

ECMA

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

STANDARD ECMA-105

DATA LINK LAYER PROTOCOL FOR THE D-CHANNEL
OF THE INTERFACES AT THE REFERENCE POINT
BETWEEN TERMINAL EQUIPMENT AND PRIVATE
TELECOMMUNICATION NETWORKS

Third Edition June 1990

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BRIEF HISTORY

This Standard ECMA-105 is one of a series of ECMA standards for the connection of Data Processing Equipment (DPE) to Private Telecommunication Networks (PTNs).

It uses ISDN concepts as developed by the CCITT and conforms to the framework of standards on Open Systems Interconnection as defined by ISO 7498. It has been produced under work items 4.2.1 and 4.2.2 of the supplement to ITSTC Memorandum M-IT-05 (Issue 1, November 1989) with the intention of submission to CENELEC as a proposed ENV.

It is based on the practical experience of ECMA member companies and results from their active and continuous participation in the work of ISO, CCITT, and ETSI, as well as numerous national standardization bodies throughout Europe and North America. It represents a pragmatic and widely based consensus.

This Standard ECMA-105 standardizes the Data Link Layer protocol to be used on the D-channel at the S reference point between Terminal Equipment and Private Telecommunication Networks (PTNs). The first edition, which was limited in scope to the attachment of Data Processing Equipment to Private Telecommunication Networks, was adopted by the General Assembly of ECMA on 13th June 1985.

To maintain alignment with results of the CCITT 1985-1988 Study Period and to provide a true reflection of the agreed position of ECMA member companies, it was found necessary to publish a second edition of this Standard in December 1987.

This third edition has been aligned with CCITT Rec. Q.921 "Blue Book" and changed, in format, to reference ETSI T/S 46-20 to avoid large duplication of text. The scope is no longer limited to Data Processing Equipment.

Adopted as the 3rd Edition of Standard ECMA-105 by the General Assembly of 28th June 1990.

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1. SCOPE

This Standard ECMA-105 specifies the characteristics of the Data Link Layer protocol for use on the D-channel at the S reference point provided by a Private Telecommunication Network (PTN). The purpose of the Data Link Layer protocol is to convey information between Network Layer entities using the D-channel.

2. FIELD OF APPLICATION

This Standard ECMA-105 is applicable to Terminal Equipment (including Terminal Adaptors) and Private Telecommunication Network Exchanges (PTNXs) interconnected at the S reference point.

3. CONFORMANCE

Conformance to this Standard by a TE or PTN implies that the requirements of sub-clauses 7.5 to 11.9 are met, with the exception that the following sub-clauses contain purely informative information:

- 7.6 - Overview of Data Link Layer Structure,
- 10.2.3 - Data Link - Data Link Layer Representation,
- 11.2 - Procedures for Unacknowledged Information Transfer.

PTNs conforming to this Standard shall support the procedures associated with automatic TEI assignment. A PTN may optionally support procedures associated with non-automatic TEI assignment.

Terminal Equipment conforming to this Standard may support the procedures associated with either automatic or non-automatic TEI assignment.

In addition, the primitives (and their contents) defined in this Standard to describe communication between the various internal functions associated with the data link are purely informative in nature and are not intended to constrain implementations.

All other clauses of this Standard and Appendices A, B, C, D, E, and F are informative.

NOTE 1:

Terminal Equipment and Terminal Adaptors supporting only the procedures associated with non-automatic TEI assignment cannot be connected to PTNs supporting only the procedures associated with automatic TEI assignment.

4. REFERENCES

ETSI T/S 46-20: User-Network Data Link Layer Specification.

In this Standard ECMA-105 most clauses refer to ETSI T/S 46-20 for their content. As a result, references within the text of T/S 46-20 should be interpreted, for this ECMA Standard, as indicated in Table 1 below:

Reference in T/S 46-20	Interpretation for the purpose of ECMA-105
I.430	ETS/L 03-07 Physical Layer at the Basic Access Interface between Data Processing Equipment and Private Switching Networks
I.431	ETS/L 03-14 Physical Layer at the Interface of a Primary Rate Access Extension Line in Private Telecommunication Networks
Q.930/1	ECMA-106 Layer 3 Protocol for Signalling over the D-channel of the S-Interfaces between Data Processing Equipment and Private Switching Networks

Table 1 - Interpretation of T/S 46-20 References

ENV 41007: Definition of Terms in Private Telecommunication Networks.

5. DEFINITIONS

In addition to the definitions already given in ETSI T/S 46-20, the following definitions apply for the purpose of this Standard. The text of T/S 46-20 refers throughout to the terms "user", "network", "network side" and "user side".

5.1 User

The Terminal Equipment (TE) attached to the Private Telecommunication Network (PTN) via the S reference point.

5.2 Network

The Private Telecommunication Network (PTN).

5.3 Network Side

The part of the extension line and associated equipment on the PTN side of the S-interface including the Data Link Layer entity in the PTN.

5.4 User Side

The part of the extension line which is between the S-interface and the TE, including the Data Link Layer entity in the TE.

6. CONCEPTS AND TERMINOLOGY

Clause Q.920/2 of T/S 46-20 shall apply.

7. OVERVIEW OF LAPD FUNCTIONS AND PROCEDURES

7.1 General

Clause Q.920/3.1 of T/S 46-20 shall apply.

7.2 Unacknowledged Operation

Clause Q.920/3.2 of T/S 46-20 shall apply.

7.3 Acknowledged Operation

Clause Q.920/3.3 of T/S 46-20 shall apply.

7.4 Establishment of Information Transfer Mode

7.4.1 Data Link Connection Identification (DLCI)

Clause Q.920/3.4.1 of T/S 46-20 shall apply.

7.4.2 Data Link States

Clause Q.920/5.4.2 of T/S 46-20 shall apply.

7.4.3 Terminal Endpoint Identifier (TEI) Administration Procedures

A TE in the TEI-unassigned state shall use the TEI assignment procedures to enter the TEI-assigned state. Conceptually, these procedures exist in the management entity. The TEI management function on the PTN side is referred to as the Assignment Source Point in this Standard.

The purpose of this procedure is to allow:

- a TE to request the PTN to select a TEI value that the Data Link Layer entities within the requesting TE will use in their subsequent communications;
- a TE to request the PTN to verify a TEI value that the Data Link Layer entities within the requesting TE will use in their subsequent communications;
- a PTN to remove a previously assigned TEI value from a TE or all TEI values from all TEs.

Additionally, the TE management entity should instruct the TE Data Link Layer entity to remove a TEI value for its own internal reasons, for example losing the ability to communicate with the PTN on a no-power condition.

The TEI value need not be memorized by the PTN side when no network layer connection exists. Since TEI assignment procedures may be of long duration, for better efficiency the TE should memorize as long as possible the TEI value it has been allocated.

Typically, one TEI value would be used by the TE (i.e. for all the SAPs associated with the Data Link Layer entity). If required, a number of TEI values may be requested by multiple use of the procedures defined in sub-clause 11.3.2. It shall be the responsibility of the TE to maintain the association between TEI, SAP1 and Connection Endpoint Suffix (CES).

The actions taken by a Data Link Layer entity to initiate these procedures on receipt of different primitives from Layer 3 or from the Physical Layer are defined in sub-clauses 10.2 and 11.3. Alternatively, the management entity may initiate these procedures for its own reasons.

7.4.4 Establishment of Multiple-Frame Operation

Clause Q.920/3.4.4 of T/S 46-20 shall apply.

7.5 Service Characteristics

7.5.1 General

Clause Q.920/4.1 of T/S 46-20 shall apply.

7.5.2 Service Provided to Layer 3

Clause Q.920/4.2 of T/S 46-20 shall apply.

7.5.2.1 Unacknowledged Information Transfer Service

Clause Q.920/4.2.1 of T/S 46-20 shall apply.

7.5.2.2 Acknowledged Information Transfer Service

Clause Q.920/4.2.2 of T/S 46-20 shall apply.

7.5.2.3 Services Provided to Layer Management

Clause Q.920/4.3 of T/S 46-20 shall apply.

7.5.2.4 Administrative Services

Clause Q.920/4.4 of T/S 46-20 shall apply.

7.5.2.5 Summary of the Data Link Service

Clause Q.920/4.5.1 of T/S 46-20 shall apply.

7.5.3 Services Required from the Physical Layer

Clause Q.920/4.6 of T/S 46-20 shall apply.

NOTE 2:

Procedures for Physical Layer reactivation are System Management responsibilities and are therefore beyond the scope of this Standard.

7.6 Overview of Data Link Layer Structure

7.6.1 Data Link Procedure

Clause Q.920/5.1 of T/S 46-20 shall apply.

7.6.2 Multiplex Procedure

Clause Q.920/5.2 of T/S 46-20 shall apply, with the following amendment:

The contention resolution procedures shall be based on the SAPI, giving priority to SAPI values with more leading zeros.

7.6.3 Structure of the Data Link Procedure

Clause Q.920/5.3 of T/S 46-20 shall apply.

7.6.4 Management Structure

Clause Q.920/5.4 of T/S 46-20 shall apply.

8. FRAME STRUCTURE FOR PEER-TO-PEER COMMUNICATION

8.1 General

Clause Q.921/2.1 of T/S 46-20 shall apply.

8.2 Flag Sequence

Clause Q.921/2.2 of T/S 46-20 shall apply.

8.3 Address Field

The address field shall consist of two octets as illustrated in Figure 1/Q.921 of T/S 46-20. The address field identifies the intended receiver of a command frame and the transmitter of a response frame. The format of the address field is defined in 9.2 below.

8.4 Control Field

Clause Q.921/2.4 of T/S 46-20 shall apply.

8.5 Information Field

Clause Q.921/2.5 of T/S 46-20 shall apply.

8.6 Transparency

Clause Q.921/2.6 of T/S 46-20 shall apply.

8.7 Frame Check Sequence (FCS) Field

Clause Q.921/2.7 of T/S 46-20 shall apply.

8.8 Format Convention

8.8.1 Numbering Convention

Clause Q.921/2.8.1 of T/S 46-20 shall apply.

8.8.2 Order of Bit Transmission

Clause Q.921/2.8.2 of T/S 46-20 shall apply.

8.8.3 Field Mapping Convention

Clause Q.921/2.8.3 of T/S 46-20 shall apply.

8.9 Invalid Frames

Clause Q.921/2.9 of T/S 46-20 shall apply.

8.10 Frame Abort

Clause Q.921/2.10 of T/S 46-20 shall apply.

NOTE 3:

The use of Frame Abort is beyond the scope of this Standard.

9. ELEMENTS OF PROCEDURES AND FORMATS FOR DATA LINK LAYER PEER-TO-PEER COMMUNICATION

9.1 General

Clause Q.921/3.1 of T/S 46-20 shall apply.

9.2 Address Field Format

Clause Q.921/3.2 of T/S 46-20 shall apply.

9.3 Address Field Variables

9.3.1 Address Field Extension Bit

Clause Q.921/3.3.1 of T/S 46-20 shall apply.

9.3.2 Command Response Field Bit

Clause Q.921/3.3.2 of T/S 46-20 shall apply.

9.3.3 Service Access Point Identifier (SAPI)

Clause Q.921/3.3.3 of T/S 46-20 shall apply.

NOTE 4:

The reservation of SAPI values for experimental purposes is beyond the scope of this Standard.

9.3.4 Terminal Endpoint Identifier (TEI)

Clause Q.921/3.3.4 of T/S 46-20 shall apply.

9.3.4.1 TEI for Broadcast Data Link Connection
Clause Q.921/3.3.4.1 of T/S 46-20 shall apply.

9.3.4.2 TEI for Point-to-Point Data Link Connection
Clause Q.921/3.3.4.2 of T/S 46-20 shall apply.

9.4 Control Field Formats
Clause Q.921/3.4 of T/S 46-20 shall apply.

9.4.1 Information Transfer (I) Format
Clause Q.921/3.4.1 of T/S 46-20 shall apply.

9.4.2 Supervisory (S) Format
Clause Q.921/3.4.2 of T/S 46-20 shall apply.

9.4.3 Unnumbered (U) Format
Clause Q.921/3.4.3 of T/S 46-20 shall apply.

9.5 Control Field Parameters and Associated State Variables
Clause Q.921/3.5 of T/S 46-20 shall apply.

9.5.1 Poll/Final (P/F) Bit
Clause Q.921/3.5.1 of T/S 46-20 shall apply.

9.5.2 Multiple-Frame Operation - Variables and Sequence Numbers

9.5.2.1 Modulus
Clause Q.921/3.5.2.1 of T/S 46-20 shall apply.

NOTE 5:

Consideration must be given to the relational operators which determine the validity of these variables and numbers.

9.5.2.2 Send State Variable V(S)
Clause Q.921/3.5.2.2 of T/S 46-20 shall apply.

9.5.2.3 Acknowledge State Variable V(A)
Clause Q.921/3.5.2.3 of T/S 46-20 shall apply.

9.5.2.4 Send Sequence Number N(S)
Clause Q.921/3.5.2.4 of T/S 46-20 shall apply.

9.5.2.5 Receive State Variable V(R)
Clause Q.921/3.5.2.5 of T/S 46-20 shall apply.

9.5.2.6 Receive Sequence Number N(R)
Clause Q.921/3.5.2.6 of T/S 46-20 shall apply.

9.5.3 Unacknowledged Operation - Variables and Parameters
Clause Q.921/3.5.3 of T/S 46-20 shall apply.

9.6 Frame Types

9.6.1 Commands and Responses

Clause Q.921/3.6.1 of T/S 46-20 shall apply, with the exception that XID frames received by an equipment conforming to this Standard shall be treated as undefined.

9.6.2 Information (I) Command

Clause Q.921/3.6.2 of T/S 46-20 shall apply.

9.6.3 Set Asynchronous Balanced Mode Extended (SABME) Command

Clause Q.921/3.6.3 of T/S 46-20 shall apply.

9.6.4 Disconnect (DISC) Command

Clause Q.921/3.6.4 of T/S 46-20 shall apply.

9.6.5 Unnumbered Information (UI) Command

Clause Q.921/3.6.5 of T/S 46-20 shall apply.

9.6.6 Receive Ready (RR) Command/Response

Clause Q.921/3.6.6 of T/S 46-20 shall apply.

9.6.7 Reject (REJ) Command/Response

Clause Q.921/3.6.7 of T/S 46-20 shall apply.

NOTE 6:

Appendix 1 of T/S 46-20 is not included in this Standard. A Data Link Layer entity conforming to this Standard shall not send the REJECT command. It shall, however, be capable of receiving a REJECT command.

9.6.8 Receive Not Ready (RNR) Command/Response

Clause Q.921/3.6.8 of T/S 46-20 shall apply.

9.6.9 Unnumbered Acknowledgement (UA) Response

Clause Q.921/3.6.9 of T/S 46-20 shall apply.

9.6.10 Disconnected Mode (DM) Response

Clause Q.921/3.6.10 of T/S 46-20 shall apply.

9.6.11 Frame Reject (FRMR) Response

Clause Q.921/3.6.11 of T/S 46-20 shall apply.

9.6.12 Exchange Identification (XID) Command/Response

XID frames (as defined in clause Q.921/3.6.12 of T/S 46-20) shall be treated as undefined by equipment conforming to this Standard.

10. ELEMENTS FOR LAYER-TO-LAYER COMMUNICATION

10.1 General

Clause Q.921/4.1 of T/S 46-20 shall apply.

10.1.1 Primitive Types

The primitive types are defined in Clause 6.

10.1.2 Generic Names

Clause Q.921/4.1.1 of T/S 46-20 shall apply, with the following amendment:

The MDL-XID primitive is not defined by this Standard. The group of Management to Layer 1 primitives is not defined by this Standard.

10.1.2.1 DL-Establish

Clause Q.921/4.1.1.1 of T/S 46-20 shall apply, with the following addition:

The DL-ESTABLISH-REQUEST primitive is used by the Layer 3 entity to cause a link to be established. The DL-ESTABLISH-CONFIRM primitive shall be returned in the case of success. In the case of unsolicited link establishment, the DL-ESTABLISH-INDICATION shall be used to inform the Layer 3 entity.

10.1.2.2 DL-Release

Clause Q.921/4.1.1.2 of T/S 46-20 shall apply, with the following addition:

The request is made by a DL-RELEASE-REQUEST and shall be acknowledged by a DL-RELEASE-CONFIRM. In the case of a Data Link Layer malfunction, Layer 3 may be notified by a DL-RELEASE-INDICATION primitive.

10.1.2.3 DL-Data

Clause Q.921/4.1.1.3 of T/S 46-20 shall apply, with the following addition:

DL-DATA-REQUEST is to be sent by the Layer 3 entity whereas DL-DATA-INDICATION shall indicate to the Layer 3 entity that a message has arrived over the line.

10.1.2.4 DL-Unit-Data

Clause Q.921/4.1.1.4 of T/S 46-20 shall apply, with the following addition:

The DL-UNIT-DATA-REQUEST primitive is used to transmit unacknowledged information and the DL-UNIT-DATA-INDICATION primitive shall be used to indicate reception of unacknowledged information.

10.1.2.5 MDL-Assign

Clause Q.921/4.1.1.5 of T/S 46-20 shall apply.

10.1.2.6 MDL-Remove

Clause Q.921/4.1.1.6 of T/S 46-20 shall apply.

10.1.2.7 MDL-Error

Clause Q.921/4.1.1.7 of T/S 46-20 shall apply.

10.1.2.8 MDL-Unit-Data

Clause Q.921/4.1.1.8 of T/S 46-20 shall apply.

10.1.2.9 PH-Data

Clause Q.921/4.1.1.10 of T/S 46-20 shall apply, with the following addition:

PH-DATA-REQUEST shall be sent by the Data Link entity to the Physical Layer; PH-DATA-INDICATION is sent in the opposite direction.

10.1.2.10 PH-Activate

Clause Q.921/4.1.1.11 of T/S 46-20 shall apply.

10.1.2.11 PH-Deactivate

Clause Q.921/4.1.1.12 of T/S 46-20 shall apply.

10.1.3 Parameter Definition

Clause Q.921/4.1.3 of T/S 46-20 shall apply.

10.2 Primitive Procedures

10.2.1 General

Clause Q.921/4.2.1 of T/S 46-20 shall apply.

10.2.2 Layer 3 - Data Link Interactions

Clause Q.921/4.2.2 of T/S 46-20 shall apply.

10.2.3 Data Link - Data Link Layer Representation

As indicated in 7.4.2, the link establishment contains three basic states (excluding transient states): TEI-unassigned, TEI-assigned, and Multiple-frame established. The state of the Data Link Layer representation of the point-to-point data link connection is dependent on:

- Layer 3 request primitives (DL-ESTABLISH-REQUEST and DL-RELEASE-REQUEST);
- Peer-to-peer mode setting commands (SABME, DISC); and
- Management function control commands (MDL-ASSIGN-REQUEST, MDL-REMOVE-REQUEST).

The information transfer capabilities are dependent on the particular state into which the data link has been placed by the above controls. The three states of a point-to-point data link and their transfer capabilities are:

- TEI Unassigned state;

No peer-to-peer information transfer capability.

- TEI Assigned state;

Only unacknowledged information transfer using UI frames is possible. The Layer 3 management entities may request this service by using the DL-UNIT-DATA-REQUEST and MDL-UNIT-DATA-REQUEST primitives.

- Multiple-frame established state:

Two modes of information transfer are possible:

- i) Unacknowledged information transfer using UI frames. The Layer 3 management entities may request this service by using the DL-UNIT-DATA-REQUEST and MDL-UNIT DATA-REQUEST primitives.
- ii) Acknowledged information transfer mode using I frames. The Layer 3 entity may request this service by using the DL-DATA-REQUEST primitive.

When a DL-ESTABLISH-REQUEST or DL-UNIT-DATA-REQUEST is received by the Data Link Layer entity and the TEI is not assigned, a TEI assignment procedure is initiated by the Data Link Layer prior to achieving the Layer 3 request.

When a DL-ESTABLISH-REQUEST is made, the TEI assignment procedure will be followed by a link establishment.

When a DL-UNIT-DATA-REQUEST is made, transmission of UI frames will start as soon as the TEI assignment procedure is completed.

11. DEFINITION OF THE PEER-TO-PEER PROCEDURES OF THE DATA LINK LAYER

Clause Q.921/5 of T/S 46-20 shall apply, with the following amendment:

Bullet point c) is not specified as part of this Standard ("connection management entity information transfer").

11.1 Procedure for the use of the P/F Bit

11.1.1 Unacknowledged Information Transfer

Clause Q.921/5.1.1 of T/S 46-20 shall apply.

11.1.2 Acknowledged Multiple-Frame Information Transfer

A Data Link Layer entity receiving a SABME, DISC, RR, RNR, REJ or I frame with the P bit set to ONE, shall set the F bit to ONE in the next response frame it transmits, as defined in Table 2.

Command received with P bit = ONE	Response transmitted with F bit = ONE
SABME, DISC	UA, DM
I, RR, RNR, REJ	RR, RNR, REJ

Table 2 - Immediate Response Operation of the P/F Bit.

In general, the P bit should not be set to ONE in the I frames. This allows greater link efficiency in that the I frames may be acknowledged via an N(R) transmitted by the peer entity in either an I frame (if the peer entity has an I frame available at the time an I frame is received from its peer) or, in a Supervisory (S) frame if no I frame is available (see 11.4.2).

NOTE 7:

However, the P bit could be set to ONE in an I frame if a unique response via a Supervisory frame is desired from the peer entity.

The P bit shall always be set to ONE in all Supervisory command frames. For those command frames the timer T200 should normally be running.

The F bit of a response frame shall be set equal to the P bit in the received command frame in the case of a valid frame received, or any frame (command or response) in the case of an invalid frame received.

11.2 Procedures for Unacknowledged Information Transfer

Clause Q.921/5.2 of T/S 46-20 shall apply.

11.3 Terminal Endpoint Identifier (TEI) Management Procedures

11.3.1 General

Clause Q.921/5.3.1 of T/S 46-20 shall apply.

NOTE 8:

TEI assignment procedures occur only on the receipt of a request for establishment or unacknowledged information transfer whilst in the TEI-unassigned state.

NOTE 9:

A formal description of TEI procedures is given in Appendix B.

11.3.2 TEI Assignment Procedure

Clause Q.921/5.3.2 of T/S 46-20 shall apply, with the following additions:

Item "d) Management entity identifier" is specified in the three enumerated lists in this sub-clause by this Standard.

11.3.2.1 Expiry of T202

Clause Q.921/5.3.2.1 of T/S 46-20 shall apply.

NOTE 10:

Once TEI assignment has been initiated, the Data Link Layer entity receiving MDL-ERROR-RESPONSE shall discard all DL-UNIT-DATA-REQUEST primitives received earlier. The values of timers T202 and N202 are specified in 11.9 below.

11.3.3 TEI Check Procedure

11.3.3.1 Use of the TEI Check Procedure

Clause Q.921/5.3.3.1 of T/S 46-20 shall apply.

11.3.3.2 Operation of the TEI Check Procedure

Clause Q.921/5.3.3.2 of T/S 46-20 shall apply, with the following addition:

Standard ECMA-105 specifies the additional bullet item c) (in the first list) and d) (in the second list) of Q.921/5.3.3.2 of T/S 46-20 as defined below:

c)/d) "Management entity identifier" (in the same way as in 11.3.2 above).

11.3.4 TEI Removal Procedure

When the network side layer management entity determines that the removal of a TEI value is necessary (see 11.3.4.2), the ASP shall transmit a message containing the following elements and issue an MDL-REMOVE-REQUEST primitive:

- a) Message type = Identity Remove;
- b) TEI value which is to be removed, as indicated in the Ai field (the value 127 indicates that all user equipment should remove their TEI values; otherwise, the specific TEI value should be removed);
- c) Management entity identifier.

The Identity Remove message shall be sent twice in succession to overcome possible message loss.

When the TE layer management entity determines that the removal of a TEI value is necessary (see 11.3.4.2), it shall instruct the Data Link Layer entity to enter the TEI-unassigned state, using the MDL-REMOVE-REQUEST primitive. This action should also be taken for all TEI values when the Ai field contains the value of 127.

Further action to be taken shall be either initiation of automatic TEI assignment for a new TEI value or notification to the TE user of the need for corrective action (i.e., when equipment uses a non-automatic TEI value and does not support the automatic TEI assignment procedure).

A request to remove a non-existent TEI shall be ignored.

NOTE 11:

In case the same TEI is used in combination with different SAPIs, the removal procedure will affect all DLCIs.

11.3.4.1 Action to be taken by the Data Link Layer Entity receiving MDL-Remove-Request

Clause Q.921/5.3.4.1 of T/S 46-20 shall apply.

11.3.4.2 Conditions for TEI Removal

Clause Q.921/5.3.4.2 of T/S 46-20 shall apply, with the following amendment:

The use of 'MPH-' primitives is not specified in this Standard.

11.3.5 Formats and Codes

Clause Q.921/5.3.6 of T/S 46-20 shall apply with the following amendment:

The "Identity verify" message type in Table 8/Q.921 of T/S 46-20 is not specified in this Standard.

11.4 Procedures for Establishment and Release of Multiple-Frame Operation

11.4.1 Establishment of Multiple-Frame Operation

Clause Q.921/5.5.1 of T/S 46-20 shall apply.

11.4.2 Information Transfer

Clause Q.921/5.5.2 of T/S 46-20 shall apply.

11.4.3 Termination of Multiple-Frame Operation

Clause Q.921/5.5.3 of T/S 46-20 shall apply, with the following exception:

In the case of Layer 1 de-activation initiated by the network system management, the Data Link Layer entity shall discard all I queues and deliver to Layer 3 a DL-RELEASE-CONFIRM primitive if a DL-RELEASE-REQUEST primitive is outstanding, or otherwise a DL-RELEASE-INDICATION primitive.

11.4.4 TEI-Assigned State

Clause Q.921/5.5.4 of T/S 46-20 shall apply.

11.4.5 Collision of Unnumbered Commands and Responses

Clause Q.921/5.5.5 of T/S 46-20 shall apply.

11.4.6 Unsolicited DM Response and SABME or DISC Command

Clause Q.921/5.5.6 of T/S 46-20 shall apply, with the exception of the sentence "This is typically caused by a user equipment applying a protocol procedure according to X.25 LAPB[6] to ask for a mode-setting command".

11.5 Procedures for Information Transfer in Multiple-Frame Operation

Clause Q.921/5.6 (and its sub-clauses) of T/S 46-20 shall apply.

NOTE 12:

Note to clause Q.921/5.6.7 of T/S 46-20:

The option of retransmission of the last transmitted I frame (last item in list a) does not apply in this Standard.

11.6 Re-establishment of Multiple-Frame Operation

Clause Q.921/5.7 of T/S 46-20 shall apply.

11.7 Exception Condition Reporting and Recovery

Clause Q.921/5.8 of T/S 46-20 shall apply.

11.7.1 N(S) Sequence Error

Clause Q.921/5.8.1 of T/S 46-20 shall apply, with the following amendment:

The optional procedures defined in Appendix I of T/S 46-20 are not specified in this Standard.

11.7.2 N(R) Sequence Error

An N(R) sequence error exception condition occurs in the transmitter when a valid Supervisory frame or I frame is received which contains an invalid N(R) value.

A valid N(R) is one that is in the range $V(A) \leq N(R) \leq V(S)$.

The Data Link Layer entity shall inform the connection management entity on this exception condition by means of the primitive MDL-ERROR-INDICATION, and initiate re-establishment according to 11.6.

11.7.3 Timer Recovery Condition

Clause Q.921/5.8.3 of T/S 46-20 shall apply.

11.7.4 Invalid Frame Condition

Clause Q.921/5.8.4 of T/S 46-20 shall apply.

11.7.5 Frame Rejection Condition

Clause Q.921/5.8.5 of T/S 46-20 shall apply.

11.7.6 Receipt of an FRMR Response Frame

Clause Q.921/5.8.6 of T/S 46-20 shall apply.

11.7.7 Unsolicited Response Frame

Clause Q.921/5.8.7 of T/S 46-20 shall apply.

11.7.8 Multiple Assignment of a TEI Value

Clause Q.921/5.8.8 of T/S 46-20 shall apply.

NOTE 13:

The management entity may ultimately decide to remove the TEI; refer to Appendix II of T/S 46-20.

11.8 Data Link Layer Monitor Function

Clause Q.921/5.10 of T/S 46-20 shall apply.

11.9 List of System Parameters

Clause Q.921/5.9 of T/S 46-20 shall apply, with the following amendments:

- Timer T201 shall not be used at the TE side.
- Timer T203 is defined as the "maximum time allowed in the multiple-frame established state without a frame being exchanged".

APPENDIX A

OCCURRENCE OF THE MDL-ERROR INDICATION PRIMITIVE

Q.921/Appendix II of T/S 46-20 shall apply.

NOTE A.1:

The user management action to be taken on "Receipt of unsolicited response" and "Unsuccessful retransmission (N200 times)" in Table 11-1/Q.921 of T/S 46-20 is specified as "Remove TEI" in this Standard. The "TEI identity verify procedure" option of T/S 46-20 is not supported.

APPENDIX B

SDL REPRESENTATION OF THE POINT-TO-POINT PROCEDURES

Q.921/Annex B of T/S 46-20 shall apply, with the following exceptions:

This Standard specifies several options present in T/S 46-20:

- i) In Figure B-7 (2 of 10) the frame retransmission option of T/S 46-20 is not permitted by this Standard.
- ii) In Figure B-7 (8 of 10) Note 2 is not included, as Appendix 1 is not defined in this Standard.
- iii) In Figure B-8 (2 of 9): as (i) above.
- iv) In Figure B-8 (7 of 9): as (ii) above.

APPENDIX C

SDL REPRESENTATION OF THE BROADCAST PROCEDURE

Q.921/Annex C of T/S 46-20 shall apply.

APPENDIX D

STATE TRANSITION TABLES

Q.921/Annex D of T/S 46-20 shall apply, with the following exceptions:

This Standard removes several options present in T/S 46-20:

- i) In Figure D-2.9, on T200 time out, the frame retransmission option of T/S 46-20 is not permitted in this Standard in states 7.0, 7.1, 7.2 and 7.3.
- ii) In Figure D-3.9, on T200 time out, the frame retransmission option of T/S 46-20 is not permitted in this Standard in states 8.0 and 8.2.

NOTE D.1:

In case of conflict between the state diagrams shown in Annex D of TS 46-20 and the text of the mandatory clauses of this Standard, the latter shall take precedence over the former.

APPENDIX E
EXAMPLES OF THE USE OF PRIMITIVES

Clause Q.920/2 of T/S 46-20 shall apply.

APPENDIX F

LIST OF ACRONYMS

ASP	Assignment Source Point
CES	Connection Endpoint Suffix
DISC	Disconnect
DLCI	Data Link Connection Identifier
DM	Disconnected Mode
FCS	Frame Check Sequence
FRMR	FRaMe Reject
ISDN	Integrated Services Digital Network
N(R)	Receive Sequence Number
N(S)	Send Sequence Number
P/F	Poll/Final
PTN	Private Telecommunication Network
PTNX	Private Telecommunication Network Exchange
REJ	Reject
RNR	Receive Not Ready
RR	Receive Ready
S	Supervisory
SABME	Set Asynchronous Balanced Mode Extended
SAP	Service Access Point
SAPI	Service Access Point Identifier
TE	Terminal Equipment
TEI	Terminal Endpoint Identifier
U	Unnumbered
UA	Unnumbered Acknowledgement
UI	Unnumbered Information
V(A)	Acknowledge State Variable
V(R)	Receive State Variable
V(S)	Send State Variable
XID	eXchange IDentification

