ECMA

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

STANDARD ECMA-105

DATA LINK LAYER PROTOCOL FOR THE D-CHANNEL OF THE S-INTERFACES BETWEEN DATA PROCESSING EQUIPMENT AND PRIVATE SWITCHING NETWORKS

2nd Edition – December 1987

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European Computer Manufacturers Association
114 Rue du Rhône – 1204 Geneva (Switzerland)

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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 Switching Networks (PSNs).

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 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 CEPT, 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 of DPE - to - PSN interfaces. The First Edition was adopted by the General Assembly of ECMA on 13-14 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.

This Second Edition of Standard ECMA-105 was adopted by the General Assembly of ECMA on 10-11 December 1987.

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1. SCOPE AND FIELD OF APPLICATION

This ECMA Standard describes in general terms the Link Access procedure on the D-channel, LAPD. This protocol is based on the Data Link Layer protocol such as described in CCITT Recommendations Q.920 and Q.921. The purpose of LAPD is to convey information between layer 3 entities across the Private Circuit Switched Network (PCSN) user-network interface using the D-channel. The definition of LAPD uses the principles and terminology of:

- CCITT Recommendation X.200 and X.210
  . the reference model for Open Systems Interconnection (OSI);
- CCITT Recommendation X.25 LAPB
  . user-network interface for packet mode terminals;
- ISO 3309 and ISO 4335
  . High-level Data Link Control (HDLC) standards for frame structure and elements of procedures.

LAPD is a protocol that operates at the Data Link Layer of the OSI architecture. The relationship between the Data Link Layer and other protocol layers is defined in CCITT Rec. I.320.

LAPD is independent of the transmission bit rate. It requires a full duplex, bit transparent D-channel. The characteristics of the D-channel are defined in CCITT Rec. I.412.

NOTE 1

A PCSN is a Circuit Switching Network with fully digital transmission capabilities operated over a private domain and bounded by S interfaces, as described in ECMA TR/24.

NOTE 2

The Physical layer is defined in Standard ECMA-103 (based on CCITT Rec. I.430) and Standard ECMA-104 (based on CCITT Rec. I.431). The Layer 3 protocol is defined in Standard ECMA-106 (based on CCITT Rec. I.450 and Rec. I.451). Reference should be made of these standards for the complete definition of the protocols and procedures across the PCSN user-network interface.

2. CONCEPTS AND TERMINOLOGY

The basic structuring technique in the OSI Reference Model is layering. According to this technique, communication among application processes is viewed as being logically positioned into a set of layers represented in a vertical sequence as shown in Figure 1.

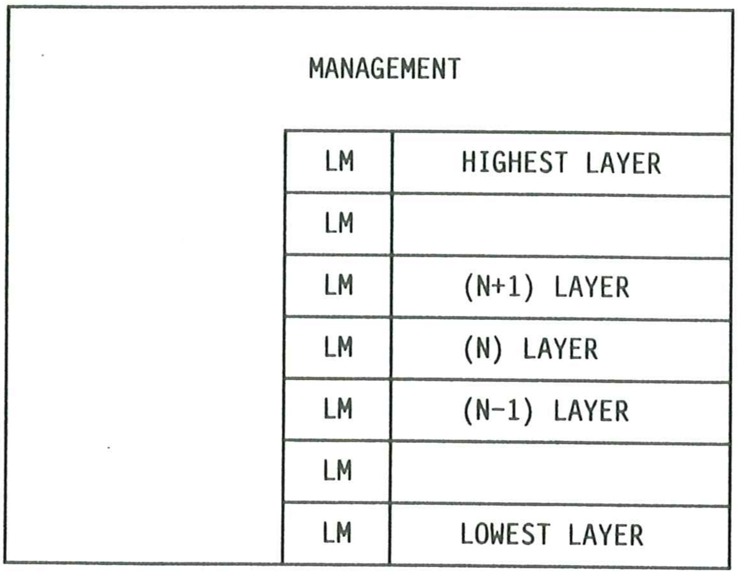


Figure 1 - Layering

Entities exist in each layer. Entities in the same layer but in different systems which must exchange information to achieve a common objective are called "peer entities". Entities in adjacent layers interact through their common boundary. In order to provide its services the Data Link Layer entity uses the services provided by the Physical Layer.

A Data Link Layer Service Access Point (SAP) is the means by which the Data Link Layer provides services to layer 3. Associated with each Data Link Layer SAP is one or more data link connection endpoint(s) (see Figure 2). A data link connection endpoint is identified by a Connection Endpoint Identifier (CEI) as seen from layer 3 and by a Data Link Connection Identifier (DLCI) as seen from the Data Link Layer.

NOTE 3

The term "Data Link Layer" is used in the main text of this Standard. However, mainly in figures and tables, the term "layer 2" and "L2" are used as abbreviations. Furthermore, in accordance with CCITT Rec. Q.930 (I.450) and Q.431 (I.451), the term "layer 3" is used to indicate the layer above the Data Link Layer.

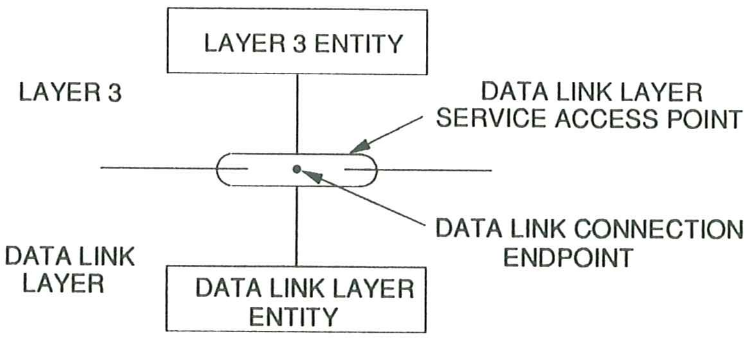


Figure 2 - Entities, Service Access Points and Data Link Connection Identifiers.

Co-operation between Data Link layer entities is governed by a peer-to-peer protocol specific to the layer. In order for information to be exchanged between two or more layer 3 entities, an association must be established between the layer 3 protocol. This association is called a data link connection. Data link connections are provided by the Data Link layer between two more SAPs that have the same SAP identifier (see figure 3). Data Link layer message units are conveyed between Data Link layer entities by means of a physical connection.

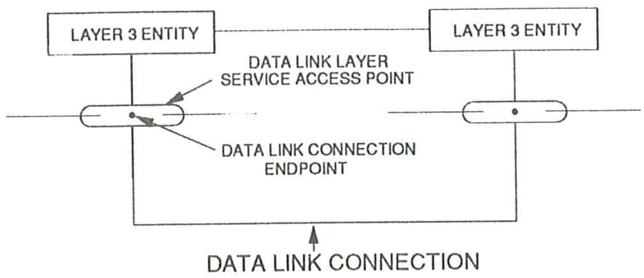


Figure 3 - Peer to Peer relationship

Layer 3 requests services from the Data Link layer via service primitives. The same applies for the interaction between the Data Link layer and the Physical Layer. The primitives represent, in an abstract way, the logical exchange of information and control between the Data Link layer and adjacent layers. They do not specify or constrain the implementation of entities or interfaces. The primitives that are exchanged between the Data Link layer and adjacent layers are of the following four types (see Figure 4):

- REQUEST,

  The REQUEST primitive type is used when a higher layer is requesting a service from the next lower layer.

- INDICATION,

  The INDICATION primitive type is used by a layer providing a service to notify the next higher layer of the occurrence of unsolicited events.

- RESPONSE,

  The RESPONSE primitive type is used by a layer to acknowledge receipt, from a lower layer, of the primitive type INDICATION.

- CONFIRM,

  The CONFIRM primitive type is used by the layer providing the requested service confirm that the activity has been completed by the peer entity.

Layer-to-layer interactions are specified in Clause 6.

Information is transferred, in various types of message units, between peer entities and between entities in adjacent layers that are attached to a specific SAP. The message units are of two types:

- Message units of a peer-to-peer protocol, and
- Message units that contain layer-to-layer information concerning status and specialized service requests.

The message units of the layer 3 peer-to-peer protocol are carried by the data link connection. The message units containing layer-to-layer information concerning status and specialized service requests are never conveyed over a data link or a physical connection.

This Standard specifies (see Figure 5):

- The peer-to-peer protocol for the transfer of information and control between any pair of Data Link layer service access points; and
- The interactions between the Data Link layer and layer 3, and between the Data Link layer and the Physical Layer.

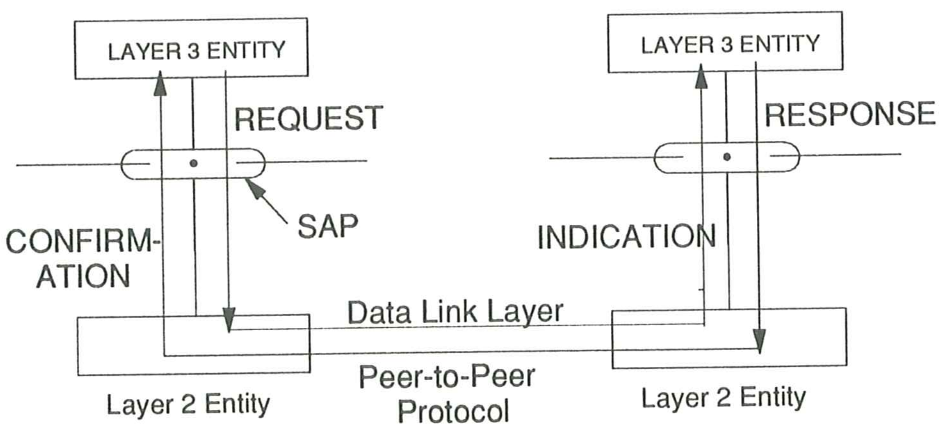


Figure 4 - Primitive Action Sequence.

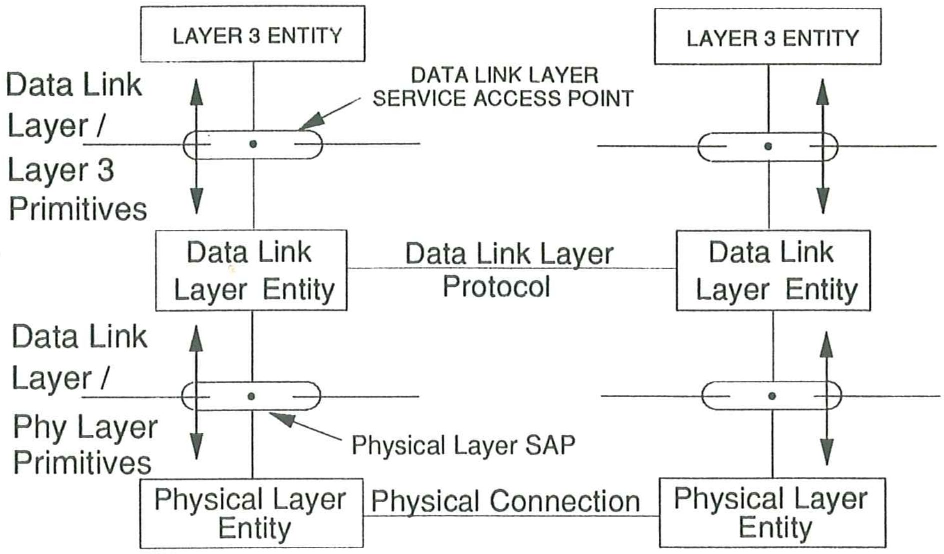


Figure 5 - Data Link Layer Reference Model.

3. REFERENCES

ECMA 103	Physical layer at the Basic Access Interface between Data Processing Equipment and Private Circuit Switching Networks.
ECMA 104	Physical Layer at the Primary Rate Access Interface between Data Processing Equipment and Private Circuit Switching Networks
ECMA 106	Layer 3 Protocol for Signalling over the D-channel of the the S-Interfaces between Data Processing Equipment and Private Circuit Switching Networks.
ECMA TR/24	Interface between Data Processing Equipment and Private Automatic Branch Exchange.
ISO 3309	Information Processing Systems - Data communication - High Level Data Link Control Procedures - Frame structure.
ISO 4335	Data Communication - High Level Data Link Control Procedures - Consolidation of Elements of Procedures.
ISO 7809	Data Communication - High Level Data Link Control Procedures - Consolidation of Classes of Procedures.
CCITT Rec. X.25	Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for terminals operating in the Packet Mode on Public Data Networks.
CCITT Rec. X.200	Reference Model of Open Systems Interconnection for CCITT applications
CCITT Rec. X.210	OSI Layer Service Conventions
CCITT Rec. I.320	Integrated Services Digital Network (ISDN) Protocol Reference Model.
CCITT Rec. I.411	ISDN User-Network Interfaces - Reference configuration.

CCITT Rec. I.430	Basic User - Network interface Layer 1 specification.
CCITT Rec. I.431	Primary rate User - Network interface Layer 1 specification.
CCITT Rec. Q.920	ISDN User - Network interface data link layer - General aspects
CCITT Rec. Q.921	ISDN User - Network interface data link layer specification.
CCITT Rec. Q.930	ISDN User - Network interface layer 3 - General aspects.
CCITT Rec. Q.931	ISDN User Network interface layer 3 specification.

4. OVERVIEW DESCRIPTION OF LAP D FUNCTIONS AND PROCEDURES

4.1 General

The purpose of LAPD is to convey information between layer 3 entities across the PCSN user-network interface using the D-channel. Specifically, LAPD will support:

- multiple terminal installations at the TE-PCSN interface, and
- multiple layer 3 entities.

All Data Link layer messages are transmitted in frames which are delimited by flags (a flag is a specific bit pattern). The frame structure is defined in Clause 3. LAPD includes functions for:

- the provision of one or more data link connections on a D-channel.
- discrimination between the data link connections by means of a data link connection identifier (DLCI) contained in each frame,
- frame delimiting, alignment and transparency, allowing recognition of a sequence of bits transmitted over a D-channel as a frame,
- sequence control, to maintain the sequential order of frames across a data link connection,
- detection of transmission, format and operational errors on a data link,
- recovery from detected transmission, format and operational errors,notification to the management entity of unrecoverable errors and
- flow control.

Data Link layer functions provide the means for information transfer between multiple combinations of connection endpoints. The information transfer may be via point-to-point data links or via broadcast data links. In the case of point-to-point information transfer, a frame is directed to a single endpoint while in case of broadcast information transfer a frame is directed towards one or more endpoints.

Figure 6 shows two examples of point-to-point information transfer.

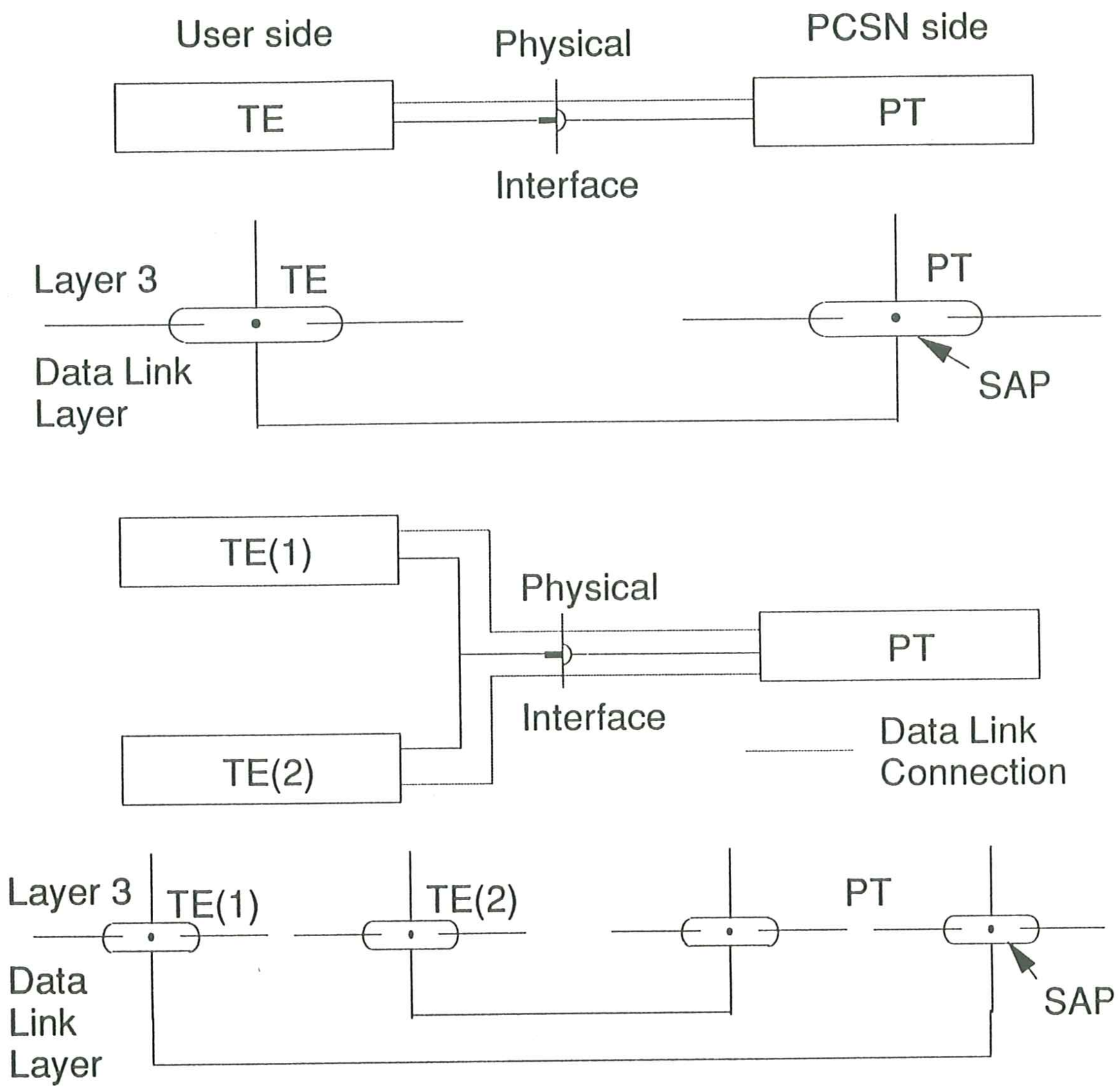


Figure 6 - Point-to-Point Links

Figure 7 shows an example of broadcast information transfer.

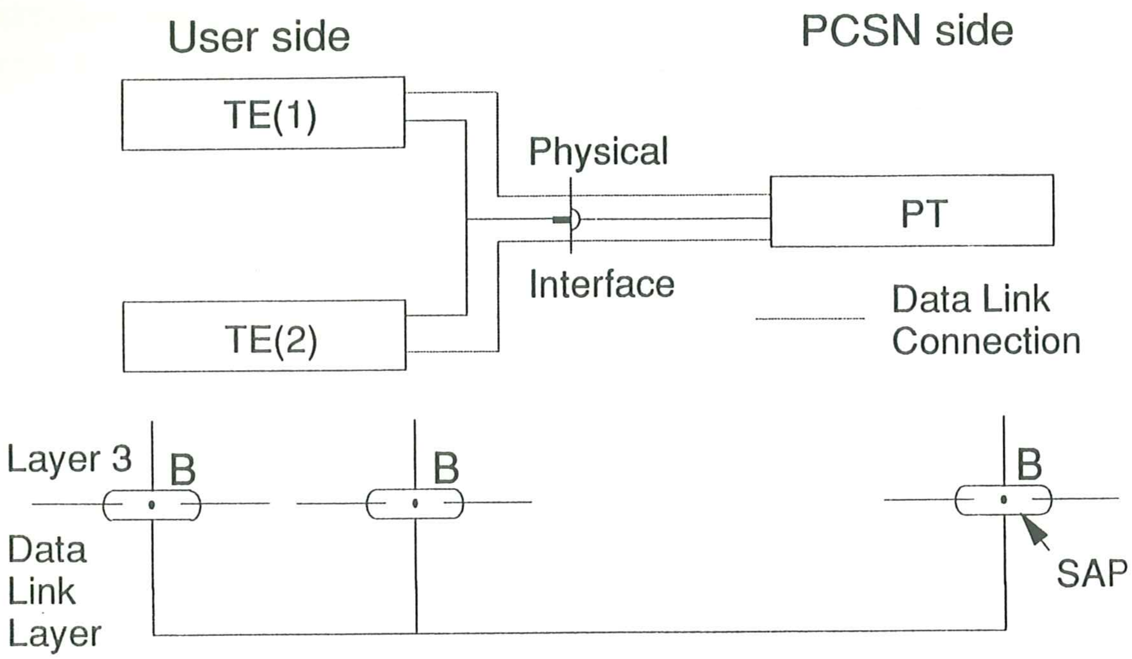


Figure 7 - Broadcast Links

Two types of operation of the Data Link layer are defined for layer 3 information transfer: unacknowledged, and acknowledged. They may coexist on a single D-channel.

4.2 Unacknowledged Operation

With this type of operation layer 3 information is transmitted in unnumbered information (UI) frames.

At the Data Link layer the UI frames are not acknowledged. Transmission and format errors may be detected but no error recovery mechanism is defined. Flow control mechanisms are not defined.

Unacknowledged operation is applicable for point-to-point and broadcast information transfer; that is an Unnumbered Information frame may be sent to a specific connection endpoint or broadcast to multiple endpoints associated with a specific Service Access Point Identifier (SAPI).

4.3 Acknowledged Operation

With this type of operation, layer 3 information is transmitted in frames that are acknowledged at the Data Link layer.

Error recovery procedures based on retransmission of unacknowledged frames are specified. In the case of errors which cannot be corrected by the Data Link layer, a report to the management entity is made. Flow control procedures are also defined.

Acknowledged operation is applicable for point-to-point information transfer and will be done by a multiple frame operation. Layer 3 information is sent in numbered information (I) frames. A number of I frames may be outstanding at the same time.

Multiple frame operation is initiated by a multiple frame establishment procedure using Set Asynchronous Balanced Mode Extended (SABME) command (see 6.3.3).

4.4 Establishment of information transfer modes

4.4.1 Data Link connection identification (DLCI)

A data link connection is identified by a Data Link Connection Identifier carried in the address field of each frame.The data link connection identifier is associated with a Connection Endpoint Identifier (CEI) at the two ends of the data link (see Figure 9). The connection endpoint identifier is used to identify message units passed between the Data Link layer and layer 3. It consists of the Service Access Point Identifier (SAPI) and the Connection Endpoint Suffix (CES). The Data Link Connection Identifier (DLCI) consists of two elements: the Service Access Point Identifier (SAPI) and the Terminal Endpoint Identifier (TEI). The SAPI is used to identify the service access point on the PCSN side or the DPE side of the DPE-PCSN interface. The TEI is used to identify a specific connection endpoint within a service access points. The TEI will be assigned automatically be means of a separate TEI assignment procedure (see 8.3.2). The same SAPI may be found in different TEs connected at the same S reference point. Two TEs connected at the same S reference point shall have two different TEIs.

The DLCI is a pure layer 2 concept. It will be internally used by the Data Link layer entity and not known by the layer 3 nor by the management entity. In these latter entities the concept of Connection Endpoint Identifier (CEI) will rather be used.

The CEI is the parameter of the layer 3 (or management) to layer 2 primitives used to map the multiplexing function of these entities onto the multiplexing function of the layer 2 entity. The CEI is composed of the SAPI information and a reference value named Connection Endpoint Suffix (CES). The CES is an arbitrary value selected by the layer 3 or management entity to refer to the request made to the Data Link layer entity. When the relevant TEI is known by this entity, it will internally associate the DLCI to the CEI until a DL-RELEASE-REQUEST is issued by the higher layer entity or the DL-RELEASE INDICATION has to be returned. The layer 3 and management entities will use this CEI to address the PCSN until they receive a DL-RELEASE-INDICATION primitive.

NOTE 4

Both CEI and DLCI identify a data link connection, but only the DLCI has the same value at both ends of the link.

Figure 8 - DLCI / CEI association

4.4.2 Data Link states with respect to TEI assignment

A point-to-point data link may be in one of three basic states, see Figure 9:

i) TEI unassigned state. In this state a TEI has not been assigned or verified. No layer 3 information transfer is possible, or

ii) TEI assigned state. In this state a TEI has been assigned/verified by means of the TEI assignment procedure. Unacknowledged information transfer is possible, or

iii) Multiple-frame-established state. This state is established by means of the multiple frame establishment procedure. Acknowledged multiple frame and unacknowledged information transfer is possible.

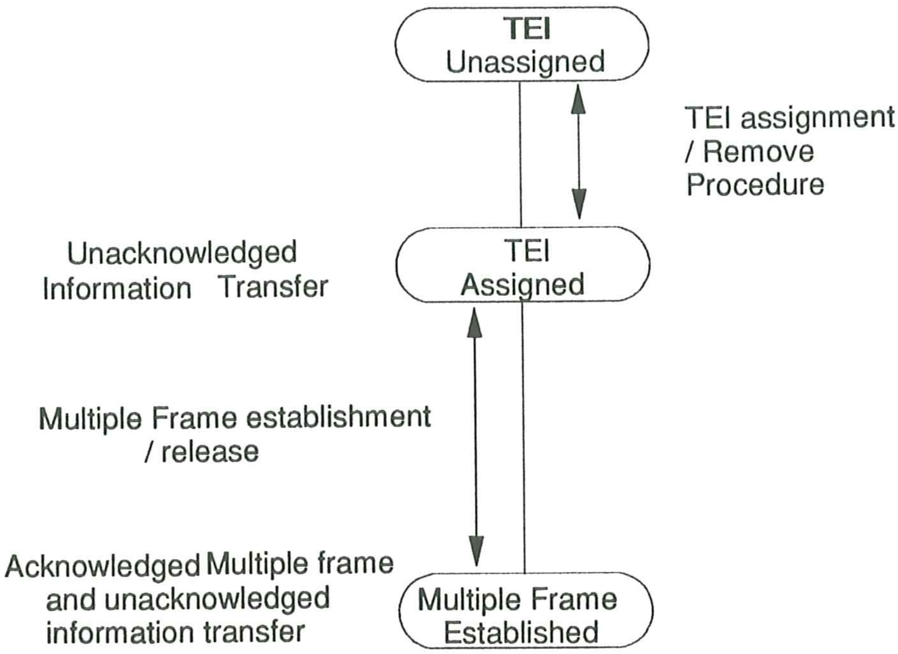


Figure 9 - Basic link states for the point to point link

A broadcast data link is always in an information transfer state capable of only unacknowledged information transfer (ie: all information is transferred on a broadcast data link by use of UI frames).

These three basic describe the major steps for establishing a logical point to point link and the operational mode of the LAP. Additional states are required for the function of the LAP, these are described in the state transition tables (see Appendix D).

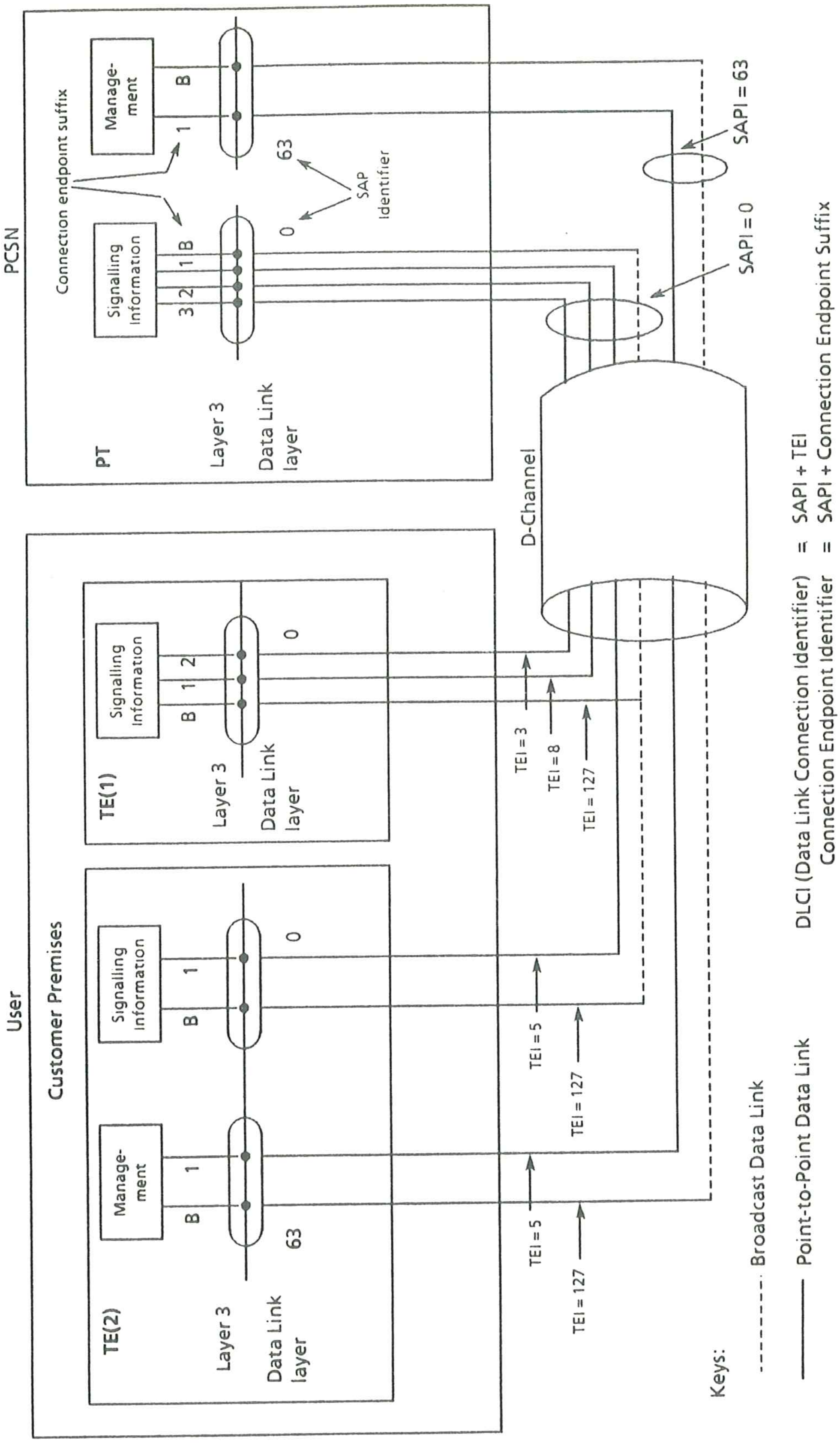


Figure 10 - Overview of the relationship between SAPI, TEI and DLCI

4.4.3 TEI Administration Procedures

The purpose of this procedure is to allow:

- A TE to obtain a TEI value that the Data Link Layer entities within the requesting TE will use in subsequent communications over the data link; and
- A TE to request the PCSN to verify a TEI value, already present in the TE, that the data link entities within the requesting TE will use in subsequent communications over the data link.

An example of the assignment procedures can be found in Appendix E.

The assigned TEI value is typically common to all SAPs (if more than one) in a TE. The procedure is conceptually located in the management entity.

When a TEI has been assigned/verified, the TE establishes an association between the TEI and a connection endpoint suffix in each SAP; that is the data link connection identifier is associated with connection endpoint identifier. In the PCSN, the corresponding association is made upon reception of the first frame containing the assigned/verified TEI.

At that point in time, a point-to-point Data Link layer connection exists.

In the Data Link layer entity, a tuple (TEI, CES) for a given SAPI exists as soon as a TEI has been assigned to a request (the reference of which is CES). The release of the multiple frame mode does not invalidate the association TEI-CES. Removal of the TEI erases the TEI and invalidates the tuple (TEI,CES).

A request from the layer 3 entity to establish a connection with a given CES will reuse the assigned TEI if the tuple CES-TEI is still valid.

The association between the data link connection identifier and connection endpoint identifier will be removed:

- in the PCSN on request from layer 3, or by the Data Link layer itself; and
- in the TE, on request from the management entity; for example, when recognizing that the TEI value is no longer valid, or by the Data Link layer itself.

When in the TEI assigned state or the multiple-frame-established state, the TEI assignment procedure may be used to check the status of a TEI. In principle the TEI is not systematically memorized outside calls on the PCSN side. Since TEI assignment procedures may be of long duration, for better efficiency the TE should memorize the TEI value it has been allocated as long as possible (see criteria for assignment/removal of TEI values).

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 PCSN side is referred to as the Assignment Source Point (ASP) in this Standard.

The purpose of this procedure is to allow:

- a TE to request the PCSN 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 PCSN to verify a TEI value already present in the TE, which the Data Link layer entities within the requesting TE will use in their subsequent communications;
- a PCSN to remove a previously assigned TEI from specific or 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 PCSN or a no power condition. Other internal reasons, for example, local monitoring or detection of malfunctions, require further study.

Typically, one TEI value would be used by the TE (for example a Data Link layer entity which has been assigned a TEI value could use that value for all SAPs which it supports). If required, a number of TEI values may be requested by multiple use of the procedures defined in 8.3.2.

It shall be the responsibility of the TE to maintain the association between TEI, SAPI and CES.

The actions taken by a Data Link layer entity to initiate these procedures on receipt of different primitives from layer 3 or from Physical layer are included in 7.2 and 8.3. Alternatively, the management entity may initiate these procedures for its own reasons.

4.4.4 Establishment of multiple frame operation

Before point-to-point multiple frame information transfer may start an exchange of an SABME frame and an Unnumbered Acknowledgement (UA) frames must take place. The multiple frame establishment procedure is specified in detail in 8.4.1.2.

4.5 Service Characteristics

4.5.1 General

The Data Link layer provides services to layer 3 and utilizes the services provided by the Physical layer.

NOTE 5

Communication between different layers in the OSI reference model makes use of primitives which are passed across the layer boundaries. Primitives represent, in an abstract way, the logical exchange of information and control between the Data Link Layer and adjacent layers. They do not specify nor constrain implementations.

4.5.2 Services provided to layer 3

The specification of the interactions with layer 3 (primitives) provides a description of the service that the Data Link layer plus the Physical layer offer to layer 3, as viewed from layer 3.

Two forms of information transfer services are associated with layer 3. The first is based on unacknowledged information transfer at the Data Link layer while the second service is based on acknowledged information transfer at the Data Link layer.

The Data Link layer also provides administrative services to layer 3 in order to implement information transfer services. Layer 3 message units are handled according to their respective layer 2 priority (see multiplex procedures 4.6.2).

4.5.2.1 Unacknowledged information transfer service

In this case the information transfer is not acknowledged at the Data Link layer. The information transfer is via broadcast or point-to-point data links. The characteristics of the unacknowledged information transfer service are summarized as follows:

- provision of a data link connection between layer 3 entities for unacknowledged information transfer of layer 3 message units,
- identification of data link connection endpoints to permit a layer 3 entity to identify another layer 3 entity, and
- no verification of message arrival within the Data link layer.

The primitives associated with the unacknowledged information transfer service are the DL-UNIT DATA-REQUEST and DL-UNIT DATA-INDICATION. The DL-UNIT DATA-REQUEST primitive is used to request that a message unit be sent using the procedures for unacknowledged information transfer service. The DL-UNIT DATA-INDICATION indicates the arrival of a message unit received by means of unacknowledged information transfer.

4.5.2.2 Acknowledged information transfer services

The characteristics of these services are summarized as follows:

- provision of a data link connection between layer 3 entities for acknowledged information transfer of layer 3 message units,
- identification of data link connection endpoints to permit a layer 3 entity to identify another layer 3 entity,
- sequence integrity of Data Link layer message units in the absence of machine malfunctions,
- notification to the peer entity in the case of machine errors, for example loss of sequence,
- notification to the management entity of unrecoverable errors detected by the Data Link layer, and
- flow control.

The primitives associated with the acknowledged information transfer services are:

- The DL-DATA-REQUEST/INDICATION primitives, which are used for data transfer.

  The DL-DATA-REQUEST primitive is used to request that a message unit be sent using the procedures for these acknowledged information transfer; DL-DATA-INDICATION indicates the arrival of a message unit received by means of acknowledged information transfer. These primitives are used for multiple frame operation.

- The DL-ESTABLISH-REQUEST/INDICATION/CONFIRM primitives, which are used for the establishment of multiple frame operation.

  These primitives are used to request, indicate and confirm the establishment of the multiple frame operation between two service access points.

- The DL-RELEASE-REQUEST/INDICATION primitives, which are used for the termination of multiple frame operation.

  These primitives are used to request and indicate an attempt to terminate multiple frame operation between two service access points.

4.5.2.3 Services provided to layer management

Only the acknowledged information transfer service is provided to layer management in order that the data link layer management can communicate with its peer layer management.

NOTE 6

In this case the information transfer is not acknowledged at the data link layer. Acknowledgement procedures may be provided by layer management.

The information transfer is via broadcast connections, but in principle information transfer can also be via point to point connections (no application for data transfer via point to point connections has been identified or included).

The characteristics of the unacknowledged information transfer service are summarized in the following:

- provision of a data link connection between layer management entities for unacknowledged information transfer of data units:

- identification of data link connection endpoints ; and
- no verification of message arrival within the peer data link layer entity.

The primitives associated with the unacknowledged information transfer service for layer management are:

- MDL-UNIT DATA-REQUEST/INDICATION

  The MDL-UNIT DATA-REQUEST primitive is used to request that a message unit be sent using the procedure for unacknowledged information transfer service for layer management. The MDL-UNIT DATA-INDICATION primitive indicates the arrival of a message unit received by means of the unacknowledged information transfer service to layer management.

4.5.2.4 Administrative services

The characteristics of the administrative services will allow the following:

- assignment and removal of TEI values to be used on all point-to-point data link connections, and
- data link connection information exchange between the PCSN and the TE.

Some of these services are considered to be conceptually provided by management entities either on the TE side or the PCSN side. The method of describing these administrative functions uses services primitives.

NOTE 7

It is recognized that the current OSI reference model does not completely define a management entity and its relations with other layer entities.

The use of the term "service primitives' between the management entity and the Data Link layer entity is provisionally adopted in the standard together with its representation method using "MDL".

The primitives associated with these services are:

- The MDL-ASSIGN-REQUEST/INDICATION primitives, which are used to assign a TEI value.

  These primitives are used to convey a TEI, obtained or verified via the automatic TEI assignment procedure in the management entity from the management entity to the Data Link layer in order that the TE Data Link layer entities can begin to communicate with the PCSN Data Link layer entities using the assigned TEI value.

- The MDL-REMOVE-REQUEST primitive, which is used for the removal of a TEI value.

  This primitive is used to convey a layer management function request for removal of a TEI value that has been previously assigned via the MDL-ASSIGN primitives.

- The MDL-ERROR-INDICATION/RESPONSE primitives, which are used for the notification of an error.

  These primitives are used to report error situations between layer management and the data link layer entities.

4.5.2.5 Summary of the Data Link Service

The ability of the data link layer to execute a service request by layer 3 depends on the internal state of the data link layer. For the layer 3 entity, the internal state of the data link layer is represented by the state of that data link connection endpoint within a data link service access point which is used by this layer 3 entity to invoke a service.

Consequently, the data link service may be defined by means of data link connection endpoint states, whereby the capabilities provided by the data link layer and the service primitives may be related to these states.

In order to allow a data link service user to invoke a service by making use of primitives, the DL-primitives defined in this standard have to be related to: point-to-point data link connections (acknowledged or unacknowledged transfer of information) and/or broadcast data link connections (unacknowledged transfer of information).

An unconfirmed service is defined as a service which does not result in an explicit confirmation. A confirmed service is defined as a service which results in an explicit confirmation from the service provider. There is not necessarily any relationship to a response from the peer service-user.

Generic name of the DL-primitive	Point-to-point information transfer mode		Broadcast information transfer mode
	Acknowledged	Unacknowledged	
ESTABLISH	Confirmed service		
RELEASE	Confirmed service		
DATA	Unconfirmed service		
UNIT DATA		Unconfirmed service	Unconfirmed service

Table 1 - Applicability of DL-Primitives to information transfer modes

4.5.3 Services Required from the Physical Layer

The services provided by the Physical layer are described in detail in Standard ECMA-103 and ECMA-104 (based on CCITT Rec. I.430 and Rec. I.431). They are summarized as follows:

- physical layer connection for the transparent transmission of bits in the same order in which they are submitted to the Physical layer;
- indication of the physical status of the D-channel;
- transmission of Data Link layer message units according to their respective Data Link layer priority.

Some of the above services may be implemented in the management entity on the TE side or PCSN side. The method of describing these services is by means of service primitives. The primitives between the Data Link layer and the Physical layer are:

- PH-DATA-REQUEST/INDICATION

  These primitives are used to request that a message unit be sent and to indicate the arrival of a message unit (ie Data transfer).

- PH-ACTIVATE-REQUEST/INDICATION

  These primitives are used to request activation of the Physical layer connection and to indicate that the Physical Layer connection has been activated.

- PH-DEACTIVATE-INDICATION

  This primitive is used to indicate that the physical connection has been deactivated.

4.6 Overview of Data Link layer structure

Figure 11 is a tutorial description of the functional block diagram of the Data Link layer supported on single D-channel that could exist at the PCSN side of the interface. This figure illustrates two procedural types: the data link procedure and the multiplex procedure. The TE configuration will be a subset of this figure.

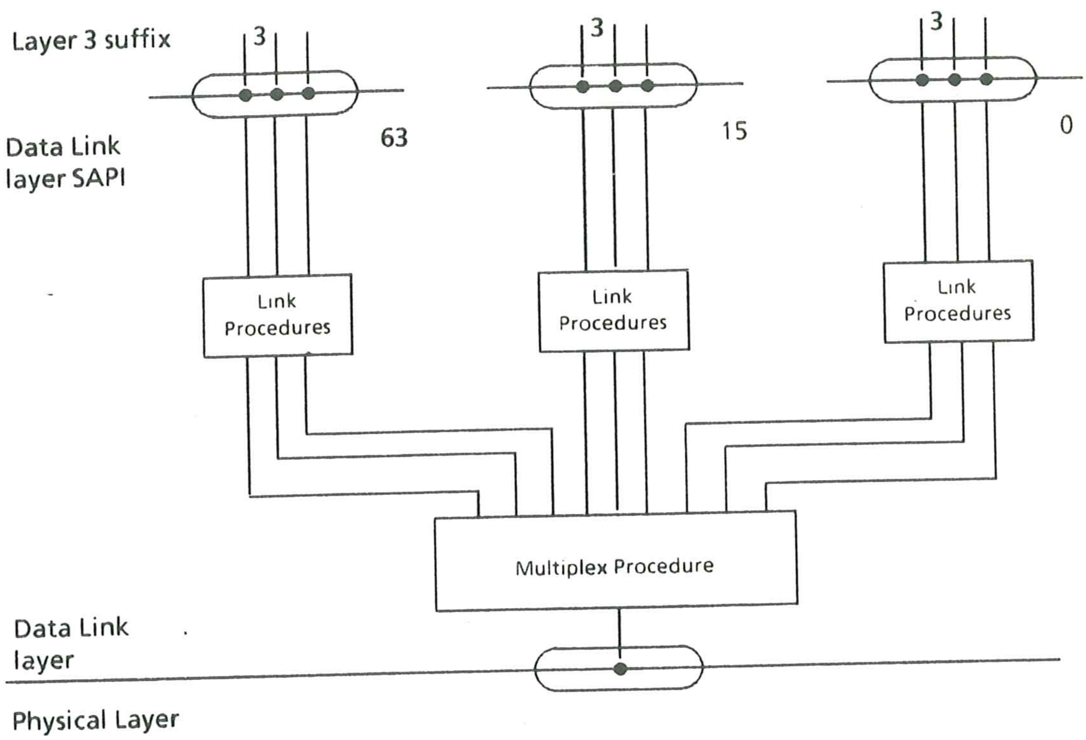


Figure 11 - Functional Block Diagram of the Data Link Layer

4.6.1 Data Link procedure

This procedure analyses the control field of the received frame (see 3.4) and provides appropriate peer-to-peer responses and layer-to-layer indications. In addition, it analyses the Data Link layer service primitives and transmits the appropriate peer-to-peer command and responses.

4.6.2 Multiplex procedure

This procedure analyses the Flag, Frame Check Sequence (FCS) and address octets of a received frame. If the frame is correct, it distributes the frame to the appropriate data link procedural block based on the data link connection identifier (see 4.4.1).

On frame transmission, this procedure may provide Data Link layer contention resolution between the various data link procedure blocks. The contention resolution is based on the SAPI, giving priority SAPI values with more leading zeros.

4.6.3 Structure of the Data Link procedure

The functional model of the data link procedure is shown in figure 12. The model consists of several functional blocks for point-to-point and broadcast connections. Each of these functional blocks consists of three functional entities, namely a transmission control, a reception control and a data link state control.

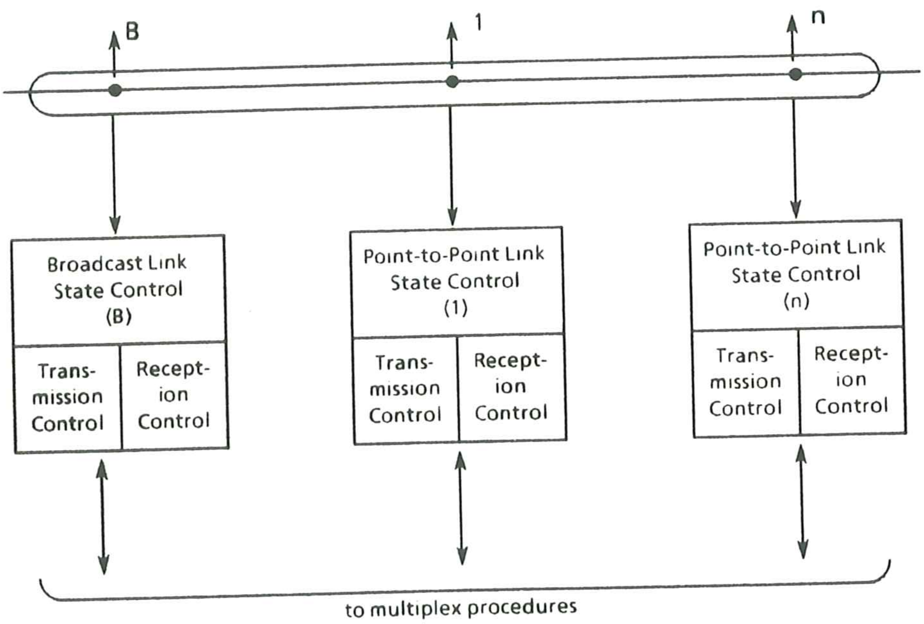


Figure 12 - Link procedure structure

4.6.4 Management structure

The data link layer management is subdivided into:

- Layer management which provides for the management of resources that have a layer wide impact (e.g. TEI management)
- Connection management entity which provides for the management of resources which have an impact on individual connections (e.g. parameters, errors).

5. FRAME STRUCTURE FOR PEER TO PEER COMMUNICATION

5.1 General

All data link layer peer-to-peer exchanges are in frames conforming to one of the formats shown in Figure 13. Two format types are shown in the figure; format A for frames where there is no information field and format B for frames containing an information field.

5.2 Flag sequence

All frames shall start and end with the flag sequence consisting of one zero bit followed by six contiguous 1 bits and one zero bit. The flag preceding the address field is defined as the opening flag. The flag following the Frame Check Sequence (FCS) field is defined as the closing flag. The closing flag may also serve as the opening flag of the next frame in some applications. However the receiver must be able to accommodate receipt of one or more consecutive flags. See layer 1 standards ECMA 103 and ECMA 104 for applicability, particularly in the multi point arrangements.

5.3 Address field

The address field shall consist of two octets as illustrated in Figure 13. 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 6.2.

5.4 Control field

The control field shall consist of one or two octets. Figure 13 illustrates the two frame formats (A and B), each with a control field of one or two octets, depending upon the type of frame. The format of the control field is defined in 6.4.

5.5 Information field

The information field of a frame, when present, follows the control field (see 5.4 above) and precedes the frame check sequence (see 5.7 below). The contents of the information field shall consist of an integer number of octets (zero length included). The maximum number of octets in the information field is defined in 8.9.3.

5.6 Transparency

A transmitting data link layer entity shall examine the frame content between the opening and closing flag sequences, (address, control, information and FCS fields) and shall insert a zero bit after all sequences five contiguous 1 bits (including the last five bits of the FCS) to ensure that a flag or an abort sequence is not simulated within the frame. A receiving data link layer entity shall examine the frame contents between the opening and closing flag sequences and shall discard any zero bit which directly follows five contiguous 1 bits.

FORMAT A

8	7	6	5	4	3	2	1	
FLAG								OCTET 1
ADDRESS (HOO)								2
ADDRESS (LOO)								3
CONTROL (i)								4
CONTROL (i)								
FCS								N-2
FCS								N-1
FLAG								

FORMAT B

8	7	6	5	4	3	2	1	
FLAG								OCTET 1
ADDRESS (HOO)								2
ADDRESS (LOO)								3
CONTROL (i)								4
CONTROL (i)								
INFORMATION								
INFORMATION								
INFORMATION								
FCS								N-2
FCS								N-1
FLAG								N

HOO = High Order Octet

LOO = Low Order Octet

i) Unacknowledged operation

- one octet Multiple frame operation
- two octets for frames with sequence numbers; one octet for frames without sequence numbers.

Figure 13 - Frame formats

5.7 Frame Check Sequence (FCS) field

The FCS field shall be a sixteen-bit sequence. It shall be the ones complement of the sum (modulo 2) of:

a) The remainder of (x raised to k power)

$$x^{15} + x^{14} + x^{13} + x^{12} + x^{11} + x^{10} + x^{9} + x^{8} + x^{7} + x^{6} + x^{5} + x^{4} + x^{3} + x^{2} + x + 1$$

divided (modulo) 2 by the generator polynomial

$$x^{16} + x^{12} + x^{5} + 1$$

where k is the number of bits in the frame existing between, but not including, the final bit of the opening flag and the first bit of the FCS, excluding bits inserted for transparency, and

1 b) The remainder of the division (modulo 2) by the generator polynomial

$$x^{16} + x^{12} + x^5 + 1$$

of the product of x^{16} by the content of the frame existing between, but not including, the final bit of the opening flag and the first bit of the FCS, excluding bits inserted for transparency.

As a typical implementation at the transmitter, the initial content of the register of the device computing the remainder of the division is preset to all 1 s and is then modified by division by the generator polynomial (as described above) of the address, control and information fields; the ones complement of the resulting remainder is transmitted as the sixteen-bit FCS.

As a typical implementation at the receiver, the initial content of the register of the device computing the remainder is preset to all 1 s. The final remainder after multiplication by x16 and then division (modulo 2) by the generator polynomial

$$x^{16} + x^{12} + x^5 + 1$$

of the serial incoming protected bits and the FCS, will be "0001 1101 0000 1111 x^{15} through 1, respectively) in the absence of transmission errors.

5.8 Format convention

5.8.1 Numbering convention

The basic convention used in this Recommendation is illustrated in Figure 14. The bits are grouped into octets. The bits of an octet are shown horizontally and are numbered from 1 to 8. Multiple octets are shown vertically and are numbered from 1 to n.

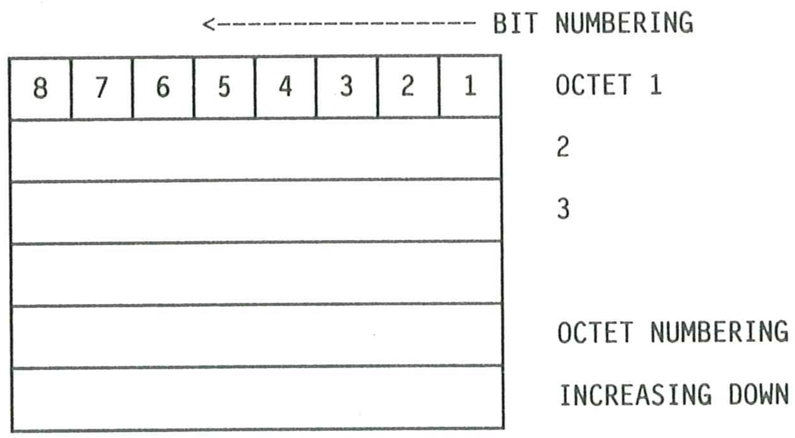


Figure 14 - Format convention

5.8.2 Order of bit transmission

The octets are transmitted in ascending numerical order; inside an octet bit 1 is the first bit to be transmitted.

5.8.3 Field mapping convention

When a field is contained within a single octet, the lowest bit number of the field represents the lowest order value. When a field spans more than one octet, the order of bit values within each octet progressively decreases as the octet number increases. The lowest bit number associated with the field represents the lowest order value.

For example, a bit number can be identified as a couple (o,b) where o is the octet number and b is the relative bit number within the octet. Figure 15 illustrates a field that spans from bit (1,3) to bit (2,7). The high order bit of the field is mapped on bit (1,3) and the low order bit is mapped on bit (2,7).

8	7	6	5	4	3	2	1	
					2^4	2^3	2^2	1st Octet of the field
2^1	2^0							2nd Octet of the field

Figure 15 - Field mapping convention

An exception to the preceding field mapping convention is the data link layer FCS field, which spans two octets. In this case, bit 1 of the first octet is the high order bit and bit 8 of the second octet is the low order bit (Figure 16)

8	7	6	5	4	3	2	1	
2^8							2^{15}	1st Octet of the field
2^0							2^7	2nd Octet of the field

Figure 16 - FCS mapping convention

5.9 Invalid Frames

An invalid frame is a frame which:

a) is not properly bounded by two flags, or

b) has fewer than 6 octets between flags of frames that contain sequence numbers and fewer than 5 octets between flags of frames that do not contain sequence numbers, or

c) does not consist of an integral number of octets prior to zero bit insertion or following zero bit extraction, or

d) contains a frame check sequence error, or

e) contains a single octet address field.

f) contains a service access point identifier (see 6.3.3) which is not supported by the receiver

Invalid frames shall be discarded without notification to the sender. No action is taken as the result of that frame.

5.10 Frame Abort

Receipt of seven or more contiguous 1 bits shall be interpreted as an abort and the data link layer entity shall ignore the frame currently being received. The need for frame abort is beyond the scope of this standard.

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

6.1 General

The elements of procedures define the commands and responses that are used on the data link connections carried on the D channel. Procedures are derived from these elements of procedures and are described in Clause 8.

6.2 Address field format

The address field format shown in Figure 17 contains the address field extension bits, a command/response indication bit, a data link layer Service Access Point Identifier (SAPI) subfield, and a Terminal Endpoint Identifier (TEI) subfield.

8	7	6	5	4	3	2	1	
SAPI						C/R	EA 0	OCTET 2
TEI							EA 1	OCTET 3

EA = Address field extension bit

C/R = Command / Response field bit

SAPI = Service access point identifier

TEI = Terminal endpoint identifier

Figure 17 - Address field format

6.3 Address field variables

6.3.1 Address field extension bit (EA)

The address field range is extended by reserving the first transmitted bit of the address field octets to indicate the final octet of the address field. The presence of a 1 in the first bit of an address field octet signals that it is the final octet of the address field. The double octet address field for LAPD operation shall have bit 1 of the first octet set to a zero and bit 1 of the second address octet set to 1.

6.3.2 Command response field bit (C/R)

The C/R bit identifies a frame as either a command or a response. The user side shall send commands with the C/R bit set to zero, and responses with the C/R bit set to 1. The network side shall do the opposite; that is commands are sent with C/R set to 1, and responses are sent with C/R set to zero. The combinations for the network side and user side are shown in Table 2.

Command/Response	Direction	C/R Value
Command	Network side --> User side	1
	User side --> Network side	0
Response	Network side --> User side	0
	User side --> Network side	1

Table 2 - Command / Response field bit usage

In conformance with HDLC rules, commands use the address of the peer data link layer entity while responses use the address of their own data link layer entity. According to these rules, both peer entities on a point-to-point data link connection use the same data link connection identifier (DLCI) composed of a SAPI-TEI where the SAPI and TEI conform to the definitions contained in 6.3.3 and 6.3.4 and define the data link connection as described in 4.4.1.

6.3.3 Service access point identifier (SAPI)

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 service access points 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 3.

SAPI Value	Related layer 3 entity or Layer Management entity
0	Call control procedures
1	Reserved for new packet mode
16	Packet communication conforming to X25 layer 3 procedures
63	Layer 2 Management
All others	Reserved for future standardization

Table 3 - Service access point identifier field usage

6.3.4 Terminal endpoint identifier (TEI)

The TEI for a point-to-point data link connection may be associated with a single Terminal Equipment (TE). A TE may contain one or more TEIs used for point-to-point data transfer. The TEI for a broadcast data link connection is associated with all user side data link layer entities containing the same SAPI. The TEI subfield allows 128 values where bit 2 of the address field octet containing the TEI is the least significant binary digit and bit 8 is the most significant binary digit. The following conventions shall apply in the assignment of these values.

6.3.4.1 TEI for broadcast data link connection

The TEI subfield bit pattern 111 1111 (=127) is defined as the group TEI. The group TEI is assigned to the broadcast data link connection associated with the addressed Service Access Point (SAP).

6.3.4.2 TEI for point-to-point data link connection

The remaining TEI values are used for the point-to-point data link connections associated with the addressed SAP. TEI values are selected by the network in the range 64 - 126 and their allocation is the responsibility of the network.

6.4 Control field formats

The control field identifies the type of frame, which will be either a command or response. The control field will contain sequence numbers, where applicable.

Three types of control field formats are specified: numbered information transfer (I format), supervisory functions (S format), and unnumbered information transfer and control functions (U format). The control field format are shown in Table 4.

Control field bits (modulo 128)	8	7	6	5	4	3	2	1	
I FORMAT	–	–	–	N(S)	---	–	–	0	OCTET 4
				N(R)				P	OCTET 5
S FORMAT	X	X	X	X	S	S	0	1	OCTET 4
	–	–	–	N(R)	---	–	–	P/F	OCTET 5
U FORMAT	M	M	M	P/F	M	M	1	1	OCTET 4

N(S) Transmitter send sequence number
N(R) Transmitter receive sequence number
S Supervisory function bit
M Modifier function bit
P/F Poll bit when issued as a command, final bit when issued as a response
X Reserved and set to 0

Table 4 - Control field formats

6.4.1 Information transfer (I) format

The I format shall be used to perform an information transfer between layer 3 entities. The functions of N(S), N(R) and P (defined in 6.5) are independent; that is, each I frame has an N(S) sequence number, and N(R) sequence number which may or may not acknowledge additional I frames received by the data link layer entity, and a P bit that may be set to zero or 1. The use of N(S), N(R) and P is defined in Clause 8.

6.4.2 Supervisory (S) format

The S format shall be used to perform data link supervisory control functions such as; acknowledge I frames, request re-transmission of I frames, and request a temporary suspension of transmission of I frames. The functions of N(R) and P/F are independent, that is, each supervisory frame has an N(R) sequence number which may or may not acknowledge additional I frames received by the data link layer entity, and a P/F bit that may be set to zero or 1.

6.4.3 Unnumbered (U) format

The U format shall be used to provide additional data link control functions and unnumbered information transfers (including unacknowledged information transfer). This format does not contain sequence numbers. It does include a P/F bit that may be set to zero or 1.

6.5 Control field parameters and associated state variables

The various parameters associated with the control field formats are described in this section. The coding of the bits within these parameters is such that the lowest numbered bit within the parameter field is the least significant bit.

6.5.1 Poll/Final (P/F) bit

All frames contain the Poll/Final (P/F) bit. The P/F bit serves a function in both command frames and response frames. In command frames the P/F bit is referred to as the P bit. In response frames it is referred to as the F bit. The P bit set to 1 is used by a data link layer entity to solicit (poll) a response frame from the peer data link layer entity. The F bit set to 1 is used by a data link layer entity to indicate the response frame transmitted as a result of a soliciting (poll) command. The use of the P/F bit is described in Clause 5.

6.5.2 Multiple frame operation - variables and sequence numbers

6.5.2.1 Modulus

Each I frame is sequentially numbered and may have the value zero through n minus 1 (where n is the modulus of the sequence numbers). The modulus equals 128 and the sequence numbers cycle through the entire range, 0 through 127. All arithmetic operations on state variables and sequence numbers contained in this standard are affected by the modulus operation. Consideration must be given to the relational operators which determine the validity of these variables and numbers.

6.5.2.2 Send state variable V(S)

Each point-to-point data link connection endpoint shall have 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) shall be incremented by 1 with each successive I frame transmission, and shall not exceed V(A) by more than the maximum number of outstanding I frames k. The value of k may be in the range 1 < = k < = 127.

6.5.2.3 Acknowledge state variable V(A)

Each point-to-point data link connection endpoint shall have an associated V(A) when using I frame commands and supervisory frame commands/responses. V(A) identifies the last frame that has been acknowledged by its peer [V(A)-1 equals the N(S) of last acknowledged I frame]. V(A) can take on the value O through n minus 1. The value of V(A) shall be updated by the valid N(R) values received from its peer (see 6.5.2.6). A valid N(R) value is one that is in the range V(A) < = N(R) < = V(S).

6.5.2.4 Send sequence number N(S)

Only I frames contain N(S), the send sequence number of transmitted I frames. At the time that an in-sequence I frame is designated for transmission, the value of N(S) is set equal to the value of V(S).

6.5.2.5 Receive state variable V(R)

Each point-to-point data link connection endpoint shall have an associated V(R) when using I frame commands and supervisory frame commands/responses. V(R) denotes the sequence number of the next in-sequence I frame expected to be received. V(R) can take on the value O through modulus minus 1. The value of V(R) shall be incremented by one with the receipt of an error-free, in-sequence I frame whose N(S) equals V(R).

6.5.2.6 Receive sequence number N(R)

All I frames and supervisory frames contain N(R), the expected send sequence number of the next received I frame. At the time that a frame of the above types is designated for transmission, the value N(R) is set equal to V(R). N(R) indicates that the data link layer entity transmitting the N(R) has correctly received all I frames numbered up to and including N(R)-1.

6.5.3 Unacknowledged operation - variables and parameters

No variables are defined. One parameter is defined, N201 (see 8.9.3).

6.6 Frame Types

6.6.1 Commands and responses

The following commands and responses are used by either the user or the network data link layer entities and are represented in Table 5. Each data link connection shall support the full set of commands and responses. For the purposes of the LAPD procedures those frame types not identified in Table 5 are identified as undefined command and/or response control fields. The actions to be taken are specified in 8.7.5 and 8.5.4. The commands and responses in Table 5 are defined in 6.6.2 to 8.5.4.

Format	Command	Responses	Encoding								Octet
			8	7	6	5	4	3	2	1	
Information	I		N(S)							0	4
Transfer			N(R)							P	5
	RR	RR	0	0	0	0	0	0	0	1	4
			N(R)							P/F	5
	RNR	RNR	0	0	0	0	0	1	0	1	4
Supervisory			N(R)							P/F	5
	REJ	REJ	0	0	0	0	1	0	0	1	4
			N(R)							P/F	5
Unnumbered	SABME		0	1	1	P	1	1	1	1	4
		DM	0	0	0	F	1	1	1	1	4
	UI		0	0	0	P	0	0	1	1	4
	DISC		0	1	0	P	0	0	1	1	4
		UA	0	1	1	F	0	0	1	1	4
		FRMR	1	0	0	F	0	1	1	1	4

Table 5 - Commands and responses

6.6.2 Information (I) command

The function of the information (I) command is to transfer, across a data link connection, sequentially numbered frames containing information fields provided by layer 3. This command is used in the multiple frame operation on point-to-point data link connections.

6.6.3 Set Asynchronous Balanced Mode Extended (SABME) command

The SABME unnumbered command is used to place the addressed user side or network side into modulo 128 multiple frame acknowledged operation. No information field is permitted with the SABME command. A data link layer entity confirms acceptance of a SABME command by the transmission at the first opportunity of a UA response. Upon acceptance of this command, the data link layer entity's V(S), V(A) and V(R) are set to zero. The transmission of a SABME command indicates the clearance of all exception conditions. Previously transmitted I frames that are unacknowledged when this command is processed remain unacknowledged and are discarded. It is the responsibility of a higher level (for example, layer 3) or the management entity to recover from the possible loss of the contents of such I frames.

6.6.4 Disconnect (DISC) command

The DISC unnumbered command is used to terminate the multiple frame operation. No information field is permitted with the DISC command. The data link layer entity receiving the DISC command confirms the acceptance of a DISC command by the transmission of a UA response. The data link layer entity sending the DISC command terminates the multiple frame operation when it receives the acknowledging UA or DM response. Previously transmitted I frames that are unacknowledged when this command is processed remain unacknowledged and shall be discarded. It is the responsibility of a higher level (for example, layer 3) or the management entity to recover from the possible loss of the contents of such I frames.

6.6.5 Unnumbered information (UI) command

When a layer 3 or management entity requests unacknowledged information transfer, the UI unnumbered command is used to send information to its peer without affecting data link layer variables. UI command frames do not carry a sequence number and therefore, the UI frame may be lost without notification.

6.6.6 Receive ready (RR) command/response

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 Clause 8); 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.

6.6.7 Reject (REJ) command/response

The REJ supervisory frame is used by a data link layer entity to request retransmission of I frames starting with the frame numbered N(R). The value of N(R) in the REJ frame acknowledges I frames numbered up to and including (N(R) - 1). New I frames pending initial transmission shall be transmitted following the retransmitted I frame(s).

Only one REJ exception condition for a given direction of information transfer is established at a time. The REJ exception condition is cleared (reset) upon the receipt of an I frame with an N(S) equal to the N(R) of the REJ frame.

The transmission of a REJ frame shall also indicate the clearance of any busy condition within the sending data link layer entity that was reported 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 REJ command with the P bit set to 1 may be used by a data link layer entity to ask for the status of its peer data link layer entity.

A data link layer entity complying with this standard shall not use the REJECT command on the sender side.It shall however be capable of receiving a REJECT command.

6.6.8 Receive not ready (RNR) command/response

The RNR supervisory frame shall be used by a data link layer entity to indicate a busy condition, that is, a temporary inability to accept additional incoming I frames. The value of N(R) in the RNR frame acknowledges I frames numbered up to and including N(R) - 1.

In addition to indicating the status of a data link layer entity, the RNR 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.

6.6.9 Unnumbered acknowledgement (UA) response

The UA unnumbered response is used by a data link layer entity to acknowledge the receipt and acceptance of the mode-setting commands (SABME or DISC). Received mode-setting commands are not processed until the UA response is transmitted. No information field is permitted with the UA response. The transmission of the UA response indicates the clearance of any busy condition that was reported by the earlier transmission of an RNR frame by that same data link layer entity.

6.6.10 Disconnected mode (DM) response

The DM unnumbered response is used by a data link layer entity to report to its peer that the data link layer is in a state such that multiple frame operation cannot be performed. No information field is permitted with the DM response.

6.6.11 Frame reject (FRMR) response

The FRMR unnumbered response may be received by a data link layer entity as a report of an error condition not recoverable by retransmission of the identical frame ie, at least one of the following error conditions, result from the receipt of a valid frame:

a) the receipt of a command or response control field that is undefined or not implemented;

b) the receipt of a supervisory or unnumbered frame with incorrect length;

c) the receipt of an invalid N(R); or

d) the receipt of a frame with an information field which exceeds the maximum established length.

An undefined control field is any of the control field encodings not identified in Table 5.

A valid N(R) value is one that is in the range V(A) < = N(R) < = V(S).

An information field which immediately follows the control field and consists of five octets (modulo 128 operation) is returned with this response and provides the reason for the FRMR response. This information field format is given in Figure 18 (modulo 128 operation).

8	7	6	5	4	3	2	1	
REJECTED FRAME								OCTET 5
CONTROL FIELD								OCTET 6
V(S)							0	OCTET 7
V(R)							C/R	OCTET 8
0	0	0	0	Z	Y	X	W	OCTET 9

- Rejected frame control field is the control field of the received frame which caused the frame reject. When the rejected frame is an unnumbered frame, the control field of the rejected frame is positioned in octet 5, with octet 6 set to "0000 0000".
- V(S) is the current send state variable value on the user side or network side reporting the rejection condition.
- C/R is set to 1 if the frame rejected was a response and is set to 0 if the frame rejected was a command.
- V(R) is the current receive state variable value on the user side or network side reporting the rejection condition.
- W set to 1 indicates that the control field received and returned in octets 5 and 6 was undefined or not implemented.
- X set to 1 indicates that the control field received and returned in octets 5 and 6 was considered invalid because the frame contained an information field which is not permitted with this frame or is a supervisory or unnumbered frame with incorrect length. Bit W must be set to 1 in conjunction with this bit.
- Y set to 1 indicates that the information field received exceeded the maximum established capacity of the user side or network side reporting the rejection condition.
- Z set to 1 indicates that the control field received and returned in octets 5 and 6 contained an invalid N(R).
- Octet 7, bit 1 and octet 9, bits 5 through 8 shall be set to zero.

Figure 18 - FRMR information field format -extended (modulo 128) operation

7. ELEMENTS FOR LAYER TO LAYER COMMUNICATION

7.1 General

Communication between layers and, for this standard, between the data link layer and the layer management entity, are accomplished by means of primitives. Primitives represent, in an abstract way, the logical exchange of information and control between the data link and adjacent layers. They do not specify or constrain implementations. Primitives consist of commands and their respective responses associated with the services requested of a lower layer. The general syntax of a primitive is:

XX - Generic name - Type: Parameters

where XX designates the interface across which the primitive flows. For this Recommendation XX is:

- DL for communication between layer 3 and the data link layer;
- PH for communication between the data link layer and the physical layer;
- MDL for communication between the layer management and the data link layer; or
- MPH for communication between the management entity and the physical layer.

7.1.1 Primitive Types

The primitive types defined in this standard are described in Clause 2.

7.1.2 Generic names

The generic name specifies the activity that the identified layer should perform. Table 6 illustrates the primitives defined in this standard. Note that not all primitives have associated parameters. The primitive generic names that are defined in this Recommendation are:

7.1.2.1 DL-ESTABLISH

The DL-ESTABLISH primitives are used to request, indicate and confirm the outcome of the procedures for establishing multiple frame operation. The DL-ESTABLISH-REQUEST primitive will be used by the upper layer to cause a link to be established, the DL-ESTABLISH-CONFIRM will be returned in case of success. In case of unsolicited link establishment th DL-ESTABLISH-INDICATION will be used to inform the layer 3 entity.

7.1.2.2 DL-RELEASE

The DL-RELEASE primitives are used to request, indicate and confirm the outcome of the procedures for terminating a previously established multiple frame operation, or for reporting an unsuccessful establishment attempt. The request will be made by a DL-RELEASE-REQUEST and 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.

7.1.2.3 DL-DATA

The DL-DATA primitives are used to request and indicate layer 3 messages which are to be transmitted, or have been received, by the data link layer using the acknowledged transfer service. DL-DATA-REQUEST will be sent by the layer 3 entity whereas DL-DATA-INDICATION will indicate to the layer 3 entity that a message has arrived over the line.

7.1.2.4 DL-UNIT_DATA

The DL-UNIT DATA primitives are used to pass layer 3 messages to and from the Data Link layer during unacknowledged operation. The DL-UNIT DATA REQUEST primitive is used to transmit unacknowledged information and the DL-UNIT DATA INDICATION is used to receive unacknowledged information.

7.1.2.5 MDL-ASSIGN

The MDL-ASSIGN-REQUEST primitive are used by the layer management entity to request that the data link layer associate the TEI value contained within the message unit of the primitive with the specified Connection Endpoint Suffix (CES) across all SAPIs. The MDL-ASSIGN primitive is used by the data link layer to indicate to the layer management entity the need for a TEI value to be associated with the CES specified in the primitive message unit.

7.1.2.6 MDL-REMOVE

The MDL-REMOVE-REQUEST primitive are used by the layer management entity to request that the data link layer remove the association of the specified TEI value with the specified CES across all SAPIs. The TEI and CES are specified by the MDL-REMOVE primitive message unit.

7.1.2.7 MDL-ERROR

The MDL-ERROR-INDICATION primitive are used to indicate to the connection management entity that an error has occurred, associated with a previous management function request or detected as a result of communication with the data link layer peer entity. The layer management entity may respond with an MDL-ERROR-INDICATION primitive if the layer management entity cannot obtain a TEI value.

7.1.2.8 MDL-UNIT__DATA

The MDL-UNIT DATA primitives are used to request and indicate layer management entity messages which are to be transmitted, or have been received, by the data link layer using the unacknowledged information transfer service.

7.1.2.9 PH-DATA

The PH-DATA primitives are used to pass to and from the physical layer message units containing frames used for data link layer peer-to-peer communication. PH-DATA-REQUEST is sent by the Data Link layer entity to the physical layer, PH-DATA-INDICATION is sent in the opposite direction.

7.1.2.10 PH-ACTIVATE

The PH-ACTIVATE primitives are used to request activation of the physical layer connection or to indicate that the physical layer connection has been activated. The REQUEST primitive is used to ask for the resumption of framing on the link from the PCSN.

7.1.2.11 PH-DEACTIVATE

The PH-DEACTIVATE primitive is used to indicate that the physical layer connection has been deactivated.

Generic name	Type				Parameters		Message unit contents
	Request	Indication	Response	Confirm	Priority indicator	Message unit	
L3 ◄——► L2							
DL-ESTABLISH	X	X	-	X	-	-	
DL-RELEASE	X	X	-	X	-	-	
DL-DATA	X	X	-	-	-	X	Layer 3 peer-to-peer message
DL-UNIT-DATA	X	X	-	-	-	X	Layer 3 peer-to-peer message
M ◄——► L2							
MDL-ASSIGN	X	X	-	-	-	X	TEI value, CES
MDL-REMOVE	X	-	-	-	-	X	TEI value, CES
MDL-ERROR	-	X	X	-	-	X	Reason for error message
MDL-UNIT DATA	X	X	-	-	-	X	Management function peer-to-peer message
MDL-XID	X	X	X	X	-	X	Connection management information
L2 ◄——► L1							
PH-DATA	X	X	-	-	X	X	Data link layer peer-to-peer message
PH-ACTIVATE	X	X	-	-	-	-	
PH-DEACTIVATE	-	X	-	-	-	-	

Table 6 - Primitives associated with Standard ECMA-105

7.1.3 Parameter definition

7.1.3.1 Priority indicator

Since several SAPs may exist on the network side or user side, protocol messages units sent by one SAP may contend with those of other service access points for the physical resources available for message transfer. The priority indicator is used to determine which message unit will have greater priority when contention exists. The priority indicator is only needed at the user side for distinguishing message units sent by the SAP with a SAPI value of zero from all other message units.

7.1.3.2 Message unit

The message unit contains additional layer-to-layer information concerning actions and results associated with requests. In the case of the DATA primitives, the message unit contains the requesting layer peer-to-peer messages. For example DL-DATA message unit contains layer 3 information. The PH-DATA message unit contains the data link layer frame.

The operations across the data link layer/layer 3 boundary shall be such that the layer sending the DL-DATA or DL-UNIT-DATA primitive can assume a temporal order of the bits within the message unit and that the layer receiving the primitive can reconstruct the message with its assumed temporal order.

7.2 Primitive procedures

7.2.1 General

Primitive procedures specify the interactions between adjacent layers to invoke and provide a service. The service primitives represent the elements of the procedures. The interactions between layer 3 and the data link layer are specified within this standard.

7.2.2 Layer 3 - Data Link Layer interactions

The states of a data link connection endpoint may be derived from the internal states of the data link layer supporting this type of a data link connection. The data link connection endpoint states are defined as follows:

a) Broadcast data link connection endpoint:

- INFORMATION TRANSFER state.

b) Point to point data link connection endpoint:

- LINK CONNECTION RELEASED state;
- AWAITING ESTABLISH state;
- AWAITING RELEASE state;
- LINK CONNECTION ESTABLISHED state.

The primitives provide the procedural means to specify conceptually how a data link service user can invoke a service.

This section defines the constraints on the sequences in which the primitives may occur. The sequences are related to the states at one point to point data link connection endpoint.

The possible overall sequence of primitives at a point to point data link connection endpoint are defined in the state transition diagram, Figure 19. The LINK CONNECTION RELEASED and LINK CONNECTION ESTABLISHED states are stable states whilst the AWAITING ESTABLISH and AWAITING RELEASE states are transition states.

The model illustrates the behaviour of layer two as seen by layer three. This model assumes that the primitives passed between layers is implemented by a first in first out queue. In this model "collisions" of REQUEST and INDICATION primitives can occur thereby illustrating actions that seem to be in conflict with the actual layer two protocol description. In some implementations, these collisions could occur.

Notes to Figure 19:

Note 1:

If the data link layer entity issues a DL-ESTABLISH-INDICATION (this applies to the case of data link layer initiated or peer system initiated re-establishment), DL-RELEASE-CONFIRM or DL-RELEASE-INDICATION, this indicates the discard of all the data link service data units representing DL-DATA-REQUEST

Note 2:

This primitive notifies to layer 3 link re-establishment.

Note 3:

This primitive will occur if a DL-RELEASE-REQUEST collides with a DL-RELEASE-INDICATION.

Note 4:

This primitive will occur if a DL-ESTABLISH-REQUEST collides with a DL-ESTABLISH-INDICATION.

Note 5:

This primitive will occur if a DL-RELEASE-REQUEST collides with a DL-ESTABLISH-INDICATION.

Note 6:

This primitive will occur if a DL-ESTABLISH-REQUEST (this applies to the case of layer 3 initiated re-establishment) collides with a DL-RELEASE-INDICATION. Since this DL-RELEASE-INDICATION is not related to the DL-ESTABLISH-REQUEST, the data link layer will establish the link and issue a DL-ESTABLISH-CONFIRM.

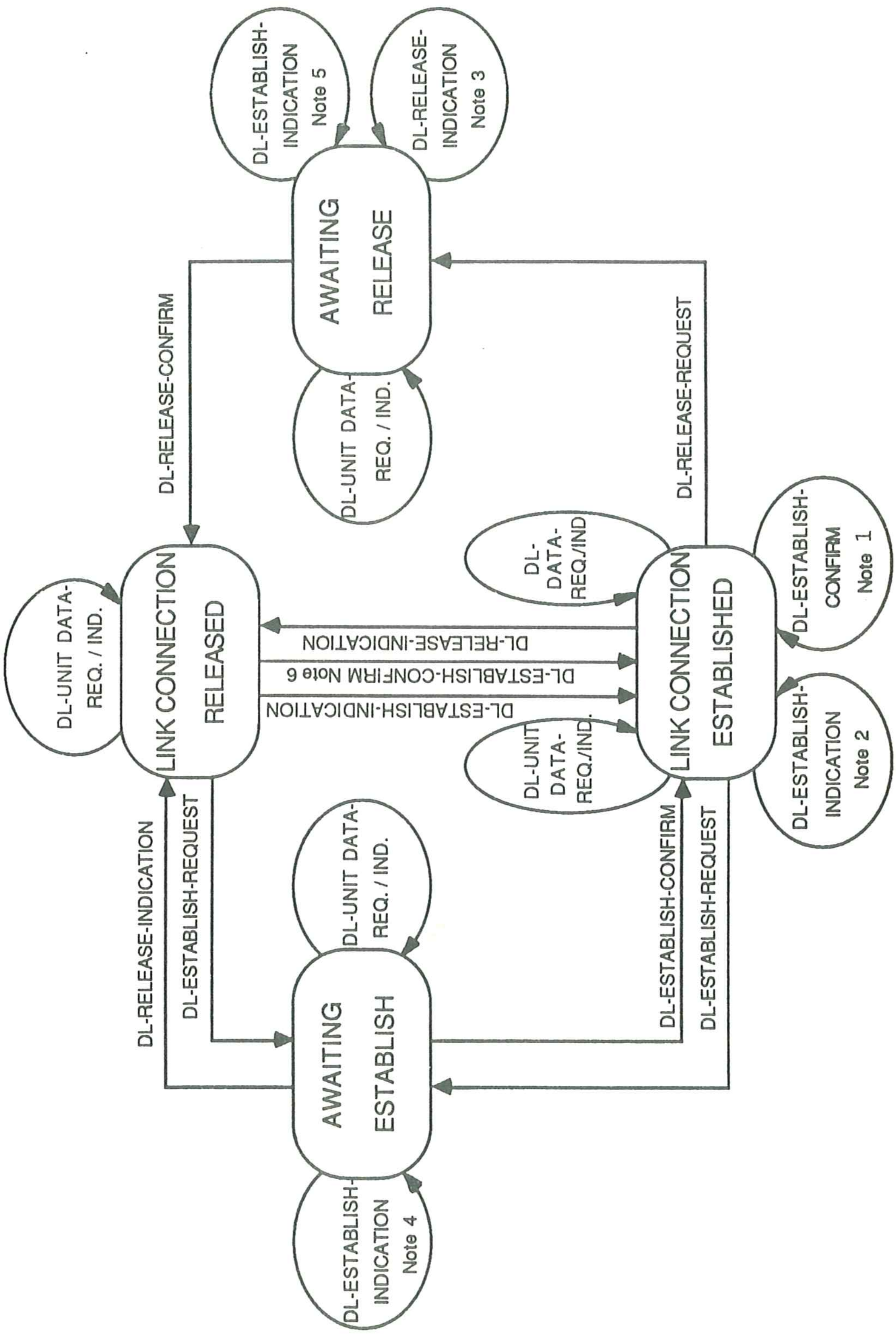


Figure 19 - State transition diagram for sequences of primitives at a point-to-point connection

7.2.3 Data Link - Data Link Layer representation

As indicated in 4.4.2 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 dependant upon:

- 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 dependant 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 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.

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

The procedures for use by the data link layer are specified in the following sections. The elements of procedure (frame types) which apply are:

a) for unacknowledged information transfer (8.2)

   UI-command

b) for multiple frame acknowledged information transfer (8.4 to 8.7)

   SABME-command
   UA-response

DM-response
DISC-command
RR-command/response
RNR-command/response
REJ-command/response
I-command
FRMR-response.

8.1 Procedure for the use of the P/F bit

8.1.1 Unacknowledged information transfer

For unacknowledged information transfer, the P/F bit is not used and shall be set to zero.

8.1.2 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 1, shall set the F bit to 1 in the next response frame it transmits, as defined in Table 7.

Command received with P bit = 1	Response transmitted with F bit = 1
SABME, DISC.	UA, DM.
I, RR, RNR, REJ.	RR, RNR, REJ.

Table 7 - Immediate response operation of the P/F bit

- In general the poll bit is not set to one in the information frames. This allows greater link efficiency in that the information frames may be acknowledged via N(R) transmitted by the peer entity in either I frames (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 8.4.2). However, the P bit could be set to one in an I frame if a unique response via a supervisory frame is desired form the peer entity.
- The Poll bit is always set to one in all supervisory command frames. For those command frames the timer T 200 is normally running.
- The Final 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.

8.2 Procedures for unacknowledged information transfer

The following general guidelines are used in the implementation of the multiple frame established mode.

8.2.1 General

The procedures which apply to the transmission of information in unacknowledged operation are defined below. No data link layer error recovery procedures are defined for unacknowledged operation.

8.2.2 Transmission of unacknowledged information

Unacknowledged information is passed to the data link layer by layer 3 or management entities using the primitives DL-UNIT-DATA-REQUEST or MDL-UNIT-DATA-REQUEST, respectively. The layer 3 or management message unit shall be transmitted in a UI command frame.

NOTE 8

The term "transmission of a UI frame" refers to the delivery of a UI frame by the data link layer to the physical layer.

For broadcast operation, the TEI value in the UI command address field shall be set to 127 (binary 111 1111, the group value).

For point-to-point operation, the appropriate TEI value shall be used.

The P bit shall be set to zero.

In the case of layer 1 deactivation initiated by the network system management, the data link layer will be informed by the PH-DEACTIVATE-INDICATION primitive. Upon receipt of this indication all UI transmission queues shall be discarded.

NOTE 9

The network side system management deactivation procedures should ensure that layer 1 is not deactivated before all UI data transfer is completed.

8.2.3 Receipt of unacknowledged information

On receipt of a UI command frame with a SAPI and TEI which are supported by the receiver, the contents of the information field shall be passed to the layer 3 or management entity using the data link layer to the layer 3 primitive DL-UNIT DATA-INDICATION or the data link layer to management primitive MDL-UNIT-DATA-INDICATION, respectively. Otherwise the UI command frame shall be discarded.

8.3 Terminal Endpoint Identifier (TEI) management procedures

8.3.1 General

TEI management is based on the following procedural means:

- TEI Assignment procedure (see 8.3.2)
- TEI Check procedure (see 8.3.3)
- TEI Removal procedure (see 8.3.4)

A user equipment in the TEI-unassigned state shall use the TEI assignment procedures to enter the TEI-assigned state. Conceptually these procedures exist in the layer management entity. The layer management entity on the network side is referred to as the Assignment Source Point (ASP) in this Recommendation. The purpose of these procedures is to:

a) allow automatic TEI equipment to request the network to assign a TEI value that the data link layer entities within the requesting user equipment will use in their subsequent communications;

b) allow a network to remove a previously assigned TEI value from specific or all user equipments;

c) allow a network to check:

- whether or not a TEI value is in use,
- whether multiple TEI assignment has occurred;

The user side layer management entity shall instruct the user data link layer entities to remove all TEI values when it is notified that the terminal is disconnected at the interface (as defined in standard ECMA-103).

Additionally, the user side layer management entity should instruct the user data link layer entity to remove a TEI value for its own internal reasons, (for example, losing the ability to communicate with the network). The layer management entity shall use the MDL-REMOVE-REQUEST primitive for these purposes.

8.3.4.1 includes the actions taken by a data link layer entity receiving a MDL-REMOVE-REQUEST primitive.

Typically, one TEI value would be used by the user equipment (for example, a data link layer entity which has been assigned a TEI value could use that value for all SAPs which it supports). If required, a number of TEI values may be requested by multiple use of the procedures defined in 8.3.2. It shall be the responsibility of the user to maintain the association between TEI and SAPI values.

The initiation of TEI assignment procedures occurs on the receipt of a request for establishment or unacknowledged information transfer while in the TEI-unassigned state. The data link layer entity shall inform the layer management entity using the MDL-ASSIGN-INDICATION primitive.

NOTE 10

In the case of initialization from a no power condition, the user equipment should postpone the start of the TEI assignment procedure until an outgoing or incoming call is to be handled.

All layer management entity messages used for these TEI management procedures are transmitted to, or received from, the data link layer entity using the MDL-UNIT DATA-REQUEST primitive, or the MDL-UNIT-DATA-INDICATION primitive respectively. The data link layer entity shall transmit management entity messages in UI command frames. The SAPI value shall be 63. The TEI value shall be 127.

A formal description of the TEI procedures using SDL (Specification and Description Language) is given in Annex B.

8.3.2 TEI assignment procedure

Upon initiation of the automatic TEI assignment procedure, the user side layer management entity shall transmit to its peer a message containing the following elements:

a) Message type = Identity request;

b) Request reference number (Ri);

c) Action indicator (Ai);

d) Management entity identifier.

The Request reference number Ri shall be used to differentiate between a number of user equipments which may simultaneously request assignment of a TEI value. Ri shall be 2 octets in length and shall be randomly generated for each request message by the user equipments.

All values in the range 0 to 65535 shall be available from the random number generator.

NOTE 11

The design of the random number generator should minimize the possibility of identical reference numbers being generated by terminals which initiate their TEI assignment procedures simultaneously.

The single octet Action indicator, Ai, shall be used to indicate a request to the Assignment Source Point (ASP) for the assignment of any TEI value available.

The coding of the Ai shall be Ai = Group address TEI (127) (This Ai value requests the ASP to assign any TEI value.)

A timer T202 shall be started.

The ASP, on receipt of the Identity request message shall either:

i) select a TEI value;

ii) deny identity requests with Ai values in the range 64-126, and ignore identity requests with the Ai value in the range 0-63; or

iii) ignore the Identity request message if a previous identity request message that contains an identical Ri has been received and no TEI has been assigned. In this case the ASP shall not assign a TEI value to either request.

Selection of a TEI value shall be on the basis of information stored at the ASP. This may consist of:

- a map of the full range of automatic TEI values; or
- an updated list of all automatic TEI values available for assignment, or a smaller subset.

The ASP, after having selected the TEI value, shall inform the network data link layer entities by means of the MDL-ASSIGN-REQUEST primitive and transmit to its peer a message containing the following elements:

a) Message type = Identity assigned;

b) Request reference number (Ri);

c) The assigned TEI value in the Ai field;

d) Management entity identifier.

If the available TEI information/resources are exhausted, a TEI check routine procedure should be initiated.

A TE layer management entity receiving this Identity assigned message shall compare the TEI value in the Ai field to its own TEI value(s) (if any) to see if it is already allocated if an Identity request message is outstanding.

If there is a match, the management entity shall either:

- initiate TEI removal; or
- initiate the TEI Identity verify procedures.

If there is no match, the user side layer management entity shall:

- compare the Ri value with any outstanding Identity request message and if it matches, consider the TEI value assigned to the user equipment, discard the value of Ri, inform the user side data link layer entities by means of the DL-ASSIGN-REQUEST primitive and stop timer T202;
- compare the Ri value with any outstanding Identity request message and if there is no match do nothing;

- if there is no outstanding Identity request message do nothing.

When the data link layer receives the MDL-ASSIGN-REQUEST primitive from the layer management entity, the data link layer entity shall:

- enter the TEI assigned state; and

- proceed with data link establishment procedures if a DL-ESTABLISH-REQUEST primitive is outstanding, or the transmission of a UI command frame if a DL-UNIT DATA-REQUEST primitive is outstanding.

To deny an Identity request message, the ASP shall transmit to its peer a message containing the following elements:

a) message type = Identity denied

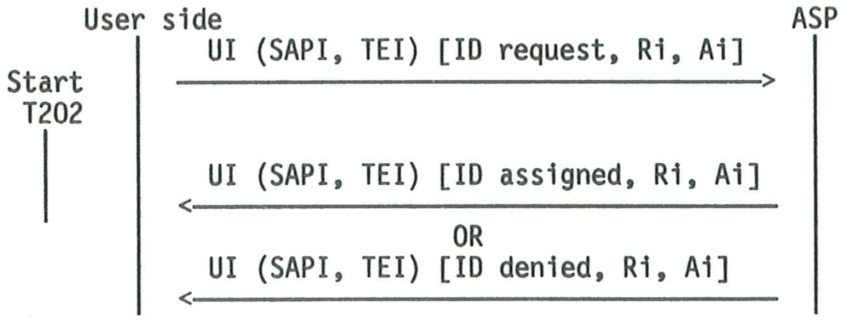
b) request reference number (Ri);

c) the value of TEI which is denied in the Ai field (a value of 127 indicates that no TEI values are available);

d) Management entity identifier.

8.3.2.1 Expiry of timer T202

If the user receives either no response or an Identity denied to its identity request message then on the expiry of timer T202, the timer shall be restarted and the Identity request message shall be re-transmitted with a new value of Ri. After N202 unsuccessful attempts to acquire a TEI value, the layer management shall inform the data link layer entity using the MDL-ERROR-RESPONSE primitive. The data link layer entity receiving the MDL-ERROR-RESPONSE primitive shall respond with the primitive DL-RELEASE-INDICATION if a request for establishment had previously occurred, and shall discard all unserved DL-UNIT DATA-REQUEST primitives. However, the TEI assignment procedure has been initiated, the data link layer entity receiving MDL-ERROR-RESPONSE shall discard all DL-UNIT-DATA-REQUESTs received earlier. The values of T202 and N202 are specified in 8.9.



SAPI	:	Service access point identifier = 63
TEI	:	Group TEI = 127
ID request	:	Identity request
ID denied	:	Identity denied
Ai	:	Action indicator,see Table 8.
Ri	:	Reference number
( )	:	Contents of the data link layer address field
[ ]	:	Contents of the Information field

Figure 20 - TEI Assignment procedure

8.3.3 TEI check procedure

8.3.3.1 Use of the TEI check procedure

The TEI check procedure shall be used in the TEI audit and recovery procedures. The TEI check procedure allows the network side layer management entity either:

- to establish that a TEI value is in use; or

- verify multiple TEI assignment.

The TEI check procedure for verifying multiple TEI assignment may also be optionally invoked in response to an Identity verify request message from the user equipment.

8.3.3.2 Operation of the TEI check procedure

The TEI check procedure is illustrated in Figure 22:

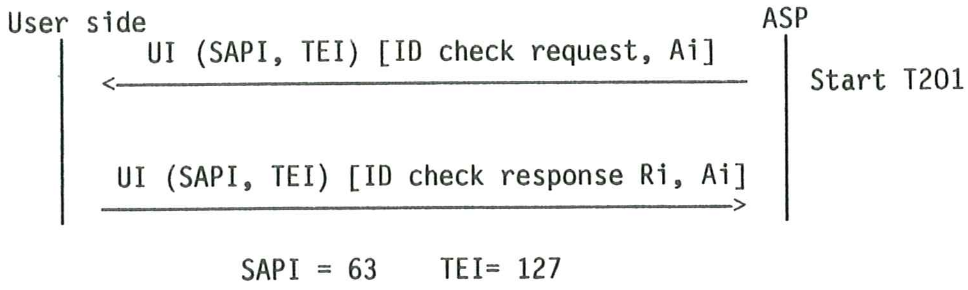


Figure 21 - TEI Check procedure

The ASP shall transmit a message containing the following elements:

a) Message type = identity check request;

b) Ai field which contains the TEI value to be checked or the value 127 when all TEI values are to be checked;

c) Management entity identifier.

Timer T201 shall be started.

If any user equipment has been assigned the TEI value specified in the Identity check request message, it shall respond by transmitting a message containing the following elements:

a) Message type = Identity check response;

b) The TEI value in the Ai field;

c) Reference number (Ri);

d) Management entity identifier.

When the TEI check procedure is used to verify multiple TEI assignment:

- If more than one identity check response is received within T201 then multiple TEI assignment shall be considered present; otherwise the request shall be repeated once and timer T201 restarted.

- If more than one Identity check response is received within the second T201 period then multiple TEI assignment shall be considered present.

- If no Identity check response is received after both T201 periods, the TEI value shall be assumed to be free and available for (re)assignment.

NOTE 12

The randomly-generated RI is present in the Identity check response to ensure that in the case more than one user equipment happen to commence transmission of the Identity check response at precisely the same time (i.e., the first zero bit of the opening flag coincides) due to different Ri values a collision at layer 1 (see ISDN user-network interfaces: Layer 1 recommendations, [I.43X series] for clarification) occurs. The resolution of this collision results in multiple Identity check responses.

- If one Identity check response is received in one or both T201 periods, the TEI value shall be assumed to be in use.

When the TEI check procedure is used to test whether a TEI is in use it is completed upon the receipt of the first Identity check response message and the TEI value is assumed to be in use. Otherwise:

- if no Identity check response is received within T201, the Identity check request shall be repeated once and timer T201 restarted;
- If no response is received after the second Identity check request, the TEI value shall be assumed to be free and available for re-assignment.

If the Ai value in the Identity check request is equal to 127, it is preferred that the receiving TE layer management respond with a single ID check response message that contains all of the TEI values in use within that user equipment (See 8.3.5.5). If an Identity check request, with Ai equal to 127, is transmitted and an Identity check response is received making use of the extension facility, each Ai variable in the Ai field shall be processed as if received in separate Identity check responses for parallel Identity check requests.

8.3.4 TEI removal procedure

When the network side layer management entity determines that the removal of a TEI value is necessary (See 8.3.4.2) 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 equipments 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 8.3.4.2), it shall instruct the data link layer entity to enter the TEI-unassigned state, using the MDL-REMOVE-REQUEST primitive. This action would 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.

A request to remove a non existent TEI is ignored.

NOTE 13

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

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

A data link layer entity receiving an MDL-REMOVE-REQUEST primitive shall either:

- if no DL-RELEASE-REQUEST primitive is outstanding and the user equipment is not in the TEI assigned state, issue a DL-RELEASE-INDICATION primitive; or
- if a DL-RELEASE-REQUEST primitive is outstanding, then the data link layer should issue a DL-RELEASE-CONFIRM primitive.

The data link layer entity shall then enter the TEI unassigned state after discarding the contents of both UI and I queues.

8.3.4.2 Conditions for TEI removal

At the user equipment, automatic TEI values shall be removed and in the case of non-automatic TEI values an appropriate indication shall be made to the user under the following conditions:

- on request from the ASP by an Identity remove message;
- on receipt of an MPH-INFORMATION-INDICATION (disconnected) primitive;
- on receipt of an MDL-ERROR-INDICATION primitive indicating that the data link layer entity has assumed possible multiple assignment of a TEI value rather than requesting a TEI check procedure by the transmission of an Identity verify request message; or
- optionally on receipt of an Identity assigned message containing a TEI value in the Ai field which is already in use within the user equipment (see 8.3.2).

At the network side, TEI values should be removed:

- following a TEI audit procedure showing that a TEI value is no longer in use or that multiple TEI assignment has occurred; or
- on receipt of an MDL-ERROR-INDICATION primitive indicating a possible multiple TEI assignment which may be confirmed by the invocation of the TEI check procedures.

8.3.5 Formats and codes

8.3.5.1 General

All messages used for TEI management procedures are carried in the information field of UI command frames with a SAPI value set to 63 (binary 11 1111) and TEI value set to 127 (binary 111 1111). All messages have the structure shown in Figure 22.

8	7	6	5	4	3	2	1	
MANAGEMENT ENTITY IDENTIFIER								OCTET 1
REFERENCE NUMBER								OCTET 2
REFERENCE NUMBER								OCTET 3
MESSAGE TYPE								OCTET 4
ACTION INDICATOR							E	OCTET 5

Figure 22 - Messages used for TEI management procedures

E is the Action indicator field extension bit (see 8.3.5.5).

Fields that are not used in a specific message are coded all zeros, and are not to be processed by either side.

The coding of each field for the various messages is specified in Table 8.

Message name	Layer Management entity identifier	Reference number Ri	Message type	Action indicator Ai
Identity request (user to network)	0000 1111	0 - 65535	0000 0001	Ai = 127, Any TEI value acceptable
Identity assigned (network to user)	0000 1111	0 - 65535	0000 0010	Ai = 64 to 126 Assigned TEI value
Identity denied (network to user)	0000 1111	0 - 65535	0000 0011	Ai = 64 to 126 Ai = 127 - no TEI value available
Identity check request (network to user)	0000 1111	Not used (coded 0)	0000 0100	Ai = 127, Check all TEI values Ai = 64 - 126, TEI value to be checked
Identity check response (user to network)	0000 1111	0 - 65535		Ai = 64 - 126, TEI value in use
Identity remove (network to user)	0000 1111	Not used (coded 0)	0000 0110	Ai = 127, Request for removal of all TEI values Ai = 64 to 126, TEI value to be removed

Table 8 - Codes for messages concerning TEI management procedures

8.3.5.2 Layer Management entity identifier

For TEI administration procedures, the layer management entity identifier octet is 0000 1111. Other values are reserved for future standardization.

8.3.5.3 Reference number (Ri)

Octets 2 and 3 contain the reference number (Ri). When used, it can assume any value between 0 and 65535.

8.3.5.4 Message type

Octet 4 contains the message type. The purpose of the message type is to identify the function of the message being sent.

8.3.5.5 Action indicator (Ai)

The Ai field is extended by reserving the first transmitted bit of the Ai field octets to indicate the final octet of the Ai field. Ai variables in the Ai field are coded as follows:

a) bit 1 is the extension bit. It shall be coded as follows:

- 0 to indicate an extension, and
- 1 to indicate the final octet;

b) bits 2 to 8 contain the action indicator.

The purpose of the action indicator is to identify the concerned TEI value(s).

8.4 Procedures for establishment and release of multiple frame operation

8.4.1 Establishment of multiple frame operation

8.4.1.1 General

These procedures shall be used to establish multiple frame operation between the network and a designated user entity.

Layer 3 will request establishment of the multiple frame operation by the use of the DL-ESTABLISH-REQUEST primitive. Re-establishment may be initiated as a result of the data link layer procedures defined in 8.6. All frames other than unnumbered frame formats received during the establishment procedures shall be ignored.

8.4.1.2 Establishment procedures

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 re-transmission counter shall be reset, and timer T200 shall then be started (timer T200 is defined in 8.9.1). All mode setting commands shall be transmitted with the P bit set to 1.

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

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 primitive DL-ESTABLISH-INDICATION primitive;

- clear all existing exception conditions (e.g clear peer receiver busy condition, clear own receiver busy condition and clear reject exception);

- stop timer T200 if running;

- start timer T203 (timer T203 is defined in 8.9.8), if implemented.

If the data link layer entity is unable to enter the multiple-frame-established state, it shall respond to the SABME command with a DM response with the F bit set to the same binary value as the P bit in the received SABME command.

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

- reset timer T200;

- start timer T203, if implemented;

- set V(S), V(R) and V(A) to 0;

- enter the multiple-frame-established state and inform the layer 3 using the DL-ESTABLISH-CONFIRM primitive;

Upon reception of a DM response with F bit set to 1, the originator of the SABME 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. DM responses with the F bit set to 0 shall be ignored in this case.

A DL-RELEASE-REQUEST primitive received during data link layer initiated re-establishment shall be serviced on completion of the establishment mode-setting operation.

8.4.1.3 Procedure on expiry of timer T200

If timer T200 expires before the UA or DM response with the F bit set to 1 is received, the data link layer entity shall:

- re-transmit the SABME command as above;

- restart timer T200; and

- increment the re-transmission counter.

After re-transmission of the SABME command N200 times, the data link layer entity shall indicate this to layer 3 and the connection management entity by means of the primitives DL-RELEASE-INDICATION and MDL-ERROR-INDICATION primitives, respectively, and enter the TEI-assigned state after discarding all outstanding DL-DATA-REQUEST primitives, and all I frames in queue.

The value of N200 is defined in 8.9.2.

8.4.2 Information transfer

Having either transmitted the UA response to a received SABME command or received the UA response to a transmitted SABM command, I frames and supervisory frames shall be transmitted and received according to the procedures described in 8.5.

If an SABME command is received while in the multiple-frame-established state the data link layer entity shall conform to the re-establishment procedure described in 8.6.

On receipt of a UI command the procedures defined in 8.2 shall be followed.

8.4.3 Termination of multiple frame operation

8.4.3.1 General

These procedures shall be used to terminate the multiple frame operation between the network and a designated TE entity.

Layer 3 will request for termination of the multiple frame operation by use of the DL-RELEASE-REQUEST primitive.

All frames other than the unnumbered frames received during the release procedures shall be ignored.

All outstanding DL-DATA-REQUEST primitives and all I frames in queues shall be discarded.

In the case of layer 1 de-activation initiated by the network system management, or in the case of persistent unsolicited layer 1 deactivation, 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.

8.4.3.2 Release procedure

A data link layer entity shall initiate a request for release of the multiple frame operation by transmitting the Disconnect (DISC) command with P bit set to 1. Timer T200 shall then be started and the re-transmission counter reset.

A data link layer entity receiving a DISC command while in the multiple frame established or timer recovery state shall transmit a UA response with the F bit set to the same binary value as the P bit in the received DISC command. A DL-RELEASE-INDICATION primitive shall be passed to layer 3 and the TEI assigned state shall be entered. If the originator of the DISC command receives:

i) a UA response with the F bit set to 1; or

ii) a DM response with the F bit set to 1 indicating that the peer data link layer entity is already in the TEI-assigned state;

it shall enter the TEI-assigned state and reset timer T200.

The data link layer entity which issued the DISC command is now in the TEI-assigned state and will notify layer 3 by means of the DL-RELEASE-CONFIRM primitive. The conditions relating to this state are defined in 8.4.4.

8.4.3.3 Procedure on expiry of timer T200

If timer T200 expires before a response with the F bit set to 1 is received, the originator of the DISC command shall:

- re-transmit the DISC command as defined in 8.4.3.2;

- restart timer T200; and

- increment the re-transmission counter.

If the data link layer entity has not received the correct response as defined in 8.4.3.2, after N200 attempts to recover, the data link layer entity shall indicate this to the connection management entity by means of the MDL-ERROR-INDICATION primitive, enter the TEI-assigned state and notify layer 3 using the DL-RELEASE-CONFIRM primitive.

8.4.4 TEI-assigned state

While in the TEI-assigned state:

- the receipt of a DISC command shall result in the transmission of a DM response with the F bit set to the value of the received P bit;
- on receipt of a SABME command, the procedures defined in 8.4.1 shall be followed;
- on receipt of an unsolicited DM response with the F bit set to zero, the data link layer entity shall initiate the establishment procedures by the transmission of a SABME (see 8.4.1.2); Otherwise the DM shall be ignored.
- on receipt of UI commands, the procedures defined in 8.2 shall be followed;
- on receipt of an unsolicited UA response an MDL-ERROR-INDICATION indicating a possible double assignment of a TEI value shall be issued; and
- all other frame types shall be discarded.

8.4.5 Collision of unnumbered commands and responses

8.4.5.1 Identical transmitted and received commands

If the transmitted and received unnumbered commands (SABME or DISC) are the same, the data link layer entities shall send the UA response at the earliest possible opportunity. The indicated state shall be entered after receiving the UA response. The data link layer entity shall notify layer 3 by means of the appropriate confirm primitive.

8.4.5.2 Different transmitted and received commands

If the transmitted and received unnumbered commands (SABME or DISC) are different, the data link layer entities shall issue a DM response at the earliest possible opportunity. Upon receipt of a DM response with the F bit set to 1, the data link layer shall enter the TEI-assigned state and notify layer 3 by means of the appropriate primitive. The entity receiving the DISC command will issue a DL-RELEASE-INDICATION primitive, while the other entity will issue a DL-RELEASE-CONFIRM primitive.

8.4.6 Unsolicited DM response and SABME or DISC command

When a DM response with the F bit set to zero is received by a data link layer entity, a collision between a transmitted SABME or DISC command and the unsolicited DM response may have occurred.

In order to avoid misinterpretation of the DM response received, a data link layer entity shall always send its SABME or DISC command with the P bit set to 1.

A DM response with the F bit set to zero colliding with an SABME or DISC command shall be ignored.

8.5 Procedures for information transfer in multiple frame operation

The procedures which apply to the transmission of an I frame are defined below.

NOTE 14

The term "transmission of an I frame" refers to the delivery of an I frame by the data link layer to the physical layer.

8.5.1 Transmitting I frames

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. The control field parameters N(S) and N(R) shall be assigned the values of V(S) and V(R), respectively. The value of 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 timer T200 expires, the procedures defined in 8.5.7 shall be followed.

If V(S) is equal to V(A) plus k (where k is the maximum number of outstanding I frames - see 8.9.5), the data link layer entity shall not transmit any new I frames, but may re-transmit an I frame as a result of the error recovery procedures as described in 8.5.4 and 8.5.7.

When the network side or user side is in the own receiver busy condition, it may still transmit I frames, provided that a peer receiver busy condition does not exist.

NOTE 15

DL-DATA-REQUEST primitives received while in the timer recovery condition shall be queued.

8.5.2 Receiving I frames

Independent of a timer recovery condition, when a data link layer entity is not in an own receiver busy condition and receives a valid I frame whose N(S) is equal to V(R), the data link layer entity shall:

- pass the information field of this frame to layer 3 using the DL-DATA-INDICATION primitive;
- increment by 1 its V(R), and act as indicated below.

8.5.2.1 P bit set to 1

If the P bit of the received I frame was set 1, the data link layer entity shall respond to its peer in one of the following ways:

- if the data link layer entity receiving the I frame is still not in an own receiver busy condition, it shall send an RR response with the F bit set to 1;
- if the data link layer entity receiving the I frame enters the own receiver busy condition upon the receipt of the I frame, it shall send an RNR response with the F bit set to 1.

8.5.2.2 P bit set to zero

If the P bit of the received I frame was set to zero and:

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

- if no I 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 zero; 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 8.5.1; or

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 zero.

When the data link layer entity is in an own receiver busy condition, it shall process any received I frame according to 8.5.6.

8.5.3 Sending and receiving acknowledgements

8.5.3.1 Sending acknowledgements

Whenever a data link layer entity transmits an I frame or a supervisory frame the value of N(R) shall be set equal to the value of V(R).

8.5.3.2 Receiving acknowledgements

On receipt of a valid I frame or supervisory frame (RR, RNR or REJ), even in the own receiver busy or timer recovery condition, 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. The value of 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 a REJ frame with an N(R) equal to V(A).

NOTE 16

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

NOTE 17

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

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 8.5.7 with respect to the unacknowledged I frames.

If timer T200 has been reset by the receipt of a REJ frame, the data link layer entity shall follow the re-transmission procedures in 8.5.4.

8.5.4 Receiving REJ frames

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 the N(R) contained in the REJ frame control field;
- stop timer T200;
- start timer T203, if implemented;
- if it was a REJ command frame with the P bit set to 1, transmit an appropriate supervisory frame (see 8.5.1) with the F bit set to 1;
- transmit the corresponding I frame as soon as possible as defined in 8.5.1 taking into account the items 1) to 3) below and the paragraph following 1) to 3); and
- notify a protocol violation to the connection management entity by means of the primitive MDL-ERROR-INDICATION; if it was an REJ response frame with the F bit set to 1.

b) if it is in the timer recovery condition and it was a 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 the N(R) contained in the REJ frame control field;
- stop timer T200;
- start timer T203, if implemented;
- enter the multiple-frame-established state; and
- transmit the corresponding I frame as soon as possible as defined in 8.5.1 taking into account the items 1) to 3) below and the paragraph following items 1) to 3).

c) if it is in the timer recovery condition and it was a REJ frame other than a response 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 a REJ command frame with the P bit set to 1, transmit an appropriate supervisory response frame (see Note 2 in 8.5.5) with the F bit set to 1.

Transmission of I frames shall take account of the following:

1) if the data link layer entity is transmitting a supervisory frame when it receives the REJ frame, it shall complete that transmission before commencing transmission of the requested frame;

2) if the data link layer entity is transmitting a SABME command, DISC command, an UA response or DM response when it receives the REJ frame, it shall ignore the request for re-transmission; and

3) if the data link layer entity is not transmitting a frame when the REJ is received, it shall immediately commence transmission of the request I frame.

All outstanding unacknowledged I frames, commencing with the I frame identified in the received REJ command shall be transmitted. Other I frames not yet transmitted may be transmitted following the re-transmitted I frame.

8.5.5 Receiving RNR frames

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 respond with an RR response with the F bit set to 1 if the data link layer entity is not in an own receiver busy condition and shall respond with an RNR response with the F bit set to 1 if the data link layer entity is in an own receiver busy condition;
- if it was an RNR response with the F bit set to 1, an existing timer recovery condition shall be cleared and the N(R) contained in this RNR response shall be used to update V(S).

NOTE 18

The N(R) in any RR or RNR supervisory command frame irrespective of the setting of the P bit will not be used to update the send state variable V(S).

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 a busy condition.

The data link layer entity shall then:

- treat N(R) contained in the received RNR frame as an acknowledgement for all the I frames that have been (re)transmitted with an N(S) up to and including N(R) minus 1, and set its V(A) to the value of the N(R) contained in the RNR frame; and
- restart timer T200 unless a supervisory response frame with the F bit set to 1 is still expected.

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 re-transmission count variable; or
- if it is already in the timer recovery condition, add one to its re-transmission count variable.

The data link layer entity shall then:

a) if the value of the re-transmission count variable is less than N200:
   - restart timer T200, and
   - transmit an appropriate supervisory command (See Note 19) with the P bit set to 1; or

b) If the value of the re-transmission count variable is equal to N200, it shall initiate a re-establishment procedure as defined in 8.6 and indicate by means of the MDL-ERROR-INDICATION primitive to the connection management entity.

The data link layer entity receiving the supervisory frame with P bit set to 1 shall respond, at the earliest opportunity, with an appropriate supervisory response frame (See Note 19) with the F bit set to 1, to indicate whether or not its own receiver busy condition still exists.

Upon receipt of the supervisory response with the F bit set to 1, the data link layer entity shall reset timer T200, and:

- if the response is RR or REJ, the peer receiver busy condition is cleared and the data link layer entity may transmit new I frames or re-transmit I frames as defined in 8.5.1 or 8.5.4 respectively; or
- if the response is an RNR, the data link layer entity receiving the response shall proceed according to this 8.5.5, first paragraph.

If a supervisory command (RR, RNR or REJ) with the P bit set to zero or 1, or a supervisory response frame with the F bit set to zero is received during the enquiry process, the data link layer entity shall:

- if the supervisory frame is an RR or REJ command frame or RR or REJ response frame with the F bit set to 0, clear the peer receiver busy condition, and if the supervisory frame received was a command with the P bit set to 1, transmit the appropriate supervisory response frame (See Note 19) with the F bit set to 1.

  However, the transmission or re-transmission of I frames shall not be undertaken until the appropriate supervisory response frame with the F bit set to 1 is received or until the expiry of timer T200;or
- if the supervisory frame is an RNR command frame or RNR response with the F bit set to zero, retain the peer receiver busy condition and if the supervisory frame received was a command frame with the P bit set to 1 transmit the appropriate supervisory response frame (see Note 19) with the F bit set to 1.

Upon receipt of an SABME command the data link layer entity shall clear the peer receiver busy condition.

NOTE 19

a) *If the data link layer entity is not in a own receiver busy condition and is in a reject exception condition [that is, an N(S) sequence error has been received and a REJ frame has been transmitted, but the requested I frame has not been received], the appropriate supervisory frame is the RR frame.*

b) *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 a REJ frame has not been transmitted], the appropriate supervisory frame is the REJ frame.*

c) *If the data link layer entity is in its own receiver busy condition, the appropriate supervisory frame is the RNR frame.*

d) *Otherwise, the appropriate supervisory frame is the RR frame.*

8.5.6 Data link layer own receiver busy condition

When the data link layer entity enters an own receiver busy condition, it shall transmit an RNR frame at the earliest opportunity.

The RNR frame may be either:

- an RNR response frame with the F bit set to a zero; or
- if this condition is entered on receiving a command frame with the P bit set to 1, an RNR response with the F bit set to 1; or
- if this condition is entered on expiry of T200 an RNR command with the P bit set to 1.

All received I frames with the P bit set to zero shall be discarded, after updating V(A).

All received supervisory frames with the P/F bit set to zero shall be processed, including updating V(A).

All received I frames with the P bit set to 1 shall be discarded, after updating the V(A). However, an RNR response frame with the F bit set to 1 shall be transmitted.

All received supervisory frames with the P bit set to 1 will be processed including updating V(A). An RNR response with the F bit set to 1 shall be transmitted.

To indicate to the peer data link layer entity, the clearance of the own receiver busy condition, the data link layer entity shall transmit an RR or, if a previously detected sequence gap has not yet been reported, an REJ response with the N(R) set to the current value of the V(R).

The transmission of a SABME command or a UA response (in reply to an SABME) also indicates to the peer data link layer entity the clearance of the own receiver busy condition.

8.5.7 Waiting acknowledgement

The data link layer entity shall maintain an internal re-transmission 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 re-transmission count variable; or
- if it is already in the timer recovery condition, add one to its re-transmission count variable.

The data link layer entity shall then:

a) if the value of the re-transmission count variable is less than N200:

- restart timer T200, and
- transmit an appropriate supervisory command (see Note 19 in 8.5.5) with the P bit set to 1; or

b) if the value of the re-transmission count variable is equal to N200, initiate a re-establishment procedure as defined in 8.6 and indicate this by passing the MDL-ERROR-INDICATION primitive to the connection management entity.

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 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 re-transmission, as appropriate. Timer T200 shall reset and restarted if it is an RNR response, to proceed with the enquiry process according to 8.5.5.

8.6 Re-establishment of multiple frame operation

8.6.1 Criteria for re-establishment

The criteria for re-establishing the multiple frame mode of operation are defined in this section by the following conditions:

- the receipt while in the multiple frame mode of operation of an SABME;
- the receipt of a DL-ESTABLISH-REQUEST from layer 3 (see 8.4.1.1);
- the occurrence of N200 re-transmission failures while in the timer recovery condition (see 8.5.7);
- the occurrence of a frame rejection condition as identified in 8.7.5)
- the receipt while in the multiple frame mode of operation of an FRMR response frame (see 8.7.6);
- the receipt while in the multiple frame mode of operation of an unsolicited DM response with the F bit set to zero (see 8.7.7);
- the receipt while in the timer recovery condition of a DM response with the F bit set to 1.

8.6.2 Procedures

In all re-establishment situations, the data link layer entity shall follow the procedures defined in 8.4.1. All locally generated conditions for re-establishment will cause the transmission of an SABME.

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

- issue an MDL-ERROR-INDICATION primitive to the connection management entity; and
- if V(S) > V(A) prior to re-establishment issue a DL-ESTABLISH-INDICATION primitive to layer 3 and discard all I queues.

In case of layer 3 initiated re-establishment or if a DL-ESTABLISH-REQUEST primitive occurs pending re-establishment, the DL-ESTABLISH-CONFIRM primitive shall be used.

8.7 Exception condition reporting and recovery

Exception conditions may occur as the result of physical layer errors or data link layer procedural errors.

The error recovery procedures which are available to effect recovery following the detection of an exception condition at the data link layer are defined in this section.

The actions to be taken by the connection management entity on receipt of an MDL-ERROR-INDICATION primitive are defined in Appendix A.

8.7.1 N(S) sequence error

An N(S) sequence error exception condition occurs in the receiver when a valid I frame is received which contains an N(S) value which is not equal to V(R) at the receiver. The information field of all I frames whose N(S) does not equal V(R) shall be discarded.

The receiver shall not acknowledge [nor increment its V(R)] the I frame causing the sequence error, nor any I frames which may follow, until an I frame with the correct N(S) is received.

A data link layer entity which receives one or more I frames having sequence errors but otherwise error-free or subsequent supervisory frames (RR, RNR and REJ) shall use the control field information contained in N(R) field and the P or F bit to perform link control functions; for example, to receive acknowledgement of previously transmitted I frames and to cause the data link layer entity to respond if the P bit is set to 1. Therefore the re-transmitted I frame may contain an N(R) field and P bit that are updated from and therefore different from, the ones contained in the originally transmitted I frame.

The REJ response is used by a receiving data link layer entity to initiate an exception recovery (re-transmission) following the detection of an N(S) sequence error.

Only one REJ exception condition for a given direction of information transfer shall be established at a time.

A data link layer entity receiving a REJ command or response shall initiate sequential transmission (re-transmission) of I frames starting with the I frame indicated by the N(R) contained in the REJ frame.

A REJ condition is cleared when the requested I frame is received or when a SABME or DISC command is received.

8.7.2 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) < = N(R) < = 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 8.6.2.

8.7.3 Timer recovery condition

If a data link layer entity, due to a transmission error, does not receive a single I frame or the last I frame(s) in a sequence of I frames, it will not detect an out-of-sequence exception condition and therefore will not transmit a REJ frame.

The data link layer which transmitted the unacknowledged I frame(s) shall, on the expiry of timer T200, take appropriate recovery action as defined in 8.5.7 to determine at which I frame retransmission must begin.

8.7.4 Invalid frame condition

Any frame received which is invalid (as defined in 5.9) shall be discarded, and no action shall be taken as a result of that frame.

8.7.5 Frame rejection condition

A frame rejection condition results from one of the conditions described in 6.6.1 (second paragraph) or 6.6.11, items b, c and d. Upon occurrence of a frame rejection condition whilst in multiple frame operation, the data link layer entity shall:

- issue an MDL-ERROR-INDICATION primitive; and
- initiate re-establishment (see 8.6.2).

Upon occurrence of a frame rejection condition during establishment or release from multiple frame operation, or whilst a data link is not established, the data link layer entity shall:

- issue an MDL-ERROR-INDICATION primitive; and
- discard the frame.

NOTE 20

For satisfactory operation it is essential that a receiver is able to discriminate between invalid frames, as defined in 2.9, and I frames with an information field which exceeds the maximum established length (see 6.6.11 item d). An unbounded frame may be assumed, and thus discarded, if twice the longest permissible frame plus two octets are received without a flag detection.

8.7.6 Receipt of an FRMR response frame

Upon receipt of an FRMR response frame in the multiple frame mode of operation, the data link layer entity shall:

- issue an MDL-ERROR-INDICATION primitive; and
- initiate re-establishment (see 8.6.2).

8.7.7 Unsolicited response frames

The action to be taken on the receipt of an unsolicited response frame is defined in Table 9.

The data link layer entity shall assume possible multiple TEI assignment on receipt of an unsolicited UA response and shall inform layer management.

Unsolicited Response	TEI Assigned	Awaiting Establishment	Awaiting Release	Multiple frame mode of operation	
					Timer Recovery
UAr F = 1	MEI	NA	NA	MEI	MEI
UAr F = 0	MEI	MEI	MEI	MEI	MEI
DMr F = 1	-	NA	NA	RE-EST MEI	RE-EST MEI
Supervisory response F = 1	-	-	-	MEI	NA
Supervisory response F = 0	-	-	-	NA	NA

MEI : MDL-ERROR-INDICATION
RE-EST : Re-establish
\- : Ignore
EST : Establish
NA : Not Applicable (ie not unsolicited)
Note : Action is RE-EST and MEI

Table 9 - Action on unsolicited responses

8.7.8 Multiple assignment of a TEI value

A data link layer entity 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 management entity by means of the MDL-ERROR-INDICATION primitive. The management entity could ultimately decide to remove the TEI (see Appendix A).

8.8 Data link layer monitor function

8.8.1 General

The procedural elements defined in Clause 8 allow for the supervision of the data link layer resource. This section describes procedures which shall be used to provide this supervision function.

8.8.2 Data Link layer supervision in the multiple frame established states

The procedures specified herein are part of the HDLC classes of procedures. The connection verification is a service provided by data link layer to layer 3. This implies that layer 3 is informed in case of a failure only. Furthermore, the procedure may be incorporated in the "normal" exchange of information and may become more efficient than a procedure based on the involvement of layer 3.

The procedure specified herein is called STATUS ENQUIRY and is based on supervisory command frames (RR command, RNR command) and timer T203 and operates in the multiple frame established state as follows.

If there are no frames being exchanged on the data link connection (neither new nor outstanding I frames nor no supervisory frames with a P bit set to 1, etc), there is no means to detect a faulty data link connection condition or a user equipment having been unplugged. Timer T203 represents the maximum time allowed without frames being exchanged.

If timer T203 expires, a supervisory command with a P bit set to 1 is transmitted. Such a procedure is protected against transmission errors by making use of the normal timer T200 procedure including re-transmission count and N200 attempts.

8.8.3 Connection verification procedures

8.8.3.1 Start timer T203

The timer T203 is started:

- when the multiple-frame-established state is entered; and
- in multiple-frame-established state whenever timer T200 is stopped. (See Note in 8.8.3.2)

Upon receiving an I or supervisory frame timer T203 will be restarted if timer T200 is not to be started.

8.8.3.2 Stop timer T203

The timer T203 is stopped:

- when in multiple-frame-established state the timer T200 is started (See Note 21); and
- upon leaving the multiple-frame-established state.

NOTE 21

These two conditions mean that timer T203 is only started whenever timer T200 is stopped and not restarted.

8.8.3.3 Expiry of timer T203

If timer T203 expires, the data link layer entity will act as follows (it should be noted that timer T200 is neither running nor expired):

1) set the re-transmission count variable to 0;

2) enter timer recovery state;

3) transmit a supervisory command with the P bit set to 1 as follows:

- if there is not a receiver busy condition own receiver not busy), transmit an RR command; and

- if there is a receiver busy condition (own receiver busy) transmit an RNR command; and

4) start timer T200

5) send MDL-ERROR-INDICATION to connection management after N200 re-transmissions.

8.9 List of system parameters

The system parameters listed below are associated with each individual SAP. The term default implies that the value defined should be used in the absence of any assignment of alternative values.

8.9.1 Timer T200

The default value for timer T200 at the end of which transmission of a frame may be initiated according to the procedures described in 8.5 shall be one second.

NOTE 22

The proper operation of the procedure requires that timer T200 be greater than the maximum time between transmission of command frames and the reception of their corresponding response or acknowledgement.

NOTE 23

When an implementation includes multiple terminals on the user side together with a satellite connection in the transmission path, a value of T200 greater than specified above may be necessary. A value of 2.5 seconds is suggested.

8.9.2 Maximum number of re-transmission (N200)

The maximum number of re-transmissions of a frame (N200) is a system parameter. The default value of N200 shall be 3.

8.9.3 Maximum number of octets in an I frame information field (N201)

The maximum number of octets in an I frame information field (N201) is a system parameter (see also 5.5).

- for an SAP supporting signalling, the default value shall be 260 octets.
- for SAPs supporting packet information, the default value shall be 260 octets.

8.9.4 Maximum number of re-transmissions of the TEI assignment identity request message (N202)

The maximum number of transmissions of an TEI identity request message (when the user requests a TEI) is a system parameter. The default value of N202 shall be 3.

8.9.5 Maximum number of outstanding I frames (k)

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 not exceed 127 for extended (modulo 128) operation.

- For an SAP supporting basic access (16kbit/s) signalling, the default value shall be 1.
- For an SAP supporting primary rate (64kbit/s) signalling, the default value shall be 7.

- For an SAP supporting basic access (16kbit/s) packet information, the default value shall be 3.
- For an SAP supporting primary rate (64kbit/s) packet information, the default value shall be 7.

8.9.6 Timer T201

The minimum time between re-transmission of the TEI-identity check request messages (T201) is a system parameter which shall be set to T200 seconds. This timer is not used at the TE side.

8.9.7 Timer T202

The minimum time between the transmission of TEI-identity request messages is a system parameter (T202) which shall be set to 2 seconds.

8.9.8 Timer T203

Timer T203 represents the maximum time allowed in the multiple frame established state without a frame being exchanged. The default value of timer T203 shall be 10 seconds.

APPENDIX A

OCCURRENCE OF THE MDL-ERROR-INDICATION WITHIN THE BASIC STATES AND ACTIONS TO BE TAKEN BY THE MANAGEMENT ENTITY

A.1 Introduction

Table A.1 gives the error situations in which the MDL-ERROR-INDICATION primitive notifies the data link layer's connection management entity of the occurred error situation. The associated error parameter contains the error code that describes the unique error conditions. Table A.1 also identifies the associated connection management actions to be taken from the network and the user side, based on the types of error conditions reported.

A.2 Layout of Table A.1

The "Error Code" column gives the identification value of each error situation to be included as a parameter with the MDL-ERROR-INDICATION primitive:

The column entitled "Error Condition" together with the "Affected States" describes unique protocol error events and the basic state of the data link layer entity at the point that the MDL-ERROR-INDICATION primitive is generated.

For given error condition, the column entitles "Network Management Action" describes the preferred action to be taken by the Network Management Entity:

The column entitled "User Management Action" describes the preferred action to be taken by the user side management entity on a given error condition.

A.3 Preferred Management Actions

The various preferred Management Actions on an error situation may be described as one of the following:

a) Error Log

This suggests that the network connection management entity has the preferred action of logging the event into an error counter. The length and the operation of counter mechanisms for the error situations is implementing dependent.

b) TEI Check

This means that the network side layer management entity invokes the TEI check procedure.

c) TEI Verify

This means that the user side layer management entity may optionally invoke a tei verify request procedure that asks the network side layer management entity to issue a TEI check procedure.

d) TEI Remove

This means that the user side layer management entity may directly remove its TEI value from services.

e) Local Remove

This means that the network side layer management entity has to correct its storage of TEI values in use.

In most of the described error situations, there is either no action to be taken by the user side layer management or the action to be taken is implementation dependent, as Table A-1 shows. "Implementation Dependent" means that it is optional whether the user side layer management has incorporated any form of error counter to log (store) the reported event.

In all these cases, the layer management entity has to take into account that the data link layer will have initiated a recovery procedure.

NOTE

For the description of affected states, see Appendix B.

Error type	Error code	Error Condition	Affected states (Note 1)	Network management action	User management action
Receipt of unsolicited response	A	Supervisory (F=1)	7	Error log	Impl. dependent
	B	DM (F=1)	7,8	Error log	Impl. dependent
	C	UA (F=1)	4,7,8	TEI removal proc. or TEI check proc.; then, if TEI: - free remove TEI - single no action - multiple TEI removal proc.	Remove TEI
	D	UA (F=0)	4,5,6,7,8		
	E	DM (F=0)	7,8	Error log	Impl. dependent
Peer initiated re-establ.	F	SABME	7,8	Error log	Impl. dependent
Unsuccessful retrans-mission (N200 times)	G	SABME	5	TEI check proc.; then, if TEI: - free remove TEI - single no action - multiple TEI removal proc.	Remove TEI
	H	DISC	6		
	I	Status enquiry	8	Error log	Impl. dependent
Other	J	N(R) error	7,8	Error log	Impl. dependent
	K	Receipt of FRMR response	7,8	Error log	Impl. dependent
	L	Receipt of frame with undefined control field	4,5,6,7,8	Error log	Impl. dependent
	M Note2	Receipt of I field not permitted	4,5,6,7,8	Error log	Impl. dependent
	N	Receipt of frame with wrong size	4,5,6,7,8	Error log	Impl. dependent
	O	N201 error	4,5,6,7,8	Error log	Impl. dependent

Table A.1 - Management Entity Actions for MDL-ERROR-INDICATIONs

Notes to Table A.1

1. *For description of the affected states, see Appendix B*
2. *According to 5.8.5 this error code will never be generated.*

APPENDIX B

SDL REPRESENTATION OF THE POINT TO POINT PROCEDURES OF THE DATA LINK LAYER

B.1 General

The purpose of this Appendix is to provide one example of an SDL representation of the point procedures of the data link layer, to assist in the understanding of this Standard. This representation does not describe all of the possible actions of the data link layer entity, as a non partitioned representation was selected in order to minimize complexity. The SDL representation does not therefore constrain implementations from exploiting the full scope of the procedures as presented within the text of this Standard. The text description of the procedure is definitive.

The representation is a peer-to-peer model of the point to point procedures of the data link layer and is applicable to the data link layer entities at both the user and network sides for all ranges of TEI values. See Figure B.1.

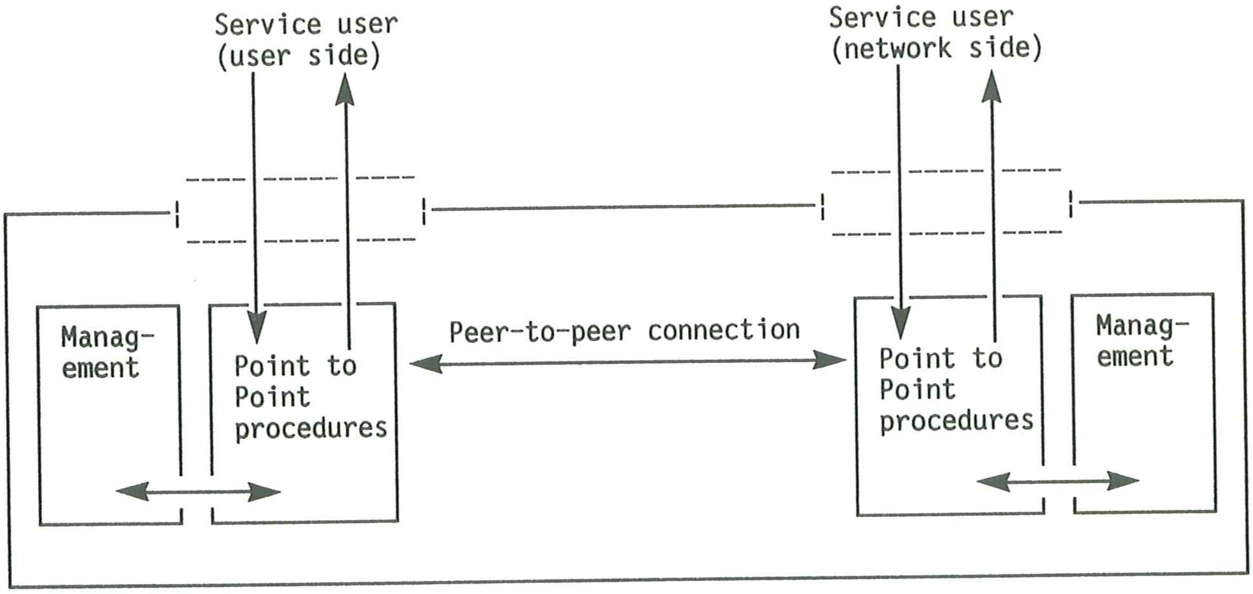


Figure B.1 - Peer-to-peer model of the point to point procedures

B.2 An overview of the states of the point to point data link layer entity

The SDL representation of the point to point procedures are based on an expansion of the three basic states identified in section 3.4.2 of CCITT Rec. Q.920 to the following 8 states:

State 1.	TEI unassigned
State 2.	Assign awaiting TEI
State 3.	Establish awaiting TEI
State 4.	TEI assigned

State 5. Awaiting establishment
State 6. Awaiting release
State 7. Multiple frame established
State 8. Timer recovery

An overview of the inter-relationship of these states is provided in Figure B.2. This overview is incomplete, and serves only as an introduction to the SDL representation. All data link layer entities are conceptually initiated in the TEI unassigned state (state 1), and will interact with the management entity in order to request a TEI value. TEI assignment initiated by a Unit data request will cause the data link layer entity to move to the TEI assigned state (state 4) via the Assign awaiting TEI state (state 2). Initiation by an Establishment request will cause a transition to the Awaiting establishment state (state 5) via the Establish awaiting TEI state (state 3). Direct TEI assignment will cause an immediate transition to the TEI assigned state (state 4). In states 4 - 8, Unit data requests can be directly serviced by the data link layer entity. The receipt of an Establish request in the TEI assigned state (state 4) will cause the initiation of the establishment procedures and the transition to the Awaiting establishment state (state 5). Completion of the LAP establishment procedures takes the data link layer entity into the Multiple frame established state (state 7). Peer initiated establishment causes a direct transition from the TEI assigned state (state 4) to the Multiple frame established state (state 7). In the Multiple frame established state (state 7), Acknowledged data transfer requests can be serviced directly subject to the restrictions of the procedures. Expiry of timer T200, which is used in both the flow control and data transfer aspects of the data link layer entity's procedures initiates the transition to the Timer recovery state (state 8). Completion of the timer recovery procedures will return the data link layer entity to the Multiple frame established state (state 7). In state 7 and 8, of the SDL representation the following conditions which are identified within the Recommendation are observed:

a) peer receiver busy

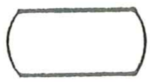
b) reject exception

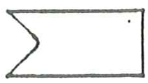
c) own receiver busy.

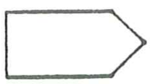
In addition other conditions are used in order to avoid identification of additional states. The complete combination of both of these categories of conditions with the 8 states of the SDL representation is the basis for the state transition table description of the data link layer entity. A peer initiated LAP release will take the data link layer entity directly into the TEI assigned state (state 4), whilst a Release request will be via the Awaiting release state (state 6). TEI removal will cause a transition to the TEI unassigned state (state 1).

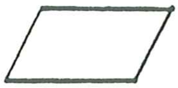
B.3 Cover notes

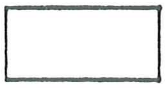
The following symbols and abbreviations are used within this description. A full description of the symbols and their meaning and application can be found in the CCITT series Z recommendations (Facsicles VI.10 and VI.11).

a.  State

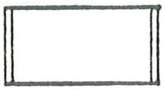
b.  Event occurrence

c.  Signal generation (which will lead to an associated event occurrence)

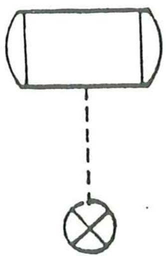
d.  Save an event (until completion of a transition)

e.  Process description

f.  Test

g.  Procedure call

h.  Implementation option

i.  procedure definition

j. * To mark an event or signal required as a result of the representation approach adopted, which is local to the data link layer entity.

k. RC Retransmission counter.

l. (A-O) The codes used in the MDL-ERROR-INDICATION signals are defined in Table A.1 in Appendix A. When multiple codes are shown, only one applies.

B.4 The use of queues

To enable a satisfactory representation of the data link layer entity, conceptual queues for the UI frame and I frame transmission have been explicitly brought out. These conceptual queues are finite but unbounded and should in no way restrict the implementation of the point to point procedures. Two additional signals have been provided in order to cause the servicing of these queues to be initiated - UI frame queued up and I frame queued up.

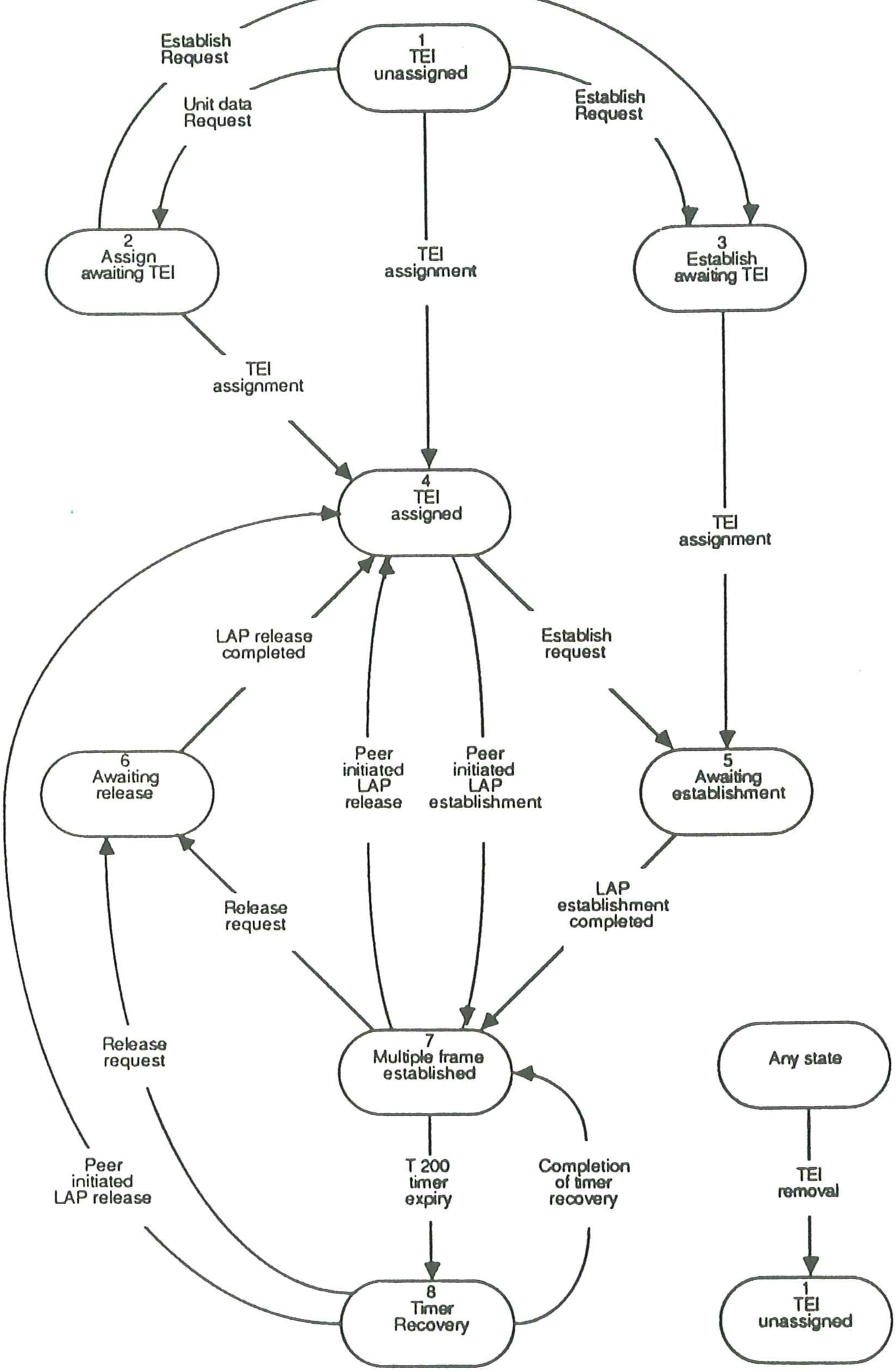
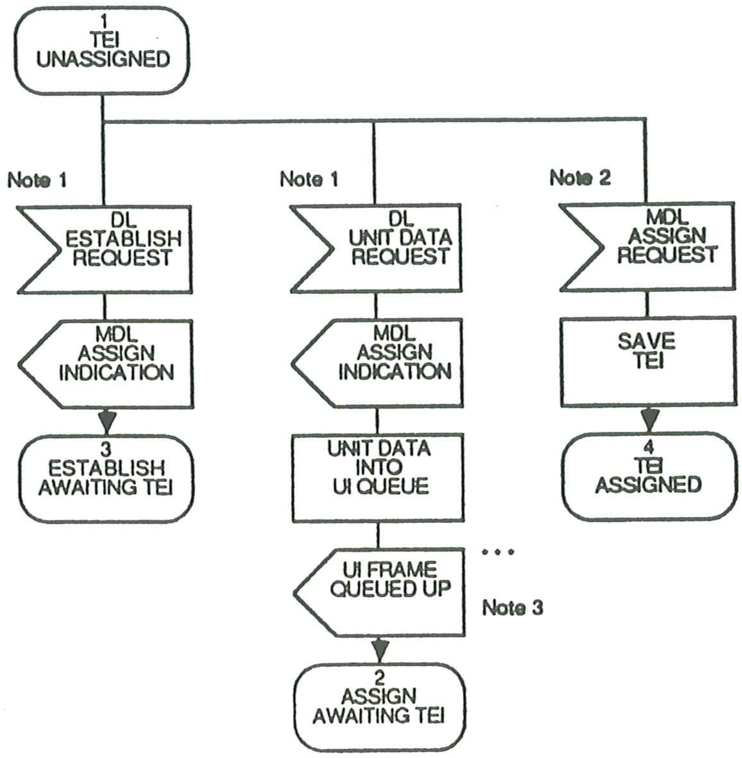


FIGURE B-2

An overview of the states of the point-to-point procedures

B.5 *SDL representation*

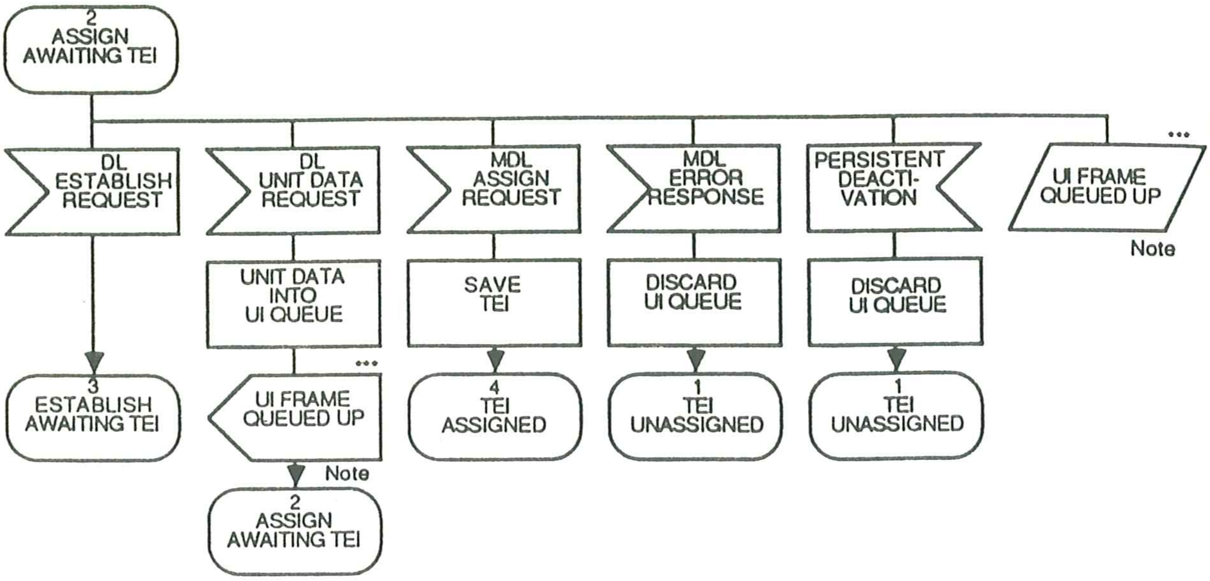


Note 1 - The use of these events on the network side is for further study.

Note 2 -
- This function may be implemented over a geographically distributed architecture.
- This primitive may occur on initialization for fixed TEIs at the network side, or as appropriate in order to correctly process a frame carrying a fixed TEI.

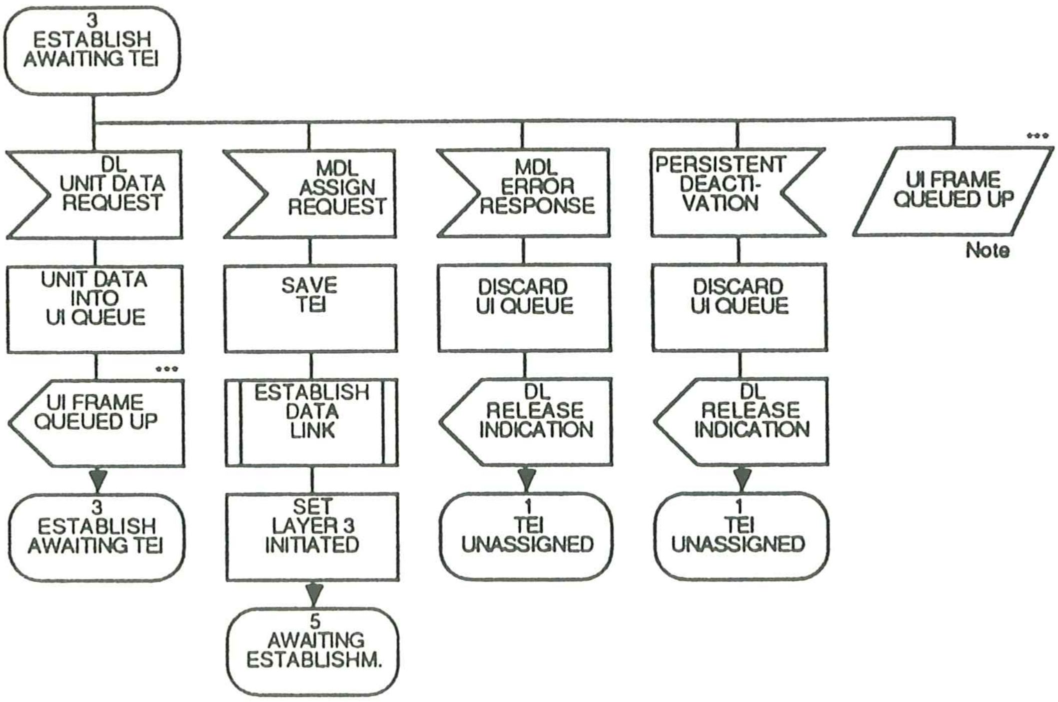
Note 3 - Processing of UI frame queued up is described in Figure B-9

FIGURE B-3 (1 of 3)



Note - Processing of UI frame queued up is described in Figure B-9

FIGURE B-3 (2 of 3)



Note - Processing of UI frame queued up is described in Figure B-9

FIGURE B-3 (3 of 3)

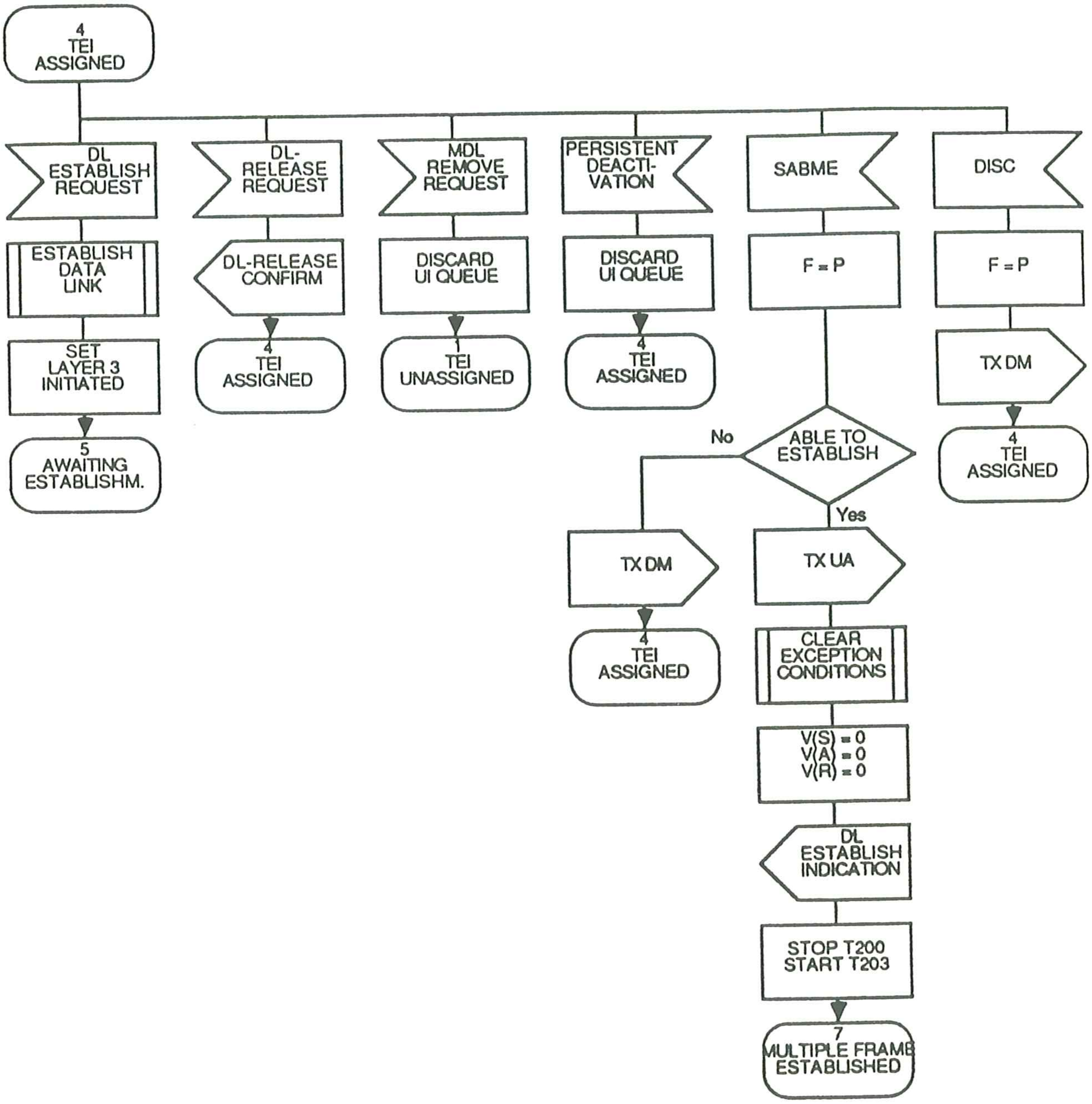


FIGURE B-4 (1 of 2)

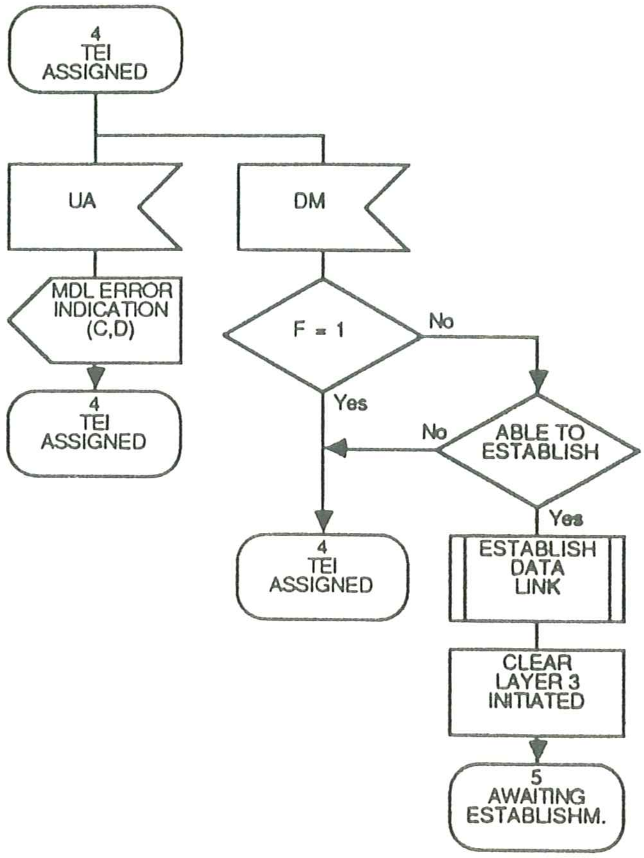
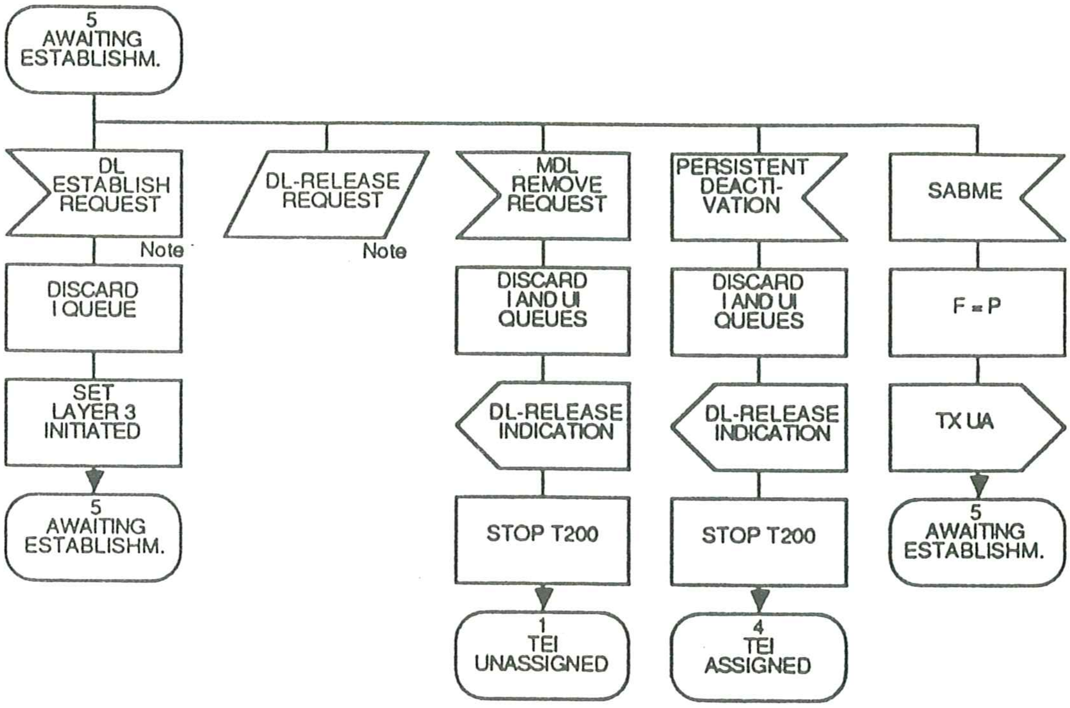


FIGURE B-4 (2 of 2)



Note - Only possible in cases of Layer 2 initiated re-establishment.

FIGURE B-5 (1 of 3)

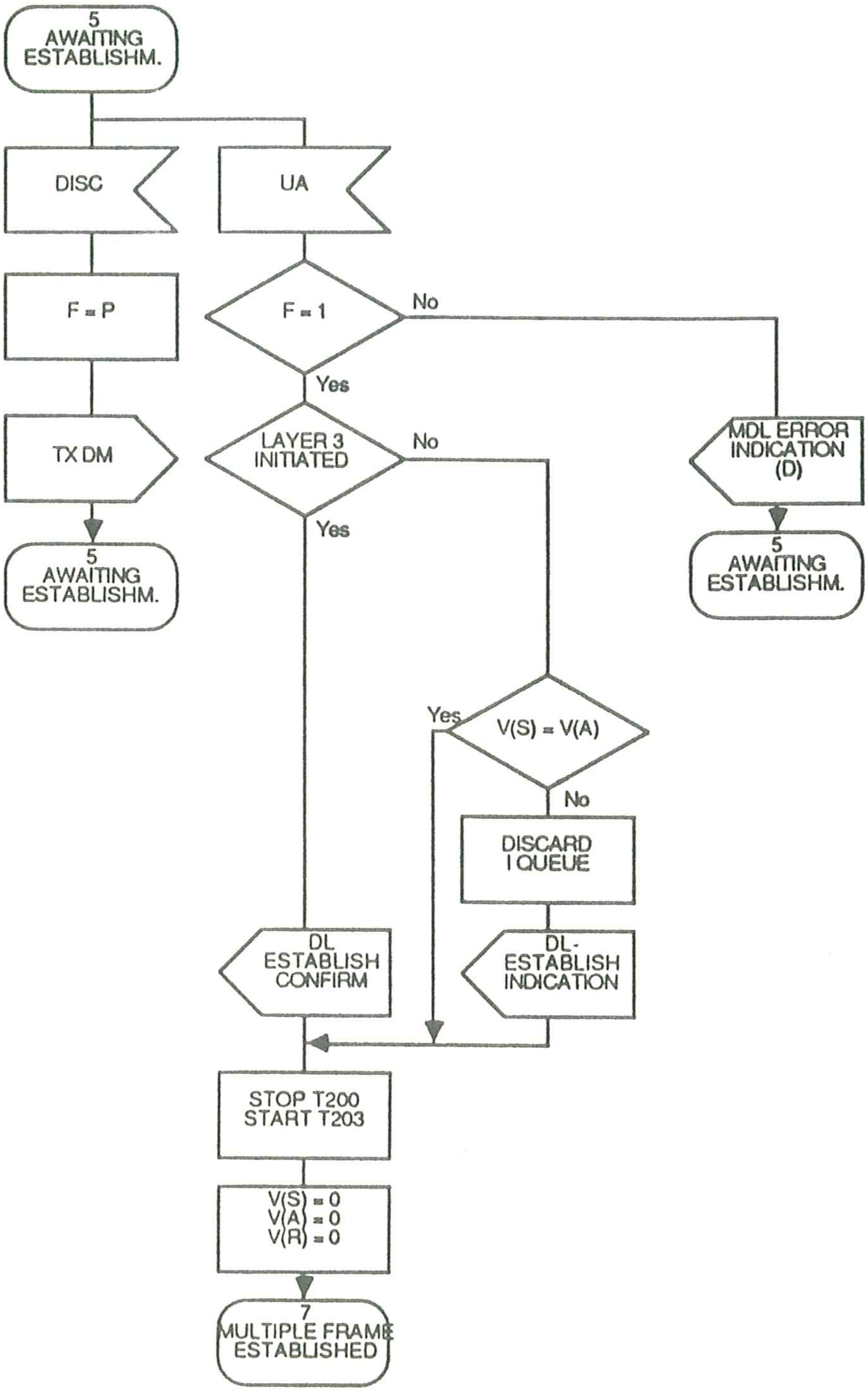
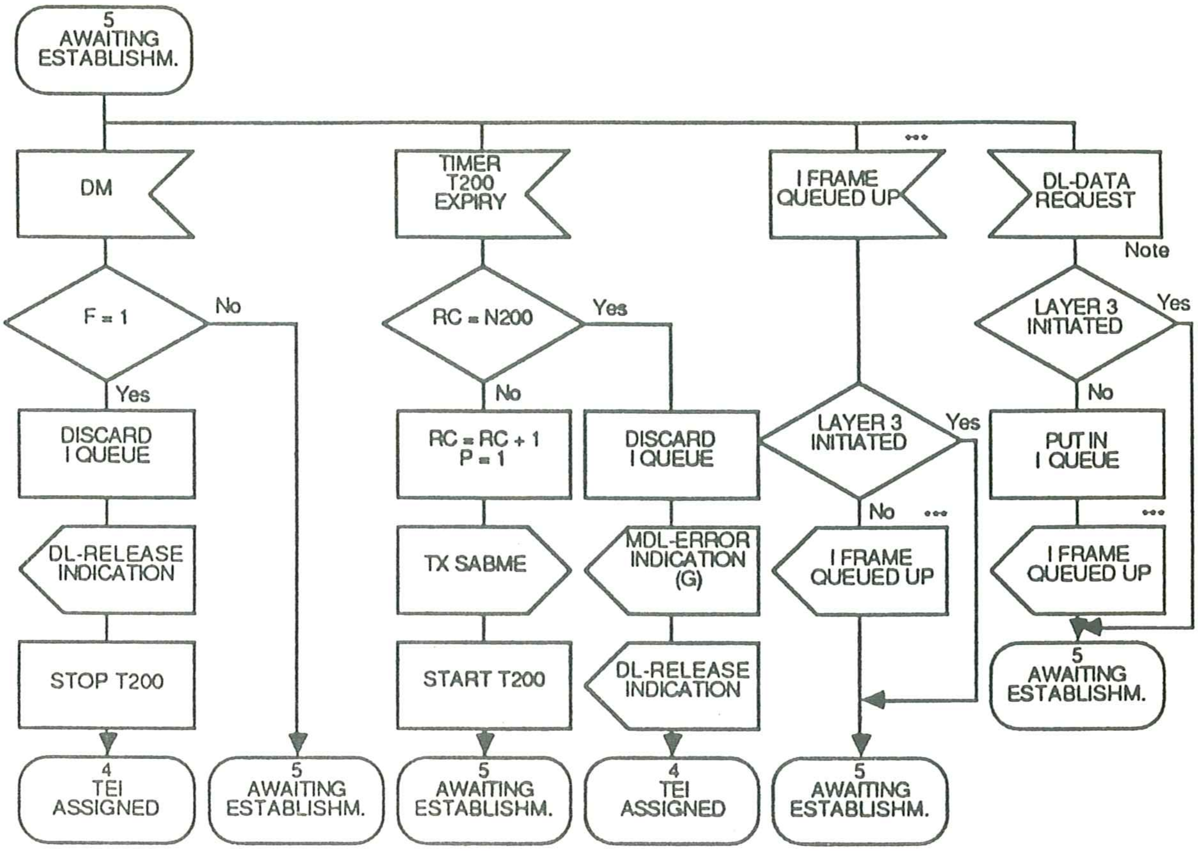


FIGURE B-5. (2 of 3)



Note - Only possible in cases of layer 2 initiated re-establishment.

FIGURE B-5 (3 of 3)

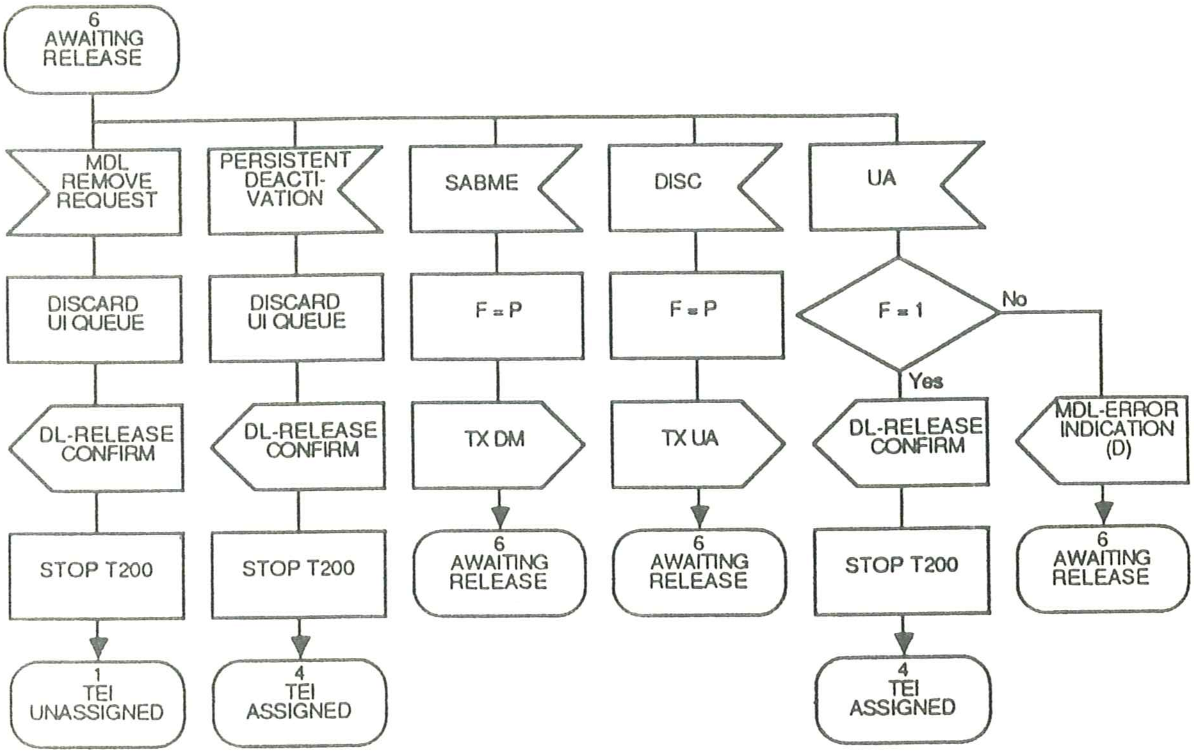


FIGURE B-6 (1 of 2)

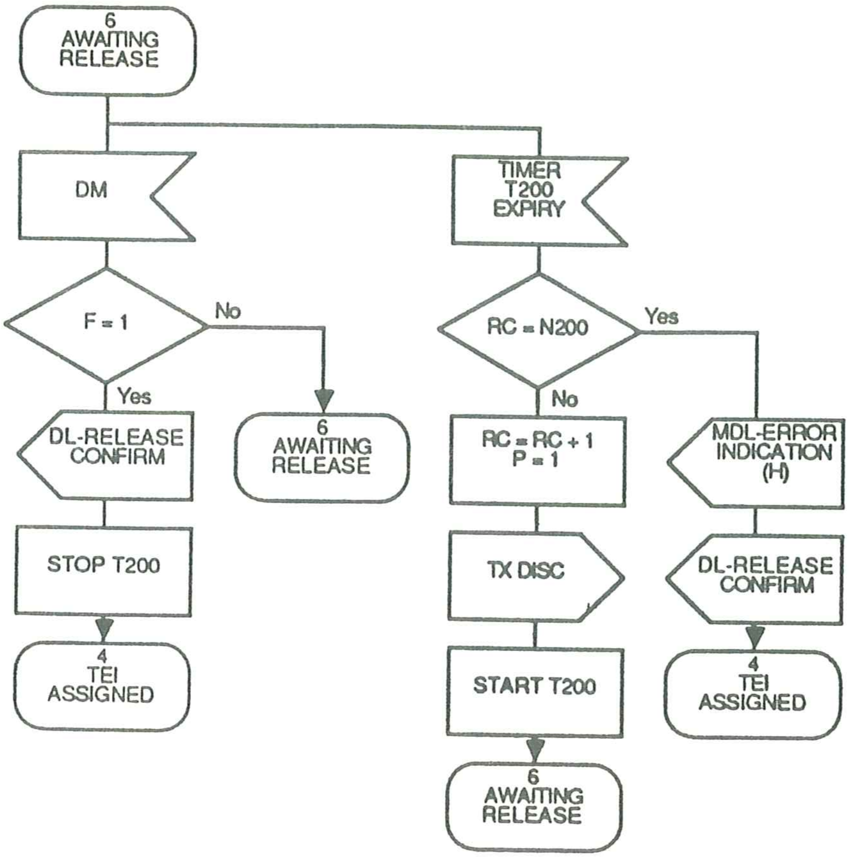
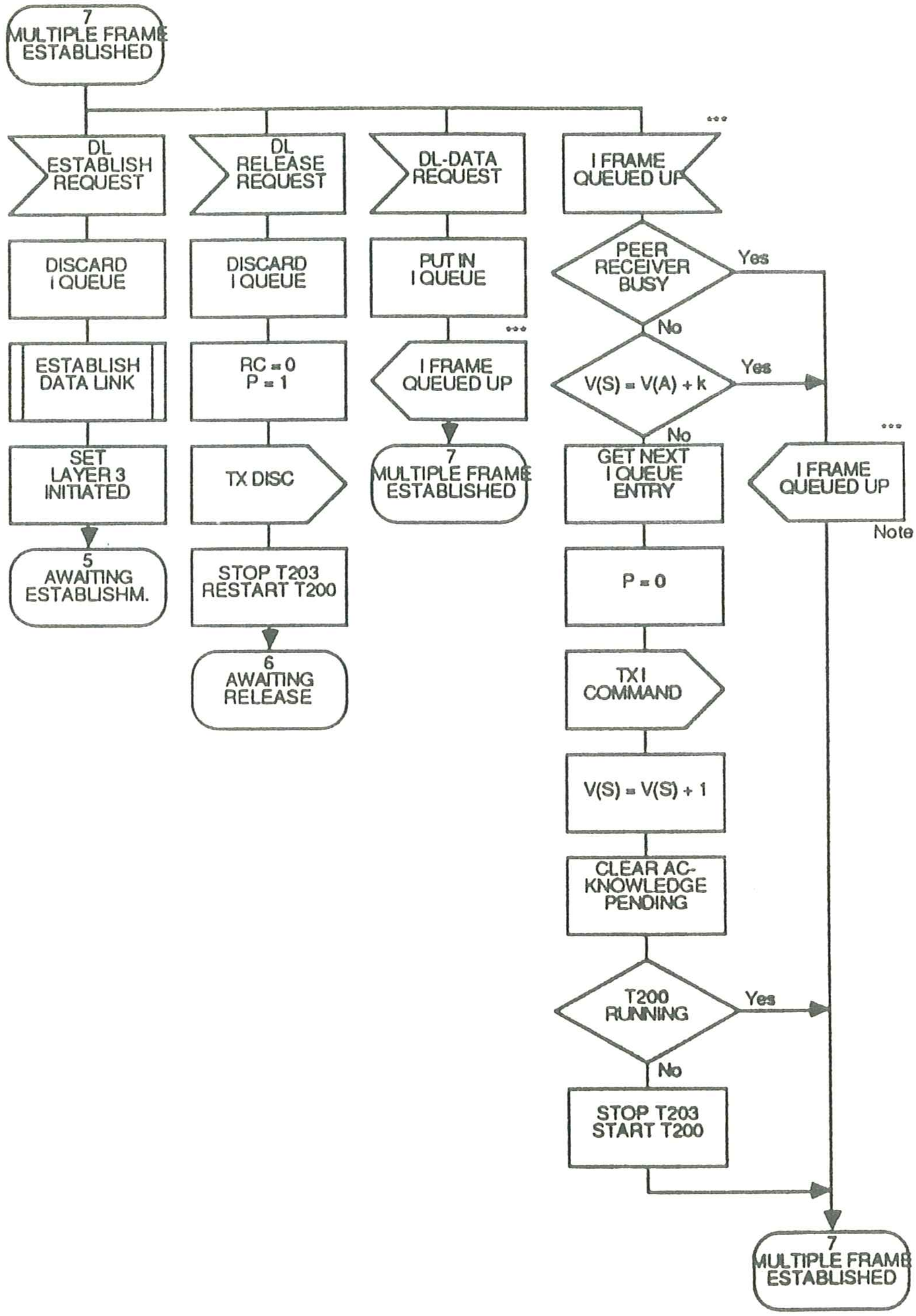


FIGURE B-6 (2 of 2)



Note - The regeneration of this signal does not affect the sequence integrity of the I queue.

FIGURE B-7 (1 of 10)

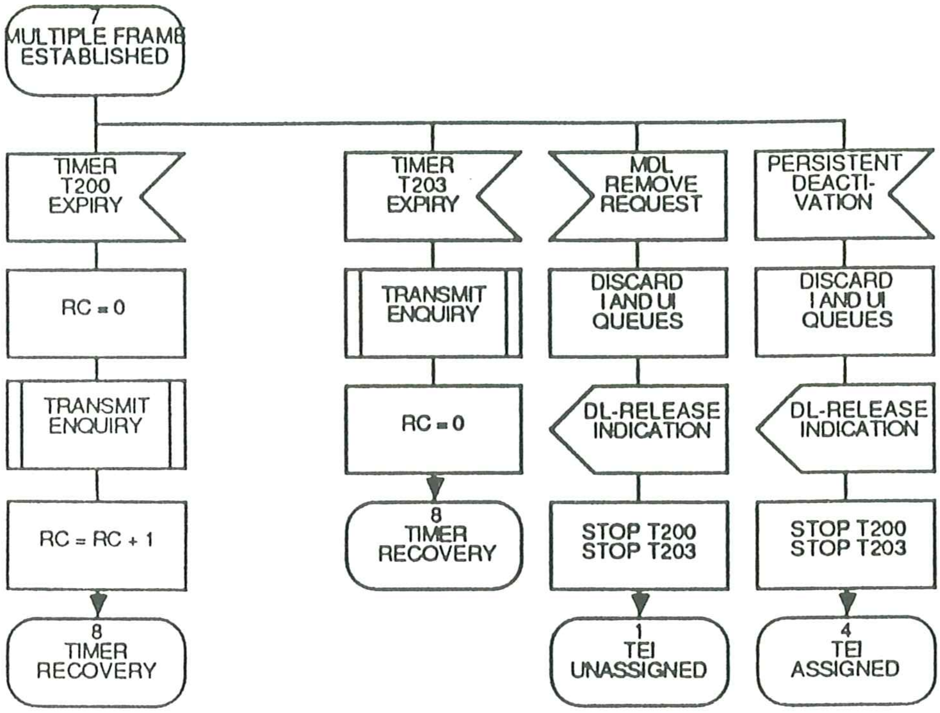


FIGURE B-7. (2 of 10)

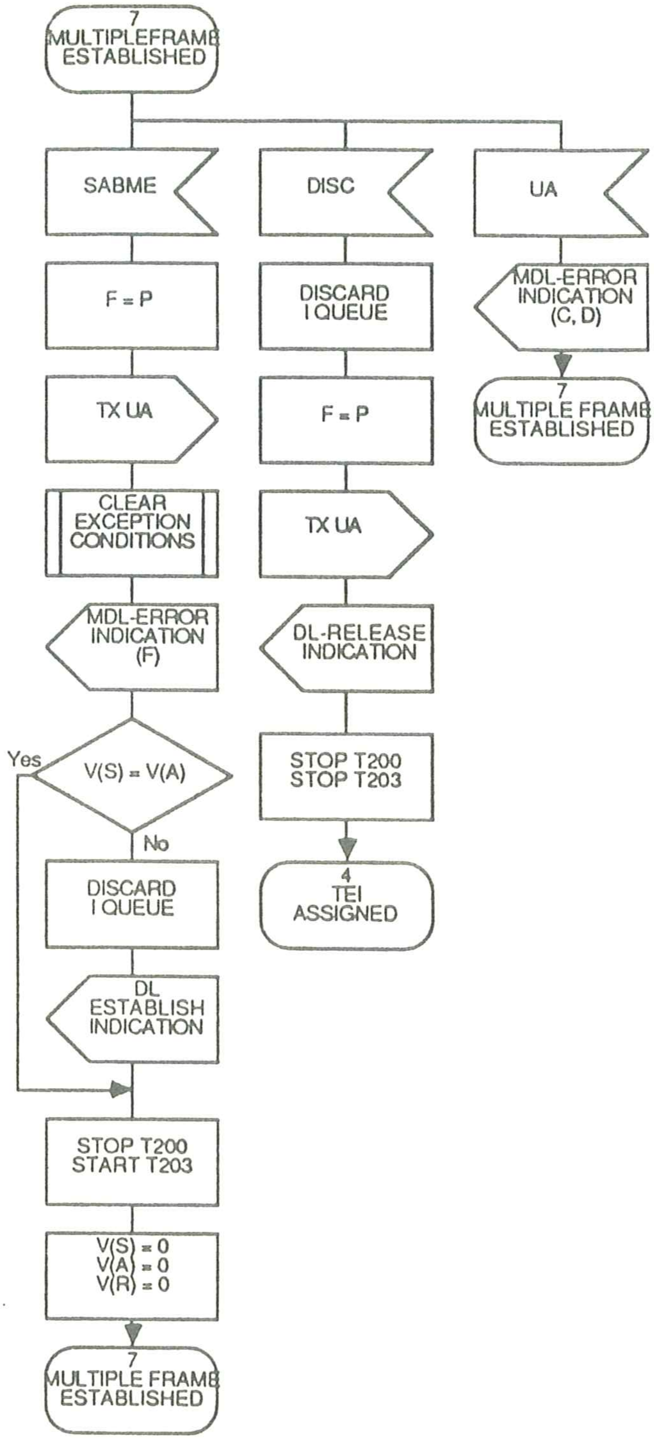
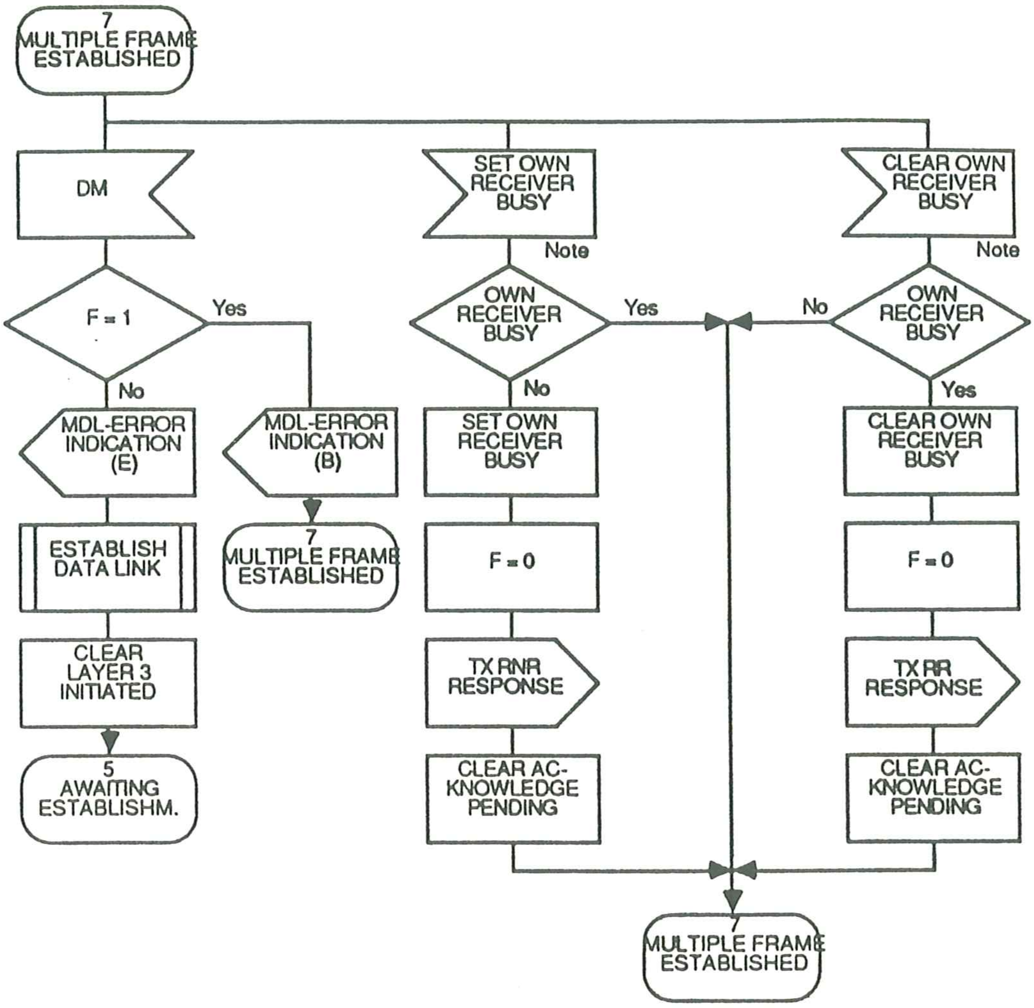


FIGURE B-7 (3 of 10)



Note - These signals are generated outside of this SDL representation, and may be generated by the connection management entity.

FIGURE B-7 (4 of 10)

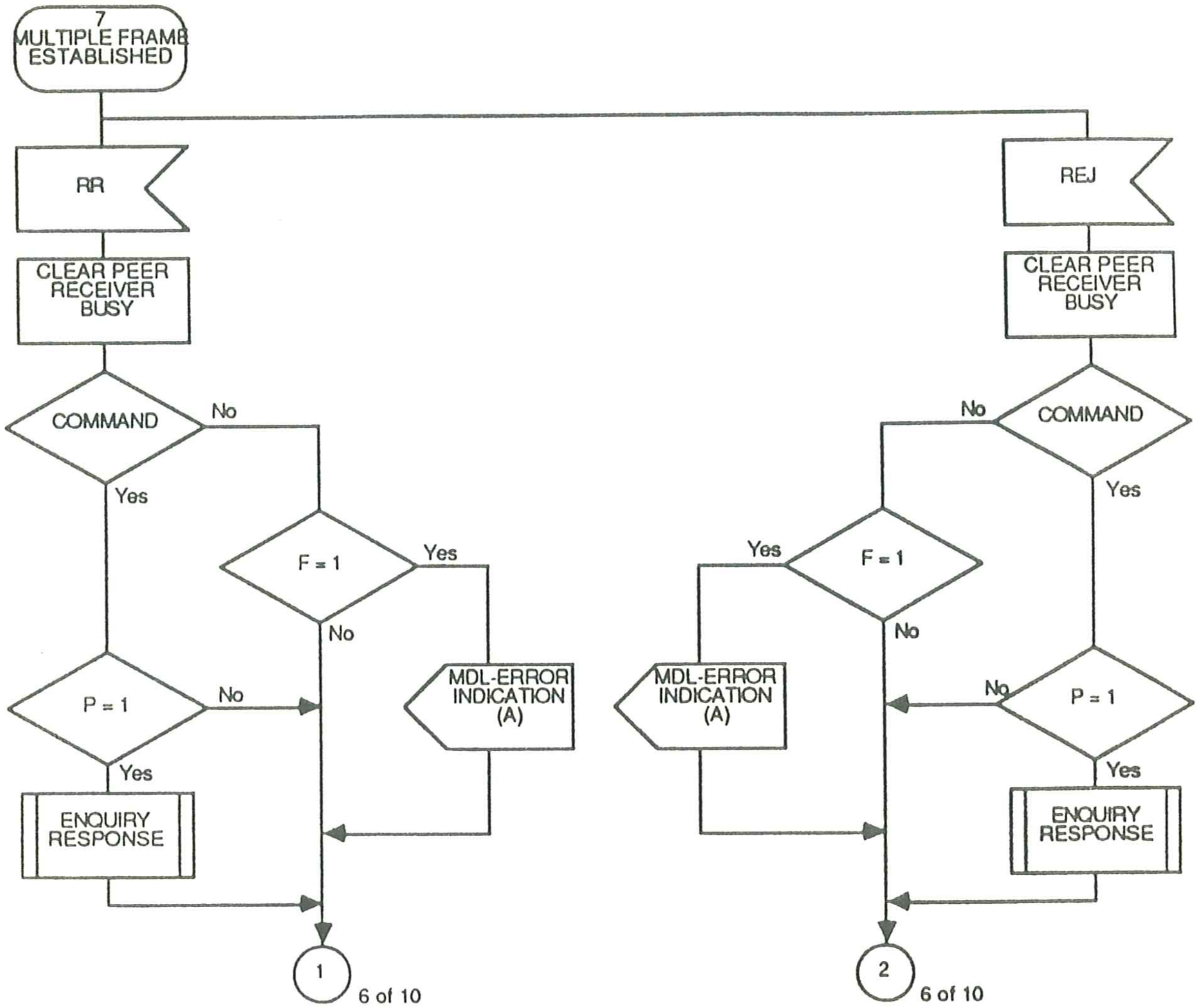


FIGURE B-7 (5 of 10)

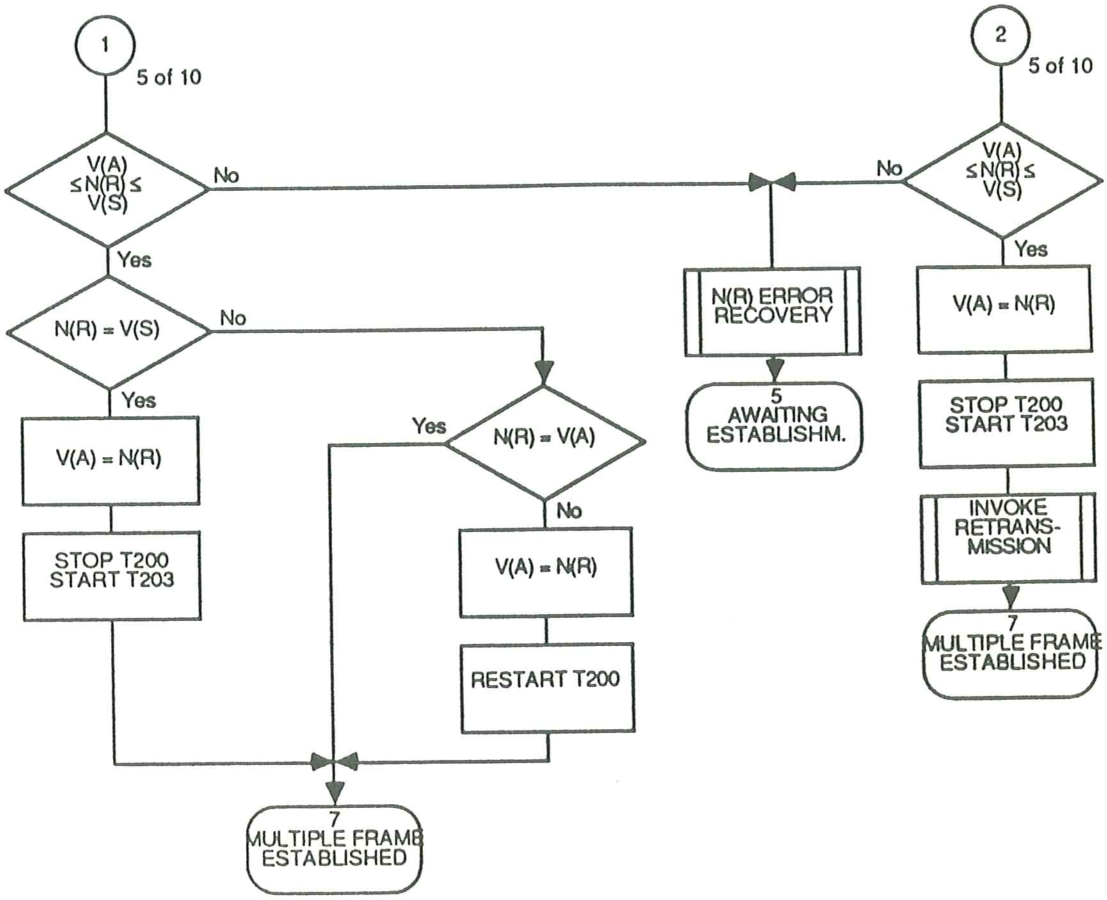


FIGURE B-7 (6 of 10)

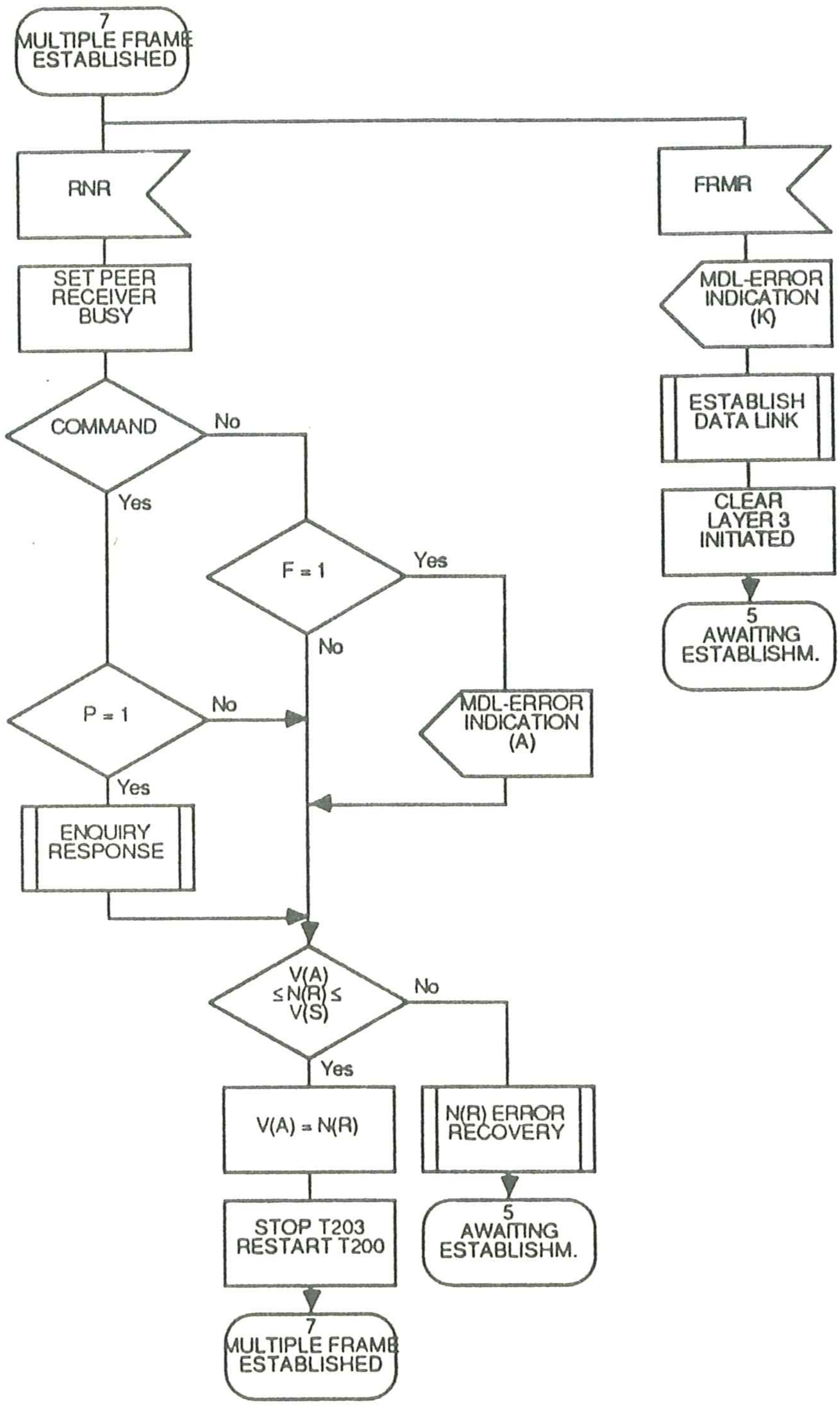
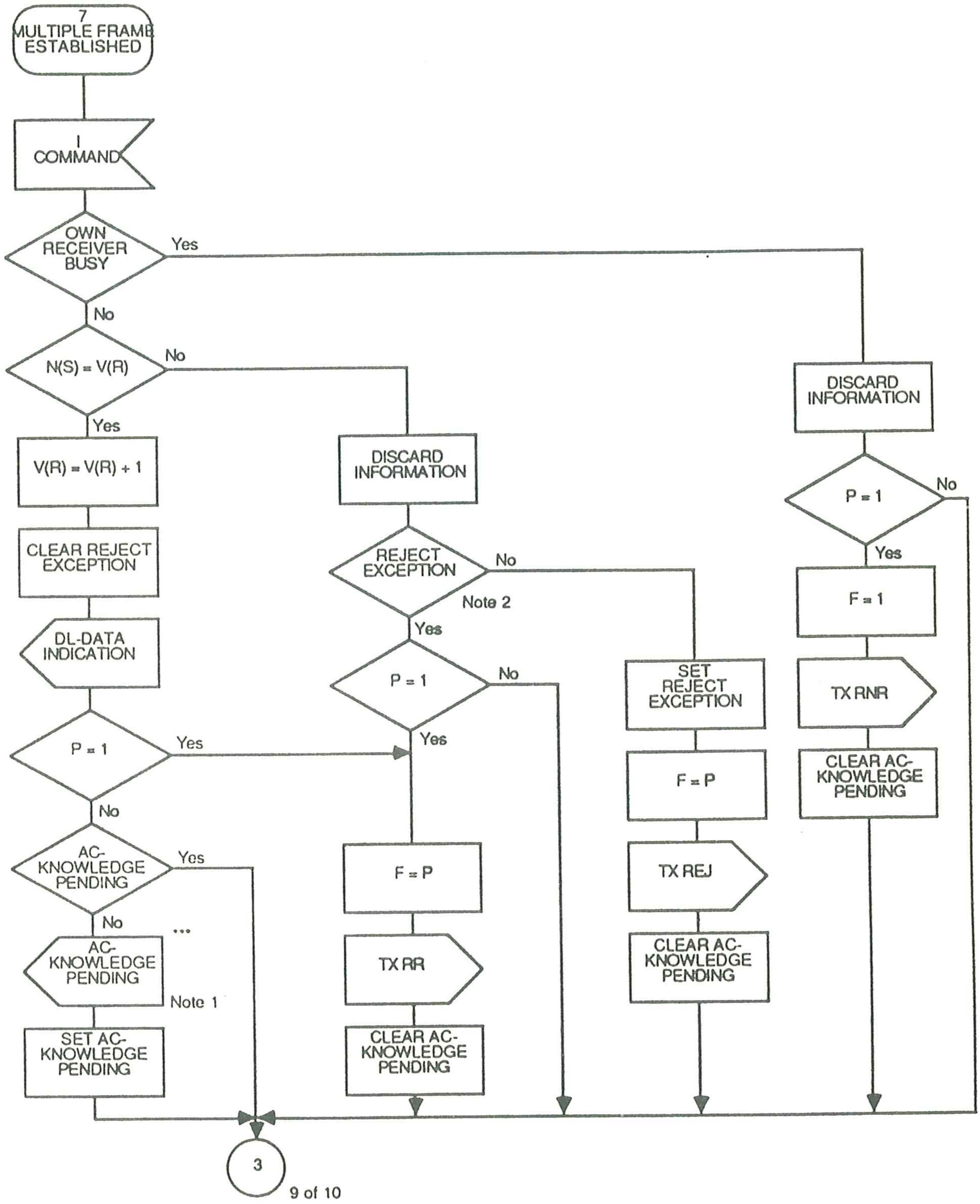


FIGURE B-7 (7 of 10)



Note 1- Processing of acknowledge pending is described on sheet 10 of this Figure

Note 2- This SDL representation does not include the optional procedure in Appendix I.

FIGURE B-7 (8 of 10)

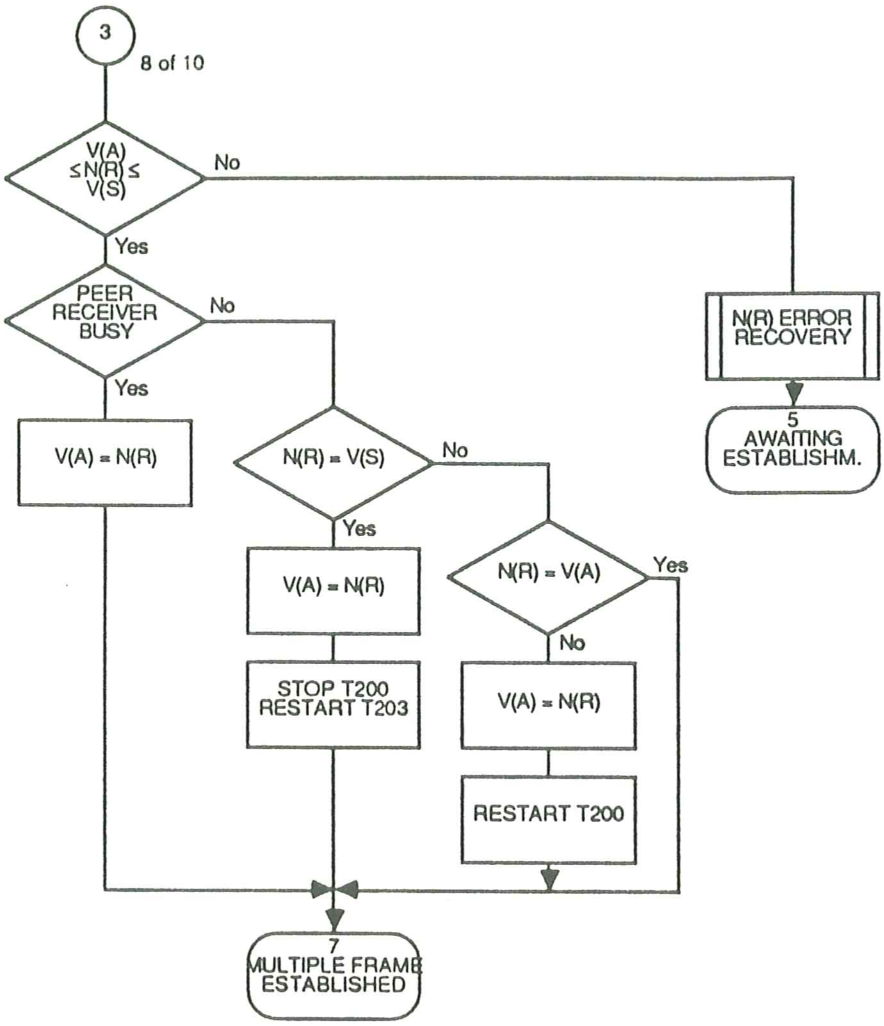


FIGURE B-7 (9 of 10)

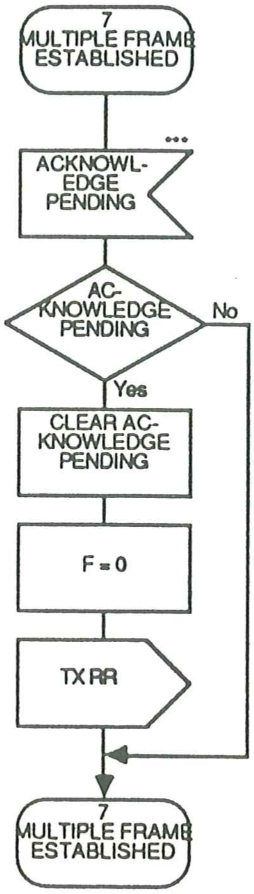


FIGURE B-7 (10 of 10)

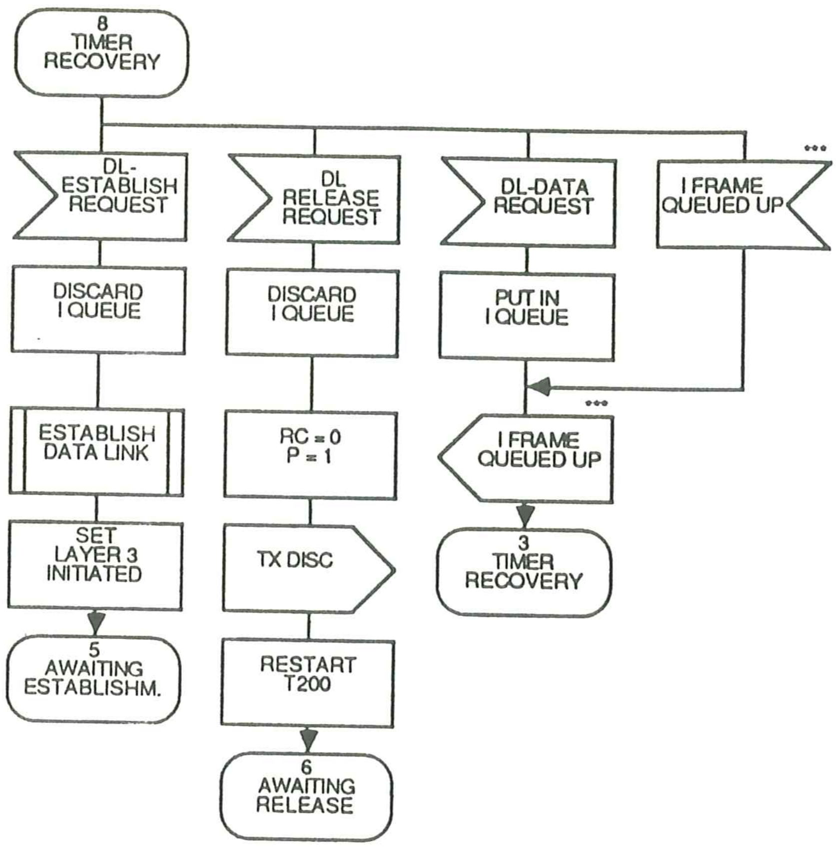


FIGURE B-8 (1 of 9)

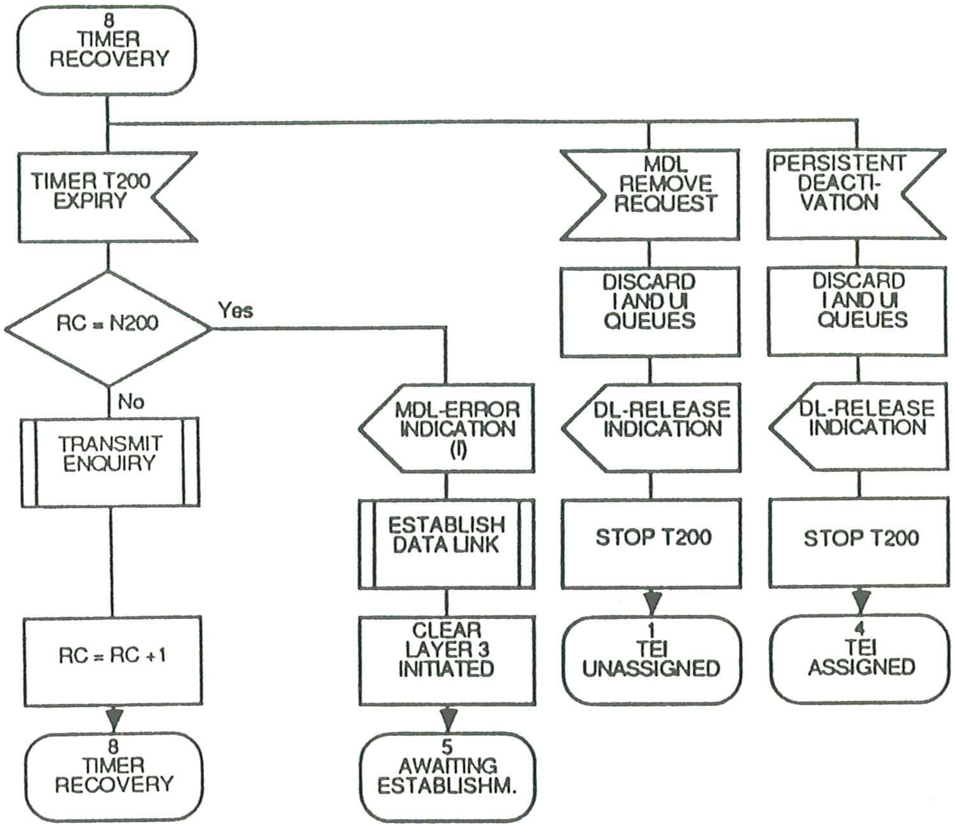


FIGURE B-8 (2 of 9)

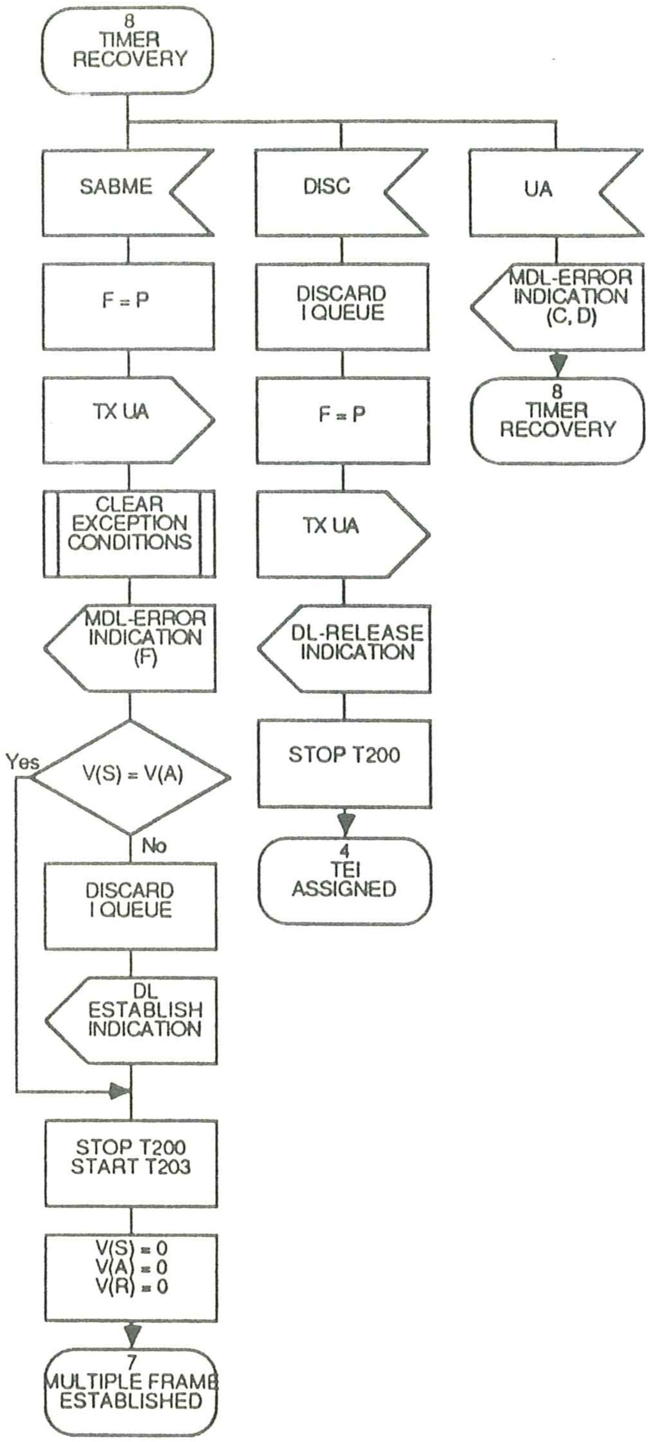
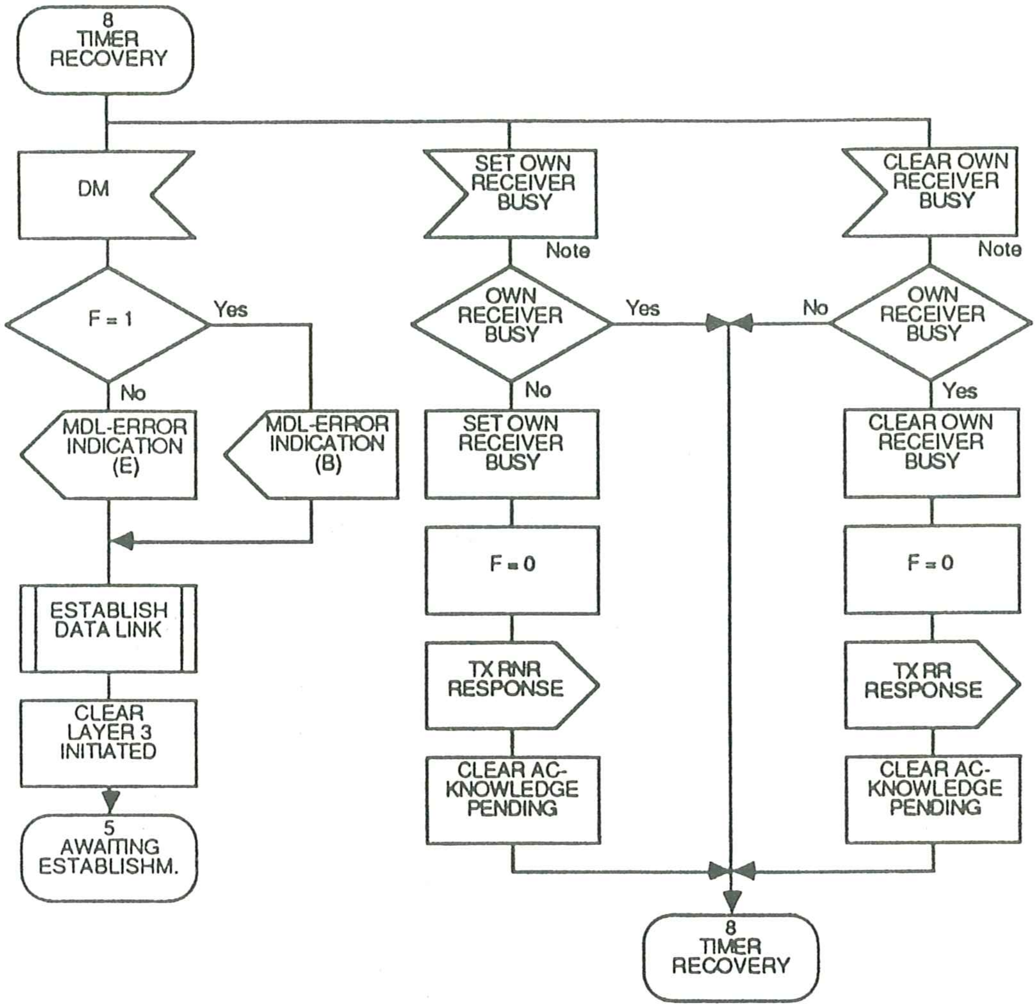


FIGURE B-8 (3 of 9)



Note - These signals are generated outside of this SDL representation, and may be generated by the connection management entity.

FIGURE B-8 (4 of 9)

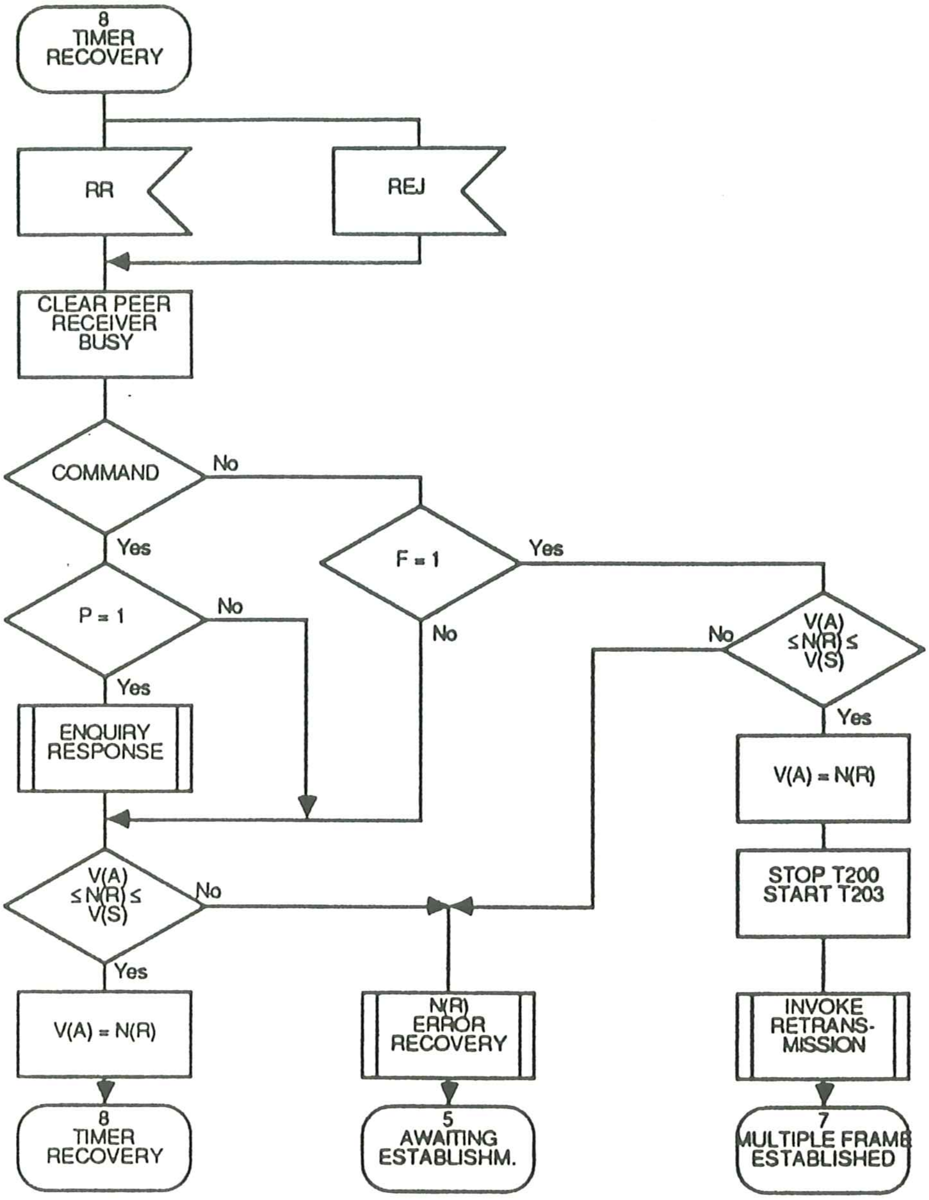


FIGURE B-8. (5 of 9)

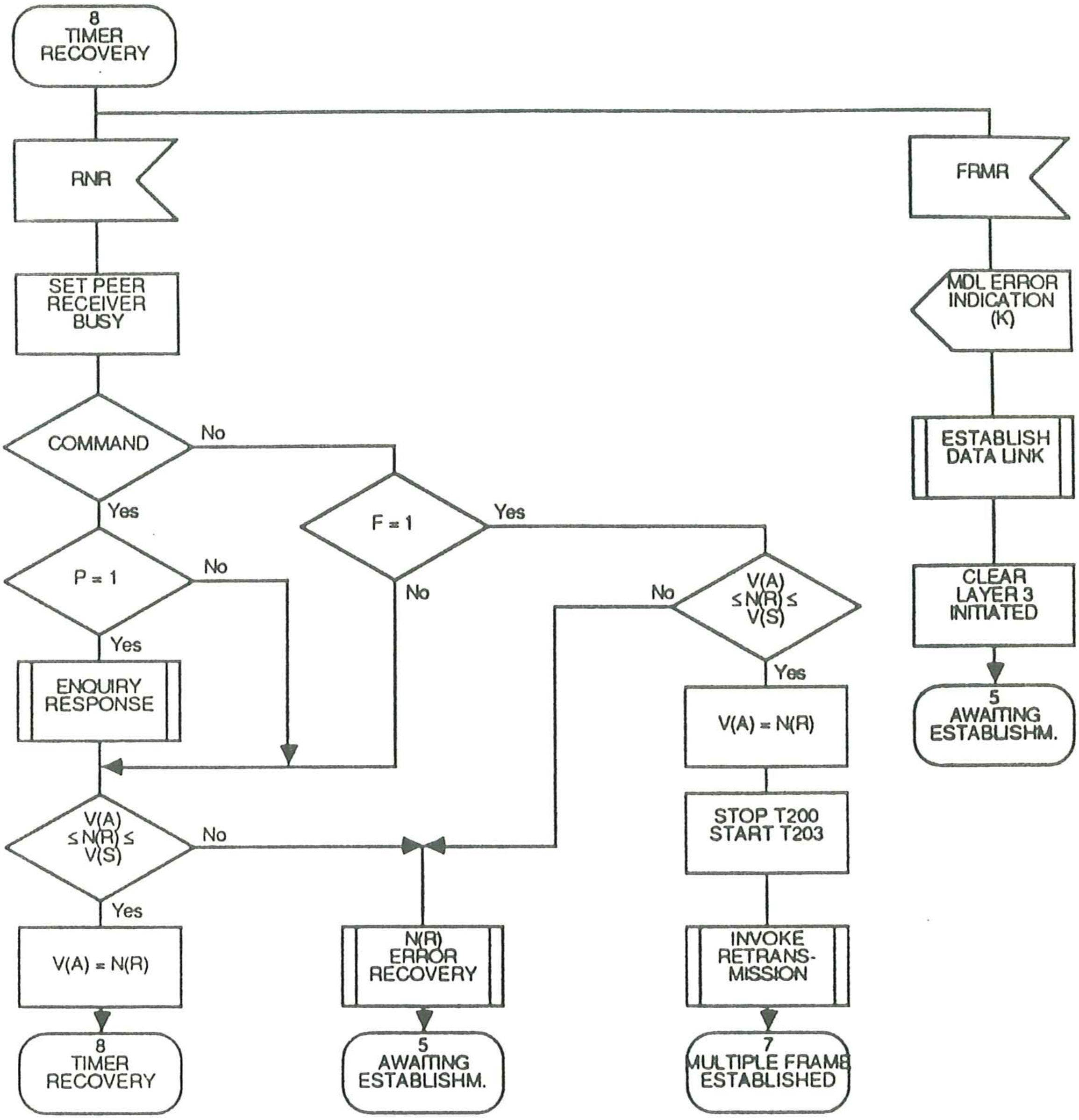
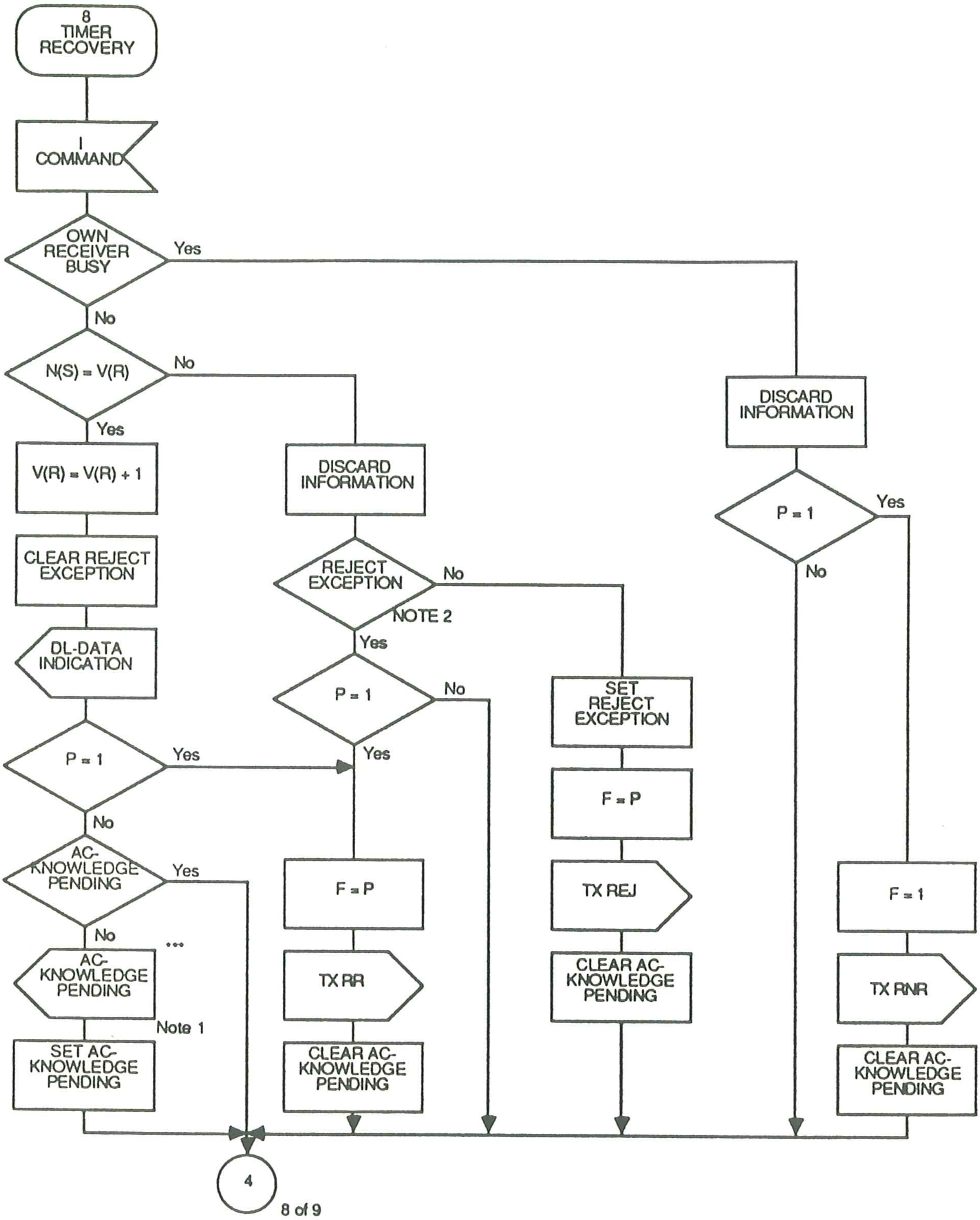


FIGURE B-8. (6 of 9)



Note 1: Processing of Acknowledge pending is described on sheet 9 of this figure

Note 2: This SDL representation does not include the optional procedure in Appendix I.

FIGURE B-8 (7 of 9)

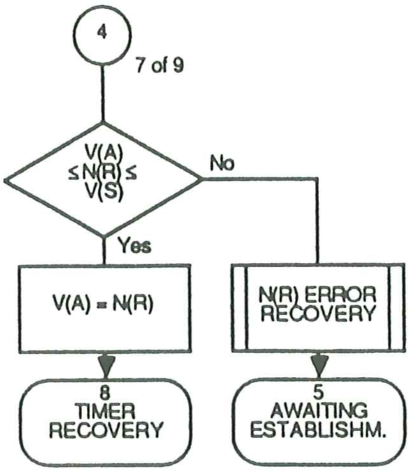


FIGURE B-8 (8 of 9)

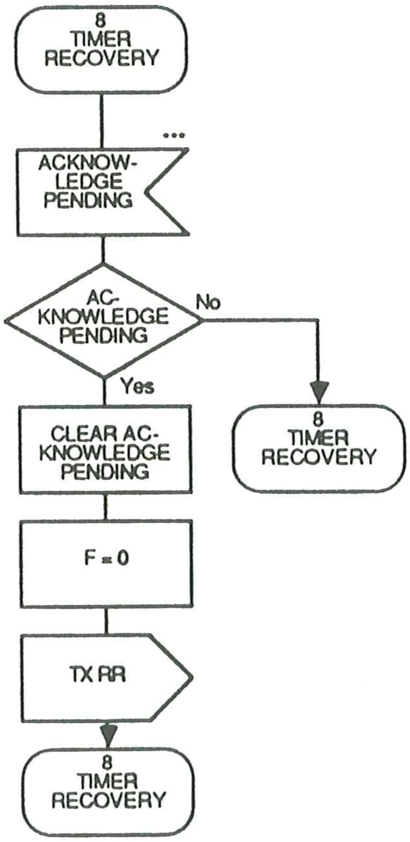
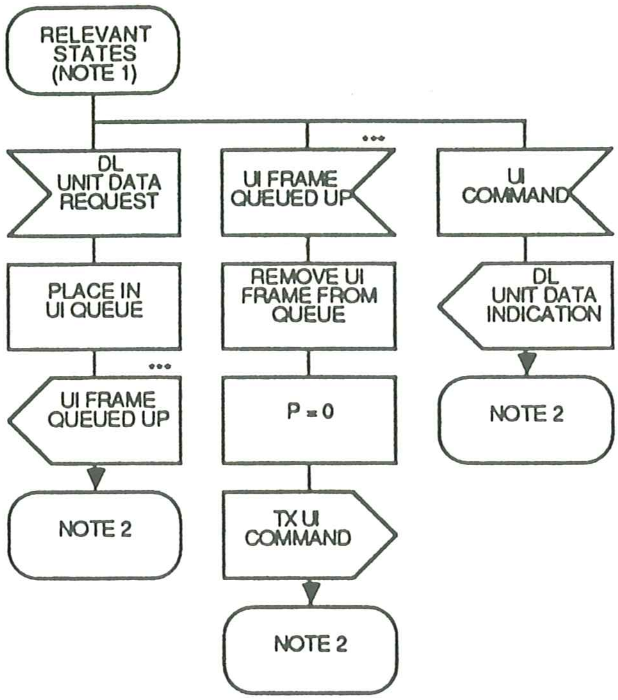


FIGURE B-8 (9 of 9)

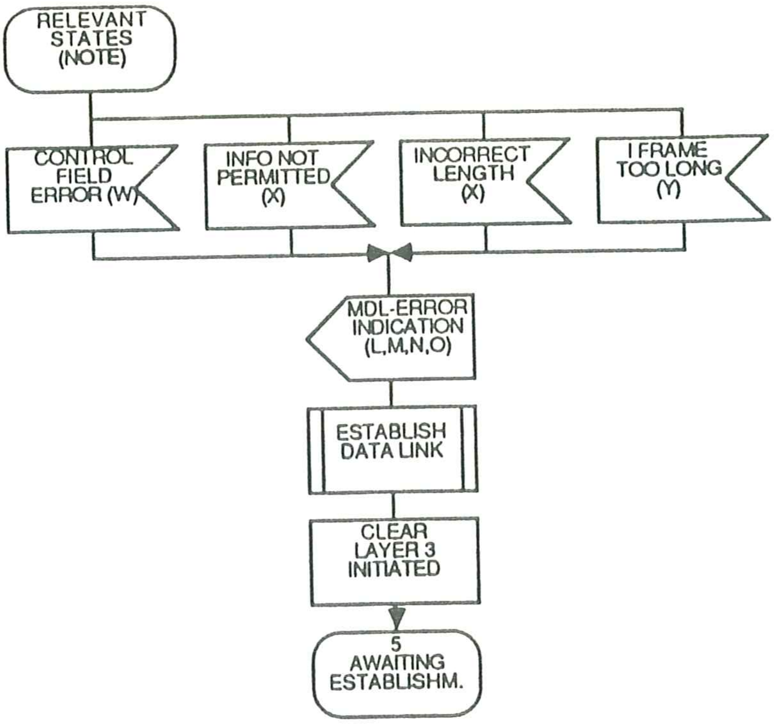


Note 1 - The relevant states are as follows:

4	TEI-assigned
5	Awaiting-establishment
6	Awaiting-release
7	Multiple-frame-established
8	Timer-recovery

Note 2 - The data link layer returns to the state it was in prior to the events shown.

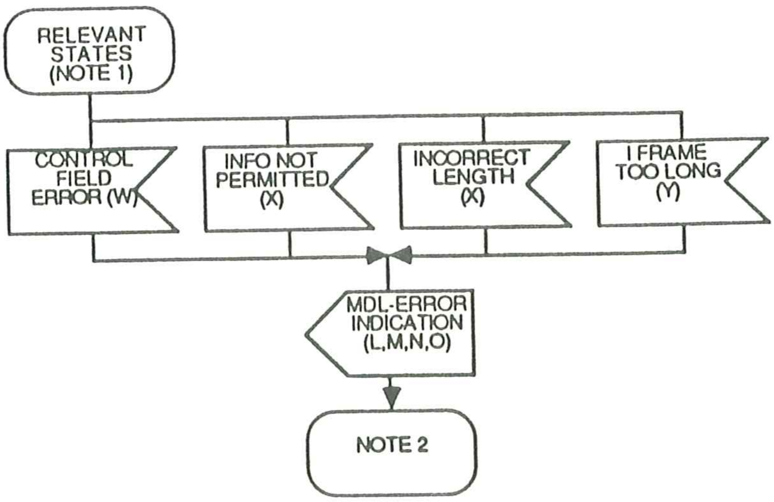
FIGURE B-9 (1 of 5)



Note - The relevant states are as follows:

7 Multiple-frame-established
8 Timer-recovery

FIGURE B-9 (2 of 5)



Note 1 - The relevant states are as follows:

4 TEI-assigned
5 Awaiting-establishment
6 Awaiting-release

Note 2 - The data link layer returns to the state it was in prior to the events shown.

FIGURE B-9 (3 of 5)

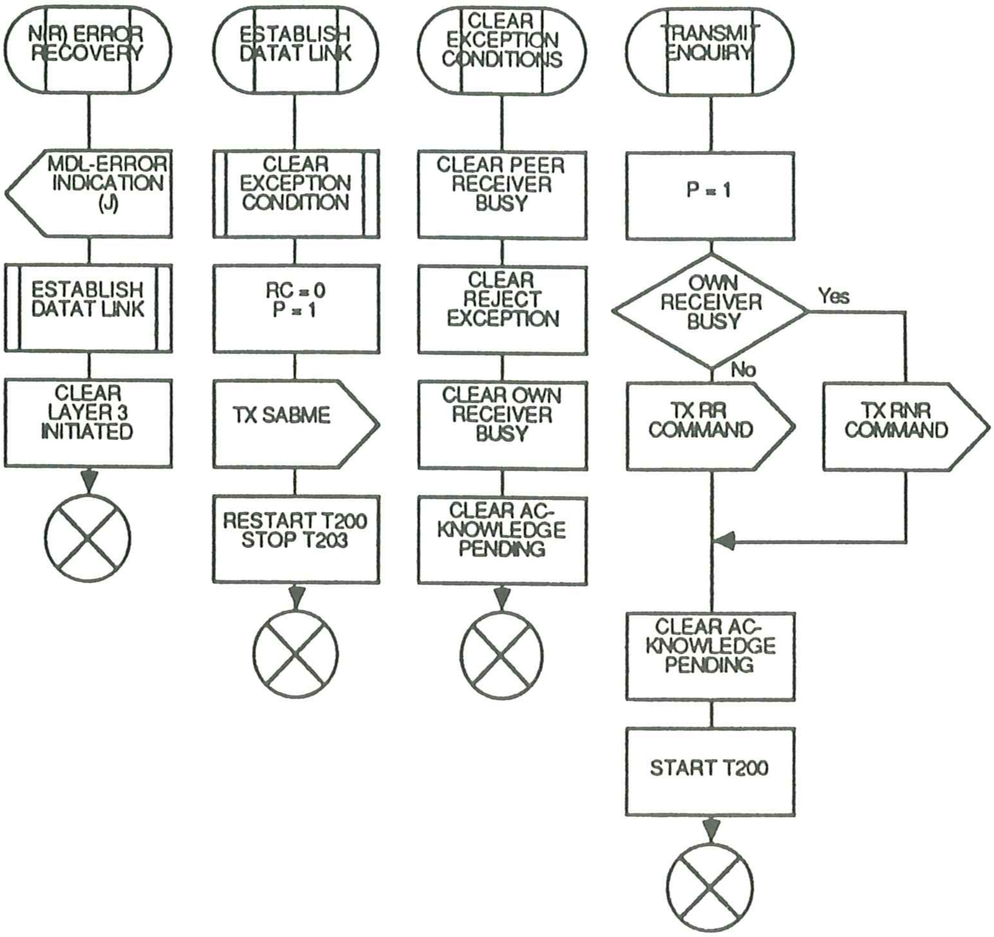
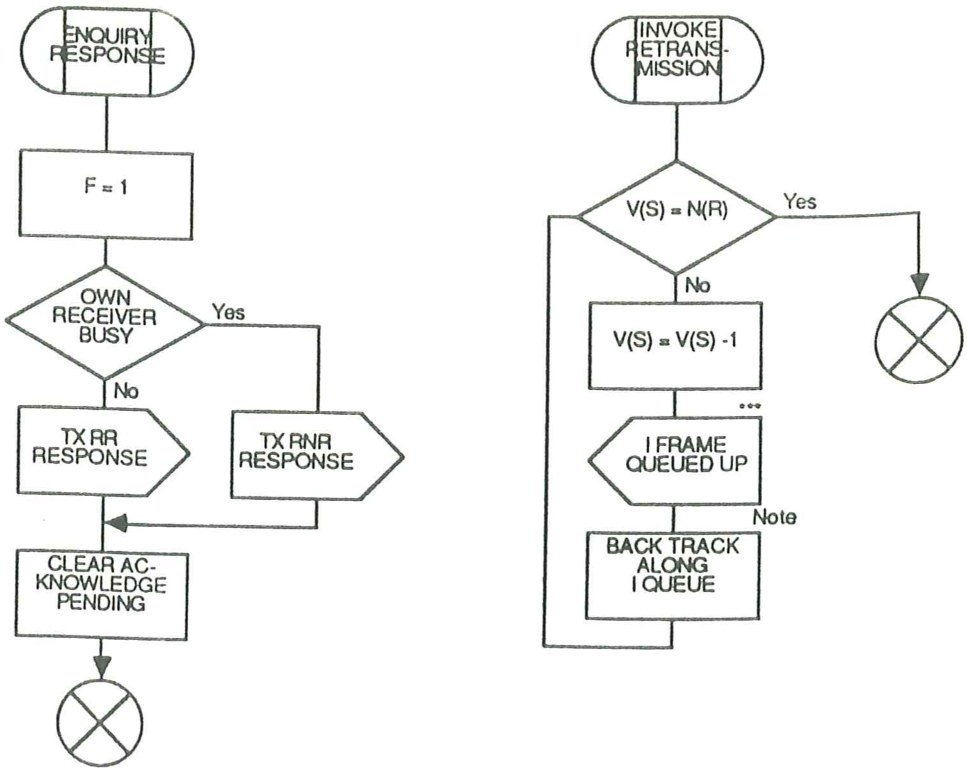


FIGURE B-9 (4 of 5)



Note - The generation of the correct number of signals in order to cause the required retransmission of I frames does not alter their sequence integrity.

FIGURE B-9 (5 of 5)

APPENDIX C

SDL REPRESENTATION OF THE BROADCAST PROCEDURES

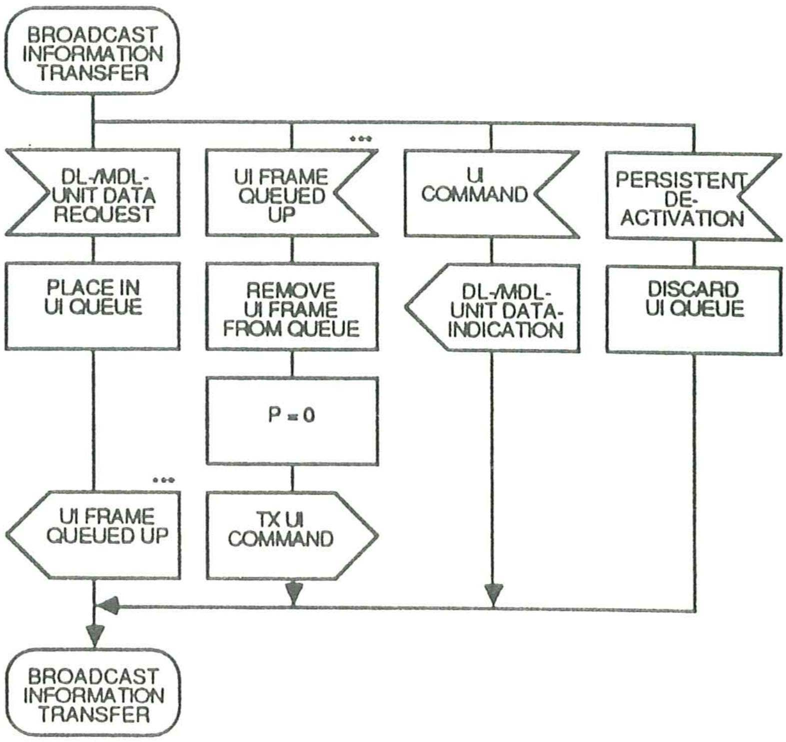


Figure C.1 - An SDL representation of the broadcast procedures of the data link layer

APPENDIX D

STATE TRANSITION DIAGRAMS OF THE POINT TO POINT PROCEDURES OF THE DATA LINK LAYER

D.1 The state transition tables presented in Tables D.1 to D.3 are based on the eight basic states (see Appendix B) recognized in the SDL representation and the related transmitter and receiver conditions.

The state transition table relinquishes to any partitioning of the procedures. It is conceptual and does not prevent a designer from partitioning his implementation. Moreover, all the processes related to primitive procedures, the management of queues and the exchange of information between adjacent layers are conceptual, not visible from outside the system and would not impose any constraints on the implementation.

The eight basic states apply to both the, transmitter and receiver within one data link layer entity. However, some of the conditions are confined to the transmitter (e.g. "peer receiver busy"), whilst some are confined to the receiver (e.g. "REJ recovery"). This implies, if the concept of non partitioning is adopted, that each transmitter condition has to be incorporated with each receiver condition resulting in composite states. This state transition table comprises 24 composite states representing the 8 basic states and the related combinations of transmitter and receiver conditions.

Events are defined as follows:

a) primitives

b) repertoire of frames to be received

- unnumbered frames (SABME, DISC, UA, DM, UI, FRMR)
- supervisory frames (RR, REJ, RNR)
- Information frames (I)

c) Internal events (servicing of timers, receiver busy condition)

The actions to be taken when an event occurs whilst in specific state comprise;

i) Transition to another state

ii) Peer-to-peer frame to be transmitted

iii) Primitives to be issued

iv) Timer actions

v) Retry variables

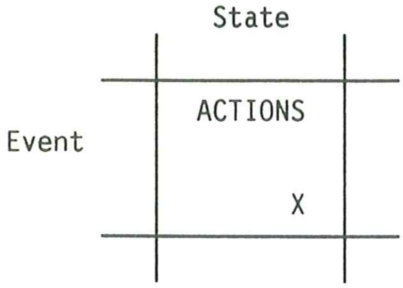
vi) State variables

vii) P/F bit setting

viii) Discarding the contents of queues.

D.2 Key to State Transition Table

D.2.1 Definition of a cell of the state transition table

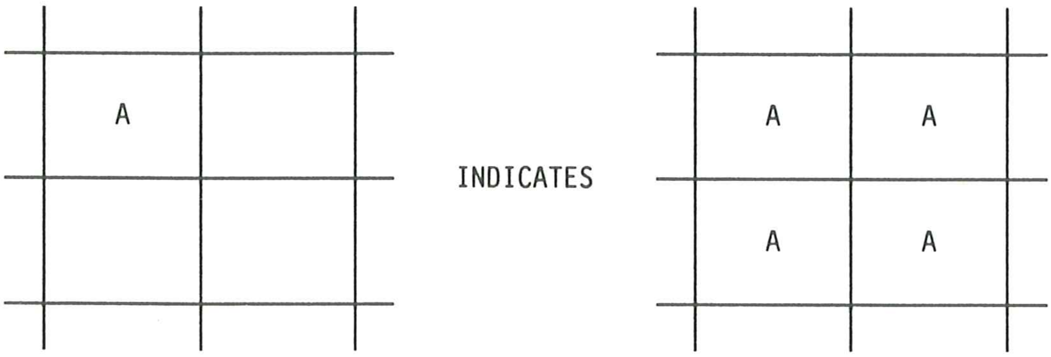


X defines the transition to the next state

X empty indicates - "remain in the current state"

D.2.2 Key to the contents of a cell

I	Impossible by the definition of the data link layer service
/	Impossible by the definition of the peer-to-peer data link procedures
-	No action, no state change
V(S) = V(A) = N(R)	Collective term for the two actions V(S) = N(R) and V(A) = N(R)
Timer T200	Start Timer T200 if not already running
TX ACK	The acknowledgment of the received I frame may be conveyed by an I frame associated with the information flow in the opposite direction or by a supervisory response frame, as appropriate.
DISCARD	Indicates the discarding of the information contained in the information field of the I frame.
(A-O)	The codes used in the MDL-ERROR-INDICATION signal are defined in Table A.1 in Appendix A. When multiple codes are shown, only one applies.



NOTE

In general this state transition table does not prevent an implementation from using N(R) to acknowledge more than one frame.

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
DL-ESTABLISH-REQUEST	MDL-ASS-IDN 3	3	I	RC=0 TX SABME P=1 START T200 5.0	I	DISC. I QUEUE 5.0	I	I
DL-RELEASE-REQUEST	I	I	I	DL-REL-CONF	I	5.2	I	I
DL-DATA-REQUEST	I	I	I	I	I	DATA INTO I QUEUE	I	I
I FRAME IN QUEUE V(S)<V(A)+k	I	I	I	I	I	LEAVE I FRAME IN QUEUE		I
I FRAME IN QUEUE V(S)=V(A)+k	I	I	I	I	I			I
DL-UNIT DATA-REQUEST	MDL-ASS-IND UNIT DATA INTO UI QUEUE 2	UNIT DATA INTO UI QUEUE						
UI FRAME IN QUEUE	I	LEAVE UI FRAME IN QUEUE		TX UI P=0				
MDL-ASSIGN-REQUEST	STORE TEI VALUE 4		STORE TEI VALUE RC=0 TX SABME P=1 START T200 5.0	I	I	I	I	I
MDL-REMOVE-REQUEST	I	I	I	DISC. UI QUEUE 1	DL-REL-IND DISC. UI QUEUE STOP T200 1	DL-REL-IND DISC. I and UI QUEUES STOP T200 1	DL-REL-CONF DISC. I and UI QUEUES STOP T200 1	DL-REL-CONF DISC. UI QUEUE STOP T200 1
MDL-ERROR-RESPONSE	I	DISC. UI QUEUE 1	DL-REL-IND DISC. UI QUEUE 1	I	I	I	I	I
PERSISTENT DEACTIVATION	-	DISC. UI QUEUE 1	DL-REL-IND DISC. UI QUEUE 1	DISC. UI QUEUE	DL-REL-IND DISC. UI QUEUE STOP T200 4	DL-REL-IND DISC. I and UI QUEUES STOP T200 4	DL-REL-CONF DISC. I and UI QUEUES STOP T200 4	DL-REL-CONF DISC. UI QUEUE STOP T200 4

TABLE D-1.1 STATE TRANSITION TABLE: Receiving primitive

Note - The transmitter condition "pending release" may occur only in cases of layer 2 initiated re-establishment.

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
SABME P=1 ABLE TO ENTER STATE 7.0	/	/	/	DL-EST-IND V(S,R,A)=0 TX UA F=1 START T203 7.0	TX UA F=1			TX DM F=1
SABME P=1 UNABLE TO ENTER STATE 7.0	/	/	/	TX DM F=1	/	/	/	/
SABME P=0 ABLE TO ENTER STATE 7.0	/	/	/	DL-EST-IND V(S,R,A)=0 TX UA F=0 START T203 7.0	TX UA F=0			TX DM F=0
SABME P=0 UNABLE TO ENTER STATE 7.0	/	/	/	TX DM F=0	/	/	/	/
DISC P=1	/	/	/	TX DM F=1	TX DM F=1			TX UA F=1
DISC P=0	/	/	/	TX DM F=0	TX DM F=0			TX UA F=0
UA F=1 V(S) = V(A)	/	/	/	MDL-ERR-IND(C)	V(S,R,A)=0 DL-EST-CONF STOP T200 START T203 7.0	V (S,R,A)=0 STOP T200 START T203 7.0	DISC. I QUEUE RC=0 TX DISC P=1 RESTART T200 6	DL-REL-CONF STOP T200 4
UA F=1 V(S) ≠ V(A)	/	/	/			DISC. I QUEUE V(S,R,A)=0 DL-EST-IND STOP T200 START T203 7.0		
UA F=0	/	/	/	MDL-ERR-IND(D)				
DM F=1	/	/	/	-	DL-REL-IND STOP T200 4	DL-REL-IND DISC. I QUEUE STOP T200 4	DL-REL-CONF DISC. I QUEUE STOP T200 4	DL-REL-CONF STOP T200 4
DM F=0 ABLE TO ENTER STATE 7.0	/	/	/	RC=0 TX SABME P=1 START T200 5.1	-	-	-	-
DM F=0 UNABLE TO ENTER STATE 7.0	/	/	/	-	/	/	/	/
UI command	/	/	/	DL-UNIT DATA-IND				

TABLE D-1.2 STATE TRANSITION TABLE: Receiving unnumbered frame with correct format

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
FRMR response rejecting SABME	/	/	/	/	-	-	-	/
FRMR response rejecting DISC	/	/	/	/	/	/	/	-
FRMR response rejecting UA	/	/	/	-	-	-	-	-
FRMR response rejecting DM	/	/	/	-	-	-	-	-
FRMR response rejecting I command	/	/	/	/	-	-	-	-
FRMR response rejecting S frame	/	/	/	/	-	-	-	-
FRMR response rejecting FRMR	/	/	/	/	/	/	/	/

TABLE D-1.3 STATE TRANSITION TABLE: Receiving FRMR unnumbered frame with correct format

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
RR command P=1	/	/	/	-	-	-	-	-
RR command P=0	/	/	/	-	-	-	-	-
RR response F=0	/	/	/	-	-	-	-	-
RR response F=1	/	/	/	-	-	-	-	-

TABLE D-1.4 **STATE TRANSITION TABLE: Receiving RR supervisory frame with correct format**

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
REJ command P=1	/	/	/	-	-	-	-	-
REJ command P=0	/	/	/	-	-	-	-	-
REJ response F=0	/	/	/	-	-	-	-	-
REJ response F=1	/	/	/	-	-	-	-	-

TABLE D-1.5 **STATE TRANSITION TABLE: Receiving REJ supervisory frame with correct format**

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
RNR command P=1	/	/	/	-	-	-	-	-
RNR command P=0	/	/	/	-	-	-	-	-
RNR response F=0	/	/	/	-	-	-	-	-
RNR response F=1	/	/	/	-	-	-	-	-

TABLE D-1.6 STATE TRANSITION TABLE: Receiving RNR supervisory frame with correct format

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
I command P=1 N(S) = V(R) N(R) = V(S)	/	/	/	-	-	-	-	-
I command P=0 N(S) = V(R) N(R) = V(S)	/	/	/	-	-	-	-	-
I command P=1 N(S) ≠ V(R) N(R) = V(S)	/	/	/	-	-	-	-	-
I command P=0 N(S) ≠ V(R) N(R) = V(S)	/	/	/	-	-	-	-	-
I command P=1 N(S) = V(R) V(A)≤N(R)≤V(S)	/	/	/	-	-	-	-	-
I command P=0 N(S) = V(R) V(A)≤N(R)≤V(S)	/	/	/	-	-	-	-	-
I command P=1 N(S) ≠ V(R) V(A)≤N(R)≤V(S)	/	/	/	-	-	-	-	-
I command P=0 N(S) ≠ V(R) V(A)≤N(R)≤V(S)	/	/	/	-	-	-	-	-

TABLE D-1.7 STATE TRANSITION TABLE: Receiving I command frame with correct format acknowledging all outstanding I frames or containing an N(R) which is V(A) ≤ N(R) ≤ V(S)

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
I command P=1 $N(S) = V(R)$ $V(A)=N(R)\leq V(S)$	/	/	/	-	-	-	-	-
I command P=0 $N(S) = V(R)$ $V(A)=N(R)\leq V(S)$	/	/	/	-	-	-	-	-
I command P=1 $N(S) \neq V(R)$ $V(A)=N(R)\leq V(S)$	/	/	/	-	-	-	-	-
I command P=0 $N(S) \neq V(R)$ $V(A)=N(R)\leq V(S)$	/	/	/	-	-	-	-	-
I command P=1 $N(S) = V(R)$ N(R) error	/	/	/	-	-	-	-	-
I command P=0 $N(S) = V(R)$ N(R) error	/	/	/	-	-	-	-	-
I command P=1 $N(S) \neq V(R)$ N(R) error	/	/	/	-	-	-	-	-
I command P=0 $N(S) \neq V(R)$ N(R) error	/	/	/	-	-	-	-	-

TABLE D-1.8 STATE TRANSITION TABLE: Receiving I command frame with correct format containing an N(R) which is $V(A) = N(R) \leq V(S)$ or an N(R) error

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
T200 TIME-OUT RC < N200	/	/	/	/	RC=RC+1 TX SABME P=1 START T200			RC=RC+1 TX DISC P=1 START T200
T200 TIME-OUT RC = N200	/	/	/	/	DL-REL-IND MDL-ERR-IND(G) 4	DISC. I QUEUE DL-REL-IND MDL-ERR-IND(G) 4	DISC. I QUEUE DL-REL-CONF MDL-ERR-IND(G) 4	DL-REL-CONF MDL-ERR-IND(H) 4
T203 TIME-OUT	/	/	/	/	/	/	/	/
SET OWN RECEIVER BUSY (Note)	/	/	/	/	/	/	/	/
CLEAR OWN RECEIVER BUSY (Note)	/	/	/	/	/	/	/	/

TABLE D-1.9 STATE TRANSITION TABLE: Internal events (Expiry of timers, receiver busy condition)

Note - These signals are generated outside the procedures specified in this state transision table, and may be generated by the connection management entity.

BASIC STATE	TEI UNASSIGNED	ASSIGN AWAITING TEI	ESTABLISH AWAITING TEI	TEI ASSIGNED	AWAITING ESTABLISHMENT			AWAITING RELEASE
TRANSMITTER CONDITION					Establish	Re-establish	Pending release	
RECEIVER CONDITION								
STATE NUMBER	1	2	3	4	5.0	5.1	5.2	6
SABME incorrect length	/	/	/	MDL-ERR-IND(N)				
DISC incorrect length	/	/	/					
UA incorrect length	/	/	/					
DM incorrect length	/	/	/					
FRMR incorrect length	/	/	/					
Supervisory frame RR, REJ, RNR incorrect length	/	/	/					
N201 error	/	/	/	MDL-ERR-IND(O)				
Undefined command and response control field	/	/	/	MDL-ERR-IND(L)				
I field not permitted	/	/	/	MDL-ERR-IND(M)				

TABLE D-1.10 STATE TRANSITION TABLE: Receiving frame with incorrect format or frame with undefined control field

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
DL-ESTABLISH-REQUEST	DISC. I QUEUE RC=0 TX SABME P=1 STOP T203 RESTART T200 5.0							
DL-RELEASE-REQUEST	DISC. I QUEUE RC=0 TX DISC P=1 STOP T203 RESTART T200 6							
DL-DATA-REQUEST	DATA INTO I QUEUE							
I FRAME IN QUEUE V(S)<V(A)+k	TX I P=0 V(S)=V(S)+1 STOP T203 TIMER T200				LEAVE I FRAME IN QUEUE			
I FRAME IN QUEUE V(S)=V(A)+k	LEAVE I FRAME IN QUEUE							
DL-UNIT DATA-REQUEST	UNIT DATA INTO UI QUEUE							
UI FRAME IN QUEUE	TX UI P=0							
MDL-ASSIGN-REQUEST	I							
MDL-REMOVE-REQUEST	DL-REL-IND DISC. I and UI QUEUES STOP T200 STOP T203 1							
MDL-ERROR-RESPONSE	I							
PERSISTENT DEACTIVATION	DL-REL-IND DISC. I and UI QUEUES STOP T200 STOP T203 4							

TABLE D-2.1 STATE TRANSITION TABLE: Receiving primitive

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
SABME P=1 V(S) = V(A)	MDL-ERR-IND(F) V(S,R,A)=0 TX UA F=1 STOP T200 START T203	MDL-ERR-IND(F) V(S,R,A)=0 TX UA F=1 STOP T200 START T203 7.0						
SABME P=1 V(S) ≠ V(A)	DL-EST-IND MDL-ERR-IND(F) DISC. I QUEUE V(S,R,A)=0 TX UA F=1 STOP T200 START T203	DL-EST-IND MDL-ERR-IND(F) DISC. I QUEUE V(S,R,A)=0 TX UA F=1 STOP T200 START T203 7.0						
SABME P=0 V(S) = V(A)	MDL-ERR-IND(F) V(S,R,A)=0 TX UA F=0 STOP T200 START T203	MDL-ERR-IND(F) V(S,R,A)=0 TX UA F=0 STOP T200 START T203 7.0						
SABME P=0 V(S) ≠ V(A)	DL-EST-IND MDL-ERR-IND(F) DISC. I QUEUE V(S,R,A)=0 TX UA F=0 STOP T200 START T203	DL-EST-IND MDL-ERR-IND(F) DISC. I QUEUE V(S,R,A)=0 TX UA F=0 STOP T200 START T203 7.0						
DISC P=1	DL-REL-IND DISC. I QUEUE TX UA F=1 STOP T200, T203 4							
DISC P=0	DL-REL-IND DISC. I QUEUE TX UA F=0 STOP T200, T203 4							

TABLE D-2.2a STATE TRANSITION TABLE: Receiving unnumbered frame with correct format

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
UA F=1	MDL-ERR-IND(C)							
UA F=0	MDL-ERR-IND(D)							
DM F=1	MDL-ERR-IND(B)							
DM F=0	MDL-ERR-IND(E) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(E) RC = 0 TX SABME P=1 RESTART T200 5.1			
UI command	DL-UNIT DATA-IND							

TABLE D-2.2b STATE TRANSITION TABLE: Receiving unnumbered frame with correct format

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
FRMR response rejecting SABME	/	/	/	/	/	/	/	/
FRMR response rejecting DISC	/	/	/	/	/	/	/	/
FRMR response rejecting UA	MDL-ERR-IND(K) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(K) RC = 0 TX SABME P=1 RESTART T200 5.1			
FRMR response rejecting DM	/	/	/	/	/	/	/	/
FRMR response rejecting I command	MDL-ERR-IND(K) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(K) RC = 0 TX SABME P=1 RESTART T200 5.1			
FRMR response rejecting S frame								
FRMR response rejecting FRMR	/	/	/	/	/	/	/	/

TABLE D-2.3 STATE TRANSITION TABLE: Receiving FRMR unnumbered frame with correct format

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
RR command P=1 N(R)=V(S)	TX RR F=1 STOP T200 RESTART T203 V(A)=N(R)		TX RNR F=1 STOP T200 RESTART T203 V(A)=N(R)		TX RR F=1 STOP T200 START T203 V(A)=N(R) 7.0	TX RR F=1 STOP T200 START T203 V(A)=N(R) 7.1	TX RNR F=1 STOP T200 START T203 V(A)=N(R) 7.2	TX RNR F=1 STOP T200 START T203 V(A)=N(R) 7.3
RR command P=0 N(R)=V(S)	STOP T200 RESTART T203 V(A)=N(R)				STOP T200 START T203 V(A)=N(R) 7.0	STOP T200 START T203 V(A)=N(R) 7.1	STOP T200 START T203 V(A)=N(R) 7.2	STOP T200 START T203 V(A)=N(R) 7.3
RR response F=0 N(R)=V(S)								
RR response F=1 N(R)=V(S)	MDL-ERR-IND(A) STOP T200 RESTART T203 V(A)=N(R)				MDL-ERR-IND(A) STOP T200 START T203 V(A)=N(R) 7.0	MDL-ERR-IND(A) STOP T200 START T203 V(A)=N(R) 7.1	MDL-ERR-IND(A) STOP T200 START T203 V(A)=N(R) 7.2	MDL-ERR-IND(A) STOP T200 START T203 V(A)=N(R) 7.3
RR command P=1 V(A) < N(R) < V(S)	TX RR F=1 RESTART T200 V(A)=N(R)		TX RNR F=1 RESTART T200 V(A)=N(R)		TX RR F=1 RESTART T200 V(A)=N(R) 7.0	TX RR F=1 RESTART T200 V(A)=N(R) 7.1	TX RNR F=1 RESTART T200 V(A)=N(R) 7.2	TX RNR F=1 RESTART T200 V(A)=N(R) 7.3
RR command P=0 V(A) < N(R) < V(S)	RESTART T200 V(A)=N(R)				RESTART T200 V(A)=N(R) 7.0	RESTART T200 V(A)=N(R) 7.1	RESTART T200 V(A)=N(R) 7.2	RESTART T200 V(A)=N(R) 7.3
RR response F=0 V(A) < N(R) < V(S)								
RR response F=1 V(A) < N(R) < V(S)	MDL-ERR-IND(A) RESTART T200 V(A)=N(R)				MDL-ERR-IND(A) RESTART T200 V(A)=N(R) 7.0	MDL-ERR-IND(A) RESTART T200 V(A)=N(R) 7.1	MDL-ERR-IND(A) RESTART T200 V(A)=N(R) 7.2	MDL-ERR-IND(A) RESTART T200 V(A)=N(R) 7.3

TABLE D-2.4a STATE TRANSITION TABLE: Receiving RR supervisory frame with correct format

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
RR command P=1 V (A) = N(R) < V(S)	TX RR F=1		TX RNR F=1		TX RR F=1 7.0	TX RR F=1 7.1	TX RNR F=1 7.2	TX RNR F=1 7.3
RR command P=0 V (A) = N(R) < V(S)	-	-	-	-	7.0	7.1	7.2	7.3
RR response F=0 V (A) = N(R) < V(S)	-	-	-	-				
RR response F=1 V (A) = N(R) < V(S)	MDL-ERR-IND(A)				MDL-ERR-IND(A) 7.0	MDL-ERR-IND(A) 7.1	MDL-ERR-IND(A) 7.2	MDL-ERR-IND(A) 7.3
RR command P=1 N(R) error	TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
RR command P=0 N(R) error	MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1			
RR response F=0 N(R) error								
RR response F=1 N(R) error	MDL-ERR-IND(A) MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(A) MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1			

TABLE D-2.4b STATE TRANSITION TABLE: Receiving RR supervisory frame with correct format

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
REJ command P=1 N(R)=V(S) (Note)	TX RR F=1 V(A)=N(R) STOP T200 RESTART T203		TX RNR F=1 V(A)=N(R) STOP T200 RESTART T203		TX RR F=1 V(A)=N(R) STOP T200 START T203 7.0	TX RR F=1 V(A)=N(R) STOP T200 START T203 7.1	TX RNR F=1 V(A)=N(R) STOP T200 START T203 7.2	TX RNR F=1 V(A)=N(R) STOP T200 START T203 7.3
REJ command P=0 N(R)=V(S) (Note)	V(A)=N(R) STOP T200 RESTART T203				V(A)=N(R) STOP T200 START T203 7.0	V(A)=N(R) STOP T200 START T203 7.1	V(A)=N(R) STOP T200 START T203 7.2	V(A)=N(R) STOP T200 START T203 7.3
REJ response F=0 N(R)=V(S) (Note)								
REJ response F=1 N(R)=V(S) (Note)	MDL-ERR-IND(A) V(A)=N(R) STOP T200 RESTART T203				MDL-ERR-IND(A) V(A)=N(R) STOP T200 START T203 7.0	MDL-ERR-IND(A) V(A)=N(R) STOP T200 START T203 7.1	MDL-ERR-IND(A) V(A)=N(R) STOP T200 START T203 7.2	MDL-ERR-IND(A) V(A)=N(R) STOP T200 START T203 7.3
REJ command P=1 V(A) ≤ N(R) < V(S)	TX RR F=1 V(S)=V(A)=N(R) STOP T200 START T203		TX RNR F=1 V(S)=V(A)=N(R) STOP T200 START T203		TX RR F=1 V(S)=V(A)=N(R) STOP T200 START T203 7.0	TX RR F=1 V(S)=V(A)=N(R) STOP T200 START T203 7.1	TX RNR F=1 V(S)=V(A)=N(R) STOP T200 START T203 7.2	TX RNR F=1 V(S)=V(A)=N(R) STOP T200 START T203 7.3
REJ command P=0 V(A) ≤ N(R) < V(S)	V(S)=V(A)=N(R) STOP T200 START T203				V(S)=V(A)=N(R) STOP T200 START T203 7.0	V(S)=V(A)=N(R) STOP T200 START T203 7.1	V(S)=V(A)=N(R) STOP T200 START T203 7.2	V(S)=V(A)=N(R) STOP T200 START T203 7.3
REJ response F=0 V(A) ≤ N(R) < V(S)								
REJ response F=1 V(A) ≤ N(R) < V(S)	MDL-ERR-IND(A) V(S)=V(A)=N(R) STOP T200 START T203				MDL-ERR-IND(A) V(S)=V(A)=N(R) STOP T200 START T203 7.0	MDL-ERR-IND(A) V(S)=V(A)=N(R) STOP T200 START T203 7.1	MDL-ERR-IND(A) V(S)=V(A)=N(R) STOP T200 START T203 7.2	MDL-ERR-IND(A) V(S)=V(A)=N(R) STOP T200 START T203 7.3

TABLE D-2.5a STATE TRANSITION TABLE: Receiving REJ supervisory frame with correct format

Note - This event is impossible by the definition of the peer-to-peer data link procedures. However, it would not harm the information transfer, if actions according to this table are taken.

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
REJ command P=1 N(R) error	TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
REJ command P=0 N(R) error	MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1			
REJ response P=0 N(R) error								
REJ response P=1 N(R) error	MDL-ERR-IND(A) MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(A) MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1			

TABLE D-2.5b STATE TRANSITION TABLE: Receiving REJ supervisory frame with correct format

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
RNR command P=1 N(R)=V(S)	TX RR F=1 STOP T203 RESTART T200 V(A)=N(R) 7.4	TX RR F=1 STOP T203 RESTART T200 V(A)=N(R) 7.5	TX RNR F=1 STOP T203 RESTART T200 V(A)=N(R) 7.6	TX RNR F=1 STOP T203 RESTART T200 V(A)=N(R) 7.7	TX RR F=1 RESTART T200 V(A)=N(R)		TX RNR F=1 RESTART T200 V(A)=N(R)	
RNR command P=0 N(R)=V(S)	STOP T203 RESTART T200 V(A)=N(R) 7.4	STOP T203 RESTART T200 V(A)=N(R) 7.5	STOP T203 RESTART T200 V(A)=N(R) 7.6	STOP T203 RESTART T200 V(A)=N(R) 7.7	RESTART T200 V(A)=N(R)			
RNR response F=0 N(R)=V(S)								
RNR response F=1 N(R)=V(S)	MDL-ERR-IND(A) STOP T203 RESTART T200 V(A)=N(R) 7.4	MDL-ERR-IND(A) STOP T203 RESTART T200 V(A)=N(R) 7.5	MDL-ERR-IND(A) STOP T203 RESTART T200 V(A)=N(R) 7.6	MDL-ERR-IND(A) STOP T203 RESTART T200 V(A)=N(R) 7.7	MDL-ERR-IND(A) RESTART T200 V(A)=N(R)			
RNR command P=1 $V(A) \le N(R) < V(S)$	TX RR F=1 RESTART T200 V(A)=N(R) 7.4	TX RR F=1 RESTART T200 V(A)=N(R) 7.5	TX RNR F=1 RESTART T200 V(A)=N(R) 7.6	TX RNR F=1 RESTART T200 V(A)=N(R) 7.7	TX RR F=1 RESTART T200 V(A)=N(R)		TX RNR F=1 RESTART T200 V(A)=N(R)	
RNR command P=0 $V(A) \le N(R) < V(S)$	RESTART T200 V(A)=N(R) 7.4	RESTART T200 V(A)=N(R) 7.5	RESTART T200 V(A)=N(R) 7.6	RESTART T200 V(A)=N(R) 7.7	RESTART T200 V(A)=N(R)			
RNR response F=0 $V(A) \le N(R) < V(S)$								
RNR response F=1 $V(A) \le N(R) < V(S)$	MDL-ERR-IND(A) RESTART T200 V(A)=N(R) 7.4	MDL-ERR-IND(A) RESTART T200 V(A)=N(R) 7.5	MDL-ERR-IND(A) RESTART T200 V(A)=N(R) 7.6	MDL-ERR-IND(A) RESTART T200 V(A)=N(R) 7.7	MDL-ERR-IND(A) RESTART T200 V(A)=N(R)			

TABLE D-2.6a STATE TRANSITION TABLE: Receiving RNR supervisory frame with correct format

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
RNR command P=1 N(R) error	TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
RNR command P=0 N(R) error	MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1			
RNR response P=0 N(R) error								
RNR response P=1 N(R) error	MDL-ERR-IND(A) MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1				MDL-ERR-IND(A) MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1			

TABLE D-2.6b STATE TRANSITION TABLE: Receiving RNR supervisory frame with correct format

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
I command P=1 N(S) = V(R) N(R) = V(S)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 STOP T200 RESTART T203 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 STOP T200 RESTART T203 V(A)=N(R) 7.0	"DISCARD" TX RNR F=1 STOP T200 RESTART T203 V(A)=N(R)		V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R) 7.4	"DISCARD" TX RNR F=1 V(A)=N(R)	
I command P=0 N(S) = V(R) N(R) = V(S)	V(R)=V(R)+1 DL-DATA-IND TX ACK STOP T200 RESTART T203 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX ACK STOP T200 RESTART T203 V(A)=N(R) 7.0	"DISCARD" STOP T200 RESTART T203 V(A)=N(R)		V(R)=V(R)+1 DL-DATA-IND TX RR F=0 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=0 V(A)=N(R) 7.4	"DISCARD" V(A)=N(R)	
I command P=1 N(S) ≠ V(R) N(R) = V(S)	"DISCARD" TX REJ F=1 STOP T200 RESTART T203 V(A)=N(R) 7.1	"DISCARD" TX RR F=1 STOP T200 RESTART T203 V(A)=N(R)	"DISCARD" TX RNR F=1 STOP T200 RESTART T203 V(A)=N(R)		"DISCARD" TX REJ F=1 V(A)=N(R) 7.5	"DISCARD" TX RR F=1 V(A)=N(R)	"DISCARD" TX RNR F=1 V(A)=N(R)	
I command P=0 N(S) ≠ V(R) N(R) = V(S)	"DISCARD" TX REJ F=0 STOP T200 RESTART T203 V(A)=N(R) 7.1	"DISCARD" STOP T200 RESTART T203 V(A)=N(R)			"DISCARD" TX REJ F=0 V(A)=N(R) 7.5	"DISCARD" V(A)=N(R)		
I command P=1 N(S) = V(R) $V(A) < N(R) < V(S)$	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 RESTART T200 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 RESTART T200 V(A)=N(R) 7.0	"DISCARD" TX RNR F=1 RESTART T200 V(A)=N(R)		V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R) 7.4	"DISCARD" TX RNR F=1 V(A)=N(R)	
I command P=0 N(S) = V(R) $V(A) < N(R) < V(S)$	V(R)=V(R)+1 DL-DATA-IND TX ACK RESTART T200 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX ACK RESTART T200 V(A)=N(R) 7.0	"DISCARD" RESTART T200 V(A)=N(R)		V(R)=V(R)+1 DL-DATA-IND TX RR F=0 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=0 V(A)=N(R) 7.4	"DISCARD" V(A)=N(R)	
I command P=1 N(S) ≠ V(R) $V(A) < N(R) < V(S)$	"DISCARD" TX REJ F=1 RESTART T200 V(A)=N(R) 7.1	"DISCARD" TX RR F=1 RESTART T200 V(A)=N(R)	"DISCARD" TX RNR F=1 RESTART T200 V(A)=N(R)		"DISCARD" TX REJ F=1 V(A)=N(R) 7.5	"DISCARD" TX RR F=1 V(A)=N(R)	"DISCARD" TX RNR F=1 V(A)=N(R)	
I command P=0 N(S) ≠ V(R) $V(A) < N(R) < V(S)$	"DISCARD" TX REJ F=0 RESTART T200 V(A)=N(R) 7.1	"DISCARD" RESTART T200 V(A)=N(R)			"DISCARD" TX REJ F=0 V(A)=N(R) 7.5	"DISCARD" V(A)=N(R)		

TABLE D-2.7 STATE TRANSITION TABLE: Receiving I command frame with correct format acknowledging all outstanding I frames or containing an N(R) which is $V(A) < N(R) < V(S)$

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
I command P=1 N(S) = V(R) V(A)=N(R)≤V(S)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 7.0	"DISCARD" TX RNR F=1		V(R)=V(R)+1 DL-DATA-IND TX RR F=1	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 7.4	"DISCARD" TX RNR F=1	
I command P=0 N(S) = V(R) V(A)=N(R)≤V(S)	V(R)=V(R)+1 DL-DATA-IND TX ACK	V(R)=V(R)+1 DL-DATA-IND TX ACK 7.0	"DISCARD"		V(R)=V(R)+1 DL-DATA-IND TX RR F=0	V(R)=V(R)+1 DL-DATA-IND TX RR F=0 7.4	"DISCARD"	
I command P=1 N(S) ≠ V(R) V(A)=N(R)≤V(S)	"DISCARD" TX REJ F=1 7.1	"DISCARD" TX RR F=1	"DISCARD" TX RNR F=1		"DISCARD" TX REJ F=1 7.5	"DISCARD" TX RR F=1	"DISCARD" TX RNR F=1	
I command P=0 N(S) ≠ V(R) V(A)=N(R)≤V(S)	"DISCARD" TX REJ F=0 7.1	"DISCARD"			"DISCARD" TX REJ F=0 7.5	"DISCARD"		
I command P=1 N(S) = V(R) N(R) error	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		"DISCARD" TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		V(R)=V(R)+1 DL-DATA-IND TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		"DISCARD" TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
I command P=0 N(S) = V(R) N(R) error	V(R)=V(R)+1 DL-DATA-IND MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		"DISCARD" MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		V(R)=V(R)+1 DL-DATA-IND MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		"DISCARD" MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
I command P=1 N(S) ≠ V(R) N(R) error	"DISCARD" TX REJ F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1	"DISCARD" TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1	"DISCARD" TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1		"DISCARD" TX REJ F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
I command P=0 N(S) ≠ V(R) N(R) error	"DISCARD" TX REJ F=0 MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1	"DISCARD" MDL-ERR-IND(J) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1			"DISCARD" TX REJ F=0 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		

TABLE D-2.8 STATE TRANSITION TABLE: Receiving I command frame with correct format containing an N(R) which is V(A) = N(R) ≤ V(S) or an N(R) error

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
T200 TIME-OUT RC < N200	TX RR P=1 then RC=RC+1 START T200 8.0	TX RR P=1 then RC=RC+1 START T200 8.1	TX RNR P=1 then RC=RC+1 START T200 8.2	TX RNR P=1 then RC=RC+1 START T200 8.3	RC=0 TX RR P=1 RC=RC+1 START T200 8.4	RC=0 TX RR P=1 RC=RC+1 START T200 8.5	RC=0 TX RNR P=1 RC=RC+1 START T200 8.6	RC=0 TX RNR P=1 RC=RC+1 START T200 8.7
T200 TIME-OUT RC = N200	/	/	/	/	/	/	/	/
T203 TIME-OUT	RC=0 TX RR P=1 START T200 8.0	RC=0 TX RR P=1 START T200 8.1	RC=0 TX RNR P=1 START T200 8.2	RC=0 TX RNR P=1 START T200 8.3	/	/	/	/
SET OWN RECEIVER BUSY (Note)	TX RNR F=0 7.2	TX RNR F=0 7.3	-	-	TX RNR F=0 7.6	TX RNR F=0 7.7	-	-
CLEAR OWN RECEIVER BUSY (Note)	-	-	TX RR F=0 7.0	TX RR F=0 7.1	-	-	TX RR F=0 7.4	TX RR F=0 7.5

TABLE D-2.9 STATE TRANSITION TABLE: Internal events (Expiry of timers, receiver busy condition)

Note - These signals are generated outside the procedures specified in this state transition table, and may be generated by the connection management entity.

BASIC STATE	MULTIPLE FRAME ESTABLISHED							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7
SABME incorrect length	MDL-ERR-IND(N) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1							
DISC incorrect length								
UA incorrect length								
DM incorrect length								
FRMR incorrect length								
Supervisory frame RR, REJ, RNR incorrect length								
N201 error	MDL-ERR-IND(O) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1							
Undefined command and response control field	MDL-ERR-IND(L) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1							
I field not permitted	MDL-ERR-IND(M) RC = 0 TX SABME P=1 STOP T203 RESTART T200 5.1							

TABLE D-2.10 STATE TRANSITION TABLE: Receiving frame with incorrect format or frame with undefined control field

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
DL-ESTABLISH-REQUEST	DISC. I QUEUE RC=0 TX SABME P=1 RESTART T200 5.0							
DL-RELEASE-REQUEST	DISC. I QUEUE RC=0 TX DISC P=1 RESTART T200 6							
DL-DATA-REQUEST	DATA INTO I QUEUE							
I FRAME IN QUEUE V(S)<V(A)+k	LEAVE I FRAME IN QUEUE							
I FRAME IN QUEUE V(S)=V(A)+k								
DL-UNIT DATA-REQUEST	UNIT DATA INTO UI QUEUE							
UI FRAME IN QUEUE	TX UI P=0							
MDL-ASSIGN-REQUEST	I							
MDL-REMOVE-REQUEST	DL-REL-IND DISC. I and UI QUEUES STOP T200 1							
MDL-ERROR-RESPONSE	I							
PERSISTENT DEACTIVATION	DL-REL-IND DISC. I and UI QUEUES STOP T200 4							

TABLE D-3.1 STATE TRANSITION TABLE: Receiving primitive

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
SABME P=1 V(S) = V(A)	MDL-ERR-IND(F) V(S,R,A)=0 TX UA F=1 STOP T200 START T203 7.0							
SABME P=1 V(S) ≠ V(A)	DL-EST-IND MDL-ERR-IND(F) DISC. I QUEUE V(S,R,A)=0 TX UA F=1 STOP T200 START T203 7.0							
SABME P=0 V(S) = V(A)	MDL-ERR-IND(F) V(S,R,A)=0 TX UA F=0 STOP T200 START T203 7.0							
SABME P=0 V(S) ≠ V(A)	DL-EST-IND MDL-ERR-IND(F) DISC. I QUEUE V(S,R,A)=0 TX UA F=0 STOP T200 START T203 7.0							
DISC P=1	DL-REL-IND DISC. I QUEUE TX UA F=1 STOP T200 4							
DISC P=0	DL-REL-IND DISC. I QUEUE TX UA F=0 STOP T200 4							

TABLE D-3.2a STATE TRANSITION TABLE: Receiving unnumbered frame with correct format.

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
UA F=1	MDL-ERR-IND(C)							
UA F=0	MDL-ERR-IND(D)							
DM F=1	MDL-ERR-IND(B) RC = 0 TX SABME P=1 RESTART T200 5.1							
DM F=0	MDL-ERR-IND(E) RC=0 TX SABME P=1 RESTART T200 5.1							
UI command	DL-UNIT DATA-IND							

TABLE D-3.2b STATE TRANSITION TABLE: Receiving unnumbered frame with correct format.

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
FRMR response rejecting SABME	/	/	/	/	/	/	/	/
FRMR response rejecting DISC	/	/	/	/	/	/	/	/
FRMR response rejecting UA	/	/	/	/	/	/	/	/
FRMR response rejecting DM	/	/	/	/	/	/	/	/
FRMR response rejecting I command	MDL-ERR-IND(K) RC = 0 TX SABME P=1 RESTART T200 5.1							
FRMR response rejecting S frame								
FRMR response rejecting FRMR	/	/	/	/	/	/	/	/

TABLE D-3.3 STATE TRANSITION TABLE: Receiving FRMR unnumbered frame with correct format

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
RR command P=1 V(A) $\leq$ N(R) $\leq$ V(S)	TX RR F=1 V(A)=N(R)		TX RNR F=1 V(A)=N(R)		TX RR F=1 V(A)=N(R) 8.0	TX RR F=1 V(A)=N(R) 8.1	TX RNR F=1 V(A)=N(R) 8.2	TX RNR F=1 V(A)=N(R) 8.3
RR command P=0 V(A) $\leq$ N(R) $\leq$ V(S)	V(A)=N(R)				V(A)=N(R) 8.0	V(A)=N(R) 8.1	V(A)=N(R) 8.2	V(A)=N(R) 8.3
RR response F=0 V(A) $\leq$ N(R) $\leq$ V(S)								
RR response F=1 V(A) $\leq$ N(R) $\leq$ V(S)	V(S)=N(R) STOP T200 START T203 V(A)=N(R) 7.0	V(S)=N(R) STOP T200 START T203 V(A)=N(R) 7.1	V(S)=N(R) STOP T200 START T203 V(A)=N(R) 7.2	V(S)=N(R) STOP T200 START T203 V(A)=N(R) 7.3	V(S)=N(R) STOP T200 START T203 V(A)=N(R) 7.0	V(S)=N(R) STOP T200 START T203 V(A)=N(R) 7.1	V(S)=N(R) STOP T200 START T203 V(A)=N(R) 7.2	V(S)=N(R) STOP T200 START T203 V(A)=N(R) 7.3
RR command P=1 N(R) error	TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
RR command P=0 N(R) error	MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1							
RR response F=0 N(R) error								
RR response F=1 N(R) error								

TABLE D-3.4 STATE TRANSITION TABLE: Receiving RR supervisory frame with correct format; clearance of timer recovery if there is F=1 only

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
REJ command P=1 V(A) ≤ N(R) ≤ V(S)	TX RR F=1 V(A)=N(R)		TX RNR F=1 V(A)=N(R)		TX RR F=1 V(A)=N(R) 8.0	TX RR F=1 V(A)=N(R) 8.1	TX RNR F=1 V(A)=N(R) 8.2	TX RNR F=1 V(A)=N(R) 8.3
REJ command P=0 V(A) ≤ N(R) ≤ V(S)	V(A)=N(R)				V(A)=N(R) 8.0	V(A)=N(R) 8.1	V(A)=N(R) 8.2	V(A)=N(R) 8.3
REJ response F=0 V(A) ≤ N(R) ≤ V(S)								
REJ response F=1 V(A) ≤ N(R) ≤ V(S)	V(S)=V(A)=N(R) STOP T200 START T203 7.0	V(S)=V(A)=N(R) STOP T200 START T203 7.1	V(S)=V(A)=N(R) STOP T200 START T203 7.2	V(S)=V(A)=N(R) STOP T200 START T203 7.3	V(S)=V(A)=N(R) STOP T200 START T203 7.0	V(S)=V(A)=N(R) STOP T200 START T203 7.1	V(S)=V(A)=N(R) STOP T200 START T203 7.2	V(S)=V(A)=N(R) STOP T200 START T203 7.3
REJ command P=1 N(R) error	TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
REJ command P=0 N(R) error	MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1							
REJ response F=0 N(R) error								
REJ response F=1 N(R) error								

TABLE D-3.5 STATE TRANSITION TABLE: Receiving REJ supervisory frame with correct format; clearance of timer recovery if there is F=1 only

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
RNR command P=1 $V(A) \le N(R) \le V(S)$	TX RR F=1 V(A)=N(R) 8.4	TX RR F=1 V(A)=N(R) 8.5	TX RNR F=1 V(A)=N(R) 8.6	TX RNR F=1 V(A)=N(R) 8.7	TX RR F=1 V(A)=N(R)		TX RNR F=1 V(A)=N(R)	
RNR command P=0 $V(A) \le N(R) \le V(S)$	V(A)=N(R) 8.4	V(A)=N(R) 8.5	V(A)=N(R) 8.6	V(A)=N(R) 8.7	V(A)=N(R)			
RNR response F=0 $V(A) \le N(R) \le V(S)$								
RNR response F=1 $V(A) \le N(R) \le V(S)$	V(S)=N(R) RESTART T200 V(A)=N(R) 7.4	V(S)=N(R) RESTART T200 V(A)=N(R) 7.5	V(S)=N(R) RESTART T200 V(A)=N(R) 7.6	V(S)=N(R) RESTART T200 V(A)=N(R) 7.7	V(S)=N(R) RESTART T200 V(A)=N(R) 7.4	V(S)=N(R) RESTART T200 V(A)=N(R) 7.5	V(S)=N(R) RESTART T200 V(A)=N(R) 7.6	V(S)=N(R) RESTART T200 V(A)=N(R) 7.7
RNR command P=1 N(R) error	TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
RNR command P=0 N(R) error	MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1							
RNR response F=0 N(R) error								
RNR response F=1 N(R) error								

TABLE D-3.6 STATE TRANSITION TABLE: Receiving RNR supervisory frame with correct format; clearance of timer recovery if there is F=1 only

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
I command P=1 N(S) = V(R) N(R) = V(S)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R) 8.0	"DISCARD" TX RNR F=1 V(A)=N(R)		V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R) 8.4	"DISCARD" TX RNR F=1 V(A)=N(R)	
I command P=0 N(S) = V(R) N(R) = V(S)	V(R)=V(R)+1 DL-DATA-IND TX ACK V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX ACK V(A)=N(R) 8.0	"DISCARD" V(A)=N(R)		V(R)=V(R)+1 DL-DATA-IND TX RR F=0 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=0 V(A)=N(R) 8.4	"DISCARD" V(A)=N(R)	
I command P=1 N(S) ≠ V(R) N(R) = V(S)	"DISCARD" TX REJ F=1 V(A)=N(R) 8.1	"DISCARD" TX RR F=1 V(A)=N(R)	"DISCARD" TX RNR F=1 V(A)=N(R)		"DISCARD" TX REJ F=1 V(A)=N(R) 8.5	"DISCARD" TX RR F=1 V(A)=N(R)	"DISCARD" TX RNR F=1 V(A)=N(R)	
I command P=0 N(S) ≠ V(R) N(R) = V(S)	"DISCARD" TX REJ F=0 V(A)=N(R) 8.1	"DISCARD" V(A)=N(R)			"DISCARD" TX REJ F=0 V(A)=N(R) 8.5	"DISCARD" V(A)=N(R)		
I command P=1 N(S) = V(R) V(A)<N(R)<V(S)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R) 8.0	"DISCARD" TX RNR F=1 V(A)=N(R)		V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 V(A)=N(R) 8.4	"DISCARD" TX RNR F=1 V(A)=N(R)	
I command P=0 N(S) = V(R) V(A)<N(R)<V(S)	V(R)=V(R)+1 DL-DATA-IND TX ACK V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX ACK V(A)=N(R) 8.0	"DISCARD" V(A)=N(R)		V(R)=V(R)+1 DL-DATA-IND TX RR F=0 V(A)=N(R)	V(R)=V(R)+1 DL-DATA-IND TX RR F=0 V(A)=N(R) 8.4	"DISCARD" V(A)=N(R)	
I command P=1 N(S) ≠ V(R) V(A)<N(R)<V(S)	"DISCARD" TX REJ F=1 V(A)=N(R) 8.1	"DISCARD" TX RR F=1 V(A)=N(R)	"DISCARD" TX RNR F=1 V(A)=N(R)		"DISCARD" TX REJ F=1 V(A)=N(R) 8.5	"DISCARD" TX RR F=1 V(A)=N(R)	"DISCARD" TX RNR F=1 V(A)=N(R)	
I command P=0 N(S) ≠ V(R) V(A)<N(R)<V(S)	"DISCARD" TX REJ F=0 V(A)=N(R) 8.1	"DISCARD" V(A)=N(R)			"DISCARD" TX REJ F=0 V(A)=N(R) 8.5	"DISCARD" V(A)=N(R)		

TABLE D-3.7 STATE TRANSITION TABLE: Receiving I command frame with correct format acknowledging all outstanding I frames or containing an N(R) which is V(A) < N(R) < V(S); no clearance of timer recovery

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
I command P=1 N(S) = V(R) V(A)=N(R)<V(S)	V(R)=V(R)+1 DL-DATA-IND TX RR F=1	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 8.0	"DISCARD" TX RNR F=1		V(R)=V(R)+1 DL-DATA-IND TX RR F=1	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 8.4	"DISCARD" TX RNR F=1	
I command P=0 N(S) = V(R) V(A)=N(R)<V(S)	V(R)=V(R)+1 DL-DATA-IND TX ACK	V(R)=V(R)+1 DL-DATA-IND TX ACK 8.0	"DISCARD"		V(R)=V(R)+1 DL-DATA-IND TX RR F=0	V(R)=V(R)+1 DL-DATA-IND TX RR F=0 8.4	"DISCARD"	
I command P=1 N(S) ≠ V(R) V(A)=N(R)<V(S)	"DISCARD" TX REJ F=1 8.1	"DISCARD" TX RR F=1	"DISCARD" TX RNR F=1		"DISCARD" TX REJ F=1 8.5	"DISCARD" TX RR F=1	"DISCARD" TX RNR F=1	
I command P=0 N(S) ≠ V(R) V(A)=N(R)<V(S)	"DISCARD" TX REJ F=0 8.1	"DISCARD"			"DISCARD" TX REJ F=0 8.5	"DISCARD"		
I command P=1 N(S) = V(R) N(R) error	V(R)=V(R)+1 DL-DATA-IND TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		"DISCARD" TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		V(R)=V(R)+1 DL-DATA-IND TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		"DISCARD" TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
I command P=0 N(S) = V(R) N(R) error	V(R)=V(R)+1 DL-DATA-IND MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		"DISCARD" MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		V(R)=V(R)+1 DL-DATA-IND MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		"DISCARD" MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
I command P=1 N(S) ≠ V(R) N(R) error	"DISCARD" TX REJ F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		"DISCARD" TX REJ F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" TX RR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" TX RNR F=1 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	
I command P=0 N(S) ≠ V(R) N(R) error	"DISCARD" TX REJ F=0 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1			"DISCARD" TX REJ F=0 MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1	"DISCARD" MDL-ERR-IND(J) RC = 0 TX SABME P=1 RESTART T200 5.1		

TABLE D-3.8 STATE TRANSITION TABLE: Receiving I command frame with correct format containing an N(R) which is V(A) = N(R) < V(S) or an N(R) error

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
T200 TIME-OUT RC <N200 V(A) <V(S)	TX RR P=1 then RC=RC+1 START T200		TX RNR P=1 then RC=RC+1 START T200		TX RR P=1 RC=RC+1 START T200		TX RNR P=1 RC=RC+1 START T200	
T200 TIME-OUT RC <N200 V(A) = V(S)	TX RR P=1 RC = RC+1 START T200		TX RNR P=1 RC = RC+1 START T200					
T200 TIME-OUT RC = N200	MDL-ERR-IND(I) RC=0 TX SABME P=1 START T200 5.1							
T203 TIME-OUT	/	/	/	/	/	/	/	/
SET OWN RECEIVER BUSY (Note)	TX RNR F=0 8.2	TX RNR F=0 8.3	-	-	TX RNR F=0 8.6	TX RNR F=0 8.7	-	-
CLEAR OWN RECEIVER BUSY (Note)	-	-	TX RR F=0 8.0	TX RR F=0 8.1	-	-	TX RR F=0 8.4	TX RR F=0 8.5

TABLE D-3.9 STATE TRANSITION TABLE: Internal events (Expiry of timers, receiver busy condition); initiation of a re-establishment procedure if the value of the retransmission count variable is equal to N200

Note - These signals are generated outside the procedures specified in this state transition table, and may be generatd by the connection management entity.

BASIC STATE	TIMER RECOVERY							
TRANSMITTER CONDITION	NORMAL	NORMAL	NORMAL	NORMAL	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY	PEER REC. BUSY
RECEIVER CONDITION	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY	NORMAL	REJ RECOVERY	OWN REC. BUSY	REJ&OWN RX BUSY
STATE NUMBER	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7
SABME incorrect length	MDL-ERR-IND(N) RC = 0 TX SABME P=1 RESTART T200 5.1							
DISC incorrect length								
UA incorrect length								
DM incorrect length								
FRMR incorrect length								
Supervisory frame RR, REJ, RNR incorrect length								
N201 error	MDL-ERR-IND(O) RC = 0 TX SABME P=1 RESTART T200 5.1							
Undefined command and response control field	MDL-ERR-IND(L) RC = 0 TX SABME P=1 RESTART T200 5.1							
I field not permitted	MDL-ERR-IND(M) RC = 0 TX SABME P=1 RESTART T200 5.1							

TABLE D-3.10 STATE TRANSITION TABLE: Receiving frame with incorrect format or frame with undefined control field

APPENDIX E

EXAMPLES OF THE USE OF PRIMITIVES

```
              L3 Call request (CEI)
   ^        +-------------------------+                ^
   |                |                                  |
   |                V                                  |
   |           DL-ESTABLISH-REQUEST (CEI)              |
+----------         |                                  |
|DL-EST-CONF\     New link? ---+                       |
| (CEI)     /    |No        Yes|                  +-----------
+----------      |             |                  | DL-REL-IND \
   |        Link already       |                  |   (CEI)    /
   |<-------established?       |                  +-----------
   |  Yes         No |<--------+                       |
   |          +-----+--                           +--------
   |          | PH-ACT. \                         | MDL-ERR.\
   |          |   REQ.  /                         |  IND.   /
   |          +-----+--                           +--------
   |                +------------------Time out----->+
   |                |                                ^
   |         -----------+                            |
   |         \ PH-ACTIV.|                            |
   |         /  INDIC.  |                            |
   |         -------+---+                            |
   |          TEI assigned ?                         |
   |                |                                |
   |     +----Yes---+                                |
   |     |         No                                |
   |     |    +-----+--                              |
   |     |    | MDL-ASS.\                            |
   |     |    |  INDIC. /                            |
   |     |    +-----+--                              |
   |     |          +----T202 + N202 retries-------->+
   |     |       OK |                                ^
   |     |   ------------+                           |
   |     |   \ MDL-ASSIGN|                           |
   |     |   /  REQUEST  |                           |
   |     |   ------------+                           |
   |     |          |                                |
   |     |   Associate CEI-DLCI                      |
   |     +--------->|                                |
   |            TEI memorized                        |
   ^                |                                |
   |       ESTABLISH LINK (SABM,UA)                  |
   |                |                                |
   |           UA received--------No-----------------+
   +---Yes----------+
     Multiple frame
      Established
```

Figure E.1 - Example of the use of primitives on the TE side on an outgoing call

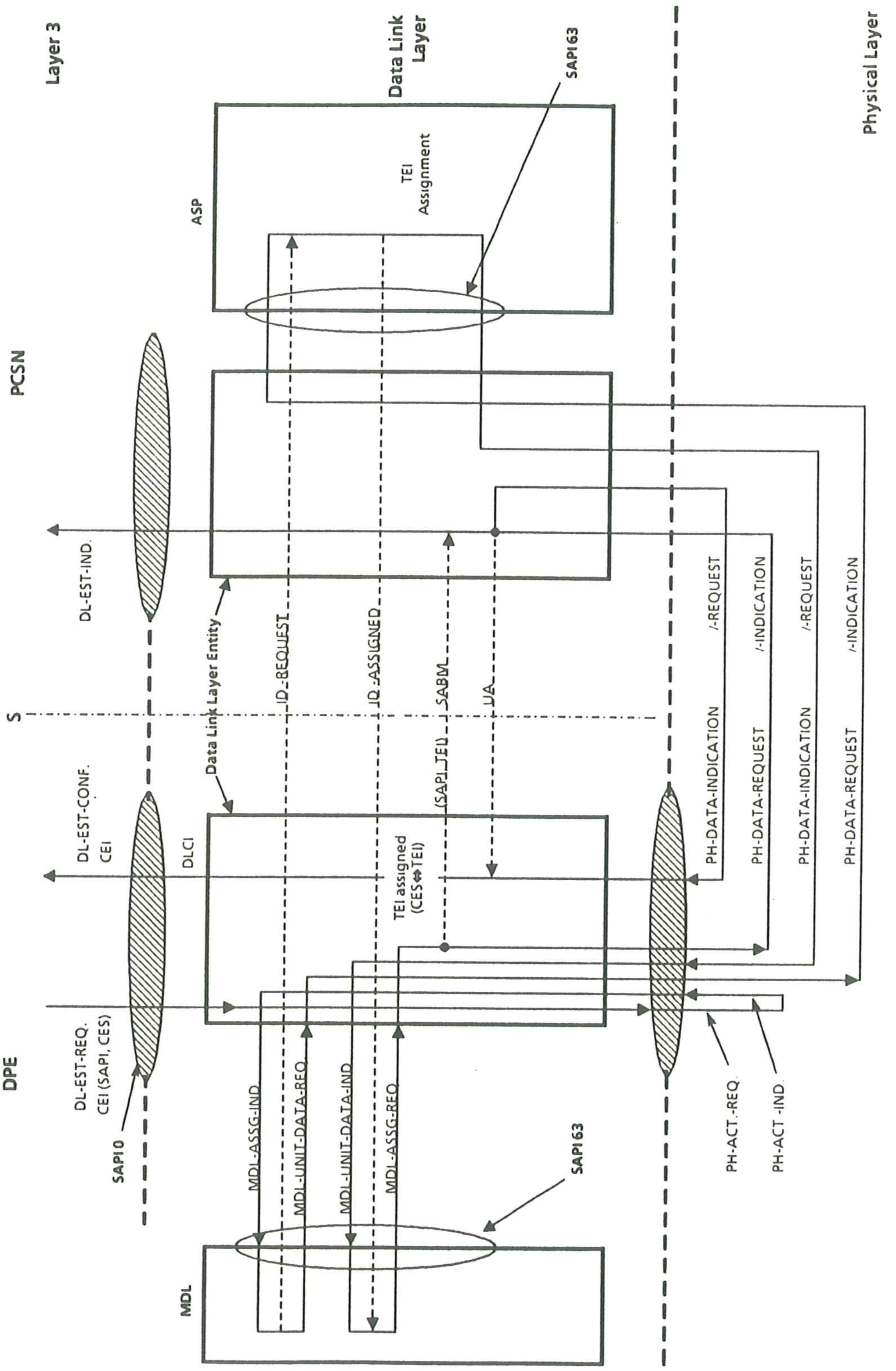


Figure E.2 - Example of the Information Flow on a DATA-LINK ESTABLISHMENT REQUEST (e.g. for an outgoing Call)

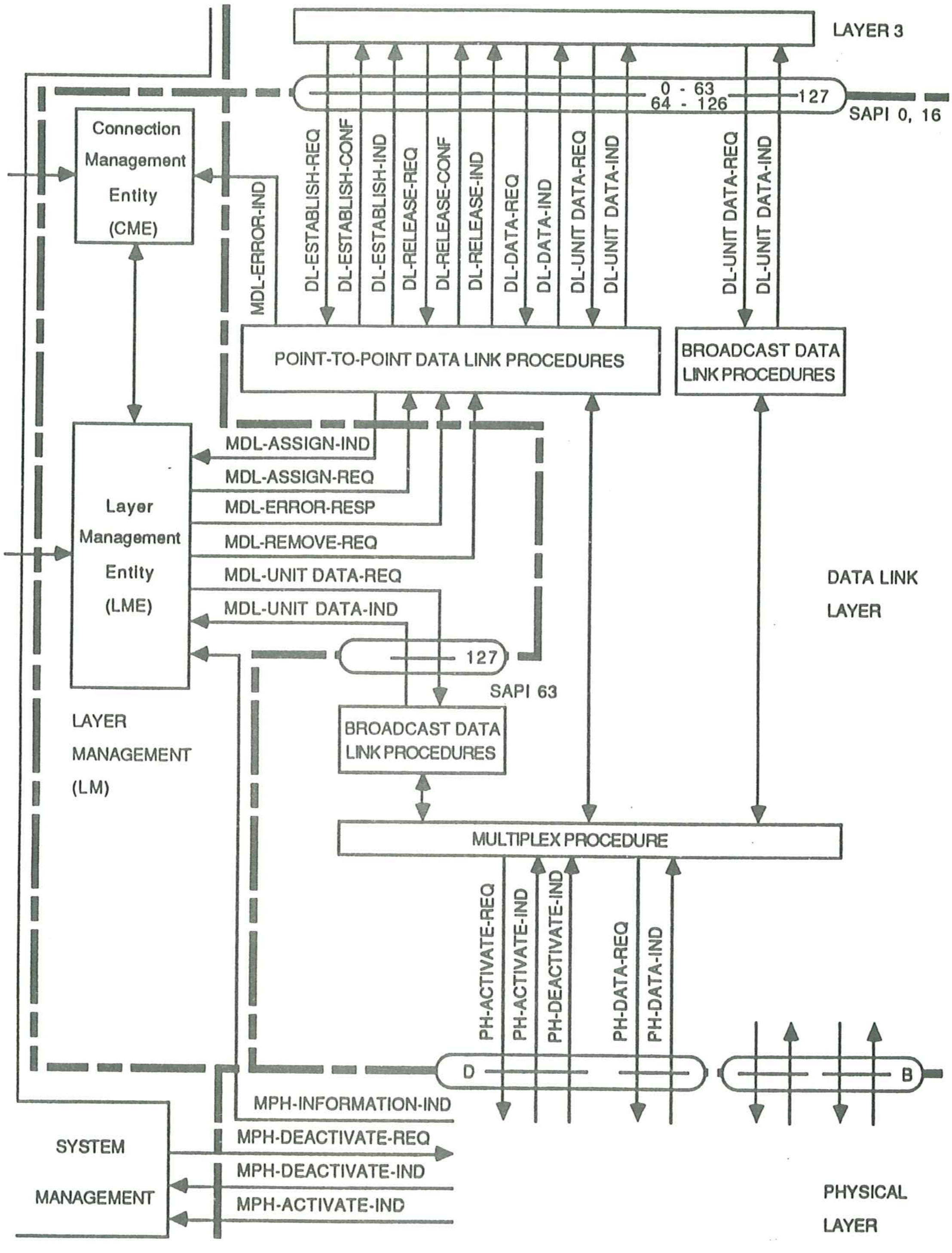


Figure E.3 - Block interaction diagram

APPENDIX F

LIST OF ACRONYMS

Ai	Action Indicator
ASP	Assignment Source Point
C/R	Command/Response field bit
CEI	Connection Endpoint Identifier
CES	Connection Endpoint Suffix
DISC	DISConnect
DL	Between layer 3 and Data Link Layer
DLCI	Data Link Connection Identifier
DM	DIsconnect Mode
EA	Extended Address field bit
ET	Exchange Termination
FCS	Frame Check Sequence
FRMR	FRaMe Reject
I	Information
ID	IDentity
ISDN	Integrated Services Digital Network
ISO	International Organization of Standardization
L3	Layer 3
L2	Layer 2
L1	Layer 1
LAPB	Link Access Procedure - Balanced
LAPD	Link Access Procedure on the D-channel
M	Modifier function bit
MDL-	Between Management entity and Data Link Layer
NT2	Network Termination 2
OSI	Open System Interconnection
P/F	Poll/Final bit
PH-	Between Data Link Layer and Physical layer
REJ	REJect
Ri	Request reference number
RNR	Receive Not Ready
RR	Receive Ready
S	Supervisory
S	Supervisory function bit
SABME	Set Asynchronous Balanced Mode Extended
SAP	Service Access Point
SAPI	Service Access Point Identifier
TE	Terminal Equipment
TEI	Terminal Equipment Identifier
U	Unnumbered
UA	Unnumbered Acknowledgement
UI	Unnumbered Information
XID	Exchange Identification