ETSI TECHNICAL REPORT

ETR 087

June 1993

Source: ETSI TC-BTC

Reference: DTR/BT-2042

ICS: 33.020

Key words: ONP, leased lines

Business Telecommunications (BT)
Open Network Provision (ONP) technical requirements;
Standardisation requirements for ONP leased lines
Higher order leased lines

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

Foreword

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

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

Blank page

Executive summary

This ETSI Technical Report (ETR) has been produced at the request of the European Commission DG XIII, (BC-T-147). The object is to investigate the production of additional European Standards required to define the implementation of Higher Order ONP Leased Lines at the bit rates of 34 Mbit/s and 140 Mbit/s. From the technical point of view it can be concluded that:

a) there are no currently available standards that cover the requirements for Higher Order ONP Leased Lines, however there is a large quantity of information that can be brought together to form the basis of the standards;

b) for protection no requirements exist and careful consideration should be given to the specification of new requirements in these areas; note that timescale for the development of these new requirements may be critical for the production of the ONP standards;

c) the application of a structure to Higher Order ONP Leased Lines allows the possibility of common monitoring of connection performance by both the users and the Telecommunications Operators (TOs); new standards currently undergoing approval within ETSI (draft prETS 300 337) and CCITT (G.832) should be used as the basis for any structure, ensuring compatibility with Synchronous Digital Hierarchy and Asynchronous Transfer Mode networks;

d) the standards for the Higher Order ONP Leased Lines should be drafted in a manner similar to that used for the existing ONP digital leased line standards; that is, specifying ETSs for the network interface, the connection performance and the terminal equipment interface, with a Technical Basis for Regulation (TBR) defining the attachment requirements for the terminal equipment;

e) the same approach as for the existing ONP standards should be used wherever possible for issues such as jitter, safety and protection;

f) editorial consistency with the existing ONP standards should be maintained where possible.

However:

g) the TOs are of the opinion that any service offered should be structured, allowing both the TOs and the users the possibility of monitoring and comparing line performance and also giving the TOs the capability of full fault location which does not exist in an unstructured service; the use of this structure does not impose restrictions on the use of proprietary frame structures within the user data part of the main frames, i.e. the service can be considered as an unstructured service with a reduced bit rate;

h) some of the terminal manufacturers request that unstructured services should be offered as part of the ONP minimum set, allowing them complete flexibility to use their own proprietary frame structures since they consider that this better serves needs of the users; whilst these terminal manufacturers have no objection to the offering of a structured service, they do not want a structured service to be seen as an alternative to offering an unstructured service as they perceive fewer benefits in the use of a structured service than do the TOs.

Following consideration of various options, it is recommended that:

ETSI draft standards for structured leased lines at 34 Mbit/s and 140 Mbit/s, and the corresponding terminal equipment interface requirements including TBRs, using the structure defined in draft prETS 300 337 [16].

These standards be added to the ONP minimum set of leased lines.

The Commission invite the Approvals Committee for Terminal Equipment (ACTE) to add the TBRs to the formal list of TBRs.

There is some demand for unstructured leased lines and a minority or participants in the work are strongly of the opinion that unstructured services should also be offered as part of the ONP minimum set. The provision of standards for these leased lines could very easily be undertaken for minimal additional cost.

TOs will be free to offer an unstructured service on a voluntary basis. The provision of these standards by ETSI would ensure harmonisation when these services are offered.

TOs are concerned that the production of standards for unstructured leased lines will lead to their being added to the minimum set requirements in addition to the structured leased lines.

The following recommendations refer to the specific technical and editorial issues regarding the leased lines:

It is recommended that the configuration of the higher order leased line standards be based on those of the existing standards, currently being developed, for the minimum set of leased lines.

For 34 Mbit/s structured leased line:

a) the electrical and timing characteristics of the leased line and terminal equipment should be based on CCITT Recommendation G.703 [4] § 8;

b) the requirements for safety and jitter should follow the approach taken for the existing leased line standards;

c) as there are no protection requirements defined for 75 ohm interfaces further work should be necessary, outside TC-BT, to develop these requirements;

d) the error performance of the leased line should be based on CCITT Recommendations G.826 [8] and M.2100 [11];

e) the structure should be according to draft prETS 300 337 [16] Clause 5;

f) the standards should be presented in the same manner and editorial form as the existing ONP digital leased line standards.

and

For 140 Mbit/s structured leased line:

a) the electrical and timing characteristics of the leased line and terminal equipment should be based on CCITT Recommendation G.703 [4] § 9;

b) the requirements for safety and jitter should follow the approach taken for the existing leased line standards;

c) as there are no protection requirements defined for 75 ohm interfaces further work should be necessary, outside TC-BT, to develop these requirements;

d) the error performance of the leased line should be based on CCITT Recommendations G.826 [8] and M.2100 [11];

e) the structure should be according to draft prETS 300 337 [16] Clause 6;

f) the standards should be presented in the same manner and editorial form as the existing ONP digital leased line standards.

1 Introduction

This ETSI Technical Report (ETR) has been produced in response to a mandate given to ETSI by the European Commission DG XIII (BC-T-147). The object of the mandate is to establish, in two phases, the set of additional European Standards required to add higher order leased lines at the bit rates of 34 Mbit/s and 140 Mbit/s to the Open Network Provision (ONP) minimum set. The two phases of the mandate are, firstly, an assessment of the current standards situation in relation to ONP higher order leased lines together with proposals for the additional work necessary, and secondly, the preparation of any proposed standards. This ETR is concerned with the first phase only.

An additional request has been received from the commission requesting consideration of whether 8 MBit/s leased lines should also be standardised. This issue has been discussed and some points regarding 8 Mbit/s leased lines can be found in Annex E.

The ETR has been prepared by Project Team 29V (PT29V), which was established for the purpose, under the supervision of the ETSI Technical Committee responsible for Business Telecommunications, TC-BT and a Steering Group with representatives TC-TM.

The ETR is based on the approach to the harmonization of technical specifications, usage conditions, and tariff principles for leased lines described in the Directive on the "Application Of Open Network Provision To Leased Lines" (92/44/EEC) [2]. The ETR covers the technical aspects of the standardisation, and the work which will be required to establish the necessary European Telecommunication Standards (ETS).

A previous report, ETR 038 [19], on the standardisation of other leased lines[1)] has already been produced and the standardisation of these leased lines is in progress. ETR 038 [19] discusses the application of the Directive, produces a model for leased lines and examines the use of the CCITT attribute method as an appropriate means of describing ONP leased lines. The ETR considers the relationships at the Network Termination Point (NTP) as well as the performance parameters and produces a proposal for the approach to be adopted to the ONP Leased Lines standardization work.

This ETR examines the existing standards situation for higher order leased lines, leading to a proposal for the standards required, their scopes and contents. A detailed examination is made of various technical options within the standards, especially consideration of possible frame structuring and timing, taking account of the existing Plesiochronous Digital Hierarchy (PDH) networks and the emergence of Synchronous Digital Hierarchy (SDH) networks.

2 References

This ETR incorporates by dated and 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 ETR only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] 91/263/EEC: "Council Directive of 29 April 1991 on the approximation of the laws of Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity".

[2] 92/44/EEC: "Council Directive of 5 June 1992 on the application of Open Network Provision to leased lines".

[3] CCITT Recommendation G.114 (1988): "Mean one-way propagation time".

[4] CCITT Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical digital interfaces".

---

1) These leased lines are the 64 kbit/s unstructured, 2 048 kbit/s unstructured, 2 048 kbit/s structured, 2 and 4 wire ordinary quality and 2 and 4 wire special quality.

[5] CCITT Recommendation G.751 (1988): "Digital multiplex equipments operating at the third order bit rate of 34 368 kbit/s and the fourth order bit rate of 139 264 kbit/s and using positive justification".

[6] Draft CCITT Recommendation G.804 (1993): "ATM cells mapping into plesiochronous digital hierarchy".

[7] CCITT Recommendation G.823 (1988): "The control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".

[8] Draft CCITT Recommendation G.826 (1993): "Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate".

[9] Draft CCITT Recommendation G.832 (1993): "Transport of SDH elements on PDH networks: frames and multiplexing structure".

[10] CCITT Recommendation M.550 (1988): "Performance limits for bringing-into-service and maintenance of international digital paths, sections and transmission systems".

[11] CCITT Recommendation M.2100 (1992): "Performance limits for bringing-into-service and maintenance of international digital paths, sections and transmission systems".

[12] Draft prETS 300 166 (1992): "Transmission and multiplexing; Physical/electrical characteristics of hierarchical digital interfaces for equipment using the 2 048 kbit/s based plesiochronous or synchronous digital hierarchies";

[13] Draft prETS 300 246 (1993): "Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U), Interface presentation".

[14] Draft prETS 300 247 (1993): "Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U), Connection characteristics".

[15] Draft prETS 300 248 (1993): "Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U), Terminal equipment interface".

[16] Draft prETS 300 337 (1993): "Generic frame structures for the transport of various signals (including ATM cells) at the G.702 hierarchical rates of 2, 34 and 140 Mbit/s".

[17] EN 60950 (1992): "Safety of information technology equipment including electrical business equipment".

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

[19] ETR 038 (1992): "Business Telecommunications; Open Network Provision (ONP) technical requirements; Standardisation requirements for ONP leased lines".

[20] IEC 60-2 (1973): "High voltage test techniques, Part 2: Test procedures".

[21] IEC 169-8 (1976): "Radio frequency connectors; Part 8: R.F coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with bayonet lock - Characteristic impedance 50 ohms (Type BNC)".

[22] IEC 169-13 (1976): "Radio frequency connectors; Part 13: R.F coaxial connectors with inner diameter of outer conductor 5,6 mm (0,22 in) - Characteristic impedance 75 ohms (Type 1.6/5.6) - Characteristic impedance 50 ohms (Type 1.8/5.6) with similar mating dimensions".

[23] SD-Scicon UK Ltd, 8 March 1991: "Study on the Application of the Open Network Provision Principles to Broadband Networks".

3 Definitions

For the purposes of this ETR, the following definitions apply:

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

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

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

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

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

in order to send, process, or receive information.

4 Symbols and abbreviations

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

ACTE	Approvals Committee for Terminal Equipment
ATM	Asynchronous Transfer Mode
BIP-8	Bit Interleaved Parity (8 bit)
BIS	Bringing-Into-Service
B-ISDN	Broadband ISDN
CMI	Coded Mark Inversion
CTR	Common Technical Regulation
EMC	Electro-Magnetic Compatibility
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
FAS	Frame Alignment Signal
FEBE	Far End Block Error
FERF	Far End Receive Error
HDB3	High Density Bipolar of Order 3
HRP	Hypothetical Reference Path
ISDN	Integrated Services Digital Network
ISM	In Service Monitoring
NTP	Network Termination Point
NTU	Network Termination Unit
ONP	Open Network Provision
PDH	Plesiochronous Digital Hierarchy
RPO	Reference Performance Objective
SDH	Synchronous Digital Hierarchy
STM	Synchronous Transfer Mode
TBR	Technical Basis for Regulation
TE	Terminal Equipment
TO	Telecommunications Operator

5 General considerations

This ETR approaches the standardisation of leased lines in the manner previously adopted for the standardisation of the current minimum set of leased lines. That is, the splitting of the standards into:

- a network interface presentation standard (ETS), defining the interface presented by the leased line to the terminal equipment at the Network Termination Point (NTP);

- a connection characteristics standard (ETS), defining the performance of the connection between the NTPs and any structure necessary within the connection;

- a terminal interface presentation standard (ETS), defining the requirements on the terminal equipment interface in order to connect to the leased line and to achieve end-to-end communication;

with the addition of:

- a terminal equipment attachment requirements (TBR), defining the minimum requirements for attachment of the terminal equipment to the network. The TBR will be a subset of the requirements of the terminal equipment interface presentation standard (ETS).

This investigation into the standardisation of ONP leased lines has not presumed that it has to recommend the standardisation of only one type of leased line (structured or unstructured) but has considered whether both need to be standardised.

Additionally, it has not be assumed that both 34 Mbit/s and 140 Mbit/s leased lines need to be standardised in the same manner, (i.e. a proposal for 34 Mbit/s unstructured leased line will not automatically imply that the 140 Mbit/s line should be unstructured). However, a letter has been received from the Commission where they indicate their preference for only one type of leased line to be standardised.

5.1 Existing standards concerning 34 and 140 Mbit/s

The following subclauses contain tables and list the standards that exist in relationship to the standardisation of the 34 Mbit/s and 140 Mbit/s leased lines.

5.1.1 Network Interface

Table 1: Existing standards relating to interface presentation of 34 Mbit/s and 140 Mbit/s leased lines

Standard	Contents
CCITT G.703 [4] § 8	Definition of 34 Mbit/s bit rate, line coding, output port (pulse shape, impedance, jitter), input port (attenuation, jitter, return loss, immunity to reflections), earthing of screens.
CCITT G.703 [4] § 9	Definition of 140 Mbit/s bit rate, line coding, output port (pulse shape, impedance, jitter, return loss), input port (attenuation, jitter, return loss, immunity to reflections), earthing of screens.
Draft prETS 300 166 [12]	Cross reference to CCITT Recommendation G.703 [4] §§ 8 and 9. Additional requirements for output return loss for 34 368 kbit/s.
EN 60950 [17]	Safety of information technology equipment including electrical business equipment.
ETR 005 [18] subclause 4.4.8	Overvoltage protection requirements for 34 Mbit/s interfaces, referencing IEC 60-2 (1973) [20] and CCITT Recommendation G.703 [4] Annex B.
ETR 005 [18] subclause 4.5.8	Overvoltage protection requirements for 140 Mbit/s interfaces, referencing IEC 60-2 (1973) [20] and CCITT Recommendation G.703 [4] Annex B.
IEC 169-8 [21]	"Radio frequency connectors; Part 8: R.F coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with bayonet lock - Characteristic impedance 50 ohms (Type BNC)".
IEC 169-13 [22]	"Radio frequency connectors; Part 13: R.F coaxial connectors with inner diameter of outer conductor 5.6 mm (22 in) - Characteristic impedance 75 ohms (Type 1.6/5.6) - Characteristic impedance 50 ohms Type 1.8/5.6) with similar mating dimensions".

5.1.2 Connection characteristics

Table 2: Existing standards relating to the connection characteristics of 34 Mbit/s and 140 Mbit/s leased lines

Standards	Contents
CCITT G.114 [3]	End-to-end delay.
CCITT G.751 [5]	Existing frame structure for 34 Mbit/s and 140 Mbit/s bit rates.
Draft CCITT G.832 [9]	Transport of SDH elements on PDH networks; Frame and multiplexing structure.
CCITT G.823 [7]	Jitter and wander.
CCITT G.826 [8]	Error performance, implications of ATM.
CCITT M.550 [10]	Performance limits for bringing-into-service and maintenance of international digital paths, sections and transmission systems.
CCITT M.2100 [11]	Performance limits for bringing-into-service and maintenance of international digital paths, sections and transmission systems.
Draft prETS 300 337 [16]	Proposed frame structure for hierarchical bit rates, potentially applicable to higher order leased lines.

5.1.3 Terminal equipment interface

Table 3: Existing standards relating to terminal equipment interfaces of 34 Mbit/s and 140 Mbit/s

Standards	Contents
CCITT G.703 [4] § 8	Definition of 34 Mbit/s bit rate, line coding, output port (pulse shape, impedance, jitter), input port (attenuation, jitter, return loss, immunity to reflections), earthing of screens.
CCITT G.703 [4] § 9	Definition of 140 Mbit/s bit rate, line coding, output port (pulse shape, impedance, jitter, return loss), input port (attenuation, jitter, return loss, immunity to reflections), earthing of screens.
Draft G.832 [9]	Transport of SDH Elements on PDH networks; Frame and multiplexing structure.
Draft prETS 300 337 [16]	Proposed frame structure for hierarchical bit rates, potentially applicable to higher order leased lines.
Draft prETS 300 166 [12]	Cross reference to CCITT Recommendation G.703 [4]. Additional requirements for output return loss for 34 368 kbit/s.
ETR 005 [18] subclause 4.4	Requirements for connection to a 34 368 kbit/s G.703 [4] interface (see NOTE).
ETR 005 [18] subclause 4.5	Requirements for connection to a 139 264 kbit/s G.703 [4] interface (see NOTE).
EN 60950 [17]	Safety of information technology equipment including electrical business equipment.

Table 3: Existing standards relating to terminal equipment interfaces of 34 Mbit/s and 140 Mbit/s (concluded)

Standards	Contents
ETR 005 [18] subclause 4.4.8	Overvoltage protection requirements for 34 Mbit/s interfaces, referencing IEC 60-2 (1973) [20] and CCITT Recommendation G.703 [4] Annex B.
ETR 005 [18] subclause 4.5.8	Overvoltage protection requirements for 140 Mbit/s interfaces, referencing IEC 60-2 (1973) [20] and CCITT Recommendation G.703 [4] Annex B.
IEC 169-8 [21]	"Radio frequency connectors; Part 8: R.F coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with bayonet lock - Characteristic impedance 50 ohms (Type BNC)".
IEC 169-13 [22]	"Radio frequency connectors; Part 13: R.F coaxial connectors with inner diameter of outer conductor 5.6 mm (22 in) - Characteristic impedance 75 ohms (Type 1.6/5.6) - Characteristic impedance 50 ohms Type 1.8/5.6) with similar mating dimensions".
NOTE: Both structured and unstructured bit streams are allowed. The type of frame structure required is marked for further study.	

5.2 Existing Plesiochronous Digital Hierarchy (PDH) network

The existing digital PDH network, which is widely spread all over Europe, is principally based on the hierarchical interfaces recommended in CCITT Recommendation G.703 [4]. It is therefore essential for the offer of any leased line service at any bit rate that the technical characteristics of terminal equipments should be in accordance with the existing technical capacity of the network. The given capacity of the transfer rate can not be increased and for the relevant higher order leased lines the following bit rates apply:

a) 34 368 kbit/s ± 20 ppm;

b) 139 264 kbit/s ± 15 ppm.

An overhead containing frame synchronisation, error reports or any other transfer information has to be transmitted within this transport capacity. Since a defined bit sequence for frame synchronisation is generally needed, the full capacity of the line cannot be completely used for the payload. The combination

of the overhead and the payload has to comply with the CCITT Recommendation G.703 [4] regarding the bit rate.

The bit sequence for the frame synchronisation has to be generated and evaluated at the termination points (terminal equipment). The structure (including the bit sequence for synchronisation) within the public PDH network is recommended in CCITT Recommendation G.751 [5]. This structure was one option discussed in this ETR.

5.3 Existing terminal equipment

The existence of terminal equipment using either 34 Mbit/s or 140 Mbit/s has been taken into account; although the only equipment identified from a survey of the Project Team Steering Group was:

- video codecs operating at 34 Mbit/s and 140 Mbit/s (using the CCITT Recommendation G.751 [5] structure);
- multiplexers (using the CCITT Recommendation G.751 [5] structure).

For the present a few possible applications of higher order leased lines can be seen:

- Computer-centre emergency back up;
- High performance computing links;
- Fast data transfer;
- Video links;
- Interconnection of local area networks;
- Reselling by private Network Operators.

Meanwhile a few potential users have already requested 34 Mbit/s leased lines[1)]. The Telecommunications Operator (TOs) can satisfy the request just by applying their own standards and regulations introducing the problem of different types of interfaces within the Community.

Therefore it is desirable for a common ONP interface to be available as soon as possible taking account of the existing PDH network and the implementation of Synchronous Digital Hierarchy (SDH).

The terminal equipment interface as regards signal coding, impedance, waveform shape, timing and jitter shall be fully compatible with the public network.

5.4 Service structure

One of the main considerations that has occurred during the review of standardisation of ONP Higher Order Leased Lines is whether the leased line should be structured or unstructured. That is, should the complete bandwidth of the leased line be available to the user (unstructured) or should a standard frame structure be imposed.

Before considering whether to specify structured and unstructured leased lines, it is necessary to look in more detail at the possible options for a frame structure. This ETR considers two possible structures, structure to CCITT Recommendation G.751 [5] and a structure to draft prETS 300 337 [16]. Further information is given in subclauses 5.4.1 to 5.4.3.

It should be noted that the choice of a structured or an unstructured leased line is independent of the timing of the line.

5.4.1 Unstructured leased line

An unstructured leased line is one where the full bandwidth of the leased line is available to the user, with no requirement imposed on the framing of the user data in order to use the line, however some form of proprietary framing is necessary for the terminal equipment to be able to identify the correct location of the data within the bit stream.

---

1) Requests to DBP Telekom by mobile phone operators.

Subject to minor changes on the interface (e.g. plug type), existing terminal equipment designed for use on unstructured leased lines (and terminal equipment which will be installed within the next few years) could continue to be used on any unstructured service, but would be likely to be incompatible with a structured service. However, the number of terminal equipments which are in service at the moment is limited to a few countries within Europe.

The unstructured service does not readily allow the TO providing the service to monitor the leased line connection from NTP to NTP and to identify the location of faults. If the user reports a high bit error rate on the line then the TO will need to take the leased line out of service (with the agreement of the customer) to check the end-to-end performance, since there is no known data structure on the line that the TO can use for error monitoring. While this situation also applies to the 2 048 kbit/s unstructured leased lines, the problem may be more severe with the 34 Mbit/s and 140 Mbit/s unstructured leased lines since these lines are less likely to be multiplexed to higher rates where separate monitoring may be implemented. The 2 048 kbit/s lines are generally multiplexed up to higher rates at the earliest opportunity; in addition, there is more capacity for rerouting 2 048 kbit/s connections allowing complete testing of all but the access sections.

The only end-to-end path monitoring that would be available on an unstructured service would be that provided within the terminal equipment. While the complexity of the terminal equipment monitoring will vary depending on the application, the resulting information will not be available to the TOs. There is no advantage to the TO in being provided with the users proprietary frame information (to assist fault location) since compatible test equipment would not be available.

The development of SDH networks would overcome some of the disadvantages of unstructured leased lines since an additional overhead is added to the user payload and will facilitate monitoring. However this is inefficient in the use of the available bandwidth as it would require a 155 Mbit/s line (the minimum rate interface available within SDH) to carry either the 34 Mbit/s or 140 Mbit/s signal. SDH networks are unlikely to become sufficiently widely available over the next few years for them to become the principle means of providing unstructured ONP leased lines. However, where TOs do not extend SDH to customers premises, there is not the same degree of monitoring as with the draft prETS 300 337 [16] frame structure.

5.4.2 Structured to CCITT Recommendation G.751

A leased line structure according to CCITT Recommendation G.751 [5] is defined as a frame of fixed length, where the first 12 bits (34 Mbit/s) or 16 bits (140 MBit/s) form a header as defined in table 4.

Table 4: Frame length and frame alignment signal for leased line to CCITT Recommendation G.751

Leased line type	Frame length	FAS	Alarm	National use
34 Mbit/s	1536 bits	1111010000	bit 11	bit 12
140 Mbit/s	2928 bits	111110100000	bit 13	bits 14-16

The G.751 [5] frame structure was standardised by CCITT mainly for interfaces within the public networks and is not configured for the transport of Asynchronous Transfer Mode (ATM) or SDH elements.

This structure is being used for a few applications at the moment, including video codecs at 140 Mbit/s. However, the number of terminal equipments which are in service at the moment is very limited.

The G.751 [5] structured service is limited in its ability to support monitoring and fault location although it provides some advantages over the unstructured service. The frame structure does not contain an error check (unlike the 2 048 kbit/s structured service which provides a CRC-4) and so monitoring of the data is not possible. However, it is possible to monitor the Frame Alignment Signal (FAS) and from that to estimate the overall bit error rate. The monitoring of the FAS can be performed with the line still in service and can be carried out wherever necessary within the network. If this does not provide sufficient information on the location or nature of the fault, the TO need to take the leased line out of service.

The only end-to-end path monitoring that is available is that provided within the terminal equipment which will vary in complexity depending on the application. The information resulting from the users path monitoring would not be available to the TOs. While the Network Termination Units (NTUs) could estimate the line errors based on errors in the incoming FAS or line code violations, this is not done at the moment (in fact there is often no NTU for the 34 Mbit/s G.751 [5] service). There is, however, no method within the frame structure of signalling this information from the NTU back to the network (unless the error rate

exceeds a certain level, e.g. 10^{-3}, when the alarm bits are used). The most that could be done by the TO at the NTU is to display this information visually, e.g. on an LED at the NTUs, or for the Terminal Equipment (TE) to bring this to the attention of the user.

The Loss Of Frame (LOF) alignment condition is a special condition occurring at an estimated bit error rate of approximately 10^{-3}. At this point the FAS will not be clearly recognized and the intermediate digital equipments within the connection will insert an Alarm Indication Signal (AIS) onto the signal path, resulting in the alarm bit being transmitted in the opposite direction.

5.4.3 Structured to draft prETS 300 337

A leased line structured to draft prETS 300 337 [16] is a leased line with a frame structure as defined in Annex A, taken from draft prETS 300 337 [16].

This structure was drafted to carry ATM cells or SDH elements using the existing PDH networks and to provide a better service and additional maintenance facilities. This has now been submitted to CCITT SGXVIII as draft CCITT Recommendations G.804 [6] and G.832 [9]. These were agreed at the January 1993 meeting of CCITT WP7/XVIII to go forward for accelerated approval at the July 1993 meeting of SGXVIII.

The frame structure to draft prETS 300 337 [16] provides the error checking and alarm signalling information necessary for in service monitoring by the TO of each separate section of the line and of the whole connection from NTP to NTP. Monitoring can also be carried out by the terminal equipments and the results compared directly with those of the TO.

The structure contains a Bit Interleaved Parity (8 bit) (BIP-8) code which performs a parity check on user data. This code is generated by the terminal equipment and is transmitted transparently from NTP to NTP and provides a basis for the comparison of error rates. The TOs plan to implement a check on the BIP-8 code on both receive and transmit directions at each NTP. Also within the structure there is a Network Operators byte (NR) that is used by the TO to signal from one monitoring point to the next the number of errors detected.

NOTE 1: When the Network Operators byte (NR) is changed, the TO will update the BIP-8 to correspond to the changed data. This is not a recalculation of the BIP-8 and its TE-to-TE integrity as an error indication is maintained.

NOTE 2: The BIP-8 is a relatively simple code which will not detect an even number of errors within the same bit number within each byte, but it is adequate for its purpose and the occasional failure to detect such an error will occur in both the TO network and the terminal equipment.

Additionally, the Far End Receive Error (FERF) and the Far End Block Error (FEBE) bits contained within the frame structure can be used by the terminal equipment to indicate loss of received frame synchronisation and received BIP-8 errors to the terminal equipment at the opposite end.

The availability of the BIP-8 to both users and the TOs ensures a common information base about the condition of the line; this is an important point since there are contracts between the involved parties. Any discrepancy between the users information and the TOs information will most likely result from errors between the NTP and the TE; monitoring equipment connected at the NTP and the TE could readily indicate the occurrence of these errors.

5.4.4 Comparison of unstructured and structured services

Table 5 compares the issues relating to the unstructured and two structured services considered in the previous three subclauses.

There is clear agreement within the parties concerned that if a structured line is required, then the structure should be to draft prETS 300 337 [16] and not CCITT Recommendation G.751 [5].

Table 5: Comparison of possible Options for Higher Order Leased Lines

	Unstructured		**CCITT Recommendation G.751 [5]**		**Draft prETS 300 337 [16]**	
Service introduction (Broad equivalent) 34 Mbit/s: 140 Mbit/s:	Available now in some countries; Behind 34 Mbit/s;		Available in Sweden; Behind 34 Mbit/s;		Some field trials; semi-custom silicon becoming available; Identical with 34 Mbit/s;	
ONP Service introduction	Standard Early 1995;	Service Early 1996;	Standard Early 1995;	Service Early 1996;	Standard Mid 1995;	Service Mid 1996; (Start of service);
TE Standardisation (of frame structure)	None; possibly voluntary agreements to use proprietary standards;		Yes;		Yes;	
TE Complexity	Depends on structure adopted by the manufacturer;		Simpler than draft prETS 300 337; may need additional proprietary structure;		Not more complex than 2 048 kbit/s structured service; may need additional proprietary structure	
Availability of TE 34 Mbit/s: 140 Mbit/s:	National Now; few countries None yet;	Europe (ONP) Mid 1995; Mid 1995;	National Now; Video codecs;	Europe (ONP) Mid 1995; Mid 1995;	National Mid 1995 Mid 1995	Europe (ONP) Early 1996; Early 1996;
Bit rate for user data 34 Mbit/s: 140 Mbit/s:	Dependent on manufacturer's frame (Framing of some sort is essential)		99,22 % 99,45 %		98,67 % 99,26 %	
User monitoring at the TE	Performance check TE to TE depends on ability of TE; no comparison with TOs data; scope for more sophisticated system in basic overhead;		FAS available; errors in FAS give approximate indication of overall errors; alarm bit of "Far end receiving failure" gives an indication of the receiving signal at the far end;		BIP-8 code (TE to TE) available; BIP-8 code will not detect an even number of errors in the same bit within each byte; error detection on user data and FAS; direct comparison of user and TO data; performance of the line TE to TE will be indicated for both directions at both ends;	

Table 5: Comparison of possible Options for Higher Order Leased Lines (concluded)

	Unstructured	CCITT Recommendation G.751 [5]	Draft prETS 300 337 [16]
TO monitoring and maintenance (Fault location)	No NTU to NTU monitoring of user data or FAS to determine error rates but some monitoring of line code and section of higher multiplexer levels; vulnerable at connections between transmission systems e.g. distribution frames; No measuring of bit errors;	Full monitoring of FAS from NTU to NTU but not of user data; approximate estimate of bit errors;	Full monitoring of user data and FAS from NTU to NTU; intermediate monitoring only if errors are detected - not routine at present; routine monitoring could be introduced in the future; ability to measure errors from NTU to NTU;
Fault location by TO (In Network) Catastrophic: Degraded:	Satisfactory; Can locate on certain TX systems but no location capability on connection between transmission systems;	Satisfactory; Full location capability (but only on errors in FAS) inherent in the signal; use of this capability depends on the TO;	Satisfactory; Full location capability in FAS and data; use of this capability depends on the TO;
Fault location by TO (Ability of TO to determine which side of NTU errors occur)	Limited; based on capability of NTU to detect line code violations; no way of passing error information to network;	Limited; based on capability of NTU to detect line violations and FAS errors; alarm bit can be sent to network;	Full (2-way) location ability as NTU can verify BIP-8 in both directions and error location information can be carried by the Network Operator (NR) byte;
ATM compatibility	Fully compatible if suitable structure is used (e.g. draft prETS 300 337);	Not readily compatible;	Fully compatible (defined mapping);

6 Service offering

In the report on the application of ONP on the behalf of the Community [23], target estimations for 34 Mbit/s and 140 Mbit/s leased lines were made:

- 34 Mbit/s should be made available January 1994;

- 140 Mbit/s should be made available January 1996.

This has been considered by the Project Team in conjunction with the length of time that standardisation might take. The management planning information report considers that the timescales for producing the Higher Order Leased Line standards, including Public Enquiry and Voting is between 75 and 91 weeks (depending on the extent of the standards). As such, it is not anticipated that the standards could be in place until early 1995. The extent of other standards work and the development of other equipment within this period must be taken into account.

If standards for a structured leased line are adopted, i.e. in accordance with draft prETS 300 337 [16], it is unlikely that either network equipment or terminal equipment could be made widely available before early 1996. However, if standards for unstructured leased lines were adopted, these lines could be made available more rapidly using existing equipment (some lines are already available). While these lines would be compatible with existing terminal equipment and terminal equipment currently under development, they may not be compatible with a future ONP 34 Mbit/s leased line standard. While standards for 34 Mbit/s leased line services could not be made available by early 1994 (as suggested above by the target estimations), many TOs are already capable of providing unstructured services at 34 Mbit/s to their own National standards.

Another concern is that early standardisation of an unstructured leased line service would lead manufacturers to construct corresponding terminal equipments using a multitude of proprietary frames. It might then be assumed that a structured leased line service, introduced at a later date would not be widely accepted and the disadvantages for the TOs would be manifested.

If the Commission requires a 34 Mbit/s service for January 1994, this could only be an unstructured service to National standards. While this could stimulate the market in terminal equipment, it may detract from the introduction of a harmonized structured service in the longer term. However, the implications on the potential terminal equipment market, of delaying the provision of a standard, structured, 34 Mbit/s service until 1996 must be considered by the Commission.

6.1 Scenario

A number of options can be seen for the requirements for Higher Order Leased Lines Services. These options refer equally well to both 34 Mbit/s and 140 Mbit/s services. Figure 1 illustrates these options.

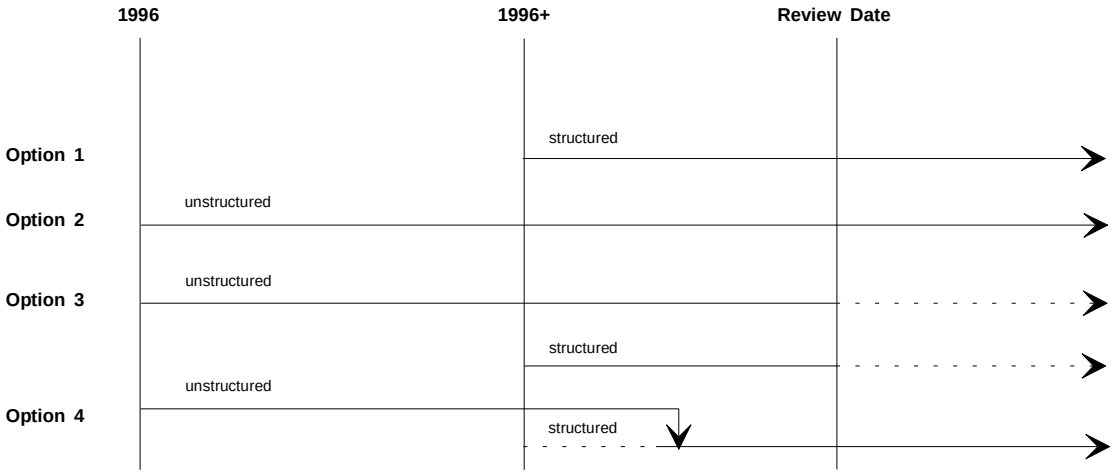


Figure 1: Options for requirements service introduction of different options for Higher Order Leased Lines

Option 1: Option 1 shows the requirements for the introduction for a structured service of Higher Order Leased Lines (34 and 140 MBit/s according to draft prETS 300 337 [16]) taking into account the time which is needed to write the standards as well as the time needed to develop new equipment.

Option 2: Option 2 shows the requirements for the introduction for an unstructured service of Higher Order Leased Lines (34 MBit/s and 140 MBit/s) taking into account the time which is needed to write the standards.

Option 3: Option 3 shows the requirements for the introduction of both a structured and an unstructured service with a review of both types of service after an interim period (e.g. 5 years). After this period a final decision should be made whether both services should be continued to be offered. This option requires standards for both structured and unstructured services.

Option 4: Option 4 shows the requirement for the introduction of either an unstructured or a structured service during an interim period but with only a structured service being required after this period. If it is intended that the interim period should be short, the unstructured service could be introduced using national standards.

6.2 Opinions

During the investigation of possible options for Higher Order Leased Lines different views were expressed. One of the main considerations is whether the leased line should be structured or unstructured. Arguments have been put forward by both TOs and terminal equipment suppliers for and against the use of a structure on the line. In general, the TOs would like to see a structure in the bit stream from the user equipment since this allows them more easily and more effectively to monitor the integrity of the data transmission. The terminal equipment suppliers, however, consider that the imposition of a structure on the line would complicate the design of the terminal equipment and inhibit innovation. The loss of user bandwidth through the use of a frame structure has not been considered by any terminal equipment supplier as a major reason for avoiding a structured leased line.

6.2.1 Users

Since there is no user group represented within the PT29V Steering Group the "Telecommunication Manager Association" (TMA) and the "European Council of Telecommunication Users Association" (ECTUA) were contacted regarding the question whether a structured or a unstructured line should be standardised. The response from these groups indicated that they would prefer both unstructured and structured services to be included in the ONP minimum set.

Users are interested in a service sufficient for their application. They would like to compare different systems on the market and have the freedom to choose from equipment corresponding to their application. They require a stable product and suitable performance of the public network. The system has to be flexible and should be able to be extended for further application requirements.

6.2.2 Terminal equipment manufacturers

Some TE manufacturers have expressed their concern regarding the proposed adoption for ONP leased lines of a structured format in that this could suppress the existing market for unstructured equipment and services, with customers delaying purchase of currently available unstructured equipment until structured equipment is available in two to three years time. The TE manufacturers have stated that they require complete flexibility to adapt and innovate traffic structures across ONP leased lines. Whilst these terminal manufacturers have no objection to the offering of a structured service, they do not want a structured service to be seen as an alternative to offering an unstructured service as they perceive fewer benefits in the use of a structured service than do the TOs.

Equipment for unstructured lines is available already and could satisfy the existing requirements. The unstructured line would enable more rapid standardisation, the possibility of different structures for different applications, full capacity of the line for the user and consistent with existing terminal equipment. The unstructured line is able to carry the draft prETS 300 337 [16] structure or any other bit stream.

6.2.3 Telecommunication operators

The main concern of the TOs is the problem of monitoring the line end-to-end to be able to offer a reasonable maintenance and acceptable quality of service for the line and in detail:

a) to have satisfactory indications for fault location;

b) to keep the line in service while measuring;

c) to make sure all involved parties have the same information on the status of the line;

d) to clarify the responsibility in case of a dispute between the involved parties since there are contracts.

The TOs are of the opinion that any service offered should be structured, allowing both the TOs and the users the possibility of monitoring and comparing line performance and also giving the TOs the capability of full fault location which does not exist in an unstructured service; the use of this structure does not impose restrictions on the use of proprietary frame structures within the user data part of the main frames, i.e. the service can be considered as an unstructured service with a reduced bit rate.

Another concern is that early standardisation of an unstructured leased line service would lead manufacturers to construct corresponding terminal equipments using a multitude of proprietary frames. It might then be the case that a structured leased line service, introduced at a later date would not be widely accepted with the disadvantages for the users and TOs.

A standardised frame is a necessary condition for users to obtain their terminal equipment from different suppliers. Any specific bit pattern for any special application could be contained within the payload. TOs will be free to offer an unstructured service but the requirement should apply only to a structured service.

7 Proposed standardisation

7.1 General

The following subclauses (7.2 to 7.4) consider the standardisation for both structured and unstructured services. Both types of service, if they are adopted for inclusion within the minimum set, should share a common set of physical and electrical characteristics. The only differences between the services are those directly related to the structure.

7.2 Network interface presentation

The recommendations for the standardisation of 34 Mbit/s and 140 Mbit/s leased line network interface presentations are given in table 6.

Table 6: Summary requirements for 34 Mbit/s and 140 Mbit/s leased line network interface presentation

Item	34 Mbit/s	140 Mbit/s
Connector	Female IEC 169-13 [22] (75 Ω). See NOTE 1.	
Coding	HDB3 CCITT Rec G.703 [4] § 8.1	CMI CCITT Rec G.703 [4] § 9.1
Waveform shape and Pulse mask	Table 8 and figure 17 in CCITT Rec G.703 [4]	Table 9 and figures 19 and 20 in CCITT Rec G.703 [4]
Timing limits	See connection characteristics.	See connection characteristics.
Jitter	See NOTE 2.	
Input loss	CCITT Rec G.703 [4] § 8.3.1	CCITT Rec G.703 [4] § 9.3
Input return loss	CCITT Rec G.703 [4] § 8.3.3	CCITT Rec G.703 [4] § 9.3
Reflection	CCITT Rec G.703 [4] § 8.3.4	Unspecified in CCITT Rec G.703 [4]
Output return loss	Draft prETS 300 166 [12] Annex 3	CCITT Rec G.703 [4] table 9
Longitudinal voltages	See NOTE 3.	
Safety	General requirements and touch current should be consistent with those defined for 2 Mbit/s equipment in prETS 300 246 [13] and prETS 300 248 [15].	
Protection	No existing requirements, new requirements may need to be drafted. See NOTE 4.	

NOTE 1: BNC connectors to IEC 169-8 [21] are frequently used for connections of this sort despite the BNC connector being for 50 Ω, not 75 Ω. The equivalent 75 Ω connector, IEC 169-13 [22], does not have the retaining bayonet lock of the BNC type, however threaded or snap-on (push-pull) versions are available. Further investigation is necessary into the specific locking mechanism to be used. Hardwired connections are not recommended.

NOTE 2: Work within PT22V on the standardisation of the 2 048 kbit/s leased lines has considered the input jitter tolerance to be a function of the connection characteristics rather than the network interface presentation. As such, in order to be compatible with other ONP leased line standards, it is recommended that the input jitter tolerance should be specified in the connection characteristics standard.

NOTE: 3 The 2 048 kbit/s ONP leased line standards contain a requirement for tolerance to longitudinal voltages in the frequency range 10 Hz to 30 MHz. There are no existing standards that apply this requirement to 34 Mbit/s and 140 Mbit/s leased lines, however it is recommended that this same requirement be considered for the Higher Order Leased Lines.

NOTE 4: The protection requirements for the 2 048 kbit/s leased lines were taken from detailed ETSI recommendations for 120 Ω ISDN primary rate interfaces. There are no equivalent ETSI recommendations for 75 Ω interfaces for 34 Mbit/s and 140 Mbit/s leased lines.

ETR 005 [18] contains recommendations for overvoltage protection requirements for 34 Mbit/s and 140 Mbit/s interfaces, based on requirements in IEC 60-2 [20] and CCITT Recommendation G.703 [4]. These recommendations are incomplete in that: the recommendation for differential mode testing defines a pulse generator, but does not define the test voltage; the recommendation for common mode testing is still under study. No other specific standards are known to exist for protection of 75 Ω interfaces.

It is anticipated that a meeting will take place between ETSI and CENELEC to discuss responsibilities for this, and similar, areas of standardisation.

Taking the previous points into account, the following recommendations are made:

For network interface characteristics of 34 Mbit/s leased lines the following technical recommendations can be made:

a) the electrical characteristics of either structured or unstructured leased lines should be based on CCITT Recommendation G.703 [4] § 8;

b) the requirements for safety and jitter should adopt the same approach as taken for the existing leased line standards;

c) there are no protection requirements defined for 75 ohm interfaces and further work will be necessary, outside TC-BT, to develop these requirements;

d) the standards should be presented in the same manner as, and editorially consistent with, the existing ONP digital leased line standards.

and

For network interface characteristics of 140 Mbit/s leased lines the following technical recommendations can be made:

a) the electrical characteristics of either structured or unstructured leased lines should be based on CCITT Recommendation G.703 [4] § 9;

b) the requirements for safety and jitter should adopt the same approach as taken for the existing leased line standards;

c) there are no protection requirements defined for 75 ohm interfaces and further work will be necessary, outside TC-BT, to develop these requirements;

d) the standards should be presented in the same manner as, and editorially consistent with, the existing ONP digital leased line standards.

7.3 Connection characteristics

The recommendations for the standardisation of 34 Mbit/s and 140 Mbit/s leased line connection characteristics are given in table 7.

Table 7: Summary requirements for 34 Mbit/s and 140 Mbit/s leased line connection characteristics

Item	34 Mbit/s	140 Mbit/s
Line rate	User timing 34 368 kbit/s ± 20 ppm CCITT Rec G.703 [4] § 8.1	User timing 139 264 kbit/s ± 15 ppm CCITT Rec G.703 [4] § 9.1
Information transfer rate (unstructured)	34 368 kbit/s	139 264 kbit/s
Information transfer rate (structured)	33 920 kbit/s	138 240 kbit/s

Table 7: Summary requirements for 34 Mbit/s and 140 Mbit/s leased line connection characteristics (concluded)

Item	34 Mbit/s	140 Mbit/s
Structure (when used)	draft prETS 300 337 [16] Clause 5	Draft prETS 300 337 [16] Clause 6
Delay	without satellite: (10 + 0,01 G) ms, where G is the geographical distance in km with satellite transmission: < 350 ms	
Jitter	See NOTE 1	
Errors Block size	Draft CCITT Rec G.826 [8] 4296 bits (125 µs)	Draft CCITT Rec G.826 [8] 17408 bits (125 µs).
RPO See NOTE 2 ESR SESR BBER	 0,075 0,002 2×10^{-4}	 0,16 0,002 2×10^{-4}
BIS See NOTE 3	0,5 * RPO	0,5 * RPO

NOTE 1: During the standardisation of the ONP 2 048 kbit/s leased lines, a long time has been spent discussing jitter and whether the jitter reduction should be in the terminal equipment or in the network. It was eventually established that some jitter reduction should be performed within the terminal equipment. It is strongly recommended that the general approach adopted for the control of jitter in the 34 Mbit/s and 140 Mbit/s leased lines should be the same as is adopted for the 2 048 kbit/s leased lines.

NOTE 2: Reference Performance Objective (RPO): Table 1/G.826 [8] refers to an evaluation period of 1 month and to an end-to-end Hypothetical Reference Path (HRP) over 27 500 km. In draft prETS 300 247 [14] these figures were adapted to a test period of 24 hours and to distances applying for Europe. A similar method is now included in CCITT Recommendation M.2100 [11] (see Annex D) and further consideration of the applicability of this, and is recommended.

NOTE 3: Bringing-Into-Service (BIS) limits: Both CCITT Recommendation M.550 [10] and CCITT Recommendation M.2100 [11] specify BIS limits of 50% of the Reference Performance Objective (RPO).

NOTE 4: Concern has been raised by one member regarding the potential for a wide range of bit error rates when using the error definitions of CCITT Recommendation G.826 [8]. It's outside the expertise of this group to consider this in detail but the project team undertaking the drafting of the standards should take into account any work to be undertaken in this area (e.g. by CCITT and ETSI, TM-2).

Taking the previous points into account, the following recommendations are made:

For 34 Mbit/s leased lines the following technical recommendations can be made for the connection characteristics:

a) the error performance of the leased lines should be based on CCITT Recommendation G.826 [8] and CCITT Recommendation M.2100 [11];

b) timing should be within the limits of CCITT Recommendation G.703 [4] § 8

c) for a structured service, the structure should be according to draft prETS 300 337 [16] Clause 5;

d) the standards should be presented in the same manner as, and editorially consistent with, the existing ONP digital leased line standards.

And

For 140 Mbit/s leased lines the following technical recommendations can be made for leased lines and terminal equipment:

a) the error performance of the leased lines should be based on CCITT Recommendation G.826 [8] and CCITT Recommendation M.2100 [11];

b) timing should be within the limits of CCITT Recommendation G.703 [4] § 9;

c) for a structured service, the structure should be according to draft prETS 300 337 [16] Clause 6;

d) the standards should be presented in the same manner as, and editorially consistent with, the existing ONP digital leased line standards.

7.4 Terminal equipment interface presentation

The recommendations for the standardisation of 34 Mbit/s and 140 Mbit/s leased line terminal equipment interface presentations are given in table 8.

Table 8: Summary requirements for 34 Mbit/s and 140 Mbit/s terminal equipment interface presentation

Item	34 Mbit/s	140 Mbit/s
Connector	Panel mounted female IEC 169-13 [22] (75 Ω) or cable terminated in male IEC 169-13 [22] (75 Ω). See NOTE 1.	
Coding	HDB3 CCITT Rec G.703 [4] § 8.1	CMI CCITT Rec G.703 [4] § 9.1
Waveform shape and Pulse mask	Table 8 and figure 17 in CCITT Rec G.703 [4]	Table 9 and figures 19 and 20 in CCITT Rec G.703 [4]
Timing limits	34 368 kbit/s ± 20 ppm CCITT Rec G.703 [4] § 8.1	139 264 kbit/s ± 15 ppm CCITT Rec G.703 [4] § 9.1
Jitter	See NOTE 2.	
Input loss	CCITT Rec G.703 [4] § 8.3.1	CCITT Rec G.703 [4] § 9.3
Input return loss	CCITT Rec G.703 [4] § 8.3.3	CCITT Rec G.703 [4] § 9.3
Reflection	CCITT Rec G.703 [4] § 8.3.4	Unspecified in CCITT Rec G.703 [4]
Output return loss	Draft prETS 300 166 [12] Annex 3	CCITT Rec G.703 [4] table 9
Longitudinal voltages	See NOTE 3.	

Table 8: Summary requirements for 34 Mbit/s and 140 Mbit/s terminal equipment interface presentation (concluded)

Item	34 Mbit/s	140 Mbit/s
Safety	General requirements and touch current should be consistent with those defined for 2 Mbit/s equipment in prETS 300 246 [13] and prETS 300 248 [15].	
Protection	No existing requirements, new requirements may need to be drafted. See NOTE 4.	
NOTE 1:	BNC connectors to IEC 169-8 [21] are frequently used for connections of this sort despite the BNC connector being for 50 Û, not 75 Û. The equivalent 75 Û connector, IEC 169-13 [22], does not have the retaining bayonet lock of the BNC type, however threaded or snap-on (push-pull) versions are available. Further investigation is necessary into the locking specific mechanism to be used. Hardwired connections are not recommended.	
NOTE 2:	Work within PT22V on the standardisation of the 2 048 kbit/s leased lines has considered the input jitter tolerance to be a function of the connection characteristics rather than the network interface presentation. As such, in order to be compatible with other ONP leased line standards, it is recommended that the input jitter tolerance should be specified in the connection characteristics standard.	
NOTE: 3	The 2 048 kbit/s ONP leased line standards contain a requirement for tolerance to longitudinal voltages in the frequency range 10 Hz to 30 MHz. There are no existing standards that apply this requirement to 34 Mbit/s and 140 Mbit/s leased lines, however it is recommended that this same requirement be considered for the Higher Order Leased Lines.	
NOTE 4:	The protection requirements for the 2 048 kbit/s leased lines were taken from detailed ETSI recommendations for 120 Û ISDN primary rate interfaces. There are no equivalent ETSI recommendations for 75 Û interfaces for 34 Mbit/s and 140 Mbit/s leased lines. ETR 005 [18] contains recommendations for overvoltage protection requirements for 34 Mbit/s and 140 Mbit/s terminal equipment interfaces, based on requirements in IEC 60-2 [20] and CCITT Recommendation G.703 [4]. These recommendations are incomplete in that: the recommendation for differential mode testing defines a pulse generator, but does not define the test voltage; the recommendation for common mode testing is still under study. No other specific standards are known to exist for protection of 75 Û interfaces. It is anticipated that a meeting will take place between ETSI and CENELEC to discuss responsibilities for this, and similar, areas of standardisation.	

Taking the previous points into account, the following recommendations are made:

For 34 Mbit/s leased line services, the following technical recommendations can be made for terminal equipment for connection to these services:

a) the electrical and timing characteristics of terminal equipment should be based on CCITT Recommendation G.703 [4] § 8;

b) the requirements for safety and jitter should follow the approach taken for the existing terminal equipment standards;

c) as there are no protection requirements defined for 75 ohm interfaces further work should be necessary, outside TC-BT, to develop these requirements;

d) for a structured service, the structure provided by the terminal equipment should be according to draft prETS 300 337 [16] Clause 5;

e) the standards should be presented in the same manner and editorial form as the existing ONP digital leased line standards.

and

For 140 Mbit/s leased line services, the following technical recommendations can be made for terminal equipment for connection to these services:

a) the electrical and timing characteristics of terminal equipment should be based on CCITT Recommendation G.703 [4] § 9;

b) the requirements for safety and jitter should follow the approach taken for the existing terminal equipment standards;

c) as there are no protection requirements defined for 75 ohm interfaces further work should be necessary, outside TC-BT, to develop these requirements;

d) for a structured service, the structure provided by the terminal equipment should be according to draft prETS 300 337 [16] Clause 6;

e) the standards should be presented in the same manner and editorial form as the existing ONP digital leased line standards.

7.5 Terminal equipment attachment requirements (TBR)

The TBR for the terminal equipment attachment requirements is being produced as the technical contribution to the Common Technical Regulation (CTR). This should contain those technical aspects requiring standardisation to fulfil the requirements of the Second Phase Directive (91/263/EEC) [1]. This standard will be a subset of the applicable ETS for the terminal equipment interface and should contain items, as detailed in the Handbook on CTRs, reference to articles in the Directive.

7.5.1 User safety (Article 4a)

Article 6.2 of the Second Phase Directive (91/263/EEC) excludes safety form the CTR (and hence TBR) content. CTRs should not impose any requirements concerning user safety, this being covered under the Low Voltage Directive or harmonized standards under articles 4a and 4b. For **information** purposes, the CTR (TBR) may identify harmonised safety standards that may be used for safety, provided it is made clear that other standards or solutions may be used instead.

However, the work of PT22V identified a need to define the safety classification of the terminal equipment interface (e.g. SELV, TNV) within the TBR as there was no other standard where this would be defined. This issue was discussed during the Public Enquiry resolution meeting for the 2 048 kbit/s unstructured leased line standards and it is hoped that it will be resolved by the Approvals Committee for Terminal Equipment (ACTE).

7.5.2 Safety of employees of public telecommunication network operators (Article 4b)

This requirement is excluded from CTRs (and hence TBRs).

7.5.3 Electro-magnetic compatibility (Article 4c)

The general aspects of Electro-Magnetic Compatibility (EMC) for a terminal equipment are covered by the EMC directive; as such, no general items should be included in the TBR. However, if it is determined that there are specific EMC requirements (it is expected that these might cover emission into the network), these should be included. Immunity from the network would only be included in a CTR (TBR) for a justified case service.

7.5.4 Protection of the public telecommunications network from harm (Article 4d)

This article covers improper characteristics of the terminal equipment which could cause harm to the network. It is against this requirement that each Clause of the terminal equipment interface ETS should be reviewed and the applicability to the TBR considered.

7.5.5 Effective use of the radio frequency spectrum (Article 4e)

It is not anticipated that there will be aspects concerning the use of the RF spectrum contained within the Terminal Equipment ETSs.

7.5.6 Interworking of the terminal equipment (Article 4f)

The application of this Clause to a leased line is debatable since there is no basic call set-up. For the 2 Mbit/s leased lines, this Clause was deemed to cover any interaction between the terminal equipment and the network and was taken to cover any signalling related to the structure of the leased line. Thus for Higher Order Leased Lines, it would not be anticipated that this Clause would be applicable to unstructured and CCITT Recommendation G.751 [5] structured lines, however for a leased line structured to draft prETS 300 337 [16] there may be interworking between terminal equipment and the network (e.g. calculation of BIP-8); this should be considered for inclusion in the CTR (TBR).

7.5.7 Interworking in justified cases (Article 4g)

This is not considered to be within the scope of the attachment requirements for Higher Order Leased Lines.

7.6 Testing

All requirements specified within the standards should have an associated to test to verify conformance with the requirement. These tests are generally to be used in the event of any dispute, to verify conformance to the standards. Tests within the TBR are, however, type approval tests.

Tests on the leased line interface should be capable of being performed by the user; however, it is recognised that some of the tests may not be suitable to be performed, by the user, on an installed leased line. Those tests which could not be performed by the user are those requiring a particular signal from, or configuration of, the leased line (e.g. the provision of a loopback within the network or NTU) and those concerned with safety and protection. The safety and protection tests can only be performed on equipment of the type used to provide the network interface.

Tests on the leased line connection should be capable of being performed by the user in order to verify the performance characteristics of the line (e.g. the line error rate). These tests should not require any involvement of the TO or leased line provider, or require access to points within the network, but may require the user to take the line out of service while the tests are performed. Tests should not be imposed on the leased line to determine the degree of monitoring by the TO of any frame structure. The frame structure is for the use of the TO to determine line error rates and it is to their advantage to use this in the most suitable manner, compatible with their network maintenance policy, to ensure that the required line performance is maintained.

All tests on the terminal equipment interface should be capable of being performed by the terminal equipment manufacturer; however, it is recognised that some of the tests may not be suitable to be performed, by the user, on the terminal equipment where these test may result in harm to the network (e.g. safety and protection tests).

8 Format of standards

8.1 Configuration

Standards for certain leased lines, defined in Annex II of the ONP Leased Line Directive [2], are already being produced by Project Team 22V; the standards for the 2 048 Mbit/s and 64 kbit/s digital unstructured leased lines (see bibliography) have already been sent out to public enquiry. Project Team 9V in their ETR 038 [19] proposed a structure for the minimum set of leased line standards; each leased line would be defined in terms of:

- an interface presentation standard (ETS), defining the interface presented to the leased line user at the NTP;

- a connection characteristics standard (ETS), defining the performance of the connection between the NTP and what structure, if any was required within the connection;

- a terminal interface presentation standard (ETS), defining the requirements on the terminal equipment in order to connect to the leased line and to achieve end-to-end communication;

- a terminal attachment requirements standard (TBR), defining the minimum set of requirements for the terminal equipment to be connected to the network in accordance with the Second Phase Directive (91/263/EEC) [1].

This configuration has been used successfully by Project Team 22V who have almost completed the drafting of the minimum set of leased line standards. No reasons can be seen why the same configuration should not be used for the higher order leased lines.

It is recommended that the configuration of the higher order leased line standards be based on those of the existing draft standards for the minimum set of leased lines.

A list of the proposed standards, and their titles, is given in Annex B.

If standards are produced for both structured and unstructured leased lines, it may be possible to:

a) have a common network interface presentation standard for both structured and unstructured leased lines. (NOTE: This assumes that details of the structure are contained in the connection characteristics standard);

b) produce the TBR for structured leased lines such that compliance with this also covers compliance for connection to the unstructured leased lines.

Further consideration should be given to these issues when the precise scope of standardisation is known.

8.2 Word processor

The standards shall be written using one of the word processors supported by ETSI, with the full and correct application of the applicable ETSI style sheets. It is recommended that the standards either be written in "Word for Windows 2.0" (or the latest version available) since this offers more flexibility than "Word 5.5" in which the original standards were written. Information contained in the existing standards can easily, and accurately, be converted, when needed, from "Word 5.5" to "Word for Windows 2.0".

Early involvement by the Project Team of the ETSI Standards Management Department in the layout of the standards and application of the ETSI development tools will aid the smooth running of the project and lead to a faster, more efficient production of the standards.

9 Conclusions

The present situation regarding the existing PDH network, available equipment and published standards on 34 Mbit/s and 140 Mbit/s equipments and services have been investigated. This has lead to three possible options for standardisation for each leased line:

a) unstructured service (no frame structure expected within the bit stream);

b) structured service with a frame structure in accordance with CCITT Recommendation G.751 [5];

c) structured service with a frame structure in accordance with draft prETS 300 337 [16].

However, there was no support for the frame structure in accordance with CCITT Recommendation G.751 [5]. The preference of the TOs was for a structured service in accordance with draft prETS 300 337 [16] while some of the terminal equipment manufacturers and users wanted a completely unstructured service in addition to a structured service.

The following four introduction scenarios were proposed:

1) to require only a structured service;

2) to require only an unstructured service;

3) to require both unstructured and structured services, reviewing the need for both services after a period of time (e.g. 5 years);

4) to require either a structured or unstructured service during an interim period but to provide a structured service at the end of that period.

There was much discussion on the choice between structured and unstructured offerings. The main points are summarised below:

i) the existing demand for Higher Order Leased Lines would suggest an unstructured service since there is currently no commonly agreed structure;

ii) the specification of a structured service, and any delay resulting from this specification, could inhibit the potential growth of the Higher Order Leased Line market; the early specification of an unstructured service could stimulate the market;

iii) allowing the user to choose whether he requires a structured or unstructured bit stream, necessitates the provision of an unstructured service, with the TO being incapable of offering in service monitoring;

iv) in order to maintain the specified standard of service, the TO needs to be able to monitor the bit stream, requiring a standard structure; the adoption of an unstructured service would inhibit the TOs in the development of the networks and reduce their maintenance capability;

v) a proprietary frame structure would preclude the user from selecting his terminal equipment from various manufacturers;

vi) a structure compatible with other services allows increased interworking;

vii) an early definition of a structure, and wide publicity for this structure throughout the Community would aid equipment manufactures in developing future equipment.

It was concluded that it should be recommended to the Commission that:

ETSI draft standards for structured leased lines at 34 Mbit/s and 140 Mbit/s, and the corresponding terminal equipment interface requirements including TBRs, using the structure defined in draft prETS 300 337 [16].

These standards be added to the ONP minimum set of leased lines.

The Commission invite ACTE to add the TBRs to the formal list of TBRs.

The provision of standards for an unstructured service in addition to a structured service could very easily be undertaken at minimal cost. TOs will be free to offer an unstructured service on a voluntary basis.

The following recommendations refer to the specific technical and editorial issues regarding the leased lines:

It is recommended that the configuration of the higher order leased line standards be based on those of the existing standards, currently being developed, for the minimum set of leased lines.

For 34 Mbit/s structured leased line:

a) the electrical and timing characteristics of the leased line and terminal equipment should be based on CCITT Recommendation G.703 [4] § 8;

b) the requirements for safety and jitter should follow the approach taken for the existing leased line standards;

c) as there are no protection requirements defined for 75 ohm interfaces further work should be necessary, outside TC-BT, to develop these requirements;

d) the error performance of the leased line should be based on CCITT Recommendation G.826 [8] and CCITT Recommendation M.2100 [11];

e) the structure should be according to draft prETS 300 337 [16] Clause 5;

f) the standards should be presented in the same manner and editorial form as the existing ONP digital leased line standards.

and

For 140 Mbit/s structured leased line:

a) the electrical and timing characteristics of the leased line and terminal equipment should be based on CCITT Recommendation G.703 [4] § 9;

b) the requirements for safety and jitter should follow the approach taken for the existing leased line standards;

c) as there are no protection requirements defined for 75 ohm interfaces further work should be necessary, outside TC-BT, to develop these requirements;

d) the error performance of the leased line should be based on CCITT Recommendation G.826 [8] and CCITT Recommendation M.2100 [11];

e) the structure should be according to draft prETS 300 337 [16] Clause 6;

f) the standards should be presented in the same manner and editorial form as the existing ONP digital leased line standards.

Annex A (informative): Frame structure proposed by TM3 for 34 and 140 Mbit/s leased lines

The following frame structure has been proposed by ETSI STC-TM3 for the 34 Mbit/s and 140 Mbit/s leased lines:

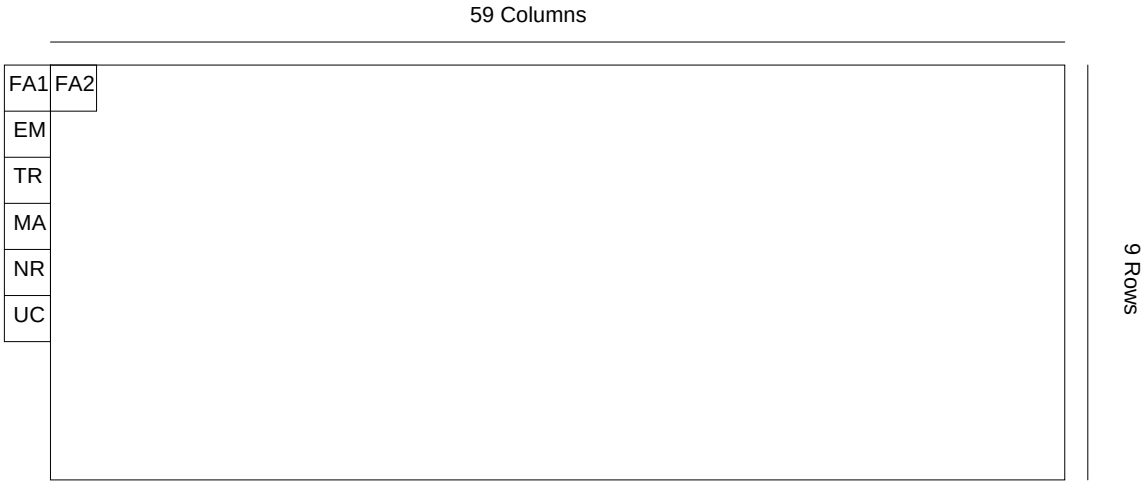


Figure A.1: Frame structure for 34 Mbit/s leased lines

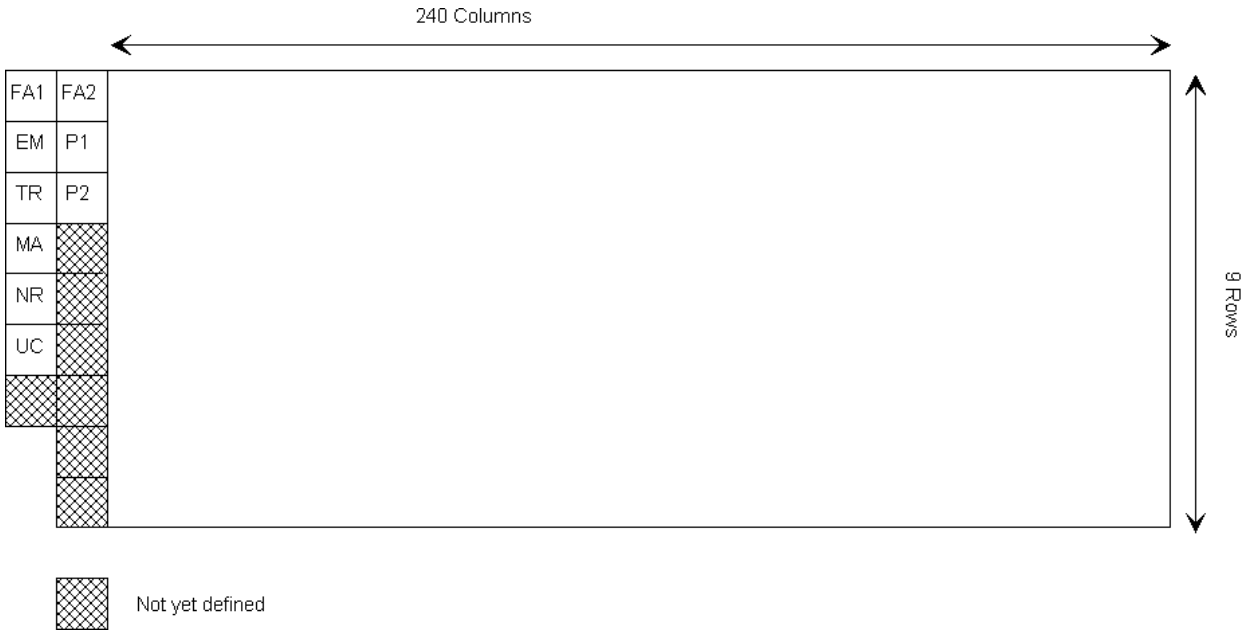
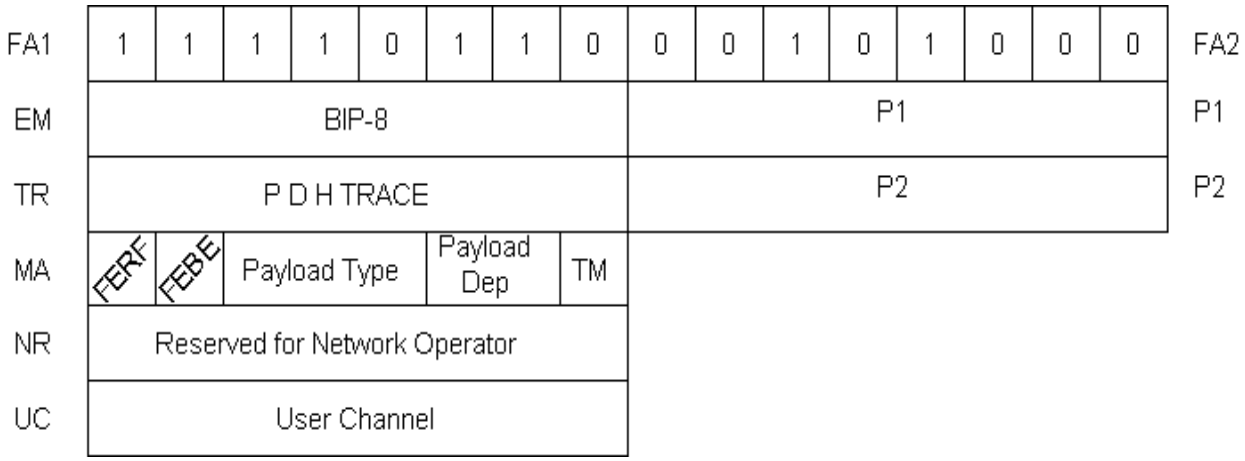


Figure A.2: Frame structure for 140 Mbit/s leased lines



BIP-8	Bit Interleaved Parity - 8
EM	Error Monitoring
FEBE	Far End Block Error
FERF	Far End Receive Error
P1/P2	Protection Switching (Only applicable for 139 264 kbit/s)
TM	Timing Marker
TR	Trail trace

NOTE: P1 and P2 have been added to draft CCITT Recommendation G.832 [9] and it is expected that these will be added to draft prETS 300 337 [16] at the next revision.

Figure A.3: Frame information for 34 and 140 Mbit/s leased lines

Annex B (informative): Proposed titles for 34 and 140 Mbit/s standards

This Annex contains proposed titles for the 34 Mbit/s and 140 Mbit/s structured leased line standards (the recommended standards) and for the 34 Mbit/s and 140 Mbit/s unstructured leased line standards

B.1 Titles for structured leased line standards

Table B.1: Proposed titles for 34 Mbit/s structured leased line standards

Structured Leased Line	
Interface presentation	Open Network Provision (ONP) technical requirements; 34 Mbit/s digital structured leased line (D34S) Network interface presentation
Connection characteristics	Open Network Provision (ONP) technical requirements; 34 Mbit/s digital structured leased line (D34S) Connection characteristics
Terminal interface	Open Network Provision (ONP) technical requirements; 34 Mbit/s digital structured leased line (D34S) Terminal equipment interface
Technical Basis for Regulation	Open Network Provision (ONP) technical requirements; 34 Mbit/s digital structured leased line (D34S) Attachment requirements for terminal equipment interface

Table B.2: Proposed titles for 140 Mbit/s structured leased line standards

Structured Leased Line	
Interface presentation	Open Network Provision (ONP) technical requirements; 140 Mbit/s digital structured leased line (D140S) Network interface presentation
Connection characteristics	Open Network Provision (ONP) technical requirements; 140 Mbit/s digital structured leased line (D140S) Connection characteristics
Terminal interface	Open Network Provision (ONP) technical requirements; 140 Mbit/s digital structured leased line (D140S) Terminal equipment interface
Technical Basis for Regulation	Open Network Provision (ONP) technical requirements; 140 Mbit/s digital structured leased line (D140S) Attachment requirements for terminal equipment interface

Annex C (informative): Proposed contents and scopes for 34 Mbit/s and 140 Mbit/s standards

The following sections contain the proposed contents lists and scopes for 34 Mbit/s and 140 Mbit/s structured leased line standards.

C.1 D34S Network interface presentation

C.1.1 Contents list

C.1.2 Scope

This ETS specifies the technical requirements and test principles for the network interface presentations of ONP 34 368 kbit/s structured leased lines.

A connection is presented via interfaces at Network Termination Points (NTP). This ETS defines the interface as presented by the leased line provider and should be used in conjunction with the companion standard which specifies the connection characteristics of the leased line. Together, these documents describe the service offered.

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

This ETS covers the physical, mechanical and electrical characteristics of the interface and specifies the conformance tests for equipment of the kind that provides the interface presentation. Some of the tests described in this ETS are not designed to be applied to the interface of an installed leased line; such tests may be applied to equipment of the kind used to provide the interface. This ETS does not include details concerning the implementation of the tests nor does it include information on any regulations concerning testing.

C.2 D34S Connection characteristics

C.2.1 Contents

C.2.2 Scope

This ETS specifies the technical requirements and test principles for connection characteristics of ONP 34 368 kbit/s structured leased lines.

A connection is presented via interfaces at Network Termination Points (NTP) and includes any equipment that may provide the NTP. Signals between terminal equipments are subject to impairments during their transfer over the connection. The limits to these impairments are stated in this standard. This document, together with the companion standard defining the interface presentation, describes the service offered.

The tests specified in this standard cannot be carried out, nor can the performance be monitored by the leased line provider, while the leased line is in service, i.e. carrying users' traffic. Thus the tests are designed for bringing into and returning into service, although there is no obligation to perform these tests each time a leased line is brought into or returned into service.

This ETS is applicable for leased lines, including part time leased lines, for which the establishment or release does not require any protocol exchange or other intervention at the NTP.

This ETS specifies the compliance tests for the connection requirements. This ETS does not include details concerning the implementation of the tests, nor does it include information on any relevant regulations.

This ETS describes those characteristics of the connection that cannot be determined only by the equipment providing the NTPs. The related standard, ETS 300 xxx, defines the interface presentation and places no further constraints on the connection.

C.3 D34S Terminal interface presentation

C.3.1 Contents

C.3.2 Scope

This ETS specifies the full physical and electrical characteristics and corresponding test principles for a terminal equipment interface for connection to the network termination points of ONP 34 368 kbit/s structured leased lines. This ETS is not written for regulatory purposes. A separate TBR covers the essential requirements for attachment under the Second Phase Directive (91/263/EEC) [1].

This ETS is written only to ensure that the interface of the terminal equipment is compatible with the ONP 34 368 kbit/s structured leased line. It is applicable to all interfaces designed for connection to the leased line, however in the cases of apparatus that carries a particular service, of complex apparatus and of apparatus in private networks, other ETSs may apply in addition to this ETS.

Customer premises wiring and installation between the terminal equipment and the NTP are outside the scope of this ETS.

C.4 D34S Terminal equipment attachment requirements

C.4.1 Contents

C.4.2 Scope

This TBR specifies the attachment requirements and corresponding test principles for a terminal equipment interface for connection to the network termination points of ONP 34 368 kbit/s structured leased lines.

The term "attachment requirements" in the context of this TBR describes the essential requirements for access which have to be fulfilled under the Second Phase Directive (91/263/EEC) [1]. Conformance to these requirements does not guarantee end-to-end interoperability.

This TBR is applicable to all interfaces designed for connection to the ONP 34 368 kbit/s structured leased line. It covers the physical and electrical characteristics of the terminal equipment interface.

Customer premises wiring and installation between the terminal equipment and the NTP are outside the scope of this TBR.

C.5 D140S Network interface presentation

C.5.1 Contents

C.5.2 Scope

This ETS specifies the technical requirements and test principles for the network interface presentations of ONP 139 264 kbit/s structured leased lines.

A connection is presented via interfaces at Network Termination Points (NTP). This ETS defines the interface as presented by the leased line provider and should be used in conjunction with the companion standard which specifies the connection characteristics of the leased line. Together, these documents describe the service offered.

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

This ETS covers the physical, mechanical and electrical characteristics of the interface and specifies the conformance tests for equipment of the kind that provides the interface presentation. Some of the tests described in this ETS are not designed to be applied to the interface of an installed leased line; such tests may be applied to equipment of the kind used to provide the interface. This ETS does not include details concerning the implementation of the tests nor does it include information on any regulations concerning testing.

C.6 D140S Connection characteristics

C.6.1 Contents

C.6.2 Scope

This ETS specifies the technical requirements and test principles for connection characteristics of ONP 139 264 kbit/s structured leased lines.

A connection is presented via interfaces at Network Termination Points (NTP) and includes any equipment that may provide the NTP. Signals between terminal equipments are subject to impairments during their transfer over the connection. The limits to these impairments are stated in this standard. This document, together with the companion standard defining the interface presentation, describes the service offered.

The tests specified in this standard cannot be carried out, nor can the performance be monitored by the leased line provider, while the leased line is in service, i.e. carrying users' traffic. Thus the tests are designed for bringing into and returning into service, although there is no obligation to perform these tests each time a leased line is brought into or returned into service.

This ETS is applicable for leased lines, including part time leased lines, for which the establishment or release does not require any protocol exchange or other intervention at the NTP.

This ETS specifies the compliance tests for the connection requirements. This ETS does not include details concerning the implementation of the tests, nor does it include information on any relevant regulations.

This ETS describes those characteristics of the connection that cannot be determined only by the equipment providing the NTPs. The related standard, ETS 300 xxx, defines the interface presentation and places no further constraints on the connection.

C.7 D140S Terminal interface presentation

C.7.1 Contents

C.7.2 Scope

This ETS specifies the full physical and electrical characteristics and corresponding test principles for a terminal equipment interface for connection to the network termination points of ONP 139 264 kbit/s structured leased lines. This ETS is not written for regulatory purposes. A separate TBR covers the essential requirements for attachment under the Second Phase Directive (91/263/EEC) [1].

This ETS is written only to ensure that the interface of the terminal equipment is compatible with the ONP 139 264 kbit/s structured leased line. It is applicable to all interfaces designed for connection to the leased line, however in the cases of apparatus that carries a particular service, of complex apparatus and of apparatus in private networks, other ETSs may apply in addition to this ETS.

Customer premises wiring and installation between the terminal equipment and the NTP are outside the scope of this ETS.

C.8 D140S Terminal equipment attachment requirements

C.8.1 Contents

C.8.2 Scope

This TBR specifies the attachment requirements and corresponding test principles for a terminal equipment interface for connection to the network termination points of ONP 139 264 kbit/s structured leased lines.

The term "attachment requirements" in the context of this TBR describes the essential requirements for access which have to be fulfilled under the Second Phase Directive (91/263/EEC) [1]. Conformance to these requirements does not guarantee end-to-end interoperability.

This TBR is applicable to all interfaces designed for connection to the ONP 139 264 kbit/s structured leased line. It covers the physical and electrical characteristics of the terminal equipment interface.

Customer premises wiring and installation between the terminal equipment and the NTP are outside the scope of this TBR.

Annex D (informative): Bringing into service limits

D.1 CCITT Recommendations M.550 and M.2100

CCITT Recommendations M.550 [10] and M.2100 [11] (which is scheduled to replace M.550 [10]) define Bringing-Into-Service (BIS) limits for digital transmission systems, paths and sections based on the Reference Performance Objective (RPO) limits derived from G-series Recommendations. While CCITT Recommendation M.550 [10] was written for systems based on the 64 kbit/s bit rate, CCITT Recommendation M.2100 [11] states (in § 2.4.1) that the principles contained within the recommendation can be applied to any performance objectives derived from the relevant G-series Recommendations. Since it is intended that CCITT Recommendation M.2100 [11] will replace CCITT Recommendation M.550 [10], the following paragraphs are based on draft CCITT Recommendation M.2100 [11].

The BIS limits defined in M.2100 [11] are between 0,1 and 0,5 times the Reference Performance Objective (RPO) error limits; the figure of 0,5 is applicable to paths (i.e to the leased lines being considered within this document). While RPO limits generally refer to a long term (greater than one month) period, M.2100 [11] (§ 2.6.1) presents a method of reducing these BIS limits to 24-hour BIS limits (S1 and S2). S1 is the limit below which bringing into service is accepted, S2 is the limit above which bringing into service is rejected. Between S1 and S2 the results are inconclusive.

Table D.1: Bringing-into-service limits (24-hour test) for errored seconds for 34 and 140 Mbit/s leased lines based on 88% hypothetical reference path

	34 Mbit/s	**140 Mbit/s**
Error seconds rate from G.826 [8]	7,5 %	16 %
Reference Performance Objective (24 hours)	5702 / 24 hours	12165 / 24 hours
Bringing Into Service Objective (0,5 * RPO)	2851 / 24 hours	6083 / 24 hours
Bringing Into Service test limits Accept (S1) Reject (S2)	 < 2744 / 24 hours > 2958 / 24 hours	 < 5927 / 24 hours > 6239 / 24 hours

Table D.2: Bringing-into-service limits (24-hour test) for severely errored seconds for 34 and 140 Mbit/s leased lines based on 88% hypothetical reference path

	34 Mbit/s	**140 Mbit/s**
Severely errored seconds rate from G.826 [8]	0,2 %	0,2 %
Reference Performance Objective (24 hours)	152 / 24 hours	152 / 24 hours
Bringing Into Service Objective (0,5 * RPO)	76 / 24 hours	76 / 24 hours
Bringing Into Service test limits Accept (S1) Reject (S2)	 < 59 / 24 hours > 93 / 24 hours	 < 59 / 24 hours > 93 / 24 hours

This method of reducing one-month test limits to 24-hour test limits is significantly simpler than that adopted in ETS 300 247 [14] for the 2 048 kbit/s leased line. As such, it is recommended that for the Higher Order Leased Lines:

a) the error rates calculated from the relevant G-series Recommendation (G.826 [8]) should be considered as Reference Performance Objectives (RPO) and that BIS limits should be derived for the leased lines in accordance with M.2100 [11] (i.e. BIS = 0,5 * RPO); and

b) that for the reduction in measurement period from one-month to 24-hours, the method defined in CCITT Recommendation M.2100 [11] should be used in preference to the method used in ETS 300 247 [14] (2 048 kbit/s unstructured leased line).

NOTE: The method of calculation in M.2100 [11] gives BIS limits for 2 048 kbit/s leased lines of 1443 errored seconds and 59 severely errored seconds compared with 1444 and 58 using the method presented in ETS 300 247 [14] (assuming in both cases BIS = 0,5 * RPO).

Annex E (informative): 8 Mbit/s Leased Line

In a Letter of the Commission (DGXIII/F/1/JH/jh**)** from the 8th January 1993 to BT2 Chairman John Horrocks the question was raised whether a 8 Mbit/s leased line should be standardised.

This matter was discussed during a PT29V Steering Group meeting (10th February 1993, Sophia Antipolis) and the following points made:

a) there is no urgent demand from users for such a line;

b) the 8 Mbit/s interface is not widely used within the within the public network, with most 2 048 kbit/s lines being multiplexed up to the 34 Mbit/s line rate;

c) the cost to the user of such an 8 Mbit/s would be similar to that for 34 Mbit/s line since similar access line would be necessary;

d) there is no recommendation for a mapping of 8 Mbit/s lines into the SDH hierarchy.

As such, it is not recommended that any further consideration be given to the specification of an 8 Mbit/s leased line.

Annex F (informative): Bibliography

1) CCITT Recommendation G.707 (1991): "Synchronous digital hierarchy bit rates".

2) CCITT Recommendation G.708 (1991): "Network node interface for the synchronous digital hierarchy".

3) CCITT Recommendation G.709 (1991): "Synchronous multiplexing structure".

4) CCITT Recommendation G.810 (1988): "Considerations on timing and synchronization issues".

5) Draft prETS 300 288 (1993): "Open Network Provision (ONP) technical requirements; 64 kbit/s digital unstructured leased line (D64U), Interface presentation".

6) Draft prETS 300 289 (1993): "Open Network Provision (ONP) technical requirements; 64 kbit/s digital unstructured leased line (D64U), Connection characteristics".

7) Draft prETS 300 290 (1993): "Open Network Provision (ONP) technical requirements; 64 kbit/s digital unstructured leased line (D64U), Terminal equipment interface".

8) Draft prTBR 012 (1993): "Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U), Terminal equipment attachment requirements".

9) Draft prTBR 014 (1993): "Open Network Provision (ONP) technical requirements; 64 kbit/s digital unstructured leased line (D64U), Terminal equipment attachment requirements".

History

Document history	
June 1993	First Edition
February 1996	Converted into Adobe Acrobat Portable Document Format (PDF)