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Integrated Services Digital Network (ISDN); Attachment requirements for packet mode terminal equipment to connect to an ISDN using ISDN basic access

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Foreword

This Technical Basis for Regulation (TBR) has been produced by the Signalling Protocols and Switching (SPS) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This TBR resulted from a mandate from the Commission of the European Community (CEC) to provide harmonized standards for the support of the Council Directive 91/263/EEC ("The Terminal Equipment Directive").

Annex F provides information relating to the articles of the Directive 91/263/EEC.

Annexes A, B, C, D, E and G are normative whereas annexes F, H and J are informative.

Overview of the Abstract Test Suites (ATSs)

This TBR is accompanied by the following ATSs (see annexes B, C and D):

- T33L1_7 (layer 1);
- T33L2_3 (layer 2);
- T33L3_5 (layer 3).

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1 Scope

This Technical Basis for Regulation (TBR) specifies the technical requirements under articles 4(c) to 4(f) of Directive 91/263/EEC for Terminal Equipment (TE) to be attached to the pan-European Integrated Services Digital Network (ISDN) at an interface at the T reference point or coincident S and T reference point for a basic access. These requirements are intended to ensure that the essential requirements of Directive 91/263/EEC continue to be met when up to eight Terminal Equipments are simultaneously connected at the coincident S and T reference point. These requirements are taken from TBR 3 [9], ETS 300 007 [10], ETS 300 047-3 [12], ETS 300 012 [11], ETS 300 102-1 [13] and ETS 300 125 [14]. This TBR does not contain the essential requirements of Article 4 (g) for interworking via the public network, and so does not provide any guarantee of correct terminal-to-terminal operation.

NOTE 1: Although this TBR provides the technical attachment requirements, it does not contain the full specification of the user side of the ISDN user-network interface. Important information necessary for correct working can be found only in the base standards mentioned above.

This TBR specifies these requirements for TE that:

a) access Packet Handler (PH) of an ISDN through either on-demand B- or D-channel mode or semi-permanent B-channel mode basic services (case B of X.31) and those supplementary services that are specified in annex G; and

b) is capable of handling either incoming calls only, outgoing calls only or both incoming and outgoing calls.

This TBR applies to all TE that is intended for connection to the forms of ISDN access referred to above, irrespective of whether the TE provides additional interfaces, telecommunications services or functions for which other TBRs or national approval requirements apply.

This TBR does not specify the requirements for a packet mode TE that uses on-demand B-channel circuit mode access (case A of X.31); the requirements for such a TE are contained in TBR 3 [9].

NOTE 2: This TBR is not applicable to TE which may be supplied in some countries for connection to an ISDN telecommunications service corresponding to, but not compatible with, the pan-European ISDN basic access standards.

2 Normative references

This TBR incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this TBR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] CCITT Recommendation G.117 (1988): "Transmission aspects of unbalance about earth (Definitions and methods)".

[2] CCITT Recommendation I.411 (1988): "ISDN user-network interfaces - Reference configurations".

[3] CCITT Recommendation I.430 (1988): "Basic user-network interface - Layer 1 specification".

[4] EN 60603-7 (1993): "Connectors for frequencies below 3 MHz for use with printed boards; Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features; (IEC 603-7:1990)".

[5] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General Concepts".

[6] ISO/IEC 9646-2: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification".

[7] ISO/IEC 9646-3: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 3: The Tree and Tabular Combined Notation (TTCN)".

[8] TBR 2 (1997): "Attachment requirements for Data Terminal Equipment (DTE) to connect to Packet Switched Public Data Networks (PSPDNs) for CCITT Recommendation X.25 interfaces at data signalling rates up to 1 920 kbit/s utilizing interfaces derived from CCITT Recommendations X.21 and X.21bis".

[9] TBR 3 (1995) and A1: "Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using basic access".

[10] ETS 300 007 (1991): "Integrated Services Digital Network (ISDN); Support of packet mode terminal equipment by an ISDN".

[11] ETS 300 012 (1992): "Integrated Services Digital Network (ISDN); Basic user-network interface; Layer 1 specification and test principles".

[12] ETS 300 047-3 (1992): "Integrated Services Digital Network (ISDN); Basic access - safety and protection; Part 3: Interface I_a - protection".

[13] ETS 300 102-1 (1990): "Integrated Services Digital Network (ISDN); User-network interface layer 3; Specifications for basic call control".

[14] ETS 300 125 (1991): "Integrated Services Digital Network (ISDN); User-network interface data link layer specification; Application of CCITT Recommendations Q.920/I.440 and Q.921/I.441".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this TBR the following definitions, together with those given in TBR 3 [9], in annex E of CCITT Recommendation I.430 [3] and in CCITT Recommendation I.411 [2] apply:

access connection: Used instead of *call* in situations where interchanging with *virtual call* should be prevented (the term "access" being derived from "packet handler access").

call: Call establishment according to ETS 300 102-1 [13] procedures.

conditional notification class: Class of methods to inform a user of an incoming virtual call, where the network can use ETS 300 102-1 [13] procedures to activate or provide a channel for the delivery of the virtual call (applicable to the use of the D-channel or of a B-channel).

notification class: Class of methods to inform a user of an incoming virtual call and provide a channel for that call.

no notification class: Class of methods to inform a user of an incoming virtual call, where the network requires that an access connection (use of B-channel) or a data link with SAPI=16 (use of D-channel) is currently established between the TE and the PH (if none of the conditions is fulfilled, the network will not inform the user of the incoming call).

on-demand B-channel: Case where a B-channel is established as a result of D-channel signalling procedures (as opposite to semi-permanent B-channel).

on-demand layer 1: Case where the physical layer is activated/deactivated as a result from requests from layer 2.

semi-permanent B-channel: Case where a B-channel is established at subscription or installation time and is kept established semi-permanently.

semi-permanent layer 1: Case where the physical layer is activated (established) at subscription or installation time and is kept activated semi-permanently.

semi-permanent layer 2: Case where the data link is kept established independent of an active call or virtual call.

virtual call: Call according to the procedures of X.25 layer 3.

3.2 Abbreviations

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

ADPCM	Adaptive Differential Pulse Code Modulation
AFI	Authority and Format Identifier
ATS	Abstract Test Suite
BCD	Binary Coded Decimal
C/R	Command/Response field bit
DISC	Disconnect
DM	Disconnected Mode
DSP	Domain Specific Part
DTE	Data Terminating Equipment
EA	Address Field Extension bit
EMC	Electro-Magnetic Compatibility
FCS	Frame Check Sequence
HDLC	High level Data Link Control
I_a	Interface point a
I_b	Interface point b
IDI	Initial Domain Identifier
ISDN	Integrated Services Digital Network
IUT	Implementation Under Test
LAN	Local Area Network
LAPB	Link Access Procedure - Balanced
LAPD	Link Access Procedure on the D-channel
LCL	Longitudinal Conversion Loss
NSAP	Network Service Access Point
NT	Network Termination
PABX	Private Automatic Branch eXchange
PCO	Point of Control and Observation
PH	Packet Handler
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
PLL	Pre-allocated Logical Link (former: Permanent Logical Link)

NOTE: The terms PLL and Long-term-PLL have been defined in ETS 300 049, second edition. The option of accessing the PH over the D-channel using PLL or Long-term-PLL is covered by this TBR, although the terms themselves are not further used.

PS	Power Source
PSPDN	Packet Switched Public Data Network
REJ	Reject
Ri	Reference number
RNR	Receiver Not Ready
RR	Receiver Ready
Rx	Receive
SABME	Set Asynchronous Balanced Mode Extended
SAP	Service Access Point
SAPI	Service Access Point Identifier

TA	Terminal Adapter
TBR	Technical Basis for Regulation
TBR-RT	TBR Requirements Table
TE	Terminal Equipment
TEI	Terminal Endpoint Identifier
TTCN	Tree and Tabular Combined Notation
UA	Unnumbered Acknowledgement
UI	Unnumbered Information (layer 2)

4 General

Each requirement in this TBR is either applicable to all TE within the scope of this TBR, or only applicable to certain TE, depending on the functions implemented within the TE. Annex A specifies the relationship between the requirements and the terminal. The supplier shall provide information on the functions implemented in the terminal and this information shall be used to determine which requirements apply and the manner in which the tests are performed. This information may be provided in the form of a complete TBR-RT proforma (a blank TBR-RT proforma is provided in annex A).

This TBR contains references to communications, called primitive procedures, between adjacent layers and between layers and their associated layer management entities. These primitive procedures are conceptual and allow the description of interactions between functions dedicated to different layers within the TE. Primitive procedures do not constrain implementation, are system internal and therefore cannot be tested in isolation. However, as seen from the Point of Control and Observation (PCO), the behaviour of the TE shall be such that the sequence of events is consistent with the primitives being implemented as described in this TBR.

The user-network interface at the T reference point, or coincident S and T reference point, provides the only test access for the purpose of performing attachment tests. However, actions at other ports or interfaces of the Implementation Under Test (IUT) (e.g. at the man-machine interface, execution of higher layer processes, at the interface at the S reference point in the case of NT2s or at the R reference point in the case of Terminal Adapters) shall be used as specified by the supplier to invoke actions at layers 1, 2 and 3 of the D-channel protocol within the IUT.

Since the verification of a layer protocol normally depends on the proper operation of lower layer services needed for those functions, the verification tests should be performed in a sequential order beginning with the lowest layer. However, this general strategy does not preclude higher layer functions from being essential for the stimulation of lower layer functions under test. Thus, at least, basic functions of each layer in the IUT may be required in order to perform an attachment test for a particular lower layer.

This TBR does not require more than one set of tests to be made on more than one of each type of basic access.

4.1 General requirements for the access of the PH

4.1.1 Channel used for the access of the PH

Reference: ETS 300 007 [10], subclause 4.2.

General requirement:

To access the PH, the TE shall support the use of:

a) one or more B-channels; or
b) the D-channel; or
c) both.

NOTE: For a given virtual call, only the use of either the D-channel or a particular B-channel is applicable.

4.1.2 Requirements for layer 1

4.1.2.1 Requirements for complete layer 1 (comprising D-channel and B-channels as a whole)

Reference: ETS 300 007 [10], clause 7.

General requirement:

The use of ISDN layer 1 shall be:

a) semi-permanent; or
b) on-demand.

Depending on case a) or case b), different requirements will apply to layer 1 in clause 9.

4.1.2.2 Requirements for layer 1 with respect to the selected channel

Reference: ETS 300 007 [10], clause 7.

General requirement:

If the only channel supported by the TE to access the PH is the D-channel, then there are no further requirements for layer 1, than those of subclause 4.1.2.1.

If the TE supports the access of the PH over a B-channel, then the TE shall support:

a) on-demand B-channel access, or
b) semi-permanent B-channel access, or
c) both.

NOTE 1: On-demand B-channel access can be accomplished via outgoing and via incoming calls (see subclauses 4.1.5.1 and 4.1.5.2).

NOTE 2: Semi-permanent B-channel access may need a special agreement with the network.

4.1.3 Requirements for layer 2 of the D-channel

4.1.3.1 Requirements for data link connections with SAPI 0

Reference: ETS 300 007 [10], clause 7.

General requirement:

If the TE supports outgoing or incoming calls (see subclauses 11.4.1 and 11.4.2), then the TE shall support the requirements of clause 10 for data links with SAPI 0 and shall further support (for SAPI 0):

a) TE demand data link establishment, or
b) network demand data link establishment, or
c) both.

In cases a) and c), the TE shall support data link establishment initiation (see subclause 10.6.1.2.1) and the transmission of SABME and receipt of UA frames (see subclause 10.2.6.1).

In cases b) and c), the TE shall support data link establishment response (see subclause 10.6.1.2.2) and the receipt of SABME and transmission of UA frames (see subclause 10.2.6.1).

NOTE: Independently of the support of cases a), b) or c), the data link connection can be established semi-permanently or on a per-call base (see also subclause 4.1.5.3).

The TE may implement TEIs in the automatic and in the non-automatic range.

4.1.3.2 Requirements for data link connections with SAPI 16

Reference: ETS 300 007 [10], clause 7.

General requirement:

If the TE supports access of the PH over the D-channel in a point-to-multipoint environment, then the TE shall support the requirements of clause 10 for data links with SAPI 16 as defined in the requirements tables of annex A.

In this case the TE shall support (for SAPI 16):

a) initiation of data link establishment; or
b) response to data link establishment request; or
c) both.

In cases a) and c), the TE shall support data link establishment initiation (see subclause 10.6.1.2.1). In this case, the TE shall support the transmission of SABME and receipt of UA frames (see subclause 10.2.6.1).

In cases b) and c), the TE shall support data link establishment response (see subclause 10.6.1.2.2) and the receipt of SABME and transmission of UA frames (see subclause 10.2.6.1).

NOTE 1: Independently of the support of case a), b) or c), the data link connection can be established semi-permanently or on a per-call base. There is no requirement to use the one or the other option. For the case of No notification class however, see the note in subclause 4.1.4.

NOTE 2: There are no requirements for SAPI 16 data links operating in a point-to-point environment.

4.1.3.3 Requirements for data link connections with SAPI 63

Reference: ETS 300 007 [10], clause 7.

General requirement:

If the TE supports a single fixed TEI in a point-to-point configuration, then the TEI management procedures (see subclause 10.5) shall not be used.

In all other cases, the TE shall support transmission and receipt of UI frames on the broadcast data link (TEI = 127) for SAPI 63. The TE shall then also support the TEI management procedures defined in subclause 10.5.

4.1.4 Notification classes

Reference: ETS 300 007 [10], subclause 4.2.3.

General requirement:

If the TE supports incoming virtual calls, it shall support one of the following notification classes:

NOTE 1: The selection of the notification class depend on whether an agreement has been made with the network for the notification of the TE in case of an incoming virtual call. The notification classes have not been defined to restrict terminal implementations, but to provide further classification to select appropriate requirements.

a) No notification class.
No agreement has been made with the network, or the agreement of "No notification" has been made (see note 2).

b) Conditional notification class.
An agreement has been made with the network, that the network informs the TE on incoming virtual calls. Call control procedures for an incoming packet mode call may be used for this purpose (see subclause 11.4.2).

There is no specific requirement for case a)

NOTE 2: In case a), if the TE supports access of the PH only over the D-channel, a data link connection with SAPI 16 should be established semi-permanently (see the note of subclause 4.1.3.2). Otherwise the TE would not be informed of incoming virtual calls. If the TE supports access of the PH only over a B-channel, either a semi-permanent B-channel should be established between the TE and the PH, or the TE should establish an on-demand B-channel connection, following the procedures of subclause 4.1.5.2.

In case b), the TE shall support the requirements of subclause 4.1.5.2 (incoming calls), except if there is an agreement between the network provider and the user, that each incoming virtual call is provided to the user over a semi-permanent B-channel or an established D-channel link (see subclause 7.2.2.3.3 of ETS 300 007 [10]).

4.1.5 Requirements for layer 3 of the D-channel

4.1.5.1 Outgoing calls

Reference: ETS 300 007 [10], subclause 7.1.2.

General requirement: Outgoing calls shall be used by the TE to initiate establishment of on-demand B-channel connections between the TE and the PH.

A TE supporting outgoing calls shall support the requirements of clause 11 applicable to outgoing call establishment and release.

4.1.5.2 Incoming calls

Reference: ETS 300 007 [10], subclause 7.2.2.

General requirement: Incoming calls shall be used by the TE to receive notification of an incoming virtual call, or to complete the establishment of a B-channel connections between the TE and the PH initiated by the PH (as result of an incoming virtual call to be awarded on a B-channel).

NOTE: Incoming call is only applicable if the TE supports the conditional notification class (see subclause 4.1.4). It is applicable to TEs using the D-channel and to TEs using a B-channel to access the PH (see also subclause 11.4.3.4.2).

A TE supporting incoming calls shall support the requirements of clause 11 applicable to incoming call establishment and release.

4.1.5.3 Use of outgoing and incoming calls to support access of the PH

Reference: ETS 300 007 [10], clause 7.

General requirement: If the TE supports outgoing **virtual** calls and supports on-demand B-channel connections to access the PH, then the TE shall support outgoing calls (see subclause 4.1.5.1).

In this case, if the data link connection using SAPI 0 is not semi-permanent (under the control of the network), the TE shall support case a) or case c) of subclause 4.1.3.1 (initiation of data link establishment for SAPI 0). Otherwise, the TE shall support case b) or case c) of subclause 4.1.3.1.

If the TE supports incoming **virtual** calls and also supports the conditional notification class, then the TE shall support incoming calls (see subclause 4.1.5.2).

In this case, if the data link connection using SAPI 0 is not semi-permanent (under the control of the TE), the TE shall support case b) or case c) of subclause 4.1.3.1 (response to data link establishment request for SAPI 0). Otherwise, the TE shall support case a) or case c) of subclause 4.1.3.1.

5 Definitions of primitives

See TBR 3 [9], clause 5.

6 Safety requirements

See clause 6 of TBR 3 [9].

7 Electro-Magnetic Compatibility (EMC) requirements

See clause 7 of TBR 3 [9].

8 Overvoltage protection requirements

See clause 8 of TBR 3 [9].

8.1 Impulse transfer from mains, common mode

Requirement: See subclause 8.1 of TBR 3 [9].

Test: The test shall be conducted according to subclause 5.7.1 of ETS 300 047-3 [12].

8.2 Impulse transfer from mains, transverse mode

Requirement: See subclause 8.2 of TBR 3 [9].

Test: The test shall be conducted according to subclause 5.7.1 of ETS 300 047-3 [12].

8.3 Conversion of common mode to transverse mode

Requirement: See subclause 8.3 of TBR 3 [9].

Test: The test shall be conducted according to subclause 5.7.3 of ETS 300 047-3 [12].

9 Layer 1 requirements

Layer 1 requirements are split into two different cases:

1) On-demand layer 1;

2) Semi-permanent layer 1.

Unless otherwise noted all requirements apply to both cases. Particular layer 1 requirements applying to case 2) only are covered in subclause 9.6.

9.1 Physical characteristics (on-demand layer 1)

See subclause 9.1 of TBR 3 [9].

9.2 Electrical characteristics (on-demand layer 1)

See subclause 9.2 of TBR 3 [9].

9.3 Functional characteristics (on-demand layer 1)

See subclause 9.3 of TBR 3 [9].

9.4 Interface procedure (on-demand layer 1)

9.4.1 D-channel access procedure

9.4.1.1 Interframe (layer 2) time fill

Reference and requirement: See TBR 3 [9] 9.4.1.1.

Test: The test shall be conducted according to annex B, TTCN test case DCBinaryOneCL1.

9.4.1.2 Multipoint contention resolution mechanism

Reference: ETS 300 012 [11], annex A, subclauses A.6.1.3 and A.6.1.4.

Requirement: The TE shall not start layer 2 frame transmission until the number of consecutive binary ONEs in the D-echo-channel is equal to, or exceeds, the value X_1 for priority class 1. The value of X_1 shall be eight for the normal level and nine for the lower level of priority.

In a priority class the value of the normal level of priority shall be changed into the value of the lower level of priority (i.e. higher number of ONEs) when a TE has successfully transmitted a layer 2 frame of that priority class.

The value of the lower level of priority is changed back to the value of the normal level of priority when the number of consecutive binary ONEs in the D-echo-channel equals the value of the lower level of priority (i.e. higher value).

The TE shall use priority class 1 for all layer 2 frames transmitted with SAPI = 0.

NOTE: The use of priority class 2 as described in ETS 300 012 [11] is not a requirement under this TBR. There may be essential requirements that are not contained within this TBR for the use of priority class 2 with SAPI values other than 0 and 16. It is recommended that priority class 2 be used for frames transmitted with SAPI 16, since terminals being already on the market may use priority class 2 for frames with SAPI 0.

Test: The test shall be conducted according to annex B, TTCN test cases DCPriorityClass1, DCNormtoLowPLCL1 and DCLowtoNormPLCL1.

9.4.1.3 Collision detection

Reference and requirement: See TBR 3 [9], subclause 9.4.1.3.

Test: The test shall be conducted according to annex B, TTCN test cases DCNormalPL1CL1 and DCNormalPL0CL1.

9.4.2 Activation/deactivation

This subclause applies only to the case a) on-demand layer 1 activation; this subclause does not apply to the case b) semi-permanent layer 1 which is covered by subclause 9.6 below.

9.4.2.1 TE states

See TBR 3 [9], subclause 9.4.2.1.

9.4.2.2 Signals

See TBR 3 [9], subclause 9.4.2.2.

9.4.2.3 Activation/deactivation procedure for TEs

9.4.2.3.1 Specification of the procedure

Reference and requirement: See TBR 3 [9], subclause 9.4.2.3.1.

Test: The test shall be conducted according to annex B, TTCN test cases AD1aF1_PS_LP_on, AD3aF2_PS_off, AD3bF2_LP_off, AD4F2_RX_I0, AD5F2_RX_I2, AD6F2_RX_I4, AD7F2_RX_IX, AD9aF3_PS_off, AD9bF3_LP_off, AD10F3_PH_AR, AD11F3_RX_I0, AD12F3_RX_I2, AD13F3_RX_I4, AD14F3_RX_IX, AD15F3_CHK_T3, CPF3PHAI, AD16aF4_PS_off, AD16bF4_LP_off, AD17F4_RX_I0, AD18F4_RX_I2, AD19F4_RX_I4, AD21F4_CHK_T3, CPF4PHDI_T3exp, CPF4Tlayer2, AD22aF5_PS_off, AD22bF5_LP_off, AD23F5_RX_I0, AD24F5_RX_I2, AD25F5_RX_I4, AD26F5_RX_IX, AD27F5_CHK_T3, CPF5PHDI_I0T3, CPF5PHDI_T3expa, CPF5PHDI_T3expb, AD28aF6_PS_off, AD28bF6_LP_off, AD29F6_Lostfr, AD30F6_PH_AR, AD31F6_RX_I0, AD32F6_RX_I2, AD33F6_RX_I4, AD34F6_CHK_T3, CPF6PHAIa, CPF6PHAIb, CPF6PHDI_I0, CPF6PHARa, AD35aF7_PS_off, AD35bF7_LP_off, AD36F7_Lostfr, AD37F7_RX_I0, AD38F7_RX_I2, AD39F7_RX_I4, CPF7PHDI_I0, CPF7DIS_I2, CPF7DIS_IX, AD40aF8_PS_off, AD40bF8_LP_off, AD41F8_PH_AR, AD42F8_RX_I0, AD43F8_RX_I2, AD44F8_RX_I4, AD45F8_RX_IX, AD46F8_CHK_T3, CPF8PHAIb, CPF8PHDI_I0T3, and CPF8PHARa.

9.4.2.3.2 Timer values

Reference and requirement: See TBR 3 [9], subclause 9.4.2.3.2.

Test: The test shall be conducted according to annex B, TTCN test case TItimerT3.

9.4.2.4 TE activation times

Reference and requirement: See TBR 3 [9], subclause 9.4.2.4.

Test: The test shall be conducted according to annex B, TTCN test cases TIF3info2, TIF3info4, TIF4info2 and TIF4info4.

9.4.2.5 Deactivation times

Reference and requirement: See TBR 3 [9], subclause 9.4.2.5.

Test: The test shall be conducted according to annex B, TTCN test cases TIF7compdeact1, TIF8compdeact1, TIF6physdeact and TIF7physdeact.

9.4.3 Frame alignment procedures

Reference and requirement: See TBR 3 [9], subclause 9.4.3.

Test: The test shall be conducted according to annex B, TTCN test cases FAinfA_1fr, FAinfB_1fr, FAinfD_1fr, FAinfA_kfr, FAinfB_kfr, FAinfD_kfr and FAregain.

9.4.4 Multiframing

Reference and requirement: See TBR 3 [9], subclause 9.4.4.

Test: The requirement is implicitly tested by the tests for subclause 9.4.3.

9.4.5 Idle Channel Code on the B-Channels

Reference and requirement: See TBR 3 [9], subclause 9.4.5.

Test: The test shall be conducted according to annex B, TTCN test case BCBinaryOne.

9.5 Power feeding (on-demand layer 1)

See TBR 3 [9], subclause 9.5

9.6 Semi-permanent layer 1 requirements

Subclauses 9.1, 9.2, 9.3, 9.4.1, 9.4.3, 9.4.4, 9.4.5 and 9.5 apply to the semi-permanent layer 1 case without any change.

Subclauses 9.6.1 and 9.6.2 below apply to the semi-permanent layer 1 case and replace subclause 9.4.2.

9.6.1 Activation/deactivation

9.6.1.1 TE States

9.6.1.1.1 State F1 (Inactive)

See TBR 3 [9], subclause 9.4.2.1.1.

9.6.1.1.2 State F2 (Sensing)

See TBR 3 [9], subclause 9.4.2.1.2.

9.6.1.1.3 State F3 (Deactivated)

See TBR 3 [9], subclause 9.4.2.1.3.

9.6.1.1.4 State F6 (synchronized)

See TBR 3 [9], subclause 9.4.2.1.6.

9.6.1.1.5 State F7 (activated)

See TBR 3 [9], subclause 9.4.2.1.7.

9.6.1.1.6 State F8 (lost framing)

See TBR 3 [9], subclause 9.4.2.1.8.

9.6.2 Signals

Reference: ETS 300 012 [11], annex A, subclause A.6.2.2.

Definition: The identifications of specific signals across the coincident S and T reference point are given in table 9.1. Also included is the coding for these signals.

Table 9.1: Definition of INFO signals

Signals from NT to TE		Signals from TE to NT	
INFO 0	No signal	INFO 0	No signal
INFO 2	Frame with all bits of B; D-and D-echo channels set to binary ZERO. Bit A set to binary ZERO. N and L bits set according to the normal coding rules.	INFO 3	Synchronized frames with operational data on B and D-channel.
INFO 4	Frames with operational data on B-, D-and D-echo-channels. Bit A set to binary ONE.		

9.6.3 Specification of the Activation/deactivation procedure for semi-permanent layer 1 TEs

Reference: ETS 300 012 [11], annex A, subclauses A.5.3.1, A.5.3.2 and A.6.2.3.2.

Requirement: A TE which is powered from PS1 shall follow the procedures described in the finite state matrix table shown in table 9.2.

A TE which is locally powered shall follow the procedures described in the finite state matrix table shown in table 9.3.

Table 9.2: Activation/deactivation semi-permanent layer 1 finite state matrix table for TEs powered from PS1

State Name	Inactive	Sensing	Deactivated	Synchronized	Activated (note 3)	Lost Framing
State Number	F1	F2	F3	F6	F7	F8
INFO Sent	INFO 0	INFO 0	INFO 0	INFO 3	INFO 3	INFO 0
Detection of PS1 (note 2)	F2	---	---	---	---	---
Disappearance of PS1 for at least 500 ms (note 2)	---	F1	MPH-II(d) F1	MPH-II(d) PH-DI F1	MPH-II(d) PH-DI F1	MPH-II(d) PH-DI F1
Receive INFO 0 (notes 4 and 5)	/	MPH-II(c) F3	---	PH-DI F3	PH-DI F3	PH-DI F3
Receive any signal (note 1)	/	---	---	/	/	---
Receive INFO 2	/	MPH-II(c) F6	F6	---	F6	F6
Receive INFO 4	/	MPH-II(c) PH-AI F7	PH-AI F7	PH-AI F7	---	PH-AI F7
Lost Framing	/	/	/	F8	F8	---

---	No change, no action.	PH-AI	Primitive PH-ACTIVATE INDICATION.
|	Impossible by the definition of the layer 1 service.	PH-DI	Primitive PH-DEACTIVATE INDICATION.
/	Impossible situation.		
a, b; Fn	Issue primitives "a" and "b" and then go to state "Fn".		
MPH-II(c)	Primitive MPH-INFORMATION INDICATION (connected).		
MPH-II(d)	Primitive MPH-INFORMATION INDICATION (disconnected).		

NOTE 1: This event reflects the case where a signal is received which is not INFO 2 or INFO 4. To ensure that a TE takes appropriate action when receiving a signal to which it cannot synchronize, operation of TEs should be verified where the received signal is any bit pattern (containing at least three ZEROs in each frame interval) to which TEs conforming to subclause 9.4.3 are not able to synchronize. In the TTCN test cases in annex B, clause B.4, this signal is called INFO X.

NOTE 2: If more than one power feeding source can be used as declared in items 1 and 2 of annex A, table A.11, the reaction of the TE may be different from that described. It may be necessary then to analyse the behaviour of the TE, when tested according to annex B, clause B.4, and when powered as declared by the supplier (see annex E, table E.2).

NOTE 3: Semi-permanent layer 1 ignores request primitives. Timer T3 is not used therefore.

NOTE 4: The timer T4 shall be started when leaving state F7 or F8 upon the reception of INFO 0. The corresponding PH-DI will be delivered to layer 2 only, if layer 1 does not re-enter an active state before expiry of this timer. The value of this timer is in the range of 500 ms to 1 000 ms. This prevents the loss of an on-going communication caused by spurious effects.

NOTE 5: INFO 0 shall be detected when 48 or more contiguous binary ONEs have been received and the TE shall perform the actions specified in table 9.2. Conformance shall be tested with a sinusoidal signal having a voltage of 100 mV peak-to-peak (with a frequency in the range of 2 kHz to 1 000 kHz, preferably 100 kHz). TE being in state F6 or F7 shall react on receipt of this signal by transmitting INFO 0 within a period of time 250 µs to 25 ms.

NOTE 6: Semi-permanent Activation of layer 1 on the NT side is assumed at installation time.

Table 9.3: Activation/deactivation semi-permanent layer 1 finite state matrix table for locally powered TEs

State Name	Inactive	Sensing	Deactivated	Synchronized	Activated (note 3)	Lost Framing
State Number	F1	F2	F3	F6	F7	F8
INFO Sent	INFO 0	INFO 0	INFO 0	INFO 3	INFO 3	INFO 0
Loss of power	/	F1	MPH-II(d) F1	MPH-II(d) PH-DI F1	MPH-II(d) PH-DI F1	MPH-II(d) PH-DI F1
Application of power (note 2)	F2	---	---	---	---	---
Detect PS1	No requirements apply					
Receive INFO 0 (notes 4 and 5)	/	MPH-II(c) F3	---	PH-DI F3	PH-DI F3	PH-DI F3
Receive any signal (note 1)	/	---	---	/	/	---
Receive INFO 2	/	MPH-II(c) F6	F6	---	F6	F6
Receive INFO 4	/	MPH-II(c) PH-AI F7	PH-AI F7	PH-AI F7	---	PH-AI F7
Lost Framing	/	/	/	F8	F8	---

---	No change, no action.	MPH-II(c)	Primitive MPH-INFORMATION INDICATION (connected).
|	Impossible by the definition of the layer 1 service.	MPH-II(d)	Primitive MPH-INFORMATION INDICATION (disconnected).
/	Impossible situation.	PH-AI	Primitive PH-ACTIVATE INDICATION.
a, b; Fn	Issue primitives "a" and "b" and then go to state "Fn".	PH-DI	Primitive PH-DEACTIVATE INDICATION.

NOTE 1: This event reflects the case in which a signal is received which is not INFO 2 or INFO 4. To ensure that a TE takes appropriate action when receiving a signal to which it cannot synchronize, operation of TEs should be verified where the received signal is any bit pattern (containing at least three ZEROs in each frame interval) to which TEs conforming to subclause 9.4.3 are not able to synchronize. In the TTCN test cases in annex B, clause B.4, this signal is called INFO X.

NOTE 2: The term power could be the full operational power or backup power. Backup power is defined such that it is enough to hold the TEI values in memory and maintain the capability of receiving and transmitting layer 2 frames associated with the TEI procedures. If more than one power feeding source can be used as declared in items 1 and 2 of annex A, table A.11, the reaction of the TE may be different from that described. It may be necessary then to analyse the behaviour of the TE, when tested according to annex B, clause B.4, and when powered as declared by the supplier (see annex E, table E.2).

NOTE 3: Semi-permanent layer 1 ignores request primitives. Timer T3 is not used therefore.

NOTE 4: The timer T4 shall be started when leaving state F7 or F8 upon the reception of INFO 0. The corresponding PH-DI will be delivered to layer 2 only, if layer 1 does not re-enter an active state before expiry of this timer. The value of this timer is in the range of 500 ms to 1 000 ms. This prevents the loss of an on-going communication caused by spurious effects.

NOTE 5: INFO 0 shall be detected when 48 or more contiguous binary ONEs have been received and the TE shall perform the actions specified in table 9.8. Conformance shall be tested with a sinusoidal signal having a voltage of 100 mV peak-to-peak (with a frequency in the range 2 kHz to 1 000 kHz, preferably 100 kHz). TE being in state F6 or F7 shall react on receipt of this signal by transmitting INFO 0 within a period of time 250 µs to 25 ms.

NOTE 6: Semi-permanent Activation of layer 1 on the NT side is assumed at installation time.

Test: The tests shall be conducted according to annex B, TTCN test cases AD1aF1_PS_LP_on, AD3aF2_PS_off, AD3bF2_LP_off, AD4F2_RX_I0, AD5F2_RX_I2, AD6F2_RX_I4, AD7F2_RX_IX, CPF2PHAI, AD9aF3_PS_off, AD9bF3_LP_off, AD11F3_RX_I0, AD12F3_RX_I2, AD13F3_RX_I4, AD14F3_RX_IX, CPF3PHAI, AD28aF6_PS_off, AD28bF6_LP_off, AD29F6_Lostfr, AD31F6_RX_I0, AD32F6_RX_I2, AD33F6_RX_I4, CPF6PHAIa, CPF6PHDI_I0, AD35aF7_PS_off, AD35bF7_LP_off, AD36F7_Lostfr, AD37F7_RX_I0, AD38F7_RX_I2, AD39F7_RX_I4, CPF7PHDI_I0, CPF7DIS_I2, CPF7DIS_IX, AD40aF8_PS_off, AD40bF8_LP_off, AD43F8_RX_I2, AD44F8_RX_I4, AD45F8_RX_IX, AD46F8_CHK_T3 and CPF8PHAIb.

9.6.4 TE activation times

Reference: ETS 300 012 [11], annex A, subclauses A.4.3 and A.6.2.6.1.

Requirement: A TE in the deactivated state (F3) shall, upon the receipt of INFO 2 or INFO 4, establish frame synchronization and initiate the transmission of INFO 3 within 100 ms.

In state F6, a TE shall recognize the receipt of INFO 4 within two frames (in the absence of errors).

Test: The test shall be conducted according to annex B, TTCN test cases TIF3info2 and TIF3info4.

9.6.5 Deactivation times

Reference and requirement: See TBR 3 [9], subclause 9.4.2.5.

Test: The test shall be performed according to annex B, TTCN test cases TIF7compdeact1, TIF8compdeact1, TIF6physdeact and TIF7physdeact.

10 Layer 2 D-channel requirements

The following clauses contain elements of procedure that are expressed in the form of definitions. These elements of procedure do not form requirements in their own right and, therefore, do not have associated conformance tests. However, these elements are used as components for procedures that are requirements.

Several configurations of accessing the PH by a TE have been identified in the scope and in clause 4 (e.g. use of B- or D-channel, use of semi-permanent B-channel and others). These configurations have associated items in the general requirements tables of annex A. Not all elements and components of procedures of this clause are requirements for all possible configurations. Requirements tables of annex A following the general requirements tables express the applicability of the elements and procedures by giving them a conditional status, depending on these items.

To ensure that the applicable requirements are satisfied, it is necessary for a TE to implement these elements of procedure in the manner specified within the associated definition. The tests for requirements implicitly test the elements associated with a definition.

Subclause 10.2.3.3 specifies the Service Access Point Identifiers (SAPI) applicable to this TBR. When there are differences in the elements with respect to the use of the SAPI, this is expressed in the text of the element. Differences in the applicability of the elements are expressed in clause 4 and in the requirements tables of annex A.

Reference: ETS 300 102-1 [13], subclause 4.6.

Requirement: Before the procedures of this clause are invoked, a physical layer connection shall be activated between the TE and the network. All layer 2 frames shall be sent to the physical layer using a PH-DATA request primitive.

NOTE 1: Apart from the TEI management procedures of subclause 10.5, the elements of this clause are applicable to SAPI=0 (call control procedures) and SAPI=16 (packet communication conforming to X.25 level 3 procedures).

NOTE 2: The reception of a PH-DI primitive by layer 2 implies the discarding of all outstanding PH-DATA requests and all LAPD frames in queue.

Test: The requirement is implicitly verified by the tests in annex B, subclause B.4.2, (Test Group ISDN1/Cp).

10.1 Frame structure for peer-to-peer communication

10.1.1 General

See subclause 10.1.1 of TBR 3 [9].

10.1.2 Flag sequence

See subclause 10.1.2 of TBR 3 [9].

10.1.3 Address field

See subclause 10.1.3 of TBR 3 [9].

10.1.4 Control field

See subclause 10.1.4 of TBR 3 [9].

10.1.5 Information field

Reference: ETS 300 125 [14], Part 2, subclause 2.5.

Definition: The information field of a frame, when present, follows the control field (see subclause 10.1.4 and table 10.1 of TBR 3 [9]) and precedes the FCS (see subclause 10.1.7). The contents of the information field consists of an integer number of octets.

The maximum number of octets in the information field is defined in subclause 10.10.3.

10.1.6 Transparency

See subclause 10.1.6 of TBR 3 [9].

10.1.7 Frame Check Sequence (FCS) field

See subclause 10.1.7 of TBR 3 [9].

10.1.8 Format convention

10.1.8.1 Numbering convention

See subclause 10.1.8.1 of TBR 3 [9].

10.1.8.2 Order of bit transmission

See subclause 10.1.8.2 of TBR 3 [9].

10.1.8.3 Field mapping convention

See subclause 10.1.8.3 of TBR 3 [9].

10.1.9 Invalid or incompatible frames

Reference: ETS 300 125 [14], Part 2, subclause 2.9.

Definition: An invalid or incompatible frame is a frame which:

a) is not properly bounded by two flags; or
b) contains a FCS error; or
c) contains a single octet address field; or
d) contains a SAPI (see subclause 10.2.3.3) which is not supported by the receiver; or
e) contains a TEI not assigned to the TE.

10.2 Elements of procedures and formats of fields for data link layer peer-to-peer communication

10.2.1 General

See subclause 10.2.1 of TBR 3 [9].

10.2.2 Address field format

See subclause 10.2.2 of TBR 3 [9].

10.2.3 Address field variables

10.2.3.1 Address field extension bit (EA)

See subclause 10.2.3.1 of TBR 3 [9].

10.2.3.2 Command/Response field bit (C/R)

See subclause 10.2.3.2 of TBR 3 [9].

10.2.3.3 Service Access Point Identifier (SAPI)

Reference: ETS 300 125 [14], Part 2, subclause 3.3.3, ETS 300 007 [10], subclause 4.2.2.

Definition: The SAPI identifies a point at which data link layer services are provided by a data link layer entity to a layer 3 or management entity. Consequently, the SAPI specifies a data link layer entity that should process a data link layer frame and also a layer 3 or management entity which is to receive information carried by the data link layer frame. The SAPI allows 64 SAPs to be specified, where bit 3 of the address field octet containing the SAPI is the least significant binary digit and bit 8 is the most significant. The SAPI values are allocated as shown in table 10.1.

Table 10.1: SAPI values

SAPI value	Related layer 3 or layer management entity
0	Call control procedures
16	Packet communication conforming to X.25 level 3 procedures
63	Layer 2 management procedures
All others	Reserved for future standardization
NOTE:	In a point-to-multipoint configuration, several Service Access Points with a SAPI value of 16 may coexist at the same time. The TEs accessing these SAPs are distinguished by the value of the TEI.

10.2.3.4 Terminal Endpoint Identifier (TEI)

See subclause 10.2.3.4 of TBR 3 [9].

10.2.3.4.1 TEI for broadcast data link connection

See subclause 10.2.3.4.1 of TBR 3 [9].

10.2.3.4.2 TEI for point-to-point data link connection

See subclause 10.2.3.4.2 of TBR 3 [9].

10.2.4 Control field formats

See subclause 10.2.4 of TBR 3 [9].

10.2.4.1 Information transfer (I) format

See subclause 10.2.4.1 of TBR 3 [9].

10.2.4.2 Supervisory (S) format

See subclause 10.2.4.2 of TBR 3 [9].

10.2.4.3 Unnumbered (U) format

See subclause 10.2.4.3 of TBR 3 [9].

10.2.5 Control field parameters and associated state variables

10.2.5.1 Poll/Final bit

See subclause 10.2.5.1 of TBR 3 [9].

10.2.5.2 Multiple frame operation - variables and sequence numbers

10.2.5.2.1 Modulus

See subclause 10.2.5.2.1 of TBR 3 [9].

10.2.5.2.2 Send state variable V(S)

Reference: ETS 300 125 [14], Part 2, subclause 3.5.2.2.

Definition: Each point-to-point data link connection endpoint has an associated V(S) when using I-frame commands. V(S) denotes the sequence number of the next I-frame to be transmitted. V(S) can take on the value 0 through n minus 1. The value of V(S) is incremented by 1 with each successive I-frame transmission, and shall not exceed V(A) by more that the maximum number of outstanding I-frames, k (see subclause 10.10.5). The value of k may be in the range $1 \leq k \leq 127$.

10.2.5.2.3 Acknowledge state variable V(A)

See subclause 10.2.5.2.3 of TBR 3 [9].

10.2.5.2.4 Send sequence number N(S)

See subclause 10.2.5.2.4 of TBR 3 [9].

10.2.5.2.5 Receive state variable V(R)

See subclause 10.2.5.2.5 of TBR 3 [9].

10.2.5.2.6 Receive sequence number N(R)

See subclause 10.2.5.2.6 of TBR 3 [9].

10.2.6 Frame types

10.2.6.1 Commands and responses

Reference: ETS 300 125 [14], Part 2, subclause 3.6.1.

Definition: The following commands and responses are used by either the user or the network data link layer entities and are represented in table 10.2. The frame types associated with each of the two applications are identified in table 10.2. Each data link connection supports the full set of commands and responses for each application implemented, except possibly for those having a note in table 10.2.

NOTE: It is not generally required from a TE conforming to this TBR, to be able to initiate data link setup by sending a SABME command frame or to respond to a received SABME frame (see also subclause 10.6.1.2). It is required however, that the TE supports at least one of the two procedures. It is also not generally required from a TE conforming to this TBR to be able to send or receive a DISC command frame.

For purposes of the LAPD procedures in each application, those frame types not identified in table 10.2 are identified as undefined command and/or response control fields.

Table 10.2: Commands and responses - modulo 128

Application	Format	Commands	Responses	Encoding 8 7 6 5 4 3 2 1								Octet
Unacknowledged and Multiple Frame acknowledged Information Transfer	Information transfer	I (Information)		N(S)							0	4
				N(R)							P	5
	Supervisory	RR (Receiver Ready)	RR (Receiver Ready)	0	0	0	0	0	0	0	1	4
				N(R)							P/F	5
		RNR (Receiver Not Ready)	RNR (Receiver Not Ready)	0	0	0	0	0	1	0	1	4
				N(R)							P/F	5
		REJ (Reject)	REJ (Reject)	0	0	0	0	1	0	0	1	4
				N(R)							P/F	5
	Unnumbered	SABME (Set Asynchronous Balanced Mode Extended) (note 1)		0	1	1	P	1	1	1	1	4
			DM (Disconnected Mode)	0	0	0	F	1	1	1	1	4
		UI (Unnumbered Information) (note 2)		0	0	0	P	0	0	1	1	4
		DISC (Disconnect) (note 3)		0	1	0	P	0	0	1	1	4
			UA (Unnumbered Acknowledgement)	0	1	1	F	0	0	1	1	4

NOTE 1: The support of sending **and** receiving an SABME command frame is not required from a TE, however it shall support at least one of the features.
NOTE 2: Sending and receiving UI frames is only required to support the Terminal Endpoint Identifier (TEI) management procedures (see subclause 10.5) and the receipt of SETUP messages on point-to-multipoint connections.
NOTE 3: The support of sending a DISC command frame is not required from a TE.

The commands and responses of table 10.2 are defined in subclauses 10.2.6.2 to 10.2.6.10.

10.2.6.2 Information (I) command

See subclause 10.2.6.2 of TBR 3 [9].

10.2.6.3 Set Asynchronous Balanced Mode Extended (SABME) command

See subclause 10.2.6.3 of TBR 3 [9].

10.2.6.4 DISConnect (DISC) command

See subclause 10.2.6.4 of TBR 3 [9].

10.2.6.5 Unnumbered Information (UI) command

See subclause 10.2.6.5 of TBR 3 [9].

10.2.6.6 Receive Ready (RR) command/response

Reference: ETS 300 125 [14], Part 2, subclause 3.6.6.

Definition: The RR supervisory frame is used by a data link layer entity to:

a) indicate it is ready to receive an I-frame;

b) acknowledge previously received I-frames numbered up to and including N(R)-1 (as defined in subclause 10.2.5); and

c) clear a busy condition that was indicated by the earlier transmission of an RNR frame by that same data link layer entity.

In addition to indicating the status of a data link layer entity, the RR command with the P bit set to 1 may be used by the data link layer entity to ask for the status of its peer data link layer entity.

10.2.6.7 REJect (REJ) command/response

See subclause 10.2.6.7 of TBR 3 [9].

10.2.6.8 Receive Not Ready (RNR) command/response

See subclause 10.2.6.8 of TBR 3 [9].

10.2.6.9 Unnumbered Acknowledgement (UA) response

See subclause 10.2.6.9 of TBR 3 [9].

10.2.6.10 Disconnected Mode (DM) response

See subclause 10.2.6.10 of TBR 3 [9].

10.3 Provision of point-to-point signalling connections

Reference and requirement: See subclause 10.3 of TBR 3 [9].

Test: No direct testing is required.

10.4 Procedures for unacknowledged information transfer

10.4.1 Transmission of unacknowledged information

Reference and requirement: See subclause 10.4.1 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test case TC14001 and annex B subclause B.4.2, TTCN test cases CPF4PHDI_T3exp, CPF5PHDI_I0T3, CPF5PHDI_T3expa, CPF6PHDI_I0, CPF7PHDI_I0 and CPF8PHDI_I0T3.

10.4.2 Receipt of unacknowledged information

Reference and requirement: See subclause 10.4.2 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test cases TC11013, TC14001, and test preamble PR37004.

10.5 Terminal Endpoint Identifier (TEI) management procedures

10.5.1 General

See subclause 10.5.1 of TBR 3 [9].

10.5.2 TEI assignment procedure

Reference and requirement: See subclause 10.5.2 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test case TC13014 and test preamble PR37004, and annex B, subclause B.4.2, TTCN test cases CPF3PHAI, CPF4Tlayer2, CPF6PHAIa, CPF6PHAIb and CPF8PHAIb.

10.5.2.1 Expiry of timer T202

Reference and requirement: See subclause 10.5.2.1 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test cases TC13008 and TC13010.

10.5.3 TEI check procedure

Reference and requirement: See subclause 10.5.3 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test cases TC14001 and TC14002.

10.5.4 TEI removal procedure

10.5.4.1 Action taken by the data link layer entity receiving the MDL-REMOVE-REQUEST primitive

Reference and requirement: See subclause 10.5.4.1 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test preamble PR31401.

10.5.4.2 Conditions for TEI removal

Reference and requirement: See subclause 10.5.4.2 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test cases TC24007, TC27031 and test preamble PR31401.

10.5.5 TEI identity verify procedure

10.5.5.1 General

See subclause 10.5.5.1 of TBR 3 [9].

10.5.5.2 Operation of the TEI identity verify procedure

Reference and requirement: See subclause 10.5.5.2 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test cases TC24007 and TC27031.

10.5.6 Formats and codes

See subclause 10.5.6 of TBR 3 [9].

10.6 Procedures for establishment and release of multiple frame operation

10.6.1 Establishment of multiple frame operation

10.6.1.1 General

Reference and requirement: See subclause 10.6.1.1 of TBR 3 [9].

Test: The test shall be conducted according to annex C, test preamble PR37004.

10.6.1.2 Establishment procedures

10.6.1.2.1 Establishment initiation

Reference: ETS 300 125 [14], Part 2, subclause 5.5.1.2.

Requirement: A data link layer entity shall initiate a request for the multiple frame operation to be set by transmitting the SABME command. All existing exception conditions shall be cleared, the retransmission counter shall be reset, and timer T200 shall then be started. All mode setting commands shall be transmitted with the P bit set to 1.

NOTE: Layer 3 initiated establishment procedures imply the discard of all outstanding DL-DATA-REQUEST primitives and all I-frames in queue.

Upon reception of the UA response with the F bit set to 1, the originator of the SABME command shall:

- reset timer T200;
- set V(S), V(R), and V(A) to 0; and
- enter the *multiple-frame-established* state and inform layer 3 using the DL-ESTABLISH CONFIRM primitive.

Upon reception of a DM response with the F bit set to 1, the originator of the SABME command shall indicate this to layer 3 by means of the DL-RELEASE-INDICATION primitive, and reset timer T200. It shall then enter the TEI-*assigned* state.

Test: The test shall be conducted according to annex C, TTCN test case TC24004 and TC25002, and annex B, subclause B.4.2, TTCN test cases CPF3PHAI, CPF4Tlayer2, CPF6PHAIa, CPF6PHAIb, CPF8PHAIb, and CPF8PHARa.

10.6.1.2.2 Establishment response

Reference: ETS 300 125 [14], Part 2, subclause 5.5.1.2.

A data link layer entity receiving an SABME command, if it is able to enter the *multiple-frame-established* state, shall:

- respond with an UA response with the F bit set to the same binary value as the P bit in the received SABME command;
- set V(S), V(R) and V(A) to 0;
- enter the *multiple-frame-established* state and inform layer 3 using the DL-ESTABLISH-INDICATION primitive;
- clear all existing exception conditions; and
- clear any existing peer receiver busy condition.

Test: The test shall be conducted according to annex C, TTCN test case TC240x1 and annex B, subclause B.4.2, TTCN test cases CPF3PHAI, CPF4Tlayer2, CPF6PHAIa, CPF6PHAIb and CPF8PHAIb.

10.6.1.3 Procedure on expiry of timer T200

Reference and requirement: See subclause 10.6.1.3 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test case TC25005.

10.6.2 Termination of multiple frame operation

Reference and requirement: See subclause 10.6.2 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test case TC27012.

10.7 Procedures for information transfer in multiple frame operation

See subclause 10.7 of TBR 3 [9].

10.7.1 Transmitting I-frames

Reference: ETS 300 125 [14], Part 2, subclause 5.6.1.

Requirement: Information received by the data link layer entity from layer 3 by means of a DL-DATA-REQUEST primitive shall be transmitted in an I-frame with the P bit set to 0. The control field parameters N(S) and N(R) shall be assigned the values V(S) and V(R), respectively. V(S) shall be incremented by 1 at the end of the transmission of the I-frame.

If timer T200 is not running at the time of transmission of an I-frame, it shall be started. If V(S) is equal to V(A) plus k (where k is the maximum number of outstanding I-frames - see subclause 10.10.5), the data link layer entity shall not transmit any new I-frames, but may retransmit an I-frame as a result of the error recovery procedures as described in subclauses 10.7.4 and 10.7.6.

Test: The test shall be conducted according to annex C, TTCN test case TC27003.

10.7.2 Receiving I-frames

Reference and requirement: See subclause 10.7.2 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test cases TC27003, TC28012 and TC28406.

10.7.2.1 P bit set to 1

Reference and requirement: See subclause 10.7.2.1 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test step CS57101.

10.7.2.2 P bit set to 0

Reference: ETS 300 125 [14], Part 2, subclause 5.6.2.2.

Requirement: If the P bit of the received I-frame was set to 0 and:

a) if the data link layer entity is still not in an own receiver busy condition:

- if no frame is available for transmission or if an I-frame is available for transmission but a peer receiver busy condition exists, the data link layer entity shall transmit an RR response with the F bit set to 0; or

- if an I-frame is available for transmission and no peer receiver busy condition exists, the data link layer entity shall transmit the I-frame with the value of N(R) set to the current value of V(R) as defined in subclause 10.7.1.

b) if, on receipt of this I-frame, the data link layer entity is now in an own receiver busy condition, it shall transmit an RNR response with the F bit set to 0.

Test: The test shall be conducted according to annex C, TTCN test case TC27003.

10.7.3 Receiving acknowledgements

Reference: ETS 300 125 [14], Part 2, subclause 5.6.3.2.

Requirement: On receipt of a valid I-frame or supervisory frame (RR, RNR, or REJ), even in the own receiver busy, or timer recovery conditions, the data link layer entity shall treat the N(R) contained in this frame as an acknowledgement for all the I-frames it has transmitted with an N(S) up to and including the received N(R)-1. V(A) shall be set to N(R). The data link layer entity shall reset the timer T200 on receipt of a valid I-frame or supervisory frame with the N(R) higher than V(A) (actually acknowledging some I-frames), or an REJ frame with an N(R) equal to V(A).

If a supervisory frame with the P bit set to 1 has been transmitted and not acknowledged, timer T200 shall not be reset.

Upon receipt of a valid I-frame, timer T200 shall not be reset if the data link layer entity is in the peer receiver busy condition.

If timer T200 has been reset by the receipt of an I, RR, or RNR frame, and if there are outstanding I-frames still unacknowledged, the data link layer entity shall restart timer T200. If timer T200 then expires, the data link layer entity shall follow the recovery procedure as defined in subclause 10.7.6 with respect to the unacknowledged I-frames.

Test: The test shall be conducted according to annex C, TTCN test cases TC27003 and TC27004.

10.7.4 Receiving REJ frames

Reference: ETS 300 125 [14], Part 2, subclause 5.6.4.

Requirement: On receipt of a valid REJ frame, the data link layer entity shall act as follows:

a) if it is not in the timer recovery condition:

- clear an existing peer receiver busy condition;
- set its V(S) and its V(A) to the value of N(R) contained in the REJ frame control field;
- stop timer T200;
- if it was an REJ command frame with the P bit set to 1, transmit an appropriate supervisory response frame with the F bit set to 1 (see subclause 10.7.5);
- transmit the corresponding I-frame as soon as possible, as defined in subclause 10.7.1;

b) if it is in the timer recovery condition and it was an REJ response frame with the F bit set to 1:

- clear an existing peer receiver busy condition;
- set its V(S) and its V(A) to the value of N(R) contained in the REJ frame control field;
- stop timer T200;
- enter the multiple-frame-established state; and
- transmit the corresponding I-frame as soon as possible, as defined in subclause 10.2.6.2;

c) if it is in the timer recovery condition and it was an REJ frame other than an REJ response frame with the F bit set to 1:

- clear an existing peer receiver busy condition;
- set its V(A) to the value of the N(R) contained in the REJ frame control field; and
- if it was an REJ command frame with the P bit set to 1, transmit an appropriate supervisory response frame with the F bit set to 1.

All outstanding unacknowledged I-frames, commencing with the I-frame identified in the received REJ frame shall be transmitted.

Test: The test shall be conducted according to annex C, TTCN test cases TC27011, TC28005 and TC28424.

10.7.5 Receiving RNR frames

See subclause 10.7.5 of TBR 3 [9].

10.7.5.1 Receiving a valid RNR command or response

Requirement: After receiving a valid RNR command or response, if the data link layer entity is not engaged in a mode-setting operation, it shall set a peer receiver busy condition and then:

- if it was an RNR command with the P bit set to 1, it shall transmit an appropriate supervisory response (see subclause 10.7.5.5) with the F bit set to 1; and
- if it was an RNR response with the F bit set to 1, an existing timer recovery condition shall be cleared.

The data link layer entity shall take note of the peer receiver busy condition and not transmit any I-frames to the peer which has indicated the busy condition.

Test: The test shall be conducted according to annex C, TTCN test case TC27404.

10.7.5.2 Expiry of timer T200 during "peer receiver busy"

Requirement: If timer T200 expires, the data link layer entity shall:

- if it is not yet in a timer recovery condition, enter the timer recovery condition and reset the retransmission count variable; or
- if it is already in a timer recovery condition, add one to its retransmission count variable.

The data link layer entity shall then:

a) if the value of the retransmission count variable is less than N200:

- transmit an appropriate supervisory command (see subclause 10.7.5.5) with a P bit set to 1;
- restart timer T200; and

b) if the value of the retransmission count variable is equal to N200, initiate a re-establishment procedure as defined in subclause 10.8, and indicate this by means of the MDL-ERROR-INDICATION primitive to the connection management entity.

Test: The test shall be conducted according to annex C test cases TC27411 and TC27417.

10.7.5.3 Receiving a valid RNR command or response during "peer receiver busy"

Requirement: See subclause 10.7.5.3 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test case TC27414.

10.7.5.4 Receiving a valid RR or REJ command or response during "peer receiver busy"

Requirement 1: The data link layer entity receiving and RR or REJ supervisory command frame with the P bit set to 1 shall respond, within a time less than the limit specified in subclause 10.10.7, with an appropriate supervisory response frame (see subclause 10.7.5.5) with the F bit set to 1 and clear the peer receiver busy condition.

Upon receipt of an RR or REJ response with the F bit set to 1, the data link layer entity shall reset timer T200, and clear the peer receiver busy condition.

Test: The test shall be conducted according to annex C, TTCN test cases TC27404 and TC27412.

Requirement 2: The data link layer entity receiving an RR or REJ supervisory frame with the P/F bit set to 0 shall clear the peer receiver busy condition.

After clearing the peer receiver busy condition the data link layer entity may transmit new I-frames or retransmit I-frames as defined in subclause 10.7.1 or subclause 10.7.4 respectively.

Test: The test shall be conducted according to annex C, TTCN test cases TC27011 and TC27413.

10.7.5.5 Appropriate supervisory response frame

Requirement: In subclauses 10.7.1 to 10.7.4, if the data link layer entity is not in an own receiver busy condition and is in a reject exception condition (that is, an N(S) sequence error has been received, and an REJ frame has been transmitted, but the requested I-frame has not been received), the appropriate supervisory frame shall be the RR frame.

If the data link layer entity is not in an own receiver busy condition but is in an N(S) sequence error exception condition (that is, an N(S) sequence error has been received but an REJ frame has not been transmitted), the appropriate supervisory frame shall be the REJ frame.

If the data link layer entity is in its own receiver busy condition, the appropriate supervisory frame shall be the RNR frame.

Otherwise, the appropriate supervisory frame shall be the RR frame.

NOTE**:** It is not possible to replicate the conditions required to bring the IUT into the state required to perform a test, and therefore no test is specified.

10.7.6 Waiting acknowledgement

Reference: ETS 300 125 [14], Part 2, subclause 5.6.7.

Requirement: The data link layer entity shall maintain an internal retransmission count variable.

If timer T200 expires, the data link layer entity shall:

- if it is not yet in the timer recovery condition, enter the timer recovery condition and reset the retransmission count variable; or

- if it is already in the timer recovery condition, add one to its retransmission count variable.

The data link layer entity shall then:

a) if the value of the retransmission count variable is less than N200:

   - restart timer T200; and either

   - transmit an appropriate supervisory command with the P bit set to 1; or

   - retransmit the last transmitted I-frame (V(S)-1) with the P bit set to 1; or

b) if the value of the retransmission count variable is equal to N200, initiate a re-establishment procedure as defined in subclause 10.8.

The timer recovery condition is cleared when the data link layer entity receives a valid supervisory frame response with the F bit set to 1. If the received supervisory frame N(R) is within the range from its current V(A) to its current V(S) inclusive, it shall set its V(S) to the value of the received N(R). Timer T200 shall be reset if the received supervisory frame response is an RR or REJ response, and then the data link layer entity shall resume with I-frame transmission or retransmission, as appropriate. Timer T200 shall be reset and restarted if the received supervisory response is an RNR response, to proceed with the enquiry process according to subclause 10.7.5.

Test: The test shall be conducted according to annex C, TTCN test cases TC27015, TC27019, TC27411, TC27417 and TC28005.

10.8 Re-establishment of multiple frame operation

Reference: ETS 300 125 [14], Part 2, subclause 5.7.2.

Requirement: In all re-establishment situations, the data link layer entity shall follow the procedures defined in subclause 10.6.1.

If the data link layer entity supports transmission of an SABME command frame (see subclause 10.2.6.1), all locally generated conditions for re-establishment shall cause the transmission of the SABME.

If the data link layer entity does not support transmission of an SABME command frame (see subclause 10.2.6.1), the data link layer entity shall perform no action until the peer entity initiates re-establishment of the data link.

In the case of data link layer and peer initiated re-establishment, the data link layer entity shall also:

- if V(S)>V(A) prior to re-establishment discard all I queues.

Test: The test shall be conducted according to annex C, TTCN test case TC27022.

10.9 Exception condition reporting and recovery

10.9.1 N(S) sequence error

Reference and requirement: See subclause 10.9.1 of TBR 3 [9].

Test: The test shall be conducted according to annex C, TTCN test cases TC27027 and TC27028.

10.9.2 Invalid frame condition

Reference: ETS 300 125 [14], Part 2, subclause 5.8.4.

Requirement: Any frame received which is invalid or incompatible (as defined in subclause 10.1.9) shall be discarded, and no action shall be taken as a result of that frame.

Test: The test shall be conducted according to annex C, TTCN test cases TC27058 and TC24020.

10.9.3 Frame rejection condition

Reference: ETS 300 125 [14], Part 2, subclause 5.8.5.

Requirement: A frame rejection condition results from the receipt of an invalid N(R).

Upon occurrence of a frame rejection condition whilst in the multiple frame operation, the data link layer entity, if it supports transmission of an SABME command frame (see subclause 10.2.6.1), shall initiate re-establishment (see subclause 10.8).

If the data link layer entity does not support transmission of an SABME command frame, it shall perform no action until the peer entity initiates re-establishment of the data link.

Test: The test shall be conducted according to annex C, TTCN test cases TC27040, TC27043 and TC27046.

10.9.4 Multiple-assignment of TEI value

Reference: ETS 300 125 [14], Part 2, subclause 5.8.8.

Requirement: A data link layer entity supporting receipt of UA response frames (see subclause 10.2.6.1) shall assume multiple-assignment of a TEI value and initiate recovery as specified below by:

a) the receipt of a UA response frame whilst in the *multiple-frame-established* state;

b) the receipt of a UA response frame whilst in the *timer recovery* state;

c) the receipt of a UA response frame whilst in the TEI-*assigned* state.

A data link layer entity, after assuming multiple-assignment of a TEI value shall inform the connection management entity by means of the MDL-ERROR-INDICATION primitive.

Test: The test shall be conducted according to annex C, TTCN test case TC27031.

10.10 List of system parameters

Reference: ETS 300 125 [14], Part 2, subclause 5.9.

Definition: The system parameters listed below are associated with each individual SAP.

10.10.1 Timer T200

See subclause 10.10.1 of TBR 3 [9].

10.10.2 Maximum number of retransmissions (N200)

See subclause 10.10.2 of TBR 3 [9].

10.10.3 Maximum number of octets in an information field (N201)

Reference: ETS 300 125 [14], Part 2, subclause 5.9.3.

Definition: The maximum number of octets in an information field (N201) is a system parameter:

- for a SAP supporting signalling (SAPI=0), the value shall be 260 octets,
- for a SAP supporting packet communication conforming to X.25 level 3 procedures (SAPI=16), the value shall be 260 octets, if the TE is operating in a physical point-to-multipoint environment.

Requirement: The manufacturer shall provide a declaration that the maximum number of octets will not be exceeded.

Test: No specific test is provided for this requirement.

10.10.4 Maximum number of transmission of the TEI identity request message (N202)

See subclause 10.10.4 of TBR 3 [9].

10.10.5 Maximum number of outstanding I-frames (k)

Reference: ETS 300 125 [14], Part 2, subclause 5.9.5.

Definition: The maximum number (k) of sequentially numbered I-frames that may be outstanding (that is, unacknowledged) at any given time is a system parameter, which shall be in the range between 1 and 127 (inclusive) for extended (modulo 128) operation:

- for an SAP supporting basic access (16 kbit/sec) signalling, the value is 1;
- for an SAP supporting Packet communication, no specific value is required.

NOTE: In subclause 5.9.5 of ETS 300 125 [14] a value of 3 is recommended.

10.10.6 Timer T202

See subclause 10.10.6 of TBR 3 [9].

10.10.7 Layer 2 response time

Reference and requirement: See subclause 10.10.7 of TBR 3 [9].

NOTE: This limit applies only under test conditions as described in annex C. In conditions of actual use, the layer 2 response time may be greater, because of queuing of outgoing frames and contention for use of the D-channel.

Test: The requirement is tested implicitly by all the test cases in the layer 2 test suite.

11 Layer 3 D-channel requirements

The following clauses contain elements of procedure that are expressed in the form of definitions. These elements of procedure do not form requirements in their own right and, therefore, do not have associated conformance tests. However, these elements are used as components for procedures that are requirements.

Several configurations of accessing the PH by a TE, using the layer 3 D-channel protocol, have been identified in the scope and in clause 4 (e.g. use of B- or D-channel, use of semi-permanent B-channel and others). These configurations have associated items in the general requirements tables of annex A. The elements and components of procedures of this clause need not be requirements or need not be requirements in total for a given access configuration. Requirements tables of annex A express the applicability of the elements and procedures by giving them a conditional status, depending on these items.

To ensure that the applicable requirements are satisfied, it is necessary for a TE to implement these elements of procedure in the manner specified within the associated definition. The tests for requirements implicitly test the elements associated with a definition.

The requirements of the various subclauses of clause 11 (excluding subclause 11.4.6) apply only to messages that carry the protocol discriminator coded as "Q.931 (I.451) user-network call control message" and that pass the requirements defined in subclause 11.4.6.

NOTE: The elements of this clause are only defined to be used for the access of the PH (packet mode bearer service). Different use of the layer 3 D-channel protocol, e.g. for other bearer services, is not precluded.

11.1 Overview of call control

Unless otherwise noted, the following state definitions are equal to the corresponding state definitions of TBR 3 [9]. However, some of the state definitions of TBR 3 [9] have been deleted, because they are not applicable to the call control for the access of the PH.

11.1.1 Call states at the user side of the interface

11.1.1.1 Null state (U0)

Reference: ETS 300 102-1 [13], subclause 2.1.1.1.

Definition: See subclause 11.1.1.1 of TBR 3 [9].

11.1.1.2 Call initiated (U1)

Reference: ETS 300 102-1 [13], subclause 2.1.1.2.

Definition: See subclause 11.1.1.2 of TBR 3 [9].

11.1.1.3 Call proceeding (U3)

Reference: ETS 300 102-1 [13], subclause 2.1.1.4.

Definition: See subclause 11.1.1.4 of TBR 3 [9].

11.1.1.4 Call present (U6)

Reference: ETS 300 102-1 [13], subclause 2.1.1.6.

Definition: See subclause 11.1.1.6 of TBR 3 [9].

11.1.1.5 Call received (U7)

Reference: ETS 300 102-1 [13], subclause 2.1.1.7.

Definition: See subclause 11.1.1.7 of TBR 3 [9].

11.1.1.6 Connect request (U8)

Reference: ETS 300 102-1 [13], subclause 2.1.1.8.

Definition: See subclause 11.1.1.8 of TBR 3 [9].

11.1.1.7 Incoming call proceeding (U9)

Reference: ETS 300 102-1 [13], subclause 2.1.1.9.

Definition: See subclause 11.1.1.9 of TBR 3 [9].

11.1.1.8 Active (U10)

Reference: ETS 300 102-1 [13], subclause 2.1.1.10.

Definition: See subclause 11.1.1.10 of TBR 3 [9].

11.1.1.9 Disconnect request (U11)

Reference: ETS 300 102-1 [13], subclause 2.1.1.11.

Definition: See subclause 11.1.1.11 of TBR 3 [9].

11.1.1.10 Disconnect indication (U12)

Reference: ETS 300 102-1 [13], subclause 2.1.1.12.

Definition: See subclause 11.1.1.12 of TBR 3 [9].

11.1.1.11 Release request (U19)

Reference: ETS 300 102-1 [13], subclause 2.1.1.15.

Definition: See subclause 11.1.1.15 of TBR 3 [9].

11.1.2 Network call states

11.1.2.1 Null state (N0)

Reference: ETS 300 102-1 [13], subclause 2.1.2.1.

Definition: See subclause 11.1.2.1 of TBR 3 [9].

11.1.2.2 Call initiated (N1)

Reference: ETS 300 102-1 [13], subclause 2.1.2.2.

Definition: See subclause 11.1.2.2 of TBR 3 [9].

11.1.2.3 Outgoing call proceeding (N3)

Reference: ETS 300 102-1 [13], subclause 2.1.2.4.

Definition: See subclause 11.1.2.4 of TBR 3 [9].

11.1.2.4 Call present (N6)

Reference: ETS 300 102-1 [13], subclause 2.1.2.6.

Definition: See subclause 11.1.2.6 of TBR 3 [9].

11.1.2.5 Call received (N7)

Reference: ETS 300 102-1 [13], subclause 2.1.2.7.

Definition: See subclause 11.1.2.7 of TBR 3 [9].

11.1.2.6 Connect request (N8)

Reference: ETS 300 102-1 [13], subclause 2.1.2.8.

Definition: See subclause 11.1.2.8 of TBR 3 [9].

11.1.2.7 Incoming call proceeding (N9)

Reference: ETS 300 102-1 [13], subclause 2.1.2.9.

Definition: See subclause 11.1.2.9 of TBR 3 [9].

11.1.2.8 Active (N10)

Reference: ETS 300 102-1 [13], subclause 2.1.2.10.

Definition: See subclause 11.1.2.10 of TBR 3 [9].

11.1.2.9 Disconnect request (N11)

Reference: ETS 300 102-1 [13], subclause 2.1.2.11.

Definition: See subclause 11.1.2.11 of TBR 3 [9].

11.1.2.10 Disconnect indication (N12)

Reference: ETS 300 102-1 [13], subclause 2.1.2.12.

Definition: See subclause 11.1.2.12 of TBR 3 [9].

11.1.2.11 Release request (N19)

Reference: ETS 300 102-1 [13], subclause 2.1.2.15.

Definition: See subclause 11.1.2.15 of TBR 3 [9].

11.1.2.12 Call abort (N22)

Reference: ETS 300 102-1 [13], subclause 2.1.2.16.

Definition: See subclause 11.1.2.16 of TBR 3 [9].

11.1.3 States associated with the global call reference

11.1.3.1 Call states at the user side of the interface

11.1.3.1.1 Null (Rest 0)

Reference: ETS 300 102-1 [13], subclause 2.4.1.1.

Definition: See subclause 11.1.3.1.1 of TBR 3 [9].

11.1.3.1.2 Restart (Rest 2)

Reference: ETS 300 102-1 [13], subclause 2.4.1.3.

Definition: See subclause 11.1.3.1.2 of TBR 3 [9].

11.1.3.2 Call states at the network side of the interface

The states which may exist on the network side of the user-network interface.

11.1.3.2.1 Null (Rest 0)

Reference: ETS 300 102-1 [13], subclause 2.4.2.1.

Definition: See subclause 11.1.3.2.1 of TBR 3 [9].

11.1.3.2.2 Restart request (Rest 1)

Reference: ETS 300 102-1 [13], subclause 2.4.2.2.

Definition: See subclause 11.1.3.2.2 of TBR 3 [9].

11.2 Message functional definitions and content

Reference: ETS 300 102-1 [13], clause 3, ETS 300 007 [10], annex B.

This provides an overview of the layer 3 message structure. Each definition includes:

a) a brief description of the message direction and use. All messages have local significance, i.e. relevant only in the originating or terminating access;

b) a table listing the codeset 0 information elements in the order of their appearance in the message (same relative order for all Message types). For each information element the table indicates:

   1) the direction which it may be sent; i.e. user-to-network ("u $\rightarrow$ n"), network-to-user ("n $\rightarrow$ u"), or both;
   2) whether inclusion is mandatory ("M") or optional ("O") with a reference to notes explaining the circumstances under which the information element is included;
   3) the length of the information element (or permissible range of lengths), in octets, where "*" denotes an undefined maximum length, which may be network or service dependent.

   NOTE 1: All messages may contain information elements from codesets 5, 6 and 7 and corresponding locking and non-locking shift information elements which comply with the coding rules specified in subclauses 11.3.5.2 to 11.3.5.4 of TBR 3 [9]. None of these information elements, however, are listed in any of the tables in subclause 11.2 of this TBR.

c) further explanatory notes, as necessary.

NOTE 2: Table 11.1 summarizes the messages for packet mode connection control that are part of the requirements of this TBR.

NOTE 3: It is strongly recommended that manufacturers use other messages or information elements only in accordance with definitions and procedures in national, European and international standards. Terminals that use messages or information elements that result in violations of the essential requirements are liable to be disconnected or required to be withdrawn from the market. The use of certain other messages or information elements may be the subject of specific requirements in other TBRs or national approval requirements.

Table 11.1: Messages for packet mode connection control

Message type	Reference
Call establishment messages:	
ALERTING	11.2.1
CALL PROCEEDING	11.2.2
CONNECT	11.2.3
CONNECT ACKNOWLEDGE	11.2.4
SETUP	11.2.8
Call clearing messages:	
DISCONNECT	11.2.5
RELEASE	11.2.6
RELEASE COMPLETE	11.2.7
Miscellaneous messages:	
STATUS	11.2.9
STATUS ENQUIRY	11.2.10

11.2.1 Alerting

Reference: ETS 300 102-1 [13], subclause 3.1.1, ETS 300 007 [10], clause B.1.

Definition: This message may be sent by the called user to the network to indicate that called user alerting has been initiated. See table 11.2.

Table 11.2: ALERTING message content

Message type: ALERTING
Significance: local
Direction: user to network

Information Element	Direction	Type	Length
Protocol discriminator	u > n	M	1
Call reference	u > n	M	2
Message type	u > n	M	1
Channel identification	u > n	O (se note)	2 - 3
NOTE: Mandatory if this message is the first message in response to SETUP, unless the user accepts the B-channel indicated in the SETUP message.			

11.2.2 Call proceeding

Reference: ETS 300 102-1 [13], subclause 3.1.2, ETS 300 007 [10], clause B.2.

Definition: This message is sent by the called user to the network or by the network to the calling user to indicate that the requested call establishment has been initiated. See table11.3.

Table 11.3: Call proceeding message content

Message type: CALL PROCEEDING
Significance: local
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1
Channel identification	both	O (see note)	2 - 3
NOTE: Mandatory in the network-to-user direction if this message is the first message in response to SETUP. Mandatory in the user-to-network direction if this message is the first message in response to SETUP, unless the user accepts the B-channel indicated in the SETUP message.			

11.2.3 Connect

Reference: ETS 300 102-1 [13], subclause 3.1.4, ETS 300 007 [10], clause B.3.

Definition: This message is sent by the called user to the network and by the network to the calling user to indicate acceptance of the call. See table 11.4.

Table 11.4: Connect message content

Message type: CONNECT
Significance: local
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1
Channel identification	both	O (see note)	2 - 3
NOTE: Mandatory in the network-to-user direction if this message is the first message in response to SETUP. Mandatory in the user-to-network direction if this message is the first message in response to SETUP, unless the user accepts the B-channel indicated in the SETUP message.			

11.2.4 Connect acknowledge

Reference: ETS 300 102-1 [13], subclause 3.1.5, ETS 300 007 [10], clause B.4.

Definition: This message is sent by the network to the called user to indicate the user has been awarded the call. It may also be sent by the calling user to the network to allow symmetrical call control procedures. See table 11.5.

Table 11.5: Connect acknowledge message content

Message type: CONNECT ACKNOWLEDGE
Significance: local
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1

11.2.5 Disconnect

Reference: ETS 300 102-1 [13], subclause 3.1.6, ETS 300 007 [10], clause B.5.

Definition: This message is sent by the user to request the network to clear a call or is sent by the network to indicate that the call clearing has been initiated. See table 11.6.

Table 11.6: Disconnect message content

Message type: DISCONNECT
Significance: local
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1
Cause	both	M	4 - 32

11.2.6 Release

Reference: ETS 300 102-1 [13], subclause 3.1.11, ETS 300 007 [10], clause B.7.

Definition: This message is sent by the user or the network to indicate that the equipment sending the message has disconnected the channel (if any) and intends to release the channel and the Call reference, and that the receiving equipment should release the channel and prepare to release the Call reference after sending RELEASE COMPLETE message. This message is also sent by the network to the called user to indicate that the call is awarded on either the D-channel or an existing channel and that the network intends to release the call reference. See table 11.7.

Table 11.7: Release message content

Message type: RELEASE
Significance: local (see note 1)
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1
Cause	both	O (see note 2)	2 - 32
NOTE 1: This message has a local significance; however, it may carry information of global significance when used as the first call clearing message.			
NOTE 2: Mandatory in the first call clearing message, including when the RELEASE message is sent as a result of an error handling condition.			

11.2.7 Release complete

Reference: ETS 300 102-1 [13], subclause 3.1.12, ETS 300 007 [10], clause B.8.

Definition: This message is sent by the user or the network to indicate that the equipment sending the message has released the channel (if any) and call reference, the channel is available for re-use and the receiving equipment shall release the call reference. See table 11.8.

Table 11.8: Release complete message content

Message type: RELEASE COMPLETE
Significance: local (see note 1)
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1
Cause	both	O (see note 2)	2 - 32
NOTE 1: This message has a local significance; however, it may carry information of global significance when used as the first call clearing message.			
NOTE 2: Mandatory in the first call clearing message, including when the RELEASE COMPLETE message is sent as a result of an error handling condition.			

11.2.8 Setup

Reference: ETS 300 102-1 [13], subclause 3.1.16, ETS 300 007 [10], clause B.9.

Definition: This message is sent by the calling user to the network and by the network to the called user to initiate call establishment. See table 11.9.

Table 11.9: Setup message content

Message type: SETUP
Significance: local
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1
Bearer capability	both	M (see note 1)	6 - 7
Channel identification	both	O (see note 2)	2 - 3
Calling party number	both	O (see note 3)	2 - 24
Calling party subaddress	both	O (see note 4)	2 - 23
Called party number	n > u	O (see note 5)	2 - 23
Called party subaddress	n > u	O (see note 6)	2 - 23

NOTE 1: Used to identify the ISDN packet mode bearer capability.
NOTE 2: Mandatory in the network-to-user direction. Included in the user-to-network direction when the user wants to indicate a channel. If not included, its absence is interpreted as "any channel acceptable".
NOTE 3: Included in the user-to-network direction depending on the user/network identification requirements. Included in the network-to-user direction, if the network implements CCITT X.25/ETS 300 102-1 [13] information element mapping and provides indication to the called user of the calling party number.
NOTE 4: Included in the user-to-network direction depending on the user/network identification requirements. Included in the network-to-user direction, if the network implements CCITT X.25/ETS 300 102-1 [13] information element mapping and provides indication to the called user of the calling party subaddress.
NOTE 5: Included in the network-to-user direction, if the network implements CCITT X.25/ETS 300 102-1 [13] information element mapping and provides indication to the called user of the called party number. Ignored by the network, if included in the user-to-network direction.
NOTE 6: Included in the network-to-user direction, if the network implements CCITT X.25/ETS 300 102-1 [13] information element mapping and provides indication to the called user of the called party subaddress. Ignored by the network, if included in the user-to-network direction.

11.2.9 Status

Reference: ETS 300 102-1 [13], subclause 3.1.18, ETS 300 007 [10], clause B.10.

Definition: This message is sent by the user or the network in response to a STATUS ENQUIRY message or at any time to report certain error conditions listed in subclause 5.8 of ETS 300 102-1 [13]. See table 11.10.

Table 11.10: Status message content

Message type: STATUS
Significance: local
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1
Cause	both	M	4 - 32
Call state	both	M	3

11.2.10 Status enquiry

Reference: ETS 300 102-1 [13], subclause 3.1.19, ETS 300 007 [10], clause B.11.

Definition: This message is sent by the user or the network at any time to solicit a STATUS message from the peer layer 3 entity. Sending a STATUS message in response to a STATUS ENQUIRY message is mandatory. See table 11.11.

Table 11.11: Status enquiry message content

Message type: STATUS ENQUIRY
Significance: local
Direction: both

Information Element	Direction	Type	Length
Protocol discriminator	both	M	1
Call reference	both	M	2
Message type	both	M	1

11.2.11 Messages used with the global call reference

See subclause 11.2.21 of TBR 3 [9].

11.2.11.1 Restart

See subclause 11.2.21.1 of TBR 3 [9].

11.2.11.2 Restart acknowledge

See subclause 11.2.21.2 of TBR 3 [9].

11.3 General message format and information elements coding

The figures and text in this subclause describe message contents. Within each octet, the bit designated "bit 1" is transmitted first, followed by bits 2, 3, 4, etc. Similarly, the octet shown at the top of each figure is sent first.

11.3.1 Overview

See subclause 11.3.1 of TBR 3 [9].

11.3.2 Protocol discriminator

See subclause 11.3.2 of TBR 3 [9].

11.3.3 Call reference

See subclause 11.3.3 of TBR 3 [9].

11.3.4 Message type

Reference: ETS 300 102-1 [13], subclause 4.4, ETS 300 007 [10], clause C.3.

Definition: The purpose of the Message type is to identify the function of the message being sent.

The Message type is the third part of every message. The Message type is coded as shown in figure 11.1 and table 11.12.

Bit 8 is reserved for possible future use as an extension bit.

8	7	6	5	4	3	2	1	Octet
0	Message type							1

Figure 11.1: Message type

Table 11.12: Message types

Bits 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	Escape to nationally specific Message type (see note).
0	0	0	-	-	-	-	-	**Call establishment messages:**
			0	0	0	0	1	ALERTING
			0	0	0	1	0	CALL PROCEEDING
			0	0	1	1	1	CONNECT
			0	1	1	1	1	CONNECT ACKNOWLEDGE
			0	0	1	0	1	SETUP
0	1	0	-	-	-	-	-	**Call clearing messages:**
			0	0	1	0	1	DISCONNECT
			0	1	1	0	1	RELEASE
			1	1	0	1	0	RELEASE COMPLETE
			0	0	1	1	0	RESTART
			0	1	1	1	0	RESTART ACKNOWLEDGE
0	1	1	-	-	-	-	-	**Miscellaneous messages:**
			1	1	1	0	1	STATUS
			1	0	1	0	1	STATUS ENQUIRY

NOTE: When allocating codes for national Message types the following principle is applied for the first octet following the escape to nationally specific type:
1 0 X X XXXX: National standard
1 1 X X XXXX: ETSI standard

11.3.5 Other information elements

11.3.5.1 Coding rules

See subclause 11.3.5.1 of TBR 3 [9].

11.3.5.1.1 Codeset 0

Reference: ETS 300 102-1 [13], subclause 4.5.1.1, ETS 300 007 [10], clause C.4.

Definition: The information elements belonging to codeset 0 are listed in table 11.13, which also gives the coding of the information identifier bits.

Table 11.13: Information element identifier coding

Bits 8	7	6	5	4	3	2	1		Maximum length octets (see note 1)
1	:	:	:	-	-	-	-	**Single octet information elements:**	
	0	0	0	-	-	-	-	Reserved	
	0	0	1	-	-	-	-	Shift (see note 2)	1
0	:	:	:	:	:	:	:	**Variable length information elements:**	
	0	0	0	0	1	0	0	Bearer capability	7
	0	0	0	1	0	0	0	Cause (see note 2)	32
	0	0	1	0	1	0	0	Call state	3
	0	0	1	1	0	0	0	Channel identification (see note 2)	3
	1	1	0	1	1	0	0	Calling party number	24
	1	1	0	1	1	0	1	Calling party subaddress	23
	1	1	1	0	0	0	0	Called party number	23
	1	1	1	0	0	0	1	Called party subaddress	23
	1	1	1	1	0	0	1	Restart indicator	3
	1	1	1	1	1	1	1	Escape for extension (see note 3)	
All other values are reserved (see note 4).									

NOTE 1: The length limits described for the variable length information elements below take into account only the present CCITT standardized coding values. Future enhancements and expansions to this TBR will not be restricted to these limits.
NOTE 2: This information element may be repeated.
NOTE 3: This escape mechanism is limited to codesets 5, 6 and 7 (see subclause 11.3.5.2 of TBR 3 [9]). When the escape for extension is used, the information element identifier is contained in octet group 3 and the content of the information element follows in the subsequent octets as shown in figure 11.2.
NOTE 4: The reserved values with bits 5-8 coded "0 0 0 0" are for future information elements for which comprehension by the receiver is required (see subclause 11.4.6.5.1).

8	7	6	5	4	3	2	1	Octet
	Protocol discriminator							
0	1	1	1	1	1	1	1	1
Length of information element contents								2
1 ext	Information element identifier							3
Contents of information element								4 etc.

Figure 11.2: Information element format using escape for extension

11.3.5.2 Extensions of codesets

See subclause 11.3.5.2 of TBR 3 [9].

11.3.5.3 Locking shift procedure

See subclause 11.3.5.3 of TBR 3 [9].

11.3.5.4 Non-locking shift procedure

See subclause 11.3.5.4 of TBR 3 [9].

11.3.5.5 Bearer capability

Reference: ETS 300 102-1 [13], subclause 4.5.5, ETS 300 007 [10], subclauses 7.1.2.1 and 7.2.2.3.1.

Definition: The purpose of the Bearer capability information element is to indicate a requested CCITT Recommendation I.231 bearer service to be provided by the network. It contains only information which may be used by the network.

The Bearer capability information element is coded as shown in figure 11.3 and table 11.14.

No default Bearer capability may be assumed by the absence of this information element.

The maximum length of this information element is 6 octets when CCITT recommended coding is used.

8	7	6	5	4	3	2	1	Octet
	Bearer capability							
0	0	0	0	0	1	0	0	1
	Information element identifier							
Length of the Bearer capability contents								2
1 ext	coding standard		information transfer capability					3
0/1 ext	transfer mode		information transfer rate					4
1 ext	1 0 layer 2 ident.		user information layer 2 protocol					6
1 ext	1 1 layer 3 ident.		user information layer 3 protocol					7

NOTE 1: The indicated octets shall always be present.

NOTE 2: In TBR 3 [9], additional octets for the Bearer capability information element are defined (octets 4a, 4b, 5, 5a, 5b, 5c and 5d). The inclusion of these octets is not recommended. However, for the purposes of this TBR, the presence of these octets is not considered to be essential.

Figure 11.3: Bearer capability information element

Table 11.14: Bearer capability information element

Coding Standard (octet 3)

Bits **7 6**	
0 0	CCITT recommended coding

All other values are reserved.

Information transfer capability (octet 3)

Bits **5 4 3 2 1**	
0 1 0 0 0	unrestricted digital information

All other values are reserved.

Transfer mode (octet 4)

Bits **7 6**	
1 0	packet mode

All other values are reserved.

Information transfer rate (octet 4, bits 5 to 1)

Bits **5 4 3 2 1**		
0 0 0 0 0	packet-mode calls	

All other values are reserved.

User information layer 2 protocol (octet 6)

Bits **5 4 3 2 1**		
0 0 0 1 0	CCITT Recommendation Q.921 (I.441).	(see note 1)
0 0 1 1 0	CCITT Recommendation X.25, link level.	(see note 2)

All other values are reserved.

NOTE 1: This value will be used by the network in the incoming SETUP message, if the incoming virtual call can only be established on the D-channel.

NOTE 2: This value shall be used by the TE in the outgoing SETUP message. The value will be used by the network in all cases where note 1 does not apply.

User information layer 3 protocol (octet 7)

Bits **5 4 3 2 1**	
0 0 1 1 0	CCITT Recommendation X.25, packet layer.

All other values are reserved.

11.3.5.6 Call state

See subclause 11.3.5.7 of TBR 3 [9].

11.3.5.7 Called party number

See subclause 11.3.5.8 of TBR 3 [9].

11.3.5.8 Called party subaddress

See subclause 11.3.5.9 of TBR 3 [9].

11.3.5.9 Calling party number

Reference: ETS 300 102-1 [13], subclause 4.5.10.

Definition: The purpose of the Calling party number information element is to identify the calling party of a call.

The Calling party number information element is coded as shown in figure 11.4 and table 11.15.

The maximum length of this information element is 24 octets.

8	7	6	5	4	3	2	1	Octet
0	Calling party number 1	1	0	1	1	0	0	1
			Information element identifier					
Length of Calling party number contents								2
0/1 ext	Type of number			Numbering plan identification				3
1 ext	Presentation indicator		0 0 0 Spare			Screening indicator		3a
0	Number digits (IA5 characters, see note)							4 etc.

NOTE: The number digits appear in multiple octets 4, in the same order in which they would be entered, that is, the number digit which would be entered first is located in the first octet.

Figure 11.4: Calling party number information element

Table 11.15: Calling party number information element

Type of number (octet 3) (see note 1)

Bits 7 6 5	
0 0 0	Unknown (see note 2).
0 0 1	International number (see note 3).
0 1 0	National number (see note 3).
0 1 1	Network specific number (see note 4).
1 0 0	Subscriber number (see note 3).
1 1 0	Abbreviated number (see note 5).
1 1 1	Reserved for extension.

All other values are reserved.

NOTE 1: For the definition of international, national and subscriber number, see CCITT Recommendation I.330.
NOTE 2: The type of number "unknown" is used when the user or the network has no knowledge of the type of number, e.g. international number, national number, etc. In this case the number digits field is organized according to the network dialling plan; e.g. prefix or escape digits might be present.
NOTE 3: Prefix or escape digits are not included.
NOTE 4: The type of number "network specific number" is used to indicate administration/service number specific to the serving network, e.g. used to access an operator.
NOTE 5: The support of this code is network dependent. The number provided in this information element presents a shorthand representation of the complete number in the specified numbering plan as supported by the network.

Numbering plan identification (octet 3)

Numbering plan (applies for type of number = 000, 001, 010 and 100)

Bits 4 3 2 1	
0 0 0 0	Unknown (see note 6).
0 0 0 1	ISDN/Telephony numbering plan (CCITT Recommendation E.164/E.163).
0 0 1 1	Data numbering plan (CCITT Recommendation X.121).
0 1 0 0	Telex numbering plan (CCITT Recommendation F.69).
1 0 0 0	National standard numbering plan.
1 0 0 1	Private numbering plan.
1 1 1 1	Reserved for extension.

All other values are reserved.

NOTE 6: The numbering plan "unknown" is used when the user or the network has no knowledge of the numbering plan. In this case the number digits field is organized according to the network dialling plan; e.g. prefix or escape digits may be present.

(continued)

Table 11.15 (concluded): Calling party number information element

Presentation indicator (octet 3a) (see note 7)

Bits **7 6**	
0 0	presentation allowed
0 1	presentation restricted
1 0	number not available due to interworking
1 1	reserved

NOTE 7: At the originating user-network interface, the presentation indicator is used for indicating the intention of the calling user for the presentation of the calling party number to the called user. This may also be requested on a subscription basis. If octet 3a is omitted, and the network does not support subscription information for the calling party number information restrictions, the value "00 - presentation allowed" is assumed.

Screening indicator (octet 3a) (see note 8)

Bits **2 1**	
0 0	user-provided, not screened
0 1	user-provided, verified and passed
1 0	user-provided, verified and failed (see note 9)
1 1	network-provided

NOTE 8: If octet 3a is omitted, "00 - user-provided - not screened" is assumed.
NOTE 9: The support of this code is network dependent.

Number digits (octets 4 etc.)

This field is coded with IA5 characters, according to the formats specified in the appropriate numbering/dialling plan.

11.3.5.10 Calling party subaddress

Reference: ETS 300 102-1 [13], subclause 4.5.11.

Definition: The purpose of the Calling party subaddress is to identify the subaddress of the Calling party of a call. For the definition of subaddress see CCITT Recommendation I.330.

The Calling party subaddress is coded as shown in figure 11.5 and table 11.16.

The maximum length of this information element is 23 octets.

8	7	6	5	4	3	2	1	Octet
0	Calling party subaddress 1 1 0 1 1 0 1 Information element identifier							1
Length of the Calling party subaddress content								2
1 ext	Type of subaddress			odd/ even ind.	0	0 spare	0	3
Subaddress information								4 etc.

Figure 11.5: Calling party subaddress information element

Table 11.16: Calling party subaddress information element

Type of subaddress (octet 3) Bits **7 6 5** 0 0 0 NSAP (CCITT Recommendation X.213/ISO 8348 AD2). 0 1 0 User specified. All other values are reserved.
Odd/even indicator (octet 3) Bit **4** 0 Even number or address signals. 1 Odd number or address signals. NOTE 1: The odd/even indicator is used when the type of subaddress is "user specified" and the coding is BCD.
Subaddress information (octet 4, etc.) The Network Service Access Point (NSAP) CCITT Recommendation X.213/ISO 8348 AD2 address, is formatted as specified by octet 4 which contains the Authority and Format Identifier (AFI). The encoding is made according to the "preferred binary encoding" as defined in CCITT Recommendation X.213/ISO 8348 AD2. For the definition of this type of subaddress, see CCITT Recommendation I.334. For user specified subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with X.25 networks BCD coding should be applied. NOTE 2: It is recommended that users apply the NSAP subaddress type since this subaddress type allows the use of decimal, binary and IA5 syntaxes in a standardized manner. NOTE 3: It is recommended that users apply the local IDI format when the subaddress is used for terminal selection purposes. In this case the IA5 character syntax using only digits 0 to 9 is used for the Domain Specific Part (DSP).

11.3.5.11 Cause

See subclause 11.3.5.10 of TBR 3 [9].

11.3.5.12 Channel identification

See subclause 11.3.5.11 of TBR 3 [9].

11.3.5.13 Restart indicator

See subclause 11.3.5.16 of TBR 3 [9].

11.4 Call control procedures for the control of packet-mode access of the PH

Reference: ETS 300 102-1 [13], clause 5, ETS 300 007 [10] clause 7.

The following procedures apply to TEs having implemented the access of the PH via on-demand B-channel connections or having implemented the access of the PH via D-channel, supporting the conditional notification class for incoming calls, or both.

11.4.1 Call establishment at the originating interface

Reference: ETS 300 102-1 [13], subclause 5.1, ETS 300 007 [10] clause 7.

Requirement: Before these procedures are invoked, a reliable data link connection shall be established between the TE and the network. All **layer** 3 messages shall be sent to the data link layer using a DL-DATA-REQUEST primitive. The data link services described in clause 10 for SAPI=0 are assumed.

Test: This requirement shall be tested according to the procedures of annex D, test preamble PR30001.

11.4.1.1 Call request

Reference: ETS 300 102-1 [13], subclause 5.1.1, ETS 300 007 [10], subclause 7.1.2.

Requirement: A TE shall initiate call establishment by transferring a SETUP message across the user-network interface. Following the transmission of the SETUP message, the call shall be considered by the TE to be in the Call initiated state.

NOTE: Initiation of a call by the TE may require stimulation of the TE at some other point (e.g. the man-machine interface). The PIXIT in annex E requests information concerning the manner in which an outgoing call can be set up.

Test: This requirement shall be tested according to the procedures of annex D, test case TC20002.

11.4.1.2 Overlap sending

Reference: ETS 300 102-1 [13], subclauses 5.1.2 and 5.1.3, ETS 300 007 [10], subclause 7.1.2.1.

Requirement: The calling TE shall not use the overlap sending procedure.

NOTE: No called party address or called party subaddress is required to be sent to the network at all (see subclause 11.2.8).

Test: This requirement is implicitly tested by other test cases, no test case provided.

11.4.1.3 Call proceeding

Reference: ETS 300 102-1 [13], subclauses 5.1.2 and 5.1.5, ETS 300 007 [10], subclause 7.1.2.1.

Requirement: If the TE receives the CALL PROCEEDING message when in the Call initiated state, the TE shall enter the Outgoing call proceeding state. The TE may attach to the B-channel.

Test: This requirement shall be tested according to the procedures of annex D, test case TC10101.

11.4.1.4 Call confirmation indication

Reference: ETS 300 102-1 [13], subclauses 5.1.2 and 5.1.7.

Requirement: N/A.

NOTE: The ALERTING message will not be sent by the network (see subclause 11.2.1).

Test: There is no test.

11.4.1.5 Call connected

Reference: ETS 300 102-1 [13], subclauses 5.1.2 and 5.1.8, ETS 300 007 [10], subclause 7.1.2.1.

Requirement: On receipt of the CONNECT message, the TE may send a CONNECT ACKNOWLEDGE message. The TE shall attach to the B-channel (if it has not already done so) and shall enter the Active state.

Test: This requirement shall be tested according to the procedures of annex D, test case TC10302.

11.4.2 Call establishment at the destination interface

Reference: ETS 300 102-1 [13], subclause 5.2, ETS 300 007 [10], subclauses 4.2.2.1.2 and 4.2.2.2.2.

Requirement: Before responding to a SETUP message, a reliable point-to-point data link connection shall be established between the TE and the network. All layer 3 messages shall be sent to the data link layer using a DL-DATA-REQUEST primitive. The data link services described in clause 10 for SAPI 0 are assumed.

Test: This requirement is tested implicitly by all the incoming call handling tests.

11.4.2.1 Incoming call

Reference: ETS 300 102-1 [13], subclause 5.2.1, ETS 300 007 [10], subclause 7.2.2.

Requirement: When the TE is intended for use in a point-to-point configuration, and a SETUP message is received on a point-to-point data link, the TE shall enter the Call present state.

When the TE is intended for use in a point-to-multipoint configuration and a SETUP message is received on the broadcast data link, the TE shall enter the Call present state.

The Compatibility checking procedure (see subclause 11.4.2.2) shall follow.

Test: This requirement shall be tested according to the procedures of annex D, test case TC10005.

11.4.2.2 Compatibility checking

Reference: ETS 300 102-1 [13], subclause 5.2.2.

Requirement: If the TE is capable of being incompatible with the Bearer capability information element contents, it shall perform compatibility checking as appropriate on receipt of a SETUP message before responding to that SETUP message.

NOTE: It is for the user to determine, on whatever basis it chooses, whether it is compatible with the contents of the Bearer capability information element in the received SETUP message. The PIXIT in annex E contains questions concerning the contents of this information element the TE responds to as compatible and incompatible.

When the SETUP message is delivered via a broadcast data link, an incompatible TE shall either:

a) ignore the incoming call; or

b) respond by sending a RELEASE COMPLETE message, and enter the Null state.

When the SETUP message is delivered via a point-to-point data link, an incompatible TE shall respond with a RELEASE COMPLETE message, and enter the Null state.

Test: This requirement shall be tested according to the procedures of annex D, test case TC10008.

11.4.2.3 Channel selection-destination

Reference: ETS 300 102-1 [13], subclause 5.2.3, ETS 300 007 [10], subclause 7.2.2.1, table 4.

Requirement: When the SETUP message delivered by the network contains channel selection information according to columns 1-3 of table 11.17, the compatible TE shall select the channel according to column 4 of table 11.17, if one of the indicated channels is supported and available.

If the network does not provide channel selection information according to columns 1-3 of table 11.17 or none of the indicated channels is supported or available, the TE shall follow the procedures of subclause 11.4.3.2 (exception conditions).

Table 11.17: Channel selection by the called TE

Channel indicated in the SETUP message sent by the network			**Allowable user response**
Information channel selection	**Preferred/exclusive**	**D-channel indicator**	
B_i	Exclusive	Not D-channel	B_i
		D-channel	B_i, D
B_i (see note)	Preferred	Not D-channel	B_i, $B_{i'}$, B_j
		D-channel	B_i, $B_{i'}$, B_j, D
No channel (see note)	Preferred	Not D-channel	B_j
		D-channel	B_i, D
	Exclusive	D-channel	D
Key: B_i indicated idle B-channel $B_{i'}$ any other idle B-channel B_j an established B-channel under user control D the D-channel			
NOTE: Only applicable if the incoming SETUP message is sent on a point-to-point data link.			

Test: This requirement shall be tested according to the procedures of annex D, test preamble PR30801, and test cases TC100x2, TC100x3, TC100x4, TC100x5, TC100x6, TC100x7, TC100x8 and TC100x9.

11.4.2.4 Overlap receiving

Reference: ETS 300 102-1 [13], subclause 5.2.4, ETS 300 007 [10], subclause 7.2.2.1.

Requirement: The TE shall not use overlap receiving on receipt of a SETUP message from the network.

The TE shall not send a SETUP ACKNOWLEDGE message to the network.

NOTE: The network will provide all available addressing and compatibility information in the SETUP message.

Test: The requirement is implicitly tested by all test cases performing an incoming call to the IUT. If the IUT responds to the incoming SETUP message with a SETUP ACKNOWLEDGE message, then the test fails.

11.4.2.5 Call confirmation

Reference: ETS 300 102-1 [13], subclause 5.2.5.1, ETS 300 007 [10], subclause 7.2.2.1.

Requirement: When the TE determines that any compatibility requirements have been satisfied according to subclause 11.4.2.2, the TE shall respond with either a CALL PROCEEDING, ALERTING, or CONNECT message, and enter the Incoming call proceeding, Call received or Connect request state, respectively.

Test: This requirement shall be tested according to the procedures of annex D, test case TC10005.

11.4.2.6 Call accept

Reference and requirement: See subclause 11.4.2.6 of TBR 3 [9].

Test: This requirement shall be tested according to the procedures of annex D, test preamble PR30801.

11.4.2.7 Active indication

Reference: ETS 300 102-1 [13], subclause 5.2.8.

Requirement: Upon receipt of the CONNECT ACKNOWLEDGE message the TE shall enter the Active state.

NOTE 1: Only the TE that is awarded the call receives the CONNECT ACKNOWLEDGE message.

NOTE 2: The CONNECT ACKNOWLEDGE message will only be sent to the TE, if the selected user has requested that the incoming virtual call is awarded over a new B-channel.

Test: This requirement shall be tested according to the procedures of annex D, test case TC10801.

11.4.2.8 Non-selected user clearing

Reference: ETS 300 102-1 [13], subclause 5.2.9, ETS 300 007 [10], subclause 7.2.2.3.1.

Requirement: A TE having previously sent a CONNECT message and having subsequently received a RELEASE message containing a cause with cause number not equal to #7 (call awarded and being delivered in an established channel), shall follow the procedures of subclause 11.4.3.4.

Test: This requirement shall be tested according to the procedures of annex D, test case TC10805.

11.4.3 Call clearing

11.4.3.1 Terminology

Reference: ETS 300 102-1 [13], subclause 5.3.1.

Definition: The following terms are used in this TBR in the description of clearing procedures:

A B-channel is "released" when the channel is not part of a ISDN connection and is available for use in a new connection. Similarly, a Call reference that is "released" is available for re-use.

11.4.3.2 Exception conditions

Reference: ETS 300 102-1 [13], subclause 5.3.2.

Requirement: Except as described in this subclause, call clearing shall be initiated when the TE sends a DISCONNECT message and follows the procedures defined in subclauses 11.4.3.3 and 11.4.3.4 respectively. The only exceptions to the above rule are as follows:

a) in response to a SETUP message, the TE may reject a call (e.g. because of the unavailability of a suitable channel) by responding with a RELEASE COMPLETE message provided no other response has previously been sent (e.g. the CALL PROCEEDING message); releasing the Call reference; and enter the Null state;

b) unsuccessful termination of the channel selection procedure by the side offering the call shall be accomplished by sending a RELEASE message as described in subclauses 11.4.3.3 and 11.4.3.4.

Test: There is no test.

NOTE: No test is specified in this version of the TBR because it was not possible to develop and verify a test due to shortage of time and resources. ETSI intends to develop and verify an appropriate test for inclusion in a later version.

11.4.3.3 Clearing initiated by the user

Reference and requirement: See subclause 11.4.3.3 of TBR 3 [9].

Test: This requirement shall be tested according to the procedures of annex D, test cases TC11105, TC20301 and TC21003.

11.4.3.4 Clearing initiated by the network

11.4.3.4.1 Clearing when tones/announcements provided

Reference: ETS 300 102-1 [13], subclause 5.3.4.1, ETS 300 007 [10], subclause 7.4.1.

Requirement: N/A.

NOTE: Tones are not provided for packet mode calls.

11.4.3.4.2 Clearing when tones/announcements not provided

Reference: ETS 300 102-1 [13], subclause 5.3.4.2, ETS 300 007 [10], subclauses 7.2.2.3.1 and 7.4.1.

Requirement: On the receipt of the DISCONNECT message, the TE shall send a RELEASE message, start timer T308, enter the Release request state and follow the procedures of subclause 11.4.3.4.3.

If, for an incoming call, the TE has selected an established B-channel according to subclause 11.4.2.3, and has sent the CONNECT message to the network, the network, if it accepts the connection, will send a RELEASE message containing cause #7 "call awarded and being awarded in an established channel".

Upon receipt of the RELEASE message containing the indicated cause, the TE shall send a RELEASE COMPLETE message and remain in the active state.

If, for an incoming call, the TE has selected the D-channel according to subclause 11.4.2.3, and has sent the CONNECT message to the network, the network, if it accepts the connection, will send a RELEASE message containing cause #7 "call awarded and being awarded in an established channel".

Upon receipt of the RELEASE message containing the indicated cause, the TE shall send a RELEASE COMPLETE message, release the call reference and enter the Null state.

NOTE: There is no time significance between the receipt of the RELEASE message containing cause #7 and the receipt of the Incoming Call packet on the indicated channel, i.e. either may occur first.

Test: This requirement shall be tested according to the procedures of annex D, test cases TC10303, TC10701, TC10802, TC108x1, TC108x2 and TC10901.

11.4.3.4.3 Completion of clearing

Reference and requirement: See subclause 11.4.3.4.3 of TBR 3 [9].

Test: This requirement shall be tested according to the procedures of annex D, test case TC11903.

11.4.3.5 Clear collision

Reference and requirement: See subclause 11.4.3.5 of TBR 3 [9].

Test: This requirement shall be tested according to the procedures of annex D, test cases TC11101 and TC11904.

11.4.4 Call rearrangements

Reference: ETS 300 102-1 [13], subclause 5.6, ETS 300 007 [10] table 11.1.

Requirement: The procedure shall not be used by the TE.

Test: There is no test.

11.4.5 Call collisions

See subclause 11.4.5 of TBR 3 [9].

11.4.6 Handling of error conditions

See first paragraph of subclause 11.4.6 in TBR 3 [9].

Subclauses 11.4.6.1 through 11.4.6.7 are listed in order of precedence.

The term "Ignore" in the following subclauses means to do nothing, as if the message had never been received.

11.4.6.1 Call reference procedural errors

Reference and requirement: See subclause 11.4.6.1 of TBR 3 [9].

Test: This requirement shall be tested according to the procedures of annex D, test cases TC10010, TC10002, TC10125 and TC10011.

11.4.6.2 Message type or message sequence errors

Reference and requirement: See subclause 11.4.6.2 of TBR 3 [9].

Test: This requirement shall be tested according to the procedures of annex D, test cases TC10107, TC10120, TC11008, TC11021, TC10103, TC11005, TC10102, TC11004, TC11908 and TC11909.

11.4.6.3 Duplicated information elements

Reference and requirement: See subclause 11.4.6.3 of TBR 3 [9].

Test: This requirement shall be tested according to the procedures of annex D, test cases TC10024, TC11908 and TC11909.

11.4.6.4 Mandatory information element errors

11.4.6.4.1 Mandatory information element missing

Reference: ETS 300 102-1 [13], subclause 5.8.6.1.

Requirement: When a SETUP or RELEASE message is received which has one or more mandatory information elements missing, a RELEASE COMPLETE message shall be returned.

Test: This requirement shall be tested according to the procedures of annex D, test case TC10015.

11.4.6.5 Non-mandatory information element errors

Reference: ETS 300 102-1 [13], subclause 5.8.7.

The following subclauses identify actions on information elements not recognized as mandatory.

11.4.6.5.1 Unrecognized information element

Reference: ETS 300 102-1 [13], subclause 5.8.7.1.

Requirement: When a message is received which has one or more unrecognized information elements, the TE shall check whether any are encoded to indicate "comprehension required" (refer to table 11.13 for information element identifiers reserved with this meaning). If any unrecognized information element is encoded to indicate "comprehension required", then the procedures in subclause 11.4.6.4.1 are followed; i.e. as if a "missing mandatory information element" error condition had occurred. If all unrecognized information elements are not encoded to indicate "comprehension required", then the TE shall proceed as follows.

Action shall be taken on the message and those information elements which are recognized and have valid content. When the received message is other than DISCONNECT, RELEASE or RELEASE COMPLETE, a STATUS message may be returned containing one Cause information element. The STATUS message shall indicate the Call state of the receiver after taking action on the message. The Cause information element shall contain Cause #99 "information element non-existent or not implemented", and the diagnostic field, if present, shall contain the information element identifier for each information element which was unrecognized.

Subsequent actions are determined by the sender of the unrecognized information elements. If a clearing message contains one or more unrecognized information elements, the error is reported to the local TE in the following manner:

- when a RELEASE message is received which has one or more unrecognized information elements, a RELEASE COMPLETE shall be returned.

Test: This requirement shall be tested according to the procedures of annex D, test cases TC10027, TC10028 and TC11118.

11.4.6.5.2 Non-mandatory information element content error

Reference: ETS 300 102-1 [13], subclause 5.8.7.2.

Requirement: When a message is received which has one or more non-mandatory information elements with invalid content, action shall be taken on the message and those information elements which are recognized and have valid content. A STATUS message may be returned containing one Cause information element. The STATUS message indicates the Call state of the receiver after taking action on the message. The Cause information element shall contain Cause #100 "invalid information element contents", and the diagnostic field, if present, shall contain the information element identifier for each information element which has invalid contents.

Information elements with a length exceeding the maximum length (given in subclause 11.2) shall be treated as an information element with content error with the exception of:

- other access information elements (i.e. a user-to-user information or subaddress information element) may be truncated and processed.

Also, for access information elements treated as information elements with content error, Cause #43 "access information discarded" shall be used instead of Cause #100 "invalid information element contents" in the STATUS message.

NOTE: As an option of a TE (e.g. NT2) Cause values, location codes, and diagnostics which are not understood by the NT2 may be accepted, or in the case of an NT2, passed on to another entity (e.g. user or NT2) instead of ignoring the Cause information element contents and optionally sending a STATUS message with Cause #100 "invalid information element contents". This option is intended to aid the TE to be compatible with future additions of Cause values, location codes, and diagnostics to this TBR.

Test: This requirement shall be tested according to the procedures of annex D, test cases TC10029 and TC100x1.

11.4.6.6 Status enquiry procedure

Reference: ETS 300 102-1 [13], subclause 5.8.10.

Requirement: When the TE is required to perform the procedures of this subclause, and a STATUS ENQUIRY message has not already been sent, a STATUS ENQUIRY message shall be sent. The TE shall treat any responding STATUS message according to the procedures of subclause 11.4.6.7.

Upon receipt of a STATUS ENQUIRY message, the receiver shall respond with a status message reporting the current Call state.

If the STATUS ENQUIRY message specifies a call reference which is not related to an active call or to a call in progress, then the receiver shall either respond with a STATUS message reporting the current call state, or the procedures of subclause 11.4.6.1 shall be followed.

Test: This requirement shall be tested according to the procedures of annex D, test case TC11107 and postamble CS59901.

11.4.6.7 Receiving a STATUS message

Reference: ETS 300 102-1 [13], subclause 5.8.11.

Requirement:

a) If a STATUS message indicating any Call state except the Null state is received in the Null state, then the receiving entity shall either:

   1) send a RELEASE message; and then follow the procedures of subclause 11.4.3; or
   2) send a RELEASE COMPLETE message; and remain in the Null state.

b) If a STATUS message indicating any Call state except the Null state is received in the Release request state, no action shall be taken.

c) If a STATUS message, indicating the Null state, is received in any state except the Null state, the receiver shall release all resources and move into the Null state.

Test: This requirement shall be tested according to the procedures of annex D, test cases TC10004, TC10105, TC11007 and TC11906.

11.4.7 User notification procedure

Reference: ETS 300 102-1 [13], subclause 5.9, ETS 300 007 [10], subclause 7.1.2.1.

Requirement: N/A.

NOTE: The procedure is not applicable since the network does not send a NOTIFY message.

Test: There is no test.

11.4.8 Restart procedure

Reference: ETS 300 102-1 [13], subclauses 5.5 and 5.5.2.

Requirement: When a point-to-point configuration exists using one of the point-to-point data links according to subclause 10.3 then the TE shall implement the following procedures:

Upon receiving a RESTART message the TE shall enter the Restart state associated to the global call reference; it shall then initiate the appropriate internal actions to return the specified channels to the idle condition and Call references to the Null state. Upon completion of internal clearing and within 2 minutes of receipt of the RESTART, a RESTART ACKNOWLEDGE message shall be transmitted to the network, and the Null state entered.

Test: This requirement shall be tested according to the procedures of annex D, test case TC19003.

11.5 TE timers

Reference and requirement: See subclause 11.5 of TBR 3 [9].

Test: This requirement shall be tested according to the procedures of annex D, test cases TC21001 and TC21006.

12 X.25

12.1 X.25 requirements

There are no new requirements in this TBR not contained in TBR 2 [8].

12.2 X.25 procedures

This clause is not intended to express requirements on the use of X.25 packet layer elements or procedures. It only serves as an overview and as a means to select applicable requirements on the use of the D-channel protocols, depending on which kind of virtual call is supported.

12.2.1 Data link protocol supporting the X.25 packet level protocol

When a B-channel is used for the access of the PH, the data link protocol is the LAPB protocol as defined in ITU-T Recommendation X.25 (HDLC procedures).

When the D-channel is used for the access of the PH, the data link protocol is the LAPD protocol as defined in clause 10 of this TBR for SAPI 16.

12.2.2 X.25 packet level protocol

Independently of which channel is used for the access of the PH, the layer 3 protocol is the packet layer protocol as defined in ITU-T Recommendation X.25.

12.2.3 Outgoing and incoming virtual calls

An X.25 terminal supports either:

1) outgoing virtual calls only; or
2) incoming virtual calls only; or
3) both.

NOTE: This is no restriction on X.25 terminal capabilities; the classification is only intended to serve for the selection of applicable requirements in other clauses of this TBR.

Annex H shows some examples of access configurations with small sets of requirements for TEs supporting only outgoing or only incoming virtual calls.

12.2.4 Identification of X.25 terminals

Some networks require identification according to CCITT X.32 procedures of X.25 terminals requesting access to the PH. However, this is out of the scope of this TBR.

Annex A (normative): TBR Requirements Table (TBR-RT)

The purpose of this TBR-RT is to state the logical inter-relationship of the various requirements within this TBR, and their dependence on the implementation or non-implementation of options within particular items of TE.

The contents of this TBR-RT can also perform a similar function to that of an Implementation Conformance Statement (ICS). Therefore, in order to facilitate the provision of information by the manufacturers to test laboratories, a blank column for "Support" has been added so that the TBR-RT may be copied and used as part of an ICS proforma (additional information to identify uniquely the IUT shall be needed).

It is not a requirement of this TBR that information is provided to laboratories in this way, and other methods for providing information (e.g. ICSs for the base standards identified in the Scope) may be used.

A.1 Guidance for completion of the TBR-RT

For each layer, there are one or more tables of requirements.

The Number column, when taken with the table number, provides an unique identifier to each requirement (i.e. A1.6 is item 6 in table A.1).

The Reference column lists the subclause reference in the TBR where the requirement may be found.

The TBR Requirement column gives the clause title of the relevant clause, supplemented by any additional information necessary to identify the requirement.

The Status column contains one of the following items:

- m: support for the requirement is mandatory;
- cx: support for the requirement is mandatory if the relevant condition is met;
- o: support for the requirement is optional;
- o.n: support for the requirement is optional, subject to certain options being selected according to the numbered footnote;
- n/a: support for the requirement is not applicable;
- x: support for the requirement is forbidden.

The outcome of a condition may be any of the other status values listed.

The Support column is blank for the user to complete.

A.2 General classification of requirements TBR-RT

Table A.1: General type of packet-mode TE operations

No.	Reference	Type of Packet-Mode TE Operation	Status	Support (Y/N)	Comment
1	4.1.1 a), c), 4.1.2.1 a)	Is the TE able to operate with semi-permanent B-channel?	o.1		Affects layer 1 and data link requirements
2	4.1.1 a), c), 4.1.2.1 b)	Is the TE able to operate with on-demand B-channel?	o.1		Affects layer 1 and data link requirements
3	4.1.5.2	Is the TE able to operate with ISDN incoming calls?	c1		ETS 300 102-1 [13] procedures
4	4.1.5.1	Is the TE able to operate with ISDN outgoing calls ?	c2		ETS 300 102-1 [13] procedures
5	4.1.1 b), c)	Is the TE able to operate PH access over the D-channel?	o.1		
6	4.1.1 b)	Is the TE able to operate PH access over the D-channel only?	o.1		
7	12.2.3 2, 3)	Is the TE able to handle incoming virtual calls?	o.2		
8	12.2.3 1, 3)	Is the TE able to handle virtual outgoing calls?	o.2		
9	4.1.2.1 a)	Does the TE implement semi-permanent layer 1?	o.3		
10	4.1.2.1 b)	Does the TE implement on-demand layer 1?	o.3		

c1: m if A.1.7 and A.1.2 else o
c2: m if A.1.8 and A.1.2 else o
o.1: One or more options shall be chosen
o.2: One or more options shall be chosen
o.3: Only one option shall be chosen

Table A.2: General type of packet-mode TE operations data link

No.	Reference	Type of Packet-Mode TE Operation	Status	Support (Y/N)	Comment
1	4.1.3.1	Is the TE capable of TE demand data link activation (SAPI 0)?	c1		On-demand B-channel
2	4.1.3.1	Is the TE capable of network demand data link activation (SAPI 0)?	c1		On-demand B-channel
3	4.1.3.2	Is the TE capable of semi-permanent data link operation (SAPI 16)	c2		D-channel or D-channel only
4	4.1.3.2	Is the TE capable of TE demand data link activation (SAPI 16)?	c2		D-channel or D-channel only
5	4.1.3.2	Is the TE capable of network demand data link activation (SAPI 16)?	c2		D-channel or D-channel only
6	4.1.3.2	Does the TE implement a fixed (non-automatic) TEI for PH access over the D-channel?	c3		
7	4.1.3.2	Does the TE implement a fixed (non-automatic) TEI for PH access over the B-channel?	c4		
8	4.1.3.2 4.1.3.3	Does the TE implement a TEI in the automatic range for PH access over the B-channel?	c4		

c1 = o.1 if A.1.2 else n/a
c2 = o.2 If A.1.5 else n/a
c3 = m if A.3.1 else o
c4 = o.3 if (not A.1.6) else n/a
o.1: One or more options shall be chosen
o.2: One or more options shall be chosen
o.3: Only one option shall be chosen

Table A.3: Notification classes

No.	Reference	Type of Packet-Mode TE Operation	Status	Support (Y/N)	Comment
1	4.1.4 a)	Does the TE operate with the No notification class?	c1		
2	4.1.4 b)	Does the TE of operate with the Conditional notification class?	c1		

c1: o.1 if A.1.7 else n/a
o.1: Only one option shall be chosen

A.3 Layer 1 and overvoltage requirements TBR-RT

A.3.1 On-demand layer 1 requirement tables

Table A.4: On-demand layer 1 and overvoltage conditions

No.	Condition	Status	Support (Y/N)	Comment
1	Is TE mains powered?	c1		Affects requirements in clause 8.
2	Is TE PS1 powered?	c1		Affects requirements in subclauses 9.4 and 9.5.
3	Is the TE intended to operate as a designated TE?	c2		Affects requirements in subclause 9.5.
4	Does the TE have a connection to earth?	c1		Affects requirements in subclause 9.5.
5	Is the TE intended for use only in a physical point-to-point configuration?	c1		Affects requirements in subclauses 9.2 and 9.4.
6	Is the TE capable of transmitting INFO 3 within 5 ms of receipt of INFO 2 or INFO 4 in state F4?	c1		Affects requirements in subclause 9.4.
c1 = o If A.1.2 else n/a c2 = o If A.1.2 and A.4.2 else n/a				

Table A.5: On-demand layer 1 overvoltage requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	8.1	Impulse transfer from mains, common mode.	c1	
2	8.2	Impulse transfer from mains, transverse mode.	c1	
3	8.3	Conversion of common mode to transverse mode.	c2	
c1 = m if (A.1.2 and A.4.1) else n/a c2 = o If A.1.2 else n/a				

Table A.6: On-demand layer 1 physical characteristics requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.1.1	Case A	c1	
2	9.1.2	Case B	c1	
3	9.1.3	Case C	c1	
c1 = o.1 If A.1.2 else n/a o.1: One or more options shall be chosen				

Table A.7: On-demand layer 1 electrical characteristics requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.2.1	Bit rate	c1	
2	9.2.2.2	Timing extraction jitter, configuration 1)	c1	
3	9.2.2.2	Timing extraction jitter, configuration 2)	c2	
4	9.2.2.2	Timing extraction jitter, configuration 3a)	c2	
5	9.2.2.2	Timing extraction jitter, configuration 3b)	c2	
6	9.2.2.2	Timing extraction jitter, configuration 4)	c1	
7	9.2.2.3	Total phase deviation input to output, configuration 1)	c1	
8	9.2.2.3	Total phase deviation input to output, configuration 2)	c2	
9	9.2.2.3	Total phase deviation input to output, configuration 3a)	c2	
10	9.2.2.3	Total phase deviation input to output, configuration 3b)	c2	
11	9.2.2.3	Total phase deviation input to output, configuration 4)	c1	
12	9.2.3 a)	TE transmitter output impedance, requirement (a)	c1	
13a	9.2.3 b)	TE transmitter output impedance, requirement (b) at 50 Ω load.	c2	
13b	9.2.3 b)	TE transmitter output impedance, requirement (b) at 400 Ω load.	c2	
14	9.2.4	Pulse shape and amplitude (binary ZERO)	c1	
15	9.2.5.1	Pulse amplitude when transmitting a high density pattern	c1	
16	9.2.5.2	Pulse unbalance of an isolated couple of pulses	c1	
17	9.2.6.1	Voltage on other test loads: 400 Ω load	c2	
18	9.2.6.2	Voltage on other test loads: 5,6 Ω load	c2	
19	9.2.7	Longitudinal Conversion Loss (LCL) of the transmitter outputs	c1	
20	9.2.8	TE receiver input impedance	c1	
21	9.2.9 (1)	Receiver sensitivity - Noise and distortion immunity, configuration 1)	c1	
22	9.2.9 (2)	Receiver sensitivity - Noise and distortion immunity, configuration 2)	c2	
23	9.2.9 (3a)	Receiver sensitivity - Noise and distortion immunity, configuration 3a)	c2	
24	9.2.9 (3b)	Receiver sensitivity - Noise and distortion immunity, configuration 3b)	c2	
25	9.2.9 (4)	Receiver sensitivity - Noise and distortion immunity, configuration 4)	c1	
26	9.2.10	Longitudinal Conversion Loss (LCL) of the receiver inputs	c1	
c1 = m If A.1.2 else n/a c2 = m If (A.1.2 and not A.4.6) else n/a				

Table A.8: On-demand layer 1 functional characteristics requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.3.1.1	TE to NT	c1	
2	9.3.1.3	Relative bit positions	c1	
3	9.3.2	Line code	c1	
c1 = m If A.1.2 else n/a				

Table A.9: On-demand layer 1 interface procedure requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.4.1.1	Interframe (Data Link) time fill	m	
2	9.4.1.2	Multipoint contention resolution mechanism	c1	
3	9.4.1.3	Collision detection	c1	
4	9.4.2.3.1	Activation/deactivation procedure for TEs powered from PS1, not including tests in state F5 and not including the procedures after PH-ACTIVATE in state F4 (see table 9.7 of TBR 3 [15]).	c2	
5	9.4.2.3.1	Activation/deactivation procedure for TEs powered from PS1, state F5 tests.	c3	
6	9.4.2.3.1	Procedures after PH-ACTIVATE in state F4 for TEs powered from PS1.	c7	
7	9.4.2.3.1	Activation/deactivation procedure for TEs locally powered, not including tests in state F5 and not including the procedures after PH-ACTIVATE in state F4 (see table 9.8 of TBR 3 [16]).	c4	
8	9.4.2.3.1	Activation/deactivation procedure for TEs locally powered, state F5 tests.	c5	
9	9.4.2.3.1	Procedures after PH-ACTIVATE in state F4 for TEs locally powered.	c8	
10	9.4.2.3.2	Timer values	m	
11	9.4.2.4	TE activation times, not including tests in state F5.	m	
12	9.4.2.4	TE activation times, state F5 tests.	c6	
13	9.4.2.5	Deactivation times	m	
14	9.4.3	Frame alignment procedures	m	
15	9.4.4	Multiframing	m	
16	9.4.5	Idle Channel Code on the B-channels	c3	

c1 = n/a If A.1.2 and A.4.6 else m
c2 = m if (A.1.2 and A.4.2) else n/a
c3 = m if (A.1.2 and A.9.4 and not A.4.7) else n/a
c4 = m if (A.1.2 and not A.4.3) else n/a
c5 = m if (A.1.2 and A.9.6 and not A.4.7) else n/a
c6 = m if (A.1.2 and not A.4.7) else n/a
c7 = m if (A.1.2 and A.1.4 and A.4.2) else
o if (A.1.2 and A.4.2) else n/a
c8 = m if (A.1.2 and A.1.4 and not A.4.3) else
o if (A.1.2 and not A.4.3) else n/a

Table A.10: On-demand layer 1 power feeding requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.5.2	Current transient	c11	
2	9.5.3.1	Normal power conditions, PS1 powered terminal	c11	
3	9.5.3.1	Normal power conditions, locally powered terminal	c12	
4	9.5.3.2.1	Power available to the TE "designated" for restricted power operation	c13	
5	9.5.3.2.2	Power available to locally powered and "non-designated" TEs	c14	
6	9.5.4	Galvanic isolation	c15	
7	9.5.5.1.1a	Current/time limitations for remotely powered TEs in normal mode, option a)	c16	
8	9.5.5.1.1b	Current/time limitations for remotely powered TEs in normal mode, option b)	c16	
9	9.5.5.1.2a	Current/time limitations for designated TEs in restricted mode, option a)	c17	
10	9.5.5.1.2b	Current/time limitations for designated TEs in restricted mode, option b)	c17	
11	9.5.5.1.3	Current/time limitations for non-designated and locally powered TEs in restricted mode	c18	
12	9.5.5.2.1	Minimum TE start up current, restricted power mode	c13	
13	9.5.5.2.1	Minimum TE start up current, normal power mode	c11	
14	9.5.5.2.2	Protection against short term interruptions, restricted power mode	c13	
15	9.5.5.2.2	Protection against short term interruptions, normal power mode	c11	
16	9.5.5.2.3	Behaviour at the switch-over	c13	
17	9.5.5.3.1	DC unbalance of power sink 1	c11	
18	9.5.5.3.2	Current unbalance in a pair	c19	

c11 = m if (A.1.2 and A.4.2) else n/a
c12 = m if (A.1.2 and not A.4.2) else n/a
c13 = m if (A.1.2 and A.4.4) else n/a
c14 = m if (A.1.2 and not A.10.4) else n/a
c15 = m if (A.1.2 and A.4.5) else n/a
c16 = o.2 if (A.1.2 and A.4.2) else n/a
c17 = o.3 if (A.1.2 and A.4.4) else n/a
c18 = m if (A.1.2 and not A.4.4) else n/a
c19 = m if A.1.2 else n/a
o.2. Only one option shall be chosen
o.3. Only one option shall be chosen

A.3.2 Semi-permanent layer 1 requirement tables

Table A.11: Semi-permanent layer 1 and overvoltage conditions

No.	Condition	Status	Support (Y/N)	Comment
1	Is TE mains powered?	o.1		Affects requirements in clause 8.
2	Is TE PS1 powered?	o.1		Affects requirements in subclauses 9.5 and 9.6.
3	Is the TE intended to operate as a designated TE?	n/a		
4	Does the TE have a connection to earth?	o.1		Affects requirements in subclause 9.5.
5	Is the TE intended for use only in a physical point-to-point configuration?	o.1		Affects requirements in subclauses 9.2 and 9.4.
o.1: One or more options shall be chosen				

Table A.12: Semi-permanent layer 1 overvoltage requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	8.1	Impulse transfer from mains, common mode.	c1	
2	8.2	Impulse transfer from mains, transverse mode.	c1	
3	8.3	Conversion of common mode to transverse mode.	c2	
c1 =m if (A.1.1 and A.4.1) else n/a c2 = m if A.1.1 else n/a				

Table A.13: Semi-permanent layer 1 physical characteristics requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.1.1	Case A	c1	
2	9.1.2	Case B	c1	
3	9.1.3	Case C	c1	
c1 = o.1 if A.1.1 else n/a o.1: One or more options shall be chosen				

Table A.14: Semi-permanent layer 1 electrical characteristics requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.2.1	Bit rate	c1	
2	9.2.2.2	Timing extraction jitter, configuration 1)	c1	
3	9.2.2.2	Timing extraction jitter, configuration 2)	c2	
4	9.2.2.2	Timing extraction jitter, configuration 3a)	c2	
5	9.2.2.2	Timing extraction jitter, configuration 3b)	c2	
6	9.2.2.2	Timing extraction jitter, configuration 4)	c1	
7	9.2.2.3	Total phase deviation input to output, configuration 1)	c1	
8	9.2.2.3	Total phase deviation input to output, configuration 2)	c2	
9	9.2.2.3	Total phase deviation input to output, configuration 3a)	c2	
10	9.2.2.3	Total phase deviation input to output, configuration 3b)	c2	
11	9.2.2.3	Total phase deviation input to output, configuration 4)	c1	
12	9.2.3 a)	TE transmitter output impedance, requirement (a)	c1	
13	9.2.3 b)	TE transmitter output impedance, requirement (b)	c2	
14	9.2.4	Pulse shape and amplitude (binary ZERO)	c1	
15	9.2.5.1	Pulse amplitude when transmitting a high density pattern	c1	
16	9.2.5.2	Pulse unbalance of an isolated couple of pulses	c1	
17	9.2.6.1	Voltage on other test loads: 400 Ω load	c2	
18	9.2.6.2	Voltage on other test loads: 5,6 Ω load	c2	
19	9.2.7	Longitudinal Conversion Loss (LCL) of the transmitter outputs	c1	
20	9.2.8	TE receiver input impedance	c1	
21	9.2.9 (1)	Receiver sensitivity - Noise and distortion immunity, configuration 1)	c1	
22	9.2.9 (2)	Receiver sensitivity - Noise and distortion immunity, configuration 2)	c2	
23	9.2.9 (3a)	Receiver sensitivity - Noise and distortion immunity, configuration 3a)	c2	
24	9.2.9 (3b)	Receiver sensitivity - Noise and distortion immunity, configuration 3b)	c2	
25	9.2.9 (4)	Receiver sensitivity - Noise and distortion immunity, configuration 4)	c1	
26	9.2.10	Longitudinal Conversion Loss (LCL) of the receiver inputs	c1	
c1 = m if A.1.1 else n/a c2 = m if (A.1.1 and not A.4.6) else n/a				

Table A.15: Semi-permanent layer 1 functional characteristics requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.3.1.1	TE to NT	c1	
2	9.3.1.3	Relative bit positions	c1	
3	9.3.2	Line code	c1	
c1 = m If A.1.1 else n/a				

Table A.16: Semi-permanent layer 1 interface procedure requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	9.4.1.1	Interframe (Data Link) time fill	c8	
2	9.4.1.2	Multipoint contention resolution mechanism	c1	
3	9.4.1.3	Collision detection	c1	
4	9.6.3	Activation/deactivation procedure for TEs powered from PS1, not including tests in state F5 (table 9.2).	c2	
5	9.6.3	Activation/deactivation procedure for TEs powered from PS1, state F5 tests.	c3	
6	9.6.3	Activation/deactivation procedure for TEs locally powered, not including tests in state F5 (table 9.3).	c4	
7	9.6.3	Activation/deactivation procedure for TEs locally powered, state F5 tests.	c5	
8	9.6.4	Timer values	c6	
9	9.6.5	Deactivation times	c6	
10	9.4.3	Frame alignment procedures	c6	
11	9.4.4	Multiframing	c6	
12	9.4.5	Idle Channel Code on the B-channels	c3	
c1 = m if (A.1.1 and not A.11.6) else n/a c2 = m if (A.1.1 and A.8.2) else n/a c3 = m if (A.1.1 and A.4.2) else n/a c4 = m if (A.1.1 and not A.11.3) else n/a c5 = m if (A.1.1 and A.4.6) else n/a c6 = m if A.1.1 else n/a				

Table A.17: Semi-permanent layer 1 power feeding requirements

No.	Reference [TBR 3 [9]]	TBR requirement	Status	Support (Y/N)
1	9.5.2	Current transient	c1	
2	9.5.3.1	Normal power conditions, PS1 powered terminal	c1	
3	9.5.3.1	Normal power conditions, locally powered terminal	c2	
4	9.5.3.2.1	Power available to the TE "designated" for restricted power operation	n/a	
5	9.5.3.2.2	Power available to locally powered and "non-designated" TEs	c5	
6	9.5.4	Galvanic isolation	c3	
7	9.5.5.1.1a	Current/time limitations for remotely powered TEs in normal mode, option a)	c4	
8	9.5.5.1.1b	Current/time limitations for remotely powered TEs in normal mode, option b)	c4	
9	9.5.5.1.2a	Current/time limitations for designated TEs in restricted mode, option a)	n/a	
10	9.5.5.1.2b	Current/time limitations for designated TEs in restricted mode, option b)	n/a	
11	9.5.5.1.3	Current/time limitations for non-designated and locally powered TEs in restricted mode.	c5	
12	9.5.5.2.1	Minimum TE start up current, restricted power mode	n/a	
13	9.5.5.2.1	Minimum TE start up current, normal power mode	c1	
14	9.5.5.2.2	Protection against short term interruptions, restricted power mode	n/a	
15	9.5.5.2.2	Protection against short term interruptions, normal power mode	c1	
16	9.5.5.2.3	Behaviour at the switch-over	n/a	
17	9.5.5.3.1	DC unbalance of power sink 1	c1	
18	9.5.5.3.2	Current unbalance in a pair	c5	

c1 = m if (A.1.1 and A.11.2) else n/a
c2 = m if (A.1.1 and not A.11.2) else n/a
c3 = m if (A.1.1 and A.11.5) else n/a
c4 = o.1 if (A.1.1 and A.11.2) else n/a
c5 = m if A.1.1 else n/a
o.1: Only one option shall be chosen

A.4 Layer 2 TBR-RT

Table A.18: Layer 2 point-to-point configuration requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.3	Does the TE support a (physical) point-to-point configuration using only a single data link for each of the SAPIs 0 and 16 in use?	o	
2	10	Does the TE activate a physical layer connection between the TE and the network before the procedures of clause 10 are invoked.	m	

Table A.19: Layer 2 unacknowledged operation requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.4.1	Transmission of unacknowledged information	c1	
2	10.4.2	Receipt of unacknowledged information	c1	
c1 = n/a if A.18.1 else m.				

Table A.20: Layer 2 TEI management requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.5.2	TEI assignment procedure, automatic TEIs	c1	
2	10.5.2	TEI assignment procedure, non-automatic TEIs	c5	
3	10.5.2.1	Expiry of timer T202	c2	
4	10.5.3	Operation of the TEI check procedure	c3	
5	10.5.4.1	Action taken by the data link layer entity receiving the MDL-REMOVE-REQUEST primitive	c2	
6	10.5.4.2	Conditions for TEI removal, receipt of an identity remove message	c2	
7	10.5.4.2	Conditions for TEI removal, receipt of MDL-ERROR INDICATION indicating possible multiple TEI assignment	c4	
8	10.5.5.2	Operation of the TEI identity verify procedure	c4	
9	10.5.1	General TEI management procedures	m	
c1 = x if A.1.6 or A.18.1 else o.1 c2 = m if A.20.1 else n/a c3 = n/a if A.18.1 else m c4 = o.2 if A.20.1 else n/a c5 = m if A.1.6 and not A.18.1 else o.1 o.1: One or more options shall be chosen o.2: One or more options shall be chosen				

Table A.21: Layer 2 establishment and release procedures requirements table for SAPI 0

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.6.1.1	General	c5	
2	10.6.1.2.1	Data link establishment on TE demand on a per-call basis	c1	
3	10.6.1.2.1	Semi-permanent data link under TE responsibility	c1	
4	10.6.1.2.2	Data link establishment on network demand on a per-call basis	c2	
5	10.6.1.2.2	Semi-permanent data link under network responsibility	c2	
6	10.6.1.3	Procedure on expiry of timer T200	c3	
7	10.6.2	Receipt of DISC	c5	
8	10.6.2	Termination of multiple frame operation	c4	

c1 = o.1 if (not A.21.5) and (A.1.4 or (A.1.3 and not A.4.5)) else o
c2 = o.2 if (not A.21.3) and A.1.3 and A.4.5 else o
c3 = m if A.21.2 or A.21.3 else n/a
c4 = m if A.21.7 else n/a
c5 = m if A.1.3 or A.1.4 else n/a
o.1: Only one option shall be chosen
o.2: Only one option shall be chosen

Table A.22: Layer 2 establishment and release procedures requirements table for SAPI 16

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.6.1.1	General	c1	
2	10.6.1.2.1	Data link establishment on TE demand on a per-call basis	c2	
3	10.6.1.2.1	Semi-permanent data link under TE responsibility	c2	
4	10.6.1.2.2	Data link establishment on network demand on a per-call basis	c3	
5	10.6.1.2.2	Semi-permanent data link under network responsibility	c3	
6	10.6.1.3	Procedure on expiry of timer T200	c3	
7	10.6.2	Receipt of DISC	c1	
8	10.6.2	Termination of multiple frame operation	c4	

c1 = m if A.1.5 and (not A.18.1) else n/a
c2 = o.1 if A.1.5 and A.1.8 and (not A.18.1) and (not A.22.5) else n/a
c3 = o.2 if A.1.5 and A.1.7 and (not A.18.1) and (not A.22.3) else n/a
c4 = m if (not A.18.1) and A.22.6 else n/a
o.1: Only one option shall be chosen
o.2: Only one option shall be chosen

Table A.23: Layer 2 multiple frame operation requirements table for SAPI 0

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.7.1	Transmitting I-frames	c1	
2	10.7.2	Receiving I-frames	c1	
3	10.7.2.1	P bit set to 1	c1	
4	10.7.2.2	P bit set to 0	c1	
5	10.7.3	Receiving acknowledgements	c1	
6	10.7.4	Receiving REJ frames	c1	
7	10.7.5.1	Receiving a valid RNR command or response	c1	
8	10.7.5.2	Expiry of timer T200 during "peer receiver busy"	c1	
9	10.7.5.3	Receiving a valid RNR command or response during "peer receiver busy"	c1	
10	10.7.5.4	Receiving a valid RR or REJ command during "peer receiver busy"	c1	
11	10.7.5.5	Appropriate supervisory response frame	c1	
12	10.7.6	Waiting acknowledgement	c1	
13	10.8	Re-establishment of multiple frame operation	c1	
c1 = m if A.1.2 else n/a				

Table A.24: Layer 2 multiple frame operation requirements table for SAPI 16

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.7.1	Transmitting I-frames	c1	
2	10.7.2	Receiving I-frames	c2	
c1 = m if A.1.5 and A.1.8 and (not A.18.1) else n/a c2 = m if A.1.5 and A.1.7and (not A.18.1) else n/a				

Table A.25: Layer 2 exception condition requirements table for SAPI 0

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.9.1	N(S) sequence error	c2	
2	10.9.2	Invalid frame condition	c2	
3	10.9.3	Frame rejection condition	c2	
4	10.9.4	Multiple-assignment of TEI value	c1	
c1 = m if A.1.2 and A.20.1 else n/a c2 = m if A.1.2 else n/a				

Table A.26: Layer 2 exception condition requirements table for SAPI 16

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.9.4	Multiple-assignment of TEI value	c1	
c1 = m if A.1.5 and A.20.1 else n/a				

Table A.27: Layer 2 system parameters requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	10.10.3	Maximum number of octets in an information field.	c1	
2	10.10.7	Layer 2 response time, TE not operating in accordance with subclause 10.3 (200 ms).	c1	
3	10.10.7	Layer 2 response time, TE operating in accordance with subclause 10.3 (500 ms).	c2	
c1 = n/a if (A.1.2 or A.1.5) and A.18.1 else m c2 = m if (A.1.2 or A.1.5) and A.18.1 else n/a				

A.5 Layer 3 TBR-RT

Table A.28: Layer 3 call establishment at the originating interface requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	11.4.1	Call establishment at the originating interface	c1	
2	11.4.1.1	Call request	c1	
3	11.4.1.3	Call proceeding	c1	
4	11.4.1.5	Call connected	c1	
c1 = m if A.1.4 else n/a				

Table A.29: Layer 3 call establishment at the destination interface requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	11.4.2	Call establishment at the destination interface	c1	
2	11.4.2.1	Incoming call, SETUP message delivered by point-to-point data link	c2	
3	11.4.2.1	Incoming call, SETUP message delivered by broadcast data link	c3	
4	11.4.2.2.1	Compatibility checking on Bearer capability information element, SETUP message delivered by point-to-point data link	c2	
5	11.4.2.2.1	Compatibility checking on Bearer capability information element, SETUP message delivered by broadcast data link	c3	
6	11.4.2.3	Channel selection-destination	c1	
7	11.4.2.4	Overlap receiving	c1	
8	11.4.2.5	Call confirmation	c1	
9	11.4.2.6	Call accept	c1	
10	11.4.2.7	Active indication	c1	
11	11.4.2.8	Non-selected user clearing	c3	
c1 = m if A.1.3 else n/a c2 = m if A.1.3 and A.18.1 else n/a c3 = m if A.1.3 and not A.18.1 else n/a				

Table A.30: Layer 3 call clearing requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	11.4.3.2	Exception conditions	c1	
2	11.4.3.3	Clearing initiated by the user	c1	
3	11.4.3.4.2	Clearing when tones/announcements not provided	c1	
4	11.4.3.4.3	Completion of clearing	c1	
5	11.4.3.5	Clear collision	c1	
c1 = m if A.1.2 else n/a				

Table A.31: Layer 3 error conditions requirements

No.	Reference	TBR requirement	Status	Support (Y/N)
1	11.4.6.1	Call reference procedural error	c1	
2	11.4.6.2	Message type or message sequence errors	c1	
3	11.4.6.3	Duplicated information elements	c1	
4	11.4.6.4.1	Mandatory information element missing	c1	
5	11.4.6.5.1	Unrecognized information element	c1	
6	11.4.6.5.2	Non-mandatory information element content error	c1	
7	11.4.6.6	Status enquiry procedure	c1	
8	11.4.6.7	Receiving a STATUS message	c1	
9	11.4.7	User notification procedure	c1	
10	11.4.8	Restart procedure	c2	
11	11.5	TE timer T305	c1	
12	11.5	TE timer T308	c1	
c1 = m if A.1.2 else n/a c2 = m if A.1.2 and A.18.1 else n/a				

Annex B (normative): Conformance test principles for layer 1

B.1 Scope and general information

B.1.1 Scope

Reference: ETS 300 012 [11], annex D, subclause D.1.1.

This annex provides the test principles for the requirements of this TBR used to determine the compliance of an IUT to this TBR.

Detailed test equipment accuracy and the specification tolerance of the test devices is not a subject of this annex. Where such details are provided then those test details are to be considered as being an "informative" addition to the test description.

The test configurations given do not imply a specific realization of test equipment or arrangement or the use of specific test devices for conformance testing. However, any test configuration used shall provide those test conditions specified under "system state", "stimulus" and "monitor" for each individual test (the measurement arrangements and the equipment suggested are only for example purposes).

B.1.2 General information

Reference: ETS 300 012 [11], annex D, subclause D.1.2.

This annex is applicable to interface I_a. The field of applicability is reported at the beginning of each test.

In the case of a multi-access IUT supporting interface I_a, unless otherwise stated, only one access at a time shall receive the stimulus. All other accesses shall receive "no signal".

For conformance test purposes, it is desirable that a complete loopback 4 is provided by an IUT (see annex A, table A.1, Appendix I of ETS 300 012 [11]) and also a test pattern of INFO 3 frames with the B1 and B2 channels set to binary ZERO.

Ideal values for components and circuits are considered in the test principles.

Unless otherwise stated, the line termination resistors for both NT and TE side are considered inside the test equipment.

B.1.3 Definitions and abbreviations

Reference: ETS 300 012 [11], annex D, subclause D.1.3.

For the purpose of this annex the following definition, together with those given in clause 3, applies:

Simulator — Device generating the stimulus signal for the IUT and monitoring the signal transmitted by the IUT to find the result.

B.1.4 Environmental conditions

Testing shall be performed at a temperature:

a) within the intended operational range of the TE; and

b) within the range 19°C - 25°C.

Where there is not an overlap of at least 5°C, testing shall be performed at any temperature within the intended operational range.

Testing shall be performed at a humidity in the range 5 % - 75 %.

B.1.5 Test case selection

The selection of requirements made in annex A has an effect on the tests which are applicable to the TE. Tables B.2 and B.3 provide an index of layer 1 tests from clauses B.2, B.3 and B.5, indicating the circumstances under which each test is applicable. The status of each test is described by reference to the test case selection criteria described in table B.1. Where more than one selection criteria is named then the applicability of the test is according to the Boolean combination of the criteria.

NOTE. The TTCN tests of the activation/deactivation procedures in clause B.4 have their own index.

The characteristics measured by the electrical tests of clause B.2 and some of the power feeding tests of clause B.5 can vary with the type of power source or power sink and the extremes of voltage provided by the network. It is, therefore, necessary to repeat some of the tests of clauses B.2 and B.5 at a number of direct current voltage levels of PS1. For designated terminals both the conditions under PS1 normal power and PS1 restricted power apply. For non-designated terminals the conditions under PS1 normal power apply. Table B.2 therefore describes the applicability of each test at a number of voltages of PS1.

Table B.1: Test case selection criteria

Name	TBR-RT reference	Comments
PS	A.4.2 or A.11.2	PS1 powered TE
DES	(A.4.2 and A.4.4) or (A.11.2 and A.11.4)	PS1 powered, designated TE
NDES	(A.4.2 and not A.4.4) or (A.11.2 and not A.11.4)	PS1 powered, non-designated TE
LP	not A.4.2 and not A.11.2	Locally powered TE
PTMP	not A.4.6 and not A.11.6	TE intended to operate in a multipoint configuration
ETH	A.4.5 or A.11.5	TE has a connection to earth
-	-	Test not performed
All	-	Test performed on all TEs

Table B.2: Test case index, tests involving different PS1 voltages

Test [TBR 3 [9]]	Description	Status				
		PS1 = +42V	PS1 = +24V	PS1 = -42V	PS1 = -32V	No PS1 power
B.2.1	Bit rate when transmitting an INFO 1	PS	PS	DES	DES or LP	-
B.2.2.1	TE jitter measurement characteristics (test A), Bus configuration (1)	PS	PS	-	DES or LP	-
B.2.2.1	TE jitter measurement characteristics (test A), Bus configuration (2)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.2.1	TE jitter measurement characteristics (test A), Bus configuration (3b)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.2.1	TE jitter measurement characteristics (test A), Bus configuration (3a)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.2.1	TE jitter measurement characteristics (test A), Bus configuration (4)	PS	PS	-	DES or LP	-
B.2.2.2	TE output phase deviation (test B), Bus configuration (1)	PS	PS	-	DES or LP	-
B.2.2.2	TE output phase deviation (test B), Bus configuration (2)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.2.2	TE output phase deviation (test B), Bus configuration (3b)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.2.2	TE output phase deviation (test B), Bus configuration (3a)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.2.2	TE output phase deviation (test B), Bus configuration (4)	PS	PS	-	DES or LP	-
B.2.3.1	TE transmitter output impedance Test A	PS	PS	DES	DES or LP	-
B.2.3.2	TE transmitter output impedance Test B, 50 Ω load	PS	PS	DES	DES or LP	-
B.2.3.2	TE transmitter output impedance Test B, 400 Ω load	PS and PTMP	PS and PTMP	DES and PTMP	(DES or LP) and PTMP	-
B.2.3.3	TE transmitter output impedance Test C	PS	PS	DES	DES or LP	-
B.2.3.4	TE transmitter output impedance Test D, state F1	-	-	-	-	All
B.2.3.5	TE transmitter output impedance Test E, state F1	-	-	-	-	All
B.2.4	Pulse shape and amplitude	PS	PS	DES	DES or LP	-
B.2.5.1	Pulse amplitude	All	All	LP	DES or LP	-
B.2.5.2	Pulse unbalance of an isolated couple of pulses	All	All	LP	DES or LP	-
B.2.6.1	Voltage on other test loads Test A	PS and PTMP	PS and PTMP	DES and PTMP	(DES or LP) and PTMP	-
B.2.6.2	Voltage on other test loads Test B	PS and PTMP	PS and PTMP	DES and PTMP	(DES or LP) and PTMP	-

(continued)

Table B.2 (concluded): Test case index, tests involving different PS1 voltages

Test [TBR 3 [9]]	Description	Status				
		PS1 = +42V	PS1 = +24V	PS1 = -42V	PS1 = -32V	No PS1 power
B.2.7	Longitudinal conversion loss of transmitter output, state F3	All	All	DES or LP	DES or LP	-
B.2.7	Longitudinal conversion loss of transmitter output, state F1 and F1.0	-	-	-	-	All
B.2.8.1.1	TE receiver input impedance Test A	PS	PS or LP	DES	DES or LP	-
B.2.8.1.2	TE receiver input impedance Test B	PS	PS	DES	DES or LP	-
B.2.8.1.3	TE receiver input impedance Test C, state F1	-	-	-	-	All
B.2.8.1.4	TE receiver input impedance Test D, state F1	-	-	-	-	All
B.2.8.2	Receiver sensitivity - noise and distortion immunity, Bus configuration (1)	PS	PS	-	DES or LP	-
B.2.8.2	Receiver sensitivity - noise and distortion immunity, Bus configuration (2)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.8.2	Receiver sensitivity - noise and distortion immunity, Bus configuration (3a)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.8.2	Receiver sensitivity - noise and distortion immunity, Bus configuration (3b)	PS and PTMP	PS and PTMP	-	(DES or LP) and PTMP	-
B.2.8.2	Receiver sensitivity - noise and distortion immunity, Bus configuration (4)	PS	PS	-	DES or LP	-
B.2.8.3	Unbalance about earth of receiver input, state F3	All	All	DES or LP	DES or LP	-
B.2.8.3	Unbalance about earth of receiver input, state F1 and F1.0	-	-	-	-	All
B.5.1.1	Normal power provision (Test A)	PS	PS	-	-	-
B.5.1.2	Normal power provision (Test B)	PS	PS	-	-	-
B.5.1.3	Normal power provision (Test C)	PS	PS	-	-	-
B.5.1.4	Normal power provision (Test D)	LP	LP	-	-	-
B.5.2.1	Restricted power provision (Test A)	-	-	DES	DES	-
B.5.2.2	Restricted power provision (Test B)	-	-	DES	DES	-
B.5.2.3	Restricted power provision (Test C)	-	-	DES	DES	-
B.5.2.4	Restricted power provision (Test D)	-	-	LP	LP	-
B.5.2.5	Restricted power provision (Test F)	-	-	NDES	NDES	-
B.5.3	Current transient	PS	PS	DES	DES	-

Table B.3: Test case index, tests not involving different PS1 voltages

Test [TBR 3 [9]]	Description	Status
B.3.1.1	Binary organization of frame Test A	All
B.3.1.2	Binary organization of frame Test B	All
B.5.4.1	Limitation on power sink during transient conditions, Current/time limitation for TE, test 1	DES and PTMP
B.5.4.1	Limitation on power sink during transient conditions, Current/time limitation for TE, test 2	DES and PTMP
B.5.4.2	Limitation on power sink during transient conditions, Current/time limitation for TE when connecting	(NDES or LP) and PTMP
B.5.4.4.1	Power start-up test after removal of short-circuit, test 1 restricted mode	DES
B.5.4.4.1	Power start-up test after removal of short-circuit, test 2 normal mode	PS
B.5.4.4.2	Power start-up test at low input voltage	PS
B.5.4.5.1	Protection against short-term interruptions, Normal power	PS
B.5.4.5.2	Protection against short-term interruptions, Restricted power	DES
B.5.4.6.1	Behaviour at the switch-over, normal power	DES
B.5.4.6.2	Behaviour at the switch-over, Restricted power	DES
B.5.4.7	DC unbalance of TEs using power sink 1	PS
B.5.4.8	Effect of current unbalance	All
B.5.5	Galvanic isolation	ETH

B.2 Electrical characteristics tests

The tests shall be performed according to subclause B.2 in annex B of TBR 3 [9].

B.3 Functional characteristic tests

The tests shall be performed according to subclause B.3 in annex B of TBR 3 [9].

B.4 Interface procedure tests

This ATS has been produced using the Tree and Tabular Combined Notation (TTCN) according to ISO/IEC 9646-3 [7].

The ATS was developed on a separate TTCN software tool and therefore the TTCN tables are not completely referenced in the contents table. The ATS itself contains a test suite overview part which provides additional information and references.

The test selection criteria are part of this test suite.

B.4.1 The TTCN Graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in a PDF file (T33L1_7.PDF[1)]) which accompanies this ETS.

B.4.2 The TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII file (T33L1_7.MP[1)]) which accompanies this ETS.

NOTE: According to ISO/IEC 9646-3 [7], in case of a conflict in interpretation of the operational semantics of TTCN.GR and TTCN.MP, the operational semantics of the TTCN.GR representation takes precedence.

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1) This file is located in an archive file named 033_B1.LZH.

B.5 Power feeding

The tests shall be performed according to clause B.5 in annex B of TBR 3 [9].

Annex C (normative): Layer 2 tests

This ATS has been produced using the Tree and Tabular Combined Notation (TTCN) according to ISO/IEC 9646-3 [7].

The ATS was developed on a separate TTCN software tool and therefore the TTCN tables are not completely referenced in the contents table. The ATS itself contains a test suite overview part which provides additional information and references.

C.1 The TTCN Graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in a PDF file (T33L2_3.PDF[2)]) which accompanies this ETS.

C.2 The TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII file (T33L2_3.MP[2)]) which accompanies this ETS.

NOTE: According to ISO/IEC 9646-3 [7], in case of a conflict in interpretation of the operational semantics of TTCN.GR and TTCN.MP, the operational semantics of the TTCN.GR representation takes precedence.

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2) This file is located in an archive file named 033_B1.LZH.

Annex D (normative): Layer 3 tests

This ATS has been produced using the Tree and Tabular Combined Notation (TTCN) according to ISO/IEC 9646-3 [7].

The ATS was developed on a separate TTCN software tool and therefore the TTCN tables are not completely referenced in the contents table. The ATS itself contains a test suite overview part which provides additional information and references.

D.1 The TTCN Graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in a PDF file (T33L3_5.PDF[3)]) which accompanies this ETS.

D.2 The TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII file (T33L3_5.MP[3)]) which accompanies this ETS.

NOTE: According to ISO/IEC 9646-3 [7], in case of a conflict in interpretation of the operational semantics of TTCN.GR and TTCN.MP, the operational semantics of the TTCN.GR representation takes precedence.

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3) This file is located in an archive file named 033_B1.LZH.

Annex E (normative): Partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma

E.1 Introduction

In order to test a TE, information relating to the implementation and its testing environment in addition to that provided by the TBR-RT is needed. The form containing such extra information is called a Protocol Implementation eXtra Information for Testing (PIXIT). The PIXIT contained in this annex is intended to provide a standard layout for the provision of such information by suppliers to test laboratories. Test laboratories may choose to ask for further information or to request the information in a different format.

E.2 References

The PIXIT item references, if any, generally are the associated TBR subclause numbers.

E.3 Proforma structure and contents

The PIXIT proformas are tables containing pre-printed text and empty table space intended to be used by the supplier for explanations, specification of details, etc.

The proforma "Environmental Test Conditions" is intended to indicate the environmental conditions to be used during testing.

NOTE: In case no environmental value or range is indicated by the client, the test laboratory should use a value within the ranges pre-printed in the proforma.

E.4 Table/item identification

Each pre-printed item in a PIXIT table is provided with a serial number in the left hand table column called "Item". This provides a unique identifier of the item, distinguishing it from TBR-RT items

E.5 Guidance on completing the PIXIT

For each layer to be tested, the associated PIXIT proformas should be completed by the supplier.

The information provided in the PIXIT should be consistent with information provided in the corresponding TBR-RT.

E.6 Environmental test conditions

Table E.1: Environmental test conditions

Ambient temperature range °C	**Relative humidity range %**	**Air pressure range kPa**	**Power Supply**	
			Voltage V	**Frequency Hz**
If no values/ranges are indicated above, values in the following ranges will be used				
21 - 25°C for layer 1 15 - 35°C for layers 2 and 3	10 - 75	86 - 106	within ± 5 % of normal operating voltage	within ± 4 % of normal operating frequency
OTHER TEST CONDITIONS (indicate any other condition that may be needed/useful during testing):				

E.7 Layer 1 PIXIT

Table E.2: Procedural information

Item	Reference	Description
E.2.1	B.2	Explain how specific patterns can be transmitted in the B-channels, either by providing a loopback or a 64 kbit/s clear data path to both B-channels. Indicate whether there is any delay before the input is capable of being reproduced at the output without any slips.
E.2.2	9.1.3	If the IUT is to be permanently connected to the network according to subclause 9.1.3, state the signal identification of the wires used for connection and the location of the I_a interface point for the purpose of layer 1 testing.
E.2.3	9.4.2.3	State how the terminal operating on-demand access can be made to initiate activation procedures (layer 1 receives the PH-ACTIVATE REQUEST primitive).
E.2.4	9.5.3	State how the terminal can be placed in a condition in which the maximum power is drawn from PS1.
E.2.5	9.5.3, 9.5.5	If more than one power feeding source can be used as declared in items 1 and 2 of table A.1, state how the IUT can be placed in each of the declared power consumption modes.

(continued)

Table E.2 (concluded): Procedural information

Item	Reference	Description
E.2.6	9.2.7, 9.2.10, 9.5.4	State how and where the IUT is connected to earth (ground) under normal operating conditions.
E.2.7	B.1.2	Explain how the termination resistor (if implemented) may be disabled.

Table E.3: Implemented values

Item	Reference	Description	Value
E.3.1		State the duration of the selftest.	
E.3.2	9.4.2.4	State the value of the timer T3 (only on-demand access).	
E.3.3	9.4.2.3	State the value of timer T_APPLI1 which represents the delay needed by the application to establish a call. (layer 1 is deactivated).	
E.3.4	9.4.2.3	State the value of timer T_APPLI2 which represents the delay needed by the application to clear a call.	
E.3.5	9.4.2.3	State whether the TE initiates automatic TEI assignment immediately after receiving INFO 4 following connection to the network.	
E.3.6	9.5.5.2.1	State the time needed by the TE to reach the operational condition after removal of short circuit for: - normal mode; - restricted mode; - at low input voltage.	
E.3.7	9.5.5.2.3	State the time needed for the TE to restrict its power consumption after the switch-over from normal mode to restricted mode PS1 (applicable to designated terminals only).	

Table E.4: Supplier's additional information

E.4.1	Indicate any additional information necessary to successfully perform layer 1 testing.

E.8 Layer 2 PIXIT

Table E.5: Additional layer 2 information

Item	Reference	Description
E.5.1	10.5.2	If non-automatic TEI assignment is used: - state the TEI value(s) implemented; - explain the operation needed to assign a TEI (see note).
E.5.2	10.6.1	Does the IUT, when in state 4 and no I-frames are to be sent, remain in state 4 for more than 6 seconds.
E.5.3	10.2.3.3	State the SAPI value (0 or 16) for which the test campaign will be run.
E.5.4	10.6.1	Explain how the transmission of a SABME frame can be invoked by the user:
E.5.5	10.5.2	Explain how the transmission of an identity request frame can be invoked by the user:
NOTE: Only to be completed if an operator can assign a non-automatic TEI value to the TE.		

Table E.6: Supplier's additional information

Item	Description
E.6.1	Indicate a coding of an information field containing an activate message command. (Example codings: SAPI = 0: compatible SETUP message ‘08010105'O SAPI = 16: CALL REQUEST message ‘10010B0843551021000100000O')
E.6.2	Indicate a coding of an information field containing a dummy message which will not cause a response. (Example codings: SAPI = 0: RELEASE COMPLETE message ‘0801815A08028290'O SAPI = 16: CALL CONFIRM message ‘100117'O)
E.6.3	Indicate a coding of an information field containing a soliciting message which will cause the response as given in subclause E.6.4. (Example codings: SAPI = 0: RELEASE message ‘0801014D08028290'O SAPI = 16: RESTART INDICATION message ‘1000FB0700'O)
E.6.4	Indicate a coding of an information field containing a response message to the soliciting message as given in subclause E.6.3. (Example codings: SAPI = 0: RELEASE COMPLETE message ‘0801815A'O SAPI = 16: RESTART CONFIRM message ‘1000FF'O)

E.9 Layer 3 PIXIT

Table E.7: Test co-ordination information

Item	Reference	Description
If the following procedures are supported on the terminal, explain how they can be invoked by the user.		
E.7.1	11.4.1.1	Initiation of a demand access B-channel connection. (i.e. sending a SETUP message without Called party and Called subaddress information element).
E.7.2	11.4.2.6	Answering of an incoming call. (i.e. sending a CONNECT message).
E.7.3	11.4.3.3	Initiation of call clearing. (i.e. sending a DISCONNECT message).
E.7.4	10.6.1.2, 11.4.1	Initiation of a data link connection for SAPI = 0. (i.e. sending of a DL-ESTABLISH-REQUEST primitive at the relevant SAP).
E.7.5	10.6.1.2, 11.4.3.4.2	Initiation of a data link connection for SAPI = 16. (i.e. sending of a DL-ESTABLISH-REQUEST primitive at the relevant SAP).
E.7.6	11.4.2.7	Acceptance of an incoming virtual call on an idle B-channel.

Table E.8: Additional layer 3 information

Item	Reference	Description
E.8.1	11.1.1.7	If entering state U7, does the terminal remain in that state for at least 3 seconds?
E.8.2	11.1.9	If entering state U9, does the terminal remain in that state for at least 3 seconds?
E.8.3	11.4.2.7	If establishing a B-channel connection, does the terminal maintain that connection, if no virtual call occurs on that B-channel?
E.8.4	11.4.2.5.1	Does the terminal support sending of the CALL PROCEEDING PDU?
E.8.5	11.4.2.5.1	Does the terminal support sending of the ALERTING PDU?
E.8.6	11.4.1.5	Does the terminal support sending of the CONNECT ACKNOWLEDGE PDU?
E.8.7	11.3.5.5, 11.4.2.2.1	State a value of the Bearer capability information element which the TE accepts for the purpose of compatibility checking of incoming calls requesting the acceptance of incoming virtual calls on the B- or D-channel.
E.8.8	11.3.5.5, 11.4.2.2.1	State a value of the Bearer capability information element which the TE accepts for the purpose of compatibility checking of incoming calls requesting the acceptance of incoming virtual calls on the D-channel (i.e. the Channel identification information element in the SETUP message that carries this Bearer capability value will indicate no channel with the preferred/exclusive bit set to "exclusive: only the indicated channel is acceptable" and the D-channel indicator set to "the channel identified is the D-channel").
E.8.9	11.3.5.5, 11.4.2.2.1	State a value of the Bearer capability information element which the TE rejects for the purpose of compatibility checking of incoming calls. (Only applicable if the answer to A29.4 or A29.5 is YES).
E.8.10	11.3.5.7, 11.4.2.2	State a value of the Called party number information element which the TE accepts for the purpose of address checking of incoming calls.
E.8.11	11.3.5.9, 11.4.6.5.2	State a value of the Calling party number information element exceeding 24 octets for the purpose of checking the correct reaction to a non-mandatory information element exceeding the maximum length.

Annex F (informative): Justifications for the requirements in the TBR

F.1 Principles applicable to the whole TBR

F.1.1 General principles

The following general principles form the basis of whether a requirement is essential.

1) The only point at which conformance with the TBR is monitored is the network interface. Internal implementation of the TE is not constrained in any way. The network interface is described as a "Point of Control and Observation" (PCO) in ISO/IEC 9646-2 [6]. ISO/IEC 9646-2 [6] stresses that the addition of a second PCO would, in effect, be the addition of a requirement on the equipment under test to provide it.

2) Other interfaces (e.g. an interface for connection of other equipment, or the man-machine interface) may be used to stimulate the TE into performing actions whose effects at the user-network interface are monitored (i.e. such other interfaces may be used for control but not for observation).

3) The TE does not interwork with the network in the B-channels for the purpose of setting up, clearing, etc. real or virtual connections as described in Article 4 (f). Therefore, requirements relating to B-channels in the base standards are not included in the TBR. The TE uses the B-channels to interwork with the distant TE **via** the network. This is an Article 4 (g) issue which is outside the scope of this TBR. This TBR therefore includes no requirement for the TE to be capable of any meaningful exchange of information in the B-channel of a call in the Active state.

F.1.2 Requirements versus definitions

Generally, clauses that describe a state, frame, field, message, information element or system parameter are classed as definitions. Such definitions have only been included in the TBR where they are referred to, either directly or via other definitions, by essential requirements. These definitions are in addition to those included within clause 3 of this TBR.

Clauses that specify a change of state within the TE or an exchange of information across the interface are classed as requirements. The information exchanged by the TE is usually described by the definitions referred to above.

Only requirements have test cases attached to them, and only requirements are listed in the TBR-RT. Definitions are not testable *per se*.

F.1.3 Error conditions

This TBR assumes that (except for bit errors arising during transmission of the signal to the TE from the public exchange) the network operates without error according to the base standards. This has an effect on whether certain requirements of the base standard (particularly at layers 2 and 3) are essential. The principle followed is that where the base standard requires a specific response on the user side to a message which the network side is not permitted to send, the requirement is generally considered not to be essential.

In most cases, the requirements affected are those for the handling of various kinds of messages containing content errors from the network. However, some other requirements are also affected. These are listed individually in the tables below.

Nevertheless, some layer 3 error condition requirements from TBR 3 [9] have been retained in this TBR.

F.1.4 General editorial changes to text from the base standards

The following general changes have been made when including text from the base standards (TBR 3 [9]) within this TBR:

- deletion of requirements and definitions applicable only to the circuit mode of operation case A of ETS 300 007 [10];

- when text of this TBR is identical to text of TBR 3 [9], reference to the TBR 3 [9] clause is given. When text is changed in this TBR compared to TBR 3 [9], the full new text is given; while some text may appear extremely similar to the TBR 3 [9] text, the change of a reference clause number, the change of the test definition have resulted in the TBR 3 [9] text being reproduced in this TBR;

- at the end of every requirement, relevant test cases are indicated.

F.1.5 Detailed list of changes with respect to the base standards

Detailed changes to requirements of individual clauses of the base standards are given in a series of tables below. The format of the tables is as follows.

The first column contains the clause number and clause title of the clause of the base standard.

The second column contains the clause number of this TBR which contains text on the same subject.

The third column contains the following:

- "X" if no text from that clause has been included in the TBR;

- "D" if text has been included as a definition;

- "I" if text has been included as a note or as introductory text to subsequent clauses;

- "R" if in the subclause references are made to other subclauses of this TBR, containing changes with respect to TBR 3 [9], or referring themselves to such subclauses. The text does not change literally, but the semantics of the text has changed. Subclauses attached with this status normally have not indicated any further justification;

- "E" if the change occurs because of different requirements;

- "A" if the change consists in the addition of explaining text, e.g. notes or temporary notes;

- "N" if there is new text related to CCITT Recommendation X.25;

- a reference to one or more paragraphs of Article 4 of Directive 91/263/EEC if text has been included as a requirement. The reference is to the paragraph of the Directive under which the requirement is justified.

The fourth column includes any comment particular to that clause, including:

- for requirements, a justification for the clause being regarded as essential;

- a justification for changes made compared to the base standard. In particular, any technical changes (as opposed to merely editorial) are highlighted.

General changes in accordance with the principles described above are not listed on an individual basis.

F.1.6 Untested requirements

Certain requirements which have been regarded as essential, are not accompanied by a test. The reason for the absence of a test is generally that the requirement was not included in the NETs, that a test method is therefore not readily available, and that time and resources did not permit the development of a new test. Notes have been included in the affected requirements clauses, indicating which requirements are untested. A second edition of the TBR may result in such tests being included.

F.1.7 Primitives

See subclause F.1.7 of TBR 3 [9].

F.1.8 Supplementary services

See annex G.

F.1.9 Article 4(e) of the Directive

There are no requirements in the TBR justified under Article 4(e) because the access does not make use of the radio spectrum. However, Article 4(e) is included within the scope of the TBR, to make it clear that no other TBRs or other standards exist containing additional requirements under Article 4(e) applicable to TEs within the scope of this TBR.

F.2 Changes with respect to TBR 3

Table F.1: Summary of changes with respect to TBR 3 [9]

Clause of TBR 3 [9]	Clause in this TBR	Status	Justification
Foreword		X	The TBR contains its own foreword.
1 Scope		X	The TBR contains its own scope.
2 Normative references		X	The TBR contains its own list of Normative references.
3 Definitions	3.1	D	Appropriate new definitions are included as necessary within the TBR.
4 Abbreviations and symbols	3.2 & 3.3	D	Appropriate new abbreviations and symbols are included as necessary within the TBR.
5, 6, 7 & 8 Requirements	5, 6, 7 & 8		No change.
9 Layer 1 requirements	9		Changes due to semi-permanent B-channel case addition.
10 Layer 2 requirements	10		Changes due to the packet mode requirements and to the semi-permanent mode of operation.
11 Layer 3 requirements	11		Packet mode operation requirements.
X.25 (n/a)	12	N	New text to define X.25 requirements and procedures.
Annex A	Annex A		New RTs when applicable.
Annexes B, C, D	Annexes B, C, D		Test selection for layer 1 (annex B) and test suites (annex B, C and D) adapted to packet mode calls.
Annex E	Annex E		PIXIT proformas adapted to new suites of annexes B, C and D.
Annex F	Annex F		Change references made with respect to TBR 3 [9].
Annex G	Annex G		Supplementary services for packet mode calls introduced.
Annex H	Annex J		Reference made to the bibliography of TBR 3 [9]. Addition of a few references specific for packet mode.
	Annex H		Examples for simple access configurations added.

F.2.1 Changes for layer 1

The following general principles are followed in these requirements:

- all TEs powered from PS1 operate during normal power conditions;
- packet mode TEs operating in semi-permanent B-channel are not designated TEs;
- non-designated TEs powered from PS1 do not disturb the operation of designated TEs during restricted power conditions;
- locally powered TEs operate during normal and restricted power conditions.

F.2.1.1 Protection requirements

The requirements of clause 8 limit the common mode and transverse mode voltages at the TE output to the levels to which the network interface presentation is protected from electrical damage. Any voltages in excess of those specified could cause harm to the network (Article 4 (d)). Other requirements from ETS 300 047-3 [12] are concerned with protection of the terminal and are therefore outside the scope of this TBR.

F.2.1.2 Detailed list of changes with respect to TBR 3

Table F.2: Changes for layer 1 with respect to TBR 3 [9]

Clause of TBR 3 [9]	Clause in this TBR	Status	Justification
9	9	D	Definition of the two cases of operation at layer 1.
9.4.1.2	9.4.1.2		SAPI 16 priority mechanism.
9.4.2	9.4.2	D	Case of on-demand B-channel only.
			Drop of states F4 and F5. No activation from layer 2.
			New state table specification to insure semi-permanent layer 1 operation for the two cases of PS1 powered and locally powered TEs (prA1 of TBR 3 [9] taken into account).
			Deletion of timer T3 due to drop of states F4 and F5.

F.2.2 Changes for layer 2 of the D-channel

Table F.3: Changes for layer 2 of the D-channel with respect to TBR 3 [9]

Clause of TBR 3 [9]	Clause in this TBR	Status	Justification
10 Layer 2 requirements	10	E	Use of SAPI 0 and SAPI 16, on-demand and semi-permanent data links, TE capability of only initiating or only responding to data link establishment, new test case references (taking prA1 to TBR 3 [9] and new test suite into account).
10.1.5 Information field	10.1.5	R	
10.1.9 Invalid or incompatible frames	10.1.9	R	
10.2.3.3 Service Access Point Identifier (SAPI)	10.2.3.3	E	SAPI 16 has been added to support access of the PH over the D-channel.
10.2.5.2.2 Send state variable V(S)	10.2.5.2.2	R	
10.2.6.1 Commands and responses	10.2.6.1	R	SABM, DISC and UI have been indicated in notes to be optional under certain conditions. See justification of clause 10.
10.2.6.6 Receive Ready (RR) command/response	10.2.6.6	R	
10.5.6.5 Action indicator	10.5.6.5	A	A temporary note has been included because the original text in TBR 3 [9] contains an incorrect reference.
10.6.1.2 Establishment procedures	10.6.1.2.1, 10.6.1.2.2	E	The establishment procedures have been divided in data link establishment on-demand (initiation) of the TE and on-demand of the network (response). See also justification of clause 10.
10.7.1 Transmitting I-frames	10.7.1	R	
10.7.2.2 P bit set to 0	10.7.2.2	R	
10.7.3 Receiving acknowledgements	10.7.3	R	
10.7.4 Receiving REJ frames	10.7.4	R	
10.7.5.1 Receiving a valid RNR command or response	10.7.5.1	R	
10.7.5.2 Expiry of timer T200 during "peer receiver busy"	10.7.5.2	R	
10.7.5.4 Receiving a valid RR or REJ command or response during "peer receiver busy"	10.7.5.4	R	
10.7.5.5 Appropriate supervisory response frame	10.7.5.5	R	
10.7.6 Waiting acknowledgement	10.7.6	R	
10.8 Re-establishment of multiple frame operation	10.8	R	
10.9.2 Invalid frame condition	10.9.2	R	
10.9.3 Frame rejection condition	10.9.3	R	
10.9.4 Multiple-assignment of TEI value	10.9.4	R	
10.10.3 Maximum number of octets in an information field (N201)	10.10.3	R	
10.10.5 Maximum number of outstanding I-frames (k)	10.10.5	A	Notes have been added to indicate the independence of the values of k for SAPI 0 and SAPI 16.

F.2.3 Changes for layer 3 of the D-channel

Table F.4: Changes for layer 3 of the D-channel with respect to TBR 3 [9]

Clause of TBR 3 [9]	Clause in this TBR	Status	Justification
11 Layer 3 requirements	11	E	The introduction has been extended to point to the different access configurations and to indicate that the procedures of this clause are optional (as opposite to TBR 3 [9]), because it is possible to access the PH over the D-channel only.
11.1 Overview of call control	11.1	R	
11.1.1 Call states at the user side of the interface	11.1.1	E	The call states not applicable to the access of the packet handler (due to overlap sending, overlap receiving and call rearrangement) have been deleted.
11.1.2 Network call states	11.1.2	E	The call states not applicable to the access of the packet handler (due to overlap sending, overlap receiving and call rearrangement) have been deleted.
11.1.3 States associated with the global call reference	11.1.3	R	
11.2 Message functional definitions and content	11.2	E	Table 11.1 has been modified to contain only the messages listed in clauses B.1 to B.11 of ETS 300 007 [10].
11.2.1 Alerting	11.2.1	E	Changed according to clause B.1 of ETS 300 007 [10].
11.2.2 Call proceeding	11.2.2	E	Changed according to clause B.2 of ETS 300 007 [10].
11.2.3 Connect	11.2.3	E	Changed according to clause B.3 of ETS 300 007 [10].
11.2.4 Connect acknowledge	11.2.4	E	Changed according to clause B.4 of ETS 300 007 [10].
11.2.5 Disconnect	11.2.5	E	Changed according to clause B.5 of ETS 300 007 [10].
11.2.6 Information	-	E	Deleted because overlap sending/receiving is not used.
11.2.7 Notify	-	E	Deleted because the message is not used by the network.
11.2.8 Progress	-	E	Deleted because optional.
11.2.9 Release	11.2.6	E	Changed according to clause B.7 of ETS 300 007 [10].
11.2.10 Release complete	11.2.7	E	Changed according to clause B.8 of ETS 300 007 [10].
11.2.11 Resume	-	E	Deleted because the procedures of call rearrangement are not used.
11.2.12 Resume acknowledge	-	E	See justification for deletion of Resume (11.2.11).
11.2.13 Resume reject	-	E	See justification for deletion of Resume (11.2.11).
11.2.14 Setup	11.2.8	E	Changed according to clause B.9 of ETS 300 007 [10].
11.2.15 Setup acknowledge	-	E	
11.2.16 Status	11.2.9	E	Changed according to clause B.10 of ETS 300 007 [10].
11.2.17 Status enquiry	11.2.10	E	Changed according to clause B.11 of ETS 300 007 [10].
11.2.18 Suspend	-	E	See justification for deletion of Resume (11.2.11).
11.2.19 Suspend acknowledge	-	E	See justification for deletion of Resume (11.2.11).
11.2.20 Suspend reject	-	E	See justification for deletion of Resume (11.2.11).

(continued)

Table F.4 (continued): Changes for layer 3 of the D-channel with respect to TBR 3 [9]

Clause of TBR 3 [9]	Clause in this TBR	Status	Justification
11.3 General message format and information elements coding	11.3	R	
11.3.4 Message type	11.3.4	E	Table 11.26 has been modified (it is table 11.13 in this TBR) to contain only the messages listed in clauses B.1 to B.11 of ETS 300 007 [10].
11.3.5.1.1 Codeset 0	11.3.5.1.1	E	Table 11.27 has been modified (it is table 11.14 in this TBR) to contain only the information elements of table C.2 in annex C of ETS 300 007 [10].
11.3.5.5 Bearer capability	11.3.5.5	E	The coding of the bearer capability has been adapted to the requirements of ETS 300 007 [10] (see e.g. subclause 7.2.2.3.1 of ETS 300 007 [10]).
-	11.3.5.9	E	The calling party number IE has been included because it is used in ETS 300 007 [10] (required to be used by some networks for X.32 identification purposes).
-	11.3.5.10	E	The calling party subaddress IE has been included because it is used in ETS 300 007 [10] (required to be used by some networks for X.32 identification purposes).
11.4 Call control procedures for the control of packet-mode access connections	11.4	E	The introductory text has been changed with respect to the applicability of the requirements of this subclause. In TBR 3 [9], circuit-switched call control procedures are generally required, while in this TBR packet-mode access connections are applicable.
11.4.1 Call establishment at the originating interface	11.4.1		The requirement to use SAPI 0 for the packet-switched call control procedures has been added.
11.4.1.1 Call request	11.4.1.1	R	
11.4.1.2 Overlap sending	11.4.1.2	E	Not used in this TBR. See the justification of subclause 11.2.6 above.
11.4.1.3 Call proceeding	11.4.1.3	E	Changes necessary as result of not using overlap sending and the associated states.
11.4.1.4 Call confirmation indication	11.4.1.4	E	n/a as result of not using overlap sending and the associated states.
11.4.1.5 Call connected	11.4.1.5	R	
11.4.2 Call establishment at the destination interface	11.4.2	E	Use of SAPI 0 indicated.
11.4.2.1 Incoming call	11.4.2.1	E	Changes necessary as result of not using overlap receiving and the associated states.
11.4.2.2 Compatibility checking	11.4.2.2	E	The references to the Lower Layer Compatibility information element and the High Layer Compatibility information element have been removed, since these are not used in this TBR (see subclause 11.3.5.1.1).
11.4.2.3 B-channel selection-destination	11.4.2.3	E	Changes are necessary because the use of the D-channel also applies. The procedures of subclause 7.2.2.3.1 of ETS 300 007 [10] are used.
11.4.2.4 Overlap receiving	11.4.2.4	E	Not used in this TBR. See the justification of subclause 11.2.6 above.

(continued)

Table F.4 (concluded): Changes for layer 3 of the D-channel with respect to TBR 3 [9]

Clause of TBR 3 [9]	Clause in this TBR	Status	Justification
11.4.2.5 Call confirmation	11.4.2.5	E	Changes necessary as result of not using overlap receiving and the associated states.
11.4.2.6 Call accept	11.4.2.6	E	Changes necessary as result of not using overlap receiving and the associated states.
11.4.2.8 Non-selected user clearing	11.4.2.8	E	Changes are necessary because RELEASE from the network using cause #7 (call awarded and being established in an established channel) is applicable. See e.g. ETS 300 007 [10], subclause 7.2.2.3.1.
11.4.3.2 Exception conditions	11.4.3.2	E	The reference to the SETUP ACKNOWLEDGE message has been removed, since this message is not used. See e.g. justification of subclause 11.2.
11.4.3.4.1 Clearing when tones/announcements provided	11.4.3.4.1	E	Clearing with tones/announcements is not applicable to packet mode connections.
11.4.3.4.2 Clearing when tones/announcements not provided	11.4.3.4.2	E	Changes are necessary because RELEASE from the network using cause #7 (call awarded and being established in an established channel) is applicable. See e.g. ETS 300 007 [10], subclause 7.2.2.3.1.
11.4.4 Call rearrangements	11.4.4	E	Call rearrangements are not used in this TBR. See justification of subclause 11.2.11.
11.4.6.4.1 Mandatory information element missing	11.4.6.4.1	R	
11.4.6.5 Non-mandatory information element errors	11.4.6.5	R	
11.4.6.5.1 Unrecognized information element	11.4.6.5.1	R	
11.4.6.5.2 Non-mandatory information element content error	11.4.6.5.2	R	
11.4.6.6 Status enquiry procedure	11.4.6.6	R	
11.4.6.7 Receiving a STATUS message	11.4.6.7	R	
11.4.7 User notification procedure	11.4.7	E	The user notification procedure is not applicable. See justification of subclause 11.2.7.
11.4.8 Restart procedure	11.4.8	R	

Annex G (normative): List of supported telecommunication services

G.1 Basic telecommunication services

This TBR is applicable to packet-mode terminal TE supporting one or more of the following basic telecommunication services (ETS 300 007 [10]):

- packet switched synchronous data transmission service provided by an ISDN with access by a direct connection via a B-channel at data signalling rates of 2,4, 4,8, 9,6, 48 and 64 kbit/s (Services T1, T2, T3, T4 and T5 of X.1);

- packet switched synchronous data transmission service provided by an ISDN with access by a direct connection via a D-channel at data signalling rates of 2,4, 4,8 and 9,6 kbit/s (Services U1, U2 and U3 of X.1);

- packet switched synchronous data transmission service provided by an ISDN with access by a switched connection via a B channel at data signalling rates of 2,4, 4,8, 9,6, 48 and 64 kbit/s (Services Y1, Y2, Y3, Y4 and Y5 of X.1).

  NOTE: This does not include circuit-mode access to a PSPDN (X.31 case A) which is covered by TBR 3 [9].

G.2 Supplementary services for the access connection

- Multiple Subscriber Number (MSN);
- Direct Dialling In (DDI);
- Calling Line Identification Presentation (CLIP);
- any teleservice based on packet-mode bearer capability and using X.25 or similar protocol at layer 3.

Annex H (informative): Examples for TE access configurations with small sets of requirements

Many possibilities to access the PH have been defined in this TBR. This informative annex gives some examples of access configurations for TEs implementing only outgoing or only incoming virtual calls. Only "small" subsets of all the requirements expressed in this TBR are applicable to such TEs.

The information of this annex is only intended to serve as an overview. In case of any conflict with the requirements tables of annex A, the requirements tables supersede.

The columns under "layer 2/3 requirements" refer to the D-channel protocols only.

Table H.1 contains some examples for TEs supporting only outgoing calls and table H.2 contains some examples for TEs supporting only outgoing calls.

Table H.1: Configurations for TEs supporting only outgoing virtual calls

Access configuration	Layer 1 requirements	Layer 2 requirements	Layer 3 requirements
Semi-permanent B-channel, point-to-point	Only requirements for semi-permanent layer 1	SAPI 0: not applicable SAPI 16 not applicable SAPI 63 not applicable	Not applicable
Switched B-channel, point-to-point	Only requirements for switched layer 1	SAPI 0: only data link setup initiation SAPI 16: not applicable SAPI 63: not applicable	Only call establishment/clearing at the outgoing interface
D-channel, point-to-point, semi-permanent data link (controlled by the network)	Only requirements applicable to the D-channel	SAPI 0: not applicable SAPI 16: only data link setup response SAPI 63: not applicable	Not applicable
D-channel, point-to-point, on-demand data link (controlled by the TE)	Only requirements applicable to the D-channel	SAPI 0: not applicable SAPI 16: only data link setup initiation SAPI 63: not applicable	Not applicable

Table H.2: Configurations for TEs supporting only incoming virtual calls

Access configuration	Layer 1 requirements	Layer 2 requirements	Layer 3 requirements
Semi-permanent B-channel, point-to-point	Only requirements for semi-permanent layer 1	SAPI 0: not applicable SAPI 16: not applicable SAPI 63: not applicable	Not applicable
Switched B-channel, point-to-point, no notification	Only requirements for switched layer 1	SAPI 0: only data link setup initiation SAPI 16: not applicable SAPI 63: not applicable	Only call establishment/clearing at the outgoing interface
D-channel, point-to-point, semi-permanent data link (controlled by the network)	Only requirements applicable to the D-channel	SAPI 0: not applicable SAPI 16: only data link setup response SAPI 63: not applicable	Not applicable
D-channel, point-to-point, on-demand data link (controlled by the TE), no notification	Only requirements applicable to the D-channel	SAPI 0: not applicable SAPI 16: only data link setup initiation SAPI 63: not applicable	Not applicable

Annex J (informative): Bibliography

For the purposes of this TBR, the informative references in the Bibliography of TBR 3 [9] apply and the following additional informative references are given:

- CCITT Recommendation X.32 (1988): Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating equipment (DCE) for terminals operating in the packet mode and accessing a packet-switched public data network through a public switched telephone network or a circuit-switched public network".

- ETS 300 048 (1995): "Integrated Services Digital Network (ISDN); ISDN Packet Mode Bearer Service (PMBS); ISDN Virtual Call (CV) and Permanent Virtual Circuit (PVC) bearer services provided by the B-channel of the user access - basic and primary rate".

- ETS 300 049 (1995): "Integrated Services Digital Network (ISDN); ISDN Packet Mode Bearer Service (PMBS); ISDN Virtual Call (VC) and Permanent Virtual Circuit (PVC) bearer services provided by the D-channel of the user access - basic and primary rate".

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