with a plug suitable for connection at the NTP the requirements of this standard apply at the plug. Where the terminal equipment is not provided with such a plug the requirements of this standard apply at the end of a [2 m] length of cable attached to the terminal equipment for testing purposes.

Wiring practice and installation between the equipment and the NTP are outside the scope of this standard.

> Editorial note: The above paragraphs require further study.

ETS BT-2031
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O);
Connection Characteristics and Interface Presentation

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There is an ETS directly connected with this standard:

> ETS BT-2032: Open Network Provision Technical Requirements; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O); Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation M.1040, for leased lines for telephony, is used as the starting point for the connection characteristics.

2) Scope

This ETS specifies the technical requirements for connection characteristics and for interface presentations of ONP ordinary quality voice bandwidth 4-wire leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). Signals between terminal equipments are subject to impairments during their transfer over the leased line from the NTP at one end to the NTP at the other end, and the limits to these impairments are stated in this ETS.

The leased line provides to the user access to the full analogue voice bandwidth (300 to 3400 Hz) with no restrictions on the use of the bandwidth.

For certain parameters identified within the body of this standard, the TO providing the connection is required to declare the range within which the performance of the connection lies. This information is needed by the user for network planning.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

This specification is applicable for connections within Europe.

The specification covers the physical, mechanical, electrical and functional characteristics of the interface.

The specification assumes that the wires of the TO access connection element are directly connected to pins of the interface presentation.

This standard specifies the conformance tests for the connection and interface requirements. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2032
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O);
Terminal Equipment Attachment Requirements.

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There is a European Telecommunications Standard (ETS) directly connected with this standard:

> ETS BT-2031: Open Network Provision Technical Requirements; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O); Connection Characteristics and Interface Presentation

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

I-ETS 300 005, transmission characteristics at 4-wire analogue interfaces for digital PABXs, is used as a starting point for the attachment requirements.

2) Scope

This ETS specifies the technical requirements for attachment of terminal equipment to network terminating points (NTP) of ONP ordinary quality voice bandwidth 4-wire leased lines.

The term "attachment requirements" in the context of this standard describes the minimum essential requirements for access which have to be fulfilled under the Terminal Directive, 91/263/EEC. Conformance to these requirements does not guarantee end-to-end interoperability.

The specification covers the physical and electrical characteristics of the terminal equipment interface.

A terminal equipment may be designed for through-connecting and may only fulfil the electrical requirements if through-connected. In these cases the requirements of this ETS are valid and the tests are carried out with the through-connection suitably terminated.

> Editorial note: This arrangement requires further study before the scope can be finalised. Reference should be made to ETR 034.

Where for the purposes of testing the terminal equipment is provided with a plug suitable for connection at the NTP the requirements of this standard apply at the plug. Where the terminal equipment is not provided with such a plug the requirements of this standard apply at the end of a [2 m] length of cable attached to the terminal equipment for testing purposes.
Wiring practice and installation between the equipment and the NTP are outside the scope of this standard.

> Editorial note: The above paragraphs require further study.

ETS BT-2033
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 4-Wire Leased Line (A4S);
Connection Characteristics and Interface Presentation

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There is an ETS directly connected with this standard:

> ETS BT-2034: Open Network Provision Technical Requirements; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S); Terminal Equipment Attachment Requirements

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

CCITT Recommendation M.1020, for leased lines for uses other than telephony, is used as the starting point for the connection characteristics.

2) Scope

This ETS specifies the technical requirements for connection characteristics and for interface presentations of ONP special quality voice bandwidth 4-wire leased lines.

A connection is presented to the user via interfaces at Network Termination Points (NTPs). Signals between terminal equipments are subject to impairments during their transfer over the leased line from the NTP at one end to the NTP at the other end, and the limits to these impairments are stated in this ETS.

The leased line provides to the user access to the full analogue voice bandwidth (300 to 3400 Hz) with no restrictions on the use of the bandwidth.

For certain parameters identified within the body of this standard, the TO providing the connection is required to declare the range within which the performance of the connection lies. This information is needed by the user for network planning.

The specification is applicable for permanently assigned leased circuits and part time leased circuits. No protocol exchange or other interventions from the user is required for the establishment or release of these circuits via the interface at the NTP.

This specification is applicable for connections within Europe.

The specification covers the physical, mechanical, electrical and functional characteristics of the interface.

The specification assumes that the wires of the TO access connection element are directly connected to pins of the interface presentation.

This standard specifies the conformance tests for the connection and interface requirements. The specific application of conformance testing or the conformance declaration regime is outside the scope of this specification.

ETS BT-2034
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 4-Wire Leased Line (A4S);
Terminal Equipment Attachment Requirements.

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced under work item BT-2012 by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the standard must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

There is a European Telecommunications Standard (ETS) directly connected with this standard:

> ETS BT-2033: Open Network Provision Technical Requirements; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S); Connection Characteristics and Interface Presentation

Other standards under the ONP-LL directive are and contain technical requirements for:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

This standard is based on information from CCITT Recommendations and ETSI publications and the relevant documents are quoted where appropriate.

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with harmonised connection characteristics, presented to the user at harmonised interfaces.

I-ETS 300 005, transmission characteristics at 4-wire analogue interfaces for digital PABXs, is used as the starting point for the attachment requirements.

2) Scope

This ETS specifies the technical requirements for attachment of terminal equipment to network terminating points (NTP) of ONP special quality voice bandwidth 4-wire leased lines.

The term "attachment requirements" in the context of this standard describes the minimum essential requirements for access which have to be fulfilled under the Terminal Directive, 91/263/EEC. Conformance to these requirements does not guarantee end-to-end interoperability.

The specification covers the physical and electrical characteristics of the terminal equipment interface.

A terminal equipment may be designed for through-connecting and may only fulfil the electrical requirements if through-connected. In these cases the requirements of this ETS are valid and the tests are carried out with the through-connection suitably terminated.

> Editorial note: This arrangement requires further study before the scope can be finalised. Reference should be made to ETR 034.

Where for the purposes of testing the terminal equipment is provided with a plug suitable for connection at the NTP the requirements of this standard apply at the plug. Where the terminal equipment is not provided with such a plug the requirements of this standard apply at the end of a [2 m] length of cable attached to the terminal equipment for testing purposes.

Wiring practice and installation between the equipment and the NTP are outside the scope of this standard.

> Editorial note: The above paragraphs require further study.

Annex K: Abstract proposals for standards

ETS BT-2018
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Interface Presentation

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement. Where appropriate, the tests are based on the O.-series of the CCITT Recommendations.

The following requirements are specified:

Physical characteristics
- Connection arrangements

Electrical characteristics
- Output to TE
  - Galvanic isolation
  - Clock tolerance in operation condition
  - Signal coding
  - Pulse shape
- Input from TE
  - Galvanic isolation
  - Impedance
  - Clock tolerance for signal recognition
  - Pulse shape
- Transverse leakage current
- Electromagnetic compatibility

The physical connection arrangement will consist of:

a) a socket (to be specified during the stage 2 work, based on that currently described in EN 41001); or

b) a hardwired connection using insulation displacement connections,

and the connection arrangements will be agreed between the user and the TO at the time of provision of the ONP leased line.

There will be a requirement for galvanic isolation between the network and the interface presented to the terminal equipment. The *means* by which this will be achieved will not be specified.

The other output and input items are specified according to CCITT Recommendation G.703. The clock tolerance in operation condition is the tolerance of the network clock. The pulse shape for the input is only stated by the output pulse shape as modified by the characteristics of the interconnection arrangements.

Transverse leakage current is specified as not more than 0.1 V over 100 ohm across the interface. It shall ensure that a possible transformer in the TE is not saturated.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2019
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Connection Characteristics

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement. Where appropriate, the tests are based on the M.- and O.-series of the CCITT Recommendations.

After a list of attributes the following is specified: information transfer characteristics, error, controlled slip, jitter, wander, availability. and transmission delay.

Information transfer characteristics specify the transparency of the connection, i.e. bit sequence independence and bit sequence integrity.

Error is adopted from the CCITT Recommendation G.821.

Controlled slip is adopted from the CCITT Recommendation G.822.

It is, however, observed that both CCITT Recommendations G.821 and G.822 are for 64 kbit/s connections, and this must be taken into account.

Jitter and wander are adopted from the CCITT Recommendation G.823.

Availability is adopted from the ETSI draft document DE/TM-2003.

Transmission delay is adopted from CCITT Recommendation G.114.

ETS BT-2020
Open Network Provision Technical Requirements;
2048 kbit/s Digital Unstructured Leased Line (D2048U);
Terminal Equipment Attachment Requirements.

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

The following requirements are specified:

Physical characteristics
- Connection arrangements

Electrical characteristics
- Output from TE
  - Clock tolerance
  - Jitter transfer characteristics
  - Signal coding
  - Pulse shape
- Input to TE
  - Impedance
  - Clock tolerance for signal recognition
  - Jitter tolerance
  - Pulse shape

Power feeding
Electromagnetic compatibility

The terminal equipment will provide a means of connection which allows the use of:

a) a plug ended cord (the plug to be specified during stage 2 of the work, based on that currently described in EN 41001);

b) a means of terminating the copper conductors of a cable or wire used as a connecting medium.

The output and input items are specified according to CCITT Recommendation G.703. The clock tolerance in operation condition is either the tolerance of the network clock, in case of synchronisation of the output clock to the input clock, or the same as the clock tolerance in free running mode (+/- 32 ppm, according to ETS 300 011, Annex A. The pulse shape for the input is only stated by the output pulse shape as modified by the characteristics of the interconnection arrangements.

Power feeding specifies that the terminal equipment shall draw no power from the leased line for its operation (other than the signal power to the terminal input impedance). It shall be documented by the equipment supplier that this is complied with.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2021
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Interface Presentation

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement. Where appropriate, the tests are based on the O.-series of the CCITT Recommendations.

The following requirements are specified:

Physical characteristics
- Single line arrangement
- Multiple line arrangement

Electrical characteristics
- Output to TE
  - Galvanic isolation
  - Output impedance
  - Clock tolerance in operation condition
  - Signal coding
  - TS0 coding
  - Pulse shape
- Input from TE
  - Galvanic isolation
  - Impedance
  - Clock tolerance for signal recognition
  - TS0 coding
  - Pulse shape
- Transverse leakage current
- Electromagnetic compatibility

The physical connection arrangement will consist of:

a) a socket (to be specified during the stage 2 work, based on that currently described in EN 41001); or

b) a hardwired connection using insulation displacement connections,

and the connection arrangements will be agreed between the user and the TO at the time of provision of the ONP leased line.

There will be a requirement for galvanic isolation between the network and the interface presented to the terminal equipment. The *means* by which this will be achieved will not be specified.

The other output and input items are specified according to CCITT Recommendations G.703, G.704 and G.706. The clock tolerance in operation condition is the tolerance of the network clock. TS0 coding specifies for both output and input that CCITT Recommendations G.704 and G.706 apply. The pulse shape for the input is only stated by the output pulse shape as modified by the characteristics of the interconnection arrangements.

Transverse leakage current is specified as not more than 0.1 V over 100 ohm across the interface. It shall ensure that a possible transformer in the TE is not saturated.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2022
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Connection Characteristics

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement. Where appropriate, the tests are based on the M.- and O.-series of the CCITT Recommendations.

After a list of attributes the following is specified: information transfer characteristics, error, controlled slip, jitter, wander, availability, transmission delay, and transfer of TS0.

Information transfer characteristics specify the transparency of the connection, i.e. bit sequence independence and bit sequence integrity for the 1984 kbit/s outside TS0.

Error is adopted from the CCITT Recommendation G.821.

Controlled slip is adopted from the CCITT Recommendation G.822.

It is, however, observed that both CCITT Recommendations G.821 and G.822 are for 64 kbit/s connections, and this must be taken into account.

Jitter and wander are adopted from the CCITT Recommendation G.823.

Availability is adopted from the ETSI draft document DE/TM-2003.

Transmission delay is adopted from CCITT Recommendation G.114.

Transfer of TS0 specifies which bits in TS0 will be transferred unchanged over the connection and which bits the TOs may modify for their own use. It is also specified that whenever a TO modifies a bit, recalculation of the CRC-4 bits re CCITT Recommendation G.706 shall take place, so a subsequent supervision will reach the correct result based on the new bit pattern.

ETS BT-2023
Open Network Provision Technical Requirements;
2048 kbit/s Digital Structured Leased Line (D2048S);
Terminal Equipment Attachment Requirements.

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

The following requirements are specified:

Physical characteristics
- Connection arrangements

Electrical characteristics
- Output from TE
  - Clock tolerances
  - Jitter transfer characteristics
  - Signal coding
  - TS0 coding
  - Pulse shape
- Input to TE
  - Impedance
  - Clock tolerance for signal recognition
  - Jitter tolerance
  - TS0 coding
  - Pulse shape

Power feeding
Electromagnetic compatibility

The terminal equipment will provide a means of connection which allows the use of:

a) a plug ended cord (the plug to be specified during stage 2 of the work, based on that currently described in EN 41001);

b) a means of terminating the copper conductors of a cable or wire used as a connecting medium.

The output and input items are specified according to CCITT Recommendations G.703, G.704 and G.706. The clock tolerance in operation condition is either the tolerance of the network clock, in case of synchronisation of the output clock to the input clock, or the same as the clock tolerance in free running mode. TS0 coding specifies for both output and input that CCITT Recommendations G.704 and G.706 apply. The pulse shape for the input is only stated by the output pulse shape as modified by the characteristics of the interconnection arrangements.

Power feeding specifies that the terminal equipment shall draw no power from the leased line for its operation (other than the signal power to the terminal input impedance). It shall be documented by the equipment supplier that this is complied with.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2024
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Interface Presentation

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement. Where appropriate, the tests are based on the O.-series of the CCITT Recommendations.

The following requirements are specified:

Physical characteristics
- Single line arrangement
- Multiple line arrangement

Electrical characteristics
- Output to TE
- Galvanic isolation
- Clock tolerance in operation condition
- Signal coding
- Pulse shape
- Input from TE
- Galvanic isolation
- Impedance
- Clock tolerance for signal recognition
- Pulse shape
- Transverse leakage current
- Electromagnetic compatibility

The physical connection arrangement will consist of:

a) a socket (to be specified during the stage 2 work, based on that currently described in EN 41001); or

b) a hardwired connection using insulation displacement connections,

and the connection arrangements will be agreed between the user and the TO at the time of provision of the ONP leased line.

There will be a requirement for galvanic isolation between the network and the interface presented to the terminal equipment. The *means* by which this will be achieved will not be specified.

The other output and input items are specified according to CCITT Recommendation G.703. The clock tolerance in operation condition is the tolerance of the network clock. The pulse shape for the input is only stated by the output pulse shape as modified by the characteristics of the interconnection arrangements.

Transverse leakage current is specified as not more than 0.1 V over 100 ohm across the interface. It shall ensure that a possible transformer in the TE is not saturated.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2025
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Connection Characteristics

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement. Where appropriate, the tests are based on the M.- and O.-series of the CCITT Recommendations.

After a list of attributes the following is specified: information transfer characteristics, error, controlled slip, jitter, wander, availability and transmission delay.

Information transfer characteristics specify the transparency of the connection, i.e. bit sequence independence and bit sequence integrity.

Error is adopted from the CCITT Recommendation G.821.

Controlled slip is adopted from the CCITT Recommendation G.822.

Jitter and wander are adopted from the CCITT Recommendation G.823.

Availability is adopted from the CCITT Recommendation I.350.

Transmission delay is adopted from the CCITT Recommendation G.114.

ETS BT-2026
Open Network Provision Technical Requirements;
64 kbit/s Digital Leased Line (D64U);
Terminal Equipment Attachment Requirements.

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

The following requirements are specified:

Physical characteristics
- Connection arrangements

Electrical characteristics
- Output from TE
  - Clock tolerances
  - Jitter transfer characteristics
  - Signal coding
  - Pulse shape
- Input to TE
  - Impedance
  - Clock tolerance for signal recognition
  - Jitter tolerance
  - Pulse shape

Power feeding
Electromagnetic compatibility

The terminal equipment will provide a means of connection which allows the use of:

a) a plug ended cord (the plug to be specified during stage 2 of the work, based on that currently described in EN 41001);

b) a means of terminating the copper conductors of a cable or wire used as a connecting medium.

The output and input items are specified according to CCITT Recommendation G.703. The clock tolerances cover free running mode and possibly operation condition equal to the tolerance of the network clock, as synchronisation of the output clock to the input clock may be required. The pulse shape for the input is only stated by the output pulse shape as modified by the characteristics of the interconnection arrangements.

Power feeding specifies that the terminal equipment shall draw no power from the leased line for its operation (other than the signal power to the terminal input impedance). It shall be documented by the equipment supplier that this is complied with.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2027
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O);
Connection Characteristics and Interface Presentation

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

For the connection characteristics the following is specified in addition to a list of attributes: nominal overall loss, loss/frequency distortion, nominal delay, delay distortion, variation of overall loss with time, random circuit noise, impulsive noise, phase jitter, total distortion (including quantising distortion), single tone interference, frequency error, harmonic and intermodulation distortion, echo and stability. The values are based on CCITT Recommendation M.1040 except for delay, and the two last items. Delay distortion, variation of overall loss with time, impulsive noise, phase jitter, total distortion (including quantising distortion), single tone interference, frequency error, harmonic and intermodulation distortion are included in the contents but are not specified in CCITT Recommendation M.1040. Requirements and tests are therefore noted as "not applicable" in the text. The tests are based on CCITT Recommendations of the O.- and P.-series.

Nominal overall loss is defined by the Telecommunication Organisations (TO) stating the sending relative level (SRL) and the receiving relative level (RRL), and is SRL-RRL provided there is no digital attenuation or amplification in the connection. The permitted ranges of SRL and RRL are specified to ensure a maximum overall loss on any leased line of 29 dB.

Nominal delay is specified with a delay mask, dependent on distance.

Random circuit noise is specified as the value contained in CCITT Recommendation M.1040 for a 6000 km connection. The value applies to all leased lines, independent of length and the possible use of PCM rather than FDM.

The leased line shall enable the transmission of data in the voice band. As the leased line shall provide a full duplex connection, use of echo suppressors and cancellers is not allowed. Stability shall be assured whether the terminal equipment is connected to the network terminating point (NTP) or not.

For the interface presentation the following are specified: connection arrangements, galvanic isolation, input impedance, transverse leakage current, safety and electromagnetic compatibility. The values are based on existing European standards where available.

The physical connection arrangement will consist of:

a) a socket (to be specified during the stage 2 work, based on that currently described in EN 41001); or

b) a hardwired connection using insulation displacement connections,

and the connection arrangements will be agreed between the user and the TO at the time of provision of the ONP leased line.

There will be a requirement for galvanic isolation between the network and the interface presented to the terminal equipment. The *means* by which this will be achieved will not be specified.

Input impedance will be specified.

Transverse leakage current is specified as not more than 0.1 V over 100 ohm across the interface. It shall ensure that a possible transformer in the TE is not saturated.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2028
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O);
Terminal Equipment Attachment Requirements.

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

The following requirements are specified:

Physical characteristics
- Connection arrangements

Electrical characteristics
- Input impedance
- Impedance unbalance
- Maximum instantaneous voltage
- Maximum sending power in the speech band
- Maximum sending power outside the speech band

Power feeding
Electromagnetic compatibility

The terminal equipment will provide a means of connection which allows the use of:

a) a plug ended cord (the plug to be specified during stage 2 of the work, based on that currently described in EN 41001);

b) a means of terminating the copper conductors of a cable or wire used as a connecting medium.

Input impedance will be specified.

Impedance unbalance (longitudinal conversion loss, LCL) is specified and tested as in I-ETS 300 004, for 2-wire interfaces of digital PABXs, but without national deviations.

Maximum instantaneous voltage, maximum sending power in the speech band and maximum sending power outside the speech band are specified as in the Danish technical requirements publication 12/90. ETS 300 001 may be used instead and will also provide test methods.

Power feeding of the terminal equipment is specified not to take place from the interface. It shall be documented by the equipment supplier that this is complied with.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2029
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 2-Wire Leased Line (A2S);
Connection Characteristics and Interface Presentation

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

For the connection characteristics the following is specified in addition to a list of attributes: nominal overall loss, loss/frequency distortion, nominal delay, delay distortion, variation of overall loss with time, random circuit noise, impulsive noise, phase jitter, total distortion (including quantising distortion), maximum number of QDUs, single tone interference, frequency error, harmonic and intermodulation distortion and echo and stability. The values are based on CCITT Recommendation M.1020 except for delay, QDU, echo and stability. The tests are based on CCITT Recommendations of the O.- and P.-series.

Nominal overall loss is defined by the Telecommunication Organisations (TO) stating the sending relative level (SRL) and the receiving relative level (RRL), and is SRL-RRL provided there is no digital attenuation or amplification in the connection. The permitted ranges of SRL and RRL are specified to ensure a maximum overall loss on any leased line of 27 dB.

Nominal delay is specified with a delay mask, dependent on distance.

Random circuit noise is specified as the value contained in CCITT Recommendation M.1020 for a 6000 km connection. The value applies to all leased lines, independent of length and the possible use of PCM rather than FDM.

The maximum number of QDUs will be specified.

The leased line shall enable the transmission of data in the voice band. As the leased line shall provide a full duplex connection, use of echo suppressors and cancellers is not allowed. Stability shall be assured whether the terminal equipment is connected to the network terminating point (NTP) or not.

For the interface presentation the following are specified: connection arrangements, galvanic isolation, input impedance, transverse leakage current, safety and electromagnetic compatibility. The values are based on existing European standards where available.

The physical connection arrangement will consist of:

a) a socket (to be specified during the stage 2 work, based on that currently described in EN 41001); or

b) a hardwired connection using insulation displacement connections,

and the connection arrangements will be agreed between the user and the TO at the time of provision of the ONP leased line.

There will be a requirement for galvanic isolation between the network and the interface presented to the terminal equipment. The *means* by which this will be achieved will not be specified.

Input impedance will be specified.

Transverse leakage current is specified as not more than 0.1 V over 100 ohm across the interface. It shall ensure that a possible transformer in the TE is not saturated.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2030
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 2-Wire Leased Line (A2S);
Terminal Equipment Attachment Requirements.

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

The following requirements are specified:

Physical characteristics
- Connection arrangements

Electrical characteristics
- Input impedance
- Impedance unbalance
- Maximum instantaneous voltage
- Maximum sending power in the speech band
- Maximum sending power outside the speech band

Power feeding
Electromagnetic compatibility

The terminal equipment will provide a means of connection which allows the use of:

a) a plug ended cord (the plug to be specified during stage 2 of the work, based on that currently described in EN 41001);

b) a means of terminating the copper conductors of a cable or wire used as a connecting medium.

Input impedance is specified as 600 ohms and is tested by the return loss against this resistance being more than 6 dB. In ETS 300 001 (terminal equipment requirements for terminals to be used with the PSTN) 600 ohms is used in the majority of the present EEC countries. The low requirement of min. 6 dB ensures that also terminal equipment with an input impedance matched to long unloaded cable lengths of any type used in the distribution network of the public telecommunication network will comply.

Impedance unbalance (longitudinal conversion loss, LCL) is specified and tested as in I-ETS 300 004, for 2-wire interfaces of digital PABXs, but without national deviations.

Maximum instantaneous voltage, maximum sending power in the speech band and maximum sending power outside the speech band are specified as in the Danish technical requirements publication 12/90. ETS 300 001 may be used instead and will also provide test methods.

Power feeding of the terminal equipment is specified not to take place from the interface. It shall be documented by the equipment supplier that this is complied with.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2031
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O);
Connection Characteristics and Interface Presentation

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

For the connection characteristics the following is specified in addition to a list of attributes: nominal overall loss, loss/frequency distortion, nominal delay, delay distortion, variation of overall loss with time, random circuit noise, impulsive noise, phase jitter, total distortion (including quantising distortion), single tone interference, frequency error, harmonic and intermodulation distortion, near end crosstalk. The values are based on CCITT Recommendation M.1040 except for delay, and the last item. Delay distortion, variation of overall loss with time, impulsive noise, phase jitter, total distortion (including quantising distortion), single tone interference, frequency error, harmonic and intermodulation distortion are included in the contents but are not specified in CCITT Recommendation M.1040. Requirements and tests are therefore noted as "not applicable" in the text. The tests are based on CCITT Recommendations of the O.- and P.-series.

Nominal overall loss is defined by the Telecommunication Organisations (TO) stating the sending relative level (SRL) and the receiving relative level (RRL), and is SRL-RRL provided there is no digital attenuation or amplification in the connection. The permitted ranges of SRL and RRL are specified to ensure a maximum overall loss on any leased line of 22 dB.

Nominal delay is specified with a delay mask, dependent on distance.

Random circuit noise is specified as the value contained in CCITT Recommendation M.1040 for a 6000 km connection. The value applies to all leased lines, independent of length and the possible use of PCM rather than FDM.

Near end crosstalk is also included in the contents but requirements and tests are noted as "not applicable" in the text.

For the interface presentation the following are specified: connection arrangements, galvanic isolation, input impedance, transverse leakage current, safety and electromagnetic compatibility. The values are based on existing European standards where available.

The physical connection arrangement will consist of:

a) a socket (to be specified during the stage 2 work, based on that currently described in EN 41001); or

b) a hardwired connection using insulation displacement connections,

and the connection arrangements will be agreed between the user and the TO at the time of provision of the ONP leased line.

There will be a requirement for galvanic isolation between the network and the interface presented to the terminal equipment. The *means* by which this will be achieved will not be specified.

Input impedance will be specified.

Transverse leakage current is specified as not more than 0.1 V over 100 ohm across the interface. It shall ensure that a possible transformer in the TE is not saturated.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2032
Open Network Provision Technical Requirements;
Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O);
Terminal Equipment Attachment Requirements.

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

The following requirements are specified:

Physical characteristics
- Connection arrangements

Electrical characteristics
- Input impedance
- Impedance unbalance
- Maximum instantaneous voltage
- Maximum sending power in the speech band
- Maximum sending power outside the speech band

Power feeding
Electromagnetic compatibility

The terminal equipment will provide a means of connection which allows the use of:

a) a plug ended cord (the plug to be specified during stage 2 of the work, based on that currently described in EN 41001);

b) a means of terminating the copper conductors of a cable or wire used as a connecting medium.

Input impedance is specified as 600 ohms and is tested by the return loss against this resistance being more than 6 dB. In ETS 300 001 (terminal equipment requirements for terminals to be used with the PSTN) 600 ohms is used in the majority of the present EEC countries. The low requirement of min. 6 dB ensures that also terminal equipment with an input impedance matched to long unloaded cable lengths of any type used in the distribution network of the public telecommunication network will comply.

Impedance unbalance (longitudinal conversion loss, LCL) is specified and tested as in I-ETS 300 005, for 4-wire interfaces of digital PABXs, but without national deviations.

Maximum instantaneous voltage, maximum sending power in the speech band and maximum sending power outside the speech band are specified as in the Danish technical requirements publication 12/90. ETS 300 001 may be used instead and will also provide test methods.

Power feeding of the terminal equipment is specified not to take place from the interface. It shall be documented by the equipment supplier that this is complied with.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2033
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 4-Wire Leased Line (A4S);
Connection Characteristics and Interface Presentation

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

For the connection characteristics the following is specified in addition to a list of attributes: nominal overall loss, loss/frequency distortion, nominal delay, delay distortion, variation of overall loss with time, random circuit noise, impulsive noise, phase jitter, total distortion (including quantising distortion), maximum number of QDUs, single tone interference, frequency error, harmonic and intermodulation distortion and near-end crosstalk. The values are based on CCITT Recommendation M.1020 except for delay, QDU and near-end crosstalk. The tests are based on CCITT Recommendations of the O.- and P.-series.

Nominal overall loss is defined by the Telecommunication Organisations (TO) stating the sending relative level (SRL) and the receiving relative level (RRL), and is SRL-RRL provided there is no digital attenuation or amplification in the connection. The permitted ranges of SRL and RRL are specified to ensure a maximum overall loss on any leased line of 20 dB.

Nominal delay is specified with a delay mask, dependent on distance.

Random circuit noise is specified as the value contained in CCITT Recommendation M.1020 for a 6000 km connection. The value applies to all leased lines, independent of length and the possible use of PCM rather than FDM.

The maximum number of QDUs will be specified.

Near-end crosstalk attenuation is specified from the sending connection to the receiving connection and shall be at least 50 dB. The figure is adopted from the Danish "circular 12D".

For the interface presentation the following are specified: connection arrangements, galvanic isolation, input impedance, transverse leakage current, safety and electromagnetic compatibility. The values are based on existing European standards where available.

The physical connection arrangement will consist of:

a) a socket (to be specified during the stage 2 work, based on that currently described in EN 41001); or

b) a hardwired connection using insulation displacement connections,

and the connection arrangements will be agreed between the user and the TO at the time of provision of the ONP leased line.

There will be a requirement for galvanic isolation between the network and the interface presented to the terminal equipment. The *means* by which this will be achieved will not be specified.

Input impedance is specified as 600 ohms and is tested by the return loss against this resistance being more than 6 dB. In ETS 300 001 (terminal equipment requirements for terminals to be used with the PSTN) 600 ohms is used in the majority of the present EEC countries. The low requirement of min. 6 dB ensures that long unloaded cable lengths of any type used in the distribution network of the public telecommunication network will comply.

Transverse leakage current is specified as not more than 0.1 V over 100 ohm across the interface. It shall ensure that a possible transformer in the TE is not saturated.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

ETS BT-2034
Open Network Provision Technical Requirements;
Special Quality Voice Bandwidth 4-Wire Leased Line (A4S);
Terminal Equipment Attachment Requirements.

Abstract

After the foreword, introduction, scope, references and definitions the requirements and tests are specified. Tests are specified for each requirement.

The following requirements are specified:

Physical characteristics
- Connection arrangements

Electrical characteristics
- Input impedance
- Impedance unbalance
- Maximum instantaneous voltage
- Maximum sending power in the speech band
- Maximum sending power outside the speech band

Power feeding
Electromagnetic compatibility

The terminal equipment will provide a means of connection which allows the use of:

a) a plug ended cord (the plug to be specified during stage 2 of the work, based on that currently described in EN 41001);

b) a means of terminating the copper conductors of a cable or wire used as a connecting medium.

Input impedance is specified as 600 ohms and is tested by the return loss against this resistance being more than 6 dB. In ETS 300 001 (terminal equipment requirements for terminals to be used with the PSTN) 600 ohms is used in the majority of the present EEC countries. The low requirement of min. 6 dB ensures that also terminal equipment with an input impedance matched to long unloaded cable lengths of any type used in the distribution network of the public telecommunication network will comply.

Impedance unbalance (longitudinal conversion loss, LCL) is specified and tested as in I-ETS 300 005, for 4-wire interfaces of digital PABXs.

Maximum instantaneous voltage, maximum sending power in the speech band and maximum sending power outside the speech band are specified as in the Danish technical requirements publication 12/90. ETS 300 001 may be used instead and will also provide test methods.

Power feeding of the terminal equipment is specified not to take place from the interface. It shall be documented by the equipment supplier that this is complied with.

Only conducted emission and immunity requirements are included. Other aspects on safety, overvoltage protection and other EMC phenomena are to be addressed if it is decided that this standard should include them.

Annex L: Scope/structure for application note

Open Network Provision Technical Requirements;
Application Note For Leased Lines

Contents

Foreword

This Application Note has been produced by the Technical Committee for Business Telecommunications (TC-BT) of the European Telecommunications Standards Institute (ETSI) under a mandate from the Commission of the European Community (CEC) to provide harmonised standards for support of the directive on open network provision of leased lines (ONP-LL).

Its status at present is that actual writing of the application note must still begin. Only the Contents and the Foreword, Introduction and Scope Clauses have been prepared for approval by TC-BT before the further work can start.

The following standards apply to the leased lines covered by this application note:

ETS BT-2027 and ETS BT-2028; Ordinary Quality Voice Bandwidth 2-Wire Leased Line (A2O)

ETS BT-2031 and ETS BT-2032; Ordinary Quality Voice Bandwidth 4-Wire Leased Line (A4O)

ETS BT-2029 and ETS BT-2030; Special Quality Voice Bandwidth 2-Wire Leased Line (A2S)

ETS BT-2033 and ETS BT-2034; Special Quality Voice Bandwidth 4-Wire Leased Line (A4S)

ETS BT-2024, ETS BT-2025 and ETS BT-2026; 64 kbit/s Digital Leased Line (D64U)

ETS BT-2018, ETS BT-2019 and ETS BT-2020; 2048 kbit/s Digital Unstructured Leased Line (D2048U)

ETS BT-2021, ETS BT-2022 and ETS BT-2023; 2048 kbit/s Digital Structured Leased Line (D2048S)

1) Introduction

The aim of the directive on ONP-LL is that Telecommunication Organisations (TO) throughout the European Economic Community (EEC) as well as TOs in other countries which accept to follow the directive shall make available to users a set of leased lines between points in these countries with specified connection characteristics, presented to the user at specified interfaces. Terminal equipment to be connected to these leased lines must fulfil certain attachment requirements to comply with the essential requirements of e.g. safety for TO employees and protection of the TO network from harm.

2) Scope

This application note describes various aspects pertaining to the operation of leased lines under the ONP-LL directive, both as regards the TO and the user.

The possibilities for supervision of the leased lines during operation are explained first. There is a distinct difference in these, dependent on whether the user shall have access to the full channel capacity or whether some of it is available for supervisory and other purposes.

In parts for analogue and digital leased lines, respectively, the attributes are explained, followed by a discussion of how these attributes influence the use of the leased lines for various purposes. An important item is their influence on connections which extend to the public telecommunication network. Another is how synchronisation to the clock of the connection elements of digital leased lines influence various services.

Reference is made to European Telecommunication Standards (ETS) and ETSI Technical Reports (ETR) where appropriate due to their treatment of the same subjects. This will show how the ONP-LL standards fit in to the overall set of European standards.

Annex M: Treatment of broadband Issues

A recent study conducted by SD-Scicon, [99], on behalf of the European Commission has proposed that the Commission should give consideration to including broadband digital leased lines at two bit rates (34 Mbit/s and 140 Mbit/s Plesiochronous Digital Hierarchy) as part of the minimum set of leased lines to be provided throughout the Community. In a similar manner to digital leased lines at other bit rates the study proposes that these broadband leased lines should be based upon CCITT Recommendation G.703, [14] for the interface specification and on the G.800 series for the performance specification.

With regard to the standardisation of these bit rates, the same issues with respect to the transparency issue that have already been dealt with earlier in this document also apply.

The question of which is the most useful variant to harmonize at these rates is presently rather uncertain.

34 Mbit/s is not a favoured evolutionary bit rate for services since it can only be handled in an inefficient manner by the SDH VC-3 container.

If for performance a structured approach should be taken then the current structure according to G.751 needs to be revised and the transparent channel rate is not yet clear. The main amendment concerns the inclusion of a Cyclic Redundancy Check (CRC) procedure for end to end performance checking.

Clarification is also needed whether multi-connection similar to the approach in Annex C for 2048 kbit/s should also be urgently considered. This may have major impact on the revision work of the structure in G.751 under discussion.

Annex N: Comments received during technical committee approval

The following comments were received during Technical Committee approval and are included for information.

N.1 From France TELECOM

Considering:

- that ONP-LL issues have a considerable importance for both public network providers and users, and also for equipment manufacturers,

- and that further work to be done by Project Team 22V must be undertaken on good technical basis in order to save expert time and to draft satisfactory standards,

FRANCE TELECOM would appreciate that the following remarks could be taken into account approving this draft report at TC-BT level.

1. Connections Characteristics - Availability

Regarding the availability parameter, we consider that it is not possible to guarantee any reasonable values, i.e values stringent enough but not too much, without clear specifications on the way to measure them.

Thus, we consider that it is not possible for PT 22V to specify such characteristic in time as they have not sufficient resources to study this item in detail. This should be left for further study in all the draft standards to be provided by PT 22V.

Furthermore, whatever measurement methods are finally specified, it is clear that these measurements will need a relatively long duration during which an unstructured leased line shall be out of service. This might be incompatible with the provision of a reasonable maximum delay for offering the lines.

2. 2-Wires leased Line/Special Quality

With its experience in this domain and considering the extremely small part of the market covered by 4-Wires (*sic*) Leased Lines/Special Quality (notably because of the high performances of new modems, FRANCE TELECOM thinks that the need for 2-Wires Leased Lines/Special Quality is very low compared to its expected cost that will be ever higher than for 4-Wires/Special Quality one.

Moreover, conformance with M.1020 can be envisaged only if stability conditions can be defined, taking into account that this type of leased line may be built using 4-wires sections. It is also noted that CCITT M.1020 Recommendation does not take into account 2-wires lines.

3. Synchronization

Contrary to what is currently indicated in the draft technical report, the network clock can be easily provided only for structured digital leased lines. In the other case (unstructured), it is unclear if the network should provide network clock source at the interface, to the user, and how this could be done.

FRANCE TELECOM would appreciate that relevant informations on that topic could be introduced in the report to cover this last case.

4. Controlled Slip Rate

This parameter cannot be specified for unstructured digital leased lines.

Thus, this section could be deleted from D64U and D2048U Connection Characteristics draft standards.

It should be also noted that multiple errors on an unstructured bit stream, on high order multiplex, may cause apparent slips on the user data transmitted at the interface, on the lower multiplex.

5. Broadband Issues

Whether or not the mandate of ETSI Project Team can be extended to 34 Mbit/s and 140 Mbit/s, FRANCE TELECOM wonder to know how it can be envisaged to introduce 34 Mbit/s and 140 Mbit/s digital unstructured leased lines taking into account that it will not be possible to supervise the quality during the service (this seems completely unfeasible for the 140 Mbit/s unstructured one).

N.2 From GPT Ltd.

GPT recognise the depth of technical work performed in the development of this Draft TR and realise that its purpose is to guide the Project Teams that will create the Standards.

However, we have identified technical difficulties and differences of approach. For these reasons the Project Teams should be allowed to use the information as guidance, but should not be restricted to the technical methods.

Two examples of these problems are:

1. Section 12.1.3.1 (64 kbit/s connections) implies that, because of the fact that the bearers are multiplexed within the network, it is mandatory for the outgoing timing on any connection to be "looped" from the input timing. This is not the case, for example where a TE has multiple connections it is acceptable for the output timing of the one output to be derived from the input timing of anothr port. In practice, the same options exist for 64 kbit/s connections and therefore the same restrictions as apply in section 12.1.3.2 should be applied to 12.1.3.1.

2. Section 12.2.4.2 implies that a single strategy is required for clock recovery (jitter). Experience in the UK has demonstrated that, providing the customer is made aware of the nature of the networks, the output limits do not have to be constrained to a single, worst case, situation.

History

Document history	
February 1992	First Edition
February 1996	Converted into Adobe Acrobat Portable Document Format (PDF)