



ATIS-1000607.2014

**Integrated Services Digital Network (ISDN) –
Layer 3 Signaling Specification for Circuit
Switched Bearer Service for Digital Subscriber
Signaling System Number 1 (DSS1)**

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American National Standard

Integrated Services Digital Network (ISDN) – Layer 3 Signaling Specification for Circuit Switched Bearer Service for Digital Subscriber Signaling System Num- ber 1 (DSS1)

Alliance for Telecommunications Industry Solutions

Approved June 2014

American National Standards Institute, Inc.

Abstract:

This standard specifies the procedures for the establishing, maintaining, and clearing of network connection at the Integrated Services Digital Network (ISDN) user-network interface for the support of circuit switched calls. These procedures are defined in terms of messages exchange over the D-channel.

Foreword

The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

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At the time of consensus on this document, PTSC, which was responsible for its development, had the following leadership:

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- V. Shaikh, PTSC Vice-Chair (ACS)
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American National Standard
for Telecommunications –

Integrated Services Digital Network (ISDN) – Layer 3 Signaling Specification for Circuit Switched Bearer Service for Digital Subscriber Signaling System Number 1 (DSS1)

1 General

1.1 Scope and purpose

This standard specifies the procedures for the establishing, maintaining, and clearing of network connections at the Integrated Services Digital Network (ISDN) user-network interface for support of circuit-switched calls. These procedures are defined in terms of messages exchanged over the D-channel. The functions and procedures of this protocol, and the relationship with other layers, are described in general terms in ITU-T Recommendation Q.930, *ISDN User-Network Interface: Layer 3 General Aspects*.

One of the key characteristics of an ISDN is the use of an internationally standardized set of messages and procedures as a layer 3 protocol for control of connections at interfaces between users and the ISDN (“user-network interfaces”).

This document defines the messages and procedures employed for control of circuit-switched connections at user-network interfaces. These messages and procedures are applicable to both basic-rate and primary-rate interfaces. They are generally aligned with those defined in ITU-T Recommendation Q.931, *ISDN User-Network Interface: Layer 3 Specification*.

Packet-mode connections and supplementary services are not addressed in this standard.

Messages and procedures for the control of packet-mode connections and supplementary services are defined in other American National Standards.

1.2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indication below.

ATIS-1000602.1996(R2014), *Telecommunications – Integrated Services Digital Network (ISDN) – Data Link Layer Signaling Specification for Application at the User-Network Interface*¹

¹ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=24726>>

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ATIS-1000610.1998(R2013), *Telecommunications – Generic Procedures for the Control of ISDN Supplementary Services*²

ATIS-1000610.a.1998(R2013), *Telecommunications – Generic Procedures for the Control of ISDN Supplementary Services, Modification to the Redirecting Number Information Element*³

ATIS-1000619.1992(R2010), *Telecommunications – Integrated Services Digital Network (ISDN) – Multi-level Precedence and Preemption (MLPP) Service Capability*⁴

ATIS-1000619.a.1994(R2012), *Telecommunications – Integrated Services Digital Network (ISDN) – Multi-level Precedence and Preemption (MLPP) Service Capability (MLPP Service Domain and Cause Value Changes)*⁵

ATIS-1000621.1992(R2009), *Telecommunications – Integrated Services Digital Network (ISDN) – User-to-User Signaling Supplementary Service*⁶

ATIS-1000625.1993(R2013), *Telecommunications – Integrated Services Digital Network (ISDN) – Calling Line Identification Presentation and Restriction Supplementary Services*⁷

ATIS-1000625.a.1998(R2013), *Telecommunications – Integrated Services Digital Network (ISDN) – Calling Line Identification Presentation and Restriction Supplementary Services, Application of Standard to Wireless PCS Applications*⁸

ATIS-1000628.2000(R2010), *Telecommunications – Emergency Calling Service*⁹

ATIS-1000650.1995(R2010), *Telecommunications – Integrated Services Digital Network (ISDN) – Usage of the Cause Information Element in Digital Subscriber Signaling System Number 1 (DSS1)*¹⁰

² This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=27979>>

³ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=27980>>

⁴ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=24948>>

⁵ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=26093>>

⁶ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=24746>>

⁷ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=27977>>

⁸ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=27978>>

⁹ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=24966>>

¹⁰ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=24967>>

1.3 Definitions

For a list of common communications terms and definitions, please visit the *ATIS Telecom Glossary*, which is located at < <http://www.atis.org/glossary> >.

1.3.1 ASCII (American Standard Code for Information Interchange): A 7-bit code for 128 alphanumeric and control characters for the general interchange of information among information processing systems, communications systems, and associated equipment, defined in ANSI X3.4.

1.3.2 B-channel: A 64-kbit/s channel accompanied by timing, intended to carry a wide variety of user information streams, such as voice encoded at 64 kbit/s, data information at bit rates less than or equal to 64 kbit/s, wideband voice encoded at 64 kbit/s, and voice encoded at bit rates less than 64 kbit/s alone or combined with other digital information streams.

1.3.3 basic rate interface: An ISDN user-network interface where the interface structure is composed of two B-channels and one D-channel, 2B+D. The bit rate of the D-channel in this structure is 16 kbit/s.

1.3.4 bi-directional asymmetric: The condition in which the information flow characteristics provided by the service are different in the two directions.

1.3.5 bi-directional symmetric: The condition in which the information flow characteristics provided by the service are the same between two (or more) reference points in the forward and backward directions.

1.3.6 CCITT (International Telegraph and Telephone Consultative Committee): See ITU-T.

1.3.7 D-channel: A 16- or 64-kbit/s channel carrying control and signaling information and, optionally, packetized information and telemetry.

1.3.8 functional group: Sets of functions that may be needed in ISDN user access arrangements. In a particular access arrangement, specific functions in a functional group may or may not be present, and may be performed in one or more pieces of equipment.

1.3.9 H-Channel: A 384- or 1536-kbit/s channel (H_0 and H_{11} , respectively) accompanied by timing, intended to carry a wide variety of user information streams, such as fast facsimile, video, high-speed data, high-quality audio, information streams each at rates less than the respective H-channel bit rate that have been rate-adapted or multiplexed together, and packet-switched information.

1.3.10 ISDN (Integrated Services Digital Network): Defined as a network, in general evolving from an existing telephony network, which provides end-to-end digital connectivity to support a wide range of both voice and non-voice services. User access to an ISDN is via a limited set of standard multi-purpose interfaces.

1.3.11 ITU-T (International Telecommunication Union – Telecommunication Standardization Sector): The ITU has been a specialized agency of the United Nations since 1948. As the oldest international treaty organization, it traces its formal beginnings to 1865. The ITU-T traces its formal beginnings to 1954, when its predecessor, the International Telegraph and Telephone Consultative Committee (CCITT) was founded for the purpose of promoting and ensuring the operation of international telecommunications systems.

1.3.12 network or network side: The system or equipment on one side of the ISDN user-network interface (basic rate or primary rate) that provides a port through which the user gains access to the telecommunication services offered by the ISDN.

1.3.13 Network Termination 1 (NT1): A functional group that includes functions broadly equivalent to layer 1 (physical) of the OSI reference model. These functions are associated with the proper physical

and electromagnetic termination of the network, and include line transmission termination layer 1, the maintenance functions, performance monitoring, timing, power transfer, layer 1 multiplexing, and interface termination.

1.3.14 Network Termination 2 (NT2): A functional group that includes functions broadly equivalent to layer 1 and higher layers of the ITU-T Recommendation X.200 reference model. PBXs, local area networks, and terminal controllers are examples of equipment or combinations of equipment that provide NT2 functions. These functions include layer 2 and layer 3 protocol handling, layer 2 and layer 3 multiplexing, switching, concentration, maintenance functions, and interface termination.

1.3.15 primary rate interface: An ISDN user-network interface where the interface structure is composed of multiple B-channels and one D-Channel. The bit rate of the D-channel in this structure is 64 kbit/s. When a 1544-kbit/s primary rate interface is provided, the interface structure is 23B+D.

1.3.16 Public Safety Answering Point (PSAP): A facility equipped and staffed to receive 911 calls.

1.3.17 reference point: A conceptual point dividing functional groups in an ISDN access arrangement. In a specific access arrangement, a reference point may correspond to a physical interface between pieces of equipment, or there may not be any physical interface corresponding to the reference point.

1.3.18 S reference point: The conceptual reference point dividing the TE and NT2 in a particular ISDN access arrangement.

1.3.19 T reference point: The conceptual reference point dividing the NT2 and the NT1 in a particular ISDN access arrangement.

1.3.20 Terminal Equipment (TE): A functional group that includes functions broadly belonging to layer 1 and higher layers of the ITU-T Recommendation X.200 reference model. Digital telephones, data terminal equipment, and integrated workstations are examples of equipment (or combinations of equipment) that provide these functions. These functions include protocol handling, maintenance functions, interface functions, and connection functions to other equipment.

1.3.21 U reference point: A conceptual reference point on the network side of the NT1 in a particular ISDN access arrangement.

1.3.22 unidirectional: The condition in which the information flow is provided only in one direction.

1.3.23 user or user side: The call control in the user equipment that communicates to the network across the basic or primary rate interface.

1.4 Abbreviations & Acronyms

ANSI	American National Standards Institute
ABM	Asynchronous Balanced Mode (of HDLC)
ADPCM	Adaptive Differential Pulse Code Modulation
AFI	Authority and Format Identifier
ARM	Asynchronous Response Mode (of HDLC)
ASCII	American Standard Code for Information Interchange
ATIS	Alliance for Telecommunications Industry Solutions
BC	Bearer Capability

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BCD	Binary Coded Decimal
CCITT	International Telegraph and Telephone Consultative Committee
CEI	Connection Endpoint Identifier
CIC	Carrier Identification Codes
CLIP	Calling Line Identification Presentation
CONS	Connection Oriented Network Service
CRV	Call Reference Value
DCE	Data Circuit-terminating Equipment
DLCI	Data Link Connection Identifier
DDI	Direct Dialing-In
DISC	Disconnect
DM	Disconnected Mode
DS1	Digital Signal Level 1
DSS1	Digital Subscriber Signaling System No. 1
DTE	Data Terminal Equipment
FCC	Federal Communications Commission
FE	Far End
HDLC	High-level Data Link Control
HLC	High Layer Compatibility
ICD	International Code Designator
IEC	International Electrotechnical Commission
IS	In Service
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
IWU	Interworking Unit
LAN	Local Area Network
LATA	Local Access and Transport Area
LLC	Low Layer Compatibility
LLI	Logical Link Identifier
MB	Maintenance Busy

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MLPP	Multi-level Precedence and Preemption
MOOS	Manual Out-Of-Service
NE	Near End
NIC	Network Independent Clock
NM	Network Management
NRM	Normal Response Mode (of HDLC)
NSAP	Network Service Access Point
NT1	Network Termination 1
NT2	Network Termination 2
OOS	Out-Of-Service
OSI	Open Systems Interconnection
PBX	Private Branch Exchange
PCS	Personal Communications Service
PSAP	Public Safety Answering Point
PSTN	Public Switched Telephone Network
RX	Reception
SABME	Set Asynchronous Balanced Mode Extended
SAPI	Service Access Point Identifier
SDL	Specification and Description Language
SLP	Single Link Procedure
STBY	Standby
TE	Terminal Equipment
TEI	Terminal Endpoint Identifier
TID	Terminal Identifier
TX	Transmission
UA	Unnumbered Acknowledgment
UDI	Unrestricted Digital Information
UDI-TA	Unrestricted Digital Information with Tones/Announcements
UI	Unnumbered Information
USID	User Service Identifier

2 Overview of Call Control

In this standard, the terms “incoming” and “outgoing” are used to describe the call as viewed by the user side of the interface.

This clause defines the basic call control states that individual calls may have. These definitions do not apply to the state of the interface itself, any attached equipment, the D-channel, or the logical links used for signaling on the D-channel. Because several calls may exist simultaneously at a user-network interface, and each call may be in a different state, the state of the interface itself cannot be unambiguously defined.

Detailed descriptions of the procedures for call control are given in clause 5, in terms of:

- a) the messages defined in clause 3 that are transferred across the user-network interface; and
- b) the information processing and actions that take place at the user side and the network side.

Overview and detailed Specification and Description Language (SDL) diagrams for call control of circuit-switched calls are contained in Annex A.

Throughout this standard, references are made to B-channels. For services using H-channels, the references to B-channels should be taken to refer to the appropriate H-channel.

2.1 *Circuit-Switched Calls*

This clause defines the basic call control states for circuit-switched calls. The procedures for call control are given in clause 5.

2.1.1 **Call States at the User Side of the Interface**

The states that may exist on the user side of the user-network interface are defined in this subclause.

2.1.1.1 **Null (U0)**

No call exists.

2.1.1.2 **Call Initiated (U1)**

This state exists for an outgoing call when the user requests call establishment from the network.

2.1.1.3 **Overlap Sending (U2)**

This state exists for an outgoing call when the user has received acknowledgment of the call establishment request that permits the user to send additional call information to the network in overlap mode.

2.1.1.4 **Outgoing Call Proceeding (U3)**

This state exists for an outgoing call when the user has received acknowledgment that the network has received all call information necessary to effect call establishment.

2.1.1.5 Call Delivered (U4)

This state exists for an outgoing call when the calling user has received an indication that remote user alerting has been initiated.

2.1.1.6 Call Present (U6)

This state exists for an incoming call when the user has received a call establishment request but has not yet responded.

2.1.1.7 Call Received (U7)

This state exists for an incoming call when the user has indicated alerting but has not yet answered.

2.1.1.8 Connect Request (U8)

This state exists for an incoming call when the user has answered the call and is waiting to be awarded the call.

2.1.1.9 Incoming Call Proceeding (U9)

This state exists for an incoming call when the user has sent acknowledgement that the user has received all call information necessary to effect call establishment.

2.1.1.10 Active (U10)

This state exists for an incoming call when the user has received an acknowledgement from the network that the user has been awarded the call. This state exists for an outgoing call when the user has received an indication that the remote user has answered the call.

2.1.1.11 Disconnect Request (U11)

This state exists when the user has requested the network to clear the end-to-end connection (if any) and is waiting for a response.

2.1.1.12 Disconnect Indication (U12)

This state exists when the user has received an invitation to disconnect because the network has disconnected the end-to-end connection (if any).

2.1.1.13 Release Request (U19)

This state exists when the user has requested the network to release and is waiting for a response.

2.1.2 Network Call States

The call states that may exist on the network side of the user-network interface are defined in this sub-clause.

2.1.2.1 Null (N0)

No call exists.

2.1.2.2 Call Initiated (N1)

This state exists for an outgoing call when the network has received a call establishment request but has not yet responded.

2.1.2.3 Overlap Sending (N2)

This state exists for an outgoing call when the network has acknowledged the call establishment request and is prepared to receive additional call information (if any) in the overlap mode.

2.1.2.4 Outgoing Call Proceeding (N3)

This state exists for an outgoing call when the network has sent acknowledgement that the network has received all call information necessary to effect call establishment.

2.1.2.5 Call Delivered (N4)

This state exists for an outgoing call when the network has indicated that the remote user alerting has been initiated.

2.1.2.6 Call Present (N6)

This state exists for an incoming call when the network has sent a call establishment request but not yet received a satisfactory response.

2.1.2.7 Call Received (N7)

This state exists for an incoming call when the network has received an indication that the user is alerting but has not yet received an answer.

2.1.2.8 Connect Request (N8)

This state exists for an incoming call when the network has received an answer but the network has not yet awarded the call.

2.1.2.9 Incoming Call Proceeding (N9)

This state exists for an incoming call when the network has received acknowledgement that the user has received all call information necessary to effect call establishment.

2.1.2.10 Active (N10)

This state exists for an incoming call when the network has awarded the call to the called user. This state exists for an outgoing call when the network has indicated that the remote user has answered the call.

2.1.2.11 Disconnect Request (N11)

This state exists when the network has received a request from the user to clear the end-to-end connection (if any).

2.1.2.12 Disconnect Indication (N12)

This state exists when the network has disconnected the end-to-end connection (if any) and has sent an invitation to disconnect the user-network connection.

2.1.2.13 Release Request (N19)

This state exists when the network has requested the user to release and is waiting for a response.

2.1.2.14 Call Abort (N22)

This state exists for an incoming call for the point-to-multipoint configuration when the call is being cleared before any user has been awarded the call.

2.2 States Associated with the Global Call Reference

This subclause defines the states that the protocol may adopt using the global call reference. The procedures for use of the global call reference for restart procedures are contained in 5.5.

2.2.1 Call States at the User Side of Interface

The states that may exist on the user side of the user-network interface are defined in this subclause.

2.2.1.1 Null (Rest 0)

No transaction exists.

2.2.1.2 Restart Request (Rest 1)

This state exists for a restart transaction when the user has sent a restart request but has not yet received an acknowledgment response from the network.

2.2.1.3 Restart (Rest 2)

This state exists when a request for a restart has been received from the network and the internal idling of the specified channels and clearing of call references have not yet been completed.

2.2.2 Call States at the Network Side of the Interface

The states that may exist on the network side of the user-network interface are defined in this subclause.

2.2.2.1 Null (Rest 0)

No transaction exists.

2.2.2.2 Restart Request (Rest 1)

This state exists for a restart transaction when the network has sent a restart request but has not yet received an acknowledgment response from the user.

2.2.2.3 Restart (Rest 2)

This state exists when a request for a restart has been received from the user and the internal idling of the specified channels and clearing of call references have not yet been completed.

3 Message Functional Definitions & Content

This clause provides an overview of the message structure, which highlights the functional definition and information content (i.e., semantics) of each message. Each definition includes:

- a) A brief description of the message direction and use, including whether the message has:
 - 1) local significance, i.e., relevant only in the originating or terminating access;
 - 2) access significance, i.e., relevant in the originating and terminating access, but not in the network;
 - 3) dual significance, i.e., relevant in either the originating or terminating access and in the network;
or
 - 4) global significance, i.e., relevant in the originating and terminating access and in the network.
- b) A table listing the codeset 0 and 5 information elements in the order of their appearance in the message (same relative order for all message types). For each information element, the table indicates:

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- 1) the subclause of this standard describing the information element;
- 2) the direction in which it may be sent; i.e., user to network ('u → n'), network to user ('n → u'), or both;

NOTE — The user-network terminology in this clause refers to the TE -TE, TE - NT2, and NT2 - TE interface structures. Annex D contains a description of the information element usage for symmetric NT2 - NT2 interfaces.

- 3) whether inclusion is mandatory ('M') or optional ('O'), with a reference to notes explaining the circumstances under which the information element shall be included; and
- 4) the length of the information element (or permissible range of lengths), in octets, where "*" denotes an undefined maximum length, which may be network- or service-dependent.

NOTE — All messages may contain information elements from codesets 5, 6, and 7 and corresponding locking shift information elements that comply with the coding rules specified in 4.5.2 – 4.5.4. Codeset 6 and 7 information elements, however, are not listed in this clause.

- c) Further explanatory notes as necessary.

3.1 Messages for Circuit-Mode Connection Control

Table 1 summarizes the messages for circuit-mode connection control.

Table 1 – Messages for circuit-mode connection control

Message	Reference	Message	Reference
Call establishment messages:		Call Clearing Messages:	
ALERTING	3.1.1	DISCONNECT	3.1.5
CALL PROCEEDING	3.1.2	RELEASE	3.1.9
CONNECT	3.1.3	RELEASE COMPLETE	3.1.10
CONNECT ACKNOWLEDGE	3.1.4		
PROGRESS	3.1.8	Miscellaneous messages:	
SETUP	3.1.11	INFORMATION	3.1.6
SETUP ACKNOWLEDGE	3.1.12	NOTIFY	3.1.7
		STATUS	3.1.13
		STATUS ENQUIRY	3.1.14
<p>NOTE – In ATIS-1000607, support of user-user signaling was included for a number of reasons, including support of additional compatibility checking upon bilateral agreement with other users, or in accordance with other standards (e.g., ITU-T Recommendation X.213). To utilize this capability, the user-user information element may be included in the ALERTING, CONNECT, DISCONNECT, PROGRESS, RELEASE, RELEASE COMPLETE, and SETUP messages. Details of this capability (implicit type 1 user-user signaling) are given ATIS-1000621.</p>			

3.1.1 ALERTING

This message is sent by the called user to the network and by the network to the calling user to indicate that called user alerting has been initiated.

Table 2 - ALERTING message content

Type: ALERTING Significance: global Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Bearer capability	4.5.5	both	O (Note 1)	2-12
Channel Identification	4.5.12	both (Note 2)	O (Note 3)	2-*
Progress indicator	4.5.21	both	O (Note 4)	2-4
Display	4.5.15	n → u	O (Note 5)	2-82
Signal	4.5.24	n → u	O (Note 6)	2-3

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High layer compatibility	4.5.16	both	O (Note 7)	2-5
Locking shift	4.5.3	n → u	O (Note 8)	1
Display text	4.6.2	n → u	O (Note 5)	2-*
NOTES				
1 Included if the optional procedures of 5.11 for bearer capability selection apply. When present, progress description value 5 "interworking has occurred and has resulted in a telecommunication service change" shall also be present.				
2 May be included in the network-to-user direction for support of the procedures in Annex D.				
3 Mandatory if this message is the first message in response to a SETUP message.				
4 Included in the event of interworking. Included in the network-to-user direction in connection with the provision of in-band information and patterns. Included in the user-to-network direction in connection with the provision of in-band information and patterns if Annex N is implemented or in accordance with the procedures of 5.11.3 and 5.12.3.				
5 Included if the network provides information that can be presented to the user.				
6 Included if the network optionally provides additional information describing tones.				
7 Included if the optional procedures of 5.12 for high layer compatibility selection apply. When present, progress description value 5 "interworking has occurred and has resulted in a telecommunication service change" shall also be present.				
8 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

3.1.2 CALL PROCEEDING

This message is sent by the called user to the network and by the network to the calling user to indicate that the requested call establishment has been initiated and no more call establishment information will be accepted.

Table 3 - CALL PROCEEDING message content

Type: CALL PROCEEDING Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Bearer capability	4.5.5	both	O (Note 1)	2-12
Channel Identification	4.5.12	both	O (Note 2)	2-*
Progress indicator	4.5.21	both	O (Note 3)	2-4
Display	4.5.15	n → u	O (Note 4)	2-82
High layer compatibility	4.5.16	n → u	O (Note 5)	2-5
Locking shift	4.5.3	n → u	O (Note 6)	1
Display text	4.6.2	n → u	O (Note 4)	2-*

NOTES

- 1 Included if the optional procedures of 5.11 for bearer capability selection apply. When present, progress description value 5 "interworking has occurred and has resulted in a telecommunication service change" shall also be present.
- 2 Mandatory if this message is the first message in response to a SETUP message.
- 3 Included in the event of interworking. Included in the network-to-user direction in connection with the provision of in-band information and patterns. Included in the user-to-network direction in connection with the provision of in-band information and patterns if Annex N is implemented or in accordance with the procedures of 5.11.3 and 5.12.3.
- 4 May be included if the network provides information that can be presented to the user.
- 5 Included if the optional procedures of 5.12 for high layer compatibility selection apply. When present, progress description value 5 "interworking has occurred and has resulted in a telecommunication service change" shall also be present.
- 6 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.

3.1.3 CONNECT

This message is sent by the called user to the network and by the network to the calling user to indicate call acceptance by the called user.

Table 4 - CONNECT message content

Type: CONNECT Significance: global Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Bearer capability	4.5.5	both	O (Note 1)	2-12
Channel Identification	4.5.12	both (Note 2)	O (Note 3)	2-*
Progress indicator	4.5.21	both	O (Note 4)	2-4
Display	4.5.15	n → u	O (Note 5)	2-82
Signal	4.5.24	n → u	O (Note 6)	2-3
Connected number	4.5.13	both	O (Note 7)	2-19
Connected subaddress	4.5.14	both	O (Note 8)	2-23
Low layer compatibility	4.5.18	both	O (Note 9)	2-16
High layer compatibility	4.5.16	both	O (Note 10)	2-5
Locking shift	4.5.3	n → u	O (Note 11)	1
Display text	4.6.2	n → u	O (Note 5)	2-*

NOTES

- 1 Included if the optional procedures of 5.11 for bearer capability selection apply.
- 2 Included in the network-to-user direction for support of the procedures in Annex D.
- 3 Mandatory if this message is the first message in response to a SETUP message.
- 4 Included in the event of interworking or in connection with the provision of in-band tones and patterns.
- 5 May be included if the network provides information that can be presented to the user.
- 6 Included if the network optionally provides additional information describing tones.
- 7 May be included by the responding party to indicate to the calling party the number of the responding party. Procedures may be needed to describe treatment of the information element in conjunction with supplementary services, e.g., Call Forwarding, Line Hunting. Specification of these procedures is service-dependent and requires further study. Use of this information element to support the OSI Network Service is only applicable to the 64 kbit/s unrestricted and 64 kbit/s restricted bearer services. See Annex Q for procedures for delivery of this information element.
- 8 May be included by the responding party to indicate to the calling party the subaddress of the responding party. Procedures may be needed to describe treatment of the information element in conjunction with supplementary services, e.g., Call Forwarding, Line Hunting. Specification of these procedures is service-dependent and requires further study. Use of this information element to support the OSI Network Service is only applicable to the 64 kbit/s unrestricted and 64 kbit/s restricted bearer services. See Annex Q for procedures for delivery of this information element.
- 9 Included in the user-to-network direction when the answering user wants to return low layer compatibility information to the calling user. Included in the network-to-user direction if the user that was awarded the call included a low layer compatibility information element in the CONNECT message. Optionally included for low layer compatibility negotiation to the calling user (see Annex M).
- 10 Included if the optional procedures of 5.12 for high layer compatibility selection apply.
- 11 Included if Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.

3.1.4 CONNECT ACKNOWLEDGE

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

Table 5 - CONNECT ACKNOWLEDGE message content

Type: CONNECT ACKNOWLEDGE Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Display	4.5.15	n → u	O (Note 1)	2-82
Signal	4.5.24	n → u	O (Note 2)	2-3
Locking shift	4.5.3	n → u	O (Note 3)	1

Display text	4.6.2	n → u	O (Note 1)	2-*
NOTES 1 May be included if the network provides information that can be presented to the user. 2 Included if the network optionally provides additional information describing tones. 3 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

3.1.5 DISCONNECT

This message is sent by the user to request the network to clear an end-to-end connection or is sent by the network to indicate that the end-to-end connection is cleared.

Table 6 - DISCONNECT message content

Type: DISCONNECT Significance: global Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Cause	4.5.11	both	M	4-32
Display	4.5.15	n → u	O (Note 1)	2-82
Signal	4.5.24	n → u	O (Note 2)	2-3
Connected number	4.5.13	both	O (Note 3)	2-19
Connected subaddress	4.5.14	both	O (Note 4)	2-23
Locking shift	4.5.3	n → u	O (Note 5)	1
Display text	4.6.2	n → u	O (Note 1)	2-*

NOTES

- 1 May be included if the network provides information that can be presented to the user.
- 2 Included if the network optionally provides additional information describing tones.
- 3 May be included by the responding party to indicate to the calling party the number of the responding party. This information element may be included only when this message is used as the first clearing message for a call that has not reached the Active state (state 10). Procedures may be needed to describe treatment of the information element in conjunction with supplementary services, e.g., Call Forwarding, Line Hunting. Specification of these procedures is service-dependent and requires further study. Use of this information element to support the OSI Network Service is only applicable to the 64 kbit/s unrestricted and 64 kbit/s restricted bearer services. See Annex Q for procedures for delivery of this information element.
- 4 May be included by the responding party to indicate to the calling party the subaddress of the responding party. This information element may be included only when this message is used as the first clearing message for a call that has not reached the Active state (state 10). Procedures may be needed to describe treatment of the information element in conjunction with supplementary services, e.g., Call Forwarding, Line Hunting. Specification of these procedures is service-dependent and requires further study. Use of this information element to support the OSI Network Service is only applicable to the 64 kbit/s unrestricted and 64 kbit/s restricted bearer services. See Annex Q for procedures for delivery of this information element.
- 5 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.

3.1.6 INFORMATION

This message is sent by the user or the network to provide additional information. It may be used to provide information for call establishment (e.g., overlap sending) or miscellaneous call-related information.

Table 7 - INFORMATION message content

Type: INFORMATION Significance: local (Note 1) Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Display	4.5.15	n → u	O (Note 2)	2-82
Keypad facility	4.5.17	u → n	O (Note 3)	2-34
Signal	4.5.24	n → u	O (Note 4)	2-3
Locking shift	4.5.3	n → u	O (Note 5)	1
Display text	4.6.2	n → u	O (Note 2)	2-*

NOTES	
1	This message has local significance, but may carry information of global significance.
2	May be included if the network provides information that can be presented to the user.
3	Included by the user to convey called party number information to the network during overlap sending. The keypad facility information element may also be included if the user wants to convey other call establishment information to the network.
4	Included if the network optionally provides additional information describing tones.
5	Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.

3.1.7 NOTIFY

This message is sent by the user or the network to indicate information pertaining to a call, such as bearer service change (see Annex O).

Table 8 - NOTIFY message content

Type: NOTIFY Significance: access Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Bearer Capability	4.5.5	n → u	O (Note 1)	2-12
Notification indicator	4.5.20	both	M	3
Display	4.5.15	n → u	O (Note 2)	2-82
Locking shift	4.5.3	n → u	O (Note 3)	1
Display text	4.6.2	n → u	O (Note 2)	2-*

NOTES	
1	Included by the network to indicate a change of the bearer capability (see Annex O).
2	May be included if the network provides information that can be presented to the user.
3	Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.

3.1.8 PROGRESS

This message is sent by the user or the network to indicate the progress of a call in the event of inter-working or in relation with the provision of in-band information and patterns.

Table 9 - PROGRESS message content

Type: PROGRESS Significance: global Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Bearer capability	4.5.5	both	O (Note 1)	2-12
Cause	4.5.11	both	O (Note 2)	2-32
Progress indicator	4.5.21	both	M	4
Display	4.5.15	n → u	O (Note 3)	2-82
Signal	4.5.24	n → u	O (Note 4)	2-3
High layer compatibility	4.5.16	both	O (Note 5)	2-5
Locking shift	4.5.3	n → u	O (Note 6)	1
Display text	4.6.2	n → u	O (Note 3)	2-*
NOTES 1 Included if the procedures of 5.11 for bearer capability selection apply. The Bearer capability information element indicates the bearer service now being used for the call. 2 Included by the user or the network to provide additional information concerning the provision of in-band information and patterns. 3 May be included if the network provides information that can be presented to the user. 4 Included if the network optionally provides additional information describing tones. 5 Included if the optional procedures of 5.12 for high layer compatibility selection apply. The High layer compatibility information element indicates the high layer compatibility now being used for the call. 6 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

3.1.9 RELEASE

This message is sent by the user or the network to indicate that the equipment sending the message has disconnected the channel (if any), intends to release the channel and the call reference, and that the receiving equipment should release the channel and prepare to release the call reference after sending RELEASE COMPLETE.

Table 10 - RELEASE message content

Type: RELEASE Significance: local (Note 1) Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Cause	4.5.11	both	O (Note 2)	2-32
Display	4.5.15	n → u	O (Note 3)	2-82
Signal	4.5.24	n → u	O (Note 4)	2-3
Connected number	4.5.13	both	O (Note 5)	2-19
Connected subaddress	4.5.14	both	O (Note 6)	2-23
Locking shift	4.5.3	n → u	O (Note 7)	1
Display text	4.6.2	n → u	O (Note 3)	2-*
NOTES 1 This message has local significance; however, it may carry information of global significance when used as the first call clearing message. 2 Mandatory in the first call clearing message, including when the RELEASE message is sent as a result of an error handling condition. 3 May be included if the network provides information that can be presented to the user. 4 Included if the network optionally provides additional information describing tones. 5 May be included by the responding party to indicate to the calling party the number of the responding party. This information element may be included only when this message is used as the first clearing message for a call that has not reached the Active state (state 10). Procedures may be needed to describe treatment of the information element in conjunction with supplementary services, e.g., Call Forwarding, Line Hunting. Specification of these procedures is service-dependent and requires further study. Use of this information element to support the OSI Network Service is only applicable to the 64 kbit/s unrestricted and 64 kbit/s restricted bearer services. See Annex Q for procedures for delivery of this information element. 6 May be included by the responding party to indicate to the calling party the subaddress of the responding party. This information element may be included only when this message is used as the first clearing message for a call that has not reached the Active state (state 10). Procedures may be needed to describe treatment of the information element in conjunction with supplementary services, e.g., Call Forwarding, Line Hunting. Specification of these procedures is service-dependent and requires further study. Use of this information element to support the OSI Network Service is only applicable to the 64 kbit/s unrestricted and 64 kbit/s restricted bearer services. See Annex Q for procedures for delivery of this information element. 7 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

3.1.10 RELEASE COMPLETE

This message is sent by user or the network to indicate that the equipment sending the message has released the channel (if any) and the call reference. The channel is available for reuse, and the receiving equipment shall release the call reference.

Table 11 - RELEASE COMPLETE message content

Type: RELEASE COMPLETE Significance: local (Note 1) Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Cause	4.5.11	both	O (Note 2)	2-32
Display	4.5.15	n → u	O (Note 3)	2-82
Signal	4.5.24	n → u	O (Note 4)	2-3
Connected number	4.5.13	both	O (Note 5)	2-19
Connected subaddress	4.5.14	both	O (Note 6)	2-23
Locking shift	4.5.3	n → u	O (Note 7)	1
Display text	4.6.2	n → u	O (Note 3)	2-*

NOTES

- 1 This message has local significance; however, it may carry information of global significance when used as the first call clearing message.
- 2 Mandatory in the first call clearing message, including when the RELEASE COMPLETE message is sent as a result of an error handling condition.
- 3 May be included if the network provides information that can be presented to the user.
- 4 Included if the network optionally provides additional information describing tones.
- 5 May be included by the responding party to indicate to the calling party the number of the responding party. This information element may be included only when this message is used as the first clearing message for a call that has not reached the Active state (state 10). Procedures may be needed to describe treatment of the information element in conjunction with supplementary services, e.g., Call Forwarding, Line Hunting. Specification of these procedures is service-dependent and requires further study. Use of this information element to support the OSI Network Service is only applicable to the 64 kbit/s unrestricted and 64 kbit/s restricted bearer services. See Annex Q for procedures for delivery of this information element.
- 6 May be included by the responding party to indicate to the calling party the subaddress of the responding party. This information element may be included only when this message is used as the first clearing message for a call that has not reached the Active state (state 10). Procedures may be needed to describe treatment of the information element in conjunction with supplementary services, e.g., Call Forwarding, Line Hunting. Specification of these procedures is service-dependent and requires further study. Use of this information element to support the OSI Network Service is only applicable to the 64 kbit/s unrestricted and 64 kbit/s restricted bearer services. See Annex Q for procedures for delivery of this information element.
- 7 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.

3.1.11 SETUP

This message is sent by the calling user to the network and by the network to the called user to initiate call establishment.

Table 12 - SETUP message content

Type: SETUP Significance: global Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Repeat indicator	4.5.22	both	O (Note 1)	1
Bearer capability	4.5.5	both	M (Note 2)	4-12
Channel identification	4.5.12	both	O (Note 3)	2-*
Progress indicator	4.5.21	both	O (Note 4)	2-4
Network-specific facilities	4.5.19	both	O (Note 5)	2-*
Display	4.5.15	n → u	O (Note 6)	2-82
Keypad facility	4.5.17	u → n	O (Note 7)	2-34
Signal	4.5.24	n → u	O (Note 8)	2-3
Calling party number	4.5.9	both	O (Note 9)	2-*
Calling party subaddress	4.5.10	both	O (Note 10)	2-23
Called party number	4.5.7	both	O (Note 11)	2-*
Called party subaddress	4.5.8	both	O (Note 12)	2-23
Transit network selection	4.5.25	u → n	O (Note 13)	2-*
Low layer compatibility	4.5.18	both	O (Note 14)	2-15
High layer compatibility	4.5.16	both	O (Note 15)	2-5
Locking shift	4.5.3	both	O (Note 16)	1
Emergency call control	4.6.3	n → u	O (Note 17)	2-3
Generic information	4.6.4	both	O (Note 18)	2-*
Operator system access	4.6.1	u → n	O (Note 19)	2-3
Display text	4.6.2	n → u	O (Note 6)	2-*

NOTES

- 1 The repeat indicator information element is included immediately before the first bearer capability information element when the bearer capability negotiation procedure is used (see Annex O).
- 2 May be repeated if the bearer capability negotiation procedure is used (see Annex O). For bearer capability negotiation, two Bearer capability information elements may be included, preceded by a Repeat indicator information element, in descending order of priority, i.e., highest priority first (see Annex O). Although support of multiple Bearer capability information elements may not be supported on all networks, on networks that do support it, and through suitable subscription arrangements, two Bearer capability information elements may be included for Bearer Capability negotiations as defined in Annex O, or up to three Bearer capability information elements may be included for Bearer capability selection as defined in 5.11. When they are not preceded by a Repeat indicator information element, they are included in ascending order of priority (see 5.11).
- 3 Mandatory in the network-to-user direction. Included in the user-to-network direction when the user wants to indicate a channel. If not included, its absence is interpreted as "any channel acceptable."
- 4 Included in the event of interworking or in connection with the provision of in-band information and patterns.
- 5 Included by the calling user or the network to indicate network-specific facilities information (see Annex E).
- 6 May be included if the network provides information that can be presented to the user.
- 7 Either the called party number or the keypad facility information element is included by the user to convey called party number information to the network. The keypad facility information element may also be included by the user to convey other call establishment information to the network.
- 8 Included if the network optionally provides additional information describing tones.
- 9 May be included by the calling user or the network to identify the calling user. This message may contain up to two instances of the Calling party number information element, when it is sent in the network to user direction. When this message contains one or two instances of the Calling party number information element, the called party must be subscribed to the Calling Line Identification Presentation (CLIP) supplementary service as defined in ATIS-1000625.
- 10 Included in the user-to-network direction when the calling user wants to indicate the calling party subaddress. Included in the network-to-user direction if the calling user included a calling party subaddress information element in the SETUP message.
- 11 Either the called party number or the keypad facility information element is included by the user to convey called party number information to the network. The called party number information element is included by the network when called party number information is conveyed to the user.
- 12 Included in the user-to-network direction when the calling user wants to indicate the called party subaddress. Included in the network-to-user direction if the calling user included a called party subaddress information element in the SETUP message.
- 13 Included by the calling user to select a particular transit network (see Annex C).
- 14 Included in the user-to-network direction when the calling user wants to pass low layer compatibility information to the called user. Included in the network-to-user direction if the calling user included a low layer compatibility information element in the SETUP message.
- 15 Included in the user-to-network direction when the calling user wants to pass High layer compatibility information to the called user. Included in the network-to-user direction if the calling user included a High layer compatibility information element in the SETUP message. Although support of multiple High layer compatibility information elements may not be supported on all networks, on networks that do support it, and through suitable subscription arrangements, two High layer compatibility information elements may be included (see 5.12). When they are not preceded by a Repeat indicator information element, they are included in ascending order of priority.
- 16 Included when the Emergency call control, Generic information, Operator system access or Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.
- 17 Included in network-to-user direction when the network wants to pass emergency call control information to an ISDN PSAP for an emergency service call (see Annex V).
- 18 Included in the user-to-network direction when the calling user wants to pass generic information to the network, e.g., caller location information for an emergency service call. Included in the network-to-user direction when the network wants to pass generic information to the called user, e.g., to send caller location information to an ISDN PSAP for an emergency service call (see Annex V). The Generic information information element may be repeated.
- 19 Included by the calling user to indicate a request for connection to an operator or attendant system. This information element applies to speech, 3.1kHz audio and unrestricted digital information with tones/announcements bearer services.

3.1.12 SETUP ACKNOWLEDGE

This message is sent by the network to the calling user to indicate that call establishment has been initiated, but that additional information may be required.

Table 13 - SETUP ACKNOWLEDGE message content

Type: SETUP ACKNOWLEDGE Significance: local Direction: network → user				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	n → u	M	1
Call reference	4.3	n → u	M	2-*
Message type	4.4	n → u	M	1
Channel Identification	4.5.12	n → u	M	3-*
Progress indicator	4.5.21	n → u	O (Note 1)	2-4
Display	4.5.15	n → u	O (Note 2)	2-82
Signal	4.5.24	n → u	O (Note 3)	2-3
Locking shift	4.5.3	n → u	O (Note 4)	1
Display text	4.6.2	n → u	O (Note 2)	2-*
NOTES 1 Included in the event of interworking or in connection with the provision of in-band information and patterns. 2 May be included if the network provides information that can be presented to the user. 3 Included if the network optionally provides additional information describing tones (e.g., activate dial tone). 4 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

3.1.13 STATUS

This message is sent by the user or the network in response to a STATUS ENQUIRY message or at any time during a call to report certain error conditions as listed in 5.8.

Table 14 - STATUS message content

Type: STATUS Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Cause	4.5.11	both	M	4-32
Call state	4.5.6	both	M	3
Display	4.5.15	n → u	O (Note 1)	2-82
Locking shift	4.5.3	n → u	O (Note 2)	1
Display text	4.6.2	n → u	O (Note 1)	2-*
NOTES 1 May be included if the network provides information that can be presented to the user. 2 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

3.1.14 STATUS ENQUIRY

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

Table 15 - STATUS ENQUIRY message content

Type: STATUS ENQUIRY Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	4.4	both	M	1
Display	4.5.15	n → u	O (Note 1)	2-82
Locking shift	4.5.3	n → u	O (Note 2)	1
Display text	4.6.2	n → u	O (Note 1)	2-*
NOTES 1 May be included if the network provides information that can be presented to the user. 2 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

3.2 Messages Used with the Global Call Reference

The messages that may use the global call reference as defined in 4.3 are summarized in Table 16.

Table 16 - Global call reference messages

Message	Reference
RESTART	3.2.1
RESTART ACKNOWLEDGE	3.2.2
STATUS	3.1.13

3.2.1 RESTART

This message is sent by the user or the network to request the recipient to restart (i.e., return to an idle condition) the indicated channel(s) or interface.

Table 17 - RESTART message content

Type: RESTART Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M (Note 1)	2-*
Message type	4.4	both	M	1
Channel identification	4.5.12	both	O (Note 2)	2-*
Display	4.5.15	n → u	O (Note 3)	2-82
Restart indicator	4.5.23	both	M	3
Locking shift	4.5.3	n → u	O (Note 4)	1
Display text	4.6.2	n → u	O (Note 3)	2 - *
NOTES 1 This message is sent with the global call reference as defined by in 4.3. 2 Included if necessary to indicate the particular channel(s) that is (are) to be restarted. 3 May be included if the network provides information that can be presented to the user. 4 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

3.2.2 RESTART ACKNOWLEDGE

This message is sent to acknowledge the receipt of the RESTART message and to indicate that the requested restart is complete.

Table 18 - RESTART ACKNOWLEDGE message content

Type: RESTART ACKNOWLEDGE Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M (Note 1)	2-*
Message type	4.4	both	M	1
Channel identification	4.5.12	both	O (Note 2)	2-*
Display	4.5.15	n → u	O (Note 3)	2-82
Restart indicator	4.5.23	both	M	3
Locking shift	4.5.3	n → u	O (Note 4)	1
Display text	4.6.2	n → u	O (Note 3)	2 - *
NOTES 1 This message is sent with the global call reference as defined by in 4.3. 2 Included if necessary to indicate the particular channel(s) that is (are) to be restarted. 3 May be included if the network provides information that can be presented to the user. 4 Included if the Display text information element follows. If included for this purpose, the locking shift information element identifies codeset 5.				

4 General Message Format & Information Element Coding

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

When an information element contains a coding standard field, the structure and code points defined in this document apply to both the CCITT and national coding standard unless otherwise specified. The national coding standard shall be used only when the information element cannot be represented with the CCITT standardized coding.

4.1 Overview

Within this protocol, every message shall consist of the following parts:

- a) protocol discriminator;
- b) call reference;

- c) message type; and
- d) other information elements, as required.

Information elements (a), (b), and (c) are common to all messages and shall always be present, while information elements (d) are specific to each message type.

This organization is illustrated in the example shown in Figure 1.

A particular message may contain more information than a particular piece of (user or network) equipment needs or can understand. All equipment should be able to ignore any extra information present in a message that is not required for the proper operation of that equipment. For example, a user may ignore the calling party number if that number is of no interest to the user when a SETUP message is received.

Unless specified otherwise, a particular information element may be present only once in a given message.

The term “default” implies that the value defined should be used in the absence of any assignment, or the negotiation of alternative values.

When a field, such as the call reference value, extends over more than one octet, the order of bit values progressively decreases as the octet number increases. The least significant bit of the field is represented by the lowest-numbered bit of the highest-numbered octet of that field.

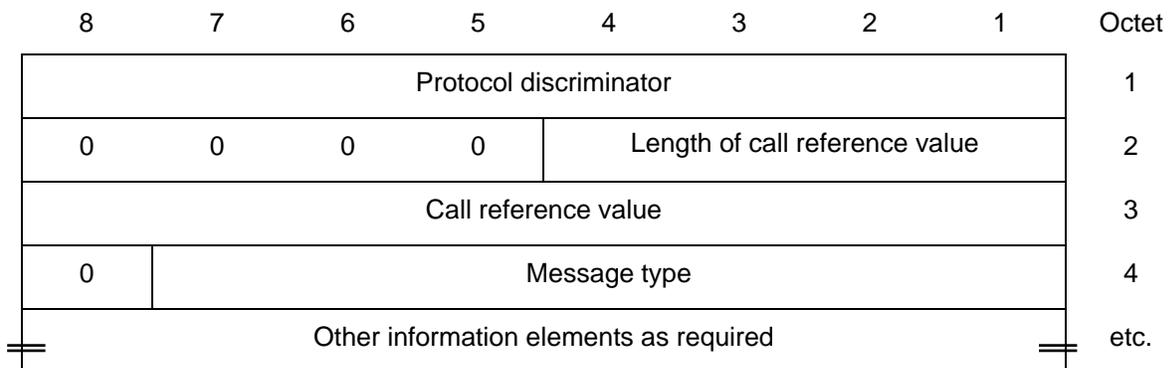


Figure 1 – General message organization example

4.2 Protocol discriminator

The purpose of the protocol discriminator is to distinguish messages for the user-network call control from other messages within this standard. It also distinguishes messages of this standard from those OSI network layer protocol units that are coded to other standards.

The protocol discriminator is the first part of every message.

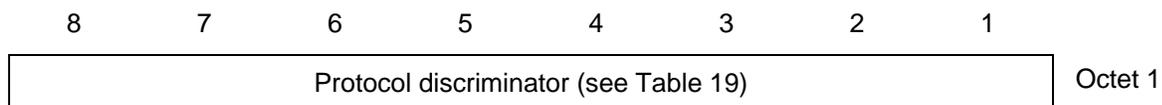


Figure 2 – Protocol discriminator

Table 19 – Protocol Discriminator

Bits	
<u>8765 4321</u>	
0000 0000 through 0000 0111	assigned in user-user information element; not available for use in the message protocol discriminator
0000 1000	ATIS-1000607 user-network call control messages (see Note 1, 2)
0001 0000 through 0011 1111	reserved for the other network layer or layer 3 protocols, including ITU-T Recommendation X.25 (see Note 3)
0100 0000 through 0100 0010	reserved for national use
0100 0011	Network management messages (see Note 4)
0100 0100 through 0100 1111	reserved for national use
0101 0000 through 1111 1110	reserved for other network layer or layer 3 protocols including ITU-T Recommendation X.25 (see Note 3)
All other values are reserved	
NOTES	
1	Same value as 'Q.931' in ITU-T Recommendation Q.931.
2	This value shall be used for messages defined in clause 3 and Annex K.
3	These values are reserved to discriminate protocol discriminators from the first octet of an ITU-T Recommendation X.25 packet including a general format identifier.
4	This value shall be used for the messages defined in Annexes F and U.

4.3 Call Reference

The purpose of the call reference is to identify the call or facility registration/cancellation request at the local user-network interface to which the particular message applies. The call reference does not have end-end significance across ISDNs.

The call reference is the second part of every message. The length of the call reference value is indicated in octet 1, bits 1-4. The default maximum length of the call reference information element is three oc-

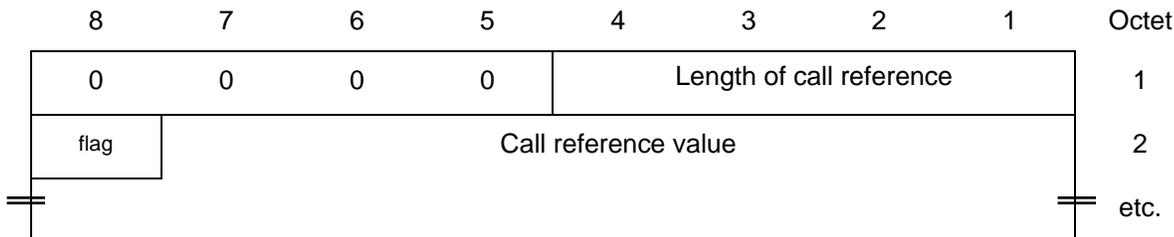
tets long. The actions taken by the receiver are based on the numerical value of the call reference and are independent of the length of the call reference information element.

At a minimum, all networks and users must be able to support a call reference value of one octet for a basic user-network interface, and a call reference value of two octets for a primary rate interface.

As a network option for a primary rate interface, a one octet call reference may also be supported. In this case, a call reference with a numerical value up to 127 may be coded using one or two octets.

The call reference information element includes the length of the call reference value, the call reference value, and the call reference flag.

Call reference values are assigned by the originating side of the interface for a call. These values are unique to the originating side only within a particular D-channel layer two logical link connection. The call reference value is assigned at the beginning of a call and remains fixed for the lifetime of a call. After a call ends, the associated call reference value may be reassigned to a later call. Two identical call reference values on the same D-channel layer two logical link connection may be used when each value pertains to a call originated at opposite ends of the link.



Call reference flag (octet 2)

Bit

8

0 The message is sent from the side that originated the call reference.

1 The message is sent to the side that originated the call reference.

Figure 3 – Call reference information element

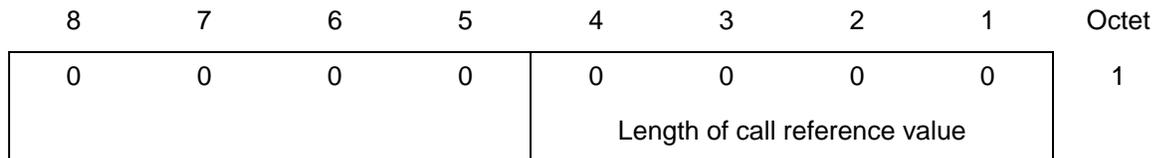


Figure 4 – Dummy call reference

The call reference flag can take the values “0” or “1.” The call reference flag is used to identify which end of the layer two logical link originated a call reference. The origination side always sets the call reference flag to “0.” The destination side always sets the call reference flag to a “1.”

The call reference flag identifies who allocated the call reference value and the only purpose of the call reference flag is to resolve simultaneous attempts to allocate the same call reference value. The call reference flag also applies to functions that use the global call reference (e.g., restart procedures).

NOTE

- 1 The call reference information element containing a dummy call reference is one octet long and is coded "0000 0000." The use of the dummy call reference is specified in ATIS-1000610.
- 2 The numerical value of the global call reference is zero. The equipment receiving a message containing the global call reference should interpret the message as pertaining to all call references associated with the appropriate data link connection identifier. The messages that can use the global call reference are defined in 3.2, Annex F, and Annex U.

8	7	6	5	4	3	2	1	Octet
0	0	0	0	0	0	0	1	1
				Length of call reference value				
0/1 flag	0	0	0	0	0	0	0	2
Call reference value								

a) One octet call reference value

8	7	6	5	4	3	2	1	Octet
0	0	0	0	0	0	1	0	1
				Length of call reference value				
0/1 flag	0	0	0	0	0	0	0	2
Call reference value								
0	0	0	0	0	0	0	0	3

b) Two octet call reference value

Figure 5 – Examples of the encoding for the global call reference

4.4 Message Type

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

The message type is the third part of every message. Bit 8 is reserved for possible future use as an extension bit. The encoding for specific message types is summarized in Table 20.

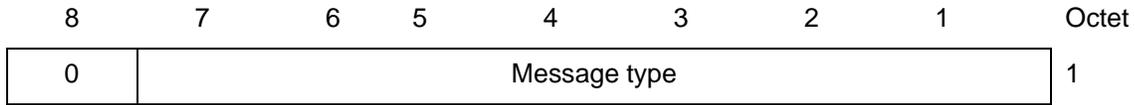


Figure 6 – Message type

Table 20 – Message types

Bits	
<u>8765 4321</u>	
0000 0000	Escape to nationally-specified message types (see Note)
000– ———	<i>Call establishment messages:</i>
0 0001	ALERTING
0 0010	CALL PROCEEDING
0 0111	CONNECT
0 1111	CONNECT ACKNOWLEDGE
0 0011	PROGRESS
0 0101	SETUP
0 1101	SETUP ACKNOWLEDGE
010– ———	<i>Call clearing messages:</i>
0 0101	DISCONNECT
0 1101	RELEASE
1 1010	RELEASE COMPLETE
0 0110	RESTART
0 1110	RESTART ACKNOWLEDGE
011– ———	<i>Miscellaneous messages:</i>
1 1011	INFORMATION
0 1110	NOTIFY
1 1101	STATUS
1 0101	STATUS ENQUIRY
<p>NOTE – Reserved for future use in American National Standards. The message type is defined in the following octet(s). The extension mechanism (bit 8 of the message type) is independent of the escape mechanism for the message.</p>	

4.5 Other Information Elements

4.5.1 Coding Rules

The rules for the coding of other information elements are formulated to allow each piece of equipment that processes a message to find information elements important to it, and to ignore information elements not important to that equipment.

Two categories of information elements are defined:

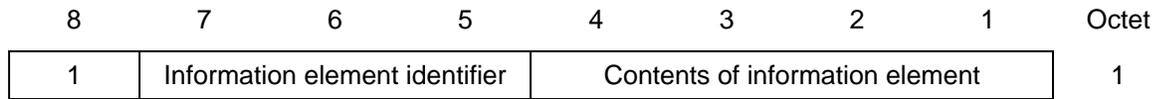
- 1) single octet information elements; and
- 2) variable length information elements.

For the information elements defined in this clause, the coding of the information element identifier bits is summarized in Table 21.

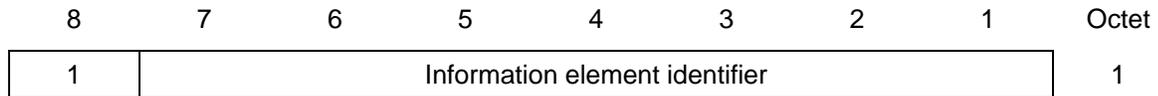
The descriptions of the information elements in this subclause are organized in alphabetical order. However, there is a particular order of appearance for each information element in a message within each codeset. The code values of the information element identifier for the variable length formats are assigned in ascending numerical order, according to the actual order of appearance of each information element in a message. This allows the receiving equipment to detect the presence or absence of a particular information element without scanning through an entire message.

Single octet information elements may appear at any point in the message. Two types of single octet information elements have been defined. Type 1 information elements provide the information element identification in bit positions 7, 6, 5. The value "010" in these bit positions is reserved for Type 2 single octet information elements.

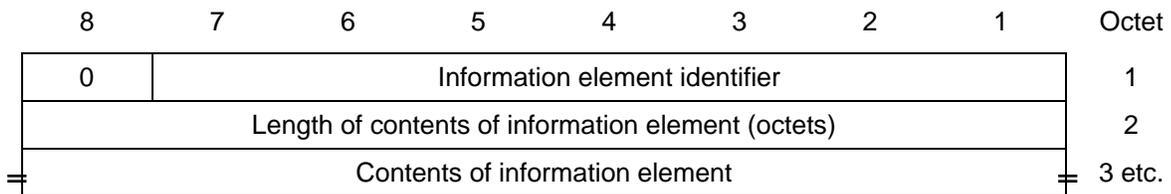
Where the description of information elements in this standard contains spare bits, these bits are indicated as being set to "0." In order to allow compatibility with future implementations, messages should not be rejected simply because a spare bit is set to "1."



(a) Single octet information element format (Type 1)



(b) Single octet information element format (Type 2)



(c) Variable length information element format

Figure 7 – Formats of information elements

Table 21 – Information element identifier coding

8 7 6 5	4 3 2 1		Reference	Max length (octets) (Note 1)	Max no. of occurrences (Note 2)
1	:::	- - - -	<i>Single octet information elements:</i>		
0 0 0	- - - -	reserved			
0 0 1	- - - -	Shift (Note 3)	4.5.3, 4.5.4	1	
1 0 1	- - - -	Repeat indicator	4.5.22	1	
0	:::	:::::	<i>Variable length information elements in codeset 0:</i>		
0 0 0	0 1 0 0	Bearer capability (Note 4)	4.5.5	12	
0 0 0	1 0 0 0	Cause (Note 3)	4.5.11	32	3
0 0 1	0 1 0 0	Call state	4.5.6	3	
0 0 1	1 0 0 0	Channel identification	4.5.12	(Note 5)	
0 0 1	1 1 1 0	Progress indicator (Note 3)	4.5.21	4	2
0 1 0	0 0 0 0	Network-specific facilities (Note 3)	4.5.19	(Note 5)	4
0 1 0	0 1 1 1	Notification indicator	4.5.20	3	
0 1 0	1 0 0 0	Display	4.5.15	82	
0 1 0	1 1 0 0	Keypad facility	4.5.17	34	
0 1 1	0 1 0 0	Signal	4.5.24	3	
1 0 0	1 1 0 0	Connected number	4.5.13	19	
1 0 0	1 1 0 1	Connected subaddress	4.5.14	23	
1 1 0	1 1 0 0	Calling party number (Note 3)	4.5.9	(Note 5)	2
1 1 0	1 1 0 1	Calling party subaddress	4.5.10	23	
1 1 1	0 0 0 0	Called party number	4.5.7	(Note 5)	
1 1 1	0 0 0 1	Called party subaddress	4.5.8	23	
1 1 1	1 0 0 0	Transit network selection (Note 3)	4.5.25	(Note 5)	4
1 1 1	1 0 0 1	Restart indicator	4.5.23	3	
1 1 1	1 1 0 0	Low layer compatibility	4.5.18	16	
1 1 1	1 1 0 1	High layer compatibility	4.5.16	5	
1 1 1	1 1 1 1	Escape for extension (Note 6)			
0	:::	:::::	<i>Variable length information elements in codeset 5:</i>		
0 0 1	0 0 0 1	Emergency call control	4.6.3	3	
0 0 1	0 0 1 0	Generic information	4.6.4	(Note 5)	(Note 7)
0 0 1	1 1 0 1	Operator system access	4.6.1	3	

0 1 0 1 0 1 0	Display text	4.6.2	(Note 5)
All other values are reserved (Note 8).			
NOTES			
1	The length limits described for the variable length information elements below take into account only the present ANSI standardized coding values.		
2	This is the maximum number of occurrences allowed for variable length information elements. Unless otherwise specified, the maximum number of occurrences is one.		
3	This information element may be repeated.		
4	This information element may be repeated in conjunction with or without the Repeat indicator information element.		
5	The maximum length is network dependent.		
6	This escape mechanism is limited to codesets 4, 5, 6, and 7 (see 4.5.2). When the escape for extension is used, the information element identifier is contained in octet-group 3 and the content of the information element follows in the subsequent octets as shown in Figure 8.		
7	The maximum number of occurrences of this information element is network dependent.		
8	The reserved values with the bits 5 to 8 coded "0000" are for future information elements for which comprehension by the receiver is required. The Bearer capability and Cause information elements are not information elements for which comprehension is required.		

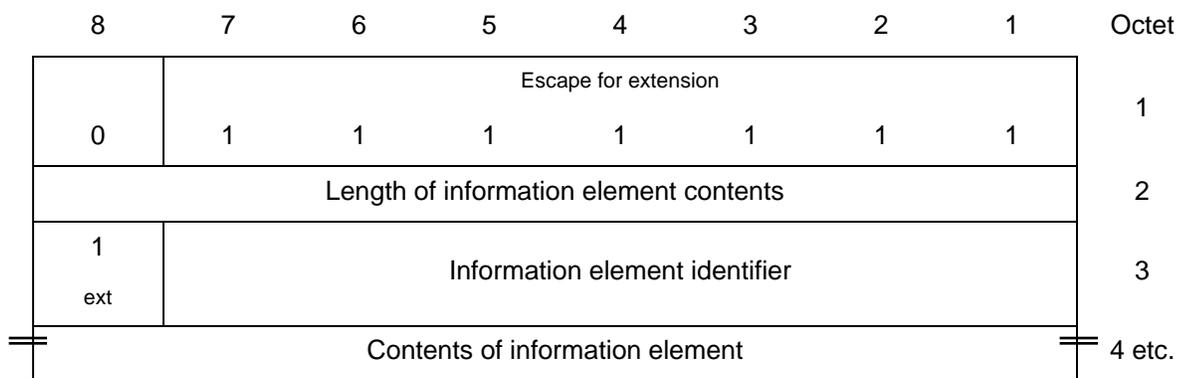


Figure 8 – Information element format using escape for extension

The second octet of a variable length information element indicates the total length of the contents of that information element excluding the octets that contain the information element identifier and length (i.e., the length starting with octet 3). The second octet is a binary coding of the number of octets of the contents, with bit 1 as the least significant bit (2^0).

An optional variable length information element may be present, but empty. For example, a SETUP message may contain a called party number information element, the content of which is of zero length. This should be interpreted by the receiver as equivalent to that information element being absent. Similarly, an absent information element should be interpreted by the receiver as equivalent to that information element being empty.

The following rules apply for the coding of the contents of variable length information elements (octet 3, etc.):

- a) The first digit in the octet number identifies one octet or a group of octets.
- b) Each octet group is a self-contained entity. The internal structure of an octet group may be defined in alternative ways.
- c) An octet group is formed by using an extension mechanism. The preferred extension mechanism is to extend an octet (N) through the next octet(s) (Na, Nb, etc.) by using bit 8 in each octet as an extension bit. The bit value "0" indicates that the octet group continues through the next octet. The bit value "1" indicates that this octet is the last octet. If an octet (Nb) is present, then the preceding octets (N and Na) must be present.

In the format descriptions appearing in 4.5.5, etc., bit 8 is marked "0/1 ext" if another octet follows. Bit 8 is marked "1 ext" if this is the last octet in the extension domain.

Additional octets may be defined later ("1 ext" changed to "0/1 ext") and equipment shall be prepared to receive such additional octets although the equipment need not be able to interpret or act upon the contents of these octets.

- d) In addition to the extension mechanism defined, an octet (N) may be extended through the next octet(s) (N.1, N.2, etc.) by indications in bits 7-1 (of octet N).
- e) The mechanisms in (c) and (d) may be combined.
- f) Optional octets are marked with asterisks (*).

4.5.2 Extensions of Codesets

There are a number of possible information element identifier values using the formatting rules described in 4.5.1; these include 128 for the variable length information element format and at least eight from the single octet information element format.

One value in the single octet format (shown in Figures 9 and 10) is specified for shift operations. One other value in both the single octet and variable format is reserved. This leaves at least 133 information element identifier values available for assignment.

It is possible to expand this structure to eight codesets of at least 133 information element identifier values each. One common value in the single octet format is employed in each codeset to facilitate shifting from one codeset to another. The content of this shift information element identifies the codeset to be used for the next information element or elements. The codeset in use at any given time is referred to as the "active codeset." By convention, codeset 0 is the initially active codeset.

Two codeset shifting procedures are supported: locking shift and non-locking shift (see 4.5.3 and 4.5.4).

- a) Codeset 4 is reserved for use by ISO/IEC standards. Use of this codeset is not required by this standard.
- b) Codeset 5 is reserved for national-specific information elements used in this standard and other American National Standards.
- c) Codeset 6 is reserved for information elements specific to the local network (either public or private).
- d) Codeset 7 is reserved for user-specific information elements.

The coding rules specified in 4.5.1 shall apply for information elements belonging to any active codeset.

Transitions from one active codeset to another (i.e., by means of the locking shift procedure) may only be made to a codeset with a higher numerical value than the codeset being left.

By using a non-locking shift procedure, an information element belonging to codesets 5, 6, or 7 may be received in the same message with information elements belonging to the active codeset of zero. However, this standard does not support the sending of a non-locking shift information element (see 4.5.4).

User or network equipment shall have the capability to recognize a shift information element and determine the length of the following information element, although the equipment need not be able to interpret and act upon the contents of the information element. This enables the equipment to determine the start of a subsequent information element.

Codeset 4 is reserved for information elements specified in ISO/IEC standards. Use of this codeset is not required by this standard.

Codeset 5 is reserved for national-specific information elements defined in this standard and other American National Standards. As such they do not have significance across an international boundary. Therefore, codeset 5 information elements shall be handled according to the procedures for unrecognized information elements (see 5.8.7.1) at the first exchange beyond the international boundary, unless there are bilateral agreements to the contrary.

Codeset 6 is reserved for information elements specific to the local network (either public or private). As such they do not have significance across the boundaries between local networks, or across a national or international boundary. Therefore, codeset 6 information elements shall be handled according to the procedures for unrecognized information elements (see 5.8.7.1) beyond the local network boundary, unless allowed by bilateral agreements.

Codeset 7 information elements shall be handled according to the procedures for unrecognized information elements (see 5.8.7.1) by the first exchange in the local network, unless allowed by a future service definition, bilateral agreement, or provision is made to support this across the local network for a specific user.

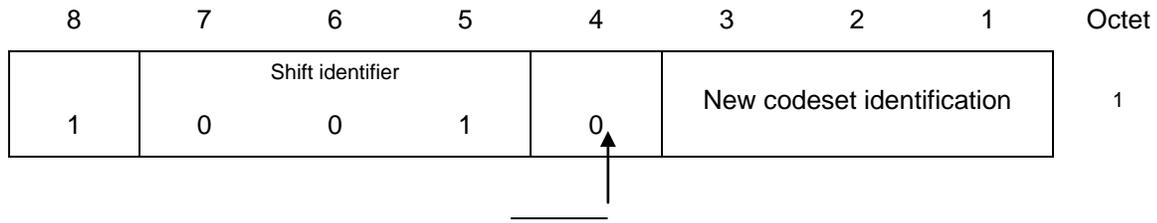
4.5.3 Locking Shift Procedures

The locking shift procedure employs an information element to indicate the new active codeset. The specified codeset remains active until another locking shift information element is encountered that specifies the use of another codeset. For example, codeset 0 is active at the start of message content analysis. If a locking shift to codeset 5 is encountered, the next information elements will be interpreted according to the information element identifiers assigned in codeset 5, until another shift information element is encountered.

This procedure is used only to shift to a higher-order codeset than the one being left.

The locking shift is valid only within that message that contains the locking shift information element. At the start of every message content analysis, the active codeset is codeset 0.

The locking shift information element uses the single octet information element format.



“0” in this position indicates locking shift.

Figure 9 – Locking shift information element

New codeset identification

Bits	
<u>3 2 1</u>	
0 0 0	not applicable
0 0 1	} Reserved
to	
0 1 1	
1 0 0	codeset 4: Reserved for information elements for ISO/IEC use
1 0 1	codeset 5: national-specific information elements used in this standard and in other American National Standards
1 1 0	codeset 6: information elements specific to the local network (either public or private)
1 1 1	codeset 7: user-specific information elements

4.5.4 Non-Locking Shift Procedures

The non-locking shift procedure provides a temporary shift to the specified lower or higher codeset.

Sending of a non-locking shift information element is not supported by this standard. A user or network receiving a message containing a non-locking shift information element shall follow two options:

- a) process the non-locking shift information element and the information element following it as described below;
- b) recognize the non-locking shift information element and ignore the information element following it. The non-locking shift information element and the information element following it are discarded and procedures for unrecognized information element shall be followed for the information element following the non-locking shift.

The non-locking shift procedure uses a single octet information element to indicate the codeset to be used to interpret the next single information element. After the interpretation of the next single information element, the active codeset is again used for interpreting any following information elements. For example, codeset 0 is active at the beginning of message content analysis. If a non-locking shift to

codeset 6 is encountered, *only* the next information element is interpreted according to the information element assigned in codeset 6. After this information element is interpreted, codeset 0 will again be used to interpret the following information elements. A non-locking shift information element indicating the current codeset shall not be regarded as an error.

A locking shift information element shall not directly follow a non-locking shift information element. If this combination is received, it shall be interpreted as though a locking shift information element only has been received.

The non-locking shift information element uses the single octet information element format.

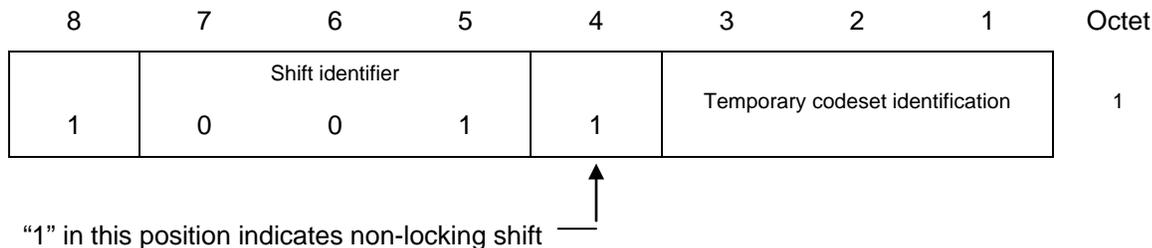


Figure 10 – Non-locking shift information element

Temporary codeset identification

- Bits
- | | | | |
|----|---|---|---|
| 3 | 2 | 1 | |
| 0 | 0 | 0 | codeset 0 (initially active): ATIS-1000607 information elements |
| 0 | 0 | 1 | reserved |
| to | | | |
| 0 | 1 | 1 | |
| 1 | 0 | 0 | codeset 4: Reserved for information elements for ISO/IEC use |
| 1 | 0 | 1 | codeset 5: national-specific information elements used in this standard and other American National Standards |
| 1 | 1 | 0 | codeset 6: information elements specific to the local network (either public or private) |
| 1 | 1 | 1 | codeset 7: user-specific information elements |

4.5.5 Bearer Capability

The purpose of the Bearer capability information element is to indicate a requested ITU-T Recommendation I.231 bearer service to be provided by the network. It contains only information that may be used by the network (see Annex L for the relationship between the Bearer capability and Low layer compatibility information elements). The use of the Bearer capability information element in relation to compatibility checking is described in Annex B.

No default bearer capability may be assumed by the absence of this information element. The maximum length of this information element is 12 octets when CCITT standard coding is used.

Examples of the coding of the bearer capability are shown in Annex H.

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The Bearer capability information element can be repeated in the SETUP message to indicate dual bearer capabilities for selection. By default, if the Bearer capability information element is repeated without the Repeat indicator information element, it shall be interpreted as increasing order of priority.

NOTE — Future extensions to the coding of the Bearer capability information element should not be in conflict with the currently defined coding of the Low layer compatibility information element.

8	7	6	5	4	3	2	1	Octet
Bearer capability information element identifier								1
0	0	0	0	0	1	0	0	
Length of the bearer capability contents								2
1 ext	Coding standard		Information transfer capability					3
1 ext	Transfer mode		Information transfer rate					4 (Note 1)
1 ext	Rate multiplier							4.1* (Note 5)
0/1 ext	0	1	User information layer 1 protocol					5*
	Layer 1 identity							
0/1 ext	Synch./ asynch.	Negot.	User rate					5a* (Note 4)
0/1 ext	Intermediate rate		NIC on Tx	NIC on Rx	Flow control on TX	Flow control on RX	0 spare	5b* (Note 2,6)
0/1 ext	Hdr/ no Hdr	Multiframe	Mode	LLI negot.	Assignor/ assignee	Inband/ outband	0 spare	5b* (Note 3,6)
0/1 ext	Number of stop bits		Number of data bits		Parity			5c* (Note 4,6)
1 ext	Duplex mode	Modem type						5d* (Note 4,6)
1 ext	1	0	User information layer 2 protocol					6* (Note 6)
	Layer 2 ident							
1 ext	1	1	User information layer 3 protocol					7* (Note 6)
	Layer 3 ident							

NOTES

- Other attributes that are not explicitly coded are shown in Table 22.
- This structure and coding applies only when octet 5 indicates CCITT standardized rate adaptation ITU-T Recommendation V.110 and X.30.
- This structure and coding applies only when octet 5 indicates CCITT standardized rate adaptation ITU-T Recommendation V.120.
- This octet may be present if octet 3 indicates *unrestricted digital information* and octet 5 indicates either of the CCITT standardized rate adaptations ITU-T Recommendations V.110 and X.30 or ITU-T Recommendation V.120. It may also be present if octet 3 indicates 3.1 kHz audio and octet 5 indicates ITU-T Recommendation G.711.
- This octet is required if octet 4 indicates multirate (64 kbit/s base rate). Otherwise, it shall not be present.

- 6 If the Bearer capability information element is coded as circuit-mode, and the network cannot interpret octets 5b, 5c, 5d, 6, and 7, the network may accept these octets without declaring a protocol error and pass these octets on without change.

Figure 11 – Bearer capability information element

Coding standard (octet 3)

Bits

7 6

0 0 CCITT standardized coding

1 0 National standard

All other values are reserved.

Information transfer capability (octet 3)

Bits

5 4 3 2 1

0 0 0 0 0 speech

0 1 0 0 0 unrestricted digital information

0 1 0 0 1 restricted digital information

1 0 0 0 0 3.1-kHz audio

1 0 0 0 1 unrestricted digital information with tones/announcements (see Note)

All other values are reserved.

NOTE – Unrestricted digital information with tones/announcements (UDI-TA) is the new information transfer attribute value that had previously been named “7-kHz audio” in ATIS-1000607.

Transfer mode (octet 4)

Bits

7 6

0 0 circuit mode

1 0 packet mode

All other values are reserved.

Information transfer rate (octet 4)

Bits

<u>5 4 3 2 1</u>	<u>Circuit-mode</u>	<u>Packet-mode</u>
0 0 0 0 0	–	This code shall be used for packet mode calls.
1 0 0 0 0	64 kbit/s	-
1 0 0 1 1	384 kbit/s	-
1 0 1 0 1	1536 kbit/s	-
1 1 0 0 0	multirate (64 kbit/s base rate)	-

All other values are reserved.

Rate multiplier (octet 4.1)

Coded as a binary representation of the multiplier to the base rate. The multiplier can take any value from 2 up to the maximum number of B-channels available on the interface (maximum of 24).

User information layer 1 protocol (octet 5) (see Note 1)

Bits

<u>5 4 3 2 1</u>	
0 0 0 0 1	CCITT standardized rate adaptation ITU-T Recommendation V.110 and X.30. This implies the presence of octet 5a and optionally octets 5b, 5c, and 5d as defined below
0 0 0 1 0	ITU-T Recommendation G.711 μ -law speech
0 0 1 0 1	ITU-T Recommendations H.221 and H.242
0 0 1 1 1	Non-CCITT standardized rate adaptation. This implies the presence of octet 5a and, optionally, octets 5b, 5c and 5d (see Note 2)
0 1 0 0 0	CCITT standardized rate adaptation ITU-T Recommendation V.120. This implies the presence of octet 5a and 5b as described below, and optionally octets 5c and 5d
0 1 0 0 1	CCITT standardized rate adaptation ITU-T Recommendation X.31 HDLC flag stuffing

All other values are reserved.

NOTES

- 1 If the transfer mode is "circuit-mode" and if the information transfer capability is "unrestricted digital information" or "restricted digital information," and if the user information layer 1 protocol is not to be identified to the network, then octet 5 shall be omitted. If the transfer mode is "packet-mode," octet 5 may be omitted. Otherwise, octet 5 shall be present.
- 2 The use of this codepoint indicates that the user rate specified in octet 5a is defined by the user. Additionally, octets 5b, 5c and 5d, if present, are defined consistent with the user-specified rate adaptation.

Synchronous/asynchronous (octet 5a)

Bit

7

0 synchronous

1 asynchronous

NOTE – The protocols synchronous and asynchronous refer to the R reference point. In case of synchronous user rate except for half duplex operation, octet 5c and 5d may be omitted for ITU-T Recommendation V.110 and X.30 or Recommendation V.120. In certain circumstances, octet 5b may be omitted for ITU-T Recommendation V.110 and X.30.

Negotiation (octet 5a)

Bit

6

0 In-band negotiation not possible

1 In-band negotiation possible

NOTE – Applicable to ITU-T Recommendations V.110 and X.30, otherwise reserved.

User rate (octet 5a)

Bits

5 4 3 2 1

0 0 0 0 0	Rate is indicated by E-bits specified in ITU-T Recommendation I.460
0 0 0 0 1	0.6 kbit/s ITU-T Recommendation X.1
0 0 0 1 0	1.2 kbit/s
0 0 0 1 1	2.4 kbit/s ITU-T Recommendation X.1
0 0 1 0 0	3.6 kbit/s
0 0 1 0 1	4.8 kbit/s ITU-T Recommendation X.1
0 0 1 1 0	7.2 kbit/s
0 0 1 1 1	8 kbit/s ITU-T Recommendation I.460
0 1 0 0 0	9.6 kbit/s ITU-T Recommendation X.1
0 1 0 0 1	14.4 kbit/s
0 1 0 1 0	16 kbit/s ITU-T Recommendation I.460
0 1 0 1 1	19.2 kbit/s
0 1 1 0 0	32 kbit/s ITU-T Recommendation I.460
0 1 1 0 1	38.4 kbit/s (see Note 1)
0 1 1 1 0	48 kbit/s ITU-T Recommendation X.1
0 1 1 1 1	56 kbit/s
1 0 0 0 0	64 kbit/s ITU-T Recommendation X.1
1 0 1 0 1	0.1345 kbit/s ITU-T Recommendation X.1
1 0 1 1 0	0.100 kbit/s ITU-T Recommendation X.1
1 0 1 1 1	0.075/1.2 kbit/s ITU-T Recommendation X.1 (see Note 2)
1 1 0 0 0	1.2/0.075 kbit/s ITU-T Recommendation X.1 (see Note 2)
1 1 0 0 1	0.050 kbit/s ITU-T Recommendation X.1
1 1 0 1 0	0.075 kbit/s ITU-T Recommendation X.1
1 1 0 1 1	0.110 kbit/s ITU-T Recommendation X.1
1 1 1 0 0	0.150 kbit/s ITU-T Recommendation X.1
1 1 1 0 1	0.200 kbit/s ITU-T Recommendation X.1
1 1 1 1 0	0.300 kbit/s ITU-T Recommendation X.1
1 1 1 1 1	12 kbit/s

All other values are reserved.

NOTES

- 1 This is an American national codepoint and can be used only with the coding standard field specifying national standard "10" (It is anticipated that this codepoint will be adopted by the ITU at which time it could be used with the coding standard field specifying CCITT standardized coding "00").
- 2 The first rate is the transmit rate in the forward direction of the call. The second rate is the transmit rate in the backward direction of the call.

Octet 5b for ITU-T Recommendation V.110 and X.30 rate adaptation

Intermediate Rate (octet 5b)

Bits

7 6

- | | |
|-----|-----------|
| 0 0 | Not used |
| 0 1 | 8 kbit/s |
| 1 0 | 16 kbit/s |
| 1 1 | 32 kbit/s |

Network Independent Clock (NIC) on Transmission (TX) (octet 5b)

Bit

5

- | | |
|---|------------------------------------|
| 0 | Not required to send data with NIC |
| 1 | Required to send data with NIC |

NOTE – This field refers to transmission in forward direction of the call.

Network Independent Clock (NIC) on Reception (RX) (octet 5b)

Bit

4

- | | |
|---|---|
| 0 | Cannot accept data with NIC (i.e., sender does not support this optional procedure) |
| 1 | Can accept data with NIC (i.e., sender does support this optional procedure) |

NOTE – This field refers to transmission in backward direction of the call.

Flow control on Transmission (TX) (octet 5b)

Bit

3

- 0 Not required to send data with flow control mechanism
- 1 Required to send data with flow control mechanism

NOTE – This field refers to transmission in forward direction of the call.

Flow control on Reception (RX) (octet 5b)

Bit

2

- 0 Cannot accept data with flow control mechanism (i.e., sender does not support this optional procedure)
- 1 Can accept data with flow control mechanism (i.e., sender does support this optional procedure)

NOTE – This field refers to transmission in backward direction of the call.

Octet 5b for ITU-T Recommendation V.120 rate adaptation

Rate adaptation header/no header (octet 5b)

Bit

7

- 0 Rate adaptation header not included
- 1 Rate adaptation header included

Multiple frame establishment support in data link (octet 5b)

Bit

6

- 0 Multiple frame establishment not supported. Only UI frames are allowed
- 1 Multiple frame establishment supported

Mode of operation (octet 5b)

Bit

5

- 0 Bit transparent mode of operation
- 1 Protocol sensitive mode of operation

Logical Link Identifier (LLI) negotiation (octet 5b)

Bit

4

- 0 Default LLI = 256 only
- 1 LLI negotiation (Note)

NOTE – A connection over which LLI negotiation will be carried is indicated in bit 2 of octet 5b.

Assignor/Assignee (octet 5b)

Bit

3

- 0 Message originator is “Default Assignee”
- 1 Message originator is “Assignor Only”

In-band/Out-of-Band negotiation (octet 5b)

Bit

2

- 0 Not applicable to this standard
- 1 Negotiation is done in-band using logical link zero

Number of stop bits (octet 5c)

Bits

7 6

- 0 0 Not used
- 0 1 1 bit
- 1 0 1.5 bits
- 1 1 2 bits

NOTE – If bit 7 of octet 5a is “0,” then these bits, when present, are set to “0” on transmission and ignored on reception.

Number of data bits excluding parity bit (octet 5c)

Bits

5 4

0 0 Not used

0 1 5 bits

1 0 7 bits

1 1 8 bits

NOTE – If bit 7 of octet 5a is “0,” then these bits, when present, are set to “0” on transmission and are ignored on reception.

Parity information (octet 5c)

Bits

3 2 1

0 0 0 Odd

0 1 0 Even

0 1 1 None

1 0 0 Forced to 0

1 0 1 Forced to 1

All other values are reserved.

NOTE – If bit 7 of octet 5a is “0,” then these bits, when present, are set to “0” on transmission and are ignored on reception.

Duplex mode (octet 5d)

Bit

7

0 Half duplex

1 Full duplex

Modem type (octet 5d)

Bits

6 5 4 3 2 1

0 0 0 0 0 0

through national use (reserved)

0 0 0 1 0 1

0 1 0 0 0 1 ITU-T Recommendation V.21

0 1 0 0 1 0 ITU-T Recommendation V.22

0 1 0 0 1 1 ITU-T Recommendation V.22 bis

0 1 0 1 0 0 ITU-T Recommendation V.23

0 1 0 1 0 1 ITU-T Recommendation V.26

0 1 0 1 1 0 ITU-T Recommendation V.26 bis

0 1 0 1 1 1 ITU-T Recommendation V.26 ter

0 1 1 0 0 0 ITU-T Recommendation V.27

0 1 1 0 0 1 ITU-T Recommendation V.27 bis

0 1 1 0 1 0 ITU-T Recommendation V.27 ter

0 1 1 0 1 1 ITU-T Recommendation V.29

0 1 1 1 0 1 ITU-T Recommendation V.32

1 0 0 0 0 0

through national use (reserved)

1 0 1 1 1 1

1 1 0 0 0 0

through user specified

1 1 1 1 1 1

All other values are reserved.

User information layer 2 protocol (octet 6)

Bits

5 4 3 2 1

0 0 0 1 0 ITU-T Recommendation Q.921/I.441

0 0 1 1 0 ITU-T Recommendation X.25 link layer

0 1 1 1 0 ITU-T Recommendation Q.922

0 1 1 1 1 Core aspects of ITU-T Recommendation Q.922

All other values are reserved.

NOTE – If the transfer mode is “packet mode,” octet 6 shall be present. For other cases, if the user layer 2 protocol is to be identified to the network, then octet 6 shall be present; otherwise, octet 6 shall be omitted.

User information layer 3 protocol (octet 7)

Bits

5 4 3 2 1

0 0 0 1 0 ITU-T Recommendation Q.931/I.451

0 0 1 1 0 ITU-T Recommendation X.25 packet layer

All other values are reserved.

NOTE – If the user layer 3 protocol is to be identified to the network, then octet 7 shall be present; otherwise, octet 7 shall be omitted.

Table 22 – Bearer capability attributes

BC Attributes		Additional Attributes			
Transfer Mode	Information transfer capability	Structure	Configuration	Establishment	Symmetry
circuit	speech	8 kHz integrity	point-to-point	demand	bi-directional symmetry
circuit	unrestricted digital information	8 kHz integrity	point-to-point	demand	bi-directional symmetry
circuit	restricted digital information	8 kHz integrity	point-to-point	demand	bi-directional symmetry
circuit	3.1 kHz audio	8 kHz integrity	point-to-point	demand	bi-directional symmetry
circuit	unrestricted digital information with tones/ announcements	8 kHz integrity	point-to-point	demand	bi-directional symmetry
packet	unrestricted digital information	Service data unit integrity	point-to-point	demand	bi-directional symmetry

NOTE – When multirate (64 kbit/s base rate) is indicated as the information transfer rate, time slot sequence integrity shall be provided.

4.5.6 Call State

The purpose of the call state information element is to describe the current status of a call (see 2.1) or a global interface state (see 2.2).

The maximum length for this information element is three octets when the CCITT standard coding is used.

8	7	6	5	4	3	2	1	Octet
Call state information element identifier								
0	0	0	1	0	1	0	0	1
Length of call state contents								2
coding standard	Call state value / Global interface state value (state value is coded in binary)						3	

Figure 12 – Call state information element

Coding standard (octet 3)

Bits

8 7

0 0 CCITT standardized coding

All other values are reserved.

Call state value (octet 3)

Bits

6 5 4 3 2 1

User State

Network State

0 0 0 0 0 0	U0 – Null	N0 – Null
0 0 0 0 0 1	U1 – Call Initiated	N1 – Call Initiated
0 0 0 0 1 0	U2 – Overlap Sending	N2 – Overlap Sending
0 0 0 0 1 1	U3 – Outgoing Call Proceeding	N3 – Outgoing Call Proceeding
0 0 0 1 0 0	U4 – Call Delivered	N4 – Call Delivered
0 0 0 1 1 0	U6 – Call Present	N6 – Call Present
0 0 0 1 1 1	U7 – Call Received	N7 – Call Received
0 0 1 0 0 0	U8 – Connect Request	N8 – Connect Request
0 0 1 0 0 1	U9 – Incoming Call Proceeding	N9 – Incoming Call Proceeding
0 0 1 0 1 0	U10 – Active	N10 – Active
0 0 1 0 1 1	U11 – Disconnect Request	N11 – Disconnect Request
0 0 1 1 0 0	U12 – Disconnect Indication	N12 – Disconnect Indication
0 1 0 0 1 1	U19 – Release Request	N19 – Release Request
0 1 0 1 1 0	–	N22 – Call Abort

Global interface state value (octet 3)

Bits

6 5 4 3 2 1 State

0 0 0 0 0 0 Rest 0 – Null
 1 1 1 1 0 1 Rest 1 – Restart Request
 1 1 1 1 1 0 Rest 2 – Restart

All other values are reserved.

4.5.7 Called Party Number

The purpose of the called party number information element is to identify the called party of a call.

The maximum length of this information element is network-dependent.

8	7	6	5	4	3	2	1	Octet
0	Called party number information element identifier							1
	1	1	1	0	0	0	0	
Length of called party number contents								2
1 ext	Type of number			Numbering plan identification				3
0	Number digits (ASCII characters – see Note)							4 etc.

NOTE – The number digits appear in octet group 4 in the same order in which they would be entered; that is, the number digit that would be entered first is located in the first octet of octet group 4.

Figure 13 – Called party number information element

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

Bits

7 6 5

- 0 0 0 unknown (see Note 2)
- 0 0 1 international number (see Note 3)
- 0 1 0 national number (see Notes 3, 5, 6, 7)
- 0 1 1 network-specific number (see Note 4)
- 1 0 0 subscriber number (see Notes 3, 7)
- 1 1 0 abbreviated number (see Note 8)
- 1 1 1 reserved for extension

All other values are reserved.

NOTES

- 1 For the definition of “international, national and subscriber number” see ITU-T Recommendation I.330.
- 2 When this codepoint is used: the number digits in octet group 4 can provide the same type information as is supported in the keypad facility information element, the called party number is provided en-bloc; and this information element cannot be used in combination with keypad facility, operator system access, or transit network selection information elements.
- 3 Prefix or escape digits shall not be included.
- 4 The type of number “network-specific number” is used to indicate administration and service number specific to the serving network.
- 5 For calls between the United States and other countries within world zone 1, where the numbering plan identification is “ISDN/telephony numbering plan,” “type of number” is coded to “national number.”
- 6 For numbers that contain service access codes (e.g., “700”, “800”, “900”), “type of number” is coded as “national number.”
- 7 Service codes in the “N11” format (e.g., “911”, “411”) are unique and may be sent using either the “subscriber number” or “national number” codepoints.
- 8 The support of this code is network dependent. The number provided in this information element presents a shorthand representation of the complete number in the specified numbering plan as supported by the network.

Numbering Plan Identification (octet 3)

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

Bits

4 3 2 1

- | | |
|---------|--|
| 0 0 0 0 | unknown (Note) |
| 0 0 0 1 | ISDN/telephony numbering plan (ITU-T Recommendation E.164) |
| 0 0 1 1 | data numbering plan (ITU-T Recommendation X.121) |
| 0 1 0 0 | telex numbering plan (ITU-T Recommendation F.69) |
| 1 0 0 1 | private numbering plan |
| 1 1 1 1 | reserved for extension |

All other values are reserved.

NOTE – When this codepoint is used:

- a) the number digits in octet group 4 can provide the same type information as is supported in the keypad facility information element,
- b) the called party number is provided en-bloc, and
- c) this information element cannot be used in combination with keypad facility, operator system access, or transit network selection information elements.

Number digits (octets 4, etc.)

This field is coded with ASCII characters, according to the formats specified in the appropriate numbering and dialing plan.

4.5.8 Called Party Subaddress

The purpose of the called party subaddress information element is to identify the subaddress of the called party of a call. For the definition of subaddress, see ITU-T Recommendations I.330 and I.334.

The maximum length of this information element is 23 octets.

8	7	6	5	4	3	2	1	Octet
Called party subaddress information element identifier								
0	1	1	1	0	0	0	1	1
Length of called party subaddress contents								2
1 ext	Type of subaddress			odd/even indicator	0	0	0	3
Subaddress information								4 etc.

NOTE – The network need not screen the information contained within this information element beyond octet 2.

Figure 14 – Called party subaddress information element

Type of subaddress (octet 3)

Bits

7 6 5

0 0 0 NSAP (ITU-T Recommendation X.213 or ISO 8348 AD2)

0 1 0 user-specified

All other values are reserved.

Odd/even indicator (octet 3)

Bit

4

0 even number of address signals

1 odd number of address signals

NOTE – The odd/even indicator is used when the type of subaddress is “user-specified” and the coding is BCD.

Subaddress information (octets 4, etc.)

The NSAP address shall be encoded using the preferred binary encoding specified in ITU-T Recommendation X.213 or ISO 8348 AD2.

When the AFI=50 (encoded in BCD as 0101 0000), IA5 characters are encoded as specified in Table 11 of ITU-T Recommendation T.50 or ISO 646 with the eighth bit set to zero. When the AFI=51 (encoded in BCD as 0101 0001), ASCII characters are encoded as specified in ANSI X3.4 with the eighth bit set to zero. Examples of encoding OSI and non-OSI NSAP addresses are included in Annex H.

For a user-specified subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with ITU-T Recommendation X.25 networks, BCD coding should be applied.

4.5.9 Calling Party Number

The purpose of the calling party number information element is to identify the origin of a call. The information element may occur two times in a message, in conjunction with called user subscription to the Calling Line Identification Presentation (CLIP) supplementary service.

The maximum length of this information element is network-dependent.

8	7	6	5	4	3	2	1	Octet
Calling party number information element identifier								1
0	1	1	0	1	1	0	0	
Length of calling party number contents								2
0/1 ext	Type of number			Numbering plan identification				3
1 ext	Presentation indicator	0	0	0	Screening indicator			3a*
0	Number digits (ASCII characters)							4 etc.

Figure 15 – Calling party number information element

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

Bits

7 6 5

0 0 0	unknown (see Note 2)
0 0 1	international number (see Note 3)
0 1 0	national number (see Notes 3, 5)
0 1 1	network-specific number (see Note 4)
1 0 0	subscriber number (see Note 3)
1 1 0	abbreviated number (see Note 6)
1 1 1	reserved for extension

All other values are reserved.

NOTES

- 1 For the definition of “international, national and subscriber number” see ITU-T Recommendation I.330.
- 2 The type of number “unknown” is used when the user or the network has no knowledge of the type of number (e.g., “international number,” “national number”). In this case the number digits field is organized according to the network dial plan; e.g., prefix or escape digits might be present.
- 3 Prefix or escape digits shall not be included.
- 4 The type of number “network-specific number” is used to indicate administration and service number specific to the serving network.
- 5 For calls between the United States and other countries within world zone 1, where the “numbering plan identification” is “ISDN/telephony numbering plan,” “type of number” is coded to “national number..”
- 6 The support of this code is network dependent. The number provided in this information element presents a shorthand representation of the complete number in the specified numbering plan as supported by the network.

Numbering Plan Identification (octet 3)

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

Bits

4 3 2 1

0 0 0 0	unknown (Note)
0 0 0 1	ISDN/telephony numbering plan (ITU-T Recommendations E.164)
0 0 1 1	data numbering plan (ITU-T Recommendation X.121)
0 1 0 0	telex numbering plan (ITU-T Recommendation F.69)
1 0 0 1	private numbering plan
1 1 1 1	reserved for extension

All other values are reserved.

NOTE – The numbering plan “unknown” is used when the user or the network has no knowledge of the numbering plan. In this case the number digits field is organized according to the network dialing plan; e.g., prefix or escape digits might be present.

Presentation indicator (octet 3a)

Bits

7 6

0 0	presentation allowed
0 1	presentation restricted
1 0	number not available
1 1	reserved

NOTE – At the originating user-network interface, the presentation indicator is used for indicating the intention of the calling user for the presentation of the calling party number to the called user. This may also be requested on a subscription basis. If octet 3a is omitted and the network does not support subscription information for the calling party number information restrictions, the value “0 0 – presentation allowed” is assumed.

Screening indicator (octet 3a)

Bits

2 1

0 0	user-provided, not screened
0 1	user-provided, verified and passed
1 0	user-provided, verified and failed
1 1	network-provided

NOTE –If octet 3a is omitted, the value “0 0 – User-provided not screened” is assumed.

Number digits (octets 4, etc.)

This field is coded with ASCII characters, according to the formats specified in the appropriate numbering and dialing plan.

4.5.10 Calling Party Subaddress

The purpose of the calling party subaddress information element is to identify a subaddress associated with the origin of a call. For the definition of subaddress, see ITU-T Recommendations I.330 and I.334.

The maximum length of this information element is 23 octets.

8	7	6	5	4	3	2	1	Octet
0	Calling party subaddress information element identifier							1
	1	1	0	1	1	0	1	
Length of calling party subaddress contents								2
1 ext	Type of subaddress			odd/even indicator	0	0	0	3
							Spare	
Subaddress information								4 etc.

Figure 16 – Calling party subaddress information element

Type of subaddress (octet 3)

Bits

7 6 5

0 0 0 NSAP (ITU-T Recommendation X.213 or ISO 8348 AD2)

0 1 0 user-specified

All other values are reserved.

Odd/even indicator (octet 3)

Bit

4

0 even number of address signals

1 odd number of address signals

NOTE – The odd/even indicator is used when type of subaddress is “user-specified” and the coding is BCD.

Subaddress information (octets 4, etc.)

The NSAP address shall be encoded using the preferred binary encoding specified in ITU-T Recommendation X.213 or ISO 8348 AD2.

When the AFI=50 (encoded in BCD as 0101 0000), IA5 characters are encoded as specified in Table 11 of ITU-T Recommendation T.50 or ISO 646 with the eighth bit set to zero. When the AFI=51 (encoded in BCD as 0101 0001), ASCII characters are encoded as specified in ANSI X3.4 with the eighth bit set to zero. Examples of encoding OSI and non-OSI NSAP addresses are included in Annex H.

For a user-specified subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with ITU-T Recommendation X.25 networks, BCD coding should be applied.

4.5.11 Cause

The Cause information element is defined in ATIS-1000650.

4.5.12 Channel Identification

The purpose of the channel identification information element is to identify a channel within the interface(s) controlled by these signaling procedures. The default maximum length for this information element is network-dependent.

Examples of the coding of the channel identification information element are shown in Annex H.

8	7	6	5	4	3	2	1	Octet
Channel identification information element identifier								
0	0	0	1	1	0	0	0	1
Length of channel identification contents								2
1 ext	Int. id. present	Int. type	0 spare	Pref./ Excl.	D- channel ind.	Info. channel selection		3
0/1 ext	Interface identifier						3.1* etc. (Note 1)	
1 ext	Coding standard		Number/ Map	Channel type / Map element type				3.2* (Note 2,5)
Channel number / Slot map (Note 3)								3.3* (Note 2,4,5)

NOTES

- 1 When the "interface identifier present" field in octet 3 indicates "interface implicitly identified," octet 3.1 is omitted. When octet 3.1 is present, it may be extended by using the extension bit (bit 8).
- 2 When the "interface type" field in octet 3 indicates "basic interface," octets 3.2 and 3.3 are functionally replaced by the "information channel selection" field in octet 3, and thus omitted.
- 3 When channel number is used and a single channel is identified, bit 8 shall be set to 1. When channel number is used and multiple channels are indicated, bit 8 shall be used as an extension bit to indicate an extension to subsequent channels encoded according to the rules specified in 4.5.1.
- 4 When channel number is used, this octet may be repeated to indicate multiple channels.
- 5 In case of RESTART procedures defined in clause 5.5, these octets shall be omitted when the RESTART indicator is coded to indicate a single interface. For multirate procedures defined in clause 8 these octets shall be omitted when the entire interface, i.e., 24 B-channels are to be identified.

Figure 17 – Channel identification information element

Interface identifier present (octet 3)

Bit

7

- 0 Interface implicitly identified (see Note)
- 1 Interface explicitly identified in one or more octets beginning with octet 3.1

NOTE – The interface that includes the D-channel carrying this information element is indicated.

Interface type (octet 3)

Bit

6

- 0 basic interface
- 1 other interface; e.g., primary rate (see Note)

NOTE – The type of interface should be understood because the interface is identified by the “interface identifier present” field (octet 3, bit 7) and the “interface identifier” field (octet 3.1), if any.

Preferred/Exclusive (octet 3)

Bit

4

- 0 Indicated channel is preferred
- 1 Exclusive; only the indicated channel is acceptable

NOTE – Preferred/Exclusive has significance only for B-channel selection.

D-channel indicator (octet 3)

Bit

3

- 0 The channel identified is not the D-channel
- 1 The channel identified is the D-channel

NOTE – D-channel indication has significance in D-channel use. No other information affects D-channel use.

Information channel selection (octet 3) (see Note 1)

Bits	<u>Basic interface</u>	<u>Other interfaces</u>
<u>2 1</u>		
0 0	no channel (see Note 2)	no channel (see Note 2)
0 1	B ₁ channel	As indicated in the following octets.
1 0	B ₂ channel	reserved
1 1	any channel (see Notes 3, 4)	any channel (see Note 3)

NOTES

- 1 The information channel selection does not apply to the D-channel.
- 2 This codepoint is included for use of supplementary and packet services.
- 3 This codepoint should not be used in the network-user direction for circuit-switched calls in a point to multipoint configuration.
- 4 This value shall be used on a basic rate access when both B-channels are to be identified, e.g., multirate (64 kbit/s base rate). This shall not be used for restart.

Interface identifier (octet 3.1)

Binary code assigned to the interface at subscription time. At subscription time the binary code for the interface identifier will specify the number of octets to be used and the content of each octet.

NOTE – When the interface is implicitly identified, octet 3.1 is omitted.

Coding standard (octet 3.2)

Bits	
<u>7 6</u>	
0 0	CCITT standardized coding
1 0	National standard

All other values are reserved.

Number/map (octet 3.2)

Bit	
<u>5</u>	
0	Channel is identified by the number in the following octet
1	Channel is indicated by the slot map (map) in the following octet(s)

NOTE – Slot map shall be used when supporting the multirate (64 kbit/s base rate) bearer capability on a primary rate access.

Channel type/map element type (octet 3.2)

Bits

4 3 2 1

0 0 1 1 B-channel units (see Note)

0 1 1 0 H₀-channel units

1 0 0 0 H₁₁-channel units

All other values are reserved.

NOTE – This value shall be used for multirate (64 kbit/s base rate) bearer capability.

Channel number (octet 3.3)

Binary number assigned to the channel. For B-channels, the channel number equals the time slot number. See ITU-T Recommendation I.431.

NOTE – Either “channel number” or “slot map” is used exclusively depending on the “number/map” information.

Slot map (octet 3.3)

Bit position(s) in slot map corresponding to time slot(s) used by the channel is (are) set to 1. Some examples are listed below.

NOTE – The length of the slot map (in bits) is defined by the capacity of the interface type (e.g., 1536 kbit/s for a primary rate interface) divided by the capacity of the channel type/map-element type (e.g., 64 kbit/s for a B-channel). The length of the slot map is the smallest number of complete octets that contain the length in bits.

8	7	6	5	4	3	2	1	Bit	
24	23	22	21	20	19	18	17		Octet 3.3.1
16	15	14	13	12	11	10	9		3.3.2
8	7	6	5	4	3	2	1		3.3.3

a) Primary rate interface, map element = B-channel

8	7	6	5	4	3	2	1	Octet
				d(4)	c(3)	b(2)	a(1)	3.3

NOTES

- 1 See ITU-T Recommendation I.431, Annex A, concerning the meaning of a-d.
- 2 Number within parentheses indicates the associated H₀-channel number when corresponding H₀-channel is represented by channel number in octet 3.3.

b) Primary rate interface, map element = H₀-channel

8	7	6	5	4	3	2	1	Octet
							H ₁₁ (1)	3.3

NOTE – Number within parentheses indicates the associated H₁₁-channel number when corresponding H₁₁-channel is represented by channel number in octet 3.3.

c) Primary rate interface, map element = H₁₁-channel

Figure 18 – Slot map

4.5.13 Connected Number

The purpose of the connected number information element is to identify the responding party to the call.

The maximum length of this information element is 19 octets.

NOTE – The connected number information element is transported transparently by the ISDN between the responding user and the calling user unless restricted by supplementary services.

8	7	6	5	4	3	2	1	Octet
0		Connected number information element identifier						1
		1	0	0	1	1	0	0
Length of connected number contents								2
0/1 ext	Type of number			Numbering plan identification				3
1 ext	Presentation indi- cator	0	0	0	Screening indicator			3a*
0		Number digits (ASCII characters)						4 etc.

Figure 19 – Connected number information element

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

Bits

7 6 5

- 0 0 0 unknown (see Note 2)
- 0 0 1 international number (see Note 3)
- 0 1 0 national number (see Notes 3, 5)
- 0 1 1 network-specific number (see Note 4)
- 1 0 0 subscriber number (see Notes 3)
- 1 1 0 abbreviated number (see Note 6)
- 1 1 1 reserved for extension

All other values are reserved.

NOTES

- 1 For the definition of “international, national and subscriber number” see ITU-T Recommendation I.330.
- 2 The type of number “unknown” is used when the user or the network has no knowledge of the type of number (e.g., “international number,” “national number”). In this case, the number digits field is organized according to the network dialing plan; e.g., prefix or escape digits might be present.
- 3 Prefix or escape digits shall not be included.
- 4 The type of number “network-specific number” is used to indicate administration and service number specific to the serving network.
- 5 For calls between the United States and other countries within world zone 1, where the numbering plan identification is “ISDN/telephony numbering plan,” “type of number” is coded to “national number.”
- 6 The support of this code is network dependent. The number provided in this information element presents a shorthand representation of the complete number in the specified numbering plan as supported by the network.

Numbering Plan Identification (octet 3)

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

Bits

4 3 2 1

0 0 0 0	unknown (Note)
0 0 0 1	ISDN/telephony numbering plan (ITU-T Recommendations E.164)
0 0 1 1	data numbering plan (ITU-T Recommendation X.121)
0 1 0 0	telex numbering plan (ITU-T Recommendation F.69)
1 0 0 1	private numbering plan
1 1 1 1	reserved for extension

All other values are reserved.

NOTE – The numbering plan “unknown” is used when the user or the network has no knowledge of the numbering plan. In this case the number digits field is organized according to the network dialing plan; e.g., prefix or escape digits might be present.

Presentation indicator (octet 3a) (see Note 1)

Bits

7 6

0 0	presentation allowed
0 1	presentation restricted (see Note 2)
1 0	number not available (see Note 2)
1 1	reserved

NOTES

1 If octet 3a is omitted, the value “0 0 – presentation allowed” is assumed.

2 Reserved for supplementary services.

Screening indicator (octet 3a) (see Note 1)

Bits

2 1

0 0	user-provided, not screened
-----	-----------------------------

- 0 1 user-provided, verified and passed (see Note 2)
- 1 0 user-provided, verified and failed (see Note 2)
- 1 1 network-provided (see Note 2)

NOTES

- 1 If octet 3a is omitted, the value "0 0 – user-provided not screened" is assumed.
- 2 Reserved for supplementary services.

Number digits (octets 4, etc.)

This field is coded with ASCII characters, according to the formats specified in the appropriate numbering or dialing plan.

4.5.14 Connected Subaddress

The purpose of the connected subaddress information element is to identify the subaddress of the responding party of a call. For the definition of subaddress, see ITU-T Recommendations I.330 and I.334.

The maximum length of this information element is 23 octets.

8	7	6	5	4	3	2	1	Octet
0	Connected subaddress information element identifier							1
1	0	0	1	1	0	1		
Length of connected subaddress contents								2
1 ext	Type of subaddress		odd/even indicator	0	0	0	Spare	3
Subaddress information								4 etc.

NOTE – The network need not screen the information contained within this information element beyond octet 2.

Figure 20 – Connected subaddress information element

Type of subaddress (octet 3)

Bits

7 6 5

- 0 0 0 NSAP (ITU-T Recommendation X.213 or ISO 8348 AD2)
- 0 1 0 user-specified

All other values are reserved.

Odd/even indicator (octet 3)

Bit

4

0 even number of address signals

1 odd number of address signals

NOTE – The odd/even indicator is used when type of subaddress is “user-specified” and the coding is BCD.

Subaddress information (octets 4, etc.)

The NSAP address shall be encoded using the preferred binary encoding specified in ITU-T Recommendation X.213 or ISO 8348 AD2.

When the AFI=50 (encoded in BCD as 0101 0000), IA5 characters are encoded as specified in Table 11 of ITU-T Recommendation T.50 or ISO 646 with the eighth bit set to zero. When AFI=51 (encoded in BCD as 0101 0001), ASCII characters are encoded as specified in ANSI X3.4 with the eighth bit set to zero. Examples of encoding OSI and non-OSI NSAP addresses are included in Annex H.

For a user-specified subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with ITU-T Recommendation X.25 networks, BCD coding should be applied.

4.5.15 Display

The purpose of the display information element is to supply display information that may be displayed by the user. The information contained in this element is coded in ASCII characters.

The display information element has a default maximum of 82 octets. If a user receives a display information element with a length exceeding the maximum length that the user can handle, the information element should be truncated by the user.

8	7	6	5	4	3	2	1	Octet
Display information element identifier								1
0	0	1	0	1	0	0	0	
Length of display contents								2
0								3 etc.

Figure 21 – Display information element

4.5.16 High Layer Compatibility

The purpose of the high layer compatibility information element is to provide a means that should be used by the remote user for compatibility checking. See Annex B.

The maximum length for this information element is five octets.

By bilateral agreement, the high layer compatibility information element can be repeated in the SETUP message to indicate dual high layer capabilities for selection. By default, if the High layer compatibility information element is repeated without the Repeat indicator information element, it shall be interpreted as increasing order of priority.

NOTES

- 1 The high layer compatibility information element is transported transparently by an ISDN between a call originating entity (e.g., a calling user) and the addressed entity (e.g., a remote user or a high layer function network node addressed by the call originating entity). However, if explicitly requested by the user (at subscription time), a network that has some capabilities to provide teleservices may interpret this information in order to provide a particular service.
- 2 Reliance on the high layer compatibility information element should be avoided; however, the high layer compatibility information element is required for international operation and ISDN telematic services.

8	7	6	5	4	3	2	1	Octet
0	High layer compatibility information element identifier							1
1	1	1	1	1	1	0	1	
Length of high layer compatibility contents								2
1 ext	Coding standard	Interpretation			Presentation method of protocol profile			3
0/1 ext	High layer characteristics identification							4
1 ext	Extended high layer characteristics identification							4a* (Note)

Note – This octet may be present when octet 4 indicates Maintenance or Management.

Figure 22 – High layer compatibility information element

Coding standard (octet 3)

Bits

7 6

- | | |
|-----|---|
| 0 0 | CCITT standardized coding |
| 0 1 | ISO/IEC standard (see Note) |
| 1 0 | National standard (see Note) |
| 1 1 | Standard defined for the network (either public or private) present at the network side of the interface (see Note) |

All other values are reserved.

NOTE – This coding standard should be used only when the desired high layer compatibility cannot be represented with CCITT standardized coding.

Interpretation (octet 3)

Bits

5 4 3

- | | |
|-------|---|
| 1 0 0 | First (primary or only) high layer characteristics identification (in octet 4) to be used in the call |
|-------|---|

All other values are reserved.

NOTES

- 1 "Interpretation" indicates how the "high layer characteristics identification" (in octet 4) should be interpreted.
- 2 Currently, "Interpretation" has only a single value. However, "Interpretation," when enhanced, will be able to indicate how the "High layer characteristics identification" in the same information element shall be interpreted when multiple "High layer characteristics identifications" are used and exact relationship among them needs to be indicated (e.g. sequential usage, alternative list, simultaneous usage). Such enhancements in conjunction with the possible negotiation procedures are left for further study.

Presentation method of protocol profile (octet 3)

Bits

2 1

- | | |
|-----|---|
| 0 1 | High layer protocol profile (without specification of attributes) |
|-----|---|

All other values are reserved.

NOTE – Currently, "Presentation method of protocol profile" has only a single value, i.e. a "profile value," that is used to indicate a service to be supported by high layer protocols as required. Necessity of other presentation methods, e.g. service indications in the forum of layer-by-layer indication of protocols to be used in high layers, is left for further study.

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High layer characteristics identification (octet 4) (see Notes 1,3)

Bits

7 6 5 4 3 2 1

0 0 0 0 0 0 1	Telephony
0 0 0 0 1 0 0	Facsimile Group 2/3 (ITU-T Recommendation F.182)
0 1 0 0 0 0 1	Facsimile Group 4 Class 1 (ITU-T Recommendation F.184)
0 1 0 0 1 0 0	Teletex service, basic and mixed mode operation (ITU-T Recommendation F.230) and facsimile service Group 4, Classes II and III (ITU-T Recommendation F.184)
0 1 0 1 0 0 0	Teletex service, basic and processable mode of operation (ITU-T Recommendation F.220)
0 1 1 0 0 0 1	Teletex service, basic mode of operation (ITU-T Recommendation F.200)
0 1 1 0 0 1 0	Syntax based Videotex (ITU-T Recommendations F.300 and T.102)
0 1 1 0 0 1 1	International Videotex interworking via gateways, or interworking units (ITU-T Recommendations F.300 and T.101)
0 1 1 0 1 0 1	Telex service (Recommendation F.60)
0 1 1 1 0 0 0	Message Handling System (MHS) (ITU-T Recommendation X.400)
1 0 0 0 0 0 1	OSI Application (ITU-T Recommendation X.200) (see Note 2)
1 0 1 1 1 1 0	Reserved For Maintenance (see Note 4)
1 0 1 1 1 1 1	Reserved For Management (see Note 4)
1 1 0 0 0 0 0	Audiovisual (ITU-T Recommendation F.721)
1 1 0 0 0 0 1	
through	Reserved for audio visual services (ITU-T Recommendation F.700 series)
1 1 0 1 1 1 1	
1 1 1 1 1 1 1	reserved

All other values are reserved.

NOTES

- 1 The coding above applies in case of "Coding standard" = "CCITT standardized coding" and "Presentation method of protocol profile" = "High layer protocol profile."
- 2 Further compatibility checking will be executed by the OSI high layer protocol.
- 3 Codepoints are added to only those services for which ITU-T Recommendations are available. See also ITU-T Recommendation I.241.
- 4 When this coding is included, octet 4 may be followed by octet 4a.

Extended high layer characteristics identification (octet 4a) (see Notes 1,3)

Bits

7 6 5 4 3 2 1

- 0 0 0 0 0 0 1 Telephony
- 0 0 0 0 1 0 0 Facsimile Group 2/3 (ITU-T Recommendation F.182)
- 0 1 0 0 0 0 1 Facsimile Group 4 Class 1 (ITU-T Recommendation F.184)
- 0 1 0 0 1 0 0 Teletex service, basic and mixed mode operation (ITU-T Recommendation F.230) and facsimile service Group 4, Classes II and III (ITU-T Recommendation F.184)
- 0 1 0 1 0 0 0 Teletex service, basic and processable mode of operation (ITU-T Recommendation F.220)
- 0 1 1 0 0 0 1 Teletex service, basic mode of operation (ITU-T Recommendation F.200)
- 0 1 1 0 0 1 0 Syntax based Videotex (ITU-T Recommendations F.300 and T.102)
- 0 1 1 0 0 1 1 International Videotex interworking via gateways, or interworking units (ITU-T Recommendations F.300 and T.101)
- 0 1 1 0 1 0 1 Telex service (ITU-T Recommendation F.60)
- 0 1 1 1 0 0 0 Message Handling System (MHS) (ITU-T Recommendation X.400)
- 1 0 0 0 0 0 1 OSI Application (ITU-T Recommendation X.200) (see Note 2)
- 1 0 1 1 1 1 0 Not available for assignment
- 1 0 1 1 1 1 1 Not available for assignment
- 1 1 0 0 0 0 0 Audiovisual (ITU-T Recommendation F.721)
- 1 1 0 0 0 0 1
- through Reserved for audio visual services (ITU-T Recommendation F.700 series)
- 1 1 0 1 1 1 1
- 1 1 1 1 1 1 1 reserved

All other values are reserved.

NOTES

- 1 The coding above applies in case of "Coding standard" = "CCITT standardized coding" and "Presentation method of protocol profile" = "High layer protocol profile."
- 2 Further compatibility checking will be executed by the OSI high layer protocol.
- 3 Codepoints are added to only those services for which ITU-T Recommendations are available. See also ITU-T Recommendation I.241.

4.5.17 Keypad Facility

The purpose of the keypad facility information element is to convey ASCII characters, which are entered by means of a terminal keypad.

The type of information carried by the digits in this information element can also be provided by the called party number as defined in 4.5.7. The Keypad facility information element cannot be used in combination with Called party number, Transit network selection, or Operator system access information element.

The default maximum length of this information element is 34 octets.

8	7	6	5	4	3	2	1	Octet
Keypad facility information element identifier								1
0	0	1	0	1	1	0	0	
Length of keypad facility contents								2
0	Keypad facility information (ASCII characters)							3 etc.

Figure 23 – Keypad facility information element

4.5.18 Low Layer Compatibility

The purpose of the Low layer compatibility information element is to provide a means that should be used for compatibility checking by an addressed entity (e.g., a remote user or an interworking unit or a high layer function network node addressed by the calling user). The low layer compatibility information element is transferred transparently by an ISDN between the call originating entity (e.g., the calling user) and the addressed entity. See Annex B and Annex L.

If low layer compatibility negotiation is allowed by the network (see Annex M), the low layer compatibility information element is also passed transparently from the addressed entity to the originating entity.

The maximum length of this information element is 15 octets.

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8	7	6	5	4	3	2	1	Octet
0	Low layer compatibility information element identifier							1
	1	1	1	1	1	0	0	
Length of the low layer capability contents								2
0/1 ext	Coding standard		Information transfer capability					3
1 ext	Negot indic	0	0	0	0	0	0	3a*
			spare					
1 ext	Transfer mode		Information transfer rate					4 (Note 1)
1 ext	Rate multiplier							4.1* (Note 5)
0/1 ext	0	1	User information layer 1 protocol					5*
	Layer 1 identity							
0/1 ext	Synch./ Asynch.	Negot.	User rate					5a* (Note 4)
0/1 ext	Intermediate rate		NIC on Tx	NIC on Rx	Flow control on Tx	Flow control on Rx	0 spare	5b* (Note 2)
0/1 ext	Hdr/ no Hdr	Multiframe	Mode	LLI Negot.	Assignor/ Assignee	Inband/ Outband	0 spare	5b* (Note 3)
0/1 ext	Number of stop bits		Number of data bits		Parity			5c* (Note 4)
1 ext	Duplex mode	Modem type					5d* (Note 4)	
0/1 ext	1	0	User information layer 2 protocol					6*
	Layer 2 ident							
1 ext	User specified layer 2 protocol information							6a* (Note 6)
0/1 ext	Mode		0	0	0	Q.933 use		6a* (Note 7)
			Spare					

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1 ext	Window size (k)				6b* (Note 7)	
0/1 ext	1	1	User information layer 3 protocol		7*	
1 ext	User specified layer 3 protocol information				7a* (Note 8)	
0/1 ext	Mode	0	0	0	0	7a* (Note 9)
0/1 ext	0	0	0	Default packet size		7b* (Note 9)
1 ext	Packet window size				7c (Note 9)	

NOTES

- 1 Other attributes that are not explicitly coded are shown in Table 23.
- 2 This structure and coding applies only when octet 5 indicates CCITT standardized rate adaptation ITU-T Recommendations V.110 and X.30.
- 3 This structure and coding applies only when octet 5 indicates CCITT standardized rate adaptation ITU-T Recommendation V.120.
- 4 This octet may be present if octet 3 indicates *unrestricted digital information* and octet 5 indicates either of the CCITT standardized rate adaptations ITU-T Recommendations V.110 and X.30 or ITU-T Recommendation V.120. It may also be present if octet 3 indicates 3.1 kHz audio and octet 5 indicates ITU-T Recommendation G.711.
- 5 This octet is required if octet 4 indicates multirate (64 kbit/s base rate). Otherwise, it shall not be present.
- 6 This octet may be present only if octet 6 indicates user specified layer 2 protocol.
- 7 This octet may be present only if octet 6 indicates certain acknowledged mode HDLC elements.
- 8 This octet may be present only if octet 7 indicates user specified layer 3 protocol.
- 9 This octet may be present only if octet 7 indicates a layer 3 protocol based on ITU-T Recommendation X.25 (ISO/IEC 8208) or ITU-T Recommendation X.223 (ISO 8878).

Figure 24 – Low layer capability information element

Coding standard (octet 3)

Bits

7 6

- 0 0 CCITT standardized coding
- 0 1 ISO/IEC standard (see Note)
- 1 0 National standard as described below.
- 1 1 Standard defined for the network (either public or private) present at the network side of the interface (see Note)

All other values are reserved.

NOTE – This coding standard should be used only when the desired low layer compatibility cannot be represented with either CCITT or national standardized coding.

Information transfer capability (octet 3)

Bits

5 4 3 2 1

- 0 0 0 0 0 speech
- 0 1 0 0 0 unrestricted digital information
- 0 1 0 0 1 restricted digital information
- 1 0 0 0 0 3.1-kHz audio
- 1 0 0 0 1 unrestricted digital information with tones/announcements (see Note)

All other values are reserved.

NOTE – Unrestricted digital information with tones/announcements (UDI-TA) is the new information transfer attribute value that had previously been named “7-kHz audio” in ATIS-1000607..

Negotiation indicator (octet 3a)

Bit

7

- 0 Out-of-band negotiation not possible
- 1 Out-of-band negotiation possible

NOTES

- 1 See Annex M for description of low layer compatibility negotiation.
- 2 When octet 3a is omitted, “out-of-band negotiation not possible” shall be assumed.

Transfer mode (octet 4)

Bits

7 6

0 0 circuit mode

1 0 packet mode

All other values are reserved.

Information transfer rate (octet 4)

Bits

<u>5 4 3 2 1</u>	<u>Circuit-mode</u>	<u>Packet-mode</u>
------------------	---------------------	--------------------

0 0 0 0 0	–	This code shall be used for packet mode calls.
-----------	---	--

1 0 0 0 0	64 kbit/s	-
-----------	-----------	---

1 0 0 1 1	384 kbit/s	-
-----------	------------	---

1 0 1 0 1	1536 kbit/s	-
-----------	-------------	---

1 1 0 0 0	Multirate (64 kbit/s base rate)	-
-----------	---------------------------------	---

All other values are reserved.

Rate multiplier (octet 4.1)

Coded as a binary representation of the multiplier to the base rate. The multiplier can take any value from 2 up to the maximum number of B-channels available on the interface (maximum of 24).

User information layer 1 protocol (octet 5) (see Note 1)

Bits

5 4 3 2 1

0 0 0 0 1	CCITT standardized rate adaptation ITU-T Recommendation V.110 and X.30. This implies the presence of octet 5a and optionally octets 5b, 5c, and 5d as defined below
-----------	---

0 0 0 1 0	ITU-T Recommendation G.711 μ -law
-----------	---------------------------------------

0 0 0 1 1	ITU-T Recommendation G.711 A-law
-----------	----------------------------------

0 0 1 0 0	ITU-T Recommendation G.721 32 kbit/s ADPCM and ITU-T Recommendation I.460
-----------	---

0 0 1 0 1	ITU-T Recommendations H.221 and H.242
-----------	---------------------------------------

0 0 1 1 1	Non-CCITT standardized rate adaptation. This implies the presence of octet 5a and, optionally, octets 5b, 5c and 5d (see Note 2)
-----------	--

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- 0 1 0 0 0 CCITT standardized rate adaptation ITU-T Recommendation V.120. This implies the presence of octet 5a and 5b as described below, and optionally octets 5c and 5d
- 0 1 0 0 1 CCITT standardized rate adaptation ITU-T Recommendation X.31 HDLC flag stuffing

All other values are reserved.

NOTES

- 1 If the transfer mode is "circuit-mode" and if the information transfer capability is "unrestricted digital information" or "restricted digital information," and if the user information layer 1 protocol is not to be identified to the network, then octet 5 shall be omitted. If the transfer mode is "packet-mode," octet 5 may be omitted. Otherwise, octet 5 shall be present.
- 2 The use of this codepoint indicates that the user rate specified in octet 5a is defined by the user. Additionally, octets 5b, 5c and 5d, if present, are defined consistent with the user-specified rate adaptation.

Synchronous/asynchronous (octet 5a)

Bit

7

- 0 synchronous data
- 1 asynchronous data

NOTE – The protocols synchronous and asynchronous refer to the R reference point. In case of synchronous user rate except for half duplex operation, octet 5c and 5d may be omitted for ITU-T Recommendation V.110 and X.30 or V.120. In certain circumstances, octet 5b may be omitted for ITU-T Recommendation V.110 and X.30.

Negotiation (octet 5a)

Bit

6

- 0 In-band negotiation not possible
- 1 In-band negotiation possible

NOTE – Applicable to ITU-T Recommendations V.110 and X.30 or modem type recommendations.

User rate (octet 5a)

Bits

5 4 3 2 1

0 0 0 0 0	Rate is indicated by E-bits specified in ITU-T Recommendation I.460
0 0 0 0 1	0.6 kbit/s ITU-T Recommendation X.1
0 0 0 1 0	1.2 kbit/s
0 0 0 1 1	2.4 kbit/s ITU-T Recommendation X.1
0 0 1 0 0	3.6 kbit/s
0 0 1 0 1	4.8 kbit/s ITU-T Recommendation X.1
0 0 1 1 0	7.2 kbit/s
0 0 1 1 1	8 kbit/s ITU-T Recommendation I.460
0 1 0 0 0	9.6 kbit/s ITU-T Recommendation X.1
0 1 0 0 1	14.4 kbit/s
0 1 0 1 0	16 kbit/s ITU-T Recommendation I.460
0 1 0 1 1	19.2 kbit/s
0 1 1 0 0	32 kbit/s ITU-T Recommendation I.460
0 1 1 0 1	38.4 kbit/s (Note 1)
0 1 1 1 0	48 kbit/s ITU-T Recommendation X.1
0 1 1 1 1	56 kbit/s
1 0 0 0 0	64 kbit/s ITU-T Recommendation X.1
1 0 1 0 1	0.1345 kbit/s ITU-T Recommendation X.1
1 0 1 1 0	0.100 kbit/s ITU-T Recommendation X.1
1 0 1 1 1	0.075/1.2 kbit/s ITU-T Recommendation X.1 (see Note 2)
1 1 0 0 0	1.2/0.075 kbit/s ITU-T Recommendation X.1 (see Note 2)
1 1 0 0 1	0.050 kbit/s ITU-T Recommendation X.1
1 1 0 1 0	0.075 kbit/s ITU-T Recommendation X.1
1 1 0 1 1	0.110 kbit/s ITU-T Recommendation X.1
1 1 1 0 0	0.150 kbit/s ITU-T Recommendation X.1
1 1 1 0 1	0.200 kbit/s ITU-T Recommendation X.1
1 1 1 1 0	0.300 kbit/s ITU-T Recommendation X.1
1 1 1 1 1	12 kbit/s

All other values are reserved.

NOTES

- 1 This is an American national codepoint and can be used only with the coding standard field specifying national standard "10" (It is anticipated that this codepoint will be adopted by the ITU at which time it could be used with the coding standard field specifying CCITT standardized coding "00").
- 2 The first rate is the transmit rate in the forward direction of the call. The second rate is the transmit rate in the backward direction of the call.

Octet 5b for ITU-T Recommendation V.110 and X.30 rate adaptation

Intermediate Rate (octet 5b)

Bits

7 6

- | | |
|-----|-----------|
| 0 0 | Not used |
| 0 1 | 8 kbit/s |
| 1 0 | 16 kbit/s |
| 1 1 | 32 kbit/s |

Network Independent Clock (NIC) on Transmission (TX) (octet 5b)

Bit

5

- | | |
|---|------------------------------------|
| 0 | Not required to send data with NIC |
| 1 | Required to send data with NIC |

NOTE – This field refers to transmission in forward direction of the call.

Network Independent Clock (NIC) on Reception (RX) (octet 5b)

Bit

4

- | | |
|---|---|
| 0 | Cannot accept data with NIC (i.e., sender does not support this optional procedure) |
| 1 | Can accept data with NIC (i.e., sender does support this optional procedure) |

NOTE – This field refers to transmission in backward direction of the call.

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Flow control on Transmission (TX) (octet 5b) (see Note 1)

Bit

3

0 Not required to send data with flow control mechanism

1 Required to send data with flow control mechanism

NOTE – This field refers to transmission in forward direction of the call.

Flow control on Reception (RX) (octet 5b) (see Note 1)

Bit

2

0 Cannot accept data with flow control mechanism (i.e., sender does not support this optional procedure)

1 Can accept data with flow control mechanism (i.e., sender does support this optional procedure)

NOTE – This field refers to transmission in backward direction of the call.

Octet 5b for ITU-T Recommendation V.120 rate adaptation

Rate adaptation header/no header (octet 5b)

Bits

7

0 Rate adaptation header not included

1 Rate adaptation header included

Multiple frame establishment support in data link (octet 5b)

Bit

6

0 Multiple frame establishment not supported. Only UI frames are allowed

1 Multiple frame establishment supported

Mode of operation (octet 5b)

Bit

5

- 0 Bit transparent mode of operation
- 1 Protocol sensitive mode of operation

Logical Link Identifier (LLI) negotiation (octet 5b)

Bit

4

- 0 Default LLI=256 only
- 1 LLI negotiation (Note)

NOTE – A connection over which LLI negotiation will be carried is indicated in bit 2 of octet 5b.

Assignor/Assignee (octet 5b)

Bit

3

- 0 Message originator is “Default Assignee”
- 1 Message originator is “Assignor Only”

In-band/Out-of-Band negotiation (octet 5b)

Bit

2

- 0 Not applicable to this standard
- 1 Negotiation is done in-band using logical link zero

Number of stop bits (octet 5c)

Bits

7 6

- 0 0 Not used
- 0 1 1 bit
- 1 0 1.5 bits
- 1 1 2 bits

NOTE – If bit 7 of octet 5a is “0,” then these bits, when present, are set to “0” on transmission and are ignored on reception.

Number of data bits excluding parity bit (octet 5c)

Bits

5 4

0 0	Not used
0 1	5 bits
1 0	7 bits
1 1	8 bits

NOTE – If bit 7 of octet 5a is “0,” then these bits, when present, are set to “0” on transmission and are ignored on reception.

Parity information (octet 5c)

Bits

3 2 1

0 0 0	Odd
0 1 0	Even
0 1 1	None
1 0 0	Forced to 0
1 0 1	Forced to 1

All other values are reserved.

NOTE – If bit 7 of octet 5a is “0,” then these bits, when present, are set to “0” on transmission and are ignored on reception.

Duplex mode (octet 5d)

Bit

Z

0	Half duplex
1	Full duplex

Modem type (octet 5d)

Bits

6 5 4 3 2 1

0 0 0 0 0 0

through national use (reserved)

0 0 0 1 0 1

0 1 0 0 0 1 ITU-T Recommendation V.21

0 1 0 0 1 0 ITU-T Recommendation V.22

0 1 0 0 1 1 ITU-T Recommendation V.22 bis

0 1 0 1 0 0 ITU-T Recommendation V.23

0 1 0 1 0 1 ITU-T Recommendation V.26

0 1 0 1 1 0 ITU-T Recommendation V.26 bis

0 1 0 1 1 1 ITU-T Recommendation V.26 ter

0 1 1 0 0 0 ITU-T Recommendation V.27

0 1 1 0 0 1 ITU-T Recommendation V.27 bis

0 1 1 0 1 0 ITU-T Recommendation V.27 ter

0 1 1 0 1 1 ITU-T Recommendation V.29

0 1 1 1 0 1 ITU-T Recommendation V.32

1 0 0 0 0 0

through national use (reserved)

1 0 1 1 1 1

1 1 0 0 0 0

through user specified

1 1 1 1 1 1

All other values are reserved.

User information layer 2 protocol (octet 6)

Bits

5 4 3 2 1

0 0 0 0 1	basic mode ISO 1745
0 0 0 1 0	ITU-T Recommendation Q.921 (I.441) (see Note 1)
0 0 1 1 0	ITU-T Recommendation X.25 link layer (see Note 1, 2)
0 0 1 1 1	ITU-T Recommendation X.25 multilink (see Note 1)
0 1 0 0 0	extended LAPB for half duplex operation (ITU-T Recommendation T.71)
0 1 0 0 1	HDLC ARM (ISO 4335) (see Note 1)
0 1 0 1 0	HDLC NRM (ISO 4335) (see Note 1)
0 1 0 1 1	HDLC ABM (ISO 4335) (see Note 1)
0 1 1 0 0	LAN logical link control (ISO 8802 Part 2)
0 1 1 0 1	ITU-T Recommendation X.75, Single Link Procedure (SLP) (see Note 1)
0 1 1 1 0	ITU-T Recommendation Q.922 (see Note 1)
0 1 1 1 1	Core Aspects of ITU-T Recommendation Q.922
1 0 0 0 0	user-specified (see Note) (Note 3)
1 0 0 0 1	ISO 7776 DTE-DTE operation (Notes 1, 4)

All other values are reserved.

NOTE

- 1 When this coding is included, octets 6a and 6b with CCITT encoding may be included.
- 2 This Recommendation is compatible with ISO 7776 DTE-DCE operation.
- 3 When this coding is included, octet 6a will include the codepoint for user-specified layer 2 protocol.
- 4 This Standard is compatible with Recommendation X.75 modified by the application rules defined in Recommendation T.90.

Octet 6a for user-specified layer 2 protocol

User specified layer 2 protocol information (octet 6a)

User-specified layer 2 protocol.

Octet 6a for CCITT coded layer 2 protocol

Mode of operation (octet 6a)

Bits

7 6

- 0 1 Normal mode of operation
- 1 0 Extended mode of operation

All other values are reserved.

Q.933 use (octet 6a)

Bits

7 6

- 0 0 For use when the coding defined in Recommendation Q.933 is not used.

All other values are reserved.

Packet size (octet 6b)

Bits 7-1 binary coding of *k* parameter value in the range from 1 to 127.

User information layer 3 protocol (octet 7)

Bits

5 4 3 2 1

- 0 0 0 1 0 ITU-T Recommendation Q.931 (I.451)
- 0 0 1 1 0 ITU-T Recommendation X.25 packet layer (see Note 1)
- 0 0 1 1 1 ISO 8208 (ITU-T Recommendation X.25 packet level protocol for data terminal equipment) (see Note 1)
- 0 1 0 0 0 ITU-T Recommendation X.223 (ISO 8878) (use of ISO/IEC 8208 and ITU-T Recommendation X.25 to provide the OSI-CONS) (see Note 1)
- 0 1 0 0 1 ISO 8473 (OSI connectionless service)
- 0 1 0 1 0 ITU-T Recommendation T.70 minimum network layer
- 0 1 0 1 1 ISO/IEC TR 9577 [82] (Protocol identification in the network layer)
- 1 0 0 0 0 user-specified (see Note 2)

All other values are reserved.

NOTES

- 1 When this coding is included, octets 7a, 7b and 7c with CCITT encoding may be included.
- 2 When this coding is included, octet 7a will include the codepoint for user-specified layer 3 protocol.

Octet 7a for user-specified layer 3 protocol

User specified layer 3 protocol information (octet 7a)

User-specified layer 3 protocol.

Octet 7a for CCITT coded layer 3 protocol

Mode of operation (octet 7a)

Bits

7 6

0 1 Normal packet sequence numbering

1 0 Extended packet sequence numbering

All other values are reserved.

Default packet size (octet 7b)

Bits

4 3 2 1

0 1 0 0 Default packet size 16 octets

0 1 0 1 Default packet size 32 octets

0 1 1 0 Default packet size 64 octets

0 1 1 1 Default packet size 128 octets

1 0 0 0 Default packet size 256 octets

1 0 0 1 Default packet size 512 octets

1 0 1 0 Default packet size 1024 octets

1 0 1 1 Default packet size 2048 octets

1 1 0 0 Default packet size 4096 octets

All other values are reserved.

Packet window size (octet 7c)

Bits 7-1 binary coding of packet window size value in the range from 1 to 127.

Table 23 – Low layer compatability attributes

LLC Attributes		Additional Attributes			
Transfer Mode	Information transfer capability	Structure	Configuration	Establishment	Symmetry
circuit	speech	8 kHz integrity	point-to-point	demand	bi-directional symmetry
circuit	unrestricted digital information	8 kHz integrity	point-to-point	demand	bi-directional symmetry
circuit	restricted digital information	8 kHz integrity	point-to-point	demand	bi-directional symmetry
circuit	3.1 kHz audio	8 kHz integrity	point-to-point	demand	bi-directional symmetry
circuit	unrestricted digital information with tones/ announcements	8 kHz integrity	point-to-point	demand	bi-directional symmetry
packet	unrestricted digital information	Service data unit integrity	point-to-point	demand	bi-directional symmetry
NOTE – When multirate (64 kbit/s base rate) is indicated as the information transfer rate, time slot sequence integrity shall be provided.					

4.5.19 Network-Specific Facilities

The purpose of the network-specific facilities information element is to indicate which network facilities are being invoked. No more than four network-specific facilities information elements may be included in a single message.

The maximum length of this information element is network-dependent.

8	7	6	5	4	3	2	1	Octet
Network-specific facilities information element identifier								1
0	0	1	0	0	0	0	0	
Length of network-specific facilities contents								2
Length of network identification								3
1 ext	Type of network identification			Network identification plan				3.1* (Note 1)
0 spare	Network identification (ASCII characters)							3.2* (Note 1,2)
Network-specific facility specification								4 etc.

NOTES

- 1 Octets 3.1 and 3.2 are only present when the length in octet 3 is non-zero.
- 2 Octet 3.2 may be repeated as appropriate.

Figure 25 – Network-specific facilities information element

Length of network identification (octet 3)

This field contains the length, in octets, of the network identification found in octet 3.1 and repetition of octet 3.2. If the value is "00000000," then default provider (see E.2) is assumed and octets 3.1 and 3.2 are omitted.

Type of network identification (octet 3.1)

Bits

7 6 5

- 0 0 0 user-specified
- 0 1 0 national network identification
- 0 1 1 international network identification

All other values are reserved.

Network identification plan (octet 3.1)

Bits

4 3 2 1

0 0 0 0 unknown/user-specified

0 0 0 1 carrier identification code (see Notes 1,2)

0 0 1 1 data network identification plan (ITU-T Recommendation X.121)

All other values are reserved.

NOTES

- 1 Carrier identification codes (CICs) may be an appropriate method of identifying the network serving the remote user.
- 2 For use in the United States, Carrier Identification Codes are assigned by the North American Numbering Plan Administrator to interexchange carriers (InterLATA or IntraLATA) and international carriers. CICs are coded in ASCII characters corresponding to the digits '0' – '9'.

Network identification (octets 3.2, etc.)

These ASCII characters are organized according to the network identification plan specified in octet 3.1.

Network-specific facilities (octets 4, etc.)

This field is encoded according to the rules specified by the identified network.

4.5.20 Notification Indicator

The purpose of the notification indicator information element is to indicate information pertaining to a call.

The maximum length of this information element is three octets.

8	7	6	5	4	3	2	1	Octet
Notification indicator information element identifier								
0	0	1	0	0	1	1	1	1
Length of notification indicator contents								2
1 ext	Notification description							3

Figure 26 – Notification indicator information element

Notification description (octet 3)

Bits

7 6 5 4 3 2 1

0 0 0 0 0 1 0 bearer service change (see Annex O)

All other values are reserved.

NOTE – Other notification description values may be used in conjunction with supplementary services defined in other American National Standards.

4.5.21 Progress Indicator

The purpose of the Progress indicator information element is to describe an event that has occurred during the life of the call. The information element may occur two times in a message.

The default maximum length of this information element is 4 octets.

8	7	6	5	4	3	2	1	Octet
Progress indicator information element identifier								1
0	0	0	1	1	1	1	0	
Length of the progress indicator contents								2
1 ext	Coding standard		0 spare	Location				3
1 ext	Progress description							4

Figure 27 – Progress indicator information element

Coding standard (octet 3)

Bits

7 6

0 0 CCITT standardized coding

1 0 National standard

All other values are reserved.

Location (octet 3)

Bits

4 3 2 1

0 0 0 0 user

0 0 0 1 private network serving the local user

0 0 1 0 public network serving the local user

0 0 1 1 transit network

0 1 0 0 private network serving the remote user

0 1 0 1 public network serving the remote user

1 0 1 0 network beyond interworking point

All other values are reserved.

NOTE – Depending on the location of the users, the local public network and the remote public network may be the same network.

Progress description (octet 4) (see Note 1)

Bits

7 6 5 4 3 2 1

0 0 0 0 0 1	1	Call is not end-to-end ISDN; further call progress information may be available in-band
0 0 0 0 1 0	2	Destination address is non-ISDN
0 0 0 0 1 1	3	Origination address is non-ISDN
0 0 0 1 0 0	4	Call has returned to the ISDN
0 0 0 1 0 1	5	Interworking has occurred and has resulted in a telecommunication service change (see Note 2)
0 0 0 1 0 0 0	8	In-band information or appropriate pattern is now available
0 0 0 1 0 1 0	10	Delay in response at the called interface or within the network (see Note 3)

All other values are reserved.

NOTES

- 1 The use of the different progress descriptions is further explained in Annex I.
- 2 This progress description value shall be used only in the case of interworking in a full ISDN environment, e.g., when bearer capability selection is not supported or when resource or route of the preferred capability is not available. In case of interworking with a non-ISDN environment the progress description value 1 shall be used. If the destination address is non-ISDN, the progress description value 2 shall be used.
- 3 This is an American national codepoint and can be used only with the coding standard field specifying national standard "10."

4.5.22 Repeat Indicator

The purpose of the repeat indicator information element is to indicate how repeated information elements shall be interpreted when included in a message. The repeat indicator information element is included before the first occurrence of the information element that will be repeated in the message.

NOTE – Use of the repeat indicator information element in conjunction with an information element that occurs only once in a message shall not of itself constitute an error.

8	7	6	5	4	3	2	1	Octet
1	Repeat indicator information element			Repeat indication				1
1	1	0	1					

Figure 28 – Repeat indicator information element

Repeat indication (octet 1)

Bits

4 3 2 1

0 0 1 0 priority list for selection (see Note)

All other values are reserved.

NOTE – Used for bearer service change procedures (see Annex O).

4.5.23 Restart Indicator

The purpose of the restart indicator information element is to identify the class of the facility (i.e., channel or interface) to be restarted.

The maximum length of this information element is three octets.

8	7	6	5	4	3	2	1	Octet
Restart indicator information element identifier								
0	1	1	1	1	0	0	1	1
Length of restart indicator contents								2
1	0	0	0	0	Class			3
ext	spare							

Figure 29 – Restart indicator information element

Class (octet 3)

Bits

3 2 1

0 0 0 indicated channel (see Note 1)

1 1 0 single interface (see Note 2)

1 1 1 all interfaces

All other values are reserved.

NOTES

- 1 The Channel identification information element must be included and indicates which channel is to be restarted.
- 2 If non-associated signaling is used, the Channel identification information element must be included to indicate the interface to be restarted if it is other than the one on which the D-channel is present.

4.5.24 Signal

The purpose of the signal information element is to allow the network to optionally convey information to a user regarding tones and alerting signals.

The maximum length of this information element is three octets.

8	7	6	5	4	3	2	1	Octet
Signal information element identifier								1
0	0	1	1	0	1	0	0	
Length of signal contents								2
0	0	0	0	0	0	0	1	
Signal value								3

Figure 30 – Signal information element

Signal Value (octet 3)

Bits

8 7 6 5 4 3 2 1

0 0 0 0 0 0 0 0	dial tone on
0 0 0 0 0 0 0 1	ring back tone
0 0 0 0 0 0 1 0	intercept tone on
0 0 0 0 0 0 1 1	network congestion tone on
0 0 0 0 0 1 0 0	busy tone on
0 0 0 0 0 1 0 1	confirm tone on
0 0 0 0 0 1 1 0	answer tone on
0 0 0 0 0 1 1 1	call waiting tone on
0 0 0 0 1 0 0 0	off-hook warning tone on
0 0 0 0 1 0 0 1	preemption tone on
0 0 1 1 1 1 1 1	tones off
0 1 0 0 0 0 0 0	alerting on – pattern 0 (see Note)
0 1 0 0 0 0 0 1	alerting on – pattern 1 (see Note)
0 1 0 0 0 0 1 0	alerting on – pattern 2 (see Note)
0 1 0 0 0 0 1 1	alerting on – pattern 3 (see Note)
0 1 0 0 0 1 0 0	alerting on – pattern 4 (see Note)
0 1 0 0 0 1 0 1	alerting on – pattern 5 (see Note)
0 1 0 0 0 1 1 0	alerting on – pattern 6 (see Note)
0 1 0 0 0 1 1 1	alerting on – pattern 7 (see Note)
0 1 0 0 1 1 1 1	alerting off

All other values are reserved.

NOTE – The use of these patterns is network-dependent (see Annex R).

4.5.25 Transit Network Selection

The purpose of the transit network selection information element is to identify one requested transit network. The transit network selection information element may be repeated in a message to select a sequence of transit networks through which a call must pass (see Annex C).

The maximum length of this information element is network-dependent.

8	7	6	5	4	3	2	1	Octet
0	Transit network selection information element identifier							1
	1	1	1	1	0	0	0	
Length of transit network selection contents								2
1 ext	Type of network identification			Network identification plan				3
0	Network identification (ASCII characters)							4 etc.

Figure 31 – Transit network selection information element

Type of network identification (octet 3)

Bits

7 6 5

- 0 0 0 user-specified
- 0 1 0 national network identification
- 0 1 1 international network identification

All other values are reserved.

Network identification plan (octet 3)

Bits

4 3 2 1

- 0 0 0 0 unknown/user-specified
- 0 0 0 1 carrier identification code (see Notes 1, 2)
- 0 0 1 1 data network identification code (ITU-T Recommendation X.121)

All other values are reserved.

NOTES

- 1 Carrier identification codes (CICs) may be an appropriate method of identifying the network serving the remote user
- 2 For use in the United States, carrier identification codes are assigned by the North American Numbering Plan Administrator to interexchange carriers (InterLATA and IntraLATA) and international carriers. CICs are coded in ASCII characters corresponding to the digits '0' – '9'.

Network identification (octets 4, etc.)

These ASCII characters are organized according to the network identification plan specified in octet 3.

4.5.26 User-User

See ATIS-1000621 for the definition of and procedures for the use of the User-user information element.

4.6 Information Elements in Codeset 5

4.6.1 Operator System Access

The purpose of the operator system access information element is to allow the user to request access to operator services or attendant system.

The operator access information element is coded as shown below. The length of this information element is three octets.

8	7	6	5	4	3	2	1	Octet
Operator system access information element identifier								
0	0	0	1	1	1	0	1	1
Length of operator system access contents								2
1	0	0	0	0	0	Type of access		3
ext	spare							

Figure 32 – Operator system access information element

Type of access (octet 3)

Bits

2 1

0 0 public/principle: default operator system

0 1 public/alternate: operator system determined by user subscription

1 0 private/principle: private network or business group attendant

All other values are reserved.

4.6.2 Display Text

See ATIS-1000610 for the definition of and procedures for the use of the Display text information element.

4.6.3 Emergency Call Control

See ATIS-1000628 for the definition of and procedures for the use of the Emergency call control information element.

4.6.4 Generic Information

See ATIS-1000628 for the definition of and procedures for the use of the Generic information information element.

5 Circuit-Switched Call Control Procedures

This clause provides the D-channel signaling procedures in support of circuit-mode bearer capabilities other than multirate (64 kbit/s base rate).

Extensions to this basic protocol and exceptions that apply in the case of circuit-mode multirate (64 kbit/s base rate) are described in clause 8 of this standard.

The call states referred to in this clause cover the states perceived by the network, states perceived by the user and states that are common to both user and network. Unless specifically qualified, all states described in the following text should be understood as common (see 2.1.1 and 2.1.2 for user and network call states, respectively).

Detailed SDL diagrams for the procedures specified in this clause are contained in Annex A. When there is an ambiguity in the narrative text, the SDL diagrams should be used to resolve the conflict. Where the text and the SDL are in disagreement, the text should be used as the prime source.

NOTE – This clause describes the sequence of messages associated with the control of circuit-switched connections. Optional extensions to this basic protocol and exceptions that apply in the case of packet-mode connections or supplementary services are described in other American National Standards. Annex D contains optional extensions to the basic call for symmetric signaling.

All messages in this standard may contain two types of information elements, functional as well as stimulus. Functional information elements are characterized as requiring a degree of intelligent processing by the terminal in either their generation or analysis. Stimulus information elements, on the other hand, are either generated as a result of a single event at the user or terminal interface or contain a basic instruction from the network to be executed by the terminal.

As a general principle, all the messages sent by the network to the user may contain a Display information element whose contents may be displayed by the terminal; the contents of this information element shall be network-dependent.

NOTE – Keypad facility information elements shall only be conveyed in the direction user to network. Display information elements shall only be conveyed in the direction network to user.

In addition to the messages exchanged as described in the following clauses, INFORMATION messages for call control may be sent by the user or by the network only after the first response to a SETUP message has been sent or received, and before the clearing of the call reference is initiated. An INFORMATION message received in the Release Request state may be ignored.

5.1 Call Establishment at the Originating Interface

Before these procedures are invoked, a reliable data-link connection must be established between the user (TE/NT2) and the network. All layer 3 messages shall be sent to the data-link layer using a DL-DATA-REQUEST primitive. The data-link services described in ATIS-1000602 are assumed.

5.1.1 Call Request

A user initiates call establishment by transferring a SETUP message across the user-network interface. Following the transmission of the SETUP message, the call shall be considered by the user to be in the Call Initiated state. The message shall always contain a call reference, selected according to the procedures given in 4.3. In selecting a call reference, the dummy call reference value shall not be used in association with the basic call. The Bearer capability information element is mandatory in the SETUP message, even in the case of overlap sending.

If the user knows all appropriate channels controlled by the D-channel are in use, it shall not transfer a SETUP message across the user-network interface. If the user does not monitor the status of channels in use, it may send a SETUP during an all channel busy condition. In this case, the network returns a RELEASE COMPLETE message with cause 34 "no circuit or channel available."

Furthermore, the SETUP message may also contain all or part of the call information (i.e., address and facility requests) necessary for call establishment depending on whether en-bloc or overlap procedures (see 5.1.3) are being used, respectively.

If en-bloc sending is used, the SETUP message shall contain all the information required by the network to process the call, and, in particular, the called party address information, if present, is contained as follows:

- a) in the Called party number information element possibly accompanied by the Called party subaddress information element; or
- b) the Keypad information element (this information element may also be used to convey other call information).

NOTE – All networks are required to support both methods.

For overlap sending see 5.1.3.

5.1.2 B-Channel Selection – Originating

In the SETUP message, the user will indicate one of the following:

- a) channel is indicated, no acceptable alternative (i.e., channel is indicated by the information channel selection field of octet 3 (bits 2-1) and octet 3.3 (if applicable), and the preferred/exclusive field (bit 4 of octet 3) is set to "1" in the Channel identification information element);
- b) channel is indicated, any alternative is acceptable (i.e., channel is indicated by the information channel selection field of octet 3 (bits 2-1) and octet 3.3 (if applicable), and the preferred/exclusive field (bit 4 of octet 3) is set to "0" in the Channel identification information element); or
- c) any channel is acceptable (i.e., either the information channel selection field of octet 3 (bits 2-1) of the Channel identification information element indicate "any channel" or the Channel identification information element is not present).

If no Channel identification information element is included, alternative c) is assumed. In cases a) and b), if the indicated channel is available, the network selects it for the call.

In case b), if the network cannot grant the preferred channel, it selects any other available B-channel associated with the D-channel. In case c), the network selects any available B-channel associated with the D-channel.

The selected B-channel is indicated in the Channel identification information element coded as "channel is indicated, no acceptable alternative" in the first message returned by the network in response to the SETUP message. After transmitting this message, the network shall activate the B-channel connection.

The user need not connect the B-channel until receiving a CALL PROCEEDING, SETUP ACKNOWLEDGE, PROGRESS, or ALERTING message with a Progress indicator information element with a progress description value 8 "in-band information or appropriate pattern is now available" or 1 "call is not end-to-end ISDN; further call progress information may be available in band." Prior to this time, the network cannot assume that the user has connected the B-channel. After this time, the user shall be connected to the B-channel, provided the equipment does not generate local tone. Upon receipt of the CONNECT message, the user shall connect the B-channel (if it has not already done so).

In case a), if the specified channel is not available, and in cases b) and c) if no channel is available, a RELEASE COMPLETE message with cause 44 "requested circuit or channel not available" or 34 "no circuit or channel available," respectively, is sent by the network as described in 5.3.

5.1.3 Overlap Sending

If overlap sending is used, the SETUP message contains either:

- a) no called number information;
- b) incomplete called number information; or
- c) called number information that the network cannot determine to be complete.

On receipt of such a SETUP message, the network shall start timer T302 (the value of timer T302 is specified in 9.1), send a SETUP ACKNOWLEDGE message to the user, and enter the Overlap Sending state. In case a), the network shall return dial tone, if required by the tone option. In this case, it may include Progress indicator information element with a progress description value 8 "in-band information or appropriate pattern is not available" in the SETUP ACKNOWLEDGE message.

When the SETUP ACKNOWLEDGE message is received, the user shall enter the Overlap Sending state and optionally start timer T304 (the value of timer T304 is specified in 9.2).

After receiving the SETUP ACKNOWLEDGE message, the user shall send the remainder of the call information (if any) in one or more INFORMATION messages.

When overlap sending is used for circuit-switched calls, the called party number information shall be provided by the user in the Keypad facility information element, exclusively.

NOTE – Besides the possible called party number the INFORMATION messages may contain additional call information (i.e., for supplementary services). The interpretation of the contents of Keypad facility information elements is network-specific and in accordance with the dialing plan provided to that user.

If, for symmetry purposes, the user employs timer T304, the user shall restart timer T304 when each INFORMATION message is sent.

The call information in the message that completes the information sending may contain a "sending complete" indication (e.g., the # character) appropriate to the dialing plan being used. The network shall re-

start timer T302 on the receipt of every INFORMATION message not containing a sending complete indication.

5.1.4 Invalid Call Information

If, following the receipt of the SETUP message or during overlap sending, the network determines that the call information received from the user is invalid (e.g., invalid number), then the network shall initiate call clearing in accordance with 5.3 with a cause such as one of the following:

- 1 “unallocated (unassigned) number”;
- 3 “no route to destination”;
- 22 “number changed”; or
- 28 “invalid number format (address incomplete).”

5.1.5 Call Proceeding

5.1.5.1 Call Proceeding, En-Bloc Sending

If en-bloc sending is used (i.e., the network can determine that the SETUP message contains all the information required from the user to establish the call) and if the network can determine that access to the requested service is authorized and available, the network shall send a CALL PROCEEDING message to the user. This acknowledges the SETUP message, and indicates that the call is being processed. The network shall then enter the Outgoing Call Proceeding state. When the user receives the CALL PROCEEDING message, the user shall enter the Outgoing Call Proceeding state.

Similarly, if the network determines that a requested service is not authorized or is not available, the network shall initiate call clearing in accordance with 5.3 with one of the following causes:

- 57 “bearer capability not authorized”;
- 58 “bearer capability not presently available”;
- 63 “service or option not available, unspecified”; or
- 65 “bearer service not implemented.”

NOTE – The above procedure applies to unauthorized or unavailable bearer services. If a supplementary service is not authorized or is not available, the procedure to be used is defined in the supplementary service control procedures (see ATIS-1000602).

5.1.5.2 Call Proceeding, Overlap Sending

If overlap sending is used, following the occurrence of:

- a) the receipt by the network of a sending complete indication that the network understands; or
- b) analysis by the network that all call information necessary to effect call establishment has been received;

and if the network can determine that access to the requested service and supplementary service is authorized and available, the network shall send a CALL PROCEEDING message to the user, stop timer

T302, and enter the Outgoing Call Proceeding state. Similarly, if the network determines that a requested service is not authorized or is not available, the network shall initiate call clearing in accordance with 5.3 with one of the following causes:

- 57 "bearer capability not authorized";
- 58 "bearer capability not presently available";
- 63 "service or option not available, unspecified"; or
- 65 "bearer service not implemented."

NOTES

- 1 The CALL PROCEEDING message is sent by the network to indicate that the requested call establishment has been initiated, and that no more call establishment information will be accepted.
- 2 The above procedure applies to unauthorized or unavailable bearer services. If a supplementary service is not authorized or is not available, the procedure to be used is defined in the supplementary service control procedures (see ATIS-1000610).

When the user receives the CALL PROCEEDING message, the user shall enter the Outgoing Call Proceeding state. If for symmetry purposes, the calling user employs timer T304, the user shall stop timer T304 when the CALL PROCEEDING message is received. On the expiry of T304, the user shall initiate call clearing in accordance with 5.3 with cause 102 "recovery on timer expiry."

Upon the expiration of timer T302, the network shall:

- a) initiate call clearing in accordance with 5.3 with cause 28, "invalid number format (address incomplete)," sent to the calling user, if the network determines that the call information is definitely incomplete; otherwise,
- b) send a CALL PROCEEDING message and enter the Outgoing Call Proceeding state.

5.1.6 Notification of Interworking at the Originating Interface

During call establishment, the call may leave or return to an ISDN environment (e.g., because of interworking with another network, with a non-ISDN user, or with non-ISDN equipment within the called user's premises). When such situations occur, a Progress indicator information element shall be returned to the calling user either:

- a) in an appropriate call control message when a state change is required (SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING, or CONNECT); or
- b) in the PROGRESS message when no state change is appropriate.

One of the following progress description values shall be included in the Progress indicator information element in the message sent to the user (see Annex I):

- 1 "call is not end-to-end ISDN; further call progress information may be available in-band";
- 2 "destination address is non-ISDN"; or
- 4 "call has returned to the ISDN."

If the Progress indicator information element is included in a call control message, the procedures as described in the rest of 5.1 apply. If the Progress indication information element is included in the PROGRESS message, no state change will occur but any supervisory timers shall be stopped. In both cases,

if indicated by the Progress indicator information element, the user shall connect to (if not connected already) and then monitor the B-channel for further in-band information.

If the interface at which the progress indicator originates is the point at which a call enters the ISDN environment from a non-ISDN environment, one or more of the following Progress indicator information elements shall be included in the SETUP message sent to the network:

- 1 "call is not end-to-end ISDN; further call progress information may be available in-band"; or
- 3 "origination address is non-ISDN."

5.1.7 Call Confirmation Indication

Upon receiving an indication that user alerting has been initiated at the called address, the network shall send an ALERTING message across the user-network interface of the calling address and enter the Call Delivered state. When the user receives the ALERTING message, the user may begin an internally generated alerting indication; and shall enter the Call Delivered state.

5.1.8 Call Connected

Upon receiving an indication that the call has been accepted, the network shall: send a CONNECT message across the user-network interface to the calling user and enter the Active state.

This message indicates to the calling user that a connection has been established through the network.

On receipt of the CONNECT message, the calling user shall stop any user-generated alerting indications, optionally send a CONNECT ACKNOWLEDGE message, and shall enter the Active state. The network shall not take any action on receipt of a CONNECT ACKNOWLEDGE message when it perceives the call to be in the Active state.

5.1.9 Call Rejection

Upon receiving an indication that the network or the called user is unable to accept the call, the network shall initiate clearing at the originating user-network interface as described in 5.3, using the cause provided by the terminating network or the called user.

5.1.10 Transit Network Selection & Operator System Access

When the Transit network selection or operator system access information element is present, the call shall be processed according to Annex C and Annex P, respectively.

5.2 Call Establishment at the Destination Interface

This procedure assumes that a data-link connection providing services described in ATIS-1000602 may not exist before the first layer 3 message (e.g. SETUP) is transferred across the interface. However, reliable data-link connections must be established by each of the users (TEs as well as NT2s) at the interface before they respond to the SETUP message.

Data-link connections may be established by the user as soon as a TEI is assigned (either by local or automatic procedures) and retained indefinitely. This is recommended in this American National Standard.

The SETUP message offered on a point-to-point data-link shall be delivered to layer 2 using a DL-DATA-REQUEST primitive. No use shall be made of the DL-UNIT-DATA-REQUEST primitive other than for operation using the broadcast capability of the data-link layer.

The call reference contained in all messages exchanged across the user-network interface shall contain the call reference value specified in the SETUP message delivered by the network. In selecting a call reference, the dummy call reference shall not be used in association with the basic call (see 4.3).

5.2.1 Incoming Call

The network will indicate the arrival of a call at the user-network interface by transferring a SETUP message across the interface. This message is sent if the network can select an idle B-channel. In some circumstances (e.g., provision of other bearer services), the SETUP message may also be sent when no B-channel is idle. The number of calls presented in these circumstances may be limited.

In addition to the mandatory information elements, the SETUP message may include, as required, the optional information elements described in 3.1.11 (e.g., display, low layer compatibility).

If a multipoint terminal configuration exists at the user-network interface, this message shall be sent using a broadcast capability at the data-link layer. In this case, the SETUP message should contain the appropriate part of the called party number as required (e.g., for Direct Inward Dialing) as well as sub-address if provided. However, if the network has knowledge that a single-point configuration exists at the interface, a point-to-point data-link shall be used to carry the SETUP message. After sending the SETUP message, the network shall start timer T303. (The value of timer T303 is specified in 9.1.)

In addition, if the terminating network provider chooses to implement the optional procedures associated with notification of delay in call progress, the network shall start timer TDEL (the value of timer TDEL is chosen by the terminating network provider).

If the SETUP message was sent via a broadcast data-link, timer T312 shall also be started. (The value of timer T312 is specified in 9.1.) The network shall then enter the Call Present state.

NOTE – Timer T312 is used to supervise the retention of the call reference when the SETUP message was transmitted by a broadcast data-link. The value of timer T312 is such that if a network disconnect indication is received during the call establishment phase, it maximizes the probability that all responding users will be released prior to release of the call reference. Refer to 5.3.2 (d) and 5.2.5.3.1 for procedures to be followed on expiry of timer T312.

The SETUP message shall contain all the information required by the called user to process the call. Upon receipt of a SETUP message, the user shall enter the Call Present state.

If no response to the SETUP message is received by the network before the first expiry of timer T303, the SETUP message shall be retransmitted and timers T303 and T312 shall be restarted.

If timer TDEL was started by the network upon sending the SETUP message, and no response to the SETUP message in the form of an ALERTING, PROGRESS, or CONNECT message is received by the network before timer TDEL expires, the network shall send notification to the calling user that a delay in call progress has occurred. This notification shall be in the form of a PROGRESS message containing the Progress indicator information element with national specific progress description value 10 “delay in response at called interface or within the network.” If the network is providing in-band tones (i.e., audible ringing) in association with the notification of delay in call progress, the PROGRESS message shall contain a second Progress indicator information element with progress description value 8 “in-band information or appropriate pattern now available.” Timer TDEL should not be restarted. (The network should not provide indication of delays in call progress for packet switched calls.)

5.2.2 Compatibility Checking

A user receiving a SETUP message shall perform compatibility checking before responding to that SETUP message. Any reference to “user” in 5.2.3 through 5.2.7 implicitly refers to compatible user equipment. Annex B defines compatibility checking to be performed by users upon receiving a SETUP message.

When the SETUP message was delivered via a broadcast data link, an incompatible user shall either

- a) ignore the incoming call; or
- b) respond by sending a RELEASE COMPLETE message with cause 88 “incompatible destination,” and enter the Null state. The network shall process this RELEASE COMPLETE message in accordance with 5.2.5.3.

When the SETUP message was delivered via a point-to-point data link, an incompatible user shall respond with a RELEASE COMPLETE message with cause 88 “incompatible destination,” and enter the Null state. The network shall process this RELEASE COMPLETE message in accordance with 5.2.5.3.

5.2.3 B-Channel Selection – Destination

5.2.3.1 SETUP Message Delivered by Point-to-Point Data Link

When the SETUP message is delivered by a point-to-point data link, negotiation for the selection of a B-channel will be permitted between the network and the user. Only B-channels controlled by the same D-channel will be the subject of the selection procedure. The selection procedure is as follows:

- a) In the SETUP message, the network shall indicate one of the following:
 - 1) channel is indicated, no acceptable alternative (i.e., channel is indicated by the information channel selection field of octet 3 (bits 2-1) and octet 3.3 (if applicable), and the preferred/exclusive field (bit 4 of octet 3) is set to “1” in the Channel identification information element);
 - 2) channel is indicated, any alternative is acceptable (i.e., channel is indicated by the information channel selection field of octet 3 (bits 2-1) and octet 3.3 (if applicable), and the preferred/exclusive field (bit 4 of octet 3) is set to “0” in the Channel identification information element); or
 - 3) any channel is acceptable (i.e., the information channel selection field of octet 3 (bits 2-1) of the Channel identification information element indicates “any channel”).
- b) In cases (1) and (2), if the indicated channel is acceptable and available, the user shall select it for the call.

In case (2), if the user cannot grant the indicated channel, the user may select any other available B-channel associated with the D-channel, and identify that channel in the Channel identification information element as “channel is indicated, no acceptable alternative” in the first message sent in response to the SETUP message.

In case (3), the user may select any available B-channel associated with the D-channel, and identify that channel in the first message sent in response to the SETUP message.

If in case (1) the B-channel indicated in the first response message is not the channel offered by the network, or in cases (2) and (3) the B-channel indicated in the first response message is unacceptable to the network, the network shall clear the call by sending a RELEASE message with cause 6 “channel unacceptable,” see 5.3.2(c).

- c) When a B-channel has been selected by the user, that channel may be connected by the user.
- d) In case (1) if the indicated B-channel is not available, or in cases (2) and (3) if no B-channel is available and the user cannot proceed with the offered call, the user shall return a RELEASE COMPLETE message with cause 44 "requested circuit or channel not available" or 34 "no circuit or channel available," respectively, and return to the Null state.

5.2.3.2 SETUP Message Delivered by Broadcast Data Link

When the SETUP message is delivered by a broadcast data link, the channel selection procedure, provided in 5.2.3.1, is not applicable. The network shall send a SETUP message with the Channel identification information element indicating a specific channel with no alternative acceptable (i.e., channel is indicated by the information channel selection field of octet 3 (bits 2-1) and octet 3.3 (if applicable), and the preferred/exclusive field (bit 4 of octet 3) is set to "1" in the Channel identification information element).

If a user can accept the call on the indicated channel, that user shall send the appropriate message (see 5.2.5). If a user cannot accept the call on the indicated channel, that user shall send a RELEASE COMPLETE message with cause 44 "requested circuit or channel not available."

The user, in any case, must not connect to the channel until a CONNECT ACKNOWLEDGE message has been received.

5.2.4 Overlap Receiving

Overlap receiving is not supported by this standard.

5.2.5 Call Confirmation

5.2.5.1 Response to En-Bloc SETUP

When the user determines that sufficient call setup information has been received and compatibility requirements (see Annex B) have been satisfied, the user shall respond with either a CALL PROCEEDING, ALERTING, or CONNECT message (see Note) and enter the Incoming Call Proceeding, Call Received, or Connect Request state, respectively.

NOTE – A Progress indicator information element may be included in CALL PROCEEDING, ALERTING and CONNECT messages (e.g., when an analogue terminal is connected to an NT2 functional grouping). The CALL PROCEEDING message may be sent by the user that cannot respond to a SETUP message with an ALERTING, CONNECT, or RELEASE COMPLETE message before expiration of timer T303.

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

- a) ignore the incoming call; or
- b) respond by sending a RELEASE COMPLETE message with cause 88 "incompatible destination," and enter the Null state. The network processes this RELEASE COMPLETE message in accordance with 5.2.5.3.

When the SETUP message was delivered via a point-to-point data link, an incompatible user shall respond by sending a RELEASE COMPLETE message with cause 88 "incompatible destination" and enter the Null state. The network shall process this RELEASE COMPLETE message in accordance with 5.2.5.3.

A busy user that satisfies the compatibility requirements indicated in the SETUP message shall normally respond with a RELEASE COMPLETE message with cause 17 "user busy." The network shall process this RELEASE COMPLETE message in accordance with 5.2.5.3.

If the user wishes to refuse the call, the user shall send a RELEASE COMPLETE message with the cause 21 "call rejected" and enter the Null state. The network shall process this RELEASE COMPLETE message in accordance with 5.2.5.3.

5.2.5.2 Receipt of CALL PROCEEDING & ALERTING

When the SETUP message is delivered on a broadcast data link, the network shall maintain a state machine that tracks the overall progression of the incoming call. The network shall also maintain an associated call state for each responding user as determined by the data link on which a message is received.

Upon receipt of the first CALL PROCEEDING message from a user (assuming no other user has previously responded with an ALERTING or CONNECT message when the SETUP message has been delivered on a broadcast data link), the network shall stop timer T303, start timer T310, and enter the Incoming Call Proceeding state. Timer T310 shall not be restarted on the receipt of subsequent CALL PROCEEDING message.

If timer TDEL was started upon sending of the SETUP message, timer TDEL should continue to run upon receipt of the CALL PROCEEDING message.

When the SETUP message has been delivered on a broadcast link, the network shall (at a minimum) associate the Incoming Call Proceeding state with each called user that sends a CALL PROCEEDING message as a first response to the broadcast SETUP message prior to the expiration of timer T312. Actions to be taken when a user sends a first response to an incoming call after the expiration of timer T312 are described in 5.2.5.4.

Upon receipt of the first ALERTING message from a user (assuming no other user has previously responded with a CONNECT message when the SETUP message has been delivered on a broadcast link), the network shall stop timers T303 or T310 (if running) and TDEL (if running), start timer T301 (unless another internal alerting supervision timer function exists, e.g., incorporated in call control), enter the Call Received state, and send a corresponding ALERTING message to the calling user. Timer T301 shall not be restarted upon the receipt of subsequent ALERTING messages.

When a SETUP message has been delivered on a broadcast link, the network shall (at a minimum) associate the Call Received state with each called user that sends an ALERTING message either as a first response to the broadcast SETUP message or following a CALL PROCEEDING message.

5.2.5.3 Called User Clearing During Incoming Call Establishment

If the SETUP message has been delivered on a point-to-point data link and a RELEASE COMPLETE or DISCONNECT message is received before a CONNECT message has been received, the network shall stop timer T303, T310, or T301 (if running), continue to clear the user as described in 5.3.3, and clear the call to the calling user with the cause received in the RELEASE COMPLETE or DISCONNECT message.

If the SETUP message has been delivered on a broadcast data link and a RELEASE COMPLETE message is received while timer T303 is running, the cause received in the RELEASE COMPLETE message shall be retained by the network. If timer T303 expires (i.e., if no valid message such as CALL PROCEEDING, ALERTING, or CONNECT has been received), the cause previously retained when a RELEASE COMPLETE message was received shall be sent back to the calling user in a DISCONNECT message and the network shall enter the Call Abort state. When multiple RELEASE COMPLETE messages are received with different causes, the network shall:

- a) ignore any cause 88 “incompatible destination”; and
- b) give preference to the following causes (if received) in the order listed below:
 - 17 “user busy”;
 - 21 “call rejected.”
- c) any other received cause may also be included in the clearing message sent to the originating user (see 5.3).

If the SETUP message has been delivered on a broadcast link and a user that has previously sent a CALL PROCEEDING or ALERTING message sends a DISCONNECT message to the network, the actions taken by the network depend on whether timer T312 is running and whether other called users have responded to the SETUP message.

5.2.5.3.1 DISCONNECT received prior to expiry of T312

If timer T312 is running and the network receives a DISCONNECT message after having received a CALL PROCEEDING or ALERTING message from a called user (but before receiving a CONNECT message), timer T312, as well as timer T310 or T301 (if running), should continue to run. The network shall retain the cause in the DISCONNECT message and shall continue to clear to the user side as described in 5.3.3.

Upon expiration of timer T312, if either

- a) no other users have responded to the incoming call; or
- b) all users that have responded to the incoming call have been cleared or are in the process of being cleared,

the network shall stop timer T310 or T301 (if running), and shall clear the call to the calling user. If an ALERTING message has been received, the cause sent to the calling user shall be a cause received from a called user, giving preference to (in order of priority): 21 “call rejected”; any other cause sent by a called user. If only CALL PROCEEDING messages have been received from called users, the cause sent to the calling user shall be a cause received from a called user, giving preference to (in order of priority): 17 “user busy”; 21 “call rejected”; any other cause sent by a called user.

5.2.5.3.2 DISCONNECT received after expiry of timer T312

If timer T312 has expired and the network receives a DISCONNECT message from a called user after having received a CALL PROCEEDING or ALERTING message (but before receiving a CONNECT message), the network shall continue to clear that user as described in 5.3.3.

If other called users have responded to the SETUP message with a CALL PROCEEDING or ALERTING message, and still have the opportunity to accept the call by sending a CONNECT message, the network shall retain the cause in the DISCONNECT message. The network shall continue to process the incoming call for the remaining responding users. (T310 or T301, if running, shall continue to run.)

If either:

- a) no other users have responded to the incoming call; or
- b) all users that have responded to the incoming call have been cleared or are in the process of being cleared,

the network shall stop timer T310 or T301 (if running) and shall clear the call to the calling user. If an ALERTING message has been received, the cause sent to the calling user shall be a cause received from a called user, giving preference to (in order of priority): 21 "call rejected"; any other cause sent by a called user. If only CALL PROCEEDING messages have been received, the cause sent to the calling user shall be a cause received from a called user, giving preference to (in order of priority): 17 "user busy"; 21 "call rejected"; any other cause sent by a called user.

5.2.5.4 Call Failure

If the network does not receive any response to the retransmitted SETUP message prior to the expiration of timer T303, then the network shall initiate clearing procedures towards the calling user with cause 18 "no user responding" and:

- a) If the SETUP message was delivered by a broadcast link, the network shall enter the Call Abort state;
- b) If the SETUP message was delivered on a point-to-point data link, the network shall also initiate clearing procedures toward the called user in accordance with 5.3.4, using cause 102 "recovery on timer expiry."

If the network receives a user's first response to SETUP when in the Call Abort state, but before timer T312 expires, the network shall initiate call clearing to the responding user as described in 5.3.2(b), except that the cause 102 "recovery on timer expiry" shall be sent. If the network receives a message that is the user's first response to an incoming call after timer T312 has expired, the network will interpret this message as a message with an invalid call reference value, as described in 5.8.3.2.

If the network has received a CALL PROCEEDING message, but does not receive an ALERTING, CONNECT, or DISCONNECT message prior to the expiration of timer T310, then the network shall: initiate clearing procedures toward the calling user with cause 18 "no user responding" and initiate clearing procedures towards the called user(s):

- a) if the SETUP message was delivered by a broadcast link, called users shall be cleared in accordance with 5.3.2(d), except that cause 102 "recovery on timer expiry" shall be sent;
- b) if the SETUP message was delivered on a point-to-point data link, the called user shall be cleared in accordance with 5.3.4, using cause 102 "recovery on timer expiry."

If the network has received an ALERTING message, but does not receive a CONNECT or DISCONNECT message prior to the expiration of timer T301 (or a corresponding internal alerting supervision timing function), then the network shall initiate clearing procedures toward the calling user with cause 19 "no answer from user (user alerted)" and initiate clearing procedures toward the called user.

- a) If the SETUP message was delivered by a broadcast link, called users shall be cleared in accordance with 5.3.2(d), except that cause 102 "recovery on timer expiry" shall be sent;
- b) If the SETUP message was delivered on a point-to-point data link, the called user shall be cleared in accordance with 5.3.4, using cause 102 "recovery on timer expiry."

If prior to the offering of the call, the network determines that the bearer capability requested in the incoming call request cannot be supported to the destination addressed, the network shall initiate clearing procedures towards the calling user with cause 65 "Bearer capability not implemented," or 57 "Bearer capability not authorized," or 58 "Bearer capability not presently available," without offering the call to the called party.

5.2.6 Notification of Interworking at the Terminating Interface

During call establishment, the call may enter an ISDN environment (e.g., because of interworking with another network, with a non-ISDN user, or with non-ISDN equipment within the calling user's premises). When this occurs, the point at which the call enters an ISDN environment shall cause a Progress indicator information element to be included in the SETUP message to be sent to the called user with a progress description of:

- 1 "Call is not end-to-end ISDN; further call progress information may be available in-band";
- 3 "origination address is non-ISDN."

In addition, the called user shall notify the calling party if the call has left or returned to the ISDN environment within the called user's premises, or upon the availability of in-band information and patterns. When such situations occur, a Progress indicator information element shall be sent by the user to the network either:

- in an appropriate call control message when a state change is required (CALL PROCEEDING, ALERTING, or CONNECT); or
- in the PROGRESS message when no state change is appropriate.

One of the following progress description values shall be included in the Progress indicator information element in the message sent to the network (for further information see Annex I):

- 1 "Call is not end-to-end ISDN; further call progress information may be available in-band";
- 2 "Destination address is non-ISDN";
- 4 "Call has returned to the ISDN."

If the Progress indicator information element is included in a call control message, the procedures as described in the rest of 5.2 apply. If the Progress indicator information element is included in the PROGRESS message, no state change will occur but any supervisory timers shall be stopped.

5.2.7 Call Accept

A user indicates acceptance of an incoming call by sending a CONNECT message to the network. Upon sending the CONNECT message, the user shall start timer T313 (the value of timer T313 is specified in 9.2) and enter the Connect Request state. If an ALERTING message had previously been sent to the network, the CONNECT message may contain only the call reference.

If a call can be accepted using the B-channel indicated in the SETUP message, and no user alerting is required, a CONNECT message may be sent without a previous ALERTING message.

5.2.8 Active Indication

On receipt of the first CONNECT message, the network shall stop (if running) timers T301, T303, T310 and TDEL, complete the circuit-switched path to the selected B-channel, send a CONNECT ACKNOWLEDGE message to the user that first accepted the call, initiate procedures to send a CONNECT message towards the calling user, and enter the Active state.

The CONNECT ACKNOWLEDGE message indicates completion of the circuit-switched connection. There is no guarantee of an end-to-end connection until a CONNECT message is received at the calling user. Upon receipt of the CONNECT ACKNOWLEDGE message the called user shall stop timer T313 and enter the Active state.

When timer T313 expires prior to receipt of a CONNECT ACKNOWLEDGE message, the called user shall initiate clearing in accordance with 5.3.3.

A user that has received the SETUP via the broadcast data link, and has been awarded the call, shall connect to the B-channel only after it has received the CONNECT ACKNOWLEDGE message. Only the user that is awarded the call will receive the CONNECT ACKNOWLEDGE message.

A user that has received the SETUP via a point-to-point data link may connect to the B-channel as soon as channel selection has been completed.

5.2.9 Non-Selected User Clearing

In addition to sending the CONNECT ACKNOWLEDGE message to the user selected for the call, the network shall send RELEASE messages, as described in 5.3.2 (b), to all other users at the interface that have sent CALL PROCEEDING, ALERTING or CONNECT messages in response to the SETUP message. These RELEASE messages are used to notify the users that the call is no longer offered to them. The procedures described in 5.3.4 are then followed. Any user, which having previously sent a CONNECT message and started timer T313, and which subsequently receives a RELEASE message, shall stop timer T313 and follow the procedures of 5.3.4.

5.3 Call Clearing

5.3.1 Terminology

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

- A channel is “connected” when the channel is part of a circuit-switched ISDN connection established according to this standard.
- A channel is “disconnected” when the channel is no longer part of a circuit-switched ISDN connection, but is not yet available for use in a new connection.
- A channel is “released” when the channel is not part of a circuit-switched ISDN connection and is available for use in a new connection. Similarly, a call reference that is “released” is available for reuse.

5.3.2 Exception Conditions

Under normal conditions, call clearing is usually initiated when the user or the network sends a DISCONNECT message and follows the procedures defined in 5.3.3 and 5.3.4, respectively. The only exceptions to the above rule are as follows:

- a) in response to a SETUP message, the user or network can reject a call (e.g., because of the unavailability of a suitable B-channel) by responding with a RELEASE COMPLETE message provided no other response has previously been sent (e.g., the CALL PROCEEDING message in the case of overlap sending), releasing the call reference, and entering the Null state;
- b) in the case of a multipoint terminal configuration, non-selected user call clearing will be initiated with RELEASE message(s) from the network (see 5.2.9). The RELEASE message shall contain cause 26 “non-selected user clearing”;

- c) unsuccessful termination of the B-channel selection procedure (see 5.2.3.1 and 5.1.2) by the side offering the call is accomplished by sending a RELEASE message as described in 5.3.3 and 5.3.4. The RELEASE message shall contain cause 6 "channel unacceptable";
- d) in the case of a SETUP message sent via the broadcast data link,
 - 1) if a network disconnect indication is received during call establishment, and prior to the expiration of timer T312, the network shall stop timer T303 (if running) and the network enters the Call Abort state (N22). Any user that has responded or subsequently responds before timer T312 expires, shall be cleared by a RELEASE message (with the cause(s) contained in the network disconnect indication) and the procedures of 5.3.4 shall then be followed for that user. Upon expiry of timer T312, the network shall treat any subsequent response as a message with an invalid call reference according to the procedures defined in 5.8.3.2. The network shall enter the Null state upon completion of clearing procedures for all responding users;
 - 2) if a network disconnect indication is received during call establishment after expiry of timer T312, any user that has responded shall be cleared by a RELEASE message (with the cause(s) contained in the network disconnect indication) and the procedures of 5.3.4 shall then be followed for that user. The network shall enter the Null state upon completion of clearing procedures for all responding users.

NOTE – A separate state machine exists for each responding user.

5.3.3 Clearing Initiated by the User

Apart from the exception conditions identified in 5.3.2 and 5.8, the user shall initiate clearing by sending a DISCONNECT message, starting timer T305 (the value of timer T305 is specified in 9.2), disconnecting the B-channel, and entering the Disconnect Request state.

NOTE – When a user initiates call clearing by sending a RELEASE message, the procedures described in 5.3.4 are then followed:

Upon receipt of a DISCONNECT message, the network shall disconnect the B-channel initiate procedures for clearing the network connection to the remote user, and enter the Disconnect Request state. Once the B-channel used for the call has been disconnected, the network shall send a RELEASE message to the user, start timer T308 (the value of timer T308 is specified in 9.1), and enter the Release Request state.

NOTE – The RELEASE message has only local significance and does not imply an acknowledgment of clearing from the remote user.

On receipt of the RELEASE message, the user shall cancel timer T305, release the B-channel, send a RELEASE COMPLETE message, release the call reference and return to the Null state. Following the receipt of a RELEASE COMPLETE message from the user, the network shall stop the timer T308, release both the B-channel and the call reference, and return to the Null state.

If a RELEASE COMPLETE message is not received by the network before the first expiry of timer T308, the RELEASE message shall be retransmitted and timer T308 shall be restarted. If no RELEASE COMPLETE message is received from the user before T308 expires a second time, the network shall place the B-channel in a maintenance condition, release the call reference, and return to the Null state.

If time T305 expires, the user shall send a RELEASE message to the network with the cause originally contained in the DISCONNECT message, start timer T308 and enter the Release Request state. In addition, the user may include a second Cause information element with cause 102 "recovery on timer expiry."

If user timer T308 expires for the first time, the user shall retransmit the RELEASE message and the restart timer T308. In addition, the user may include a second Cause information element with a cause 102 "recovery on timer expiry." If no RELEASE COMPLETE message is received from the network before timer T308 expires a second time, the user shall release the call reference and return to the Null state. The user may optionally place the B-channel in a maintenance condition.

The actions to be taken with regard to the maintenance condition are network dependent.

NOTE – The restart procedures contained in 5.5 may be used on B-channels in the maintenance condition.

5.3.4 Clearing Initiated by the Network

Apart from the exceptions identified in 5.3.2 and 5.8, the network shall initiate clearing by sending a DISCONNECT message and entering the Disconnect Indication state.

NOTE – When the network initiates clearing by sending a RELEASE message, procedures in 5.3.3 are followed.

5.3.4.1 Clearing When Tones or Announcements Provided

When tones or announcements are provided in conjunction with call clearing, the network shall send a PROGRESS message (see 5.4, Note 2).

5.3.4.2 Clearing When Tones or Announcements Not Provided

The network shall initiate clearing by sending a DISCONNECT message, starting timer T305, disconnecting the B-channel, and entering the Disconnect Indication state.

On receipt of the DISCONNECT message the user shall disconnect the B-channel, send a RELEASE message, start timer T308, and enter the Release Request state.

On receipt of the RELEASE message, the network shall stop timer T305, release the B-channel, send a RELEASE COMPLETE message, release the call reference, and return to the Null state.

If timer T305 expires, the network shall send a RELEASE message to the user with the cause originally contained in the DISCONNECT message, start timer T308, and enter the Release Request state. In addition to the original clearing cause, the RELEASE message may contain a second Cause information element with cause 102 "recovery on timer expiry."

5.3.4.3 Completion of Clearing

Following the receipt of a RELEASE COMPLETE message from the user, the network shall: stop timer T308; release both the B-channel and the call reference; and return to the Null state.

If a RELEASE COMPLETE is not received by the network before the first expiry of timer T308, the RELEASE message shall be retransmitted and timer T308 shall be restarted. If no RELEASE COMPLETE message is received from the user before timer T308 expires a second time, the network shall place the B-channel in a maintenance condition, release the call reference, and return to the Null state.

If a RELEASE COMPLETE message is not received by the user before the first expiry of timer T308, the RELEASE message shall be retransmitted and timer T308 shall be restarted. In addition, the user may indicate a second Cause information element with cause 102, "recovery on timer expiry." If no RELEASE COMPLETE message is received from the network before T308 expires a second time the user shall re-

lease the call reference and return to the Null state. The user may optionally place the B-channel in a maintenance condition.

NOTE – The restart procedures contained in 5.5 may be used on a B-channel in the maintenance condition.

5.3.5 Clear Collision

Clear collision occurs when both the user and the network simultaneously transfer DISCONNECT messages specifying the same call reference value. When the network receives a DISCONNECT message while in the Disconnect Indication state, the network shall stop timer T305, send a RELEASE message, start timer T308, and enter the Release Request state. Similarly, when the user receives a DISCONNECT message while in the Disconnect Request state, the user shall stop timer T305, disconnect the B-channel (if not disconnected), send a RELEASE message, start timer T308, and enter the Release Request state.

Clear collision can also occur when both sides simultaneously transfer RELEASE messages related to the same call reference value. The entity receiving such a RELEASE message while within the Release Request state shall stop timer T308, release the call reference and B-channel if appropriate, and enter the Null state (without sending or receiving a RELEASE COMPLETE message).

5.4 In-Band Tones & Announcements

When the in-band tones and announcements not associated with a call state change are to be provided by the network before reaching the Active state, a PROGRESS message shall be returned simultaneously with the application of the in-band tone or announcement. The PROGRESS message shall contain a Progress indicator information element with the progress description value 8 “in-band information or appropriate pattern is now available.”

When tones and announcements have to be provided together with a call state change, then the appropriate message (e.g., for ALERTING, etc. – see appropriate subclause) containing a Progress indicator information element with the progress description value 8 “in-band information or appropriate pattern is now available” shall be sent simultaneously with the application of the in-band tone or announcement.

NOTES

- 1 When the network provides ITU-T-standardized telecommunication services, the service requirement for provision of in-band tones and announcements is as indicated in the I.200 Series Recommendations.
- 2 When the PROGRESS message is used, the user may initiate call clearing as a result of the applied in-band tone or announcement, according to procedures specified in 5.3.3.
- 3 The protocol currently described in 5.4 applies at the calling user-network interface.

5.5 Restart Procedure

The restart procedure is used to return channels and interfaces to an idle condition. The procedure is usually invoked when the other side of the interface does not respond to other call control messages or a failure has occurred (e.g., following a data-link failure, when a backup D-channel can be used; or following the expiration of timer T308 due to the absence of a response to a clearing message). It may also be initiated as a result of local failure, maintenance action or mis-operation.

NOTES

- 1 Layer 3 procedures and resources associated with those data links with SAPI="0000 00" are initialized by the restart procedures.

- 2 The call reference flag of the global call reference applies to restart procedures. In the case when both sides of the interface initiate simultaneous restart requests, they shall be handled independently. In the case when the same channel(s) or interface(s) are specified, they shall not be considered free for reuse until all the relevant restart procedures are completed.

When:

- a) both the user and the network are aware of the configuration of the interface; and
- b) the interface is a basic rate access (see ITU-T Recommendation I.430) where a point-to-point configuration exists; or
- c) the interface is a primary rate access (see ITU-T Recommendation I.431);

then the user and the network shall implement the procedures of 5.5. In all other cases, the procedures of 5.5 are optional.

Procedures that allow the sending and receipt of multiple RESTART messages are optional. The provisioning of these procedures between the user and network is by bilateral agreement.

5.5.1 Sending RESTART Message

A RESTART message is sent by the network or user equipment in order to return channels or interfaces to Null states. The Restart indicator information element shall be present in a RESTART message to indicate whether an *Indicated channel*, *Single interface*, or *All interfaces* are to be restarted. If the Restart indicator information element is coded as "Indicated channel," or "Single interface" and the interface is one other than the one containing the D-channel, then the Channel identification information element shall be present to indicate which channel or interface is to be returned to the idle condition. If the Restart indicator information element is coded as "Single interface" and the interface is the one containing the D-channel, then the Channel identification information element is normally present, or, as an implementation option (by bilateral agreement) may be omitted. If the Restart indicator information element is coded as "All interfaces" then the Channel identification information element shall not be included.

Upon transmitting the RESTART message, the sender shall enter the Restart Request state, start timer T316, and wait for a RESTART ACKNOWLEDGE message. The sender of the RESTART message shall maintain a record of the facilities being restarted (B-channels or interface[s]). Upon the receipt of a RESTART ACKNOWLEDGE message while timer T316 is running, the recipient shall stop timer T316, free the channels and call reference values for reuse, and enter the Null state.

While timer T316 is running if a subsequent RESTART message is to be sent due to a system management request, then the sender shall send the RESTART message and remain in the Restart Request state. The sender of the restart request shall also initiate a new timer T316, and maintain a new record of the facilities being restarted. The sender of the RESTART message shall remain in the Restart Request state until all outstanding RESTART messages have been acknowledged.

A RESTART message shall not be sent if any of the following conditions exist:

- a) A RESTART message shall not be sent if a previous RESTART message had been sent on the same D-channel, Timer T316 is running, and a bilateral agreement for the support of multiple outstanding RESTART request does not exist.
- b) A RESTART message shall not be sent indicating a B-channel, if a previous RESTART message had been sent indicating the same B-channel and timer T316 is running for that restart request.
- c) A RESTART message shall not be sent indicating an interface or B-channel within an interface, if a previous RESTART message had been sent indicating the same interface and timer T316 is running for that restart request.

- d) A RESTART message shall not be sent indicating all interfaces, an interface, or a B-channel, if a previous RESTART message had been sent indicating all interfaces, and timer T316 is running for that restart request.

If a RESTART ACKNOWLEDGE message is not received prior to the expiration of timer T316, one or more subsequent RESTART messages may be sent until a RESTART ACKNOWLEDGE message is returned. Meanwhile, no calls shall be placed or accepted over the channel or interface by the originator of the RESTART message. A network shall limit the number of consecutive unsuccessful restart attempts to a default limit of two. When this limit is reached, the network shall make no further restart attempts. An indication will be provided to the appropriate maintenance entity. The channel or interface is considered to be in an out-of-service condition until maintenance action has been taken.

In the case where multiple RESTART messages are sent, they shall be handled independently. Channel(s) or interface(s) specified shall not be considered free for reuse until all the relevant restart procedures are completed. In this case, any RESTART ACKNOWLEDGE message(s) received while other outstanding RESTART message(s) still exist on that channel or interface will only result in stopping the associated T316 timer(s).

The RESTART and RESTART ACKNOWLEDGE message shall contain the global call reference value (all zeroes) to which the Restart Request state is associated. These messages are transferred via the appropriate point-to-point data link in the multiple frame mode using the DL-DATA-REQUEST primitive.

5.5.2 Receipt of RESTART Message

Upon receiving a RESTART message, the recipient shall enter the Restart state associated with the global call reference and start timer T317. It shall then initiate the appropriate internal actions to return the specified channels to the idle condition and call references to the Null state. The recipient of the RESTART message shall maintain a record of the facilities requested to be restarted (B-channels or interface[s]). Upon completion of internal clearing, timer T317 shall be stopped, a RESTART ACKNOWLEDGE message transmitted to the originator, and the Null state entered.

If a subsequent RESTART message is received while the recipient is in the Restart state, the recipient shall remain in the Restart state. In the case where multiple RESTART messages are supported, the recipient shall also initiate a new timer T317, and maintain a new record of the facilities requested to be restarted (B-channel or interface[s]) for the subsequent RESTART message received, and proceed as previously defined.

The recipient of the RESTART message shall remain in the Restart state until all RESTART messages received have been responded to with a RESTART ACKNOWLEDGE message.

If the recipient of a RESTART message determines that,

- a) the RESTART message was received while in the Restart state and a bilateral agreement for the support of multiple outstanding RESTART requests does not exist;
- b) the RESTART message received indicates a B-channel for which a previous RESTART message had been received and timer T317 is running for that RESTART message;
- c) the RESTART message received indicates an interface or B-channel within an interface for which a previous RESTART message had been received indicating the same interface and timer T317 is running for that RESTART message; or
- d) the RESTART message received indicates all interfaces, an interface, or a B-channel for which a previous RESTART message had been received indicating all interfaces, and timer T317 is running for that RESTART message, the recipient shall take no action on the message.

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If timer T317 expires prior to completion of internal clearing, an indication shall be sent to the maintenance entity (i.e., a primitive should be transmitted to the system management entity).

If the Restart indicator information element is coded as "all interfaces," then all calls on all interfaces associated with the D-channel shall be cleared. If the Restart indicator information element is coded as "all interfaces" and a Channel identification information element is included, the Channel identification information element is treated as described in 5.8.7.3.

If the Restart indicator information element is coded as "indicated channel" and the Channel identification information element is not included, then the procedures in 5.8.6.1 shall be followed.

If the Restart indicator information element is coded as "single interface" and the Channel identification information element is not included, then the procedures of 5.8.6.1 shall be followed, except where the implementation option described in 5.5.1 is supported.

If the Restart indicator information element is coded as "single interface" and that interface includes the D-channel, then only those calls associated with the D-channel on that interface shall be cleared.

The following entities shall be released:

- a) B and H channels established by the ATIS-1000607 messages including channels used for packet access (case B), not established over a semi-permanent connection (i.e., provisioned channels); and
- b) user signaling bearer service connections when "single interface" is specified and that interface includes the D-channel, or when "all interfaces" are specified.

The following entities shall not be released:

- a) semi-permanent connections that are established by human-machine commands (i.e., provisioned channels);
- b) calls associated with DSS1 protocol control entities supported by any DLCI other than the one supporting the DSS1 protocol entity for the global call reference which received the RESTART message;
- c) X.25 virtual calls and permanent virtual circuits using SAPI = 16; or
- d) TID and USID values established using terminal initialization procedures (ATIS-1000610).

If semi-permanent connections established by the human-machine command are implicitly specified (by specifying "single interface" or "all interfaces"), no action shall be taken on these channels, but a RESTART ACKNOWLEDGE message shall be returned containing the appropriate indications (i.e., "single interface" or "all interfaces").

If semi-permanent connections established by human-machine commands are implicitly specified (by including a Channel identification information element in the RESTART message) no action shall be taken on these channels.

NOTES

- 1 Even if all call references are in the Null state, and all channels are in the idle condition, the receiving entity shall transmit a RESTART ACKNOWLEDGE message to the originator upon receiving a RESTART message.
- 2 If the RESTART message is sent by a user, the network shall return to the Null state only those ATIS-1000607 calls that are:
 - a) associated with the data link connection end point identifier [DLCI, see ATIS-1000602]; and
 - b) that correspond to the specified channel(s) or interface.

5.6 Call Rearrangements

Call rearrangements are not supported by this standard.

5.7 Call Collisions

Call collisions, as such, cannot occur at the network. Any simultaneous incoming or outgoing calls are dealt with separately and assigned different call references.

Channel selection conflicts may occur if an incoming call and outgoing call select the same channel. This is resolved by the network through channel selection mechanisms described in 5.1.2 and 5.2.3.

In the case of such conflicts, the network shall give priority to the incoming call over the call request received from the user. It shall clear the outgoing call whenever the B-channel can not be allocated by the network or accepted by the user originating the call.

Note - Some terminal adapters supporting existing non-voice terminals (e.g., ITU-T Recommendation X.21) may need to resolve double channel selection by clearing the incoming call and reattempting the outgoing call set-up in order to satisfy the requirements of the interface at reference point R.

5.8 Handling of Error Conditions

All procedures for transferring signaling information using the protocol discriminator value "ATIS-1000607 user-network call control messages" are applicable only to those messages that pass the checks described in 5.8.1 through 5.8.7. The error handling procedures of 5.8.1 through 5.8.7 apply to messages using an ordinary call reference or the global call reference, except where otherwise noted.

Detailed error handling procedures are implementation-dependent and may vary from network to network. However, capabilities facilitating the orderly treatment of error conditions are provided for in this subclause and shall be provided in each implementation.

Subclauses 5.8.1 through 5.8.7 are listed in order of precedence.

5.8.1 Protocol Discriminator Error

When a message is received with an unrecognized protocol discriminator, that message shall be ignored (this means to do nothing, as if the message had never been received).

5.8.2 Message Too Short

When a message is received that is too short to contain a complete Message type information element, that message shall be ignored.

5.8.3 Call Reference Error

5.8.3.1 Invalid Call Reference Format

If the Call reference information element octet 1, bits 5 through 8 do not equal 0000, then the message shall be ignored.

If the Call reference information element octet 1, bits 1 through 4, indicates a length greater than the maximum length supported by the receiving equipment (see 4.3), then the message shall be ignored.

When a message is received with the dummy call reference it shall be ignored unless it is required for a supplementary service (see ATIS-1000610).

5.8.3.2 Call Reference Procedural Errors

Only items e) and f) apply to messages using the global call reference.

- a) Whenever any message except SETUP, RELEASE COMPLETE, STATUS, or STATUS ENQUIRY is received specifying a call reference that is not recognized as relating to an active call or to a call in progress, the recipient shall initiate clearing by sending a RELEASE COMPLETE message with cause 81 "invalid call reference value" specifying the call reference in the received message and shall remain in the Null state;
- b) When a RELEASE COMPLETE message is received specifying a call reference that is not recognized as relating to an active call or to a call in progress, no action should be taken;
- c) When a SETUP message is received specifying a call reference that is not recognized as relating to an active call or to a call in progress, and with a call reference flag incorrectly set to "1," this message shall be ignored;
- d) When a SETUP message is received specifying a call reference that is recognized as relating to an active call or to a call in progress, this SETUP message shall be ignored;
- e) When any message except RESTART, RESTART ACKNOWLEDGE, or STATUS is received using the global call reference, no action should be taken on this message and a STATUS message using the global call reference with a call state indicating the current state associated with the global call reference and cause 81 "invalid call reference" shall be returned.
- f) When RESTART or RESTART ACKNOWLEDGE is received with a call reference flag incorrectly set, the message shall be ignored;
- g) When a STATUS message is received specifying a call reference that is not recognized as relating to an active call or to a call in progress, the procedures of 5.8.11 shall apply.
- h) When a STATUS ENQUIRY message is received specifying a call reference that is not recognized as relating to an active call or to a call in progress, the procedures of clause 5.8.10 shall apply.

NOTE – As an option of the user equipment (e.g., NT2), cause values, location codes, and diagnostics which are not understood by the NT2 may be passed on to another entity (e.g., user or NT2), instead of treating the cause value as if it were cause 31, "normal, unspecified" and sending cause 100, "invalid information element contents" within the RELEASE message. This option is intended to aid user equipment to be compatible with future additions of cause values, location codes, and diagnostics to the American National Standard.

5.8.4 Message Type or Message Sequence Errors

Whenever an unexpected message, except RELEASE or RELEASE COMPLETE, or unrecognized message is received in any state other than the Null state, a STATUS message shall be returned with cause 98 "message not compatible with call state or message type non-existent or not implemented" and the corresponding diagnostic. If a network or user can distinguish between unimplemented (or non-existent) message types and implemented message types that are incompatible with the call state, then a STATUS message may be sent with one of the following causes:

- a) cause 97 "message type non-existing or not implemented"; or

- b) cause 101 “message not compatible with the call state.”

However, two exceptions to this procedure exist. The first exception is when the network or the user receives an unexpected RELEASE message (e.g., if the DISCONNECT message was corrupted by undetected transmission errors). In this case, no STATUS or STATUS ENQUIRY message is sent. Whenever the network receives an unexpected RELEASE message, the network shall: disconnect and release the B-channel; clear the network connection and the call to the remote user with cause in the RELEASE message sent by the user or, if not included, cause 31 “normal, unspecified”; return a RELEASE COMPLETE message to the user; release the call reference; stop all timers; and enter the Null state. Whenever the user receives an unexpected RELEASE message, the user shall: disconnect and release the B-channel; return a RELEASE COMPLETE message to the network; release the call reference; stop all timers; and enter the Null state.

The second exception is when the network or the user receives an unexpected RELEASE COMPLETE message. Whenever the network receives an unexpected RELEASE COMPLETE message, the network shall: disconnect and release the B-channel; clear the network connection and the call to the remote user with the cause indicated by the user or, if not included, cause 111 “protocol error, unspecified”; release the call reference; stop all timers; and enter the Null state. Whenever the user receives an unexpected RELEASE COMPLETE message, the user shall: disconnect and release the B-channel; release the call reference; stop all timers; and enter the Null state.

In addition, as an option, when an unexpected or unrecognized message is received before the active state is reached, the call may be cleared using cause 98 “message not compatible with call state or message type non-existent or not implemented,” 101 “message not compatible with the call state,” or 97 “message type non-existing or not implemented” as appropriate.

5.8.5 General Information Element Errors

The general information element error procedures may apply to information elements in codesets other than 0. In that case, the diagnostics in the cause information element may indicate information elements other than those in codeset 0 by applying the locking shift procedure described in 4.5.3.

5.8.5.1 Information Element Out of Sequence

A variable length information element that has a code value lower than the code values of the variable length information element preceding it shall be considered as an out of sequence information element.

If the network or user receives a message containing an out of sequence information element, it may ignore this information element and continue to process the message. If this information is mandatory, and the network or user chooses to ignore this out of sequence information element, then the error handling procedure for missing mandatory information elements as described in 5.8.6.1 shall be followed. If the ignored information element is non-mandatory, the receiver continues to process the message.

5.8.5.2 Duplicated Information Elements

If an information element is repeated in a message in which repetition of the information element is not permitted, only the contents of the information element appearing first shall be handled and all subsequent repetitions of the information element shall be ignored. When repetition of information elements is permitted, only the contents of permitted information elements shall be handled. If the limit on repetition of information elements is exceeded, the contents of information elements appearing first up to the limit of repetitions shall be handled and all subsequent repetitions of the information element shall be ignored.

5.8.6 Mandatory Information Element Error

5.8.6.1 Mandatory Information Element Missing

When a message other than SETUP, DISCONNECT, RELEASE, or RELEASE COMPLETE is received that has one or more mandatory information elements missing, no action should be taken on the message and no state change should occur. A STATUS message is then returned with cause 96 “mandatory information element is missing.” As an option, when a message is received that has one or more mandatory information elements missing before the active state is reached the call may be cleared using cause 96 “mandatory information element is missing.”

When a SETUP or RELEASE message is received that has one or more mandatory information elements missing, a RELEASE COMPLETE message with cause 96 “mandatory information element is missing” shall be returned.

When a DISCONNECT message is received with the cause information element missing, the actions taken shall be the same as if a DISCONNECT message with cause 31 “normal unspecified” was received (see 5.3), with the exception that the RELEASE message sent to the user contains cause 96, “mandatory information element is missing.”

When a RELEASE COMPLETE message is received with a Cause information element missing, it will be assumed that a RELEASE COMPLETE message was received with cause 31 “normal, unspecified.”

5.8.6.2 Mandatory Information Element Content Error

When a message other than SETUP, DISCONNECT, RELEASE, or RELEASE COMPLETE is received that has one or more mandatory information elements with invalid content, no action should be taken on the message and no state change should occur. A STATUS message is then returned with cause 100 “invalid information element contents.” As an option, when a message is received that has one or more mandatory information elements with invalid contents before the active state is reached, the call may be cleared using cause 100 “invalid information element contents.”

When a SETUP or RELEASE message is received that has one or more mandatory information elements with invalid content, a RELEASE COMPLETE message with cause 100 “invalid information element contents” shall be returned.

When a DISCONNECT message is received with invalid content of the Cause information element, the action taken shall be the same as if a DISCONNECT message with cause 31 “normal, unspecified” was received (see 5.3) with the exception that the RELEASE message sent on the local interface contains cause 100 “invalid information element contents.”

Information elements with a length exceeding the maximum length (given in clause 3) will be treated as information elements with content error.

5.8.7 Non-Mandatory Information Element Errors

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

5.8.7.1 Unrecognized Information Elements

When a message is received that has one or more unrecognized information elements, the receiving entity shall check whether any are encoded to indicate “comprehension required” (refer to note 5 of Table 21 for information elements identified as reserved with this meaning). If any unrecognized information ele-

ment is encoded to indicate “comprehension required,” then the procedures in 5.8.6.1 are followed; i.e., as if a “missing mandatory information element” error condition had occurred.

NOTE - Unrecognized information elements are non-mandatory information elements whose information element identifiers are not implemented by the receiver of the information element.

If all unrecognized information elements are not encoded to indicate “comprehension required,” then the receiving entity shall proceed as follows.

Action shall be taken on the message and those information elements that are recognized and have valid content. When the received message is other than DISCONNECT, RELEASE, or RELEASE COMPLETE, a STATUS message may be returned containing one Cause information element. The STATUS message that may be sent as a result of receiving a message containing an unrecognized information element shall indicate the call state of the receiver after taking action on the message that contains the error. The Cause information element shall contain cause 99 “information element non-existent or not implemented,” and the diagnostic field, if present, shall contain the information element identifier for each information element that was unrecognized.

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

- a) When a DISCONNECT message is received that has one or more unrecognized information elements, a RELEASE message with cause 99 “information element non-existent or not implemented” shall be returned. The Cause information element diagnostic field, if present, shall contain the information element identifier for each information element that was unrecognized.
- b) When a RELEASE message is received that has one or more unrecognized information elements, a RELEASE COMPLETE message with cause 99 “information element non-existent or not implemented” shall be returned. The Cause information element diagnostic field, if present, shall contain the information element identifier for each information element that was unrecognized.
- c) When a RELEASE COMPLETE message is received that has one or more unrecognized information elements, no action shall be taken on the unrecognized information.

The diagnostic(s) of cause 99 “information element non-existent or not implemented” facilitates the decision in selecting an appropriate recovery procedure at the reception of a STATUS message. Therefore, it is recommended to provide cause 99 “information element non-existent or not implemented” with diagnostic(s) if a layer 3 entity expects the peer to take appropriate action at the receipt of a STATUS message, although inclusion of diagnostic(s) is optional.

5.8.7.2 Non-Mandatory Information Element Content Error

When a message is received that has one or more non-mandatory information elements with invalid content, action shall be taken on the message and those information elements that are recognized and have valid content. A STATUS message may be returned containing one Cause information element. If the message containing one or more non-mandatory information elements with invalid content is a RELEASE COMPLETE message, no STATUS message shall be returned. The STATUS message that may be sent as a result of receiving a message containing a non-mandatory information element with invalid content shall indicate the call state of the receiver after taking action on the message that contains the error. The STATUS message indicates the call state in which the receiver detected the error. The Cause information element shall contain cause 100 “invalid information element contents,” and the diagnostic field, if present, shall contain the information element identifier for each information element that had invalid contents.

Information elements with a length exceeding the maximum length (given in clause 3) will be treated as an information element with content error. But for access information elements (see ATIS-1000650); e.g., User-user information element, Called party subaddress information element), cause 43 "access information discarded" is used instead of cause 100 "invalid information element contents." However, in some networks, access information elements may be truncated and processed.

NOTE – As an option of the user equipment (e.g., NT2), cause values, location codes, and diagnostics that are not understood by the NT2 may be passed on to another entity (e.g., user or NT2), instead of treating the cause value as if it were cause 31 "normal, unspecified" and sending cause 100 "invalid information element contents" within the RELEASE message. This option is intended to aid user equipment to be compatible with future additions of cause values, location codes, and diagnostics to the American National Standard.

5.8.7.3 Unexpected Recognized Information Element

When a message is received with a recognized information element that is not marked as comprehension required and is not to be contained in that message, the receiving entity shall (except as noted below) treat the information element as an unrecognized information element and follow the procedures defined in 5.8.7.1. When a message is received with a recognized information element that is marked as comprehension required and is not to be contained in that message, the receiving entity shall follow the procedures of 5.8.6.1.

NOTE – Some implementations may choose to process unexpected recognized information elements when the procedure for processing the information element is independent of the message in which it is received.

5.8.8 Data-Link Reset

Whenever a ATIS-1000607 entity is informed of a spontaneous data-link layer reset by means of the DL-ESTABLISH-INDICATION primitive, the following procedures apply:

- a) For calls in the Overlap Sending state, the entity shall initiate clearing by sending a DISCONNECT message with cause 41 "temporary failure," and following the procedures of 5.3.
- b) For calls in the disestablishment phase (states N11, N12, N19, N22, U11, U12 and U19), no action shall be taken.
- c) Calls in the establishment phase (states N1, N3, N4, N6, N7, N8, N9, U1, U3, U4, U6, U7, U8 and U9) and in the Active state shall be maintained according to procedures contained in other parts of this clause.

5.8.9 Data-Link Failure

Whenever the ATIS-1000607 entity is notified by its data link layer entity via the DL-RELEASE-INDICATION primitive that there is a data link layer malfunction, the following procedure shall apply:

- a) Any calls not in the active state in a point-to-point configuration shall be cleared internally.
- b) For any call in the Active state, a timer T309 shall be started (if implemented).

If timer T309 is already running, it shall not be restarted.

The ATIS-1000607 entity shall request layer 2 reestablishment by sending a DL-ESTABLISH-REQUEST primitive.

When informed of layer 2 reestablishment by means of the DL-ESTABLISH-CONFIRM primitive, the ATIS-1000607 entity shall stop timer T309 and either:

- the ATIS-1000607 entity shall send a STATUS message with cause 31 “normal, unspecified” to report the current state to the peer entity; or,
- the ATIS-1000607 entity shall perform the status enquiry procedure according to 5.8.10 to verify the call state of the peer entity.

If timer T309 expires prior to data link reestablishment, the network shall clear the network connection and call to the remote user with cause 27 “destination out of order,” disconnect and release the B-channel, release the call reference, and enter the Null state.

If timer T309 expires prior to data link reestablishment, the user shall clear the connection (if any) with cause 27 “destination out of order,” disconnect and release the B-channel, release the call reference, and enter the Null state.

When a backup D-channel is available, the procedures in Annex F may be used.

The implementation of timer T309 in the user side is optional and in the network side is mandatory.

When a ATIS-1000607 entity internally clears the call as a result of data link failure it may, as an option, request the reestablishment of the data link in order to attempt to send a DISCONNECT message across the interface.

5.8.10 Status Enquiry Procedure

Whenever an entity wishes to check the correctness of a call state at a peer entity, a STATUS ENQUIRY message may be sent requesting the call state. This may, in particular, apply to procedural error conditions described in 5.8.8 and 5.8.9.

Upon sending the STATUS ENQUIRY message timer T322 shall be started in anticipation of receiving a STATUS message. While timer T322 is running, only one outstanding request for call state information shall exist. Therefore, if timer T322 is already running, it shall not be restarted. If a clearing message is received before timer T322 expires, timer T322 shall be stopped, and call clearing shall continue.

Upon receipt of a STATUS ENQUIRY message, the receiver shall respond with a STATUS message, reporting the current call state (the current state of an active call or a call in progress, or the Null state if the call reference does not relate to an active call or to a call in progress) and cause 30 “response to STATUS ENQUIRY” or 97 “message type non-existent or not implemented” (see 5.8.4). Receipt of the STATUS ENQUIRY message does not result in a state change.

The sending or receipt of the STATUS message in such a situation will not directly affect the call state of either the sender or receiver. The side having received the STATUS message shall inspect the Cause information element. If the STATUS message contains cause 97 “message type non-existent or not implemented,” timer T322 shall continue to time for an explicit response to the STATUS ENQUIRY message. If a STATUS message is received that contains cause 30 “response to status enquiry,” timer T322 shall be stopped and the appropriate action taken, based on the information in that STATUS message, relative to the current state of the receiver. If timer T322 expires and a STATUS message with cause 97 “message type non-existent or not implemented” was received, the appropriate action shall be taken, based on the information in that STATUS message, relative to the current call state of the receiver.

These further “appropriate actions” are implementation-dependent. However, the actions prescribed in the following subclauses shall apply.

If timer T322 expires, and no STATUS message was received, the STATUS ENQUIRY message may be retransmitted one or more times until a response is received. The number of times a STATUS ENQUIRY

message is retransmitted is an implementation dependent value. The call shall be cleared to the local interface with cause 41 “temporary failure” if the STATUS ENQUIRY is retransmitted the maximum number of times. If appropriate, the network shall also clear the network connection, using cause 41 “temporary failure.”

5.8.11 Receiving a STATUS Message

On receipt of a STATUS message reporting an incompatible state, if the receiving entity determines that the state mismatch is a valid error condition (see Note), it shall:

- a) clear the call by sending the appropriate clearing message with cause 101 “message not compatible with call state”; or
- b) take other actions that attempt to recover from a mismatch and are implementation options.

At a minimum, the user shall be able to report the call state when the call is active.

NOTE - The sending and receiving state machines are dynamic, and valid state mismatch can occur due to message flow during the status enquiry and response. Further, either or both entities may not implement all call states.

The determination of which states are incompatible is left as an implementation decision. As an option:

- a) if a STATUS message indicating any call state except the Null state is received in the Null state, then the receiving entity shall send a RELEASE COMPLETE message with a cause 101 “message not compatible with call state” and remain in the Null state.
- b) if a STATUS message indicating any call state except the Null state is received in the Release Request state, no action shall be taken.
- c) if a STATUS message, indicating the Null state, is received in any state except the Null state, the receiver shall release all resources and move into the Null state.

When in the Null state, the receiver of a STATUS message that indicates the Null state shall take no action other than to discard the message and shall remain in the Null state.

A STATUS message may be received indicating a compatible call state but containing one of the following causes:

- 96 “mandatory information element is missing”;
- 97 “message type non-existent or not implemented”;
- 99 “information element non-existent or not implemented”; or
- 100 “invalid information element contents.”

In this case, the actions to be taken are an implementation option. If other procedures are not defined, the receiver shall clear the call with the appropriate procedure defined in 5.3, using the cause specified in the received STATUS message.

On receipt of a STATUS message specifying a global call reference and reporting an incompatible state in the Restart Request or Restart state, the receiving ATIS-1000607 entity shall inform layer management and take no further action on this message.

On receipt of a STATUS message with the global call reference in Null state, no action shall be taken.

NOTE - Further action as a result of higher layer activity (e.g., system or layer management) are implementation-dependent (including the retransmission of RESTART).

Except for the above case, the error handling procedures when receiving a STATUS message specifying the global call reference are implementation options.

5.9 User Notification Procedure

This procedure is to support some supplementary services. The procedure allows the network to notify a user of any appropriate call-related event during the Active state of a call. It also allows a user to notify the remote user of any appropriate call-related event during the Active state of a call by sending a NOTIFY message containing a Notification indicator information element with an appropriate notification description to the network. Upon receipt of this message, the network must send a NOTIFY message containing a Notification indicator information element with the same notification description to the other user involved in the call. No state change occurs at any of the interface sides following the sending or receipt of this message.

5.10 Basic Telecommunication Service Identification & Selection

Procedures for bearer capability selection are described in 5.11 and procedures for high layer compatibility selection are described in 5.12.

For teleservices, the network and the destination user shall identify the requested teleservices by taking the presented Bearer capability and High layer compatibility information elements in all combinations. Where a permutation is not defined as a valid basic telecommunications service, that permutation shall be ignored. Where a permutation is defined as a valid basic telecommunications service, that permutation may be considered for the purpose of service provision.

For bearer services, the High layer compatibility information element, if included, does not identify a supported teleservice and the contents of the High layer compatibility information element is not used by the network. The network and the destination user shall identify the requested bearer services from the values of the presented Bearer capability information elements.

NOTES

- 1 Each basic telecommunication service will have the required Bearer capability information element encodings, and if applicable, the required High layer compatibility information element encodings, defined for that service.
- 2 These requirements do not preclude the user performing compatibility checking on all compatibility information in accordance with Annex B.

5.11 Signaling Procedures for Bearer Capability Selection

The procedures in this Clause form an optional part of this standard, but are a mandatory requirement for the provision of certain bearer services or teleservices. Provision of these procedures between the originating user and the originating network, and also between the destination network and the destination user, is thus subject to bilateral agreement, e.g., a subscription arrangement for the provision of that bearer service or teleservice to each user.

These procedures shall apply only in the case where the call, or call request, as currently routed, is entirely within the ISDN or in the case the call routes within the ISDN but completes to a switched 56 kbit/s line (see Note 2). It will not apply to situations involving interworking with non-ISDNs.

NOTES

- 1 The use of the Low layer compatibility information element in conjunction with these procedures requires further study and the interpretation of any received Low layer compatibility information element is not defined.
- 2 This latter case only applies if supported by the network and if the call explicitly requests that completion as 64 kbit/s rate adapted to 56 kbit/s be allowed for the call.

5.11.1 Procedures for the Originating User to Indicate Bearer Capability Selection is Allowed

5.11.1.1 Normal Operation

For some bearer services or teleservices, the originating user can indicate that:

- fallback to an alternative bearer capability is allowed; or
- fallback to an alternative bearer capability is not allowed.

If the calling user allows fallback to occur to an alternative bearer capability, then the user shall indicate this to the network by means of repeated Bearer capability information elements within the SETUP message sent to indicate the presence of a call request. This procedure allows a maximum of three Bearer capability information elements in the SETUP message.

When two or three Bearer capability information elements are present, their order shall indicate the priority of the bearer capabilities. Bearer capability information elements shall be in ascending order of priority, i.e., a subsequent Bearer capability information element shall indicate a bearer capability with higher priority.

If fallback allowed is indicated in the SETUP message as described above, and fallback occurs at the destination user, or fallback does not occur, or if the call completes to a switched 56 kbit/s line, the originating network shall include in the CONNECT message sent to the calling user the Bearer capability information element of the resultant bearer service or teleservice.

If fallback allowed is indicated in the SETUP message as described above, and fallback occurs within the ISDN (e.g., bearer capability selection is not supported or the selected route does not support the preferred bearer capability), the originating network shall include in a PROGRESS message or other appropriate call control message sent to the calling user a Progress indicator information element with the progress description value 5 "interworking has occurred and has resulted in a telecommunication service change." The originating network shall include the Bearer capability information element of the resultant bearer service or teleservice.

5.11.1.2 Exceptional Procedures

The procedures of 5.8 shall apply, with the addition that:

- a) if the calling user receives no Bearer capability information element in the CONNECT message, or prior to the CONNECT message in some other call control message, the user shall assume that the bearer service or teleservice corresponds to the first Bearer capability information element that the user included in the SETUP message; and
- b) if the calling user receives a Progress indicator information element with a progress description value 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or progress description value 2 "destination address is non-ISDN" subsequent to a Progress indicator information element with a progress description value 5 "interworking has occurred and has resulted in a telecommunication service change," then the last received Progress indicator information element shall be taken account of. Where the progress description value is 1 "call is not

end-to-end ISDN, further call progress information may be available in-band" or 2 "destination address is non-ISDN," the user shall assume a bearer service category of circuit-mode 64-kbit/s 8-kHz structured usable for 3.1-kHz audio information transfer unless otherwise indicated by a Bearer capability information element included in the CONNECT message.

5.11.2 Procedures for Bearer Capability Selection at the Destination Side is Allowed

5.11.2.1 Normal Operation

If the calling user and the network operator allow fallback to occur to an alternative bearer capability, then the destination network shall indicate this to the destination user by means of repeated Bearer capability information elements within the SETUP message sent to indicate the presence of a call request.

When two or three Bearer capability information elements are present, their order shall indicate the priority of the bearer capabilities. Bearer capability information elements shall be in ascending order of priority, i.e., a subsequent Bearer capability information element shall indicate a bearer capability with higher priority.

If fallback allowed is indicated in the SETUP message as described above, and the user wishes to accept the call without having fallback occur, the user shall include in the CONNECT message sent to the network the Bearer capability information element of the requested bearer service or teleservice.

If fallback allowed is indicated in the SETUP message as described above, and the user wishes to accept the call with having fallback occur to the lowest priority alternative bearer capability, the user may, but need not, include in the CONNECT message sent to the network the Bearer capability information element of the alternative bearer service or teleservice.

If no Bearer capability information element is indicated by the called user, the network shall assume that the lowest priority bearer capability is selected.

If fallback allowed is indicated in the call request, and no interworking has been encountered (i.e., a progress description value 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or 2 "destination address is non-ISDN" has not been sent), the destination network shall indicate the resultant bearer capability and connection type to the originating network at the time the bearer is established, even if no Bearer capability information element is received from the destination user.

5.11.2.2 Exceptional Procedures

The procedures of 5.8 shall apply.

5.11.3 Procedures for Interworking with Private ISDNs

5.11.3.1 Procedures for the Originating User to Indicate Bearer Capability Selection is Allowed

The procedures of 5.11.1 shall apply.

5.11.3.2 Procedures for Bearer Capability Selection at the Destination Side of a Public ISDN

5.11.3.2.1 Normal Operation

If a private ISDN is attached to the access at the destination interface, the following procedures are applicable at call request. The private ISDN acts as the called user.

If the calling user allows fallback to occur to an alternative bearer capability, then the network shall indicate this to the called user by means of repeated Bearer capability information elements within the SETUP message sent to indicate the presence of a call request.

When two or three Bearer capability information elements are present, their order shall indicate the priority of the bearer capabilities. Bearer capability information elements shall be in ascending order of priority, i.e., a subsequent Bearer capability information element shall indicate a bearer capability with higher priority.

If fallback allowed is indicated in the SETUP message as described above, and fallback occurs at the destination user (beyond the private ISDN) or fallback does not occur, the user shall include in the CONNECT message sent to the network the Bearer capability information element of the resultant bearer service or teleservice.

If fallback allowed is indicated in the SETUP message as described above, and fallback occurs within the private ISDN, the user shall include in a PROGRESS message or other appropriate call control message sent to the network a Progress indicator information element with a progress description value 5 "interworking has occurred and has resulted in a telecommunication service change." The user shall include the Bearer capability information element of the resultant bearer service or teleservice.

5.11.3.2.2 Exceptional procedures

The procedures of 5.8 shall apply, with the addition that:

- a) if the network receives no Bearer capability information element in the CONNECT message or prior to the CONNECT message in some other call control message, the network shall assume that the bearer service or teleservice corresponds to the first Bearer capability information element that the network included in the SETUP message. In addition, a Progress indicator information element containing progress description value 5 "interworking has occurred and has resulted in a telecommunication service change" shall be returned to the calling user in the CONNECT message unless a Progress indicator information element containing progress description value 1 "call is not end-to-end ISDN, further call progress information may be available in-band"

or 2 "destination address is non-ISDN" is returned in the CONNECT message. The lowest priority Bearer capability information element is also returned in the CONNECT message.

- b) if the network receives a Progress indicator information element with a progress description value 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or progress description value 2 "destination address is non-ISDN" subsequent to a Progress indicator information element with a progress description value 5 "interworking has occurred and has resulted in a telecommunication service change," then the last received Progress indicator information element shall be taken account of. Where the last received progress description value is 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or 2 "destination address is non-ISDN," the network shall assume a bearer service category of circuit-mode 64-kbit/s 8-kHz structured usable for 3.1-kHz audio information transfer unless otherwise indicated by a Bearer capability information element included in the CONNECT message.

5.12 Signaling Procedures for High Layer Compatibility Selection

The procedures in this subclause form an optional part of this standard, but are a mandatory requirement for the provision of certain teleservices. Provision of these procedures between the originating user and the originating network, and also between the destination network and the destination user, is thus subject to bilateral agreement (e.g., a subscription arrangement for the provision of that teleservice to each user).

These procedures shall apply only in the case where the call, or call request, as currently routed, is entirely within the ISDN. It will not apply to situations involving interworking with non-ISDNs.

5.12.1 Procedures for the Originating User to Indicate High Layer Compatibility Selection is Allowed

5.12.1.1 Normal Operation

In some networks, the originating user can indicate that:

- fallback to an alternative high layer compatibility is allowed; or
- fallback to an alternative high layer compatibility is not allowed.

If the calling user allows fallback to occur to an alternative high layer compatibility, then the user shall indicate this to the network by means of repeated High layer compatibility information elements within the SETUP message sent to indicate the presence of a call request. The user shall ensure that the first High layer compatibility information element shall be compatible with the first Bearer capability information element. This procedure allows a maximum of two High layer compatibility information elements in the SETUP message.

The order of the information elements shall be in ascending order of priority, i.e., a subsequent High layer compatibility information element shall indicate a high layer compatibility with higher priority.

If fallback allowed is indicated in the SETUP message as described above, and fallback occurs at the destination user, or fallback does not occur, the originating network shall include in the CONNECT message sent to the calling user the High layer compatibility information element of the resultant high layer compatibility.

If fallback allowed is indicated in the SETUP message as described above, and fallback occurs within the ISDN, the originating network shall include in a PROGRESS message or other appropriate call control message sent to the calling user a Progress indicator information element with the progress description

value 5 "interworking has occurred and has resulted in a telecommunication service change." The originating network shall include the High layer compatibility information element of the resultant high layer compatibility.

5.12.1.2 Exceptional Procedures

The procedures of 5.8 shall apply, with the addition that:

- a) if the calling user receives no High layer compatibility information element in the CONNECT message, or prior to the CONNECT message in some other call control message, the user shall assume that the high layer compatibility is unknown; and

NOTE – It may be possible to subsequently identify the high layer compatibility from any in-band protocol within the B-channel.

- b) if the calling user receives a Progress indicator information element with a progress description value 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or 2 "destination address is non-ISDN" subsequent to a Progress indicator information element with a progress description value 5 "interworking has occurred and has resulted in a telecommunication service change," then the last received Progress indicator information element shall be taken account of. Where the progress description value is 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or 2 "destination address is non-ISDN" the user shall assume a bearer service category of circuit-mode 64-kbit/s 8-kHz structured usable for 3.1 kHz audio information transfer.

5.12.2 Procedures for High Layer Compatibility Selection at the Destination Side

5.12.2.1 Normal Operation

If the calling user and the network operator allow high layer compatibility selection, then the destination network shall indicate this to the destination user by means of repeated High layer compatibility information elements within the SETUP message sent to indicate the presence of a call request.

The order of the information elements shall be in ascending order of priority, i.e., a subsequent High layer compatibility information element shall indicate a high layer compatibility with higher priority.

If fallback allowed is indicated in the SETUP message as described above, and the user wishes to accept the call without having fallback occur, the user shall include in the CONNECT message sent to the network the High layer compatibility information element of the requested high layer compatibility.

If fallback allowed is indicated in the SETUP message as described above, and the user wishes to accept the call with having fallback occur to the lowest priority alternative high layer compatibility, the user may, but need not, include in the CONNECT message sent to the network the High layer compatibility information element of the alternative high layer compatibility.

If no High layer compatibility information element is indicated by the called user, the network shall assume that the lowest priority high layer compatibility is selected.

If fallback allowed is indicated in the call request, and no interworking has been encountered (i.e., a progress description value 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or 2 "destination address is non-ISDN" has not been sent), then the destination network shall indicate the resultant high layer compatibility to the originating network at the time the bearer is established, even if no High layer compatibility information element is received from the destination user.

5.12.2.2 Exceptional Procedures

The procedures of 5.8 shall apply.

5.12.3 Procedures for Interworking with Private ISDNs

5.12.3.1 Procedures for the Originating User to Indicate High Layer Compatibility Selection is Allowed

The procedures of 5.12.1 shall apply.

5.12.3.2 Procedures for High Layer Compatibility Selection at the Destination Side of a Public ISDN

5.12.3.2.1 Normal Operation

If a private ISDN is attached to the access at the destination interface, the following procedures are applicable at call request. The private ISDN acts as the called user.

If the calling user allows fallback to occur to an alternative high layer compatibility, then the network shall indicate this to the called user by means of repeated High layer compatibility information elements within the SETUP message sent to indicate the presence of a call request.

The order of the information elements shall be in ascending order of priority, i.e., a subsequent High layer compatibility information element shall indicate a high layer compatibility with higher priority.

If fallback allowed is indicated in the SETUP message as described above, and fallback occurs at the destination user (beyond the private ISDN) or fallback does not occur, the user shall include in the CONNECT message sent to the network the High layer compatibility information element of the resultant high layer compatibility.

If fallback allowed is indicated in the SETUP message as described above, and fallback occurs within the private ISDN, the user shall include in a PROGRESS message or other appropriate call control message sent to the network a Progress indicator information element with a progress description value 5 "interworking has occurred and has resulted in a telecommunication service change." The user shall include the High layer compatibility information element of the resultant high layer compatibility.

5.12.3.2.2 Exceptional Procedures

The procedures of 5.8 shall apply, with the addition that:

- a) if the network receives no High layer compatibility information element in the CONNECT message, or prior to the CONNECT message in some other call control message, the network shall assume that the high layer compatibility is unknown; and

NOTE - It may be possible to subsequently identify the high layer compatibility from any in-band protocol within the B-channel.

- b) if the network receives a Progress indicator information element with a progress description value 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or 2 "destination address is non-ISDN" subsequent to a Progress indicator information element with a progress description value 5 "interworking has occurred and has resulted in a telecommunication service change," then the last received Progress indicator information element shall be taken ac-

count of. Where the progress description is value 1 "call is not end-to-end ISDN," further call progress information may be available in-band or progress description is value 2 "destination address is non-ISDN" the network shall assume a bearer service category of circuit-mode 64-kbit/s 8 kHz-structured usable for 3.1-kHz audio information transfer.

6 Packet Communication Procedures

See ATIS-1000608.

7 User-to-User Signaling Procedures

See ATIS-1000621.

8 Circuit-Mode Multirate (64 kbit/s Base Rate) Procedures

This clause provides the D-channel signaling procedures in support of circuit-mode multirate (64-kbit/s base rate) bearer capability, else they are not required.

The procedures of clause 5 shall apply except as identified in the following subclauses.

8.1 Call Establishment at the Originating Interface

8.1.1 Compatibility Information

The Bearer capability information element shall be encoded as in 4.5.5 (Bearer capability) with the following exceptions:

- 1) Octet 3 shall be coded unrestricted digital information.
- 2) Octet 4 shall be coded circuit mode and the information transfer rate (bits 5 to 1) shall be encoded:

Bits						
	5	4	3	2	1	Circuit mode
	1	1	0	0	0	multirate (64 kbit/s base rate)

- 3) Octet 4.1 (Rate multiplier) shall be included. Bit 8 is for extension and set to 1. Bits 7-1 contain the binary coding of the multiplier that applies to the multirate codepoint contained in the information transfer rate subfield. Bit 1 is least significant. The multiplier value range is 2 – 24, all other values are reserved. Octet 4.1 shall be included if and only if the transfer rate is coded for multirate.

Note – When the information transfer rate is 384 kbit/s or 1536 kbit/s, the information transfer rate in the Bearer capability information element may also be coded as 384 kbit/s (10011) or 1536 kbit/s (10101), respectively, instead of using the multirate (64 kbit/s base rate) codepoint and the associated rate multiplier field.

8.1.2 Channel Selection

The channels selected for the multirate call shall be on one interface and shall be indicated in the SETUP message. The procedures in 5.1.2 and 5.2.3.1 shall be followed to complete the channel selection.

The Channel identification information element shall be coded as per 4.5.12.

The number of channels identified shall provide the information transfer rate identified in the Bearer capability information element. If the information transfer rate implied by the channel(s) or interface indicated in the Channel identification information element does not match the information transfer rate in the Bearer capability information element, the procedures in 5.8.6.2 shall apply.

Channel selection conflict occurs when the channels selected for an incoming and outgoing call do not constitute two disjoint sets of time slots. When channel selection conflict occurs, the procedures in 5.7 shall apply.

Some networks may offer on access:

- 1) contiguous channel assignment (channels must be adjacent within a single interface), and/or
- 2) non-contiguous channel assignment (channels may be either adjacent or non-adjacent within a single interface).

Some networks may require that 384 kbit/s occupy specified contiguous time slots (see ITU-T Recommendation I.431, Annex A).

If the entire interface of a primary rate interface is used (i.e., 24 B-channels on a 1544 kbit/s interface) octets 3.2 and 3.3 of the Channel identification information element shall not be included.

If the entire interface of a basic access interface is used (i.e., 2 B-channels, octets 3.2 and 3.3 of the Channel identification information element shall not be included and the "information channel selection" shall be coded "11," any channel.

In cases a) and b) of 5.1.2, if all the indicated B-channels are available, the network shall select them for the call.

In case b) of 5.1.2, if the network cannot grant any of the preferred B-channels, it shall select any other available B-channel(s) associated with the D-channel and on the same access, to replace the unavailable preferred B-channel(s), or select all the B-channels on another interface controlled by the D-channel.

Note – Whether only the B-channels that cannot be provided should be changed, or if all the B-channels can then be changed is for further study.

In case c) of 5.1.2, the network shall select any available suitable B-channels.

In case a) of 5.1.2, if any specified B-channel is not available, and in cases b) and c) if insufficient B-channels are available, the network shall send a RELEASE COMPLETE message with cause 44 "requested circuit/channel not available" or 34 "no circuit/channel available," respectively, as described in 5.3.

The following recommendations are made on the use of cause values.

- 1) When the calling user or called user is not an authorized subscriber of the multirate circuit-mode bearer capability, cause 57 "bearer capability not authorized" shall be returned to the calling user.
- 2) When a network (public or private) cannot support the specified transfer rate or bearer capability, cause 65 "bearer capability not implemented" shall be returned to the calling user.
- 3) When there are insufficient channels on a single interface to support the information transfer rate requested, cause 34 "no circuit/channel available" or 17 "user busy" shall be returned to the calling user [See ATIS-1000650].

8.1.3 Interworking

Interworking is possible between:

- 1) A user who has subscribed to the multirate circuit-mode bearer capability and a user who has subscribed to the 384 kbit/s unrestricted circuit-mode service when the information transfer rate is 384 kbit/s.
- 2) A user who has subscribed to the multirate circuit-mode bearer capability and a user who has subscribed to the 1536 kbit/s unrestricted circuit-mode service when the information transfer rate is 1536 kbit/s.

When any other information transfer rate is specified, interworking is not possible between the multirate circuit-mode capability and other services.

8.2 Call Establishment at the Destination Interface

8.2.1 Compatibility Information

The Bearer capability information element shall be encoded as in 4.5.5 (Bearer capability) with the following exceptions:

- 1) Octet 3 shall be coded unrestricted digital information.
- 2) Octet 4 shall be circuit-mode and the information transfer rate (bits 5 to 1) shall be encoded:

Bits						
	5	4	3	2	1	Circuit mode
	1	1	0	0	0	multirate (64 kbit/s base rate)

- 3) Octet 4.1 (Rate multiplier) shall be included. Bit 8 is for extension and set to 1. Bits 7-1 contain the binary coding of the multiplier that applies to the multirate codepoint contained in the information transfer rate subfield. Bit 1 is least significant. The multiplier value range is 2 – 24, all other values are reserved. Octet 4.1 shall be included if and only if the transfer rate is coded for multirate.

Note – When the information transfer rate is 384 kbit/s or 1536 kbit/s, the information transfer rate in the Bearer capability information element may also be coded as 384 kbit/s (10011) or 1536 kbit/s (10101), respectively, instead of using the multirate (64 kbit/s base rate) codepoint and the associated rate multiplier field.

8.2.2 Channel Selection

The channels selected for the multirate call shall be on one interface and shall be indicated in the SETUP message. The procedures in 5.1.2 and 5.2.3.1 shall be followed to complete the channel selection.

The Channel identification information element shall be coded as shown in 4.5.13.

The number of channels identified shall provide the information transfer rate identified in the Bearer capability information element. If the information transfer rate implied by the channel(s) or interface indicated in the Channel identification information element does not match the information transfer rate in the Bearer capability information element the procedures in 5.8.6.2 shall apply.

Channel selection conflict occurs when the channels selected for an incoming and outgoing call do not constitute two disjoint sets of time slots. When channel selection conflict occurs, the procedures in 5.7 shall apply.

Some networks may offer on access:

- 1) contiguous channel assignment (channels must be adjacent within a single interface), and/or
- 2) non-contiguous channel assignment (channels may be either adjacent or non-adjacent within a single interface).

Some networks may require that 384 kbit/s occupy specified contiguous time slots (see Recommendation I.431, Annex A).

If the entire interface of a primary rate interface is used (i.e., 24 B-channels on a 1544 kbit/s interface) octets 3.2 and 3.3 of the Channel identification information element shall not be included.

If the entire interface of a basic access interface is used (i.e., 2 B-channels) octets 3.2 and 3.3 of the Channel identification information element shall not be included and the "information channel selection" shall be coded "11" *any channel*.

The following recommendations are made on the use of cause values:

- 1) When a network (public or private) cannot support the specified transfer rate or bearer capability, cause 65 "bearer capability not implemented" shall be returned to the calling user.
- 2) When there are insufficient channels on a single interface to support the information transfer rate requested, cause 34 "no circuit/channel available" or 17 "user busy" shall be returned to the calling user (see Annex J).

8.2.2.1 Point-to-Point Configuration

In cases (1) and (2) of 5.2.3.1 if all the indicated traffic channels are available, the user shall select them for the call.

In case (2) of 5.2.3.1, if the user cannot grant any of the preferred access channels, it shall select any other available access channel(s) associated with the D-channel and on the same access to replace the unavailable preferred access channel(s), or select all the channels on another interface controlled by the D-channel.

Note – Whether only the B-channels that cannot be provided should be changed, or if all the channels can then be changed is for further study.

In case (3) of 5.2.3.1, the user shall select any available suitable access channels.

In case (1) of 5.2.3.1, if any specified access channel is not available, and in cases (2) and (3) if insufficient access channels are available, the user shall send a RELEASE COMPLETE message with cause as described in 5.3.

8.2.2.2 Point-to-Multipoint Configuration

In case 1) of 5.2.3.2, if all the indicated traffic channels are available, the user shall select them for the call.

8.2.3 Interworking

Interworking is possible between:

- 1) A user who has subscribed to the multirate circuit-mode bearer capability and a user who has subscribed to the 384 kbit/s unrestricted circuit-mode service when the information transfer rate is 384 kbit/s.
- 2) A user who has subscribed to the multirate circuit-mode bearer capability and a user who has subscribed to the 1536 kbit/s unrestricted circuit-mode service when the information transfer rate is 1536 kbit/s.

When any other information transfer rate is specified, interworking is not possible between the multirate circuit-mode bearer capability and other services.

8.3 Call Clearing

When the call is cleared, by the user or by the network, all channels associated with the call shall be released.

8.4 Restart Procedures

B-channels can be restarted irrespective of their usage within a multirate bearer capability. If any of the B-channels associated with a multirate call are restarted, the ATIS-1000607 entity shall clear the call.

8.5 Call Rearrangements

Call rearrangements are not supported by this standard.

9 List of system parameters

9.1 Timers in the Network Side

The timers specified in Table 24 are maintained in the network side of the interface.

9.2 *Timers in the User Side*

The timers specified in Table 25 are maintained in the user side of the interface. Timers T305, T308 and T313 are mandatory for all user side implementations.

The description of timers in the following tables should be considered a brief summary. The precise details are found in clause 5, which should be considered the definitive descriptions.

Table 24 – Timers in the network side

TIMER NUMBER	DEFAULT TIME OUT VALUE	STATE OF CALL	CAUSE FOR START	NORMAL STOP	AT THE FIRST EXPIRY	AT THE SECOND EXPIRY	CROSS REFERENCE
T301	Minimum 3 min.	Call Received	ALERT received.	CONNECT received.	Clear call.	Timer is not restarted.	Note 2
T302	10 – 15 s Note 5	Overlap Sending	SETUP ACKNOWLEDGE sent. Receipt of INFORMATION restarts T302.	With sending complete indication, or network alert, or connect request received.	Clear if call information determined to be definitely incomplete; otherwise send CALL PROCEEDING	Timer is not restarted.	Mandatory
T303	4 s Note 1	Call Present	SETUP sent.	ALERT, CONNECT, or CALL PROCEEDING received, RELEASE COMPLETE received if SETUP sent on point-to-point data link.	Retransmit SETUP; restart T303. If RELEASE COMPLETE has been received, clear the call.	Clear network connection. Enter Call Abort state.	Mandatory
T305	30 s	Disconnect Indication	DISCONNECT sent.	DISCONNECT or RELEASE received.	Network sends RELEASE.	Timer is not restarted.	Mandatory
T308	4 s Note 1	Release Request	RELEASE sent	RELEASE COMPLETE or RELEASE received.	Retransmit RELEASE and restart T308.	Place B-channel in maintenance condition. Release call reference. Note 7	Mandatory
T309	90 s	Any Stable State	Data-link disconnection. Calls in stable states are not lost.	Data-link reconnected	Clear network connection. Release B-channel and call reference.	Timer is not restarted.	Mandatory See also Annex F.
T310	10 s Note 6	Incoming Call Proceeding	CALL PROCEEDING received.	ALERTING, CONNECT, or DISCONNECT received. If DISCONNECT received, retain cause and continue timing.	Clear call in accordance with 5.2.5.3	Timer is not restarted.	Mandatory
T312	T303 + 2 s	Call Present, Call Abort, etc.	SETUP sent or resent on broadcast data link.	Timeout	Note 4	Timer is not restarted.	Mandatory
T316	2 min	Restart Request	RESTART sent.	RESTART ACKNOWLEDGE received.	RESTART may be retransmitted several times.	RESTART may be retransmitted several times.	Mandatory when 5.5 is implemented.
T317	Note 3	Restart	RESTART received.	Internal clearing of call references.	Maintenance notification.	Timer is not restarted.	Mandatory when 5.5 is implemented.
T321	30 s	Any call state	D-channel failure	Response to layer 3 message received.	Send DL-ESTABLISH request on both D-channels.	Timer is not restarted.	Mandatory when Annex F is implemented.
T322	4 s	Any call state	STATUS ENQUIRY sent.	STATUS, DISCONNECT, RELEASE or RELEASE COMPLETE received.	STATUS ENQUIRY may be retransmitted several times.	STATUS ENQUIRY may be retransmitted several times.	Mandatory when 5.8.10 is implemented.
T323	120 s	Any state	SERVICE sent.	SERVICE ACKNOWLEDGE received.	Retransmit SERVICE message and restart T323. (Note 8)	Retransmit SERVICE message and restart T323	Mandatory when Annex U is implemented.
TDEL	Network-specific	Call present	SETUP sent	ALERTING, PROGRESS, CONNECT, DISCONNECT, or RELEASE COMPLETE received.	Notification to the calling user.	Timer is not restarted.	Optional national timer.

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TIMER NUMBER	DEFAULT TIME OUT VALUE	STATE OF CALL	CAUSE FOR START	NORMAL STOP	AT THE FIRST EXPIRY	AT THE SECOND EXPIRY	CROSS REFERENCE
NOTES							
1	This default value assumes the use of the default values at layer 2; i.e., (N200+1) times T200. Whether these values should be modified when layer 2 default values are modified by an automatic negotiation procedure is a question for further study.						
2	The network may already have applied an internal alerting supervision timing function; e.g., incorporated within call control. If such a function is known to be operating on the call, then timer T301 is not used.						
3	The value of this timer is implementation-dependent but should be less than the value of T316.						
4	If in the Call Abort state, the call reference is released. Otherwise, no action is taken on expiry of timer T312.						
5	The value of timer T302 may vary beyond these limits; e.g., as a result of called party number analysis.						
6	The value of timer T310 may be different in order to take into account the characteristics of a private network.						
7	The restart procedure in 5.5 may be used on B-channels in the maintenance condition.						
8	The SERVICE may be retransmitted up to 4 times, where the default number of retransmissions is 2.						

Table 25 – Timers in the user side

TIMER NUMBER	DEFAULT TIME OUT VALUE	STATE OF CALL	CAUSE FOR START	NORMAL STOP	AT THE FIRST EXPIRY	AT THE SECOND EXPIRY	CROSS REFERENCE
T301	Minimum 3 min.	Call Delivered	ALERT received.	CONNECT received.	Clear call.	Timer is not restarted.	Mandatory when Annex D is implemented. Note 3.
T303	4 s Note 1	Call Initiated	SETUP sent.	ALERT, CONNECT, or CALL PROCEEDING received, RELEASE COMPLETE received if SETUP sent on point-to-point data link.	Retransmit SETUP; restart T303. If RELEASE COMPLETE has been received, clear the call.	Clear network connection. Enter Call Abort state.	Mandatory when Annex D is implemented; Otherwise optional.
T304	15 s	Overlap Sending	INFORMATION sent. Restarted when INFORMATION sent again.	CALL PROCEEDING, ALERT, CONNECT or DISCONNECT received.	DISCONNECT sent.	Timer is not restarted.	Optional
T305	30 s	Disconnect Request	DISCONNECT sent.	DISCONNECT or RELEASE received.	RELEASE sent.	Timer is not restarted.	Mandatory
T308	4 s Note 1	Release Request	RELEASE sent	RELEASE COMPLETE or RELEASE received.	Retransmit RELEASE and restart T308.	B-channel placed in maintenance condition. Release call reference. Note 5	Mandatory
T309	90 s	Any Stable State	Data-link disconnection. Calls in stable states are not lost.	Data-link reconnected	Clear internal connection. Release B-channel and call reference.	Timer is not restarted.	Optional See also Annex F.
T310 Note 4	30 - 120 s	Outgoing Call Proceeding	CALL PROCEEDING received.	ALERTING, CONNECT, DISCONNECT, or PROGRESS received.	Send DISCONNECT.	Timer is not restarted.	Mandatory when Annex D is implemented.
T313	4 s Note 1	Connect Request	CONNECT sent.	CONNECT ACKNOWLEDGE received.	Send DISCONNECT.	Timer is not restarted.	Mandatory
T316	2 min	Restart Request	RESTART sent.	RESTART ACKNOWLEDGE received.	RESTART may be retransmitted several times.	RESTART may be retransmitted several times.	Mandatory when 5.5 is implemented.
T317	Note 2	Restart	RESTART received.	Internal clearing of call references.	Maintenance notification.	Timer is not restarted.	Mandatory when 5.5 is implemented.
T321	30 s	Any call state	D-channel failure	Response to layer 3 message received.	Send DL-ESTABLISH request on both D-channels.	Timer is not restarted.	Mandatory when Annex F is implemented.
T322	4 s	Any call state	STATUS ENQUIRY sent.	STATUS, DISCONNECT, RELEASE or RELEASE COMPLETE received.	STATUS ENQUIRY may be retransmitted several times.	STATUS ENQUIRY may be retransmitted several times.	Mandatory when 5.8.10 is implemented.
T323	120 s	Any state	SERVICE sent.	SERVICE ACKNOWLEDGE received.	Retransmit SERVICE message and restart T323. (Note 6)	Retransmit SERVICE message and restart T323	Mandatory when Annex U is implemented

NOTES

- 1 This default value assumes the use of the default values at layer 2; i.e., (N200+1) times T200. Whether these values should be modified when layer 2 default values are modified by an automatic negotiation procedure is a question for further study.
- 2 The value of this timer is implementation-dependent but should be less than the value of T316.
- 3 The network may already have applied an internal alerting supervision timing function; e.g., incorporated within call control. If such a function is known to be operating on the call, then timer T301 is not used.
- 4 T310 is not started if Progress indicator information element with a progress description value of 1 "call is not end-to-end ISDN, further call progress information may be available in-band" or 2 "destination address is non-ISDN" has been delivered in the CALL PROCEEDING message or in a previous PROGRESS message.
- 5 The restart procedure in 5.5 may be used on B-channels in the maintenance condition.
- 6 The SERVICE may be retransmitted up to 4 times, where the default number of retransmissions is 2.

Annex A: Specification and description language diagrams

(normative)

This annex includes overview and detailed Specification and Description Language (SDL) diagrams that show ATIS-1000607 protocol control for circuit-switched basic calls. In the event of conflict between these diagrams and the text of clause 5, the text should be the prime source. Similarly, in the event of conflict between overview SDL and detailed SDL diagrams, the detailed SDL diagrams should be the prime source.

Figures A.1 and A.2 show the key to ATIS-1000607 protocol control SDL diagrams for both the user side and the network side.

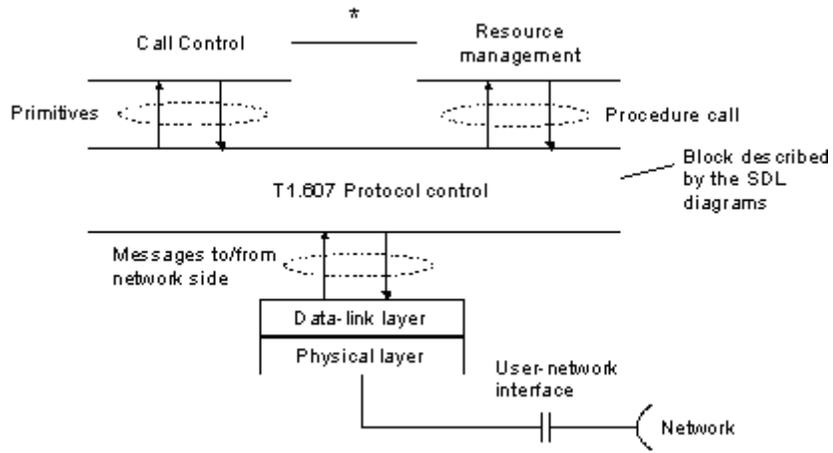
NOTE – The same name as is specified in ITU-T Recommendation Q.930 is used for each primitive to be exchanged between ATIS-1000607 protocol control and call control, whenever it is possible. Alignment of primitive names with those specified as Open Systems Interconnection (OSI) terminology may be required.

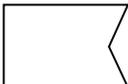
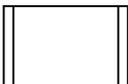
Figures A.3 through A.29 show overview and detailed protocol control SDL diagrams for the user-side.

Figures A.30 through A.32 show detailed SDL diagrams for the global call reference to be applied to both user and network sides. Although these figures show SDL diagrams in the user side only, the same diagrams can be applied to the network side by just changing the direction of the input and output symbols.

Figures A.33 through A.61 show overview and detailed protocol control SDL diagrams for the network-side. Only procedures for the point-to-point configuration are described in the network-side.

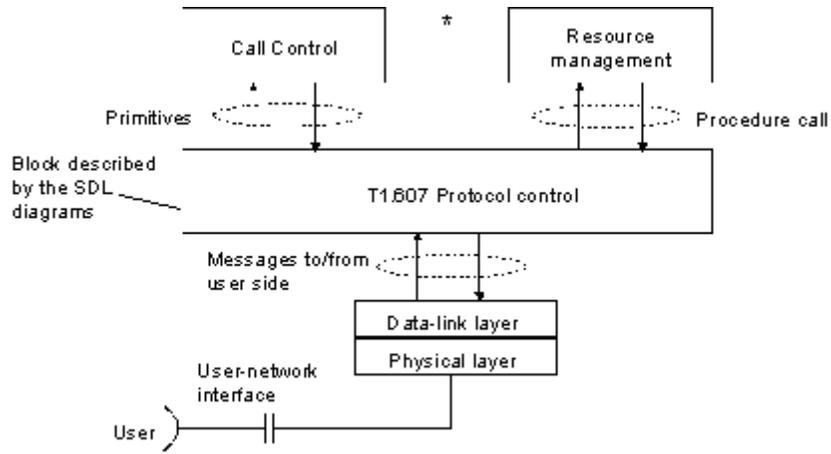
NOTE – Some timers are optional; refer to the timer tables in clause 9 for the mandatory or optional status of specific timers. Also, refer to the timer tables for the default values.



-  : State
-  : Primitive from call control
-  : Primitive to call control
-  : Message from network side
-  : Message to network side
-  : Procedure call
-  : Decision
-  : Alternative
-  : Save
-  : Not described in SDL

User side SDL symbols

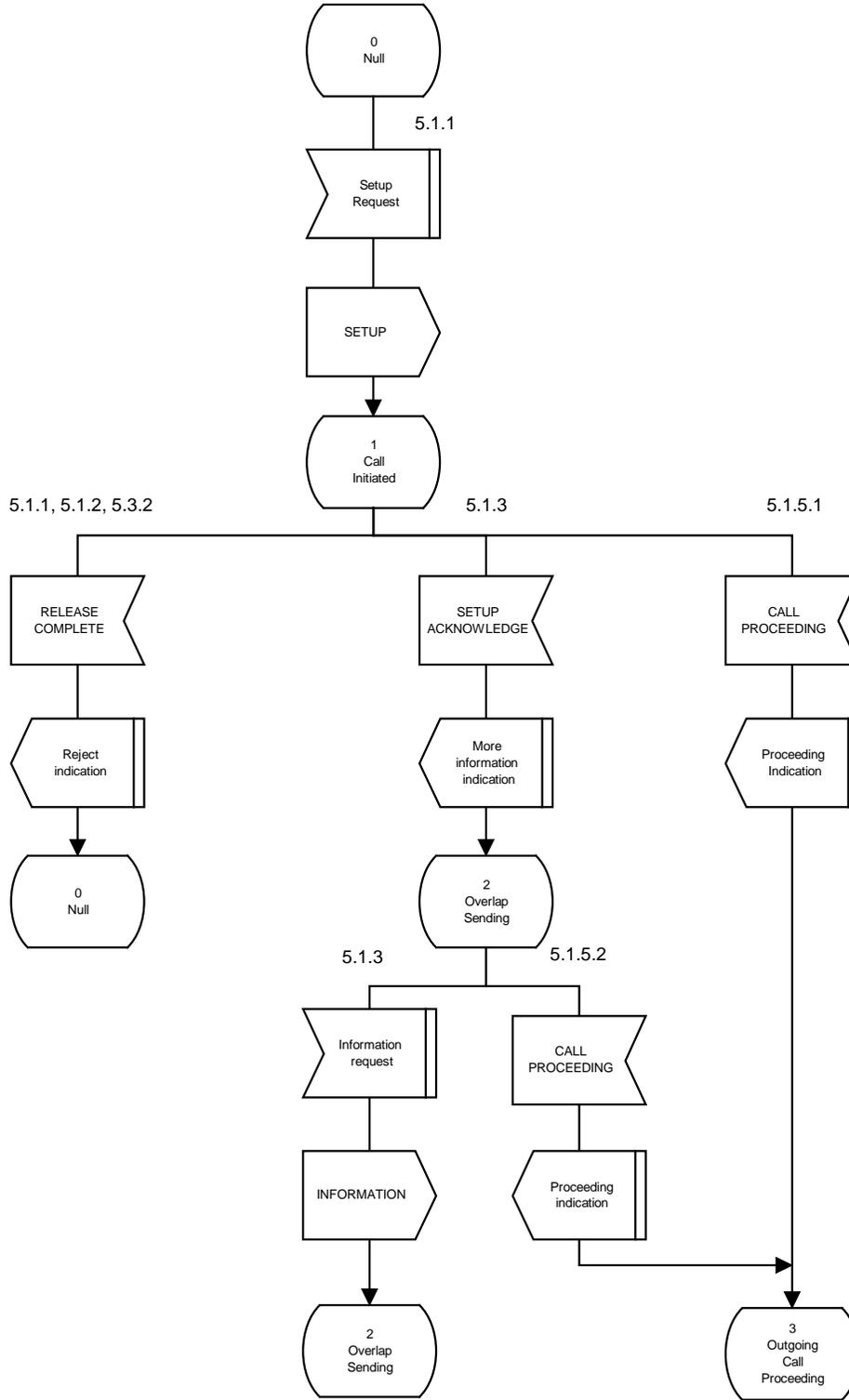
Figure A.1 – Key to protocol control SDL diagrams for the user side



-  : State
-  : Primitive from call control
-  : Primitive to call control
-  : Message from user side
-  : Message to user side
-  : Procedure call
-  : Decision
-  : Alternative
-  : Save
-  : Not described in SDL

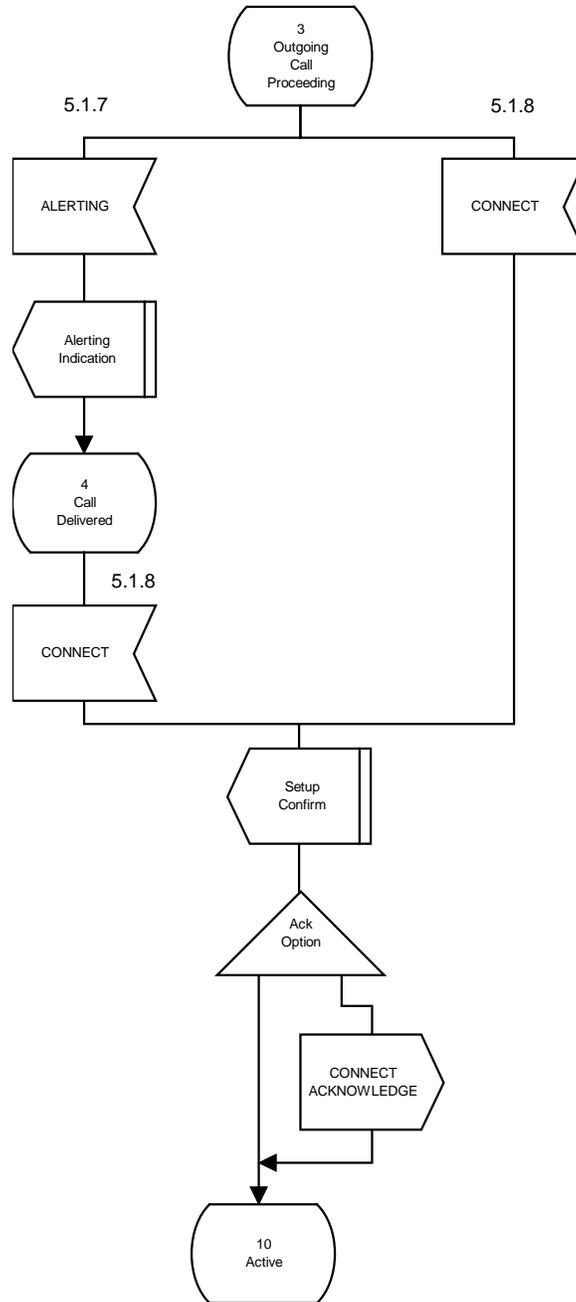
Network side SDL symbols

Figure A.2 – Key to protocol control SDL diagrams for the network side



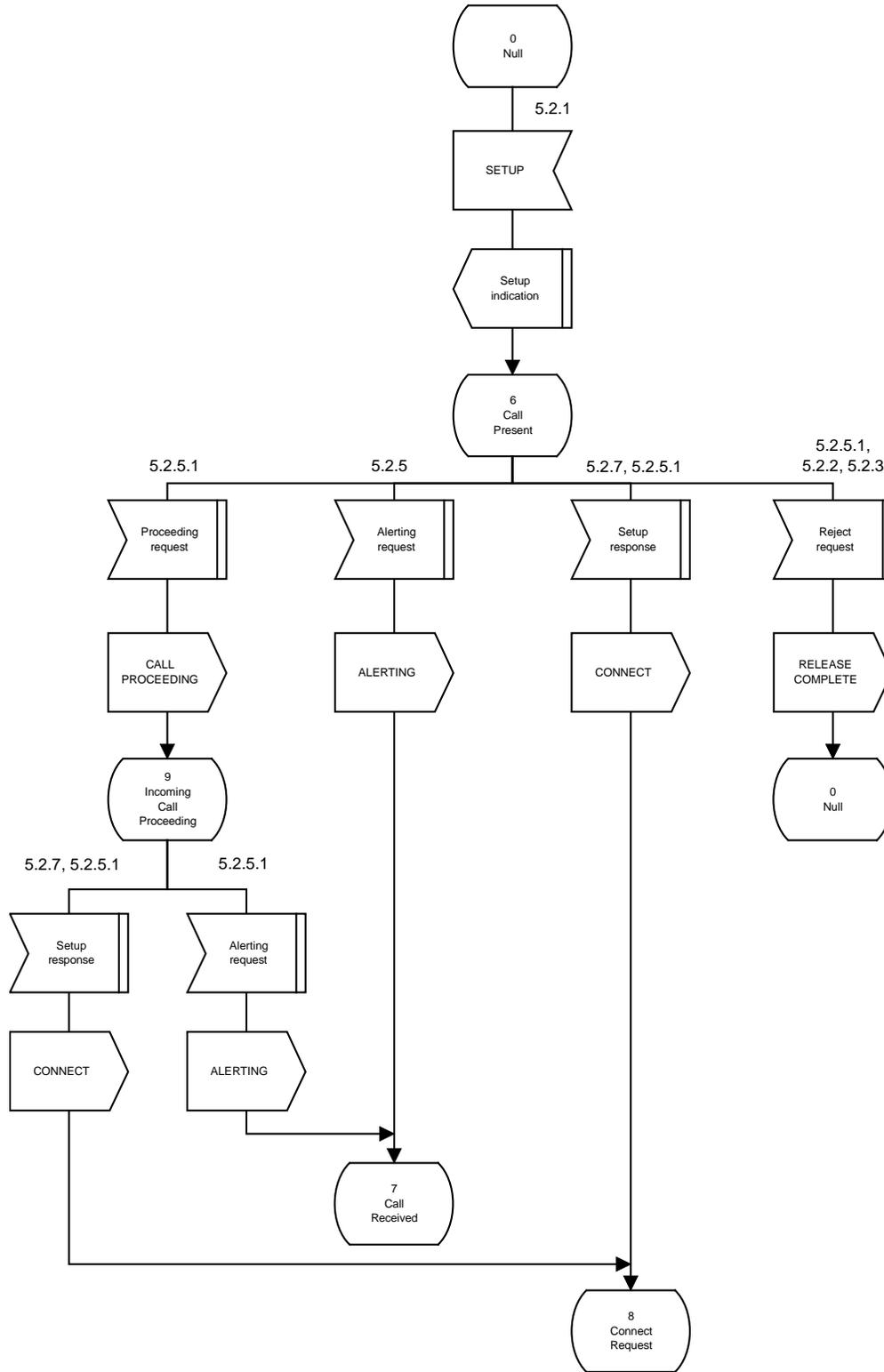
Outgoing setup procedure (1 of 2)

Figure A.3 – Overview protocol control (user side) (Part 1)



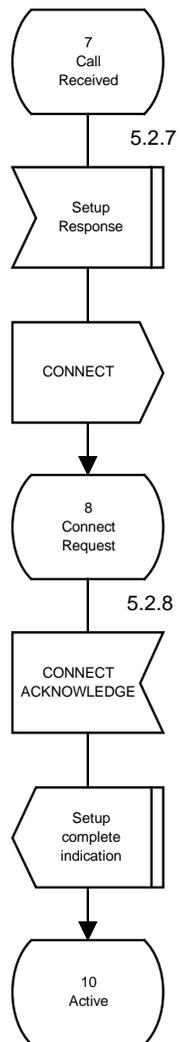
Outgoing setup procedure (2 of 2)

Figure A.4 – Overview protocol control (user side) (Part 2)



Incoming setup procedure (1 of 2)

Figure A.5 – Overview protocol control (user side) (Part 3)



Incoming setup procedure (2 of 2)

Figure A.6 – Overview protocol control (user side) (Part 4)

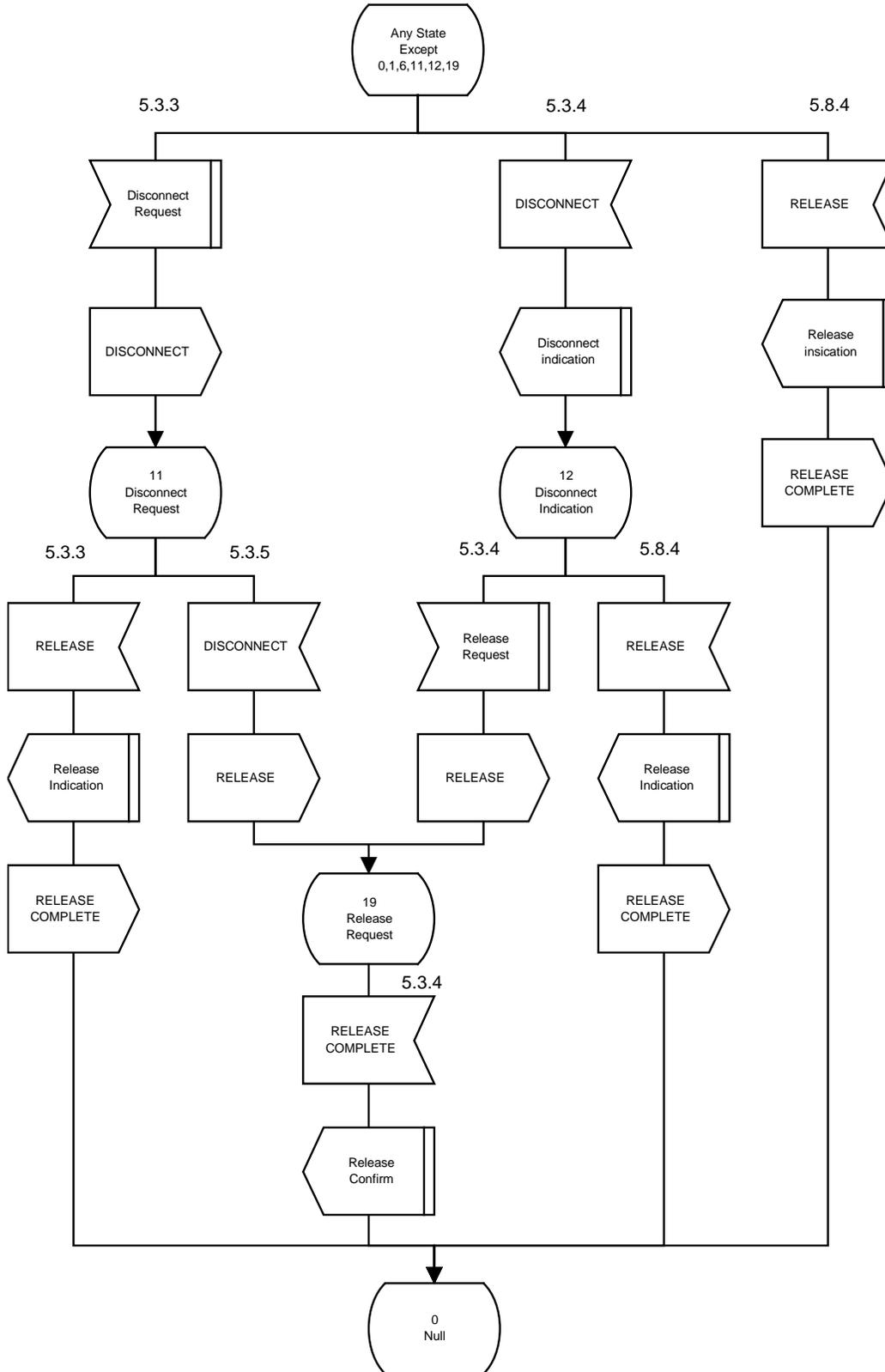
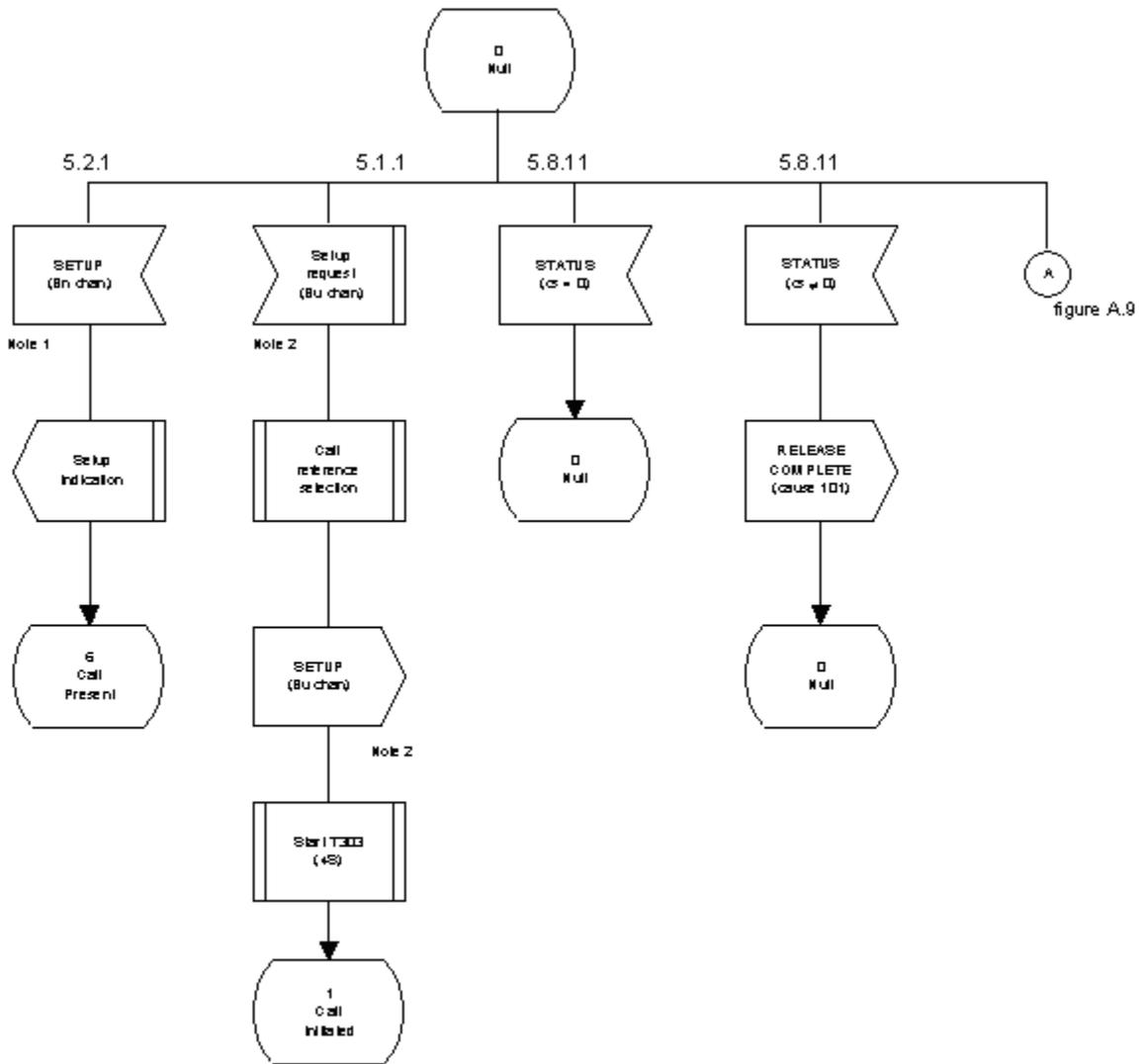


Figure A.7 – Overview protocol control (user side) (Part 5)



- NOTES
- 1 "Bn chan" is a B-channel selected by the network.
 - 2 "Bu chan" is a B-channel selected by the user.

Figure A.8 – Detail protocol control (user side) (Part 1)

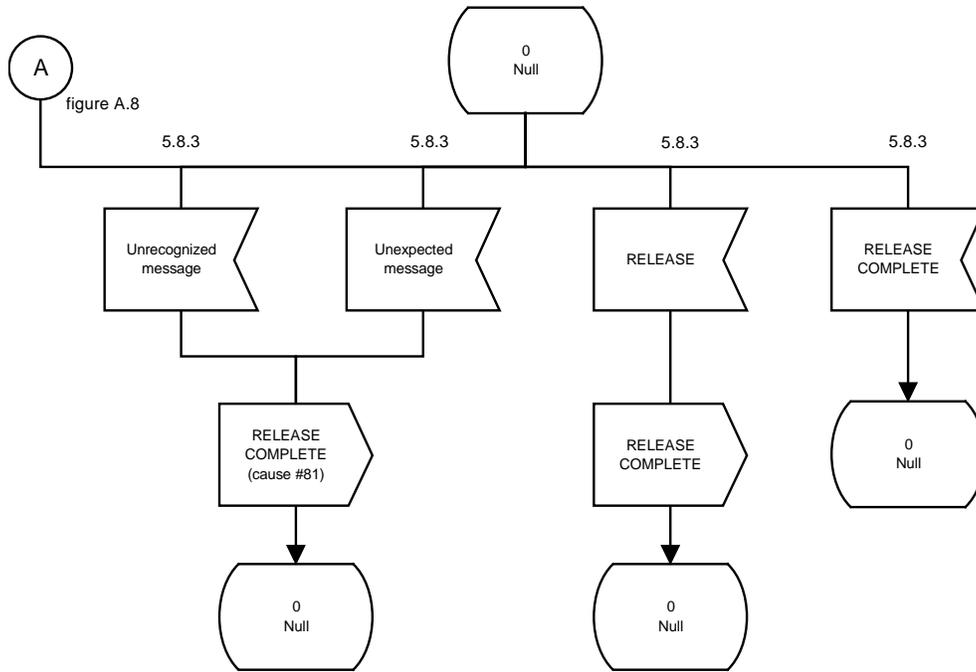
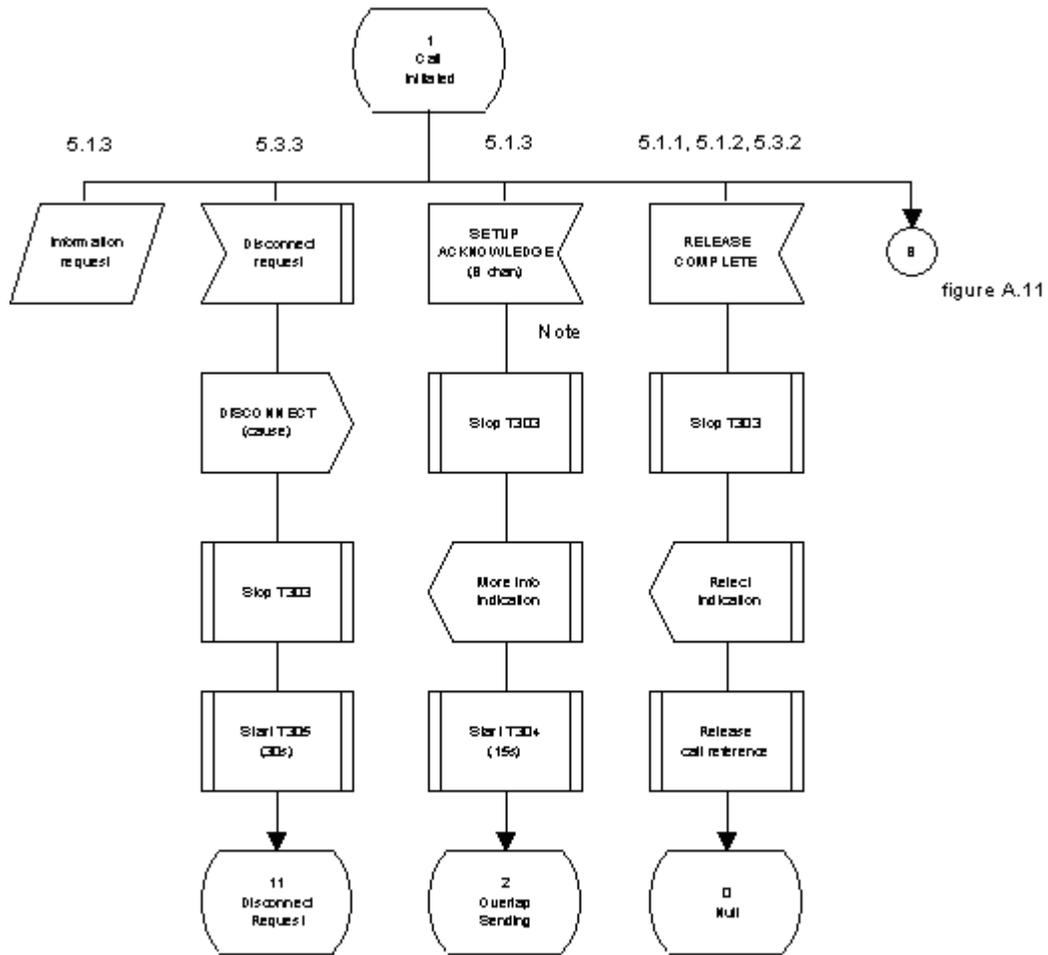


Figure A.9 – Detail protocol control (user side) (Part 2)



NOTE - "B chan" is a B-channel negotiated by the network and user.

Figure A.10 – Detail protocol control (user side) (Part 3)

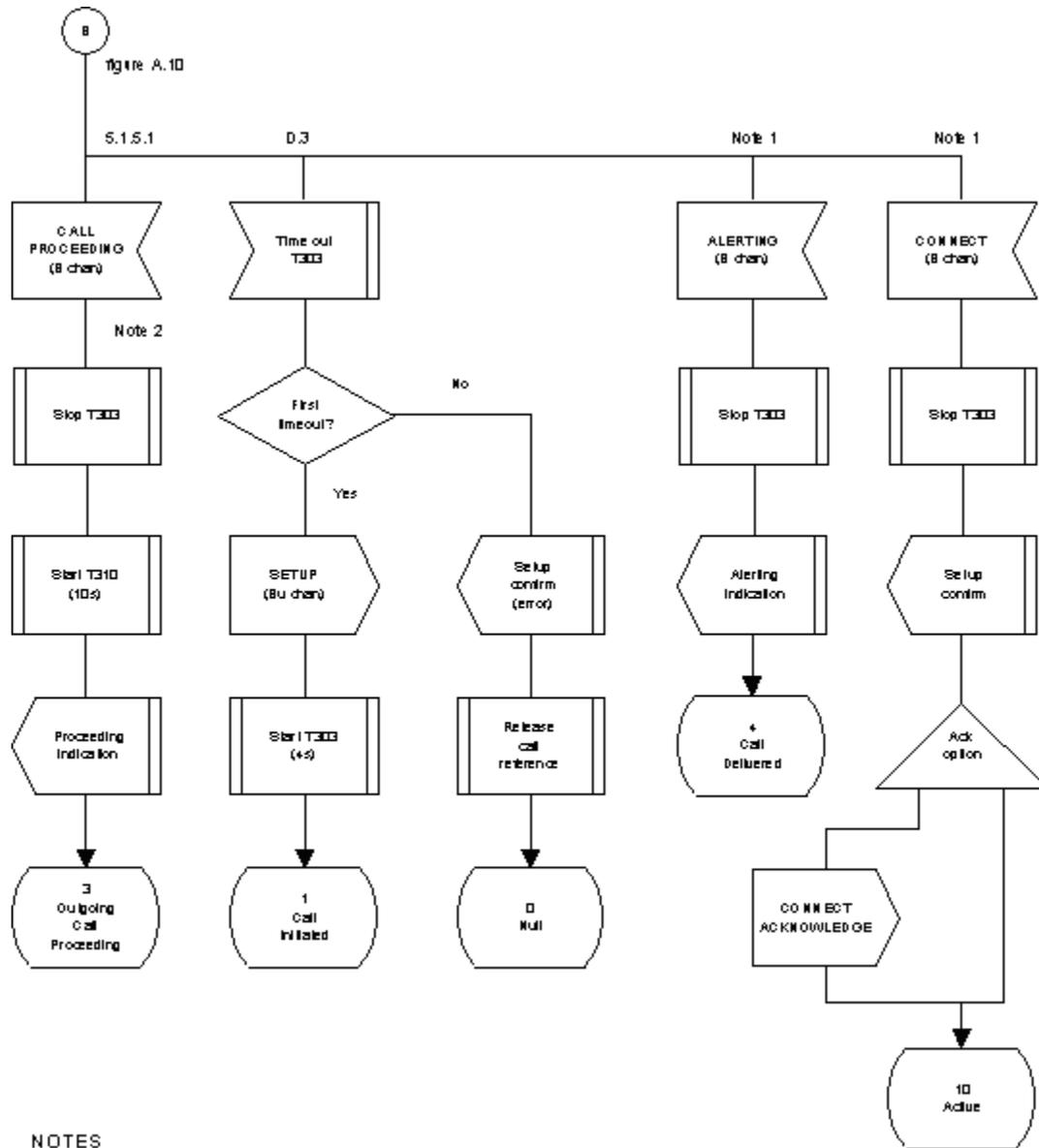
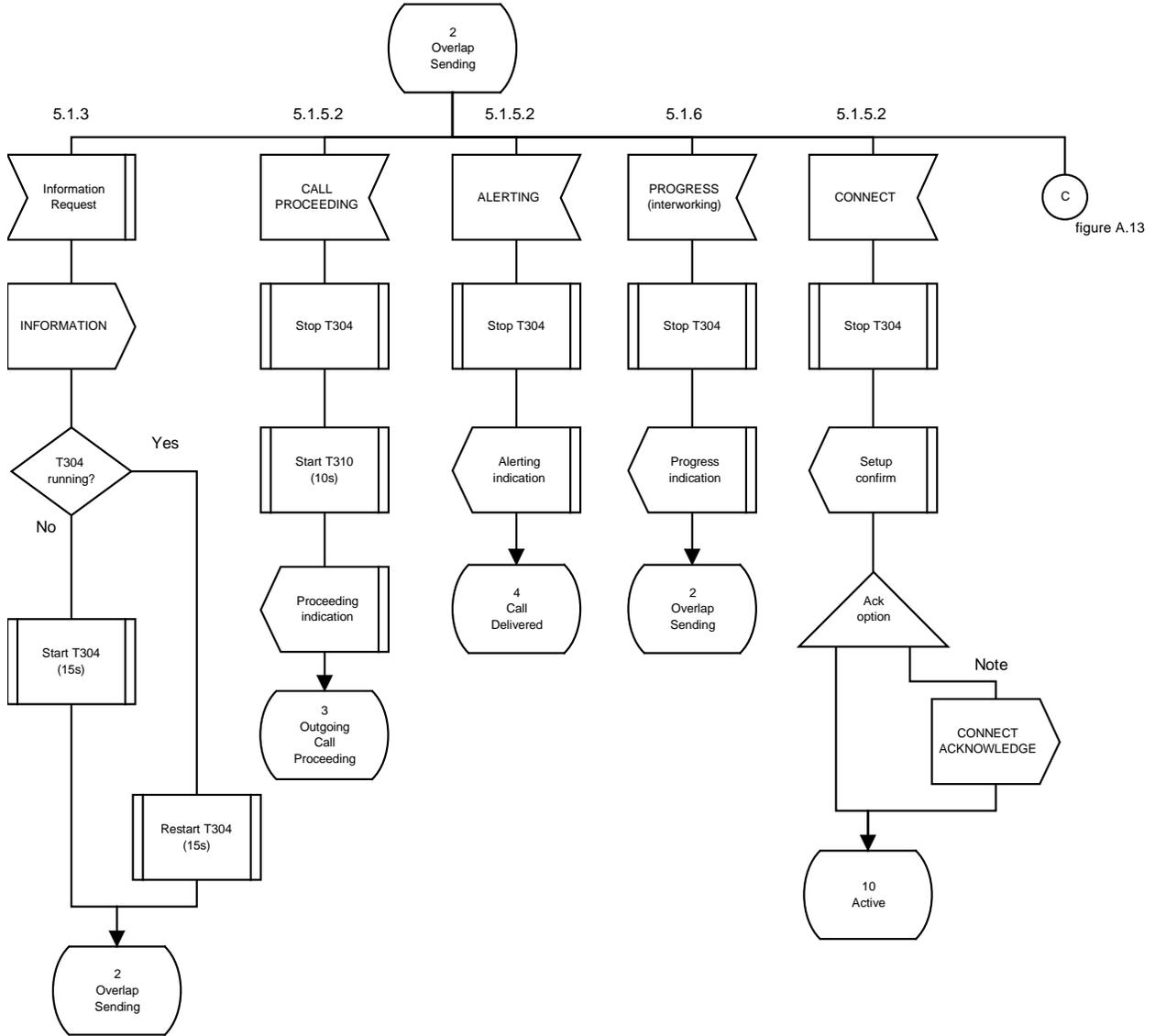


Figure A.11 – Detail protocol control (user side) (Part 4)



Note - This option is used when the procedures in annex D are implemented.

Figure A.12 – Detail protocol control (user side) (Part 5)

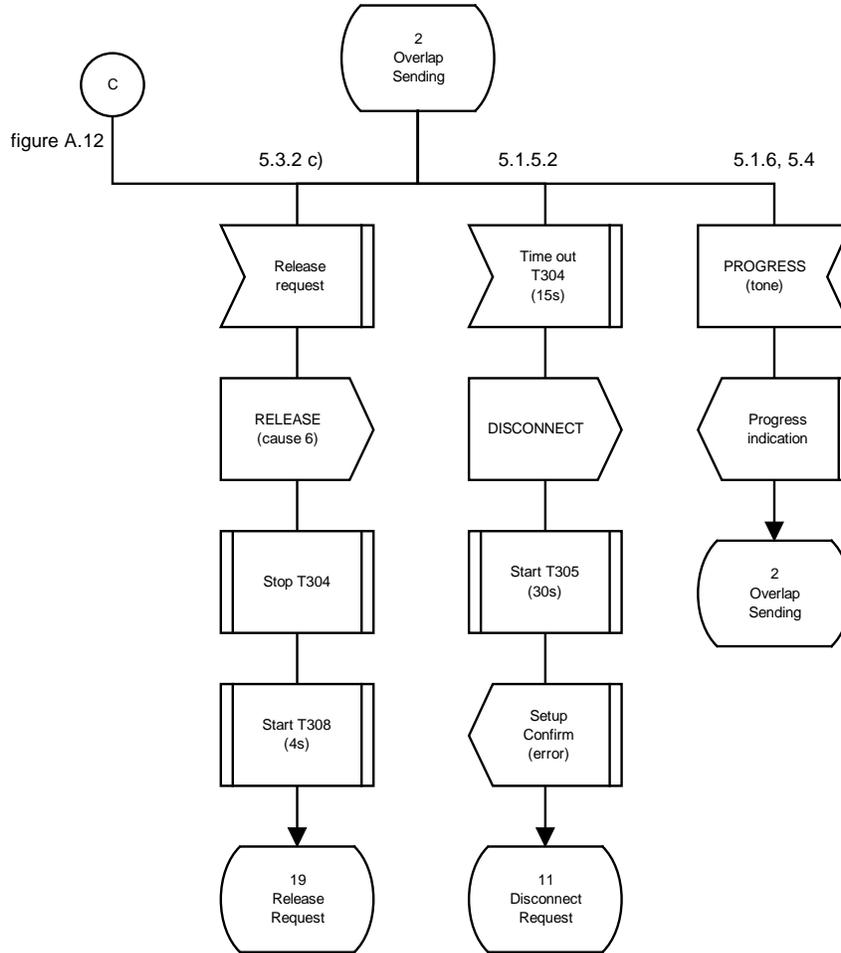
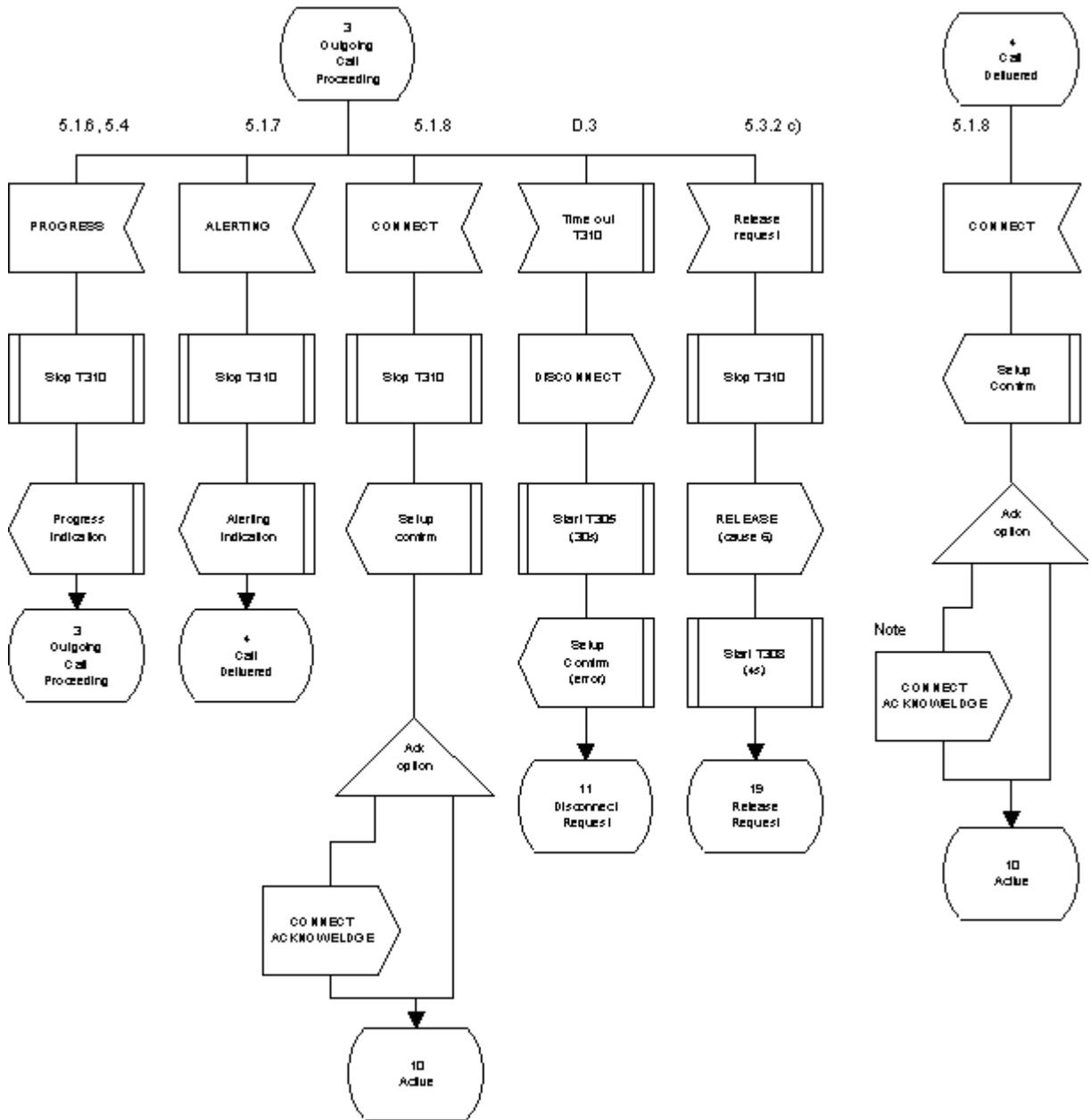
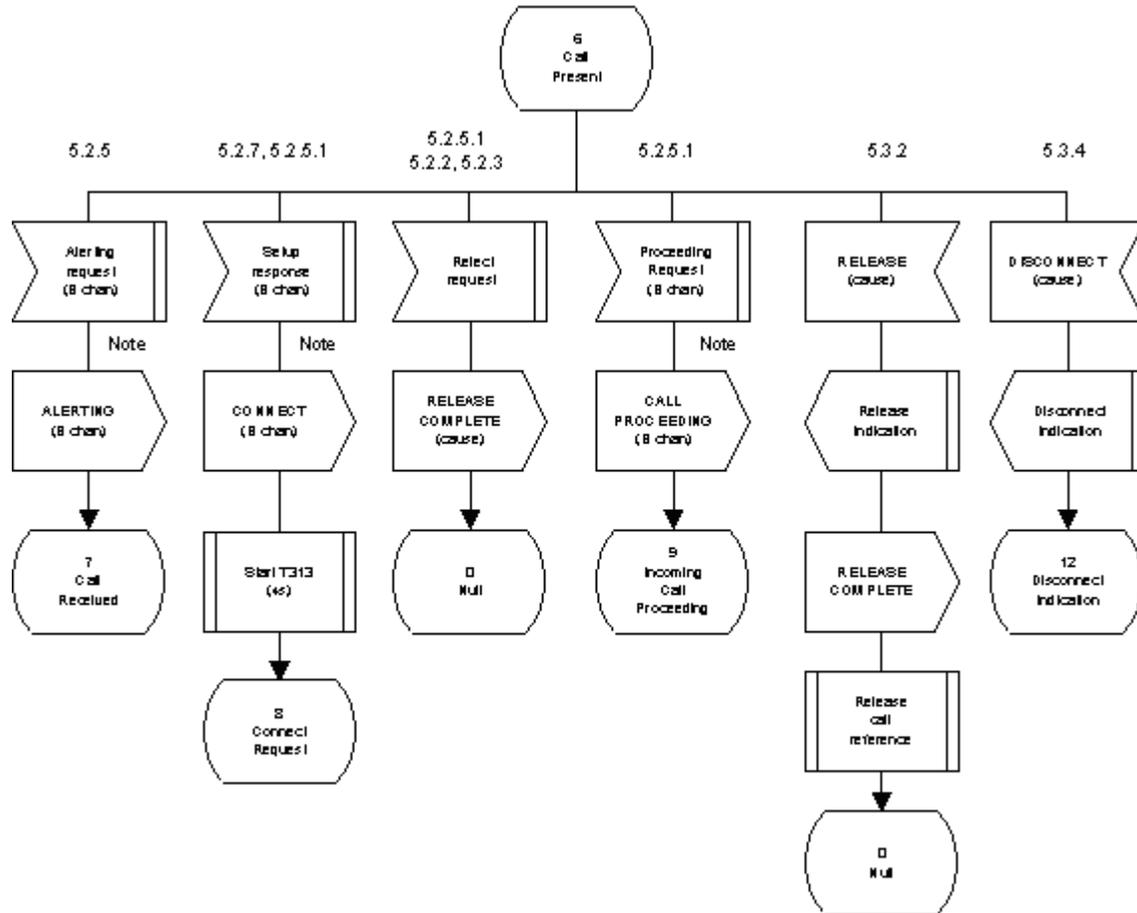


Figure A.13 – Detail protocol control (user side) (Part 6)



NOTE - Only applicable for the procedures defined in Annex D.

Figure A.14 – Detail protocol control (user side) (Part 7)



Note - "B chan" is a B-channel negotiated by the network and user.

Figure A.15 – Detail protocol control (user side) (Part 8)

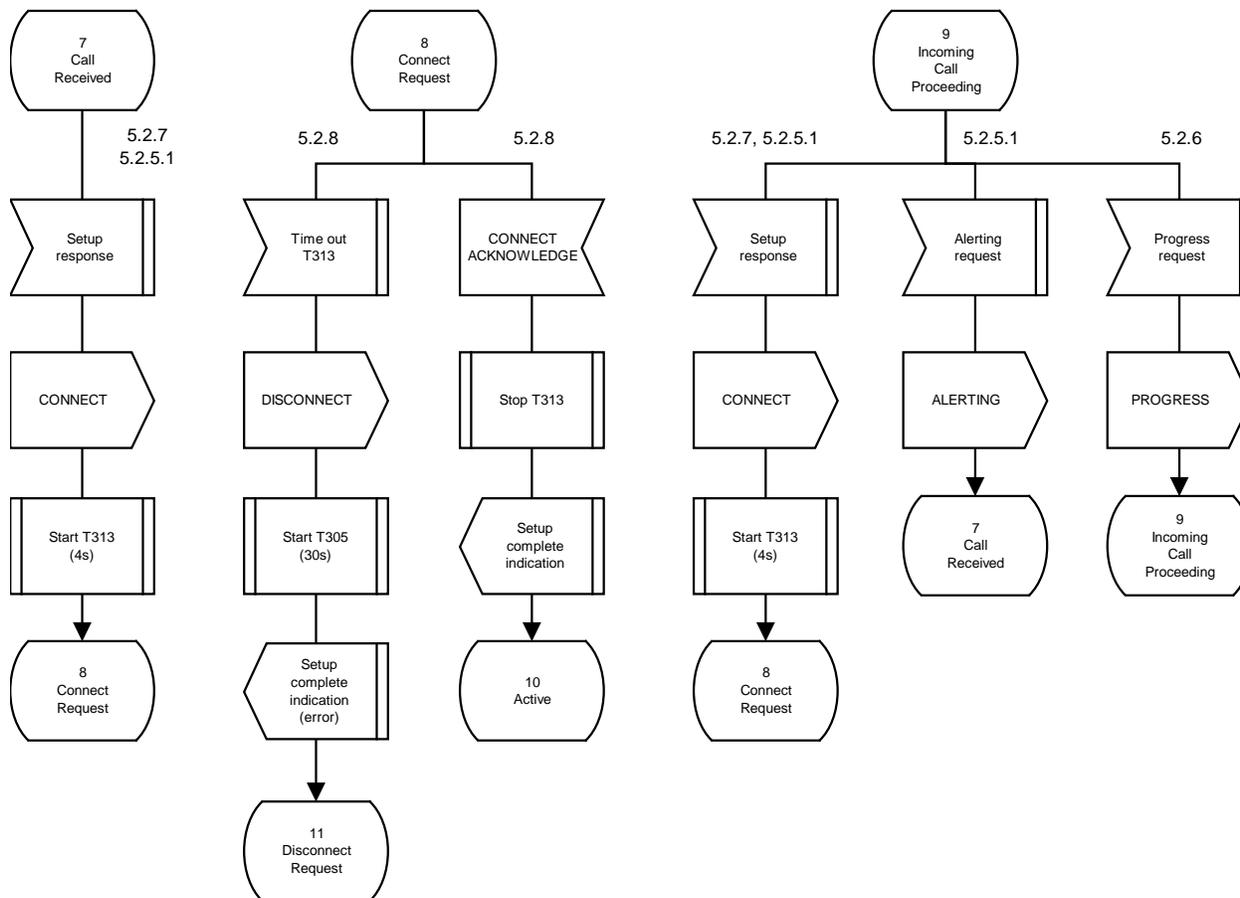


Figure A.16 – Detail protocol control (user side) (Part 9)

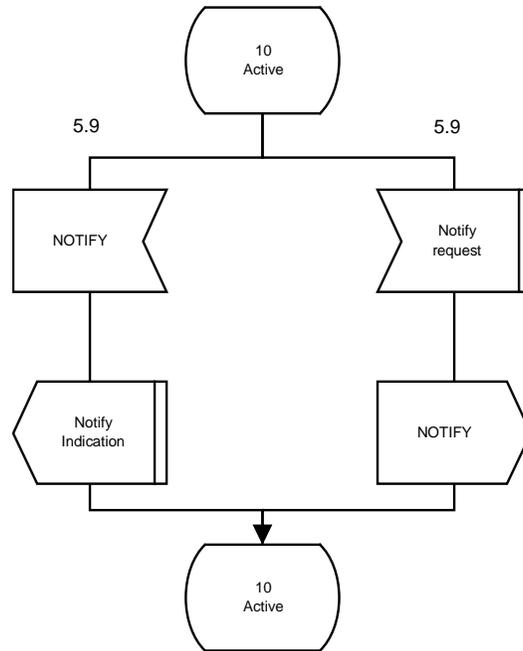
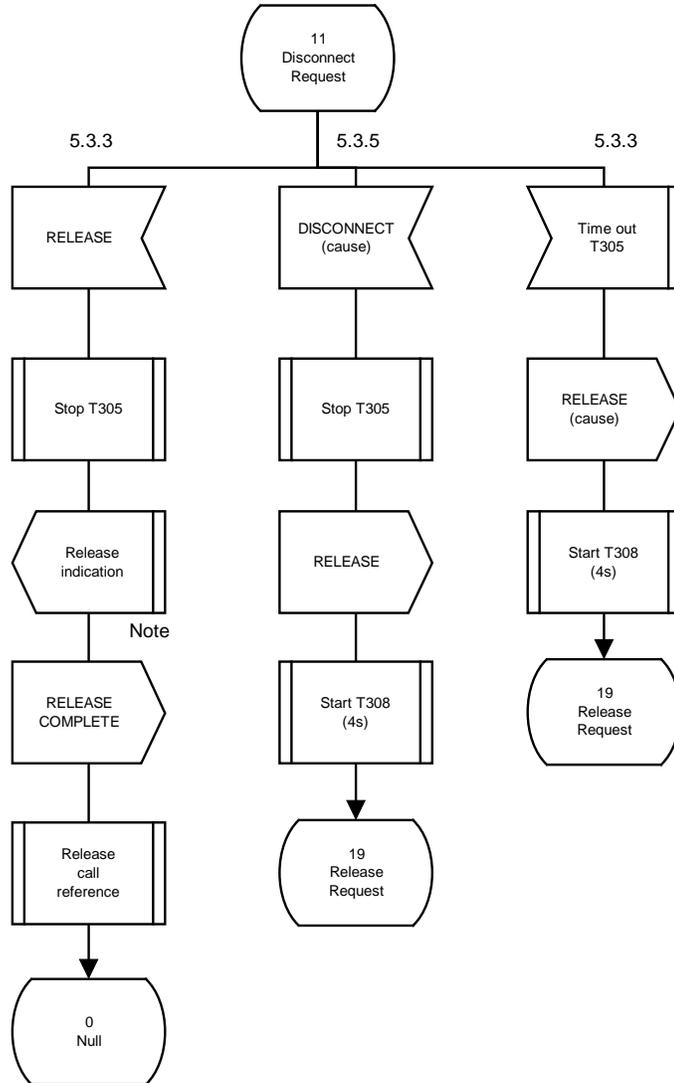
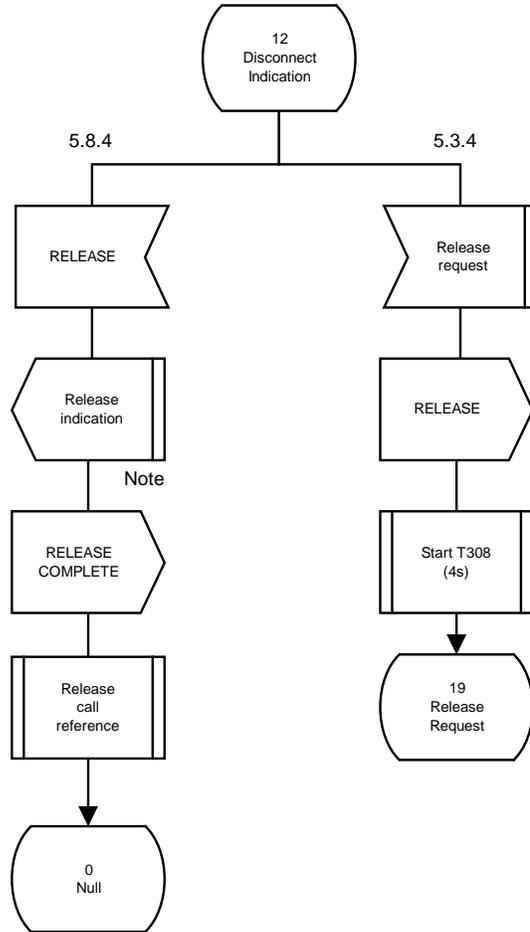


Figure A.17 – Detail protocol control (user side) (Part 10)



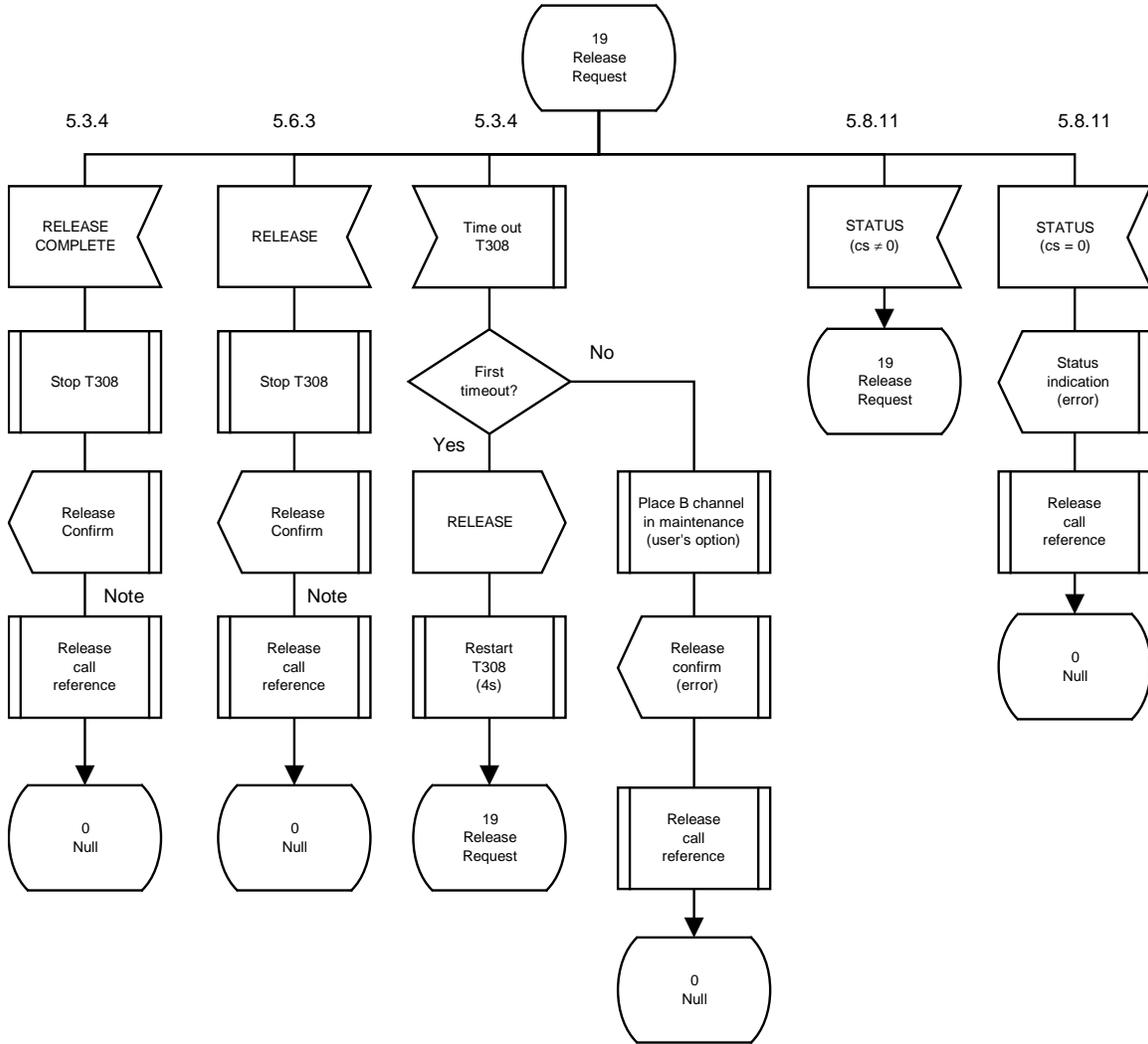
NOTE - After receiving this primitive, the call control process should release the B-channel.

Figure A.18 – Detail protocol control (user side) (Part 11)



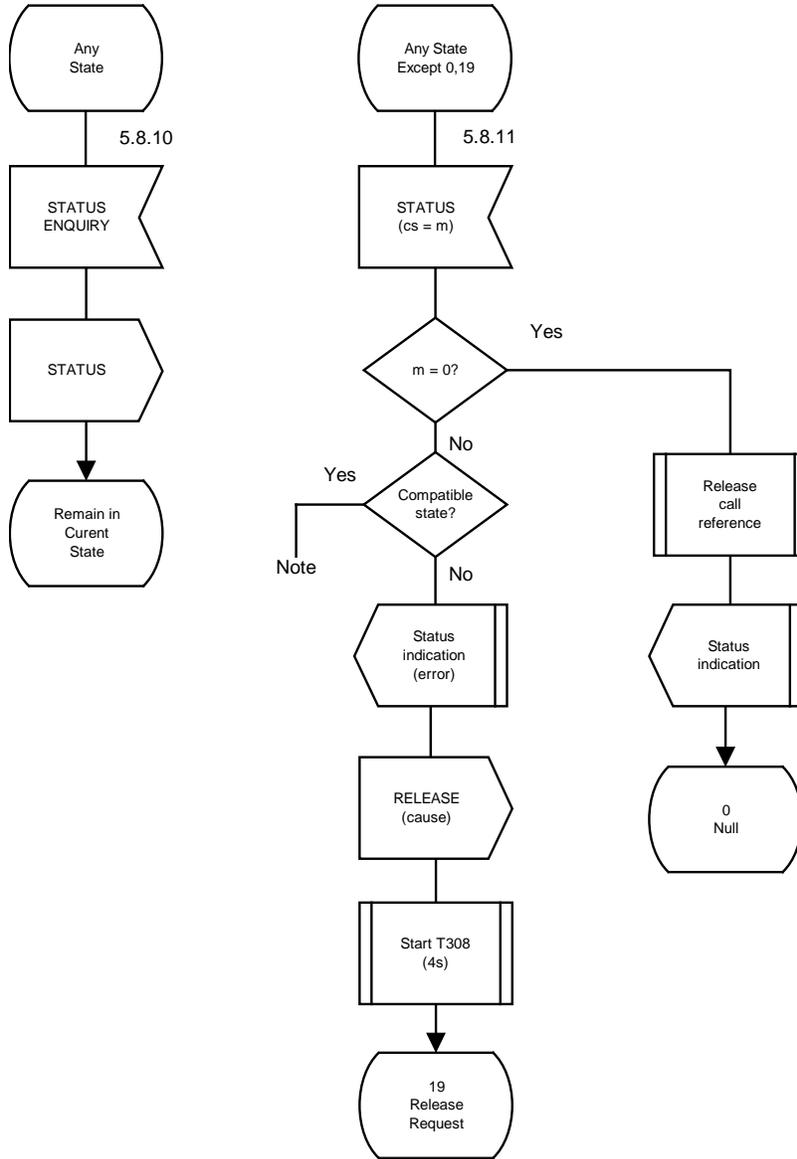
NOTE - After receiving this primitive, the call control process should release the B-channel.

Figure A.19 – Detail protocol control (user side) (Part 12)



NOTE - After receiving this primitive, the call control process should release the B-channel.

Figure A.20 – Detail protocol control (user side) (Part 13)



NOTE - Action on receipt of STATUS indicating a compatible call state is implementation-dependent (see 5.8.11).

Figure A.21 – Detail protocol control (user side) (Part 14)

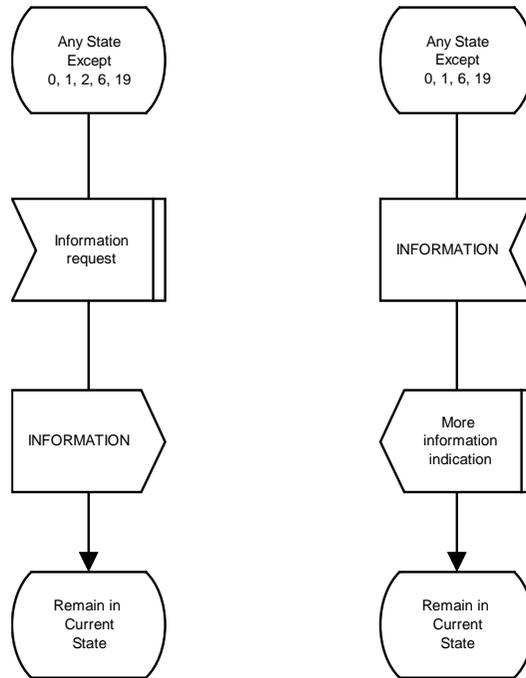
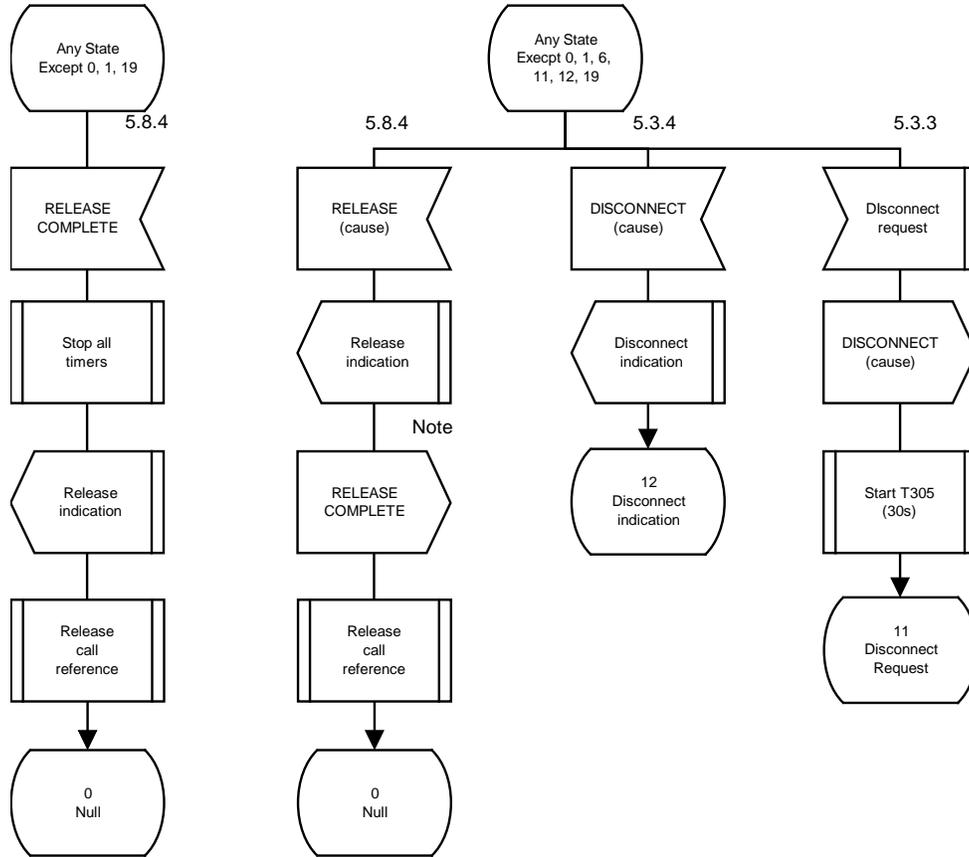
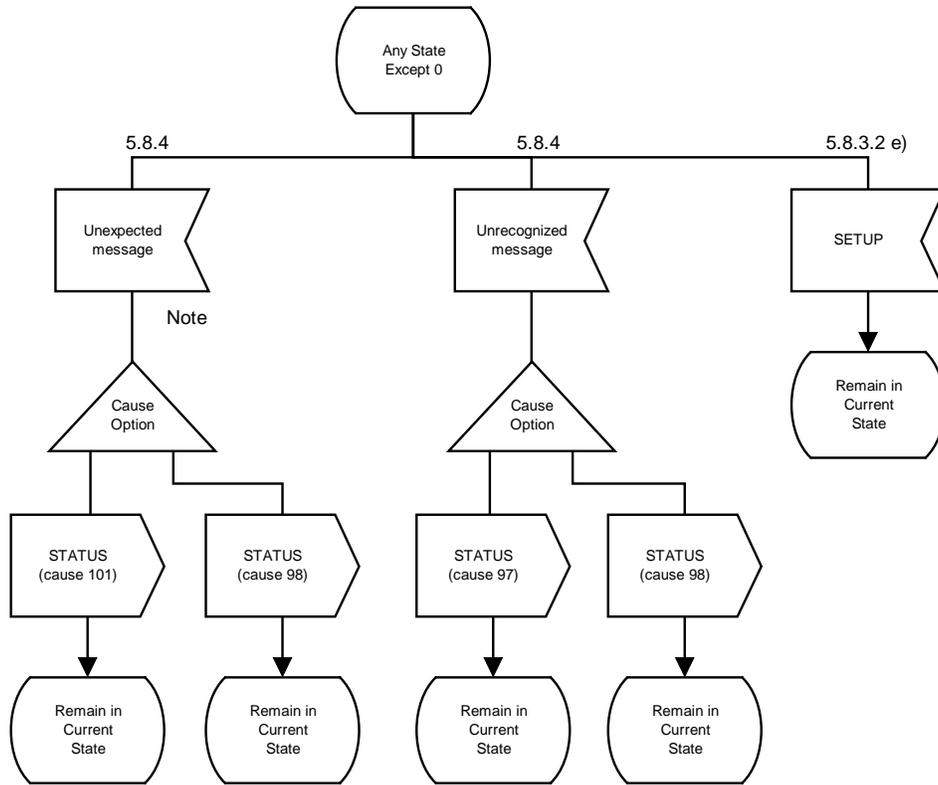


Figure A.22 – Detail protocol control (user side) (Part 15)



NOTE - After receiving this primitive, the call control process should release the B-channel.

Figure A.23 – Detail protocol control (user side) (Part 16)



NOTE - Except RELEASE or RELEASE COMPLETE messages.

Figure A.24 – Detail protocol control (user side) (Part 17)

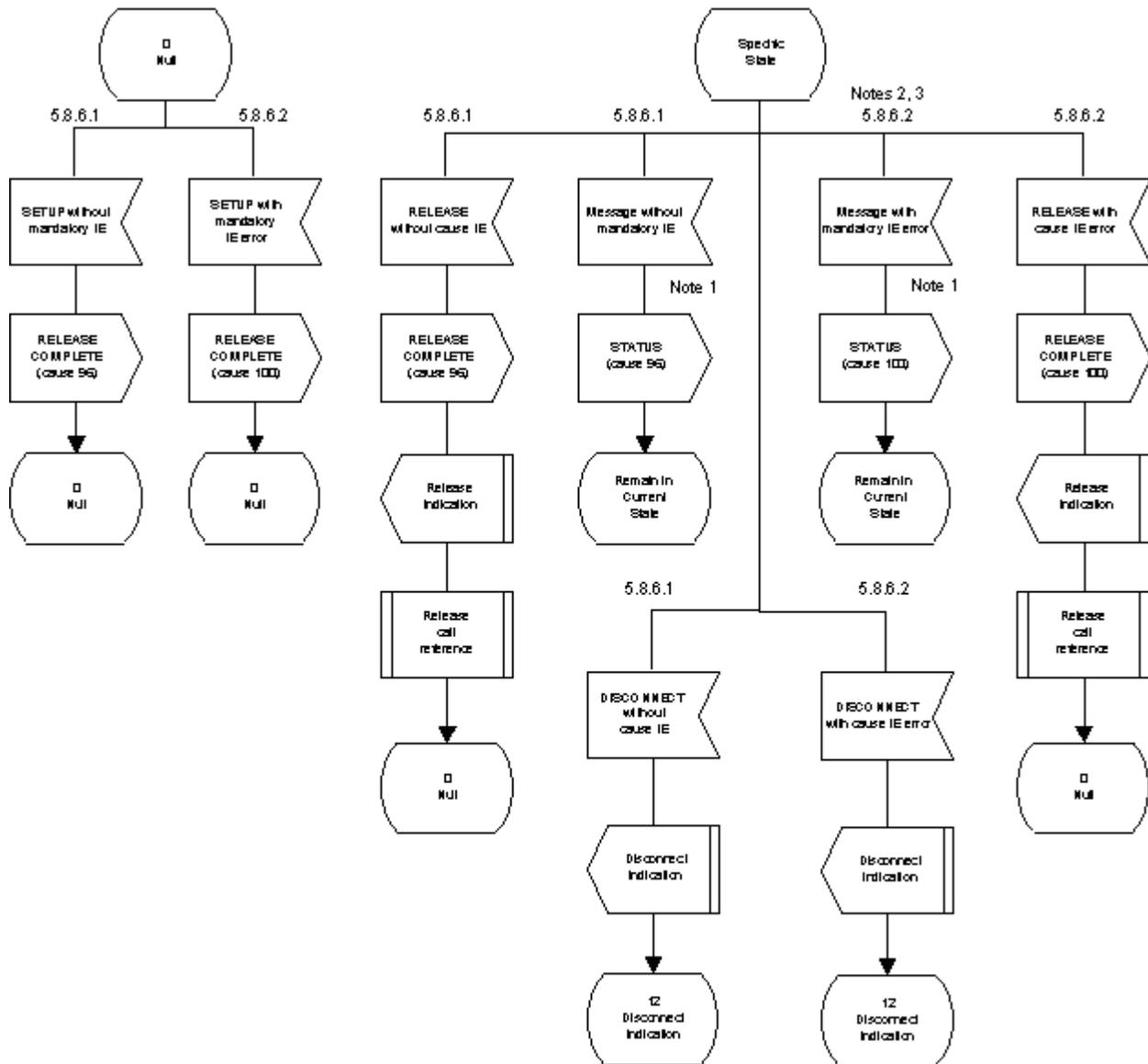


Figure A.25 – Detail protocol control (user side) (Part 18)

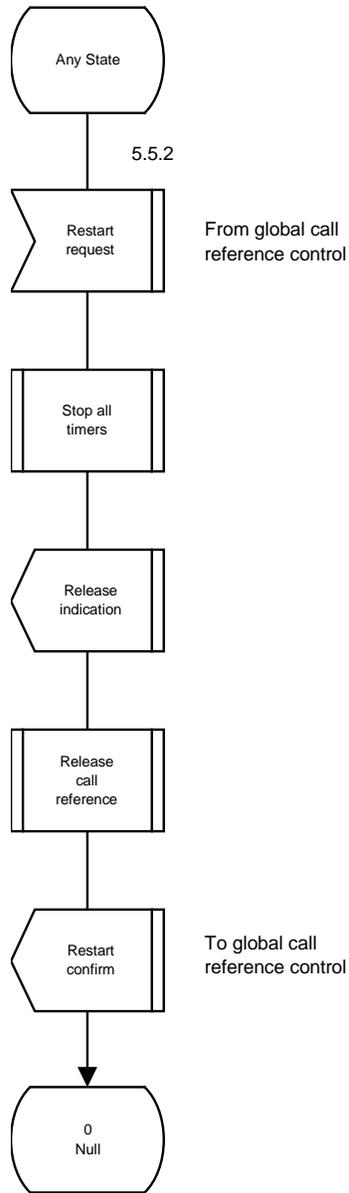
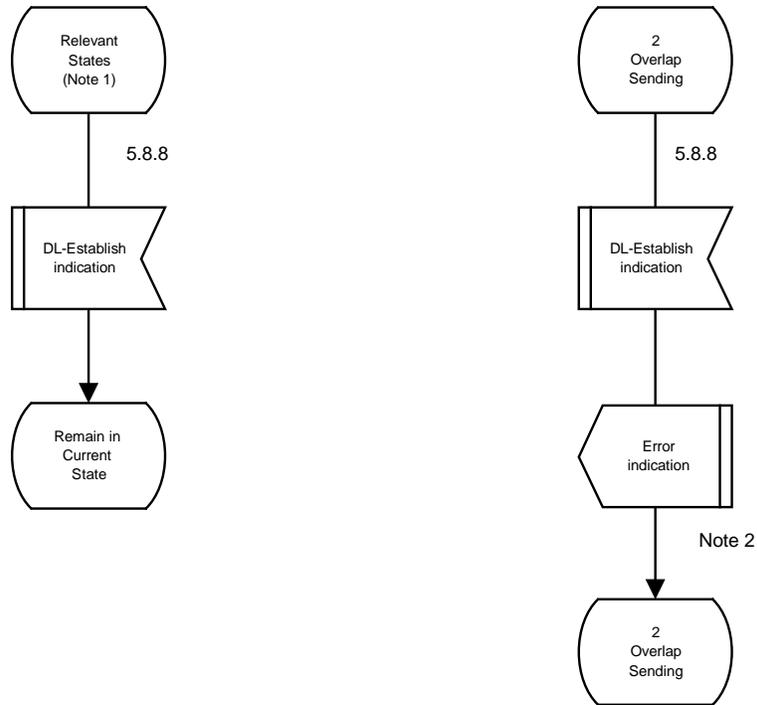


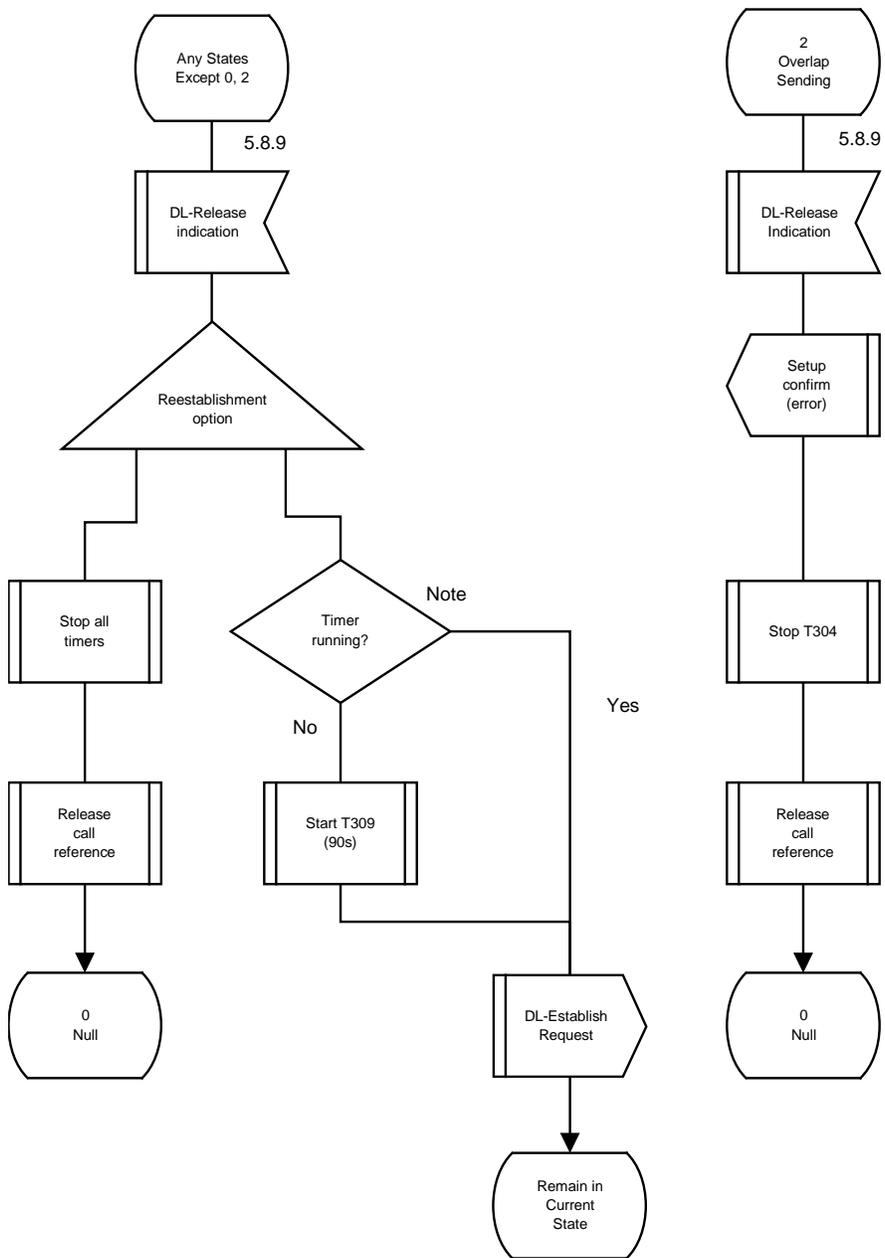
Figure A.26 – Detail protocol control (user side) (Part 19)



NOTES

- 1 The relevant states are as follows: U1, U3 - U4, U6 - U12, and U19.
- 2 At the reception of this primitive, the call control process should clear the call by sending a Disconnect Request primitive.

Figure A.27 – Detail protocol control (user side) (Part 20)



NOTE - Any timer including T309.

Figure A.28 – Detail protocol control (user side) (Part 21)

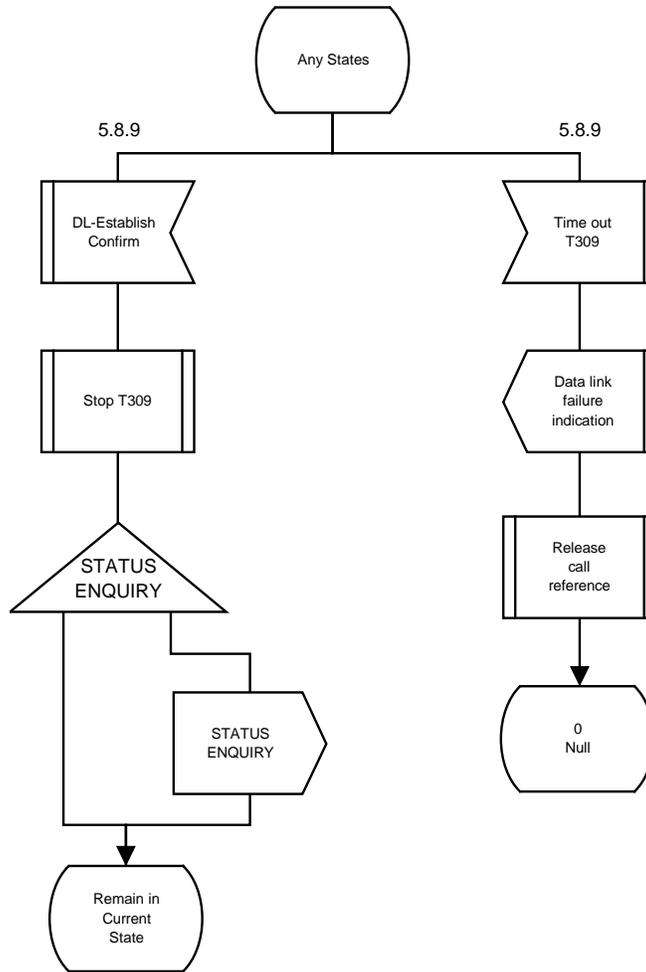
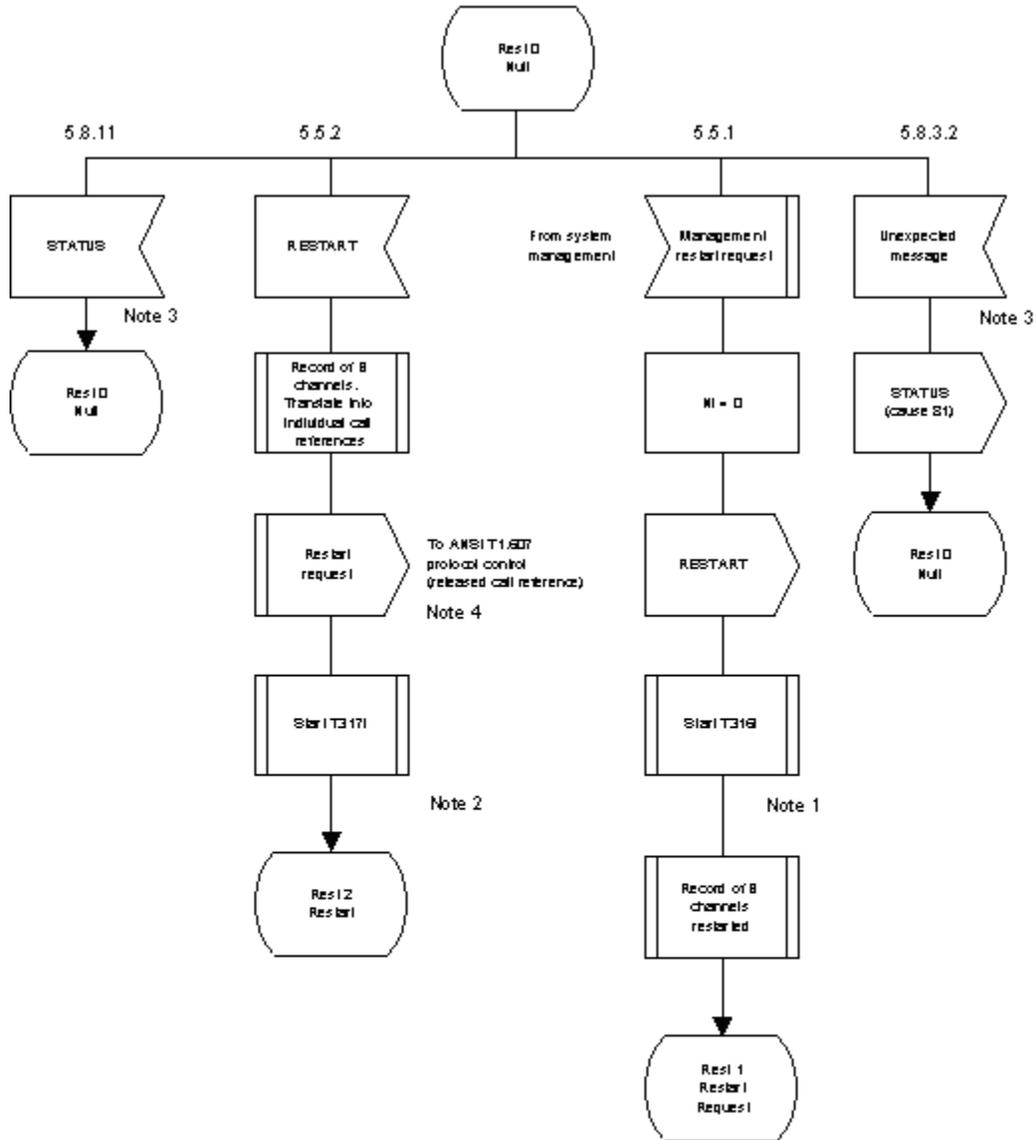


Figure A.29 – Detail protocol control (user side) (Part 22)

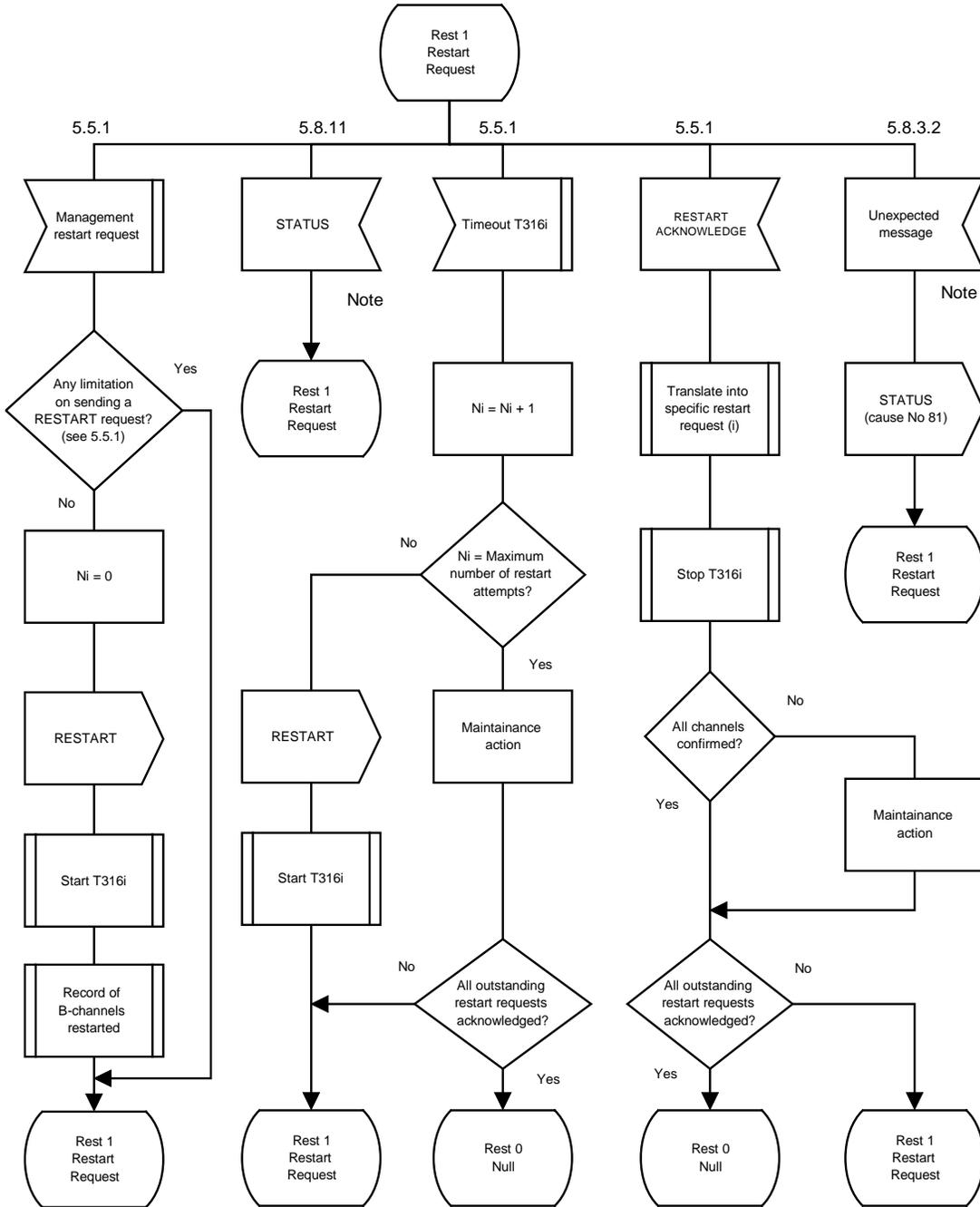


NOTES

- 1 The value of i indicates a particular restart request sent.
- 2 The value of j indicates a particular restart request received.
- 3 Messages using the global call reference.
- 4 See Figure A.26.

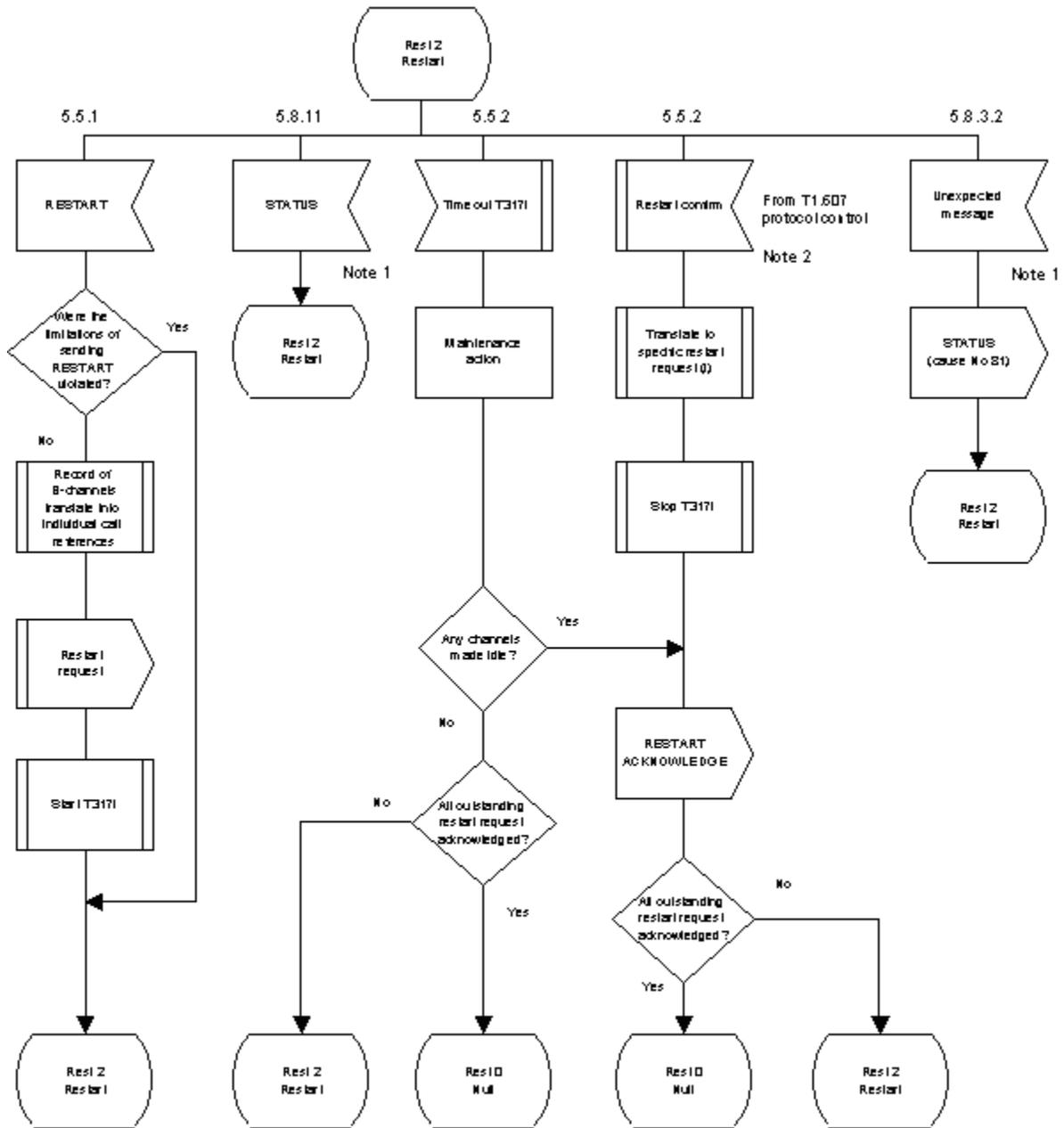
Figure A.30 – SDL to support Extended Restart Procedure (part 1)

(network and user side SDL are symmetric)



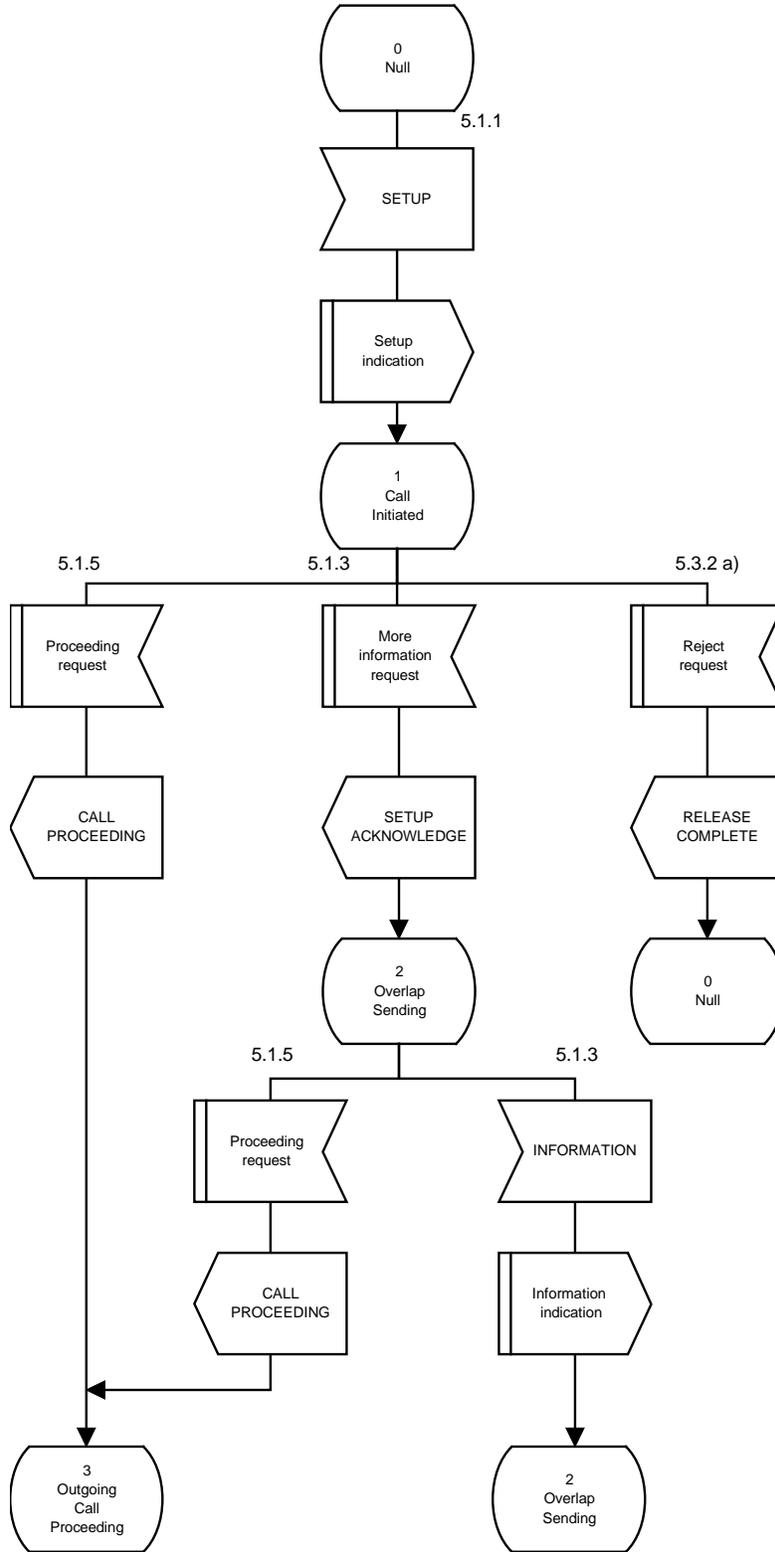
NOTE -- Messages using the global call reference.

Figure A.31 – SDL to support Extended Restart Procedure (part 2)



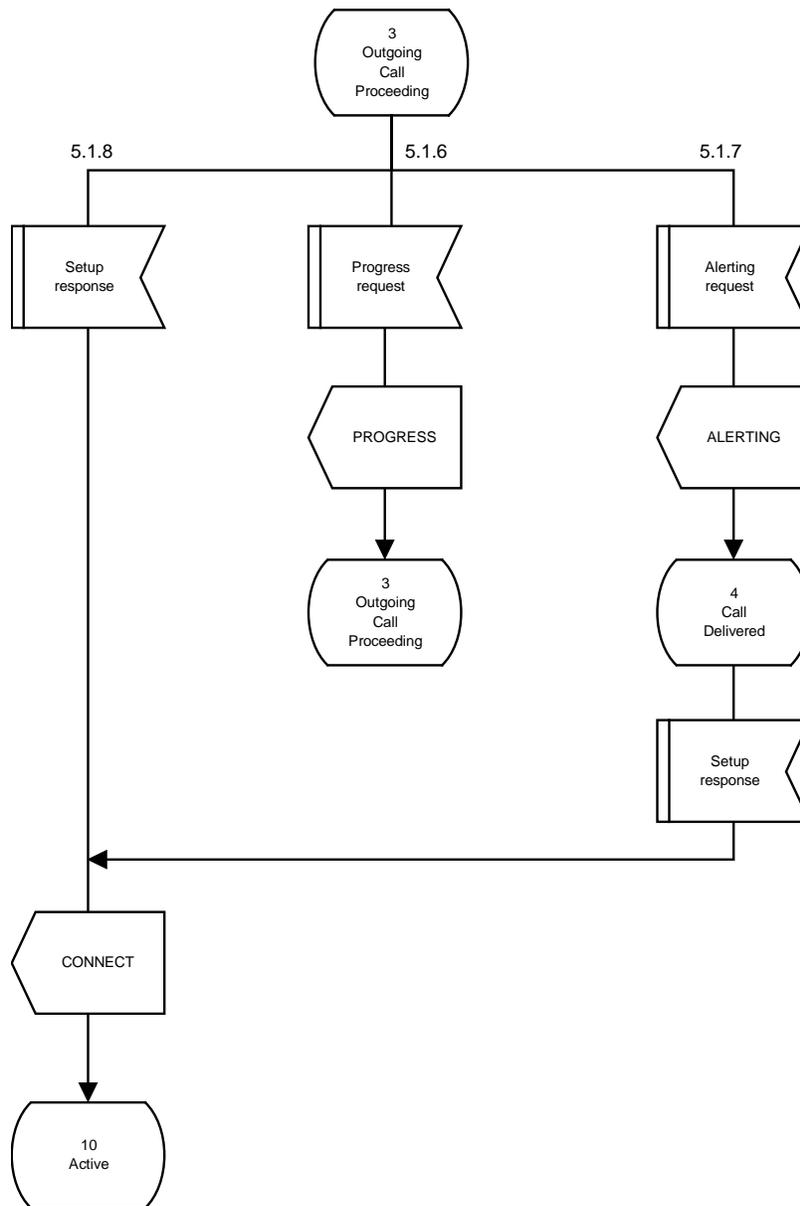
NOTES
 1 Messages using the global call reference.
 2 See Figure A.26.

Figure A.32 – SDL to support Extended Restart Procedure (part 3)



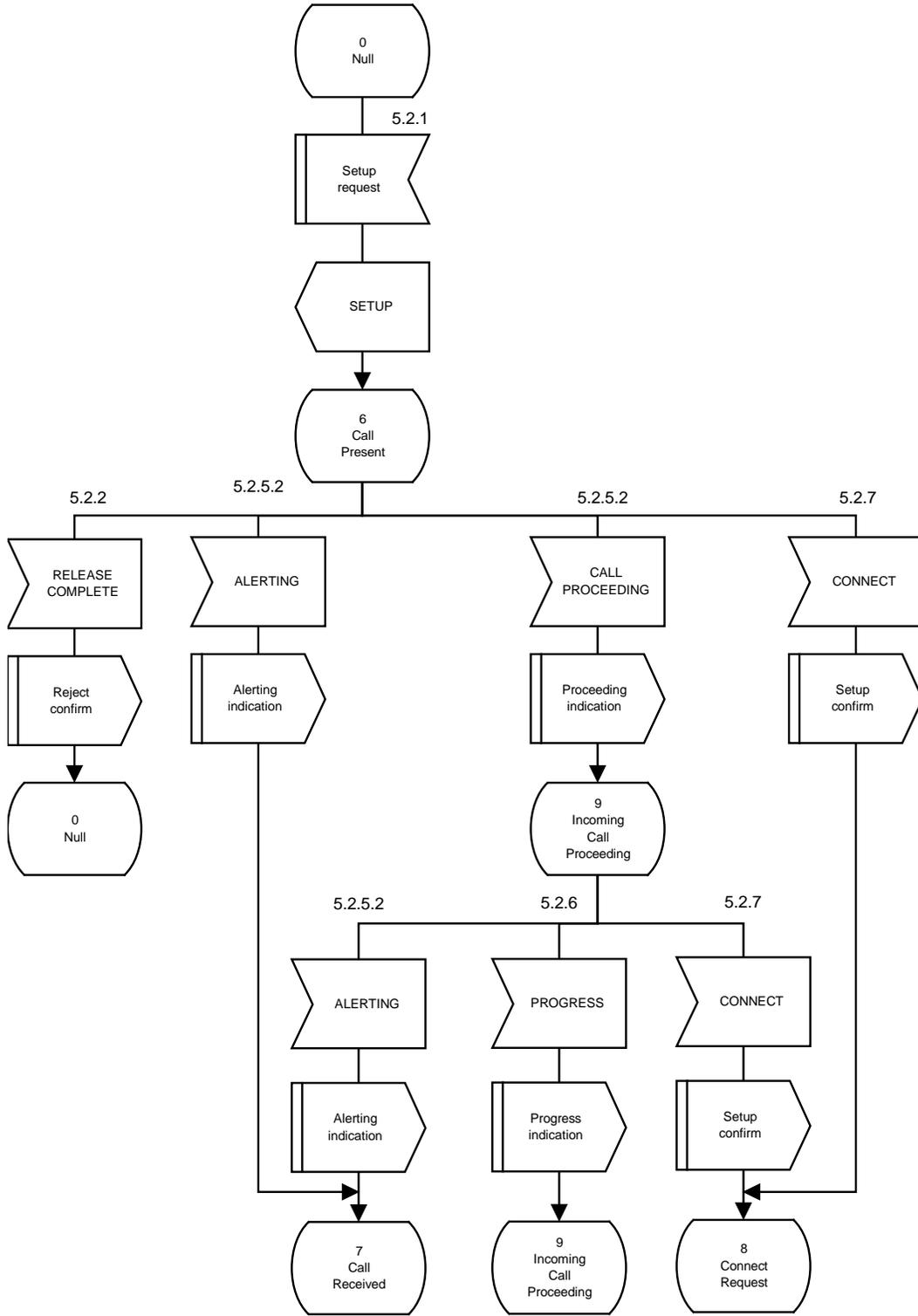
Outgoing setup procedure (1 of 2)

Figure A.33 – Overview protocol control (network side) (Part 1)



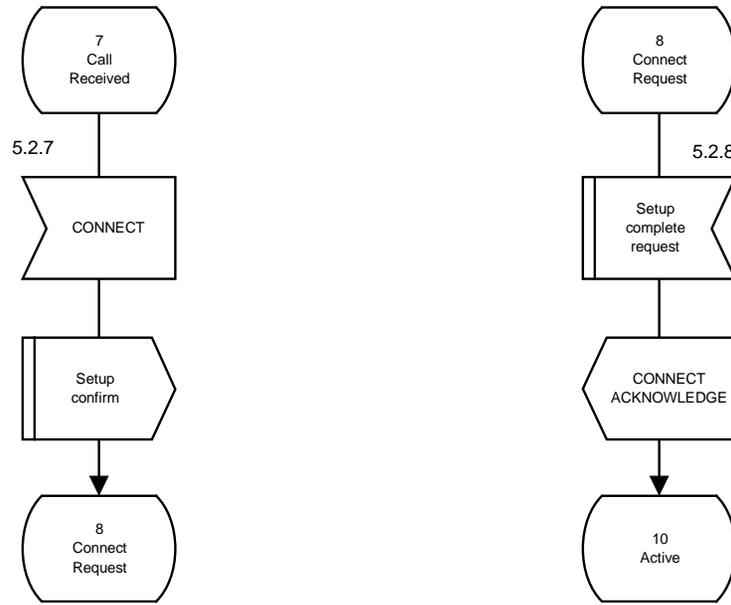
Outgoing setup procedure (2 of 2)

Figure A.34 – Overview protocol control (network side) (Part 2)



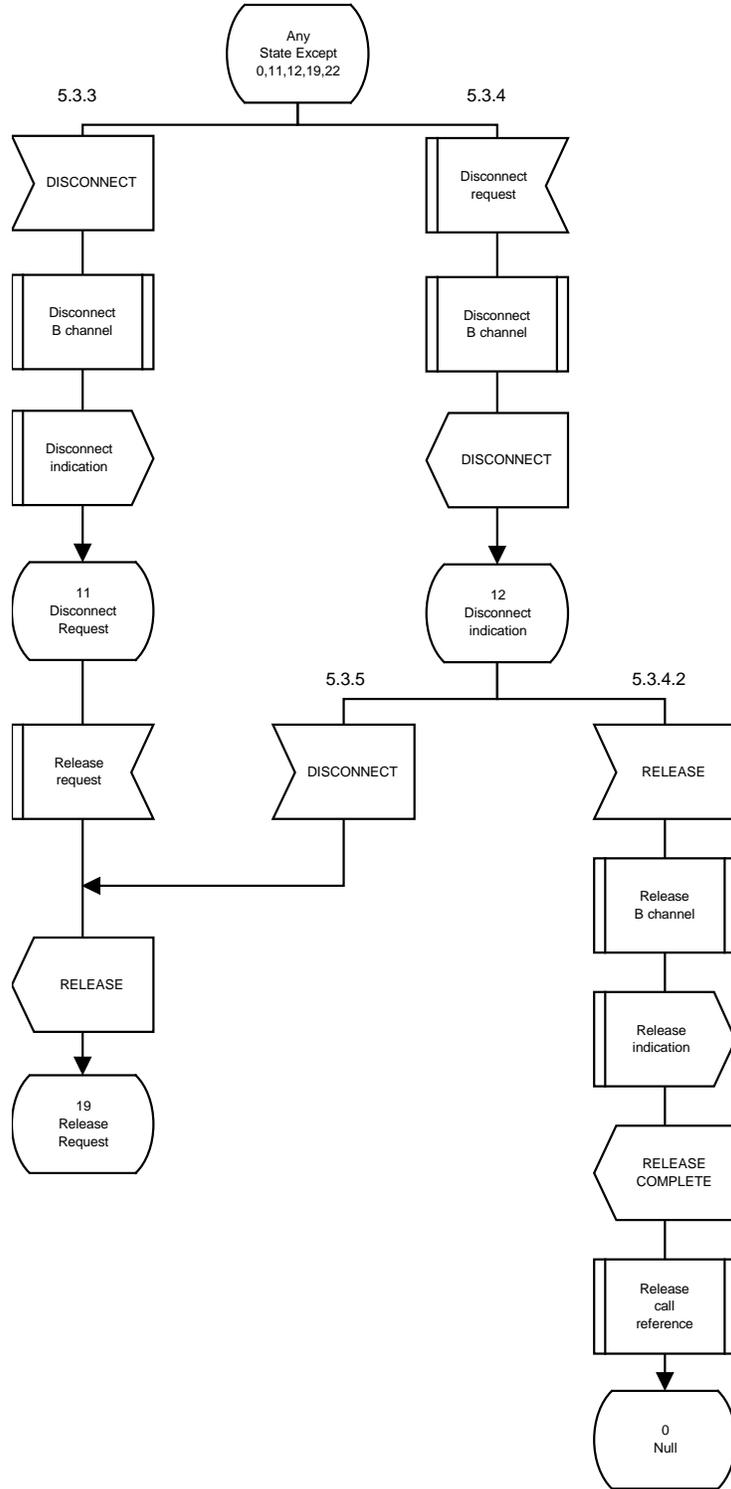
Incoming setup procedure (1 of 2)

Figure A.35 – Overview protocol control (network side) (Part 3)



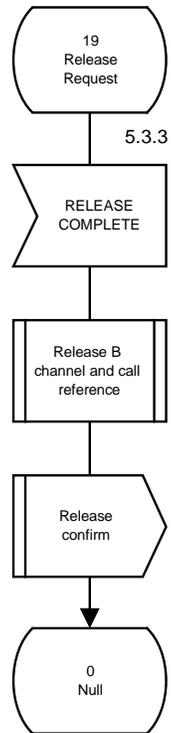
Incoming setup procedure (2 of 2)

Figure A.36 – Overview protocol control (network side) (Part 4)



Clearing procedure (1 of 2)

Figure A.37 – Overview protocol control (network side) (Part 5)



Clearing procedure (2 of 2)

Figure A.38 – Overview protocol control (network side) (Part 6)

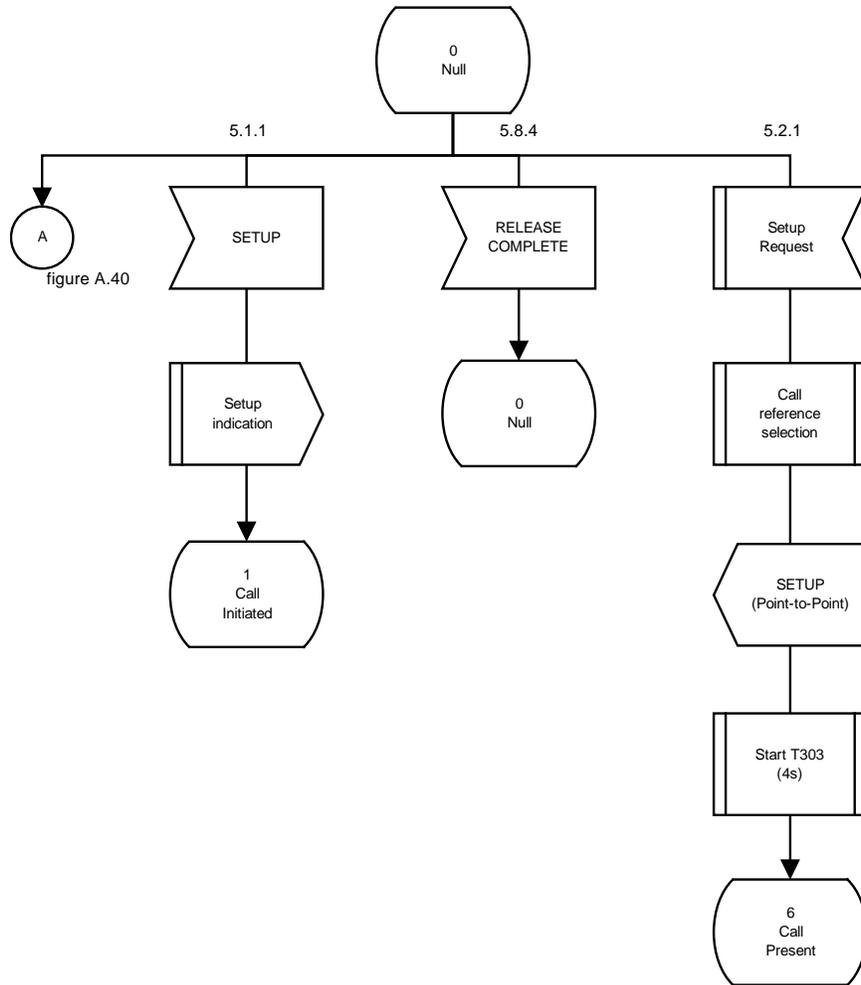


Figure A.39 – Detail protocol control (network side) (Part 1)

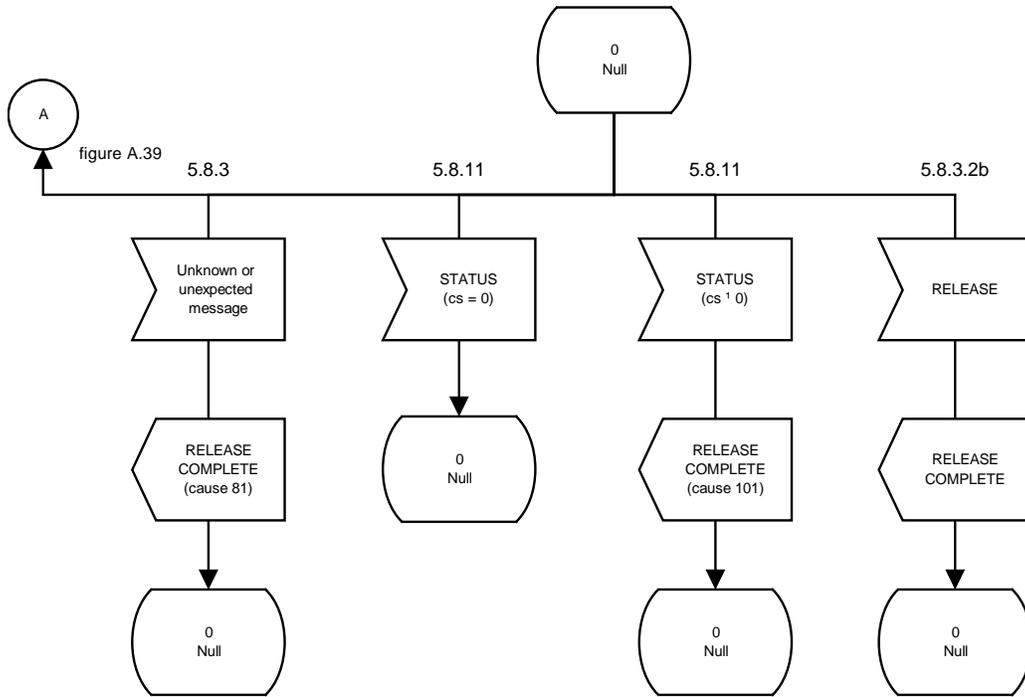


Figure A.40 – Detail protocol control (network side) (Part 2)

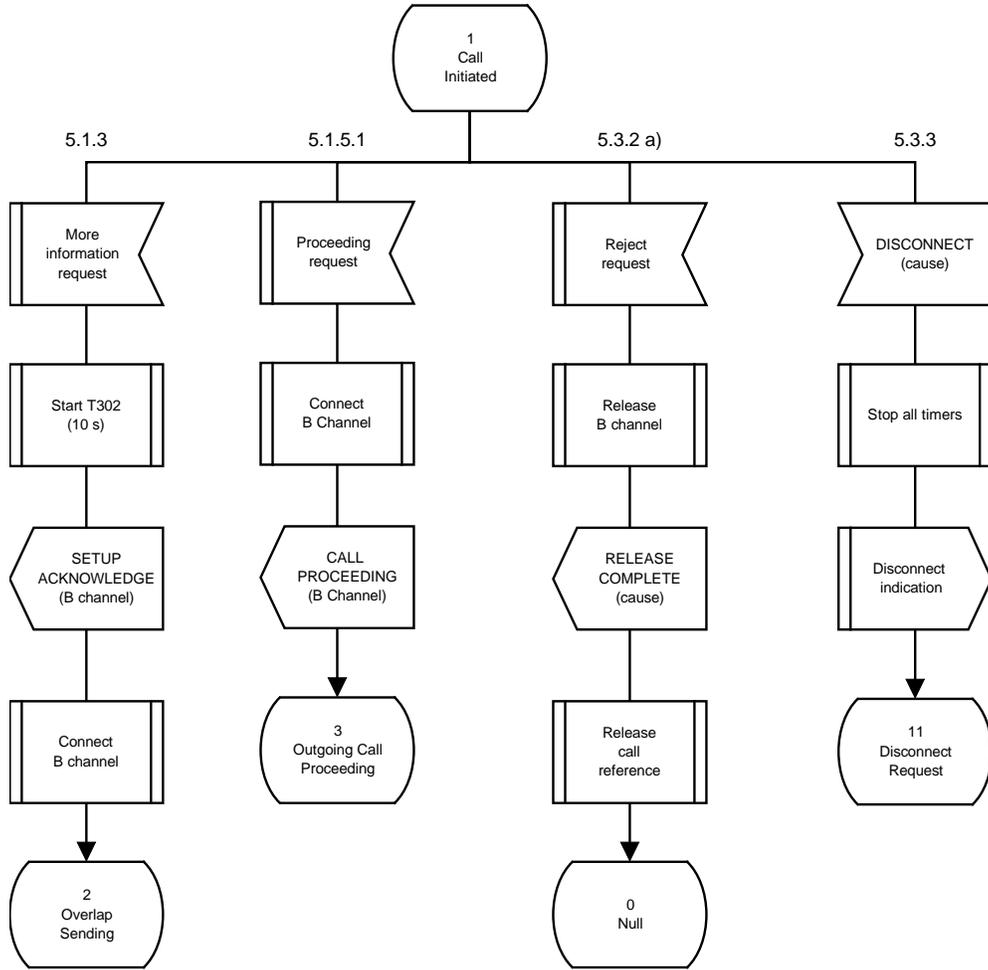
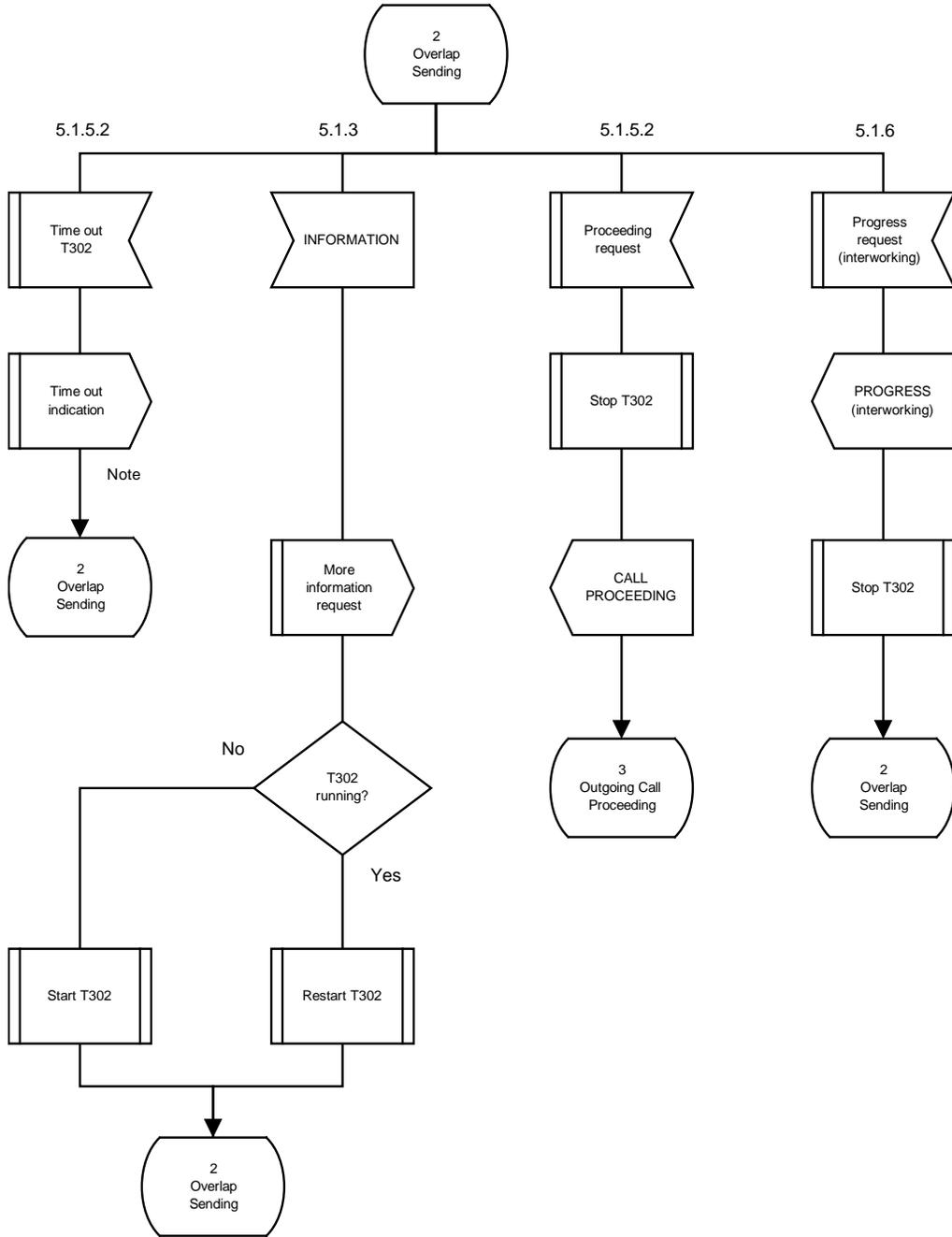


Figure A.41 – Detail protocol control (network side) (Part 3)



NOTE - It is assumed that the call control block will carry out the functions of 5.1.5.2.

Figure A.42 – Detail protocol control (network side) (Part 4)

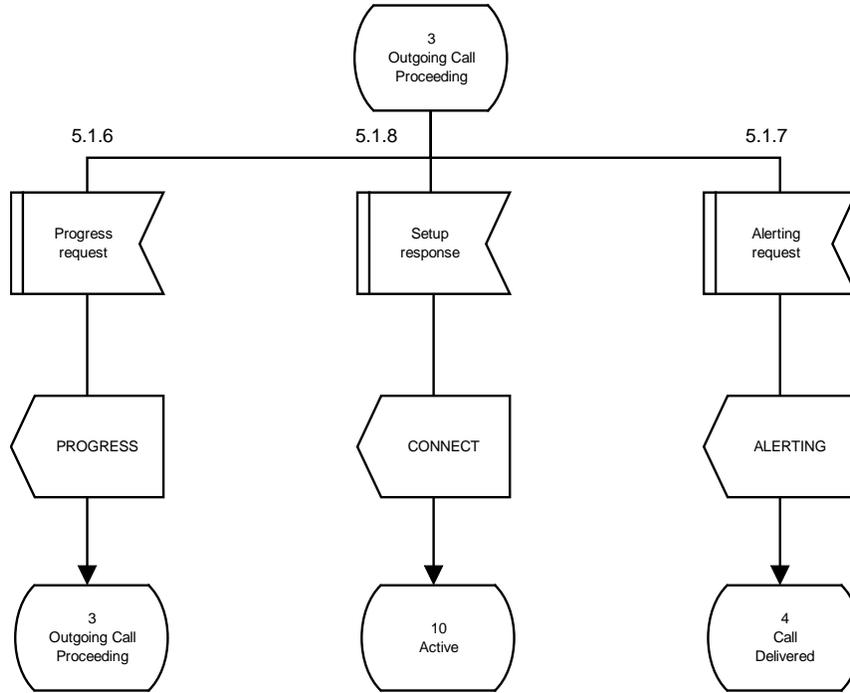


Figure A.43 – Detail protocol control (network side) (Part 5)

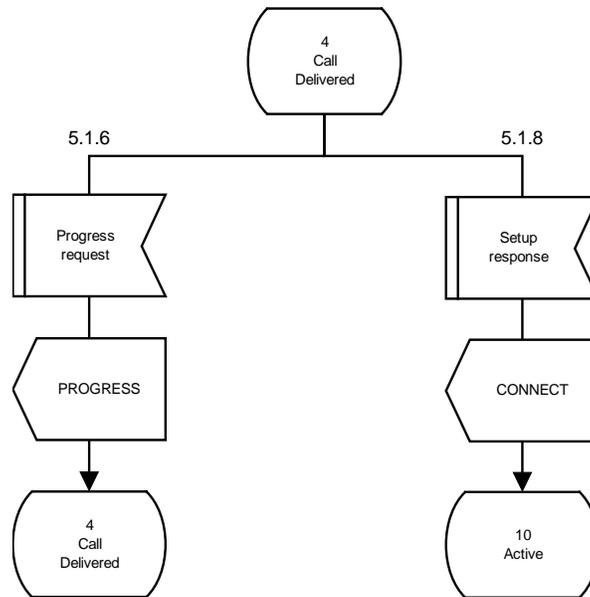
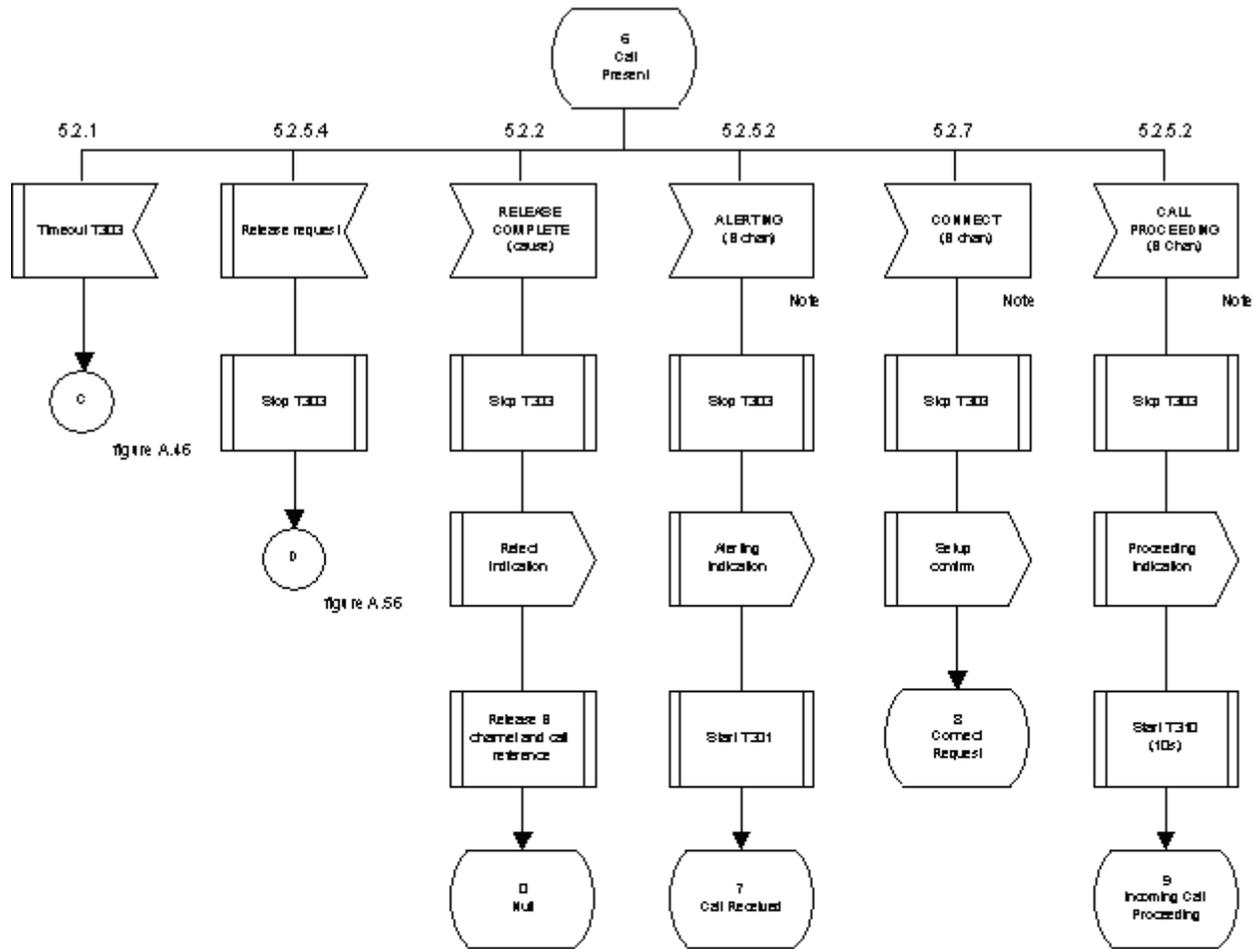


Figure A.44 – Detail protocol control (network side) (Part 6)



NOTE -- "B chan" is a B-channel negotiated by the network and user.

Figure A.45 – Detail protocol control (network side) (Part 7)

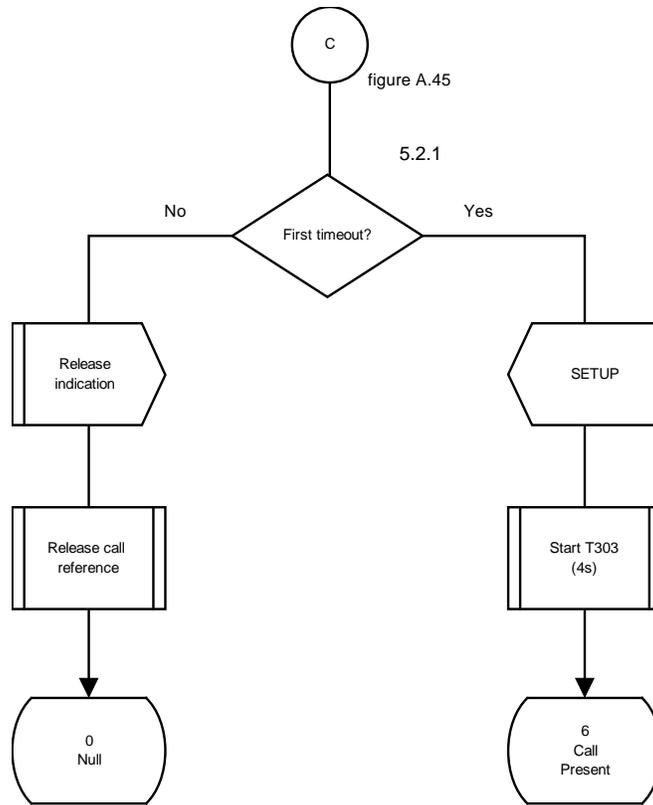


Figure A.46 – Detail protocol control (network side) (Part 8)

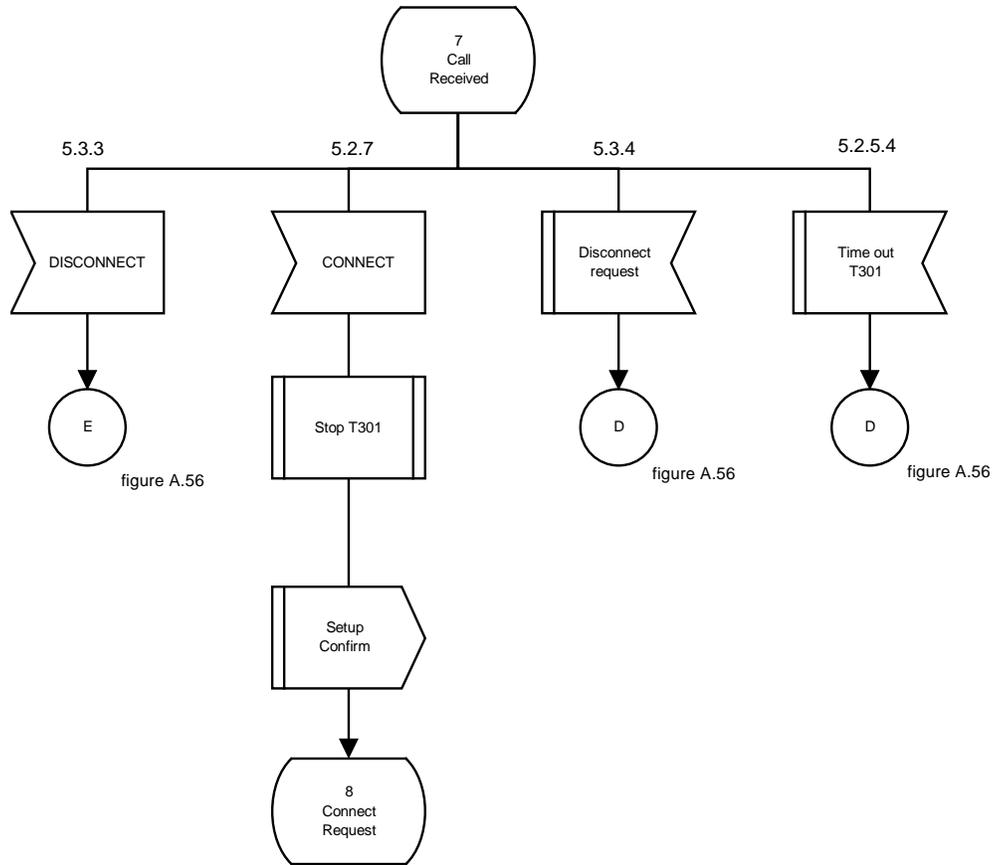


Figure A.47 – Detail protocol control (network side) (Part 9)

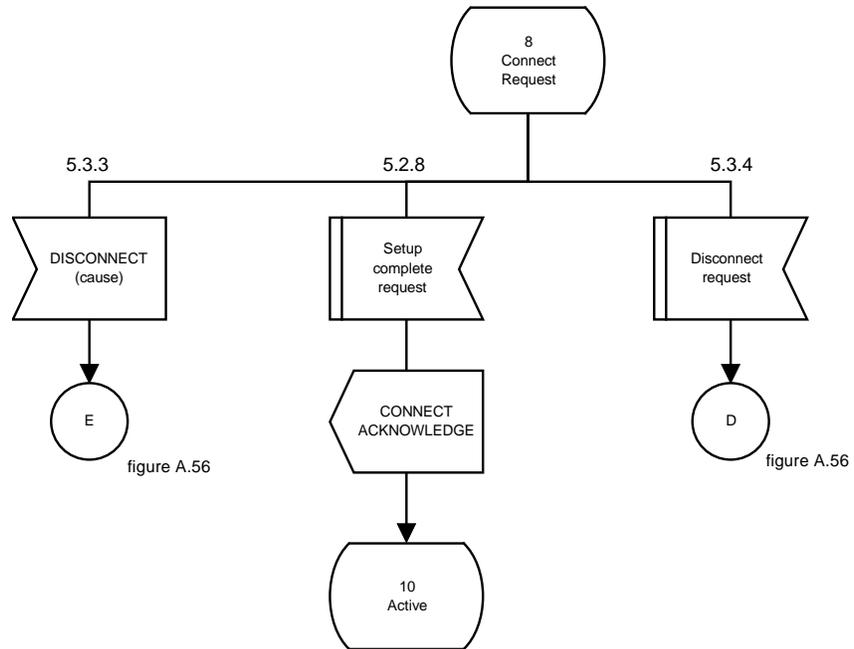


Figure A.48 – Detail protocol control (network side) (Part 10)

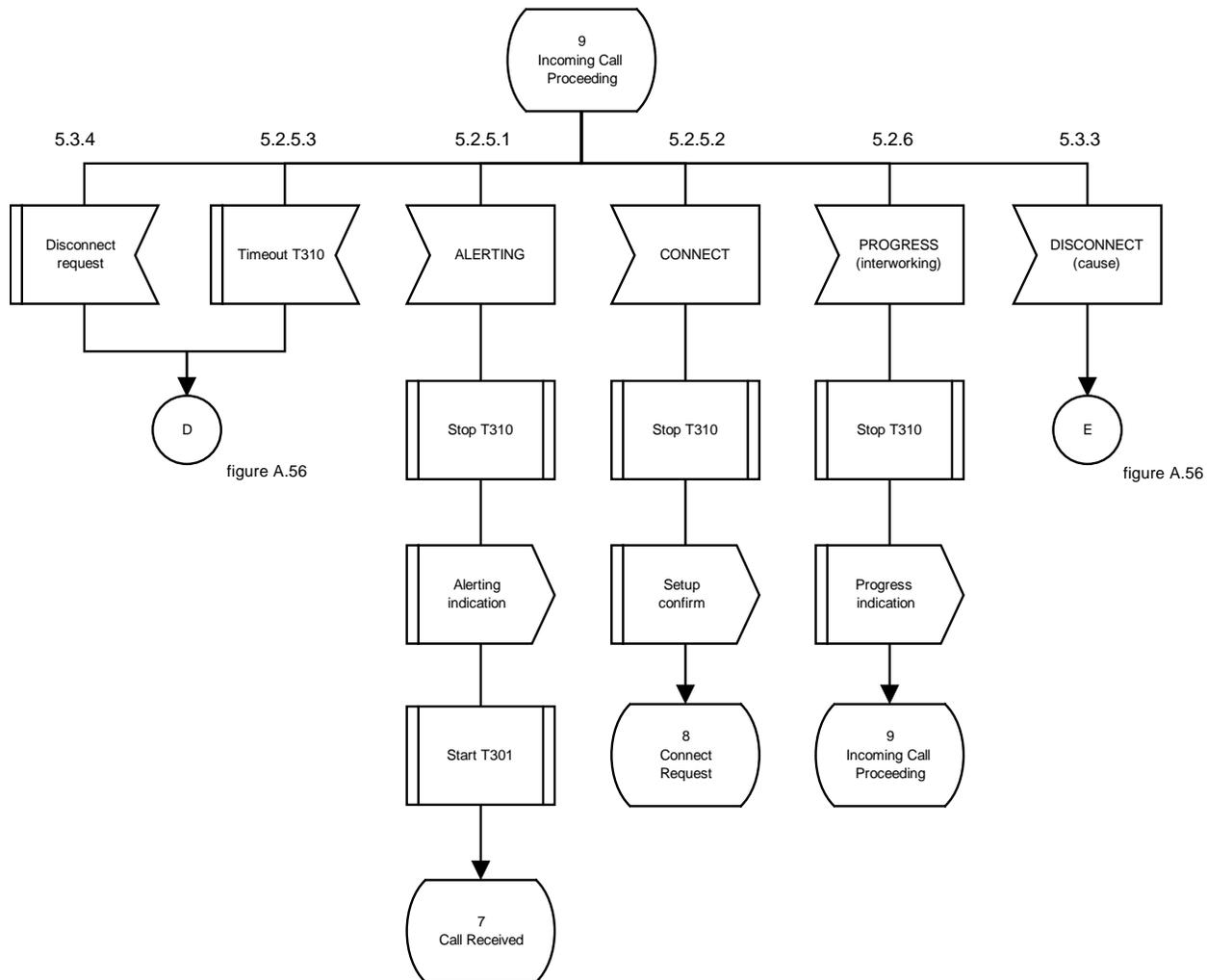


Figure A.49 – Detail protocol control (network side) (Part 11)

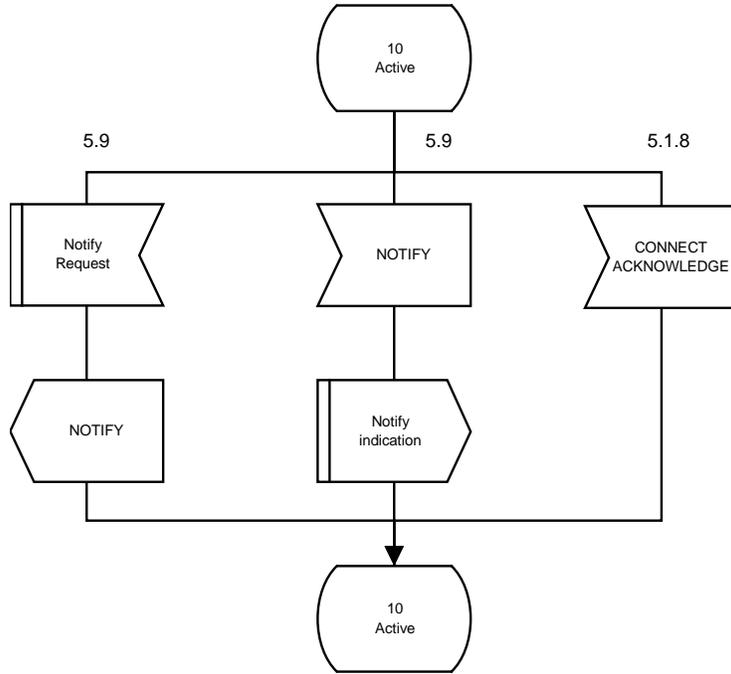


Figure A.50 – Detail protocol control (network side) (Part 12)

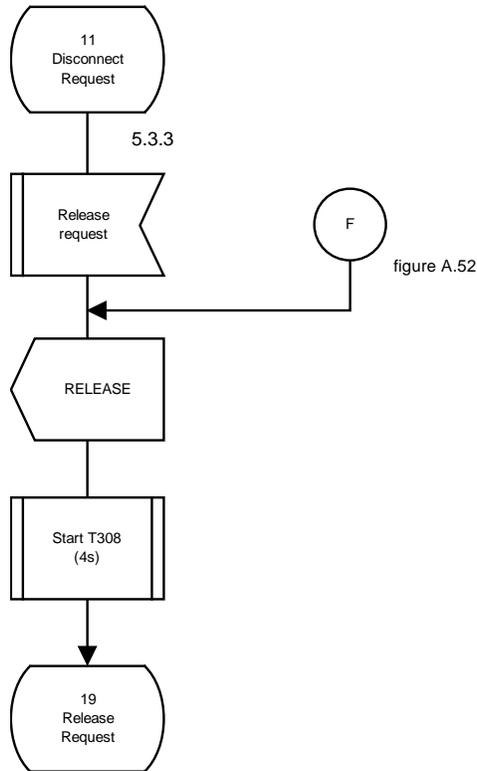


Figure A.51 – Detail protocol control (network side) (Part 13)

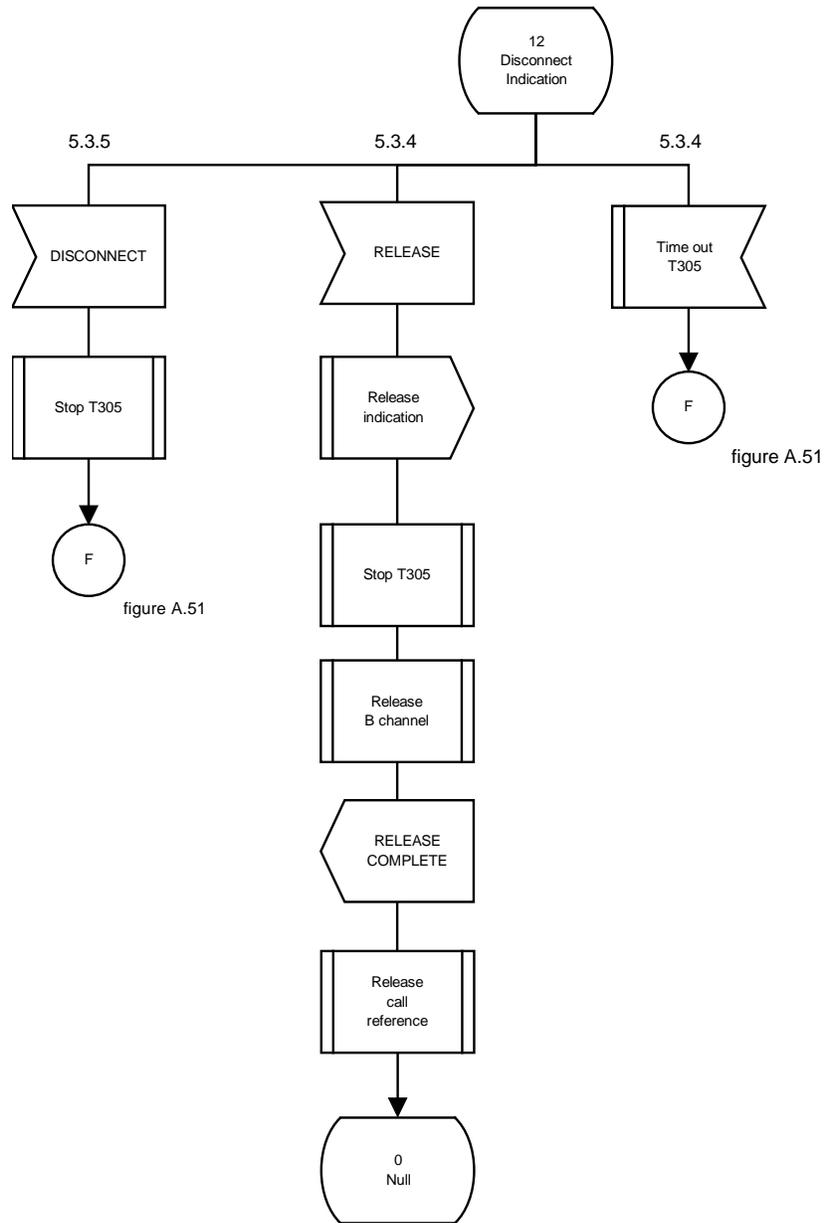


Figure A.52 – Detail protocol control (network side) (Part 14)

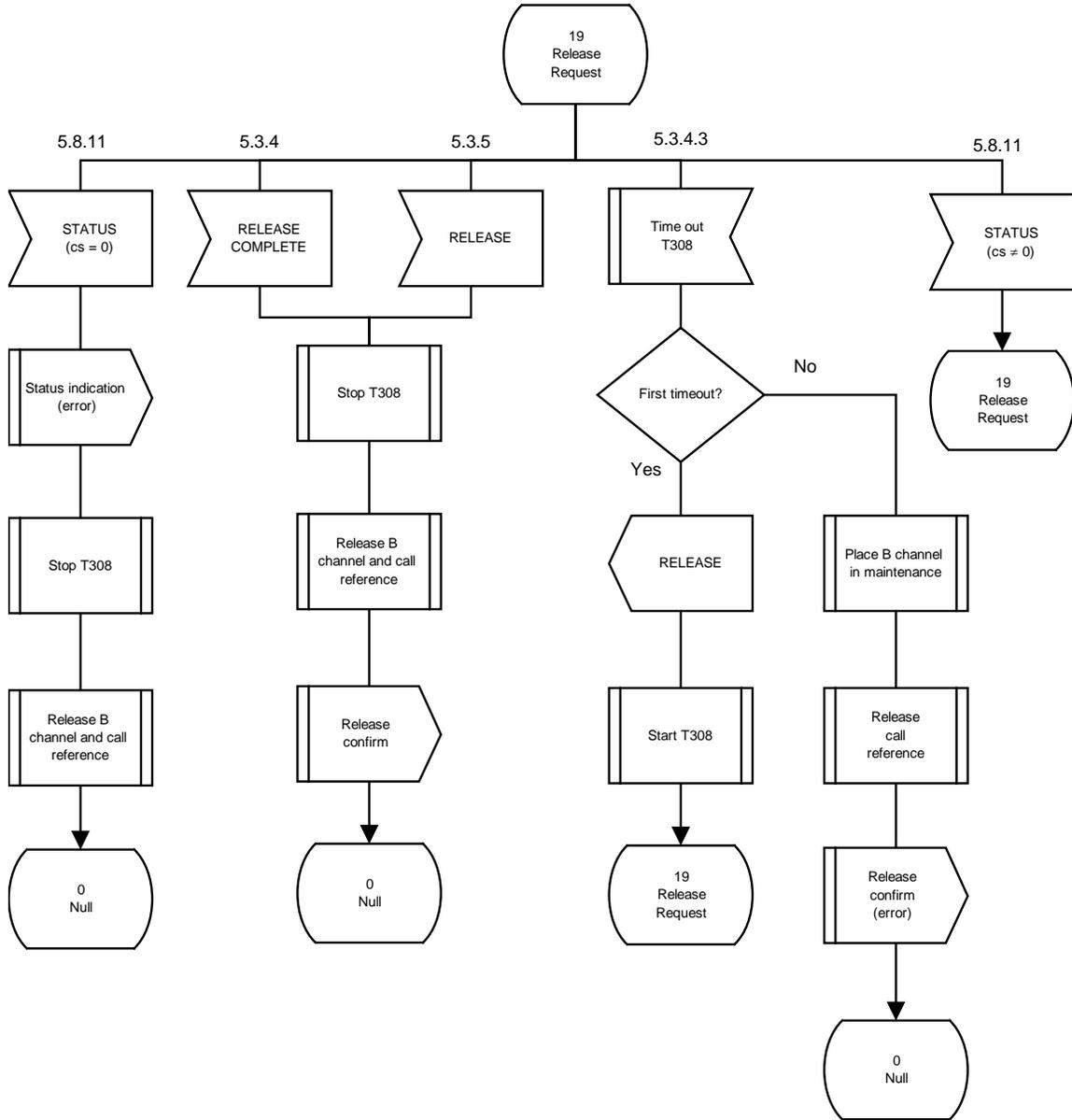


Figure A.53 – Detail protocol control (network side) (Part 15)

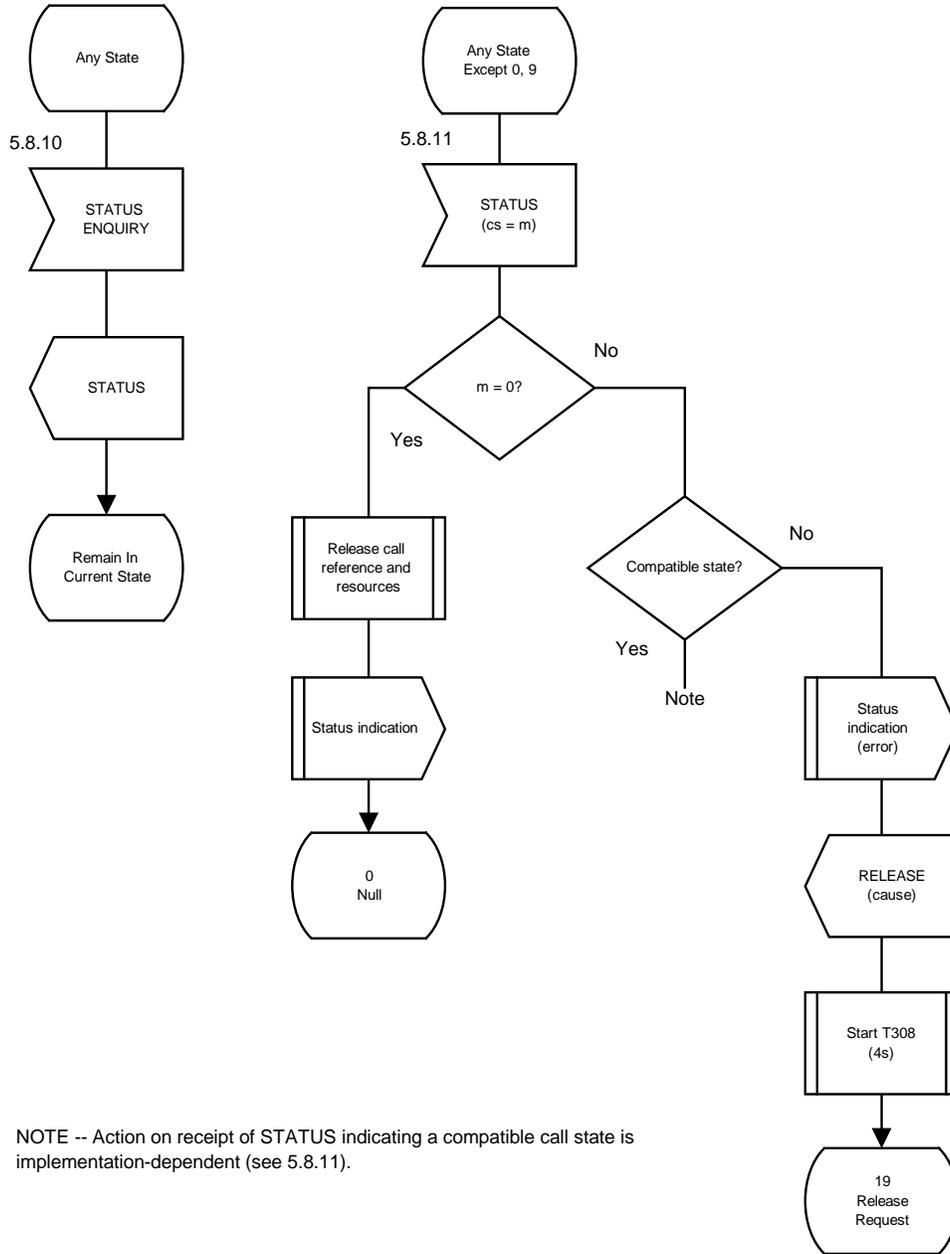


Figure A.54 – Detail protocol control (network side) (Part 16)

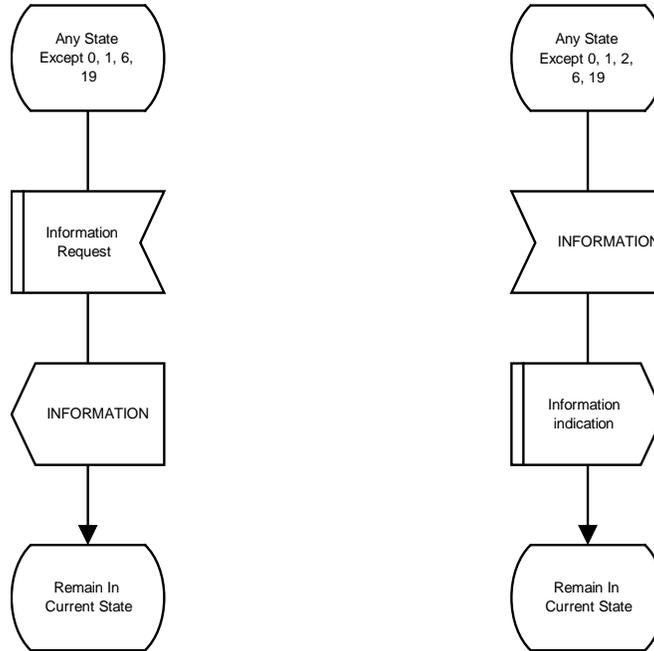


Figure A.55 – Detail protocol control (network side) (Part 17)

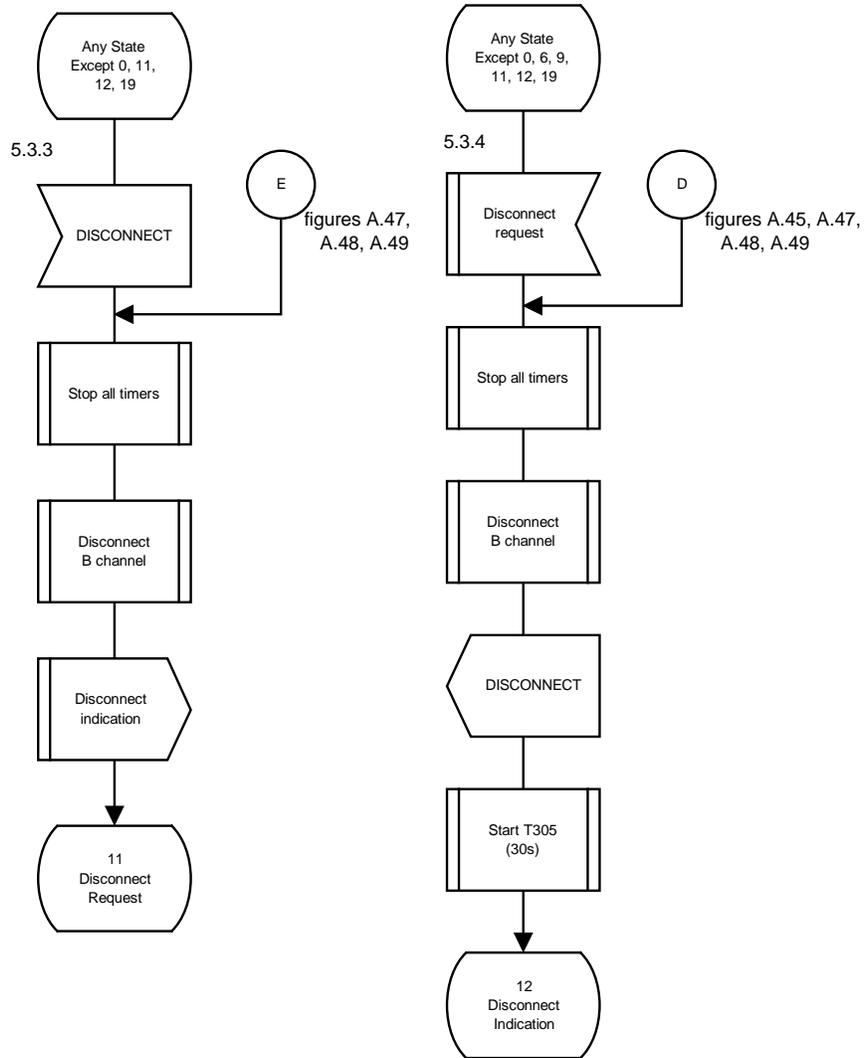
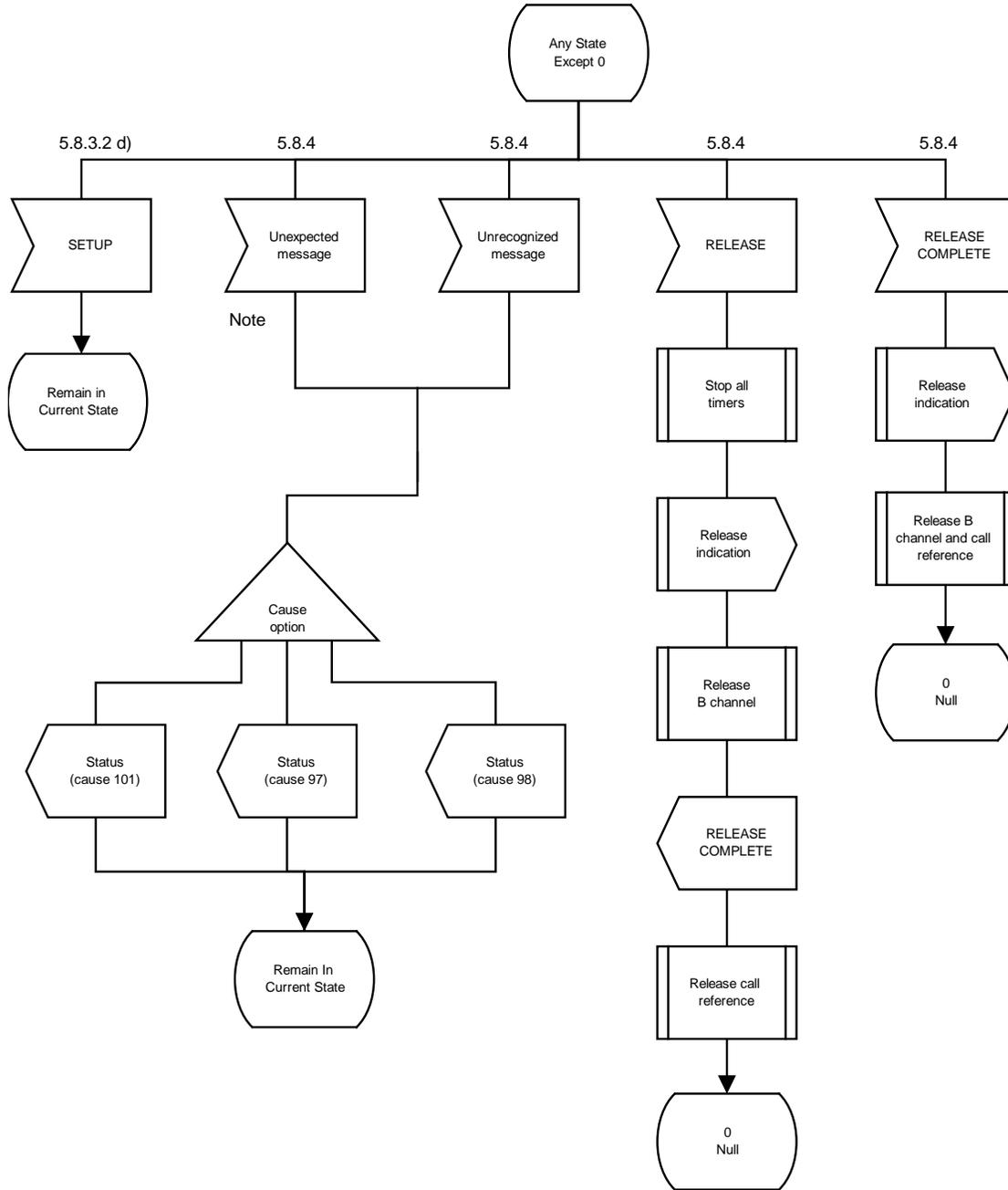
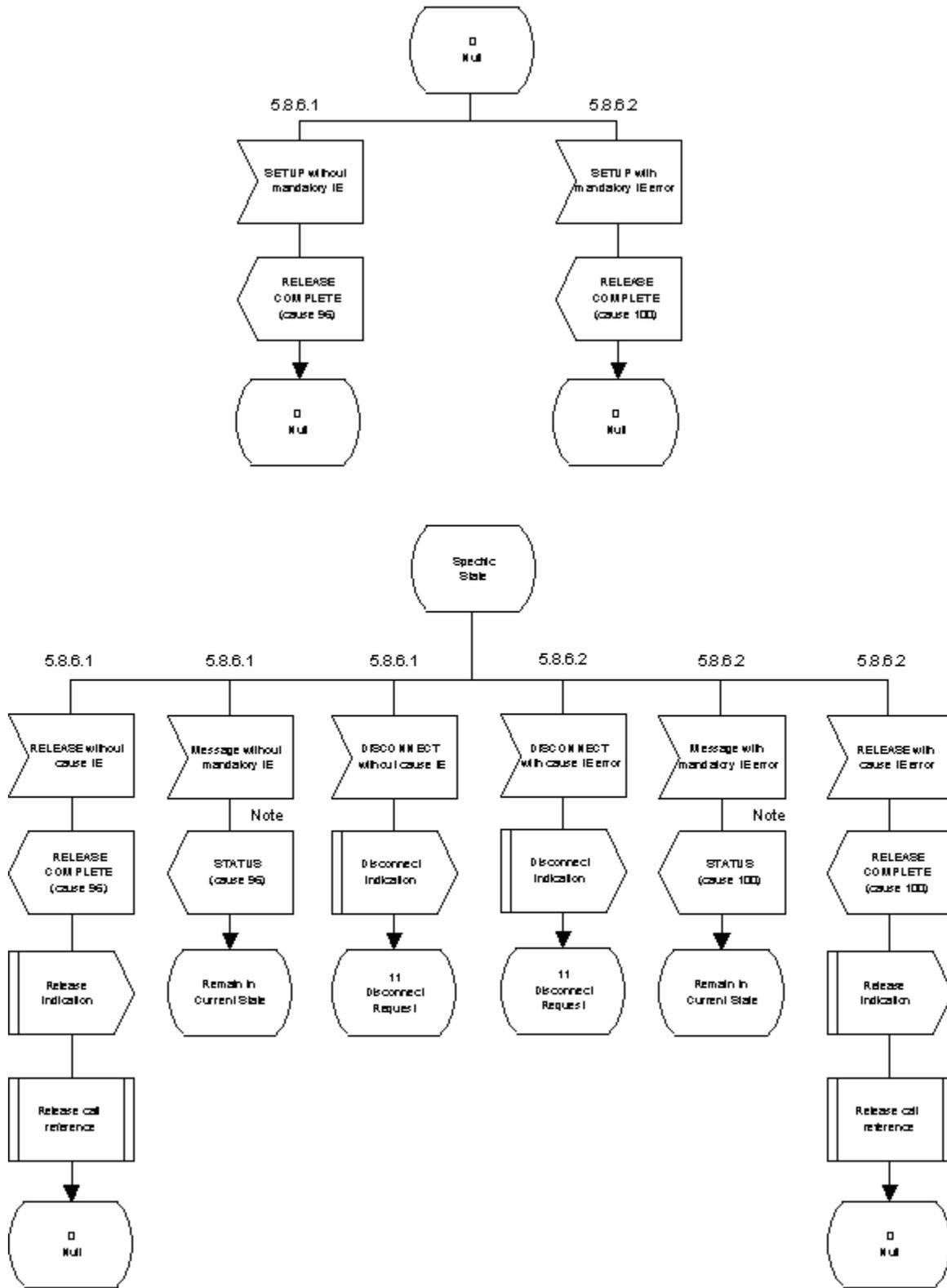


Figure A.56 – Detail protocol control (network side) (Part 18)



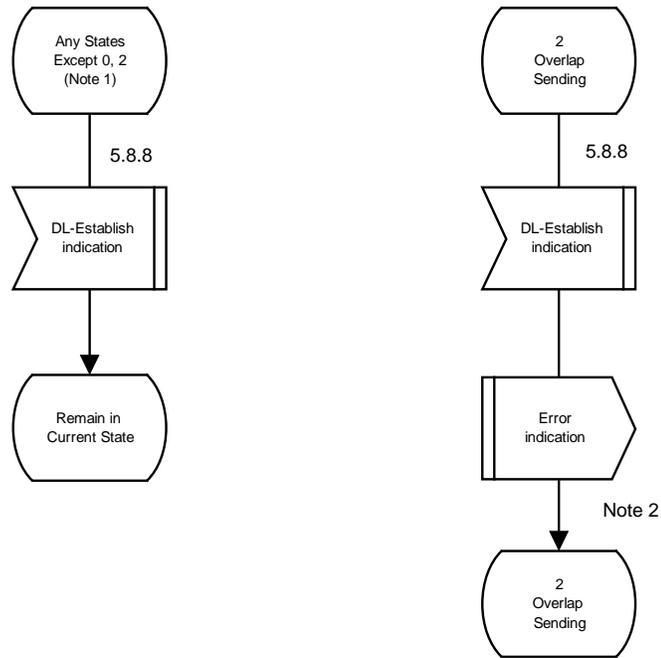
Note -- Except for RELEASE or RELEASE COMPLETE messages.

Figure A.57 – Detail protocol control (network side) (Part 19)



Note -- Except for SETUP, RELEASE COMPLETE, and DISCONNECT messages.

Figure A.58 – Detail protocol control (network side) (Part 20)

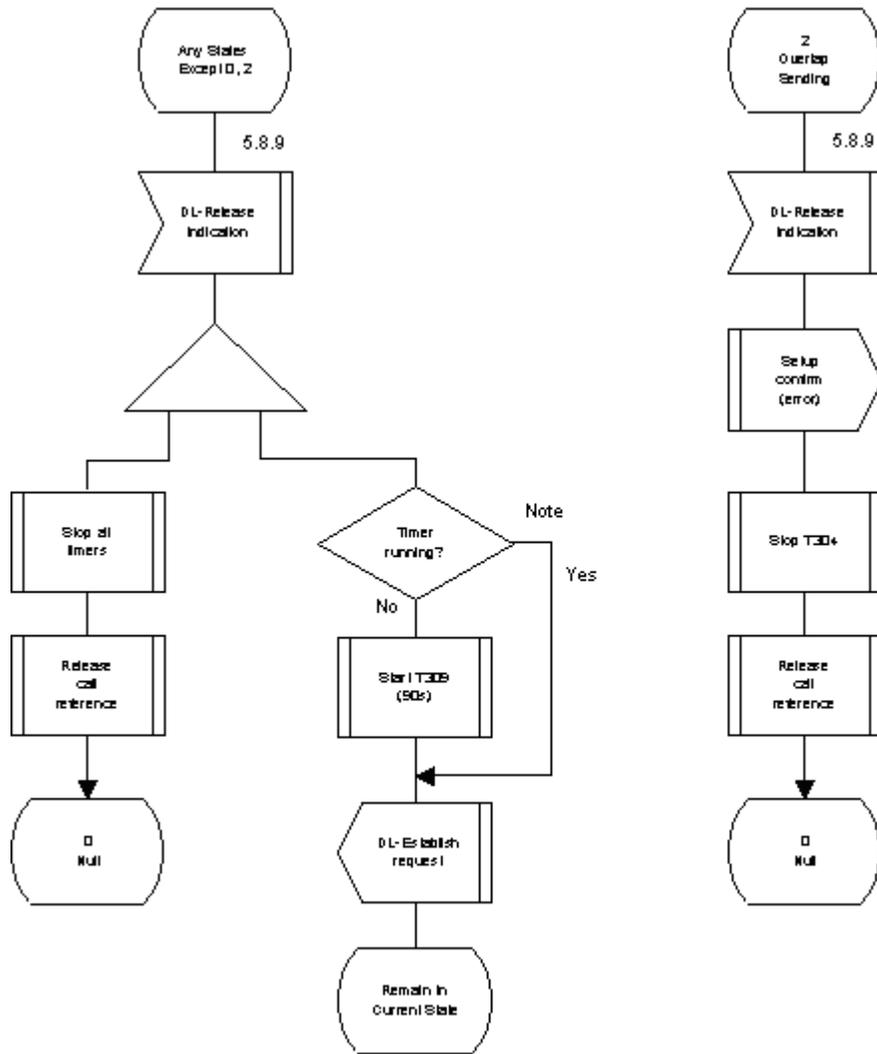


NOTES

1 The relevant states are N1, N3-N4, N6-N12, N19.

2 At the reception of this primitive, the call control process should clear the call by sending a Disconnect request primitive.

Figure A.59 – Detail protocol control (network side) (Part 21)



NOTE -- Anytimers including T309.

Figure A.60 – Detail protocol control (network side) (Part 22)

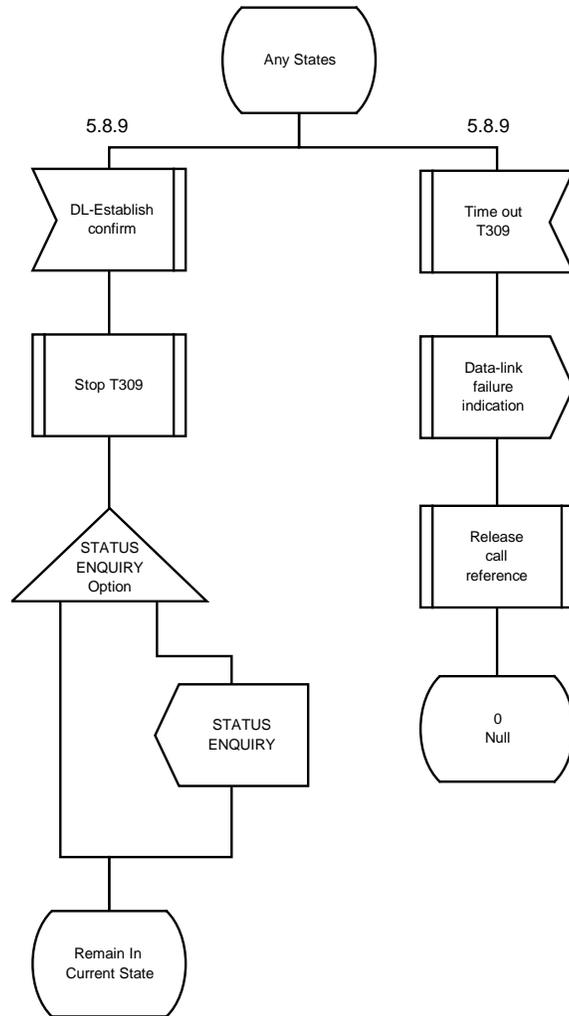


Figure A.61 – Detail protocol control (network side) (Part 23)

Annex B: Compatibility & Address Checking

(normative)

B.1 Introduction

This annex describes the various compatibility and address checks that should be carried out to ensure that the best match of user and network capabilities is achieved on a call within an ISDN.

This annex also covers interworking with existing networks.

Three different processes of compatibility checking shall be performed:

- a) at the user-to-network interface on the calling side (see B.2);
- b) at the network-to-user interface on the called side (see B.3.2); and
- c) user-to-user (see B.3.3).

NOTE – In this context and throughout this annex, the term “called user” is the end point entity that is explicitly addressed. This may be an addressed interworking unit (IWU); see ITU-T I.500 series Recommendations.

For details on the coding of the information required for compatibility checking, see Annex L.

B.2 Calling Side Compatibility Checking

At the calling side, the network shall check that the bearer service requested by the calling user in the Bearer capability information element matches the bearer services provided to that user by the network. If a mismatch is detected, then the network shall reject the call using one of the causes listed in 5.1.5.2.

Network services are described in ITU-T Recommendations I.230 and I.240 as bearer services and tele-services, respectively.

B.3 Called Side Compatibility Checking

In this annex, the word “check” means that the user examines the contents of the specified information element.

B.3.1 Checking of Addressing Information

If an incoming SETUP message is offered with addressing information (i.e., subaddress or the appropriate part of the called party number [e.g., for DDI]), the following actions will occur:

- a) if a number (e.g., for DDI) or subaddress is assigned to a user, then the information in a Called party number or Called party subaddress information element of the incoming call shall be checked by the user against the corresponding part of the number assigned to the user (e.g., for DDI) or the user’s own subaddress. In the case of a mismatch, the user shall ignore the call (See Note 3). In the case of a match, the compatibility checking described in B.3.2 through B.3.3 will follow;

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- b) if a user has no number or subaddress, then the Called party number and Called party subaddress information elements shall be ignored. The compatibility checking described in B.3.2 and B.3.3 will follow.

NOTES

- 1 According to the user's requirements, compatibility checking can be performed in various ways from the viewpoint of execution order and information to be checked; e.g., first number or subaddress and then compatibility or vice versa.
- 2 If an incoming call, offered with addressing information, is always to be awarded to the addressed user, then all users connected to the same passive bus should have a DDI-number or subaddress.
- 3 Some existing implementations conforming to ATIS-1000607 may reject the call.

B.3.2 Network-to-User Compatibility Checking

When the network is providing a bearer service at the called side, the user shall check that the bearer service offered by the network in the Bearer capability information element matches the bearer services that the user is able to support. If a mismatch is detected, then the user shall either ignore the offered call or reject the offered call using cause 88 "incompatible destination" (see 5.2.2).

B.3.3 User-to-User Compatibility Checking

The called side terminal equipment shall check that the content of the Low layer compatibility information element is compatible with the functions it supports.

The Low layer compatibility information element (if available) shall be used to check compatibility of low layers (e.g., from layer 1 to layer 3, if layered according to the OSI model).

NOTE – The Bearer capability information element is also checked (see B.3.2). Therefore, if any conflict from duplication of information in the bearer capability and the Low layer compatibility information elements is detected, this conflict shall be resolved according to Annex L (e.g., the conflicting information in the Low layer compatibility information element shall be ignored).

If the Low layer compatibility information element is not included in an incoming SETUP message, the Bearer capability information element shall be used to check the compatibility of low layers.

The called terminal equipment may check the High layer compatibility information element (if present) as part of user-to-user compatibility checking procedures, even if the network only supports bearer services.

NOTE – Reliance on the High layer compatibility information element should be avoided; however, the High layer compatibility information element is required for international operation and ISDN telematic services.

If a mismatch is detected in checking any of the information elements above, then the terminal equipment shall either ignore or reject the offered call using cause 88 "incompatible destination."

With regard to the presence or absence of the High layer compatibility and Low layer compatibility information elements, two cases arise:

- a) Compatibility assured with the available description of the call:

This is when all terminal equipment implements (i.e., understands the contents of) the High layer compatibility and Low layer compatibility information elements. Thus, based on the High layer compatibility and Low layer compatibility information element encoding, equipment is capable of accepting a call for which it has the requested functionality.

- b) Compatibility not assured with the available description of the call:

This is when all or some of the terminal equipment do not recognize (i.e., ignore) either the High layer compatibility or Low layer compatibility information elements. Without careful configuration or administration at the user installation, there is a danger that terminal equipment with incorrect functionality will accept the call.

Therefore, in order to assure compatibility with incoming calls, it is recommended that the terminal equipment check the Low layer compatibility information element.

NOTE – Some terminal equipment, upon bilateral agreement with other users or in accordance with other standards (e.g., ITU-T Recommendation X.213), may employ the User-user information element for additional compatibility checking. Such terminal equipment shall check the User-user information element in a manner identical to that described here for the High layer compatibility information element “compatibility assured” case.

B.3.3.1 User-to-User Compatibility Checking & Bearer Service Selection

If the called side terminal does not support the semantics of bearer service selection, it will respond as if the fallback bearer capability were the only offered bearer capability in applying B.3.3.

If the called side terminal does support the semantics of bearer service selection, but it is only able to accept the call using one of the bearer capabilities (either the fallback bearer capability or the preferred bearer capability), then it shall respond as if that bearer capability were the only offered bearer capability in applying B.3.3.

If the called side terminal does support the semantics of the bearer service selection, and if it is able to accept the call using either of the bearer capabilities (the fallback bearer capability or the preferred bearer capability), then it shall follow B.3.3 in separately evaluating its compatibility with the offered call for each of the offered bearer capabilities (the fallback bearer capability and the preferred bearer capability).

If both evaluations show the terminal to be incompatible with the call, it shall follow B.3.3 procedures for incompatible calls.

If the evaluations show the terminal to be compatible with the call for one of the two offered bearer capabilities (either the fallback bearer capability or the preferred bearer capability), it shall answer the call using that bearer capability.

B.3.4 User Action Figures

The following figures show the action that shall be carried out as a result of compatibility checking with the calling user’s request for a bearer service or teleservice.

BC mandatory info element	Point-to-point data link (Note 1)	Broadcast data link (Note 1)	
Compatible	Proceed	Proceed	
Incompatible	Reject (5.2.5.1)	Ignore (5.2.5.1a) (Note 4)	Reject (5.2.5.1b) (Note 4)

Figure B.1 – Bearer capability compatibility checking

LLC/HLC compatibility assured	Point-to-point data link (Note 1)		Broadcast data link (Note 1)	
Compatible	Accept		Accept	
Incompatible	Reject (5.2.5.1)	Note 3	Reject (5.2.5.1)	Note 3

Figure B.2 – Low layer and high layer compatibility checking; compatibility assured

NOTES

- 1 For broadcast data-link terminal equipment that is explicitly addressed using subaddressing, or a number (e.g., DDI), the point-to-point column in the above figures shall be used.
- 2 Some terminal equipment on this interface may understand the High layer compatibility or Low layer compatibility information element and will reject the call if incompatible.
- 3 Attempt low layer compatibility negotiation (see Annex M).
- 4 When terminal equipment on a broadcast data link is incompatible, an option of “ignore or reject” is permitted; see 5.2.2.

B.4 Interworking with Existing Networks

Limitations in network or distant user signaling (e.g., in the case of an incoming call from a PSTN or a call from an analogue terminal) may restrict the information available to the called user in the incoming SETUP message. A called user should accept limited compatibility checking (e.g., without the High layer compatibility information element) if a call is routed from an existing network that does not support High layer compatibility information element transfer.

In cases where the network cannot provide all incoming call information, or where the network is not aware of the existence or absence of some service information (such as a compatibility information), the incoming SETUP message includes a Progress indicator information element, containing progress description value 1 “Call is not end-to-end ISDN; further call progress information may be available in band” or value 3 “Origination address is non-ISDN” (see Annex I).

The terminal equipment receiving a SETUP message with a Progress indicator information element shall modify its compatibility checking; the terminal equipment should regard the compatibility as successful if it is compatible with the included information, which at a minimum, will be the Bearer capability information element. Terminal equipment expecting information in addition to the Bearer capability information element in a full ISDN environment need not reject the call if such information is absent but a Progress indicator information element is included.

Annex C: Transit Network Selection

(normative)

C.1 Introduction

This annex describes optional processing of the Transit network selection information element.

Transit network selection procedures are needed in this standard to meet certain regulatory requirements. They may also be used for other reasons.

C.2 Selection not Supported

Some networks may not support transit network selection. In this case, when a Transit network selection information element is received, that information element is processed according to the rules for unimplemented non-mandatory information elements (see 5.8.7.1).

C.3 Selection Supported

When transit network selection is supported, the user identifies the selected transit network(s) in the SETUP message. One Transit network selection information element is used to convey a single network identification.

The user may specify more than one transit network. Each identification is placed in a separate information element. The call would then be routed through the specified transit networks in the order listed in the SETUP message. For example, a user lists networks A and B, in that order, in two Transit network selection information elements within a SETUP message. The call is first routed to network A (either directly or indirectly), and then to network B (either directly or indirectly), before being delivered.

NOTE – The definition of necessary mechanisms within Signalling System Number 7 (SS7) to support selection of more than one transit network is for further study.

As the call is delivered to each selected network, the corresponding transit selection may be stripped from the call establishment signaling, in accordance with the relevant inter-network signaling arrangement. The Transit network selection information element(s) is (are) not delivered to the destination users.

No more than four Transit network selection information elements may be used in a single SETUP message. Alternatively, transit network selection information may be sent from the user to the network in the Keypad facility information element. In this case, the called party number is preceded by the prefix '10XXX', where XXX is the Carrier Identification Code, or by the prefix 101XXXX, where XXXX is the Carrier Identification Code. Neither method of carrying transit network selection is preferred, and networks that support transit network selection shall support the use of the Transit network selection information element, and, if sending of address information using the Keypad facility information element is provided, shall also support the 10XXX and 101XXXX method.

¹⁾ At the completion of Carrier Identification Code permissive period as determined by the FCC, only four-digit Carrier Identification Codes (XXXX) and seven-digit Carrier Access Codes (101XXXX) shall be used to the exclusion of three-digit Carrier Identification Codes (XXX) and five-digit Carrier Access Codes (10XXX).

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When a network cannot route the call because the route is busy, the network shall initiate call clearing in accordance with 5.3 with cause 34 “no circuit or channel available.”

If a network does not recognize the specified transit network, the network shall initiate call clearing in accordance with 5.3, with cause 2 “no route to specified transit network.” The diagnostic field shall contain a copy of the contents of the Transit network selection information element identifying the unreachable network.

A network may screen all remaining Transit network selection information elements to:

- a) avoid routing loop;
- b) ensure an appropriate business relationship exists between selected networks; or
- c) ensure compliance with national and local regulations.

If the transit network selection is of an incorrect format, or fails to meet criteria (a), (b), or (c), the network shall initiate call clearing in accordance with 5.3, with cause 91 “invalid transit network selection.”

In addition, some networks may, by bilateral arrangement, provide screening to the transit network (e.g., to ensure that a business relationship exists between the transit network and the user). Should such screening fail, the network shall initiate call clearing in accordance with 5.3, with cause 91 “invalid transit network selection.”

When a user includes the Transit network selection information element, pre-subscribed default transit network selection information (if any) is overridden.

Annex D: Extensions for Symmetric Call Operation

(normative)

D.1 Introduction

This annex describes optional extensions for symmetric call operation.

D.2 Additional Message Handling

In symmetric applications, the SETUP message will contain a Channel identification information element indicating a particular B-channel to be used for the call. A point-to-point data link shall be used to carry the SETUP message.

The procedures described in clause 5 for the user side should normally be followed. Where additional procedures are required, they are detailed below.

D.2.1 B-Channel Selection – Symmetric Interface

Only B-channels ...

- a) The SETUP message will indicate one of the following:
 - 1) channel is indicated, no acceptable alternative; or
 - 2) channel is indicated, any alternative is acceptable.
- b) In cases (1) and (2), if the indicated channel is acceptable and available, the recipient of the SETUP message reserves it for the call. In case (2), if the recipient of the SETUP message cannot grant the indicated channel, it reserves any other available B-channel associated with the D-channel.
- c) If the SETUP message included all information required to establish the call, the recipient of the SETUP message indicates the selected B-channel in a CALL PROCEEDING message transferred across the interface and enters the incoming Call Proceeding state.
- d) If the SETUP message did not include all information required to establish the call, a B-channel is indicated in a SETUP ACKNOWLEDGE message sent across the interface. The additional call establishment information, if any, is sent in one or more INFORMATION messages transferred across the interface in the same direction as the SETUP message. When all call establishment information is received, a CALL PROCEEDING, ALERTING, or CONNECT message, as appropriate, is transferred across the interface.
- e) In case (1) if the indicated B-channel is not available, or in case (2) if no B-channel is available, a RELEASE COMPLETE message with a cause 44 "requested circuit or channel not available" or 34 "no circuit or channel available" respectively, is returned to the initiator of the call. The sender of this message remains in the Null state.
- f) If the channel indicated in the CALL PROCEEDING or SETUP ACKNOWLEDGE message is unacceptable to the initiator of the call, it clears the call in accordance with 5.3.

D.2.2 Call Confirmation

Upon receipt of a SETUP message, the equipment enters the Call Present state. Valid responses to the SETUP message are a SETUP ACKNOWLEDGE, an ALERTING, a CALL PROCEEDING, a CONNECT, or a RELEASE COMPLETE message.

If the indicated channel is acceptable to the initiator of the call, the initiator shall connect to the indicated B-channel.

D.2.3 Clearing by the Called User Employing User Provided Tones & Announcements

Clearing by the called user employing user provided tones and announcements is not included in this standard.

D.2.4 Active Indication

Upon receipt of a CONNECT message, the initiator of the call shall respond with a CONNECT ACKNOWLEDGE message and enter the Active state.

D.3 Timers for Call Establishment

User end points implement the network side timers T301, T303, and T310 along with the corresponding network side procedures for actions taken upon expiration of these timers. See 9.2 for the call establishment timers for symmetrical operation.

D.4 Call Collisions

In symmetric arrangements, call collisions can occur when both sides simultaneously transfer a SETUP message indicating the same channel. In the absence of administrative procedures for assignment of channels to each side of the interface, the following procedure is employed.

First, one side of the interface will be designated the “network” and the other side of the interface will be designated the “user.” Second, for the three possible scenarios where the same channel is indicated by combinations of preferred and exclusive from the user and network sides, the following procedure is used:

- a) *“network” preferred, “user” preferred:* The “network” preferred channel is awarded and an alternate channel is indicated in the first response to the “user” SETUP message.
- b) *“network” exclusive, “user” exclusive:* The “network” exclusive channel is awarded and the “user” SETUP message is cleared with a RELEASE COMPLETE message with cause 34 “no circuit or channel available.”
- c) *“network” preferred, “user” exclusive or “network” exclusive, “user” preferred:* The side of the interface with an exclusive indicator in a SETUP message is awarded the channel and an alternate channel is indicated in the first response to the side using a preferred indicator in the SETUP message.

Channel identification is allowed in both directions for ALERTING and CONNECT.

Annex E: Network-Specific Facility Selection

(normative)

E.1 Introduction

This annex describes optional processing of the Network-specific facilities information element. The purpose of this information element is to indicate which network facilities are being invoked.

E.2 Default Provider

When the length of the network identification field is set to zero in the Network-specific facilities information element, then the services identified in this information element are to be provided by the network side of the interface receiving the information element (default provided). If the Network-specific facilities information element is recognized but the network facilities are not understood, then this information element is processed according to rules for non-mandatory information element content error (see 5.8.7.1).

E.3 Routing not Supported

Some networks may not support the routing to the remote network of the contents of the Network-specific facilities information element. In this case, when a Network-specific facilities information element is received, that information element is processed according to the rules for unimplemented non-mandatory information elements (see 5.8.7.1).

E.4 Routing Supported

When Network-specific facility information element routing is supported, the user identifies the network provider in this information element in the SETUP message. One Network-specific facility information element is used to identify a network provider.

The user may specify more than one network provider by repeating the Network-specific facilities information element. Each identification is placed in a separate information element. The information is routed to the indicated network provider as long as the call is also handled by the network provider (see Annex C, Transit network selection). For example, if the user lists network providers A and B in separate Network-specific facilities information elements in a call control message, there must be corresponding Transit network selection information elements in the SETUP message identifying those networks (or default call routing via A and B that was established prior to call establishment).

As the signaling messages containing Network-specific facilities information elements are delivered to the indicated remote network, they may be stripped from the signaling messages, in accordance with the relevant inter-networking signaling arrangement. The Network-specific facilities information elements may be delivered to the identified user.

No more than four Network-specific facilities information elements may be used in a SETUP message. When the information element is repeated, the order of presentation of the elements in a message is not significant. Further, there does not have to be a one-to-one correspondence between Network-specific facilities information elements and Transit network selection information elements.

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If a network cannot pass the information to the indicated network provider, either due to:

- the network indicated is not part of the call path; or
- no mechanism exists for passing the information to identified network;

then the network shall initiate call clearing in accordance with 5.3, with cause 2 "no route to specified transit network." The diagnostic field may optionally contain a copy of the first 5 octets of the Network-specific facilities information element.

When a user includes the Network-specific facilities information element in the SETUP message, pre-subscribed default service treatment (if any) is overridden.

Annex F: D-Channel Backup Procedures for Non-Facility Associated Signaling

(normative)

F.1 Introduction

The procedure defined in this annex can be used when non-facility-associated signaling is applied to multiple primary rate access arrangements. This feature can be provided on a subscription basis and is network dependent. These procedures are optional and may not be supported by all equipment.

In facility-associated signaling, the D-channel signaling entity can only assign calls to channels on the interface containing the D-channel. The ability of the D-channel signaling entity to assign calls to channels on more than one interface (including the one containing the D-channel) is called non-facility associated signaling. Figure F.1 is an example of facility associated signaling used on each of the three interfaces between a user (e.g., an NT2) and a Network. Replacing facility associated signaling with non-facility associated signaling on these interfaces results in the example shown in Figure F.2.

When non-facility-associated signaling is employed, the reliability of the signaling performance for the ISDN interfaces controlled by the D-channel may be unacceptable. To improve the reliability, a D-channel backup procedure employing a standby D-channel is necessary (see Figure F.3).

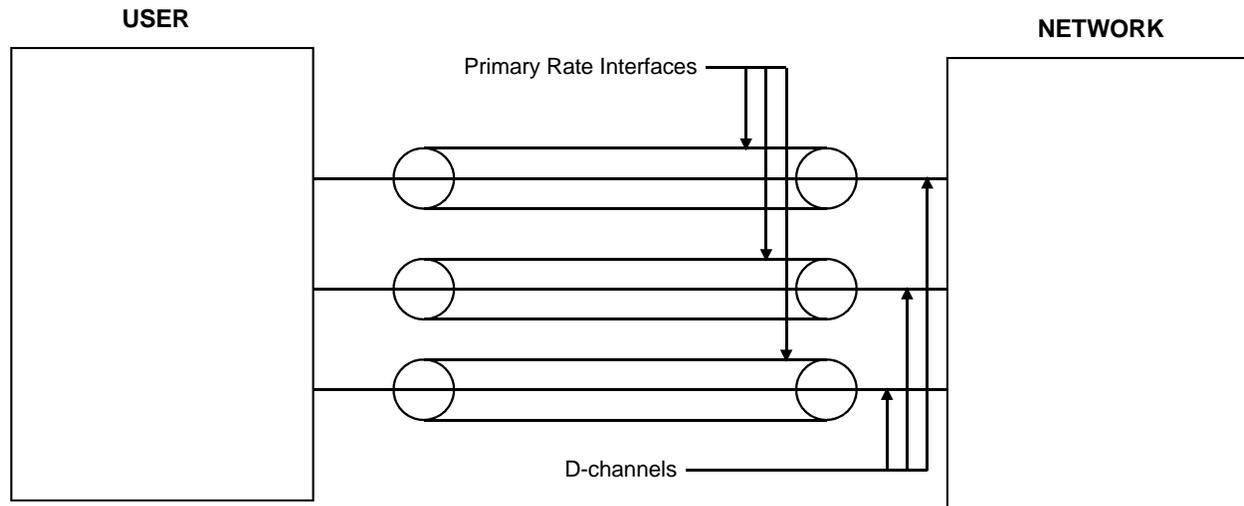


Figure F.1 – Example of associated signaling on each of three primary rate interfaces

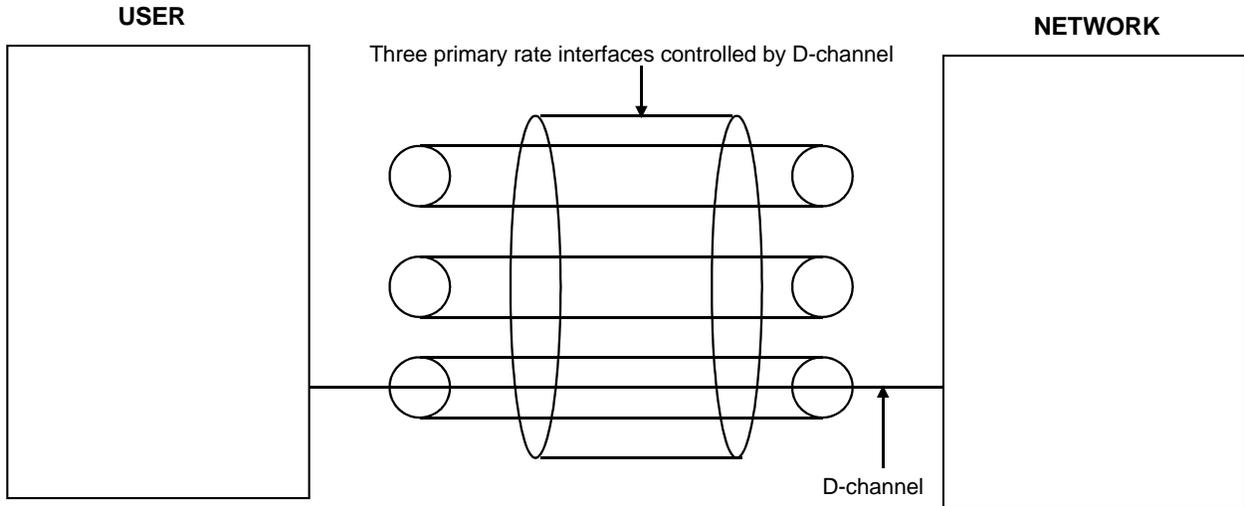


Figure F.2 – Example of non-facility-associated signaling controlling three primary rate interfaces

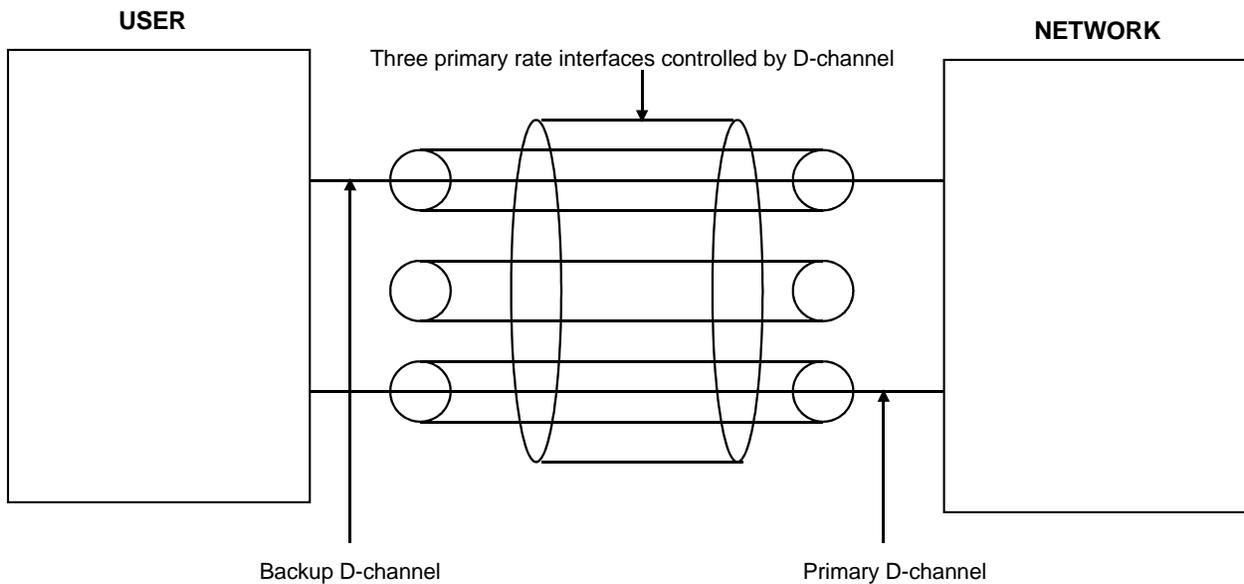


Figure F.3 – Example of non-facility-associated signaling with backup D-channel controlling three primary rate interfaces

F.2 D-Channel Backup Procedures

F.2.1 Role of Each D-Channel

The designated primary D-channel (always labeled D1) is always present on one DS1 facility. On a different DS1 facility, a backup D-channel (labeled D2) is present. Figure F.3 shows the addition of a secondary (i.e., backup) D-channel to the arrangement shown in Figure F.2.

While one of the D-channels (D1 or D2) is the active D-channel, it is used to send signaling packets across the user-network interface for multiple primary rate interfaces, including the primary rate interface containing the standby D-channel.

While one of the D-channels (D1 or D2) serves as the standby D-channel, it is in a stand-by role and is active at layer 2 only (see Figure F.4). All SAPI groups on the primary and standby channel supported by the network and user (e.g., 0 and 63) can be active at layer 2. No layer 3 signaling packets are sent on logical link 0,0 of the standby channel while the active D-channel conveys signaling packets. While the standby is in a backup role, layer 3 messages received on it shall be ignored. Following normal layer 2 procedures, at periodic intervals determined by the appropriate layer 2 timer associated with SAPI 0, a link audit frame will be sent on the point-to-point signaling link (0,0) of the standby D-channel.

Since, at any given time, one of the D-channels (D1 or D2) is in a standby role, load sharing between D1 and D2 is not possible. Neither D1 nor D2 can serve as a B-channel while designated as a backup D-channel. Any layer 3 messages received on the standby D-channel shall be ignored. Lastly, the pair D1 and D2 provide signaling for a pre-defined set of B-channels and cannot backup any other D-channel(s) on a different interface.

At any point in time, only one of the D-channels, D1 or D2, will convey layer 3 B-channel signaling information. At the point in time when a transition occurs, most stable calls, i.e., those calls that are in the Active state (Call State 10) would be preserved. Some portion of stable calls may be lost.

F.2.1.1 Provisioning

In order to avoid unnecessary signaling outages, a primary D-channel, which is always labeled as D1, is designated at pre-service provisioning time and entered into a data base by both sides of the interface.

When both D-channels are out-of-service, the designated primary (D1) has priority as the channel to carry call-control signaling. If D1 cannot be established, then D2 is chosen.

F.3 Manual Switch-Over

The procedure to manually switch-over involves logically disconnecting layer 2 of the active D-channel, following normal layer 2 procedures for placing a link into the TEI-assigned state. Next, the two sides establish the standby D-channel as the channel for carrying call-control signaling.

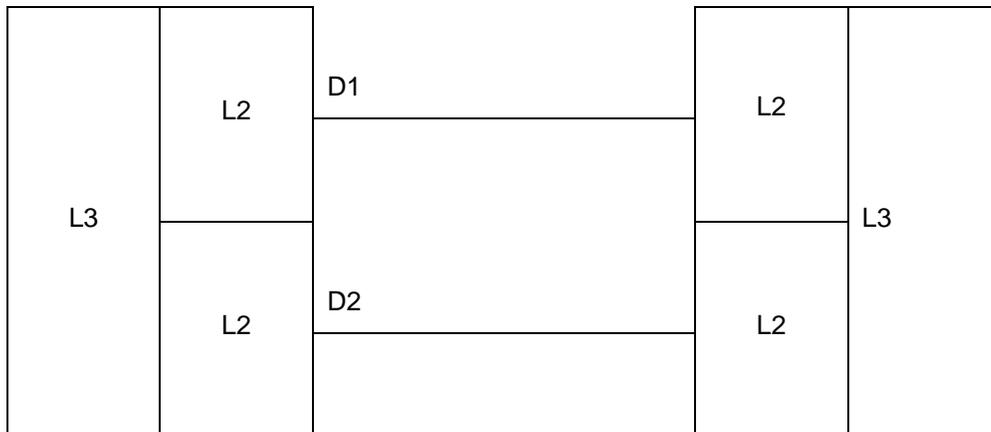


Figure F.4 – Architecture (conceptual)

F.3.1 Protocol Description

F.3.1.1 D-Channel States

For the purposes of the D-channel Backup procedure, the following states at layer 3 apply to either D1 or D2. Although six states are identified, only the first state is reported. (The remainder are needed to model the switchover procedure.)

- 1) In Service (IS): A D-channel is termed In Service when it is in the multiple-frame-established state at layer 2 and carrying normal call-control signaling at layer 3. This state is also referred to as Active.
- 2) Standby (STBY): A D-channel is termed Standby when it is in the multiple-frame-established state at layer 2, but not carrying any layer 3 call-control messages on logical link 0,0.
- 3) Out-Of-Service (OOS): A D-channel is termed Out-Of-Service when it is in the TEI-assigned state at layer 2, but periodically requested by layer 3 to attempt to establish the link. A D-channel will remain in the OOS state until any one of the following occurs:
 - a) After the transmission of a SABME, a UA (Unnumbered Acknowledgment) is received by layer 2, which will cause the D-channel to be placed in the multiple-frame-established state at layer 2. If, instead, a DM (Disconnected Mode) is received by layer 2, then the D-channel will remain in the OOS state, with layer 3 periodically requesting layer 2 to establish the link; or
 - b) A non-signaling/external control is used to place the D-channel in the MOOS state.
- 4) Maintenance Busy (MB): A D-channel is termed Maintenance Busy (MB) when it is not in the multiple-frame-established state (e.g., TEI-assigned state) at layer 2. This state is entered automatically when an active (IS) D-channel is declared failed. While in the MB state, receipt of a SABME by layer 2 shall cause the receiver to take one of the following three actions:
 - a) respond to the SABME with a DM;
 - b) ignore the SABME; or
 - c) respond to the SABME with a UA that is immediately followed by a DISC.

Action (a) is the preferred action.

A D-channel that is placed in a MB state may be placed in the OOS state without non-signaling/external control.

- 5) Manual Out-Of-Service (MOOS): A D-channel is termed Manual Out-Of-Service (MOOS) when non-signaling/external control has caused it to be placed in the TEI-assigned state at layer 2. While in the MOOS state, receipt of a SABME by layer shall cause the receiver to take one of the following three actions:
 - a) respond to the SABME with a DM;
 - b) ignore the SABME; or
 - c) respond to the SABME with a UA that is immediately followed by a DISC.

Action (a) is the preferred action.

Non-signaling/external control is required to retrieve a D-channel from the MOOS state.

- 6) WAIT: A D-channel is termed as being in a WAIT state when an attempt has been made by one side of the interface to establish layer 3 peer communication as part of the process of going to the IS state. This state is transitional in nature.

F.3.2 Difference Between IS & STDBY D-Channels

During normal operation, the IS D-channel carries all call-control signaling at layer 3. A layer 3 call-control message must be acknowledged at layer 2 (within timer T200 [see ATIS-1000602]) and may require a layer 3 response within a specified period of time (e.g., a SETUP message which requires a response before the expiry of Timer T303 [see clause 9]). The STBY D-channel carries only layer 2 audit messages (see Figure F.5), based on Timer T203 [see ATIS-1000602]. Please see Figure F.6 for a graphical depiction of normal operation on D1 and D2.

F.3.3 D-Channel Backup Rules

The following rules are provided as a high level description of the procedure without the need for detailed protocol descriptions.

As a method of abbreviation, the states of D1 and D2 are represented as (D1 state, D2 state). For example, while D1 is active (IS) and D2 is standby (STBY), the notation used is (IS, STBY).

For the purposes of this subclause on D-channel backup rules, initially D1 is IS and D2 is STBY. However, the procedure is entirely symmetrical; anything written about D1 can apply equally to D2, and vice versa.

- a) To Switch-over to D2 (i.e., D1 was IS)
 - 1) If D1 is not failed, send a layer 2 DISC on D1 and wait for a UA or time-out;
 - 2) Place D1 in a MB state, start Timer T321 (see clause 9). The states of D1 and D2 become (MB, STBY);
 - 3) As an optional procedure, re-establish the link on D2 by sending a SABME and expect to receive a UA. If you cannot establish D2 at layer 2, put both D1 and D2 in the OOS state, referred to as (OOS,OOS):
 - 4) If the layer 2 of D2 has been re-established or is deemed to be already in the multiple-frame-established state, send a Network Management (NM) message on D2, with an indication that D2=IS (abbreviated as NM(ind, D2=IS)). The acknowledgment of a NM(ind, D2=IS) is a NM(resp, D2=IS);
 - 5) If Timer T321 expires, then go to (OOS,OOS);
 - 6) If the far end responds on D2 with a NM(resp, D2=IS) or NM(ind, D2=IS), then go to (OOS,IS). Receipt of any other message on D2 shall be ignored. The NM(ind, D2=IS) message should be retransmitted several times while Timer T321 is running. A suggested retry interval is 5 seconds. Timer T321 shall be stopped when either a NM(resp, D2=IS) or NM(ind, D2=IS) message is received from the far end;
 - 7) Once the (OOS,IS) state is reached, layer 3 shall send a DL-ESTABLISH request to layer 2 in order to reestablish multiple frame operation on D1. Upon receipt of this primitive, layer 2 shall send a SABME on D1 and wait for a UA response as described in F.3.1.1, item 3.a. When D1 is reestablished in multiple frame operation at layer 2, D1 and D2 shall be placed in the (STBY,IS) state. This completes the switchover from the D1 channel to the D2 channel.
- b) If the states are (OOS,OOS), start by trying to establish D1 first, as the designated primary D-channel. The designated primary is identified at service provisioning time and entered into a data

base by both sides. In practice, this means that if D2 comes up at layer 2 followed by D1 coming up, pick D1 as the channel to become IS, even if a NM(ind, D2=IS) has already been sent on D2.

- c) Deadlock occurs when sides A and B cannot agree on the D-channel to be activated for carrying call-control signaling. Since this condition is undesirable and cannot be resolved by call control or network management messages, the state pairs (OOS,MB) or (MB,OOS) should not be entered. These pairs, which are symmetric, are especially important to avoid since no call-control signaling can occur while one of the D-channels is held in MB and the other is ready, but not yet activated, at layer 2. Consequently, transitions to these state pairs are not valid for D-channel Backup.

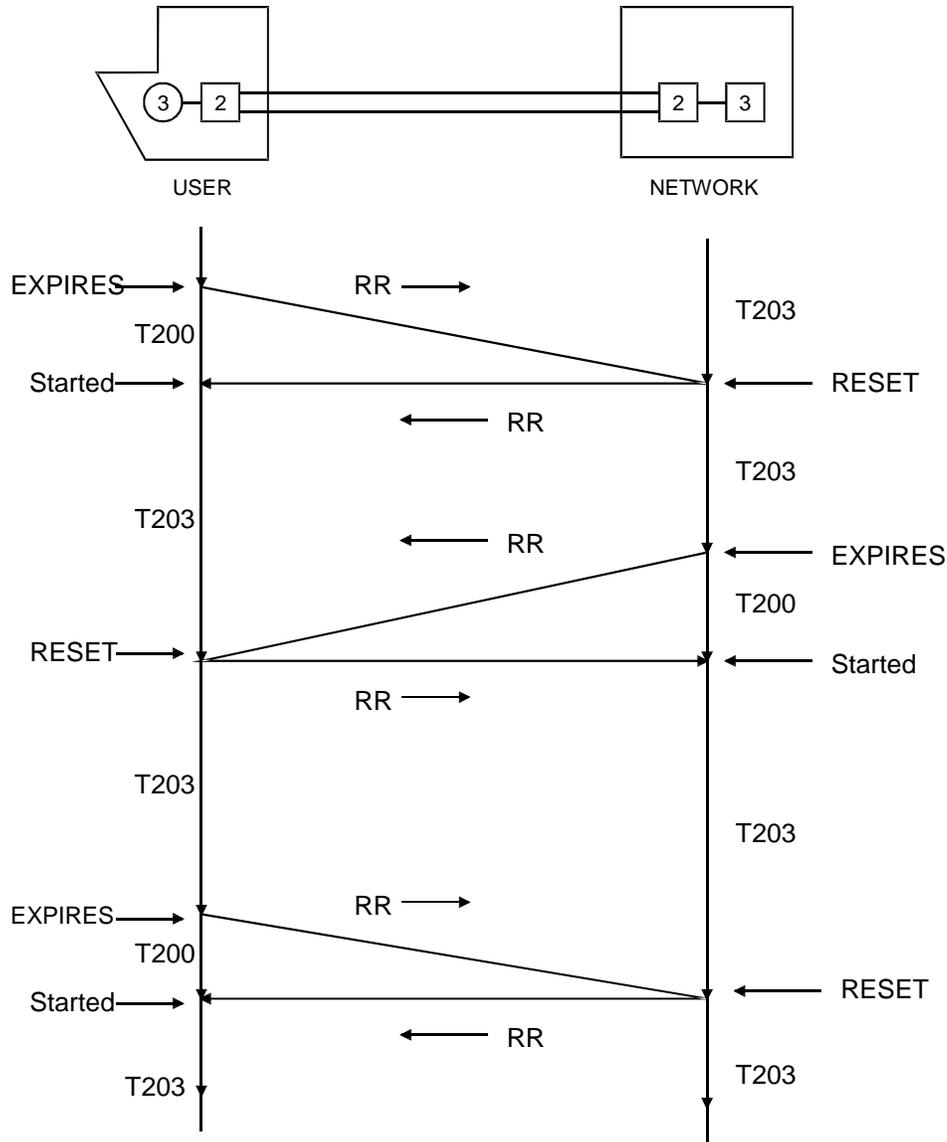


Figure F.5 – Connection verification procedure on D2

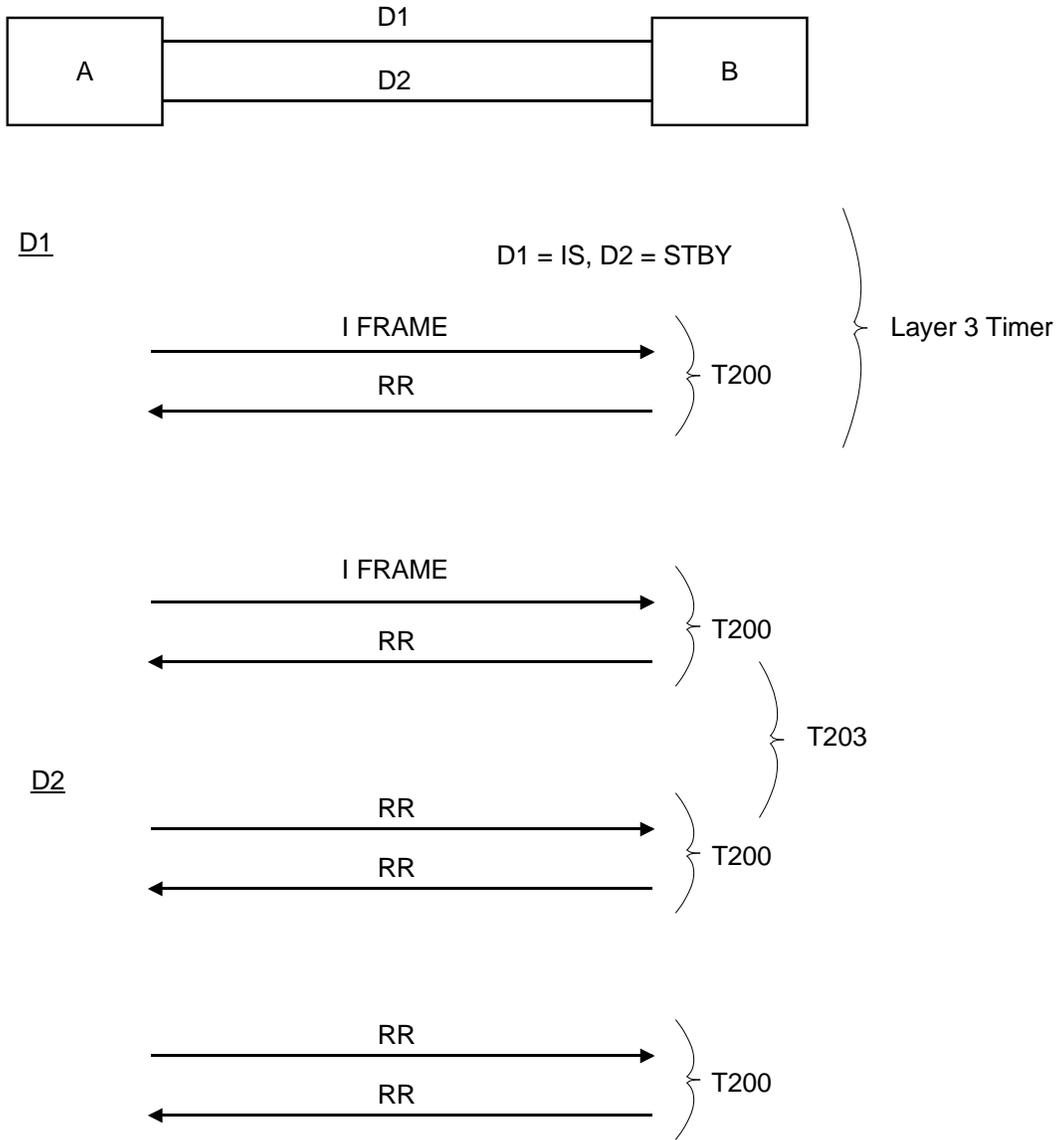


Figure F.6 – D-channel backup - normal operation

F.4 Detailed D-channel Backup Procedure

This subclause contains a detailed description of the protocol required to implement D-channel Backup. Figures F.12 through F.21 at the end of this annex show the SDLs that augment the text in this subclause.

Initially D1 is IS and D2 is STBY. The procedure is entirely symmetrical; anything written about D1 can apply equally to D2, and vice versa.

F.4.1 Switch-Over Procedure

F.4.1.1 Declaring D1 as Failed

During normal operation, call-control signaling on D1 follows procedures defined in ATIS-1000602 and this standard for information transfer in multiple frame operation. Timer T200 governs the response to I-Frames by either end. If a response (either a layer 3 call-control message or a valid layer 2 message) is not received before T200 expires, layer 2 will retransmit the message N200 [see ATIS-1000602] more times. Failing to get a response, layer 2 shall issue an MDL-ERROR indication to the connection management entity. In this scenario, the active link will be declared as failed within

- a) $2x(T200+(T200xN200))$ (e.g., for layer 2 default values, this is 8 seconds) (see Figure F.7a), during normal control signaling interaction, and
- b) a period equal to the value of T203 plus $2x(T200+(T200xN200))$ (see Figure F.7b), during idle call-control signaling traffic times.

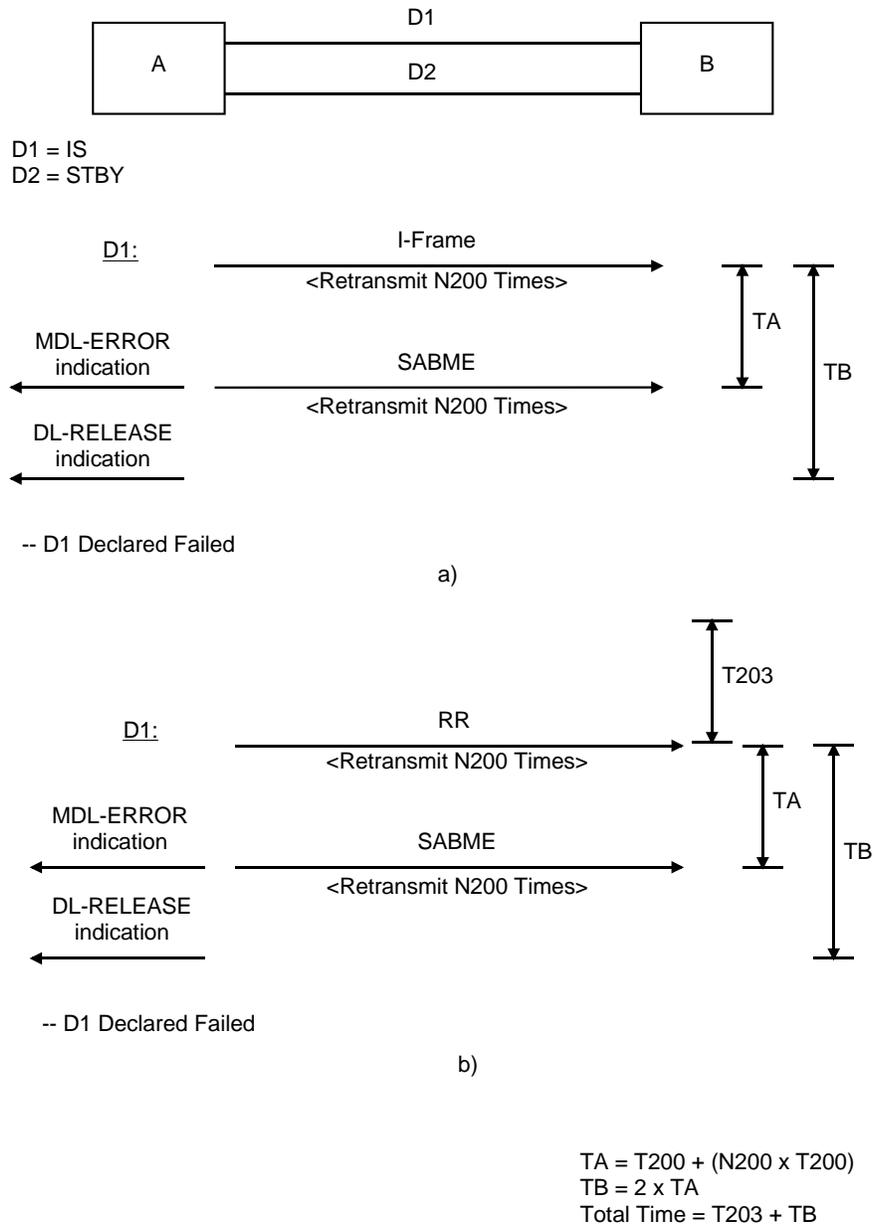


Figure F.7 – Declaring a D-channel as failed

However, at any time during normal operation, D1 will be declared as failed when layer 2 receives a DISC that requires a response of a UA. When an unsolicited DM is received in multiple frame establishment operation on an active In-Service D-channel, the receiver may choose to either declare the D-channel failed or not. If the choice is to declare the D-channel failed, then layer 2 shall enter the TEI-assigned state on this failed D-channel and the switchover of D-channel shall occur as described in F.3.3 item 1-b. If the receiver of the unsolicited DM does not declare the D-channel failed, then either:

- a) the unsolicited DM shall be ignored (regardless of the state of the F bit); or
- b) if the unsolicited DM has a value of 1 for the F bit, the receiver may re-initiate multiple frame operation following normal layer 2 procedures (i.e., sending a SABME).

Failure of D1 is indicated to layer 3 through the primitive, DL-RELEASE indication, from the data link layer (i.e., layer 2); D1 is now in the TEI-assigned state at layer 2. Upon receipt of this primitive, layer 3 shall place D1 in the maintenance busy condition (MB) and initiate the procedure for putting D2 in the IS state.

F.4.1.1.1 Initiating Switch-Over to D2

If D2 is STBY at layer 3, and D1 has been declared failed and placed in the MB state, layer 3 shall start Timer T321. Layer 3 may then execute the procedure of re-initializing layer 2 on D2 by issuing a DL-ESTABLISH request to layer 2. In this case, if layer 2 is successful in re-establishing the link, it shall communicate this event to layer 3 through the DL-ESTABLISH confirm primitive (see Figures F.8 and F.9).

When D2 is deemed to be in the multiple-frame-established state, layer 3 shall then follow procedures to establish D2 as IS through layer 3 peer communication, as outlined below in F.4.1.2.

If D2 is in the OOS state when D1 is declared failed, layer 3 shall place D1 in the OOS state as well. D1 and D2 will now be in the (OOS,OOS) state and the procedure for initialization shall begin as outlined in F.4.2.

If D2 is in the MOOS state, layer 2 shall issue a management alarm indicating that any tests being performed should be terminated. At that point, D1 should be placed in the OOS state by layer 3. Further, D1 and D2 shall stay in the (OOS,MOOS) state until non-signaling/external control places D2 into an OOS state.

Until that time, periodic attempts are made to bring D1 to IS.

F.4.1.1.2 Establishing Layer 3 Call-Control Signaling After Switch-Over

When D2 is deemed to be in the multiple-frame-established state, layer 3 shall issue a Network Management message with the indication that D2=IS -- abbreviated as NM(ind, D2=IS) -- on logical link 0,0. Layer 3 then enters the (MB,WAIT) states for D1 and D2. From (MB,WAIT), one of the following events will occur:

- 1) The MB timer, T321, expires. Layer 3 shall then go to (OOS,OOS) and the procedures for initialization shall then apply, as specified in F.4.2;
- 2) Layer 3 receives either a NM(resp, D2=IS) or NM(ind, D2=IS) message on D2. This event will cause D2 to be placed into the IS state, thus allowing layer 3 call-control signaling to begin. In addition, D1 shall be placed in the OOS state. The state transition in this scenario will be from (MB,WAIT) to (OOS,IS); or

Note - Any received call control signaling messages should be ignored until a Network Management message exchange is successfully completed.

- 3) Layer 3 receives any other message on D2. This event will cause D2 to remain in the WAIT state, and shall be ignored by layer 3. Periodically (e.g., every 5 seconds), layer 3 may retransmit the NM(ind, D2=IS) message on D2.

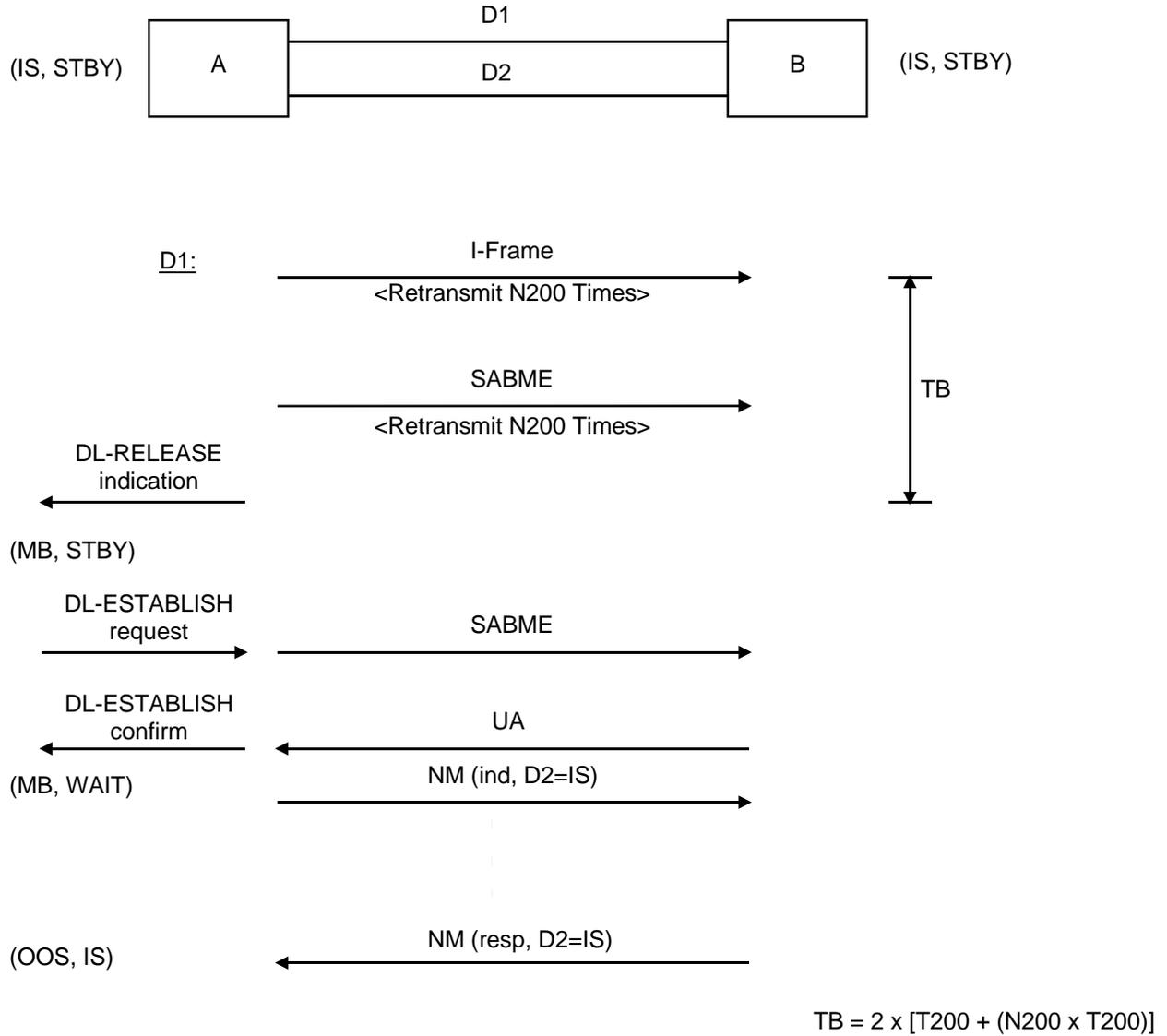


Figure F.8 – Normal switch-over

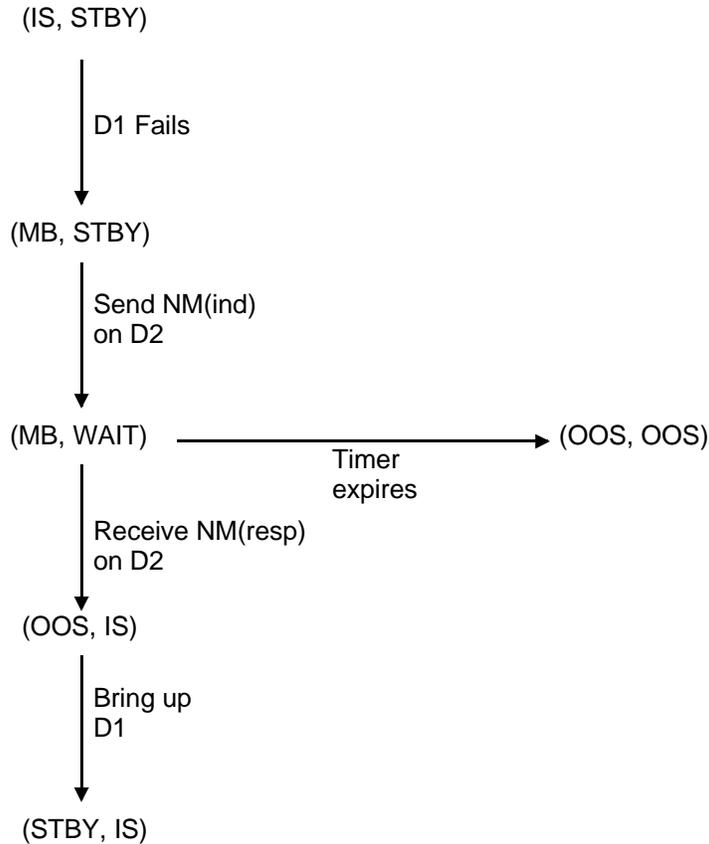


Figure F.9 – State transition for normal switch-over

Whenever one of the D-channels, D1 or D2, enters the IS state, Timer T321 shall be stopped by layer 3.

When a D-channel is declared failed, as described in F.4.1.1, the DL-RELEASE indication primitive informs layer 3, which then initiates the Data Link failure procedures. These procedures are defined in 5.8.9 when D-channel backup is not used. When D-channel backup is applicable, and a DL-RELEASE indication is received for an In Service D-channel, start timer T309 (if not already running), and clear all calls that are not in the active state. As described in F.4.5, when T309 is stopped before expiration, Status Enquiry procedures may be utilized on active calls to verify that they remain in the active state. If T309 runs to expiry, all calls shall be cleared internally. Subsequently, when a D-channel is restored to the IS state, the Restart procedures defined in 5.5 shall be performed.

Once D1 is placed in the STBY state (i.e., layer 2 on D1 goes to the multiple-frame-established state) the D-channels are available for transition again if initiated by a failure of D2, or by a maintenance switch-over request from a peer entity.

F.4.1.2 Manual Switch-Over: Release Procedure of an In Service D-Channel

Release of multiple frame operation on a D-channel is initiated by layer 3 through the DL-RELEASE request primitive to layer 2. The receipt of this primitive by the data link layer shall result in the transmission of a DISC command.

A data link layer receiving a DISC command, while in the multiple-frame-established state, shall transmit a UA over the data link and notify layer 3 through the DL-RELEASE indication primitive. At that point, the TEI-assigned state shall be entered.

The originator of a DISC command may receive either a UA or a DM. In either case, it shall enter the TEI-assigned state and notify layer 3 through the DL-RELEASE confirm primitive.

If the originator of a DISC command does not receive any response within timer T200, it shall retransmit the DISC up to N200 times. Failing to get a response, layer 2 shall enter the TEI-assigned state, notify the connection management entity and layer 3 through the MDL-ERROR indication and DL-RELEASE confirm primitives, respectively.

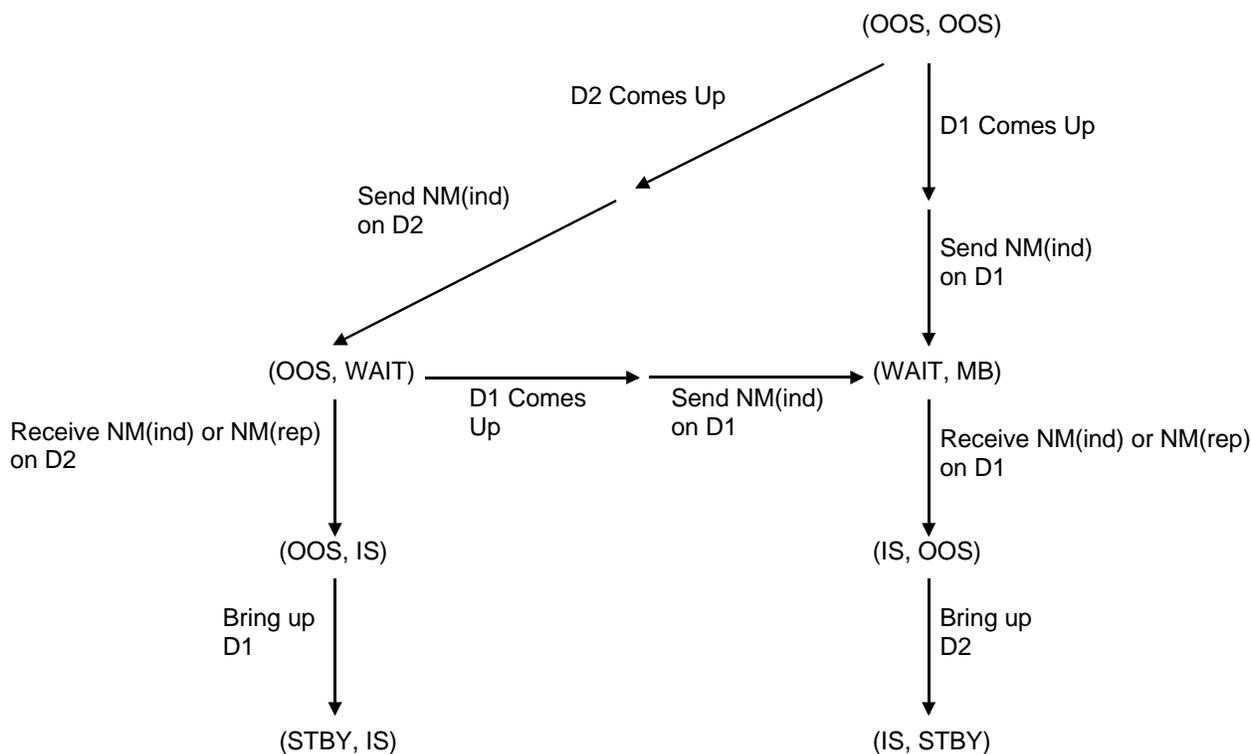


Figure F.10 – Initialization procedure

F.4.2 Initialization

At the time of service turn-up, or after an outage of both D1 and D2 (i.e., (OOS,OOS), both sides shall proceed to bring up D1, the designated primary, first (see Figure F.10). By designating a primary D-channel, D1, the following procedures apply:

- 1) If D1 goes to the multiple-frame-established state at layer 2 before D2, D2 should be placed in the MB state until D1 goes to IS. That is, the states of D1 and D2 will go from (OOS,OOS) to (WAIT,MB) to (IS,OOS);
- 2) If D2 goes to the multiple-frame-established state before D1, D1 is held in the OOS state. A NM(ind, D2=IS) message shall then be sent on D2 and the (OOS,WAIT) state is entered. If, in the process of waiting for a response on D2, D1 goes to the multiple-frame established state at

layer 2, D2 should be placed in the MB state, a NM(ind, D1=IS) message shall be sent on D1, and layer 3 shall place the D-channels into the (WAIT,MB) state.

F.4.3 In Service D-Channel Audit Procedure

An NM(ind, D1=IS) may be sent on D1, the currently "In Service" D-channel. Anytime a NM(ind, D1=IS) is received on D1, the currently "In Service" D-channel, no switchover to the backup D-channel shall take place. Instead, the recipient of the NM(ind, D1=IS) shall respond with a NM(resp, D1=IS). The status of D1 (i.e., IS) shall remain unchanged as a result of this exchange. The status of D2 shall also remain unchanged as a result of an exchange of NM(ind) and NM(rep) on D1.

F.4.4 Timer T321 Procedures

Timer T321 is used in the D-channel Backup protocol as a Maintenance Busy (MB) timer to guard against a loss in signaling for an indeterminate period of time. The value of T321 is a function of the time it takes to declare a D-channel as failed.

Timer T203 is related to the time it takes to declare a D-channel as failed. The value of T321 shall be larger than T203 to allow both sides of the interface to place the IS D-channel in a MB condition before initializing the STBY D-channel. The value of T203 is given ATIS-1000602 and the value of T321 is given in clause 9.

F.4.5 T309 Procedures

T309 shall only be started when an "In Service" D-channel is declared failed as defined in F.4.1.1 and layer 3 is informed by the DL-RELEASE indication primitive. All calls not in the Active state shall be cleared. T309 shall be stopped when a D-channel is brought to the IS state (when a NM(ind, D1/2=IS) message is acknowledged by a NM(ind, D1/2=IS) or NM(resp, D1/2=IS)). When T309 is stopped, a STATUS ENQUIRY message may be sent for calls in the Active state. If T309 runs to expiry, all calls shall be cleared internally. Subsequently, when a D-channel is restored to the IS state, the restart procedures defined in 5.5 shall be performed.

Note - The implementation of timer T309 in the user side is optional.

F.4.6 Error Handling for Maintenance Messages

If a SERVICE or SERVICE ACKNOWLEDGE message is received on the backup D-channel with invalid contents or a missing information element, the message shall be ignored.

F.5 Network Management Messages in the D-Channel Backup Protocol

F.5.1 Overview

The purpose of this subclause is to explain the use and format of the Network Management messages in the context of D-channel Backup.

In the D-channel Backup protocol, these messages are used for the following purposes:

- to bring a D-channel from the STBY to IS condition; and
- to perform audits on an IS D-channel to ensure it is operating properly, and to avoid any possible deadlock conditions.

A NM message is used to indicate or acknowledge that a particular D-channel is In Service. Transition to an IS condition for a D-channel cannot occur until the appropriate layer 2 procedures have been applied. A NM(ind, D1/2=IS) indicates that D1/2 is in service to the recipient of the message. A NM(resp, D1/2=IS) confirms that the other side of the D-channel interface knows that D1/2 is in service. NM(ind, D1/2=IS) messages may be sent at periodic intervals until a NM(resp, D1/2=IS) is received. A NM(resp, D1/2=IS) message must be received to explicitly confirm that the D-channel indicated is ready to become active (IS) at layer 3.

In the case of a simplex D-channel arrangement, a NM message cannot be used to change the status of the D-channel.

F.5.2 D-Channel Backup Maintenance Messages

F.5.2.1 SERVICE

This message is used to identify that the indicated D-channel is in the In Service state. The SERVICE message provides the NM(ind, D1/D2=IS) functionality. The Channel identification information element is used to identify D1 or D2. See Table F.1.

Table F.1 – SERVICE message content

Type: SERVICE Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	F.6.2	both	M	1
Call reference	F.6.3	both	M	2-3
Message type	F.6.4	both	M	1
Change status	F.6.5.4	both	M	3
Channel identification	F.6.5.5	both	M	3-4

F.5.2.2 SERVICE ACKNOWLEDGE

This message is used to acknowledge the SERVICE message. The SERVICE ACKNOWLEDGE message provides the NM(resp, D1/D2=IS) functionality. The Channel identification information element is used to identify D1 or D2. See Table F.2.

Table F.2 – SERVICE ACKNOWLEDGE message content

Type: SERVICE ACKNOWLEDGE Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	F.6.2	both	M	1
Call reference	F.6.3	both	M	2-3
Message type	F.6.4	both	M	1
Change status	F.6.5.4	both	M	3
Channel identification	F.6.5.5	both	M	3-4

F.6 Message Structure

F.6.1 Overview

The maintenance messages follow the same structure as that of call control messages defined in 4.1 (see Figure 1). Specifically, every message shall consist of the following parts:

- a) Protocol discriminator;
- b) call reference;
- c) message type; and
- d) other information elements as required.

F.6.2 Protocol Discriminator

The messages defined in this annex shall use the Protocol discriminator as defined in 4.2 with the value of "Network management messages" as defined in Table 19.

F.6.3 Call Reference

The messages defined in this annex shall use the global call reference as defined in 4.3.

F.6.4 D-channel Backup Message Types

The message types needed to support the D-channel backup procedure are given in Table F.3.

Table F.3 – Message Types

Bits	
<u>8765 4321</u>	
<i>D-channel backup maintenance messages:</i>	
0000 1111	SERVICE
0000 0111	SERVICE ACKNOWLEDGE

F.6.5 Other Information Elements

F.6.5.1 Coding Rules

The rules of 4.5.1 shall apply to variable length information elements included in network management messages except that Table 21 is replaced by Table F.5 and Figure 8 is not applicable.

Table F.4 – Information element identifier coding for network management messages

8 7 6 5 4 3 2 1		Reference	Max length (octets) (Note 1)	Max no. of occurrences (Note 2)
<i>Single octet information elements:</i>				
1 : : : - - - -				
0 0 0 - - - -	reserved			
0 0 1 - - - -	Shift (Note 3)	F.6.5.3	1	
<i>Variable length information elements in codeset 5:</i>				
0 : : : : : : :				
0 0 0 0 0 0 1	Change status	F.6.5.4	3	
0 0 1 1 0 0 0	Channel identification (note 3)	F.6.5.5	6	
All other values are reserved.				
NOTES				
1 The length limits described for the variable length information elements below take into account only the present ANSI standardized coding values.				
2 This is the maximum number of occurrences allowed for variable length information elements. Unless otherwise specified, the maximum number of occurrences is one.				
3 For the purposes of network management messages, this information element shall be considered as a nationally-standardized information element. Therefore the information element identifier value shall also belong to the nationally-standardized code space for information elements.				

F.6.5.2 Extensions of Codesets

The rules of 4.5.2 shall apply to network management messages. For network management messages, codeset 5 shall be the initial active codeset. Therefore, only a shift to codeset 6 is applicable.

F.6.5.3 Locking Shift Procedures

The rules of 4.5.3 shall be applicable to network management messages only to the extent for supporting a shift to codeset 6.

F.6.5.4 Change Status

The purpose of the Change status information element is to indicate that the current status of signaling channel D1 or D2 is in the In Service state. The coding of the Change status information element is shown in Figure F.11. The length of this information element is set to 1. This information element is used only with the D-channel backup messages.

8	7	6	5	4	3	2	1	Octet
Change status information element identifier								1
0	0	0	0	0	0	0	1	
Length of the Change status contents								2
0	0	0	0	0	0	0	1	
1 ext	Type	Spare			New Status			3
		0	0	0				

Figure F.11 – Change status information element

Type (octet 3)

Bits

7

1 Channel

All other values are reserved.

New status (octet 3)

Bits

3 2 1

0 0 0 In Service

0 1 0 Out of service (see Note)

All other values are reserved.

NOTE – This value is not used in D-channel backup procedures.

F.6.5.5 Channel Identification

For details on the format and coding of the Channel identification information element, see 4.5.12.

The Channel identification information element, as used in the D-channel Backup protocol for NM messages, is coded to indicate:

- Either explicit or implicit Interface identification in the Interface identifier field;
- Primary rate in the Interface type field;
- D-channel in the D-channel indicator field;
- No channel in the Channel selection field; and
- Binary Interface id in the Interface Identifier field (only if interface is explicitly identified, according to the Interface Identifier field mentioned above).

Note - if explicit interface identification is indicated in the Interface identifier field for an NM message, the explicit interface identification shall only be used to indicate the status of the same interface that the signaling is done on. For example, the NM(ind, D1=IS) shall be sent on D1. The sending of NM(ind, D1=IS) on D2 is not permitted and shall be ignored if received.

F.7 SDLs for D-Channel Backup

The SDLs for D-channel backup procedures are shown in Figures F.12 through F.21.

Following nomenclature is used for SDLs:

- b) The states of D1 and D2 are represented as (D1 state, D2 state). For example, while D1 is active (IS) and D2 is standby (STBY), the notation used is (IS, STBY);
- c) Primitives sent to or received from Layer 2 are represented as D-channel:Primitive. For example, the event “D1:DL-RELEASE indication” means that the “DL-RELEASE indication” primitive is received on D-channel D1;
- d) D-channel NM messages sent or received by Layer 3 are represented by the notation D-channel: NM(Event/Action, D-channel=state). For example, D1: Send NM(ind, D1=IS) means a Layer 3 D-channel NM message indicating In-service is sent on D1; and
- e) XFER_REQ is a primitive that represents a near-end manual transfer request.

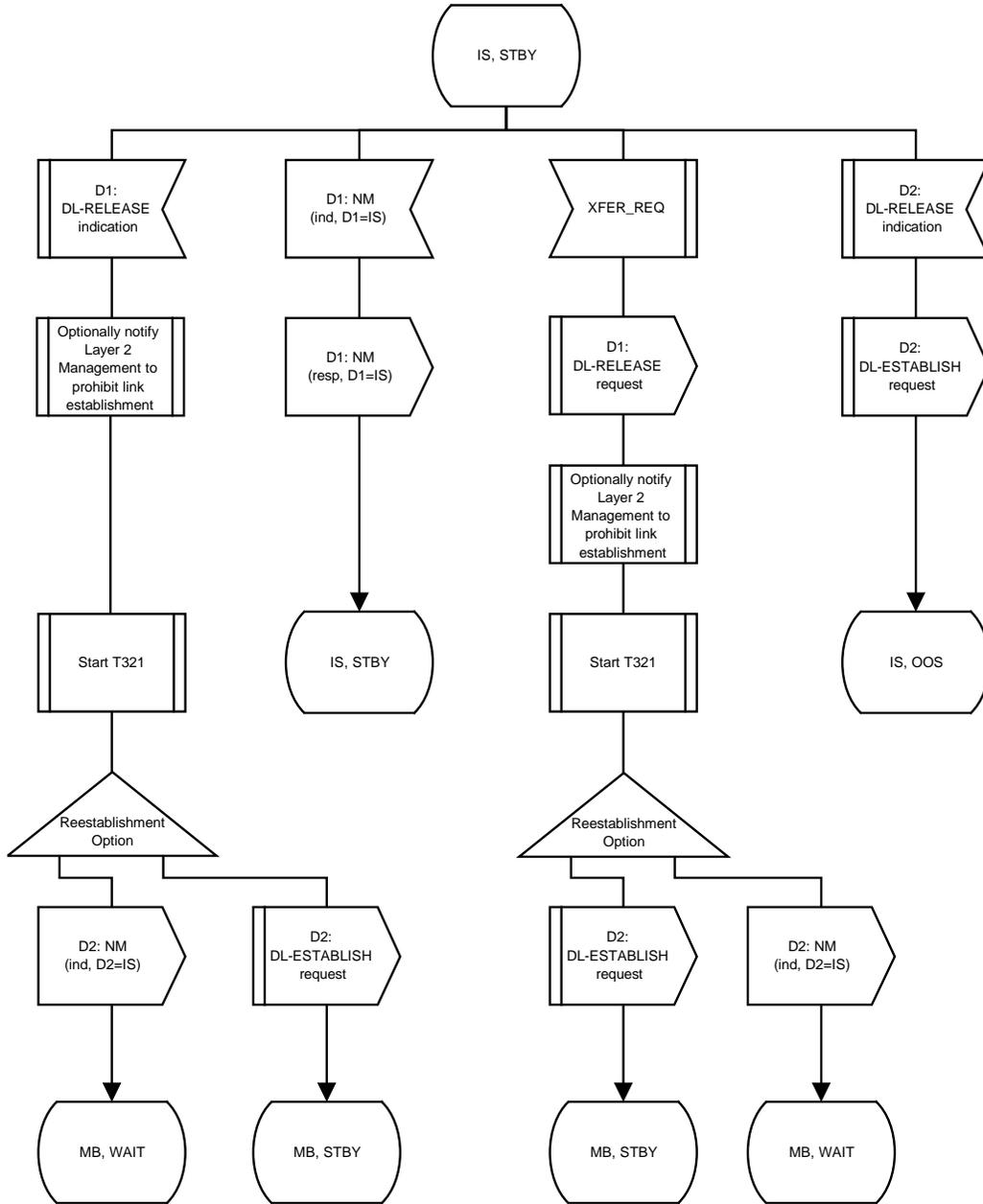


Figure F.12 – SDL for (IS, STBY)

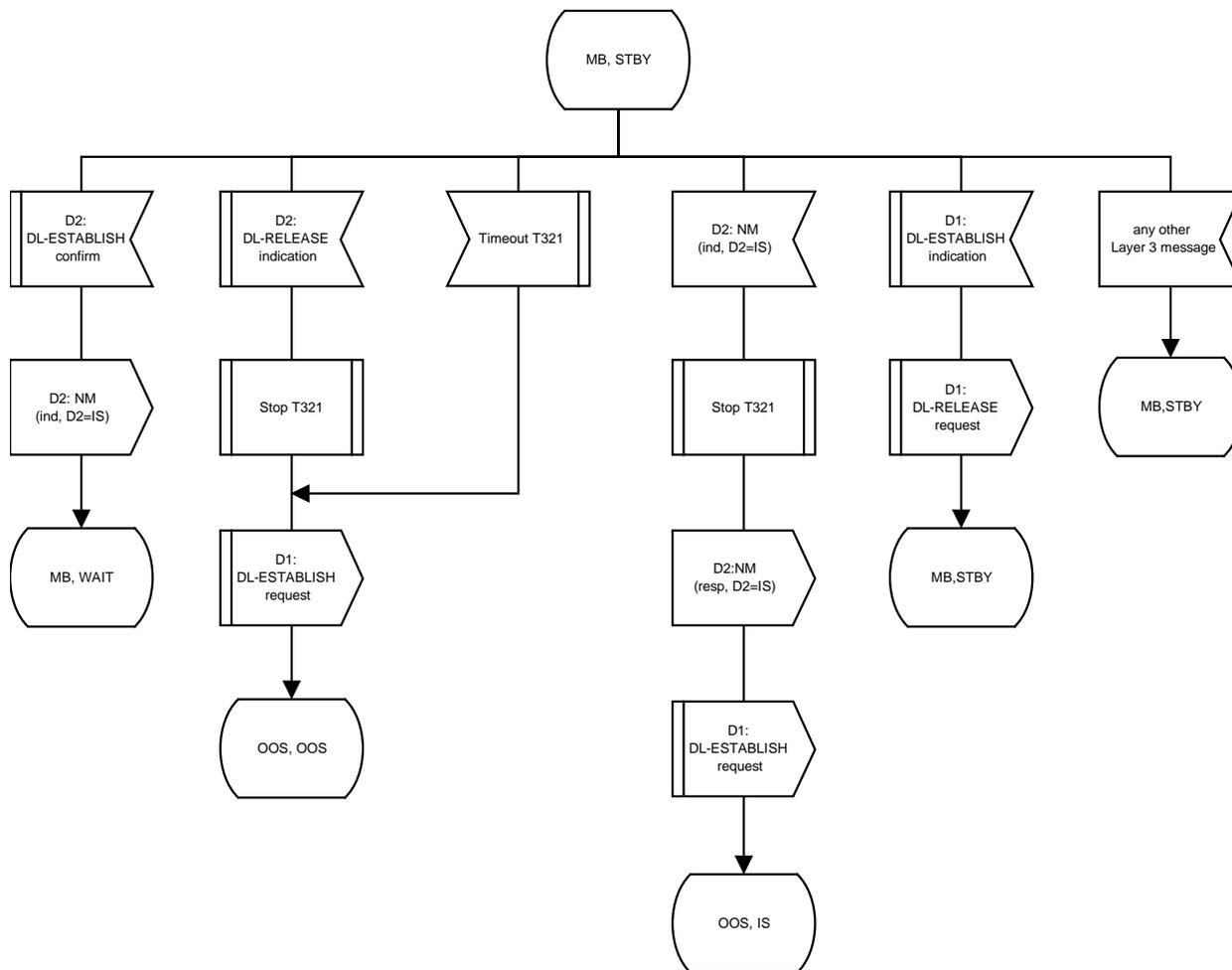


Figure F.13 – SDL for (MB, STBY)

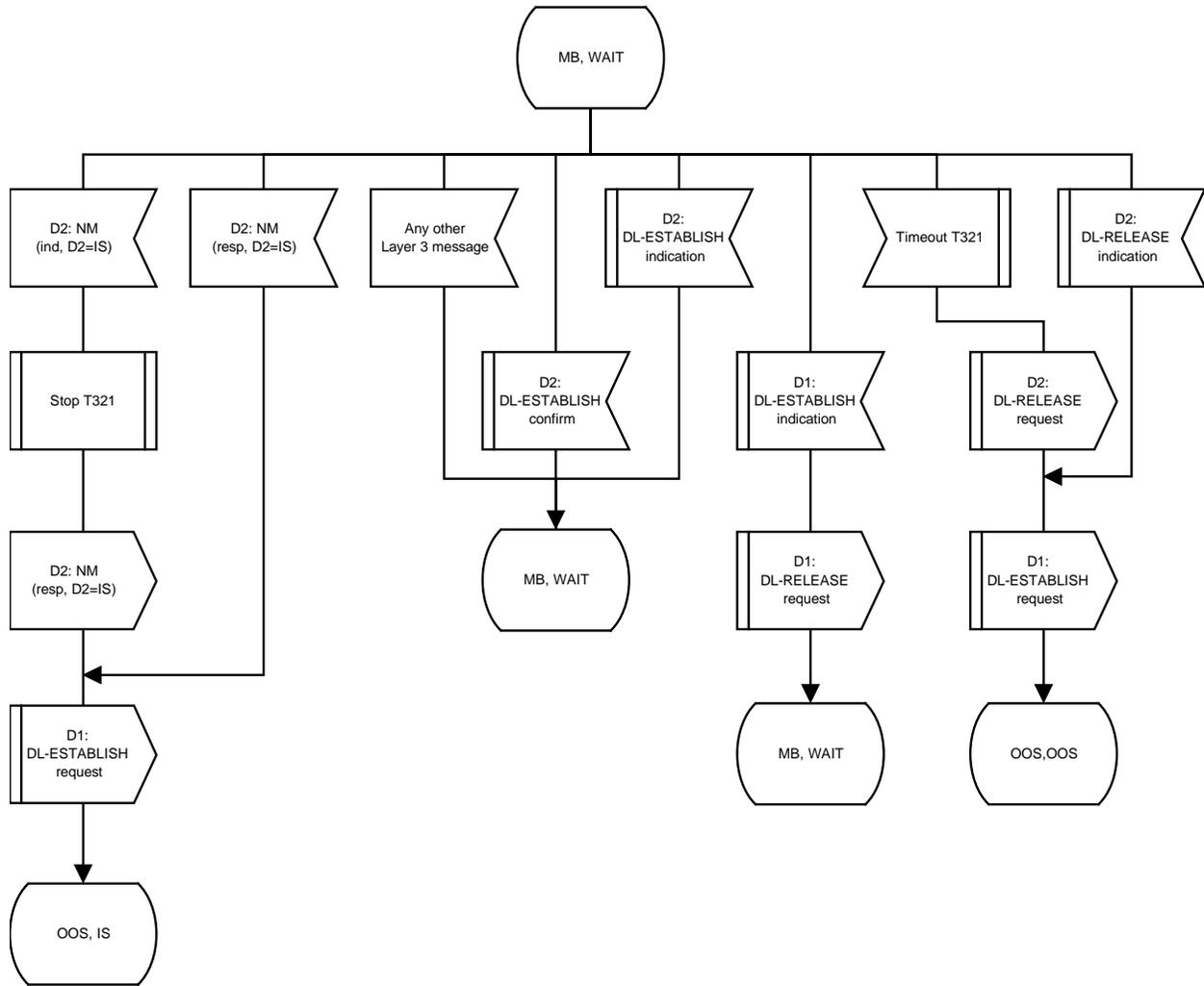


Figure F.14 – SDL for (MB, WAIT)

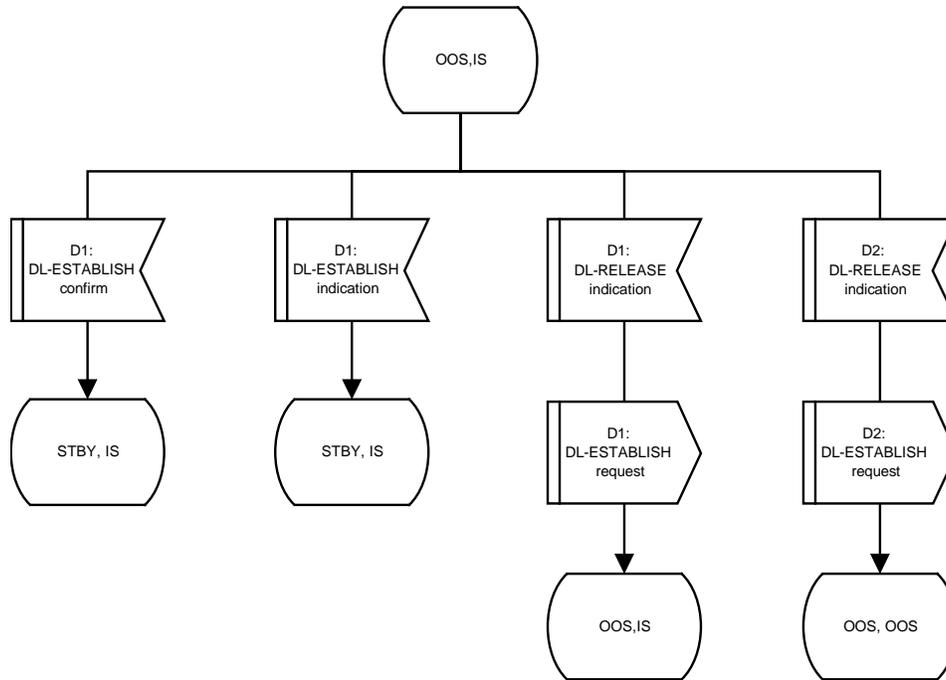


Figure F.15 – SDL for (OOS, IS)

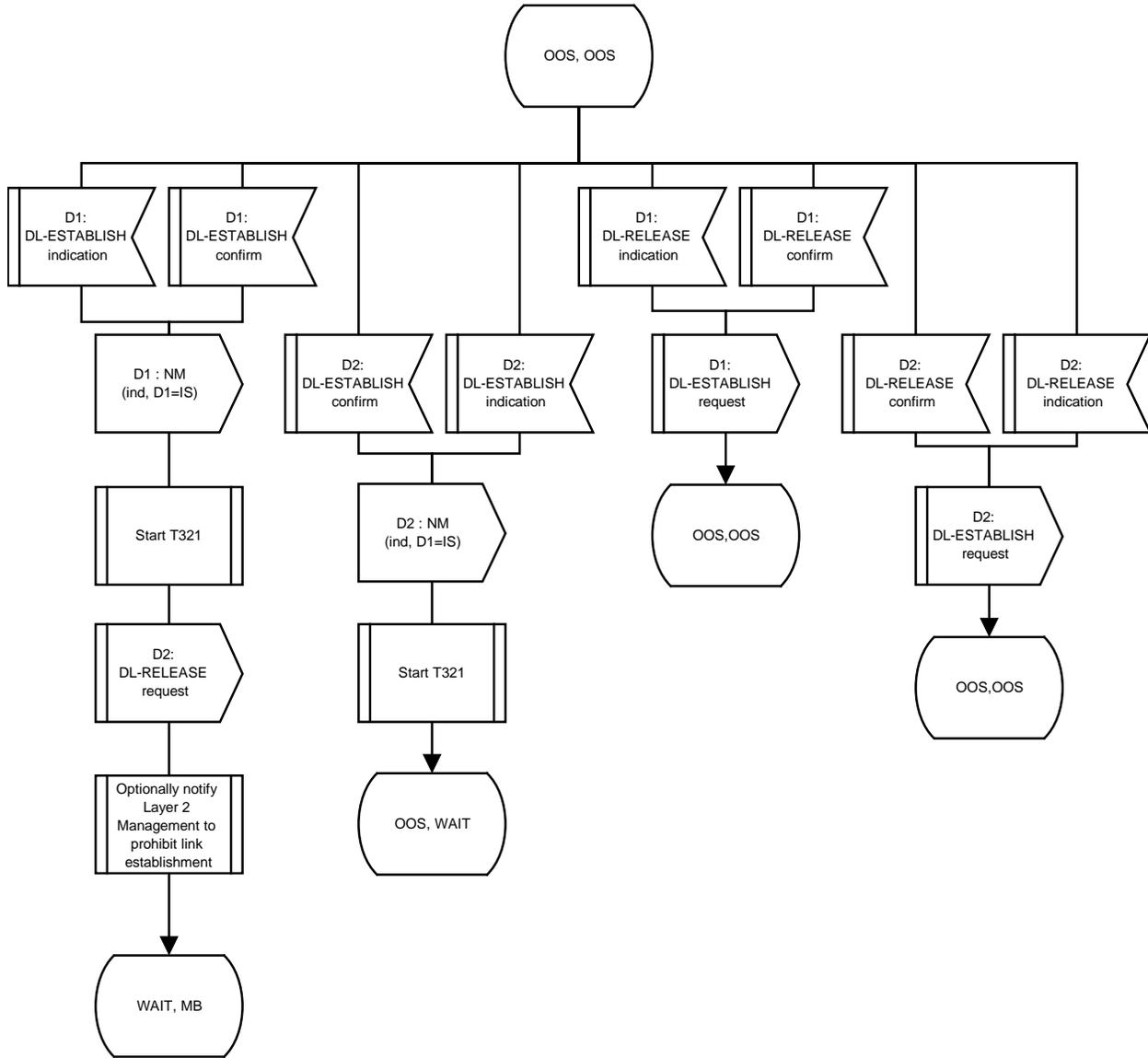


Figure F.16 – SDL for (OOS, OOS)

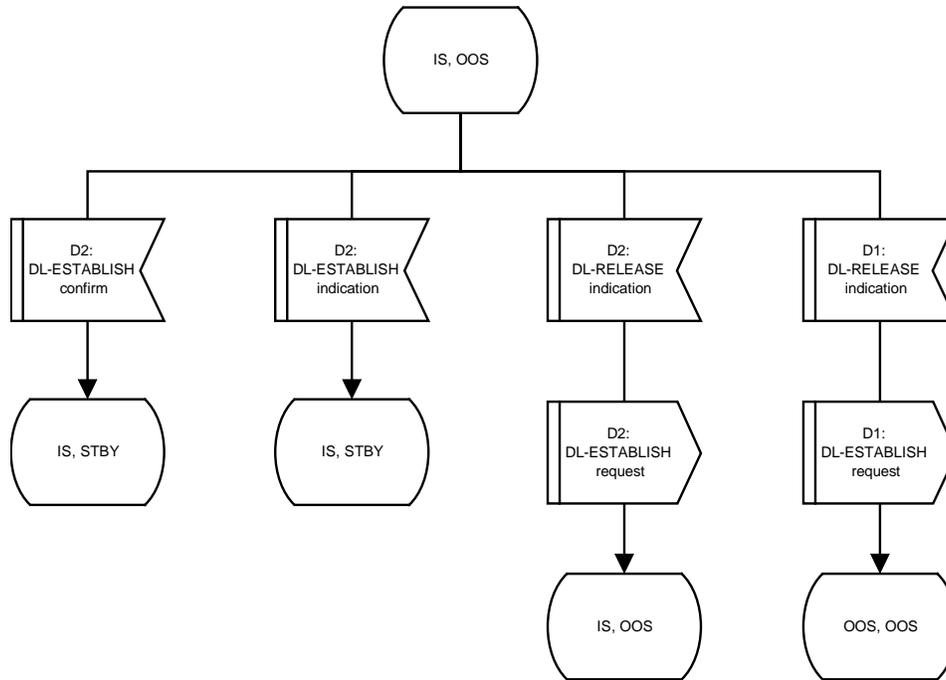


Figure F.17 – SDL for (IS, OOS)

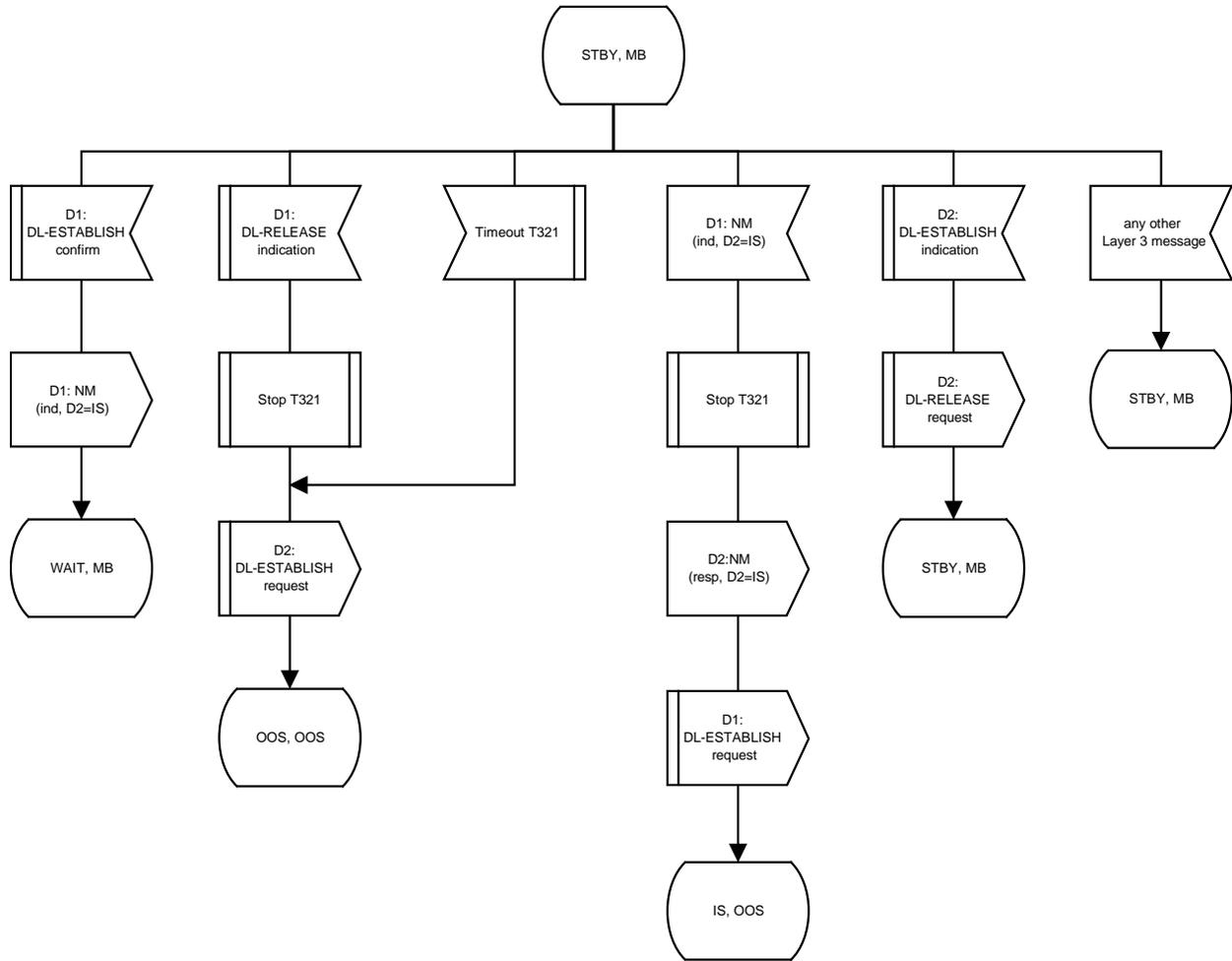


Figure F.18 – SDL for (STBY, MB)

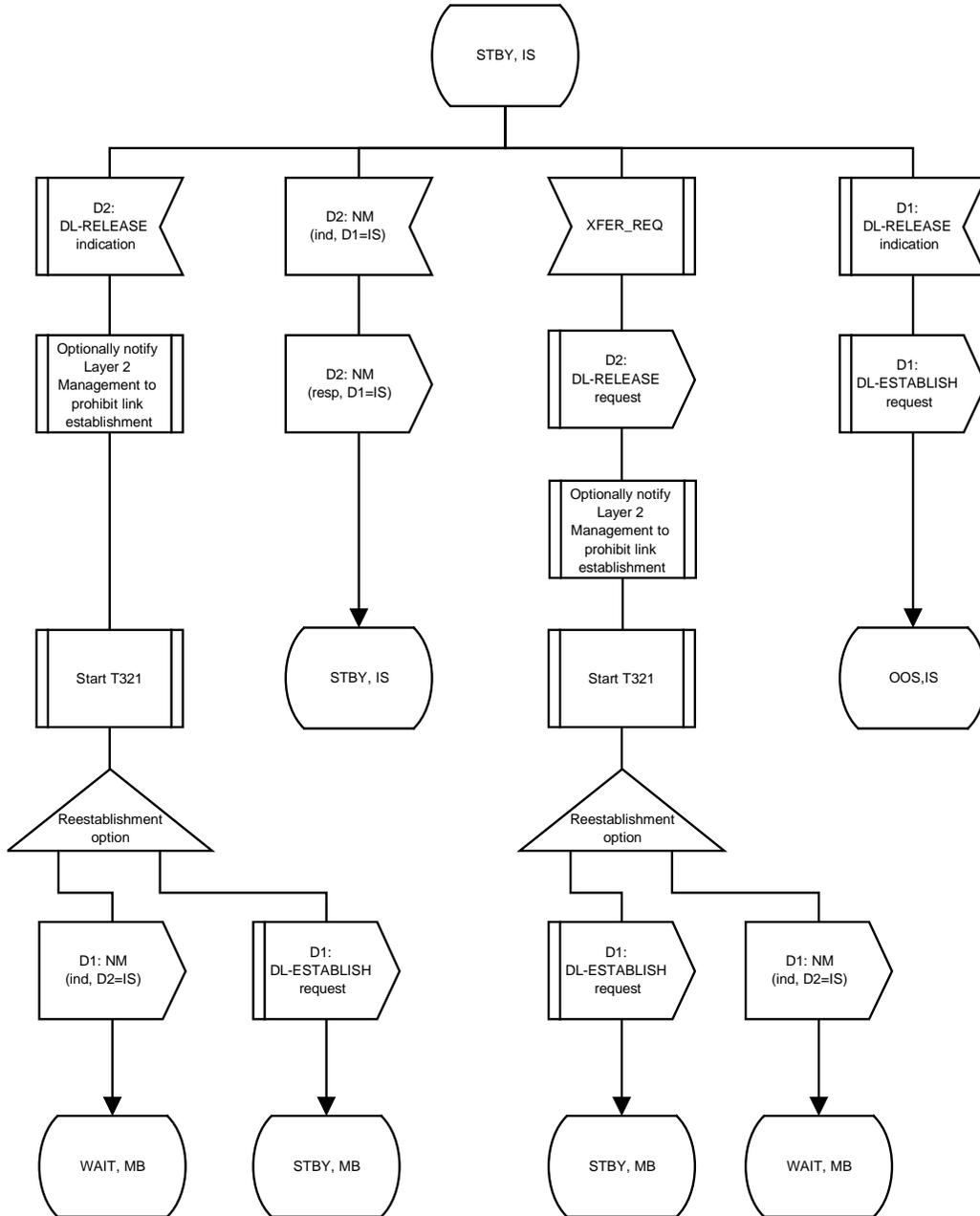


Figure F.19 – SDL for (STBY, IS)

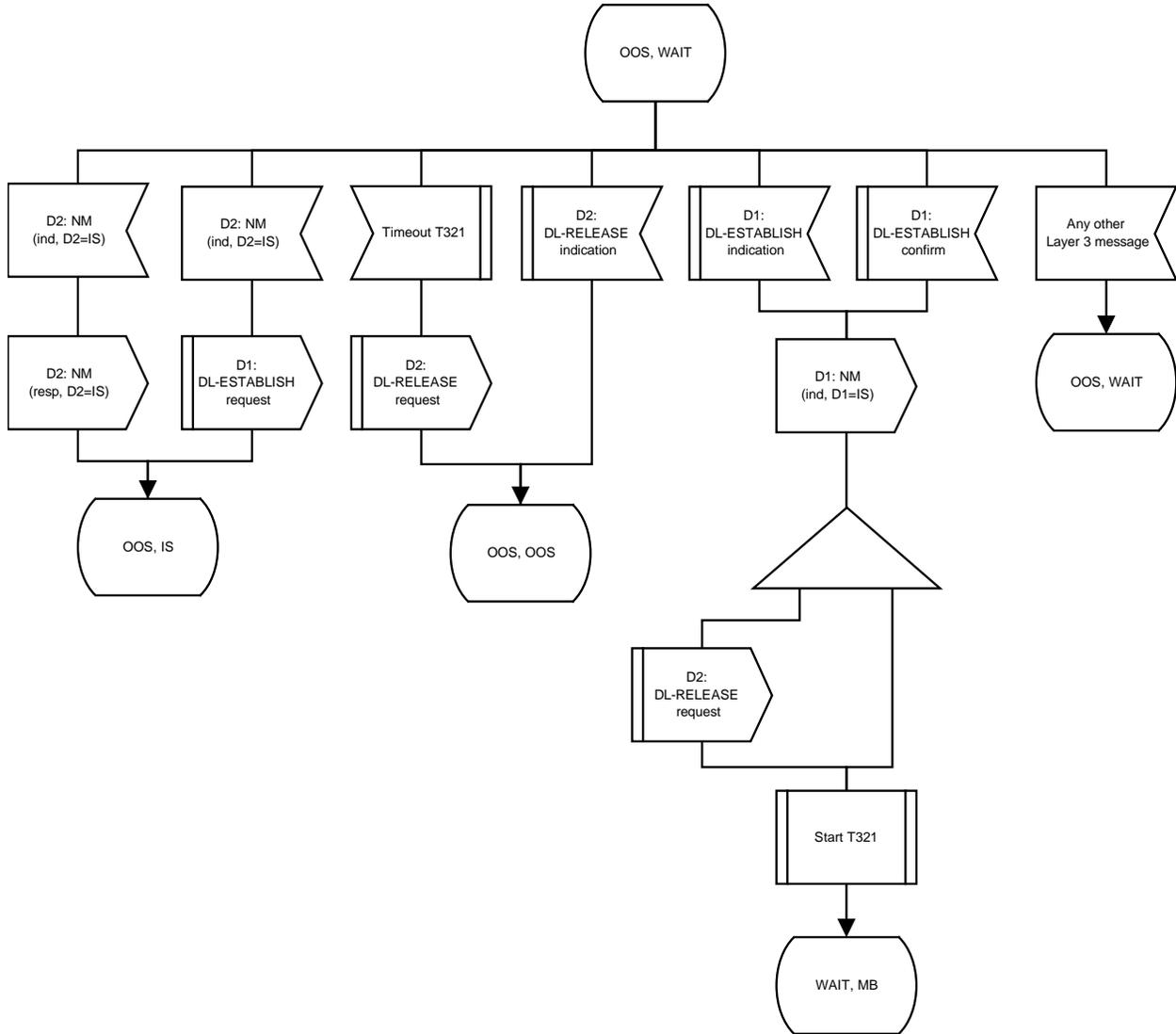


Figure F.21 – SDL for (OOS, WAIT)

Annex G: Cause definitions

(normative)

See ATIS-1000650.

Annex H; Examples of Information Elements Codings

(informative)

H.1 Introduction

The examples in this annex are not exhaustive.

It gives examples on the detailed coding of the following information elements:

- Bearer capability information element;
- Channel identification information element;
- Called or Calling party subaddress information element.

H.2 Bearer Capability Information Element

H.2.1 Voice Bearer Services

8	7	6	5	4	3	2	1	Octet
Bearer capability information element identifier								
0	0	0	0	0	1	0	0	1
Length of the bearer capability contents								
0	0	0	0	0	0	1	1	2
CCITT		speech						
1	0	0	0	0	0	0	0	3
circuit		64 kbit/s						
1	0	1	0	0	0	1	0	4
layer 1		G.711 μ -law						
1	0	1	0	0	0	1	0	5

Figure H.1 – Example coding of Bearer capability information element for speech

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8	7	6	5	4	3	2	1	Octet
0		Bearer capability information element identifier						1
0	0	0	0	0	1	0	0	
0		Length of the bearer capability contents						2
0	0	0	0	0	0	1	1	
1	0	0	1	0	0	0	0	3
		CCITT	3.1 kHz audio					
1	0	0	1	0	0	0	0	4
		circuit	64 kbit/s					
1	0	1	0	0	0	1	0	5
		layer 1	G.711 μ -law					

Figure H.2 – Example coding of Bearer capability information element for 3.1 kHz audio

8	7	6	5	4	3	2	1	Octet
0		Bearer capability information element identifier						1
0	0	0	0	0	1	0	0	
0		Length of the bearer capability contents						2
0	0	0	0	0	0	1	1	
1	0	0	1	0	0	0	1	3
		CCITT	unrestricted digital information with tones/announcements					
1	0	0	1	0	0	0	0	4
		circuit	64 kbit/s					
1	0	1	0	0	1	0	1	5
		layer 1	G.722 and G.725 7 kHz Audio					

Figure H.3 – Example coding of Bearer capability information element for unrestricted digital information with tones/announcements

H.2.2 Unrestricted or Restricted Digital Information

8	7	6	5	4	3	2	1	Octet
Bearer capability information element identifier								1
0	0	0	0	0	1	0	0	
Length of the bearer capability contents								2
0	0	0	0	0	0	1	0	
CCITT		unrestricted digital information						3
1	0	0	0	1	0	0	0	
circuit		64 kbit/s						4
1	0	0	1	0	0	0	0	

Figure H.4 – Example coding of Bearer capability information element for synchronous 64 kbit/s unrestricted digital information

8	7	6	5	4	3	2	1	Octet
Bearer capability information element identifier								1
0	0	0	0	0	1	0	0	
Length of the bearer capability contents								2
0	0	0	0	0	1	0	0	
CCITT		unrestricted digital information						3
1	0	0	0	1	0	0	0	
circuit		64 kbit/s						4
1	0	0	1	0	0	0	0	
layer 1		rate adaptation						5
1	0	1	0	0	1	0	1	
synch		negot		56 kbit/s				5a
1	0	0	0	1	1	1	1	

Figure H.5 – Example coding of Bearer capability information element for synchronous 56 kbit/s using ITU-T Recommendation V.110 or X.30 rate adaptation

H.3 Channel Identification Information Element

H.3.1 Basic Rate Interface, Circuit Mode, B-Channel

8	7	6	5	4	3	2	1	Octet
Channel identification information element identifier								
0	0	0	1	1	0	0	0	1
Length of channel identification contents								
0	0	0	0	0	0	0	1	2
1	0	0	0	0	0	0	1	3
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection		

Figure H.6 – Example coding of Channel identification information element for basic rate interface, circuit mode, channel B1 preferred

8	7	6	5	4	3	2	1	Octet
Channel identification information element identifier								
0	0	0	1	1	0	0	0	1
Length of channel identification contents								
0	0	0	0	0	0	0	1	2
1	0	0	0	0	0	1	1	3
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection		

Figure H.7 – Example coding of Channel identification information element for basic rate interface, circuit mode, any B-channel

H.3.2 Primary Rate Interface, Circuit Mode, B-Channel

8	7	6	5	4	3	2	1	Octet
Channel identification information element identifier								
0	0	0	1	1	0	0	0	1
Length of channel identification contents								
0	0	0	0	0	0	1	1	2
1	0	1	0	0	0	0	1	3
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection		
1	0	0	0	0	0	1	1	3.2
	Coding Standard		Number/ Map	Channel type / Map element type				
1	0	0	0	0	0	0	1	3.3
Channel number / Slot map								

NOTES

- 1 Channel is a B-channel.
- 2 Indicated channel is preferred.
- 3 Channel is located in the same interface as the D-channel.
- 4 Channel is identified by channel number.

Figure H.8 – Example coding of Channel identification information element for primary rate interface, circuit mode, B-channel 1, preferred, using channel number

8	7	6	5	4	3	2	1	Octet
Channel identification information element identifier								1
0	0	0	1	1	0	0	0	
Length of channel identification contents								2
0	0	0	0	0	1	0	1	
1	0	1	0	0	0	0	1	3
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection		
1	0	0	1	0	0	1	1	3.2
	Coding Standard		Number/Map	Channel type / Map element type				
0	0	0	0	0	0	0	0	3.3.1
Channel number / Slot map								
0	0	0	0	0	0	0	0	3.3.2
0	0	0	0	0	0	0	1	3.3.3

NOTE – Same as (1) but the channel is identified by slot map (1544 kbit/s primary rate interface).

Figure H.9 – Example coding of Channel identification information element for primary rate interface, circuit mode, B-channel 1, preferred, using slot map

8	7	6	5	4	3	2	1	Octet
Channel identification information element identifier								1
0	0	0	1	1	0	0	0	
Length of channel identification contents								2
0	0	0	0	0	0	0	1	
1	0	1	0	0	0	1	1	3
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection		

NOTE – Same as (1) but the channel may be any channel.

Figure H.10 – Example coding of Channel identification information element for primary rate interface, circuit mode, any B-channel

H.3.3 Primary Rate Interface, Circuit Mode, H₀-Channel

8	7	6	5	4	3	2	1	Octet
Channel identification information element identifier								
0	0	0	1	1	0	0	0	1
Length of channel identification contents								
0	0	0	0	0	0	1	1	2
1	0	1	0	0	0	0	1	3
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection		
1	0	0	0	0	1	1	0	3.2
	Coding Standard		Number/ Map	Channel type / Map element type				
1	0	0	0	0	0	0	1	3.3
Channel number / Slot map								

NOTES

- 1 Channel is an H₀-channel.
- 2 Indicated channel is preferred.
- 3 Channel is located in the same interface as the D-channel.
- 4 Channel is identified by channel number.

Figure H.11 – Example coding of Channel identification information element for primary rate interface, circuit mode, H₀-channel 1, preferred, using channel number

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8	7	6	5	4	3	2	1	Octet	
0		Channel identification information element identifier						0	1
0		Length of channel identification contents						1	2
1	0	1	0	0	0	0	1	3	
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection			
1	0 0		1	0 1 1 0				3.2	
	Coding Standard		Number/Map	Channel type / Map element type					
0		Channel number / Slot map						0	3.3

NOTE – Same as (1) but the channel is identified by slot map.

Figure H.12 – Example coding of Channel identification information element for primary rate interface, circuit mode, H₀-channel 1, preferred, using slot map

8	7	6	5	4	3	2	1	Octet	
0		Channel identification information element identifier						0	1
0		Length of channel identification contents						1	2
1	0	1	0	0	0	0	1	3	
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection			
1	0 0		1	0 0 1 1				3.2	
	Coding Standard		Number/Map	Channel type / Map element type					
0		Channel number / Slot map						1	3.3.1
0	1	1	0	1	0	0	1	3.3.2	
0	1	0	0	0	0	0	0	3.3.3	

NOTES

- 1 The channels are B-channels (6 B-channels to form an H₀-channel).
- 2 Channels are indicated by slot map (1544 kbit/s primary rate system).

3 Otherwise as for (1).

Figure H.13 – Example coding of Channel identification information element for primary rate interface, circuit mode, H₀-channel, preferred, using slot map to indicate 6 B-channels

8	7	6	5	4	3	2	1	Octet
Channel identification information element identifier								
0	0	0	1	1	0	0	0	1
Length of channel identification contents								
0	0	0	0	0	0	1	0	2
1	1	1	0	0	0	1	1	3
	Int. id	Int. type		Pref./Excl.	D-ch ind	channel selection		
1	interface identifier							3.1

NOTES

- 1 Any channel.
- 2 Interface (int. id. present = 1 and interface identifier is assigned at the subscription).

Figure H.14 – Example coding of Channel identification information element for primary rate interface, circuit mode, any H₀-channel

H.3.4 Called & Calling Party Subaddress Information Element

8	7	6	5	4	3	2	1	Octet	
Called party subaddress information element identifier								1	
0	1	1	1	0	0	0	1		
Length of called party subaddress contents								2	
0	0	0	0	0	1	0	1		
1	0	0	0	Note 3		0	0	0	3
ext	NSAP			Spare					
Authority and Format identifier (Note 1)								4	
0	1	0	1	0	0	0	0		
0	IA5 character (Note 2)							5	
0	IA5 character							6	
0	IA5 character							7	

NOTES

- 1 AFI value 50 (in BCD) indicates that the NSAP consists of IA5 characters.
- 2 The AFI of 50 implies an NSAP abstract syntax of IA5 characters, where the character set encoding is specified in ITU-T Recommendation T.50/ISO 646. The number of IA5 characters shown above is just an example. There may be up to 19 octets following octet 4.
- 3 The value of this bit has no significance when the type of subaddress is "NSAP."

Figure H.15 – Example coding of Called party subaddress information element using non-OSI local NSAP address using IA5 characters

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8	7	6	5	4	3	2	1	Octet																
Called party subaddress information element identifier								1																
0	1	1	1	0	0	0	1																	
Length of called party subaddress contents								2																
0	0	0	0	0	1	1	0																	
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:12.5%;">1</td> <td style="width:12.5%;">0</td> <td style="width:12.5%;">0</td> <td style="width:12.5%;">0</td> <td style="width:12.5%;"></td> <td style="width:12.5%;">0</td> <td style="width:12.5%;">0</td> <td style="width:12.5%;">0</td> </tr> <tr> <td>ext</td> <td colspan="3">NSAP</td> <td>Note 3</td> <td colspan="3">Spare</td> </tr> </table>								1	0	0	0		0	0	0	ext	NSAP			Note 3	Spare			3
1	0	0	0		0	0	0																	
ext	NSAP			Note 3	Spare																			
0	1	0	1	0	0	0	1																	
Authority and Format identifier (Note 1)								4																
0	ASCII character (Note 2)							5																
0	ASCII character							6																
0	ASCII character							7																
0	ASCII character							8																

NOTES

- 1 AFI value 51 (in BCD) indicates that the NSAP consists of ASCII characters.
- 2 ASCII characters imply an NSAP abstract syntax of ASCII characters within the scope of this standard. The number of IA5 characters shown above is just an example. There may be up to 19 octets following octet 4.
- 3 The value of this bit has no significance when the type of subaddress is "NSAP."

Figure H.16 – Example coding of Called party subaddress information element using non-OSI local NSAP address using ASCII characters

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The value of octet 4 indicates that an international ITU-T Recommendation E.164 number with a non-zero leading significant digit is in the initial domain identifier, and the domain specific part is binary. The initial domain identifier is in octets 5 to 12. Leading zeros must pad the initial domain identifier to the maximum length for an ITU-T Recommendation E.164 initial domain part. The semi-octet in octet 12 provides an integral number of octets to the initial domain part. The maximum number of binary octets of the domain specific part with the authority and format identifier value of 45 and 59 is nine octets.

8	7	6	5	4	3	2	1	Octet
Called party subaddress information element identifier								
0	1	1	1	0	0	0	1	1
Length of called party subaddress contents								
0	0	0	0	1	1	1	0	2
Length of called party subaddress contents								
1	0	0	0		0	0	0	3
ext	NSAP			Note 2	Spare			
Authority and Format identifier (Note 1)								
0	1	0	0	0	1	0	1	4
Authority and Format identifier (Note 1)								
0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	6
0	0	0	1	0	0	1	0	7
0	0	0	0	0	0	0	1	8
0	1	1	1	0	1	0	1	9
1	0	0	0	0	0	1	0	10
0	0	0	1	1	0	0	1	11
1	0	0	0	1	1	1	1	12
1	1	0	1	1	0	1	1	13
0	0	1	1	1	1	1	0	14
1	1	0	1	1	0	1	1	15
0	0	1	1	1	1	1	0	16

NOTES

- 1 AFI code 45 (in BCD) indicates that the NSAP address consists of an ITU-T Recommendation E.164 number (in BCD) and a binary domain-specific part.
- 2 The value of this bit has no significance when the type of subaddress is "NSAP."

Figure H.17 – Example coding of Called party subaddress information element using OSI NSAP address using ITU-T Recommendation E.164 and a binary domain-specific part

The value of octet 4 indicates that the initial domain identifier consists of 4-digit ICD octets 5 and 6 and is allocated according to ISO 6523. The ICD identifies an organizational authority responsible for allocating and assigning values of the domain-specific part that is in binary. The structure of the domain-specific part is specified by the registration authority. The maximum number of binary octets of the domain-specific part is 13.

8	7	6	5	4	3	2	1	Octet
Called party subaddress information element identifier								1
0	1	1	1	0	0	0	1	
Length of called party subaddress contents								2
0	0	0	0	1	1	0	0	
Authority and Format identifier (Note 1)								3
1 ext	0	0	0	Note 2	0	0	0	
NSAP		Spare						
0	1	0	0	0	1	1	1	4
0	0	0	0	0	0	0	0	5
0	0	0	0	0	1	1	0	6
0	0	0	1	0	0	1	0	7
0	0	0	0	0	0	0	1	8
0	1	1	1	0	1	0	1	9
1	0	0	0	0	0	1	0	10
0	0	0	1	1	0	0	1	11
0	1	1	1	0	1	0	1	12
1	0	0	0	0	0	1	0	13
1	0	0	0	1	1	1	1	14

NOTES

- 1 AFI code 47 (in BCD) indicates that the NSAP address consists of an ICD (in BCD) and a binary domain-specific part.
- 2 The value of this bit has no significance when the type of subaddress is "NSAP."

Figure H.18 – Example coding of Called part subaddress information element using OSI NSAP address using the International Code Designator (ICD)

Annex I: Use of Progress indicators

(informative)

This annex describes the use of different progress indicator values defined in 4.5.21.

Progress description value 1 "Call is not end-to-end ISDN; further call information may be available in-band" indicates that interworking with a non-ISDN has occurred within the network or networks through which the call has traversed.

Progress description value 2 "Destination address is non-ISDN" indicates that the destination user is not ISDN.

Progress description value 3 "Origination address is non-ISDN" indicates that the origination user is not ISDN.

Progress description value 4 "Call has returned to the ISDN" indicates that a call that had left the ISDN has returned to the ISDN at the same point it had left due to redirection within the non-ISDN. This progress description value would be employed when a prior ATIS-1000607 message resulted in a progress description value 1 "Call is not end-to-end ISDN; further call information may be available in-band" being delivered to the calling user.

The use of progress description values 1, 2, and 3 is illustrated in the following example. Three interworking situations are identified in Figure I.1:

- a) interworking with another network;
- b) interworking with a non-ISDN user connected to ISDN; and
- c) interworking with non-ISDN equipment within the calling or called user premises.

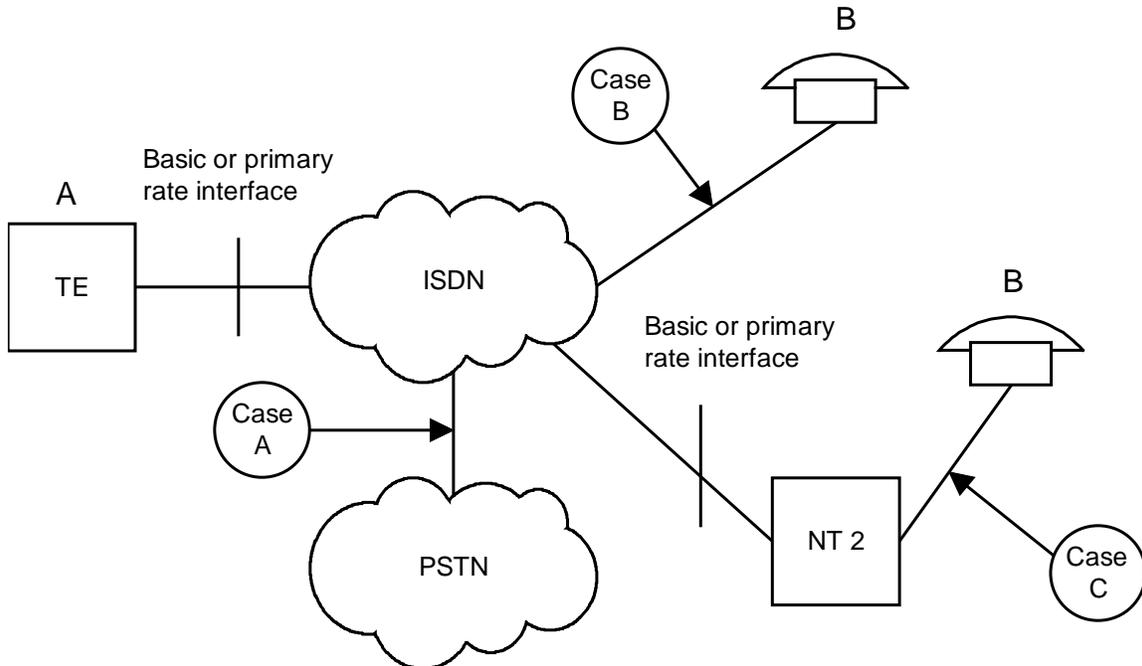


Figure I.1 – Cases A, B, C

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For calls from A, the following applies:

Case a) – Progress description value 1 sent to A.

Case b) – Progress description value 2 sent to A.

Case c) – Progress description value 2 sent to A (location = private network).

For calls towards A, the following applies:

Case a) – Progress description value 1 sent to A.

Case b) – Progress description value 3 sent to A.

Case c) – Progress description value 3 sent to A (location = private network).

The use of progress description values 5 "interworking has occurred and has resulted in a telecommunication service change," 8 "in-band information or appropriate pattern now available, and 10 delay in response at called interface" are described in clause 5.

Annex J: Examples of Cause Values & Location for Busy Condition

(informative)

See ATIS-1000605 for examples of cause values and location for busy condition.

Annex K: Message Segmentation Procedures

(informative)

K.1 Introduction

Layer 3 messages that are longer than the length of frames that the data link layer can support may be partitioned into several segments. Message segmentation shall only be used when the message length exceeds N201 [defined in ATIS-1000602]. These procedures are optional and may not be supported by all equipment.

The architectural relationship to other ATIS-1000607 functions is shown in Figure K.1. These procedures apply only within a specific data link connection and do not impact the procedures in operation on other parallel data link connections.

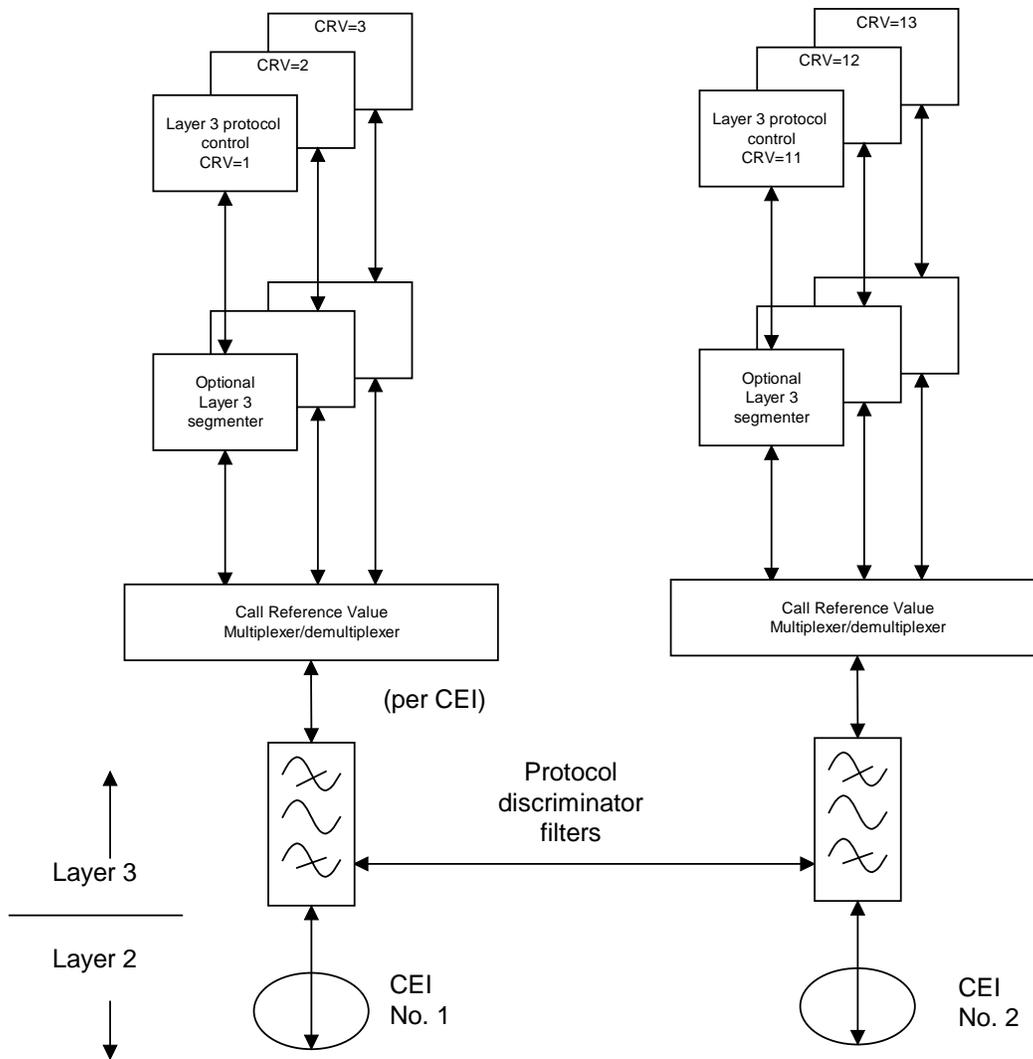


Figure K.1 – Logical architecture containing segmentation function

K.2 Message Segmentation

The following rules shall apply when ATIS-1000607 and ATIS-1000610 messages are to be segmented for transmission:

- the maximum number of message segments shall be 127. The maximum number of segments for a given application will be set by a bilateral agreement. If the message is too long to be segmented then a local maintenance activity shall be notified;
- segmentation is performed on a call reference basis. The maximum number of call references simultaneously performing segmentation is set by a bilateral agreement;
- the first message segment shall begin with the Protocol discriminator information element immediately followed by the Call reference information element, the message type coded as SEGMENT, the Segmented message information element, and one or more octets starting with the first octet following the message type of the message being segmented, subject to the maximum length of the segment not exceeding the maximum size of the data link layer information field.
- each subsequent message segment shall begin with the Protocol discriminator information element immediately followed by the Call reference information element, the message type coded as SEGMENT, the Segmented message information element and one or more octets of the message being segmented, following directly on from the octets transmitted in the previous segment, subject to the maximum length of the segment not exceeding the maximum size of the data link layer information field.
- the first segment indicator field of the Segmented message information element shall be set to indicate the first segment of a segmented message, and not set in any other segment;
- the number of segments remaining field of the Segmented message information element shall be set to indicate how many more segments are to be sent (see Figure K.2);
- the Message type information element shall be coded to indicate a SEGMENT message, and the Segmented message information element shall indicate the message type of the original message;
- once the first segment has been transmitted on a particular data link connection, then all remaining segments of that message shall be sent (in order) before any other message (segmented or not) for the same call reference is sent on the same data link connection;
- the octet order the segmented message shall be preserved shall be preserved regardless of segment boundaries.

K.3 Reassembly of Segmented Messages

A state machine shall exist for each call reference.

The following rules apply to the receipt and reassembly of segmented ATIS-1000607 and ATIS-1000610 messages:

- a) a reassembly function, on receiving a SEGMENT message containing the Segmented message information element with the first segment indicator indicating “first message,” and containing the Call reference information element and Message type information element coded as SEGMENT shall enter the Receiving Segmented Message state for that call reference and accumulate message segments;
- b) timer T314 shall be initialized or re-initialized upon receipt of a SEGMENT message for a given call reference containing the Segmented message information element with a non-zero number of segments remaining field. Timer T314 shall be stopped upon receipt of the last segment (i.e., a

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message segment containing the Segmented message information element with the number of segments remaining field coded zero). Timer T314 shall not be initialized or re-initialized if error procedures as identified in rules below are initiated;

- c) a reassembly function receiving a SEGMENT message for a given call reference with a Segmented message information element shall wait for receipt of the last message segment pertaining to the same message (i.e., containing the Segmented message information element with the number of segments remaining field coded to zero) before delivering the message for further ATIS-1000607 processing as specified in 5.8. The reassembly function shall enter the S-Null state;
- d) upon expiry of timer T314, the reassembly function shall: discard all segments of this message so far received for a given call reference; notify the layer 3 management entity for the data link connection that message segments have been lost and enter the S-Null state.

NOTE – Subsequent message segments relating to the same message and call reference shall be discarded according to rule h, below.

- e) a reassembly function, upon receiving the maximum number of SEGMENT messages of the same segmented message for a given call reference without receiving a SEGMENT message for that call reference with the number of segments remaining field of the Segmented message information element coded to zero, shall discard all message segments for that call reference so far received, notify the layer 3 management entity for the data link connection that message segments have been lost and enter the S-Null state;

NOTE – Subsequent message segments relating to the same message and call reference shall be discarded according to rule h, below.

- f) a reassembly function on receiving a SEGMENT message for a given call reference containing a Segmented message information element, while in the Receiving Segmented Message state with the number of segments remaining field that is not decremented by one from the number of segments remaining field in the Segmented message information element of the previous message segment for that call reference shall discard all segments of this message so far received and enter the S-Null state;
- g) NOTE – Subsequent message segments relating to the same message and call reference shall be discarded according to rule 8).
- h) if there is a DL-RELEASE indication primitive or DL-ESTABLISH indication primitive received while in the Receiving Segmented Message state, the reassembly function shall discard all message segments so far received for all call references, forward the DL-RELEASE indication primitive or DL-ESTABLISH-INDICATION primitive for further ATIS-1000607 processing, and enter the S-Null state (see Figure K.3);
- i) a reassembly function, upon receiving a SEGMENT message with the first segment indicator of the Segmented message information element indicating “subsequent,” while in the S-Null state, shall discard that message and remain in the S-Null state.

K.4 SDLs Message Segmenter & Reassembler

SDLs for message segment and reassembler are shown in Figures K.4 and K.5 through K.6, respectively.

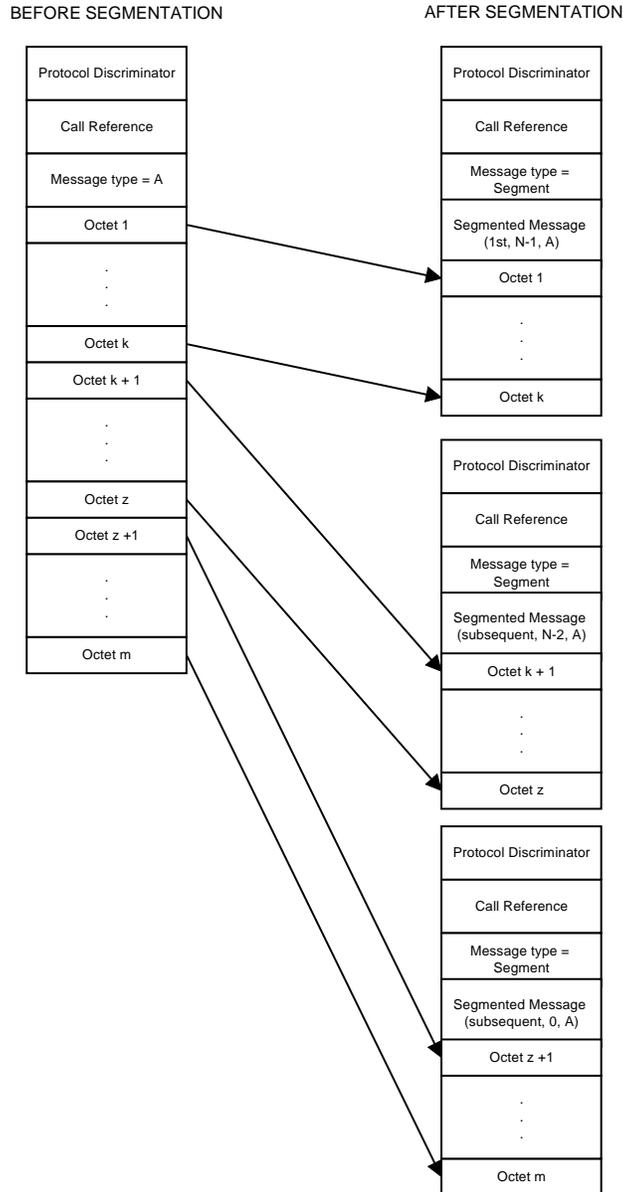


Figure K.2 – Relation between message and segments

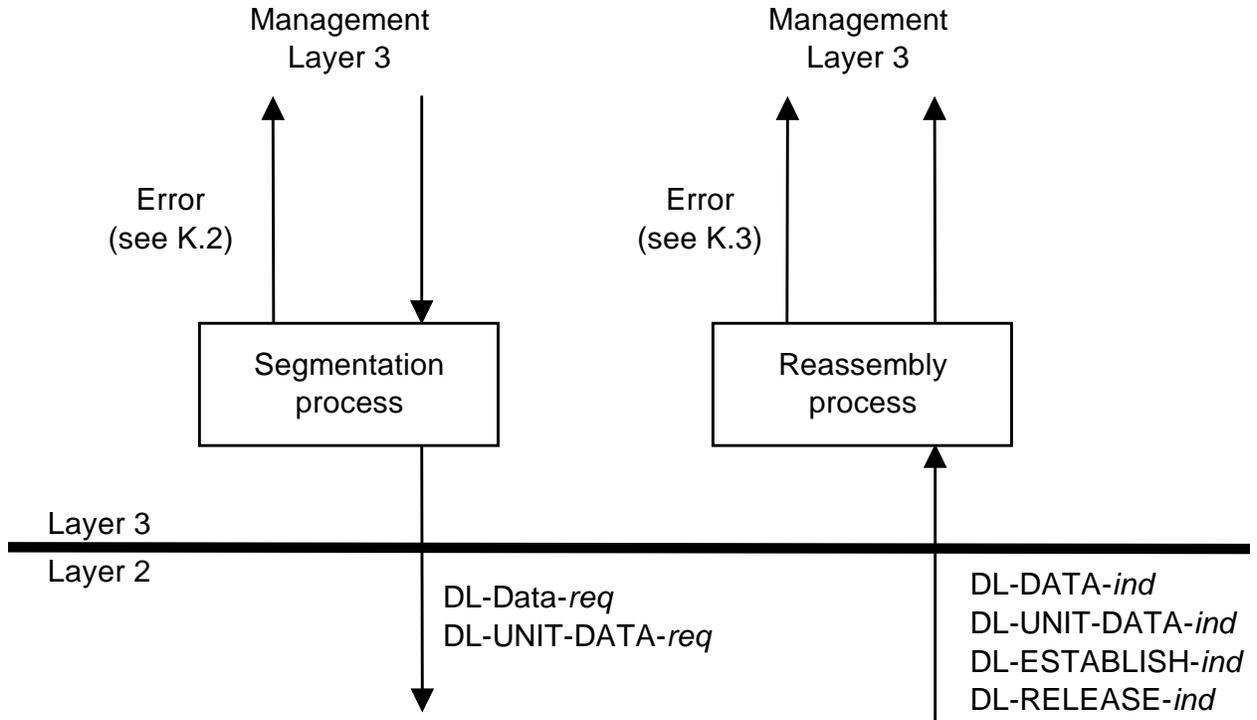


Figure K.3 – Segmentation functional interaction diagram

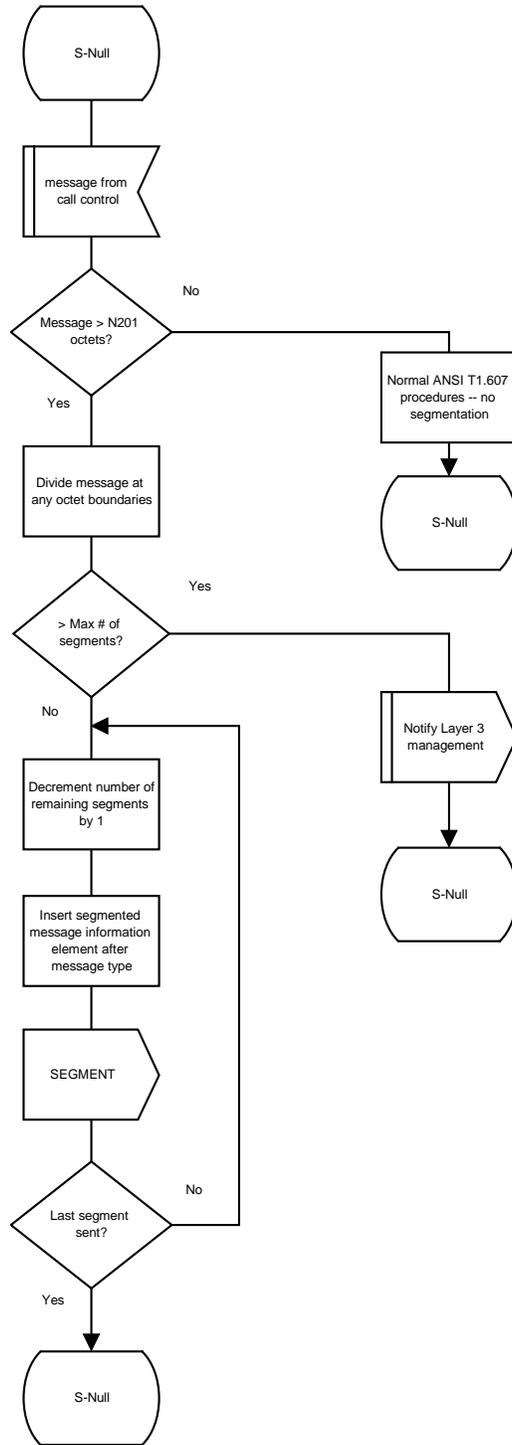


Figure K.4 – Message Segmenter SDL

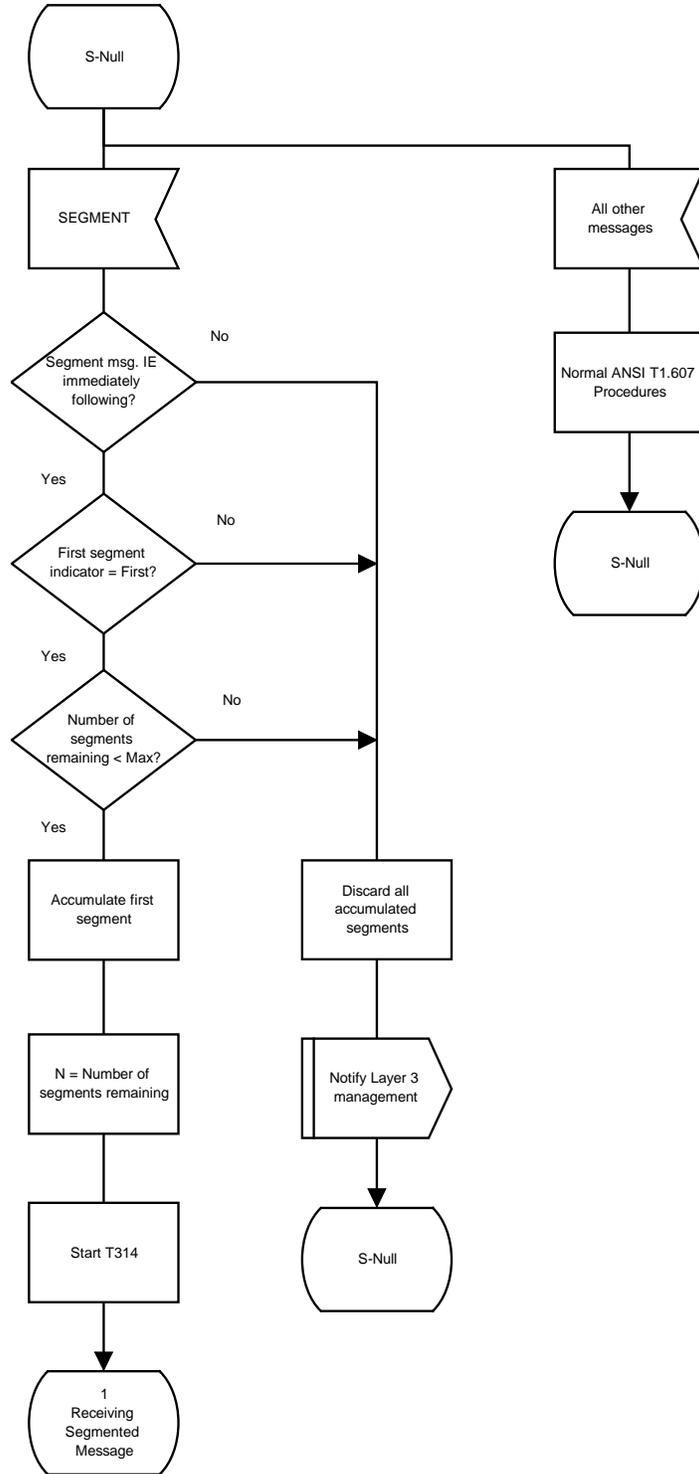


Figure K.5 – Message reassembler (1 of 2)

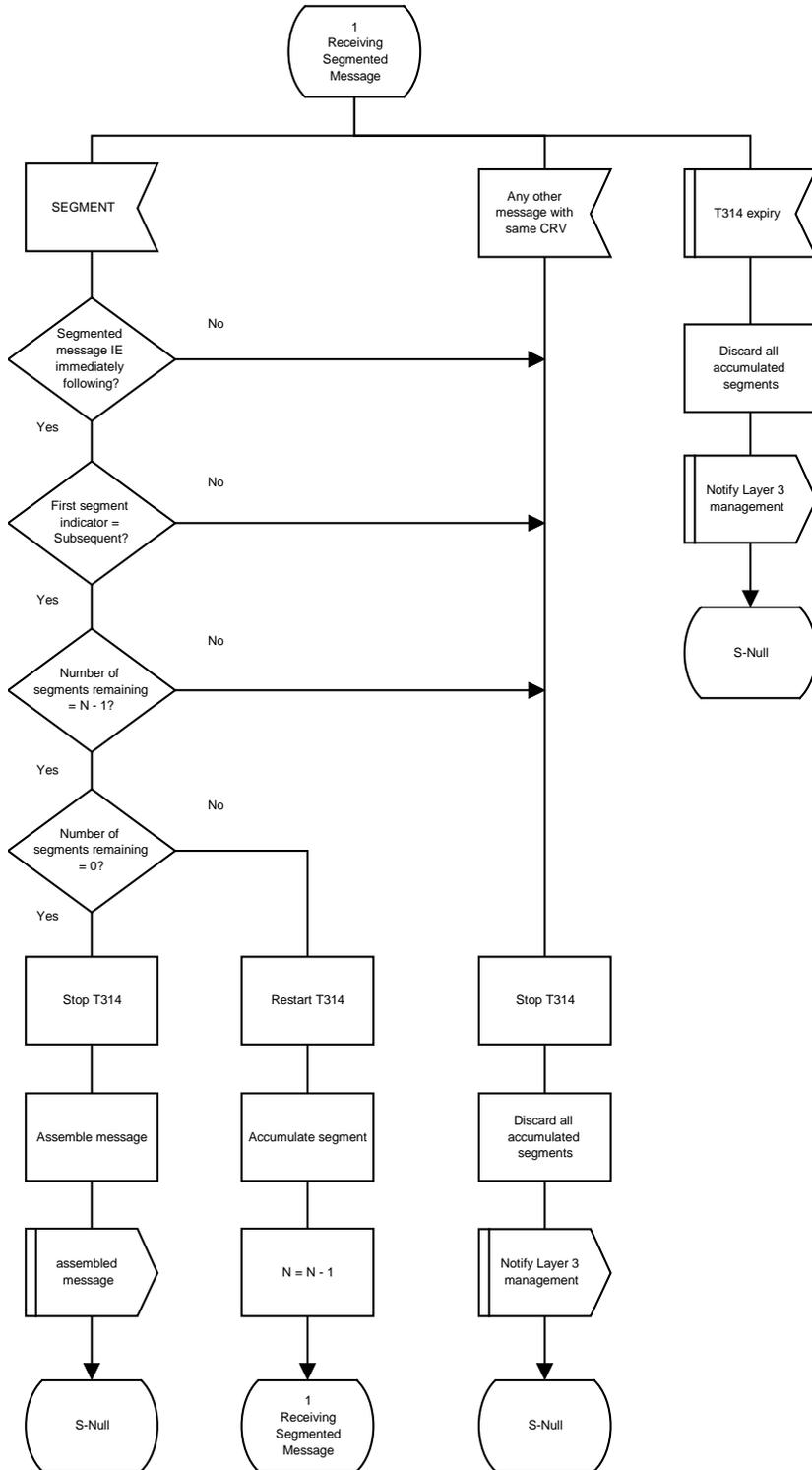


Figure K.6 – Message reassembler (2 of 2)

K.5 Message Segmentation Protocol

This clause defines the protocol needed for the message segmentation procedures. K.5.1 shows the SEGMENT message structure. K.5.2 contains the message type coding for the SEGMENT message. K.5.3 contains the structure and coding details for the Segmented message information element.

K.5.1 SEGMENT Message

The SEGMENT message shall be coded as shown in Table K.1.

Table K.1 – SEGMENT message content

Type: SEGMENT Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	4.2	both	M	1
Call reference	4.3	both	M	2-*
Message type	K.5.2	both	M	1
Segmented message	K.5.3	both	M	4-*
Continuation of the original message	(see Note)	both	M	1-*

NOTE – All octets following the Segmented message information element constitute the initial or the next portion of the message being segmented.

* – This asterisk denotes an undefined maximum length, which may be network- or service-dependent.

K.5.2 Message Type Coding

See 4.4 for the definition and purpose of the Message type information element. Table K.2 contains the coding of the Message type information element for the SEGMENT message.

Table K.2 – Message types

Bits	
<u>8765 4321</u>	
0110 0000	SEGMENT

K.5.3 Segmented Message Information Element

The purpose of the Segmented message information element is to indicate whether this is the first segment, how many segments remain, and the message type of the message being segmented.

The Segmented message information element is coded as shown in Figure K.7.

	8	7	6	5	4	3	2	1	Octet
	Segmented message information element identifier								
	0	1	1	1	0	0	0	0	1
	Length of Segmented message information contents								2
	First segment indicator	Number of segments remaining							3
	0	Segmented message type							4 etc. (Note)

Figure K.7 – Segmented Message Information Element

NOTE – The length of this information element is normally four octets. It may be longer only when the Segmented message type (Octet 4) indicates an escape to a national-specific message type, or when bit 8 indicates the Segmented message type has been extended. Both of these cases are reserved for possible future use in this standard.

First segment indicator (octet 3)

Bit

8

- 0 Subsequent segment to first segment
- 1 First segment of segmented message

Number of segments remaining (octet 3)

Binary number indicating the number of remaining segments.

Segmented Message Type (octet 4)

Message type of the original DSS1 message coded according to 4.4.

Annex L: Low layer information coding principles

(normative)

L.1 Introduction

This annex describes principles that shall be used when the calling user specifies information during call setup regarding low layer capabilities required in the network and by the destination terminal.

NOTE – In this context and throughout this annex, the term “called user” is the end point entity that is explicitly addressed. This may be an addressed interworking unit (IWU) (see ITU-T Recommendation I.500 series and X.31 case A).

L.2 Principles

L.2.1 Definitions of Type of Information

There are different types of information that the calling ISDN user may specify during call setup to identify low layer capabilities needed in the network and by the destination terminal:

- Type II information is the selection of bearer service from the choices of bearer services offered by the network to which the calling user is connected. This type of information is present even if no interworking occurs. An example is unrestricted digital information (UDI);
- Type III information is information about the terminal or intended call that is used to decide destination terminal compatibility and possibly to facilitate interworking with other ISDNs, other dedicated networks or for other purposes. An example is μ -law encoding.

L.2.2 Examination by Network

Both types II and III should be available for examination by the destination user and the network.

L.2.3 Location of Type II & III Information

Type II (i.e., bearer service selection) information shall be included in the Bearer capability information element.

L.2.4 Relationship between Bearer Capability & Low Layer Compatibility Information Elements

There shall be no contradiction of information between the Low layer compatibility and the Bearer capability information elements at the originating side (i.e., no mutually incompatible codepoints may be selected but different compatible values may be used). For instance, octet 5 of the Bearer capability information element may indicate rate adaption to 56 kbit/s while octet 5 in the Low layer compatibility information element may indicate ITU-T Recommendation V.120. These are not incompatible. Other similar examples are possible. However, as some bearer capability code points may be modified during the transport of the call, this principle implies that there should be minimal duplication of information between Bearer capability information elements and Low layer compatibility information elements.

NOTE – If as a result of duplication, a contradiction occurs between the Bearer capability information element and the Low layer compatibility information element at the terminating side, the receiving entity shall ignore the conflicting information in the Low layer compatibility information element.

The following example, dealing with the specification of the encoding scheme used by the terminal for the speech or 3.1 kHz audio bearer services, shows the consequences of duplications.

It is expected that some ISDNs will support only A-law and some only μ -law, with conversion provided by the μ -law network (see ITU-T Recommendation G.711). If the encoding scheme is specified in both the Bearer capability information element and the Low layer compatibility information element, interworking between two ISDNs might require a change of the user information Layer 1 protocol in the Bearer capability information element (e.g., from A-law to μ -law), while the encoding scheme specified in the Low layer compatibility information element would presumably be forwarded to the destination unchanged. Since to determine compatibility the destination terminal examines both the Bearer capability information element and Low layer compatibility information element, it would receive conflicting information regarding the encoding scheme used.

Annex M: Low layer compatibility negotiation

(normative)

M.1 Introduction

This annex describes an optional additional low layer compatibility checking procedure that may be applied by the user.

M.2 General

The purpose of the Low layer compatibility information element is to provide a means that should be used for compatibility checking by an addressed entity (e.g., a remote user or an interworking unit or a high layer function network node addressed by the calling user). The Low layer compatibility information element is transferred transparently by an ISDN between the call originating entity (e.g., the calling user) and the addressed entity.

The user information protocol fields of the Low layer compatibility information element indicate the low layer attributes at the call originating entity and the addressed entity. This information is not interpreted by the ISDN and therefore the bearer capability provided by the ISDN is not affected by this information. The call originating entity and the addressed entity may modify the low layer attributes by the negotiation described below if that can be supported by the bearer capability actually provided by the ISDN.

The Low layer compatibility information element is coded according to 4.5.18.

M.3 Low Layer Compatibility Notification to the Called User

When the calling user wishes to notify the called user of any information transfer attribute (contained in octets 3 to 4b) different from the one contained in the Bearer capability information element or of any low layer protocol to be used during the call and not already identified in the Bearer capability information element, then the calling user shall include a Low layer compatibility information element in SETUP message; this element is conveyed by the network and delivered to the called user. However, if the network is unable to convey this information element, it shall act as described in 5.8.7.1.

M.4 Low Layer Compatibility Negotiation between Users

If the negotiation indicator (see 4.5.18) of the Low layer compatibility information element included in the SETUP message is set to "out-of-band negotiation is possible (octet 3a, bit 7)," then one or more of the low layer protocol attribute(s) may be negotiated. In this case, the called user responding positively to the call may include a Low layer compatibility information element in the CONNECT message. This element will be conveyed transparently by the network and delivered to the calling user in the CONNECT message.

NOTE – Only the low layer protocol attributes may be negotiated and therefore the information transfer attributes (octets 3 to 4), if returned by the called user in the CONNECT message, will be identical to the ones received in the Low layer compatibility information element contained in the SETUP message.

If, for any reason, the network is unable to convey this information element, it shall act as described in 5.8.7.1. Users are advised not to include in the Low layer compatibility information element sent from the

called user to the calling user attributes that would have the same value as the ones contained in the Low layer compatibility information element received from the calling party.

M.5 Low Layer Compatibility Negotiation Options

The Low layer compatibility information element contains negotiation indicators that may specify one of the following:

- Negotiation Indicator (octet 3a, bit 7) is set to "out-of-band negotiation not possible" (default): the called user shall not invoke negotiation according to M.4;
- Negotiation Indicator (octet 3a, bit 7) is set to "out-of-band negotiation possible": the called user may then invoke low layer compatibility negotiation, as needed, according to M.4;
- Negotiation (octet 5a, bit 6) is set to "in-band negotiation possible": the called user may then invoke low layer compatibility negotiation using the supported in-band negotiation, according to service or application requirements;
- Negotiation Indicator (octet 3a, bit 7) is set to "out-of-band negotiation possible" and Negotiation (octet 5a, bit 6) is set to "in-band negotiation possible": the called user may invoke either one or the other low layer compatibility negotiation procedure according to its requirements. If the call is end-to-end ISDN, and the out-band low layer compatibility negotiation is supported by both parties, then this method of negotiation is preferred.

Annex N: Procedures for Establishment of Bearer Connection Prior to Call Acceptance

(normative)

N.1 Introduction

This annex describes optional procedures for the establishment of a bearer connection prior to call acceptance.

N.2 General

For some applications, it is desirable to allow the completion of the transmission path associated with a bearer service prior to receiving call acceptance. In particular, the completion in the backward direction of the transmission path prior to receipt of a CONNECT message from the called user may be desirable to:

- a) allow the called user to provide internally-generated tones and announcements that are sent in-band to the calling user prior to answering of the call by the called user; or
- b) avoid speech clipping on connections involving an NT2 where delays may occur in relaying the answer indication within the called user equipment.

The procedures described in this annex are only applicable to the speech and 3.1-kHz audio bearer services.

N.3 Procedures

As a network option, completion of the transmission path prior to receipt of a call acceptance indication may be provided in one of three ways:

- a) On completion of successful channel negotiation at the destination interface;
- b) On receipt of a message containing an indication that in-band information is being provided; or
- c) Not at all: i.e., this option is not supported by the network.

When criteria (a) is used to determine that a transmission path should be established, the network shall connect, at a minimum, the backward direction of the transmission path upon receipt of either a CALL PROCEEDING message or an ALERTING message containing an acceptable B-channel indication.

When criteria (b) is used to establish the transmission path, the network shall connect, at a minimum, the backward direction of the transmission path upon receipt of either an ALERTING message or a PROGRESS message containing a Progress indicator information element with a progress description value 8 "in-band information or appropriate pattern is now available" or 1 "call is not end-to-end ISDN; further call progress information may be available in-band," respectively.

The network providing the early completion of the transmission path in the backward direction may choose to support only one of methods described in (a) or (b). The network may choose to further restrict which message(s) will result in establishment of the transmission path. These restrictions may be imposed on a per-interface basis to provide an administrative means for limiting potential misuse of the early connection capabilities.

Annex O: Optional Procedures for Bearer Service Change

(normative)

The procedure for bearer service change may not be provided on all networks. On those networks that support it, a user may use this procedure after making a suitable subscription-time arrangement.

NOTES

- 1 The definition of necessary mechanisms (if any) within Signalling System Number 7 to support this procedure, including any undesirable charging implications, is for further study.

When a bearer service requested in an originator's SETUP message cannot be provided by the network, the network would reject the call or, under some circumstances, the network may change the bearer service and provide bearer service change notification. These procedures are currently applicable only to a change from 64 kbit/s unrestricted to 64 kbit/s restricted, and from 64 kbit/s restricted to 64 kbit/s restricted with rate adaptation.

- 2 During an interim period some networks may only support restricted 64 kbit/s digital information transfer capability, i.e., information transfer capability solely restricted by the requirement that the all-zero octet is not allowed. For interworking the values given in Appendix 1 of ITU-T Recommendation I.340 should apply. The interworking functions have to be provided in the network restricted capability. The ISDN with 64 kbit/s transfer capabilities will not be offered by this interworking, other than by conveying the appropriate signaling message to or from the ISDN terminal.
- 3 The possibility of changing from 3.1-kHz audio to speech is for further study.

Up to three Bearer capability information elements may be present in the SETUP message from the originating user, corresponding to the allowed bearer service modifications given above. The Bearer capability information element shall be immediately preceded by the Repeat indicator information element with the repeat indication field specifying "Priority list for selection." Hence, the order of Bearer capability information elements would indicate the order of bearer service preference.

If the SETUP message contains Bearer capability information elements not agreeing with any of the permissible ordered combinations listed above, the network shall reject the call attempt.

After sending a CALL PROCEEDING message, when the originating network or terminating premises equipment determines that the preferred bearer services cannot be provided, it sends a NOTIFY message toward the call originator. The NOTIFY message contains a Notification indicator information element with a coding that indicates to the originating party the change in bearer service and also contains a bearer capability information element specifying the attributes of the new bearer service.

Receipt of the NOTIFY message is not acknowledged. The call originator may allow the call to continue or may initiate call clearing in accordance with clause 5.

Annex P: Operator System Access

(normative)

P.1 Introduction

The optional operator system access procedures allow a user to request a call be routed to an operator system or attendant system. These procedures apply to the speech, 3.1 kHz and unrestricted digital information with tones/announcements.

The user may indicate a request for access to an operator or attendant system in one of two ways: using Keypad facility information element(s) or using the Operator system access information element.

P.2 Operator System Access Requested in Keypad Facility Information Element

When overlap sending procedures are being used or in any other case where called party address information is encoded using the Keypad facility information element, the user shall indicate a request to access an operator or attendant system using the Keypad facility information element. The digits to be encoded in keypad information shall be as appropriate for the dialing plan used at the originating access interface. The user shall supply the digits related to the request for operator or attendant system access (such as the prefix "0") in the SETUP message or, in the case of overlap sending, subsequent INFORMATION messages.

The network shall interpret all address information received in the Keypad facility information element as appropriate to the dialing plan being used and shall route the outgoing call accordingly.

P.3 Use of the Operator System Access Information Element

When en-bloc functional information elements (such as called party number and transit network selection) are used to convey address information, the user shall request access to an operator or attendant system using the Operator system access information element. In this case, the user shall include the Operator system access information element in the SETUP message.

The user shall indicate one of the following types of access in the Operator system access information element:

- a) public/principal access – used when a public network operator system is desired. The particular operator system to be accessed can be determined by the presence or lack of additional address information in the SETUP message;
- b) public/alternate access – used when the operator system of a presubscribed interexchange carrier is desired; or
- c) private/principal access – used to access Basic Business Group, PBX, or private network attendant systems. The particular attendant system to be accessed can be determined by the presence or lack of additional address information in the SETUP message.

On receipt of a SETUP message containing the Operator system access information element, the network shall provide routing to the appropriate operator or attendant system as determined by the type of

access requested and the presence of additional called party address information or transit network identification.

When the user has requested public/principal access in the Operator system access information element, the network shall act as follows:

- a) if a transit network is explicitly identified in the SETUP message (i.e., if the Transit network selection information element is present), the local serving network shall route the call to the operator system providing service for the indicated network;
- b) if the Transit network selection information element is not present in the SETUP message, but the user has provided an address in the called party number information element to which routing would occur via a transit network, the local serving network shall route the call to the operator system providing service for the transit network;
- c) if the Transit network selection information element is not present in the SETUP message, and the user has provided an address in the Called party number information element that resides in the local public network service area, the call shall be routed to the local public network operator system;
- d) if neither the transit network selection nor the Called party number information element is present in the SETUP message, the local serving network shall route the call to the local public network operator system.

When the user has requested public/alternate access in the Operator system access information element, the local serving network shall route the call to an appropriate transit network determined by user subscription (i.e., the calling user's presubscribed interexchange carrier). The request for public/alternate access is intended to be used when additional called party address and transit network selection information is not present in the SETUP message. However, if additional called party number information as well as transit network selection information is present in the SETUP message, the serving network, when capable, may interpret the user's intent and complete the call to the appropriate operator system. When the Called party number information element is present, the operator system providing service for a presubscribed interexchange carrier shall be requested using public/principal access, as described above.

When the user has requested private/principal access in the Operator system access information element, the network shall act as follows:

- a) If the SETUP message contains the Transit network selection information element, the local serving network shall route the call to the operator or attendant system providing service for the indicated network.
- b) If the Transit network selection information element is not present in the SETUP message, the local serving network shall route the call to the Basic Business Group, PBX or private network attendant system based on service agreements with the originating user.

P.4 Invalid Request

To avoid the possibility of conflicting address information, the Operator system access information element shall not be included in the same message as the Keypad facility information element. If the network receives a SETUP message containing both the Operator system access and Keypad facility information elements, it shall return a RELEASE COMPLETE message with cause 28, "invalid number format."

Annex Q: Responding Address Requirements of the OSI Network Layer Service

(normative)

The OSI network layer services (ISO 8348 or ITU-T Recommendation X.213) require the provision of the address (i.e., number and subaddress) of the NSAP responding to an N-connection. In order to provide this information, optional procedures are provided in this annex for those networks desiring to support these procedures. The far end answering point may provide its identity to the calling user by sending the Connected number as well as the Connected subaddress information elements to the network in the CONNECT message. In addition, the called party may reject the call and provide the connected number as well as connected subaddress.

The network supporting these services for the circuit mode data bearer service can pass these information elements transparently for delivery in the CONNECT message to the calling party. When the called party provides this information in a clearing message, that information can be sent to the calling party in the near end clearing message.

The specific procedures for providing this capability are not covered by this standard.

Annex R: Application of the Signal Information Element to Tones & Alerting Patterns

(informative)

This annex is intended to assist users of this standard in the application of the Signal information element to the provision of call progress tones and alerting (“ringing”) cadences. It maps the codepoints in of this standard to existing practices in the North American telephone network.

Table R.1 – Tones

Signal value	Explanation	North American Practices
0	Dial tone on	Precise dial tone is a continuous 350-Hz tone added to a 440-Hz tone.
1	Ring back tone on	Ring back tone (audible ringing tone) is a 440-Hz tone added to a 480-Hz tone repeated in a 2s-on 4s-off pattern
2	Intercept tone on	Intercept tone is alternating 440-Hz and 620-Hz tones, each on for 250 ms. Intercept tone is not ordinarily provided by the public network in North America.
3	Network congestion tone on	Network congestion tone (reorder tone) is a 480-Hz tone added to a 620-Hz tone repeated in a 250-ms-on, 250-ms-off cycle.
4	Busy tone on	Busy tone is a 480-Hz tone added to a 620-Hz tone repeated in a 500-ms-on, 500-ms-off cycle.
5	Confirm tone on	Confirm tone is a 350-Hz tone added to a 440-Hz tone repeated 3 times in a 100-ms-on, 100-ms-off cycle.
6	Answer tone on	Answer tone is not presently used in North American networks.
7	Call waiting tone on	Call waiting tone is a 300-ms burst of 440-Hz tone.
8	Off-hook warning tone on	Off-hook warning tone (“Howl” tone) is the sum of four frequencies: 1400-hz, 2060-Hz, 2450-Hz, and 2600-Hz, repeated in a 100-ms-on, 100-ms-off pattern.

Table R.2 – Alerting cadences

Signal value	Explanation	North American Practices
64	Alerting on – pattern 0 (Normal alerting)	Normal alerting is alerting 2s-on, 4s-off
65	Alerting on – pattern 1 (Intergroup alerting)	Intergroup alerting is a repeating pattern of 800-ms-on, 400-ms-off, 800-ms-on, and 4s-off,
66	Alerting on – pattern 2 (Special/Priority alerting)	Special/Priority alerting is a repeating pattern of 400-ms-on, 200-ms-off, 400-ms-on, 200-ms-off, 800-ms-on, and 4s-off,
68	Alerting on – pattern 4 (“Ping Ring”)	“Ping ring” is a single burst of 500 ms of alerting on.

Annex S: Comparison of ITU-T Recommendation Q.931 to ATIS-1000607

(informative)

NOTE – Not included in this standard.

Annex T: Bibliography

(informative)

At the time of publication, the editions indicated were valid. All standards are subject to revision, and users of this document are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

These standards are listed for information only and are not essential for the completion of requirements of this standard. The list of other standards that appear in text or as codepoints within this standard follows.

T1.601-1999, *Telecommunications – Integrated Services Digital Network (ISDN) – Basic access interface for use on metallic loops for application on the network side of the NT (layer 1 specification)*

ATIS-1000603.1993(R2009), *Telecommunications – Integrated Services Digital Network (ISDN) – Minimal set of bearer services for the primary rate interface*¹¹

ATIS-1000604.1990(R2009), *Telecommunications – Integrated Services Digital Network (ISDN) – Minimal set of bearer services for the basic rate interface*¹²

T1.605-1991 (R1991), *Telecommunications – Integrated Services Digital Network (ISDN) – Basic access Interface for S and T reference points (layer 1 specification)*

ATIS-1000608.1991(R2012), *Telecommunications – Integrated Services Digital Network (ISDN) – Signaling specification for X.25 packet-switched bearer service for Digital Subscriber Signaling System 1 (DSS1)*¹³

ATIS-1000609.1999(R2009), *Telecommunications – Interworking between the ISDN user-network interface protocol and the signalling system number 7 ISDN user part*¹⁴

ANSI X3.4-1986 (R1997), *Information Systems – Coded character sets – 7-bit American National Standard code for information interchange (7-bit ASCII)*¹⁵

ITU-T Recommendation E.164, *Numbering plan for the ISDN era (8/91)*¹⁶

ITU-T Recommendation F.60, *Operational provisions for the international telex service (8/92)*¹⁶

¹¹ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < <https://www.atis.org/docstore/product.aspx?id=24727>>

¹² This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < <https://www.atis.org/docstore/product.aspx?id=24728>>

¹³ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < <https://www.atis.org/docstore/product.aspx?id=26097>>

¹⁴ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < <https://www.atis.org/docstore/product.aspx?id=24732>>

¹⁵ This document is available from the InterNational Committee for Information Technology Standards (INCITS). < <http://www.incits.org/standards-information/>>

¹⁶ This document is available from the International Telecommunications Union. < <http://www.itu.int/ITU-T/>>

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ITU-T Recommendation F.69, *The international telex service – Service and operational provisions of telex destination codes and telex network identification* (6/94)¹⁶

ITU-T Recommendation F.182, *Operational provisions for the international public facsimile service between subscribers with Group 3 facsimile terminals (Telefax 3)* (10/96)¹⁶

ITU-T Recommendation F.182 bis, *Guidelines for the support of the communication of documents using Group 3 facsimile between user terminals via public networks* (10/96)¹⁶

ITU-T Recommendation F.184, *Operational provisions for the international public facsimile service between subscriber stations with Group 4 facsimile terminals (Telefax 4)* (7/96)¹⁶

ITU-T Recommendation F.200, *Teletex service* (8/92) [deleted as a consequence of the suppression of Teletex service, withdrawn 7/96].¹⁶

ITU-T Recommendation F.220, *Service requirements unique to the processable mode number eleven (PM11) used within the teletex service* (3-93) [deleted as a consequence of the suppression of Teletex service, withdrawn 7/96].¹⁶

ITU-T Recommendation F.230, *Service requirements unique to the mixed mode (MM) used within the teletex service* (11/88) [deleted as a consequence of the suppression of Teletex service, withdrawn 7/96].¹⁶

ITU-T Recommendation F.300, *Videotex service* (3/93)¹⁶

ITU-T Recommendation F.400 [see ITU-T Recommendation X.400].¹⁶

ITU-T Recommendation F.700, *Framework Recommendation for multimedia services* (11/00)¹⁶

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ITU-T Recommendation X.25, *Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet-mode and connected to public data networks by dedicated circuit (10/96)*¹⁶

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ISO 8802/2 (ANSI/IEEE 802.2-1989), *Information processing systems – Local area networks – Part 2: logical link control*¹⁷

ISO/IEC 9577:1999, *Information technology protocol identification in the network layer technologies*¹⁷

¹⁷ This document is available from the International Organization for Standardization. < <http://www.iso.ch/iso/en/prods-services/ISOstore/store.html> >

Annex U: B-channel Availability

(normative)

U.1 Scope

This annex lists the messages and procedures that shall be supported between the two sides of a primary rate interface in order to provide control of B-channel availability. The messages and procedures are concerned with conveying changes in the status of a B-channel.

The procedures contained herein apply only to primary rate interfaces, are optional and are provided after a suitable subscription time arrangement.

NOTE – These procedures do not preclude the network or the user from supporting internal substates for the In Service and Out of Service status categories. These substates will interact with the status categories in such a manner that a consistent view of the availability is maintained.

The procedures contained herein do not apply to the control of D-channel availability. When the D-channel is indicated in the received SERVICE message, procedures for D-channel backup shall be followed as defined in Annex F. Note that a SERVICE message cannot be used to change the status of the D-channel, except in the case of the D-channel backup (see Annex F).

U.2 Layer 2 Operation

The procedures contained herein are only applicable to point-to-point operation.

U.3 B-Channel Availability Message Definitions

U.3.1 Overview

The messages defined in this section can be sent by either the user or network. Each definition includes a brief description of the message use, and the information elements listed in order of appearance in addition to the Protocol discriminator, Call reference, and Message type information elements that are always present. The indicated information elements must be present.

U.3.2 B-Channel Availability Messages

U.3.2.1 SERVICE

This message is used to indicate that a B-channel is in the In-Service or Out-of-Service state. The Channel identification information element is used to identify the B-channel. See Table U.1.

Table U.1 – SERVICE message content

Type: SERVICE Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	U.4.2	both	M	1
Call reference	U.4.3	both	M	2-3
Message type	U.4.4	both	M	1
Change status	U.4.5.5	both	M	3
Channel identification	U.4.5.6	both	M	5-6

U.3.2.2 SERVICE ACKNOWLEDGE

This message is used to acknowledge the SERVICE message. The Channel identification information element is used to identify the B-channel. See Table U.2.

Table U.2 – SERVICE ACKNOWLEDGE message content

Type: SERVICE ACKNOWLEDGE Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	Y.4.2	both	M	1
Call reference	U.4.3	both	M	2-3
Message type	U.4.4	both	M	1
Change status	U.4.5.5	both	M	3
Channel identification	U.4.5.6	both	M	5-6

U.3.2.3 STATUS

This message is sent by the user or the network to report certain error conditions.

Table U.3 – STATUS message content

Type: STATUS Significance: local Direction: both				
Information Element	Reference	Direction	Type	Length
Protocol discriminator	U.4.2	both	M	1
Call reference	U.4.3	both	M	2-3
Message type	U.4.4	both	M	1
Cause	U.4.5.4	both	M	4-32

U.4 Message Structure

U.4.1 Overview

The messages identified for the user-network interface shall follow the same structure as call control messages defined in 4.1. The message consists of the following parts:

- 1) protocol discriminator;
- 2) call reference;
- 3) message type; and
- 4) other information elements as required.

U.4.2 Protocol Discriminator

The messages defined in this annex shall use the Protocol discriminator as defined in 4.2 with the value of "Network management messages" as defined in Table 19.

U.4.3 Call Reference

The messages defined in this annex shall use the global call reference, as defined in 4.3.

U.4.4 B-Channel Availability Message Types

The message types needed to support the B-channel availability procedures are given in Table U.4.

Table U.4 – Message types

Bits	
<u>8765 4321</u>	
<i>B-channel availability messages:</i>	
0000 1111	SERVICE
0000 0111	SERVICE ACKNOWLEDGE
0111 1101	STATUS

U.4.5 Other Information Elements

U.4.5.1 Coding Rules

The rules of 4.5.1 shall apply to variable length information elements included in network management messages except that Table 21 is replaced by Table U.5 and Figure 8 is not applicable.

Table U.5 – Information element identifier coding for network management messages

8 7 6 5 4 3 2 1	Reference	Max length (octets) (Note 1)	Max no. of occurrences (Note 2)
<i>Single octet information elements:</i>			
1 : : : - - - -			
0 0 0 - - - -	reserved		
0 0 1 - - - -	Shift (Note 3)	U.4.5.3	1
<i>Variable length information elements in codeset 5:</i>			
0 : : : : : : :			
0 0 0 0 0 0 1	Change status	U.4.5.5	3
0 0 0 1 0 0 0	Cause (note 3)	U.4.5.4	32
0 0 1 1 0 0 0	Channel identification (note 3)	U.4.5.6	6
All other values are reserved.			
NOTES			
1 The length limits described for the variable length information elements below take into account only the present ANSI standardized coding values.			
2 This is the maximum number of occurrences allowed for variable length information elements. Unless otherwise specified, the maximum number of occurrences is one.			
3 For the purposes of network management messages, this information element shall be considered as a nationally-standardized information element. Therefore the information element identifier value shall also belong to the nationally-standardized code space for information elements.			

U.4.5.2 Extensions of Codesets

The rules of 4.5.2 shall apply to network management messages. For network management messages, codeset 5 shall be the initial active codeset. Therefore, only a shift to codeset 6 is applicable.

U.4.5.3 Locking Shift Procedures

The rules of 4.5.3 shall be applicable to network management messages only to the extent for supporting a shift to codeset 6.

U.4.5.4 Cause

The coding of the cause information element is defined in ATIS-1000650.

U.4.5.5 Change status

The purpose of the Change status information element is to indicate or change the current status of a B-channel to either the In Service or Out of Service state. The coding of the Change status information element is shown in Figure U.1. The length of this information element is set to 1.

8	7	6	5	4	3	2	1	Octet
0		Change status information element identifier						1
0	0	0	0	0	0	0	1	
0		Length of the Change status contents						2
0	0	0	0	0	0	0	1	
1 ext	Type	Spare			New Status			3
		0	0	0				

Figure U.1 – Change status information element

Type (octet 3)

Bits

7

1 Channel

All other values are reserved.

New Status (octet 3)

Bits

3 2 1

0 0 0 In Service

0 1 0 Out of Service

All other values are reserved.

U.4.5.6 Channel Identification

The coding of the Channel Identification information element is given in 4.5.12. It may be 5 or 6 octets long when appearing in the messages defined in this annex.

U.5 Procedures

This clause presents the procedures to be used with the messages defined in U.7. Since the B-channel availability procedures are symmetric, they can be initiated by either side of the interface. These procedures support B-channel availability control on an individual channel basis. If multiple or all B-channels of a primary rate interface are to be placed into an Out of Service or In Service status, these procedures shall be successfully completed for each individual B-channel affected. If the D-channel is removed from service, these procedures become non-functional unless D-channel backup is provided.

U.5.1 B-Channel Status Categories

Associated with B-channel availability are two status categories. They are, in decreasing order of availability:

- In Service
- Out of Service

The procedure involving the SERVICE message changes the status of a channel within the interface. This subclause will define the meanings of the two allowed bearer channel status categories. The allowed transitions between the various bearer channel status categories are shown in the SDL diagrams in Figures U.2 through U.7. The two, going from the most to the least available category, are In Service and Out of Service. Out of Service is considered busy for normal call processing. However, origination and termination of test calls (e.g., determined by digit analysis) may be supported by both sides of the interface when the channel is in the Out of Service status. Transitions from a more to a less available category occur without negotiation while transitions from a less to a more available category require both sides of the interface to agree on the transition. (However, notification of transitions from a more to a less available category shall be made by the use of the SERVICE message defined in this annex.)

As an aid to implementation, the Out of Service category can be broken down further into Near End (NE) and Far End (FE) subcategories that signify whether that category was requested by the local system or the system on the other side of the interface. Systems may separately track the Near End and Far End status with Near End status procedures taking precedence over those of the Far End state for status of the same category. The Near End status reflects the view of the local system as to the service availability that it has of the channel. If implemented in this way, the categories/subcategories of availability are:

- In Service
- Out of Service/Far End
- Out of Service/Near End

Systems may move a channel from the Near End to the Far End subcategory by attempting to place it in a more available category and having that request denied by the Far End.

For example, suppose that a channel had been placed in the Out of Service status by side A of the interface (Out of Service/Near End from side A's point of view and Out of Service/Far End from side B's point of view). While in Out of Service a failure occurs within side B's domain which makes the channel inoperative. Side B places the channel in the Out of Service category (Out of Service/Near End from side B's point of view). When the failure clears, side B will attempt to place the circuit In Service by sending a SERVICE message with a Change status information element with a value of In Service across the interface. Side A may respond to this message by sending a SERVICE ACKNOWLEDGE message to side B with the Change status information element set to a value of Out of Service. Side B will now have returned to the previous status with the channel in the Out of Service category with the subcategory of Far End. Alternatively, side A could respond to the request by sending a SERVICE ACKNOWLEDGE message to side B with the Change status information element set to the value of In Service and placing the channel in the In Service state.

If channel negotiation is employed, the service status that governs call processing is the service status of the channel to which the call is ultimately negotiated.

The B-channel availability procedures to support these status categories are independent of and serve a different purpose than Restart procedures. Restart procedures clear all calls on specified B-channels. Further calls are prohibited on the specified B-channels only until a RESTART ACKNOWLEDGE mes-

sage is received in response. B-channel availability procedures, on the other hand, do not clear calls but may prohibit call setup of non-test calls on the specified B-channels until a less restrictive status is negotiated between the two ends.

Therefore, a SERVICE message with a Change status information element indicating Out of Service status will not change the call processing state of a stable call (see U.5.7). In the event that a manual maintenance action is desired to both initialize a stable call and to prohibit further call setup, the B-channel availability procedure with a change to an Out of Service status may be invoked to first prohibit new call setup and be followed by the Restart procedure. Thus, the Restart procedure is independent of the B-channel availability procedures and may be invoked while the channel is in an Out of Service status.

U.5.1.1. In Service

A bearer channel that has In Service status can be assigned for calls by the signaling call control entity on either side of the interface. Such bearer channels may be used for a call when a request occurs at the ISDN interface. Both normal calls and test calls may use the channel in this status.

A channel that has In Service status may be moved to the Out of Service status by either side of the interface.

U.5.1.2 Out of Service

A bearer channel may be moved from the In Service to an Out of Service status without negotiation but requires that a SERVICE message be sent to notify the far end. A channel with Out of Service status may be moved to the In Service status only if both sides of the interface agree to do so. This is accomplished by an exchange of a SERVICE message with a SERVICE ACKNOWLEDGE message response with a Change status information element (see U.7.5) indicating the In Service status.

U.5.1.2.1 Call Origination

A channel that is in the Out of Service status may not be assigned for normal outgoing traffic by either side of the interface. However, a channel that is in the Out of Service category status may be assigned by either side of the interface for outgoing test calls. A test call may be determined by digit analysis.

In the case of channel negotiation, if the originating end receives a response that attempts to negotiate to an Out of Service channel, the treatment given by the originating end is an implementation option. The options are:

- a) Respond with RELEASE COMPLETE with the local cause 44, "requested channel not available".
- b) In addition to (a) above, initiate a status audit procedure (see U.5.5).
- c) If the Out of Service status was originally requested by the Far End, accept the call, then initiate a procedure to bring the channel into service as defined in U.5.2. If the Out of Service status was originally requested by the Near End, proceed according to (a) above.

U.5.1.2.2 Call Termination

Neither side of the interface is required to process any non-test incoming calls. In the case of channel negotiation, the terminating end should not attempt to negotiate a normal call to an Out of Service chan-

nel. Incoming test calls may be accepted by either side of the interface for a channel that is in the Out of Service category status. A test call may be determined by digit analysis.

If a SETUP is received for a non-test call on a channel in the Out of Service status, an abnormal condition such as a collision (see U.5.4.2) has occurred and the response is an implementation option. The options are:

- a) Respond with RELEASE COMPLETE with the local cause 44, "requested channel not available" or follow the procedures of 5.2.3.1 in the case of channel negotiation.
- b) In addition to (a) above, initiate a status audit procedure (see U.5.5).
- c) If the Out of Service status was originally requested by the Far End, accept the call, then initiate a procedure to bring the channel into service as defined in U.5.2. If the Out of Service status was originally requested by the Near End, proceed according to (a) above.

U.5.2 Sending a SERVICE Message

Changing the status of a B-channel is accomplished by sending a SERVICE message across the interface indicating the channel and the new status. A SERVICE message may be sent for another different channel prior to receiving a response.

NOTE – A SERVICE message cannot be used to change the status of the D-channel, except in the case of D-channel backup (see Annex F).

The acknowledgment to a SERVICE message is the SERVICE ACKNOWLEDGE message indicating the same B-channel.

When a SERVICE message is sent, timer T323 shall be started. If the SERVICE message is sent as part of audit procedures (see U.5.5), then the status of the B-channel does not change unless the SERVICE ACKNOWLEDGE message indicates a lower availability. If the new status indicated in the SERVICE message is Out of Service, then the current status of the B-channel is set to Out of Service/Near End. If the new status requested is In Service and the current status is Out of Service, then the current status remains in effect (although it should be as a Far End subcategory, i.e., Out of Service/Far End) until a SERVICE ACKNOWLEDGE is received.

If timer T323 expires, this side may continue sending SERVICE messages at periodic intervals until a SERVICE ACKNOWLEDGE message is returned. If a SERVICE message is received during this time it is handled as specified in U.5.4. After a predetermined number of retransmissions (see clause 9, Tables 24 and 25), a suitable maintenance notification may be given by the local system and SERVICE messages should no longer be sent.

If the SERVICE message is sent indicating In Service and the SERVICE ACKNOWLEDGE message received in response indicates Out of Service, then timer T323 is stopped and the status of the channel is Out of Service/Far End. If the SERVICE message is sent indicating In Service and the SERVICE ACKNOWLEDGE message received in response indicates In Service, then timer T323 is stopped and the status of the channel is In Service.

If the SERVICE message is sent indicating Out of Service and the SERVICE ACKNOWLEDGE message received in response indicates Out of Service, then timer T323 is stopped and the status of the channel is Out of Service/Near End. If the SERVICE message is sent indicating Out of Service and the SERVICE ACKNOWLEDGE message received in response indicates In Service, then the receiving entity shall apply one of the following options:

- a) ignore the SERVICE ACKNOWLEDGE message (T323 is not stopped); or

- b) resend a SERVICE message indicating Out of Service, restart timer T323, and maintain the status of the channel in Out of Service/Near End.

U.5.3 Receiving a SERVICE Message

If a SERVICE message is received, a SERVICE ACKNOWLEDGE message shall be sent in response indicating the same B-channel indicated in the SERVICE message.

The following specifies the response and action to take.

- a) If the current status of the B-channel is Out of Service/Near End, then the Change status information element sent in the SERVICE ACKNOWLEDGE message shall indicate Out of Service and the B-channel shall remain Out of Service/Near End.
- b) If the current status of the B-channel is Out of Service/Far End, and the Change status information element in the received SERVICE message indicates In Service, then the Change status information element sent in the SERVICE ACKNOWLEDGE message shall indicate In Service and the status of the B-channel shall be changed to In Service.
- c) If the current status of the B-channel is Out of Service/Far End, and the Change status information element in received SERVICE message indicates Out of Service, then the Change status information element in the SERVICE ACKNOWLEDGE message shall indicate Out of Service and the status of the B-channel shall remain Out of Service/Far End.
- d) If the current status of the B-channel is In Service and the Change status information element in the received SERVICE message indicates Out of Service, then the Change status information element sent in the SERVICE ACKNOWLEDGE message shall indicate Out of Service and the status of the B-channel shall change to Out of Service/Far End.

U.5.4 Collisions

U.5.4.1 SERVICE Message Collision

Collision occurs when a SERVICE message is received in the period of time between when a SERVICE message is sent (identifying the same B-channel as in the received SERVICE message) and its responding SERVICE ACKNOWLEDGE is received. When this occurs, the incoming SERVICE message is treated in the normal manner, that is, the appropriate SERVICE ACKNOWLEDGE message is sent (see U.5.3). However, the incoming SERVICE message is treated as if it were a response to the sent SERVICE message and timer T323 is canceled. Any subsequent received SERVICE ACKNOWLEDGE message is treated as in U.5.8.2.

U.5.4.2 SETUP Message Collision

Collision occurs when a SETUP message is received in the period of time between when a SERVICE message with a Change status information element indicating an Out of Service status is sent and its responding SERVICE ACKNOWLEDGE is received. In this case, the SETUP message shall be handled in accordance with U.5.1.2.2.

The Far End, after having sent a SETUP message, will receive a SERVICE message containing a Change status information element indicating a status of Out of Service. It shall place the B-channel in the Out of Service/Far End status and respond with a SERVICE ACKNOWLEDGE message but the call processing state of the in-progress call will not be affected by the SERVICE message. If a RELEASE

COMPLETE message is then received, the call shall be cleared. In the case of channel negotiation, the procedures of 5.2.3.1 shall be followed.

U.5.5 Status Audits

The status audit procedure allows either side of an interface to bring both sides of the interface into agreement on the status by an exchange of SERVICE and SERVICE ACKNOWLEDGE messages. The support of status audits is optional, but a SERVICE ACKNOWLEDGE message shall be returned in response to the SERVICE message. The Change status information element in the SERVICE message shall be set to the In-Service value if the B-channel is in the In Service category or in the Far End subcategory of Out of Service. If the channel is in the Out of Service/Near End, then the Change status information element sent in the SERVICE message shall indicate a status of Out of Service.

This procedure will force the status to become aligned on both sides of the interface and will return resources to service if possible.

Audits may be triggered periodically or by a variety of unexpected events. Examples of events that may be used to trigger audits are:

- a) Incoming calls for B-channels with status of Out of Service.
- b) Unsolicited SERVICE ACKNOWLEDGE or unallowed responses to SERVICE messages (such as a request to place a circuit Out of Service resulting in a SERVICE ACKNOWLEDGE response of In Service).
- c) Receipt of cause 44 "requested channel not available" on any call clearing message that is not caused by a glare condition.
- d) Once every 24 hours on all channels.
- e) Once every hour on all channels that are in the Out of Service/Far End state.

U.5.6 Initial Service Status

When B-channels are newly provisioned at either end of the interface, the other end may not yet be provisioned. Newly provisioned channels are initially placed in the Out of Service category. The network should be in initial control of newly provisioned circuits. Therefore, the initial Out of Service categories shall be Near End for the network and Far End for the user.

The network or user may attempt to bring these circuits into service by sending SERVICE messages. B-channel availability control can be used to give the network initial control of newly provisioned channels to prevent unauthorized use of the network. This is useful since these channels can usually provide service before the agreed upon in-service date.

U.5.7 Relationship of Service Status to Call Processing State

The exchange of SERVICE and SERVICE ACKNOWLEDGE messages does not by itself change the call processing state of either a stable call or an in progress call. The exchange of call processing messages does not change the Service status category. However, call processing messages that are inconsistent with the current status category may trigger Service status audit procedures (see U.5.5) that result in the exchange of SERVICE and SERVICE ACKNOWLEDGE messages that change the service status category.

Similarly, a change of service status category from In Service to Out of Service may optionally trigger call processing messages that would clear a stable call or in-progress call. Call clearing may be initiated either by the sender or by the receiver of the SERVICE message. Cause 41 "temporary failure" shall be used in the call clearing message.

U.5.8 Error Conditions

U.5.8.1 Receipt of a SERVICE or Solicited SERVICE ACKNOWLEDGE Message with Invalid Contents

If a SERVICE message is received with a missing Change status or Channel identification information element, return a STATUS message with the global call reference and cause 96, "mandatory information element missing."

If a SERVICE message is received with invalid contents for either the Change status or Channel identification information element, return a STATUS message with the global call reference and cause 100 "invalid information element content."

If the Channel Identification information element received in a SERVICE message is recognized as referring to an unprovisioned or unadministered B channel, return a STATUS message with global call reference and either cause 82 "identified channel does not exist" or 100 "invalid information element content."

If a SERVICE ACKNOWLEDGE message is received with a missing Change status or Channel identification information element, return a STATUS message with global call reference and cause 96, "mandatory information element missing." Then this side may continue sending SERVICE messages at periodic intervals as specified in U.5.2.

- 1) If a SERVICE ACKNOWLEDGE message is received with a Change status or Channel identification information element with invalid contents, return a STATUS message with the global call reference and cause 100 "invalid information element content." Then this side may continue sending SERVICE messages at periodic intervals as specified in U.5.2.

U.5.8.2 Unsolicited SERVICE ACKNOWLEDGE Message

If an unsolicited SERVICE ACKNOWLEDGE message is received either:

- a) Ignore the message if the channel status agrees with that assumed by the recipient of the message. Otherwise, perform a SERVICE status audit as described in U.5.5;
- b) Treat the same as a solicited SERVICE ACKNOWLEDGE; or
- c) Ignore it.

These responses are in decreasing order of preference.

U.6 SDLs

The following SDL diagrams describe procedures for B-channel availability. SDLs for D-channel backup can be found in Annex F.

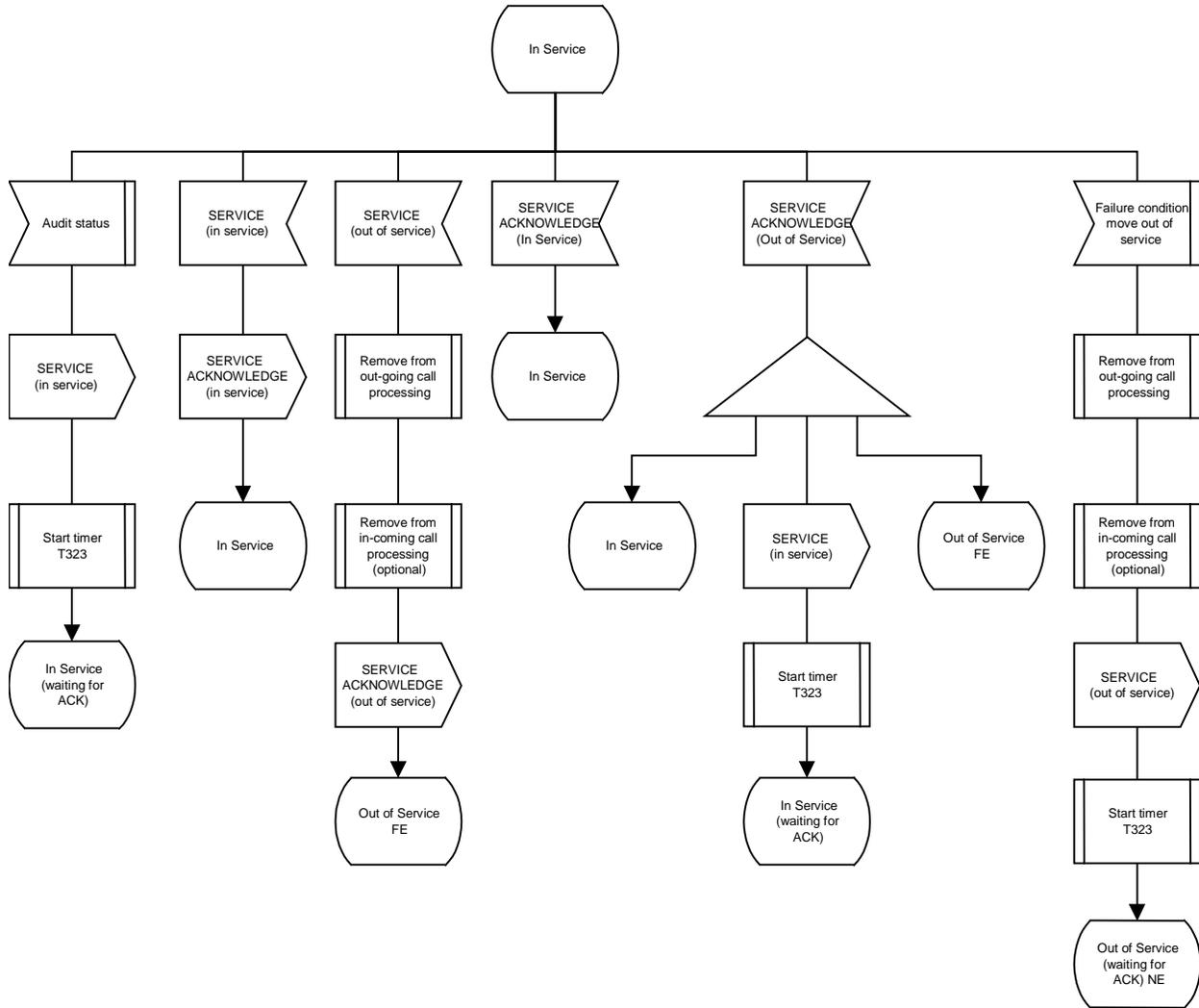


Figure U.2 – SDL SERVICE in Service (part 1 of 2)

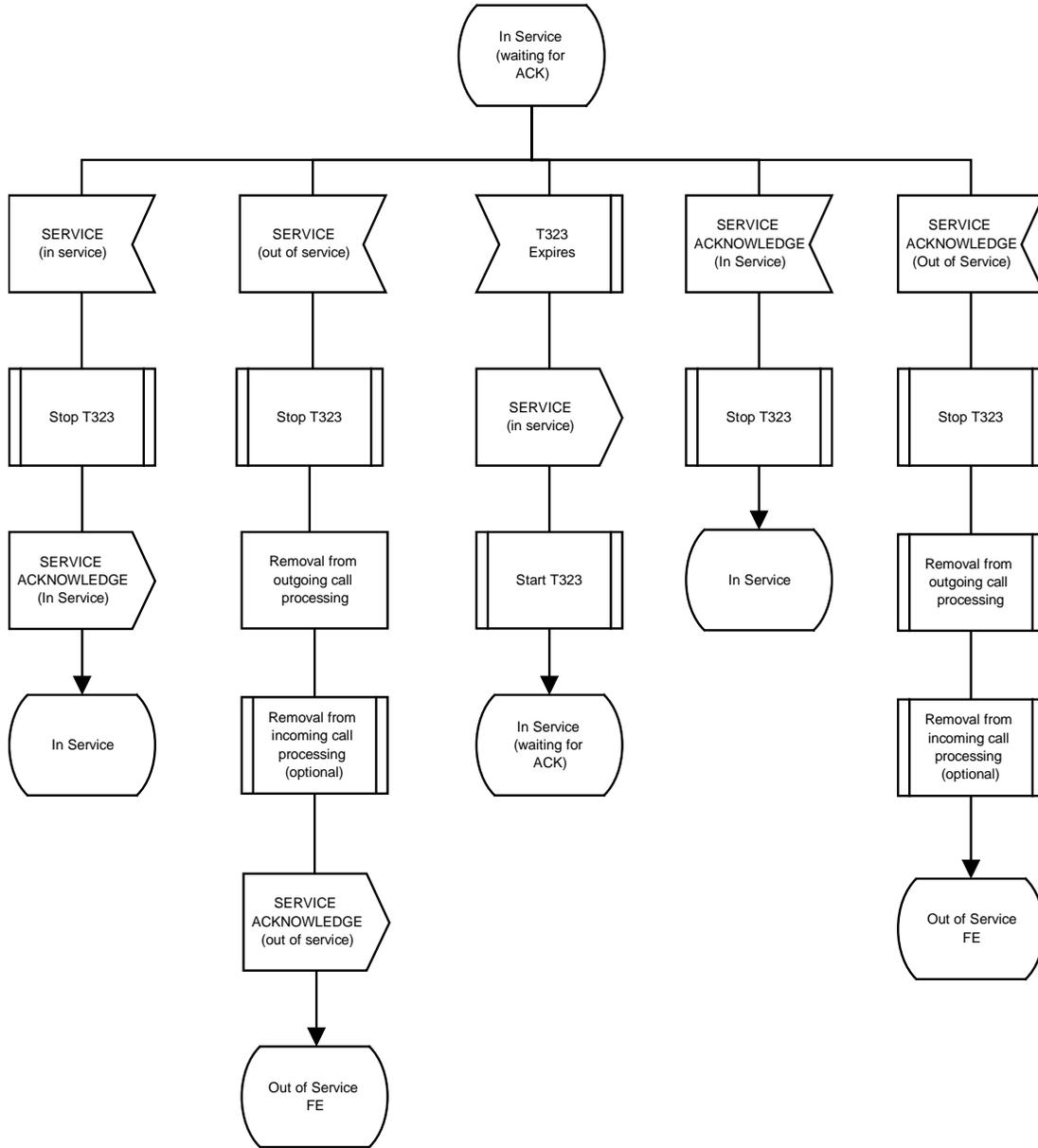


Figure U.3 – SDL SERVICE in Service (part 2 of 2)

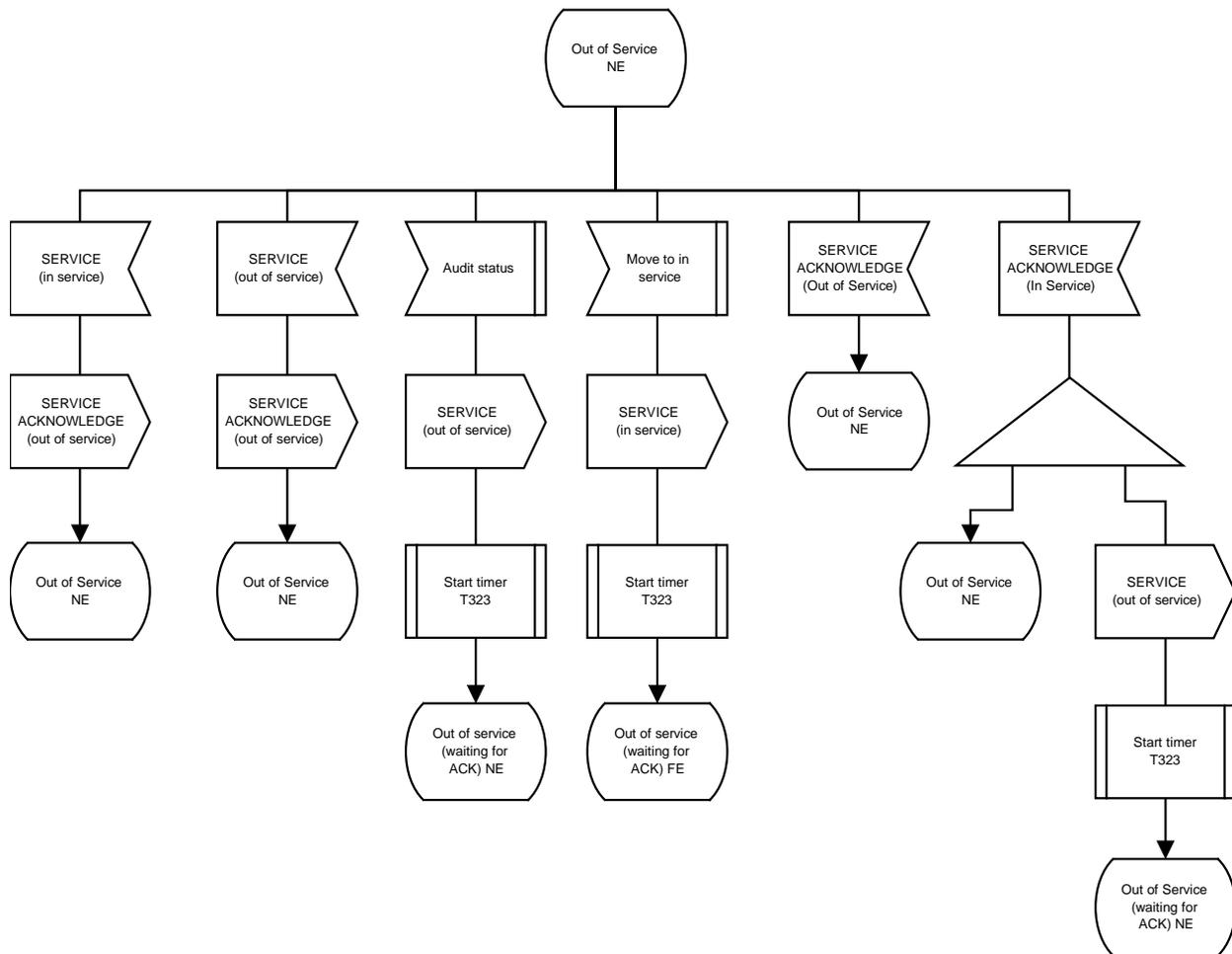


Figure U.4 – SDL SERVICE Out of Service (part 1 of 4)

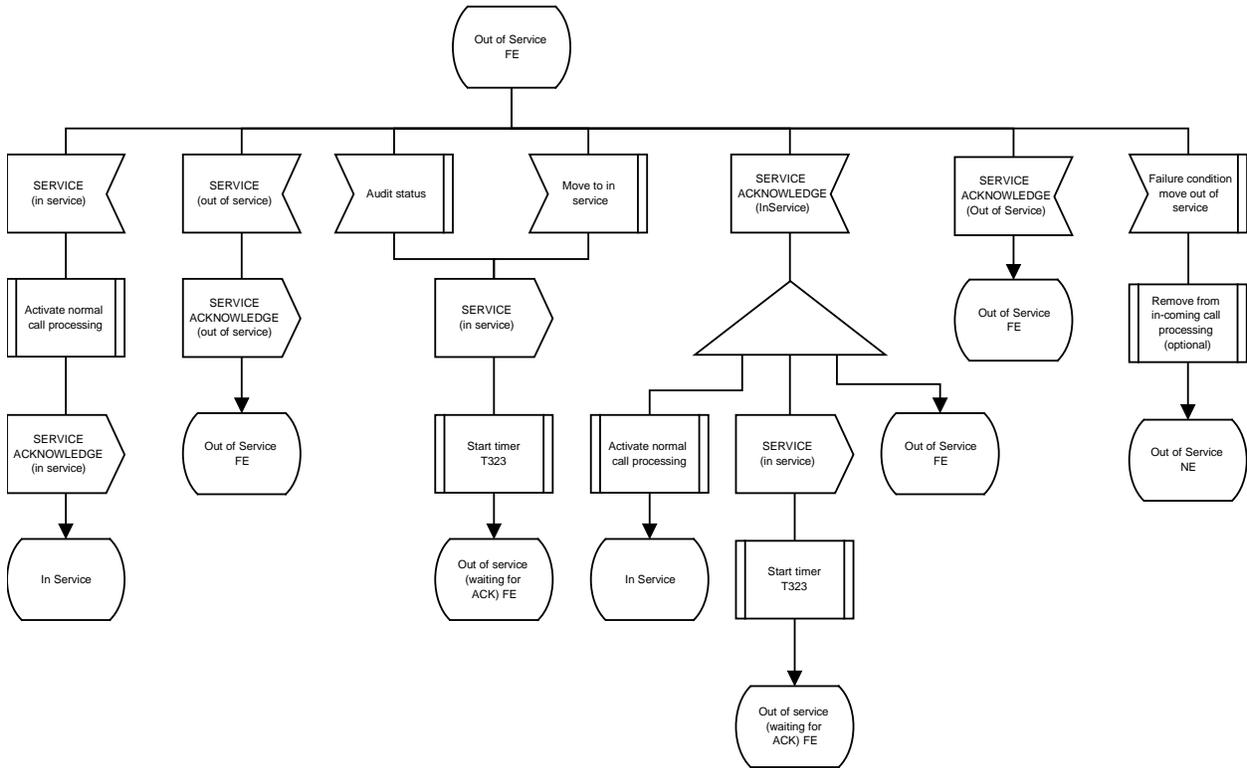


Figure U.5 – SDL SERVICE Out of Service (part 2 of 4)

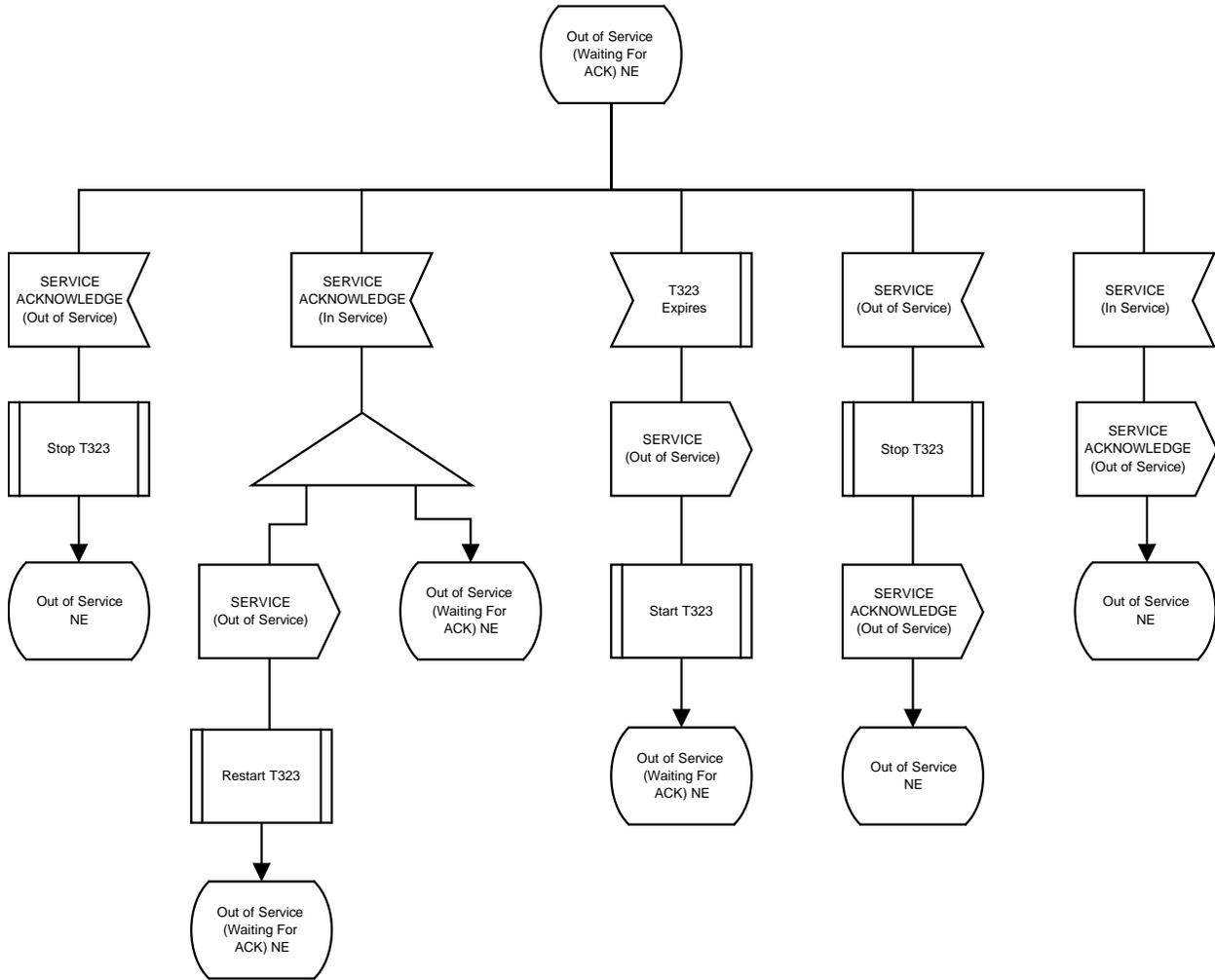


Figure U.6 – SDL SERVICE Out of Service (part 3 of 4)

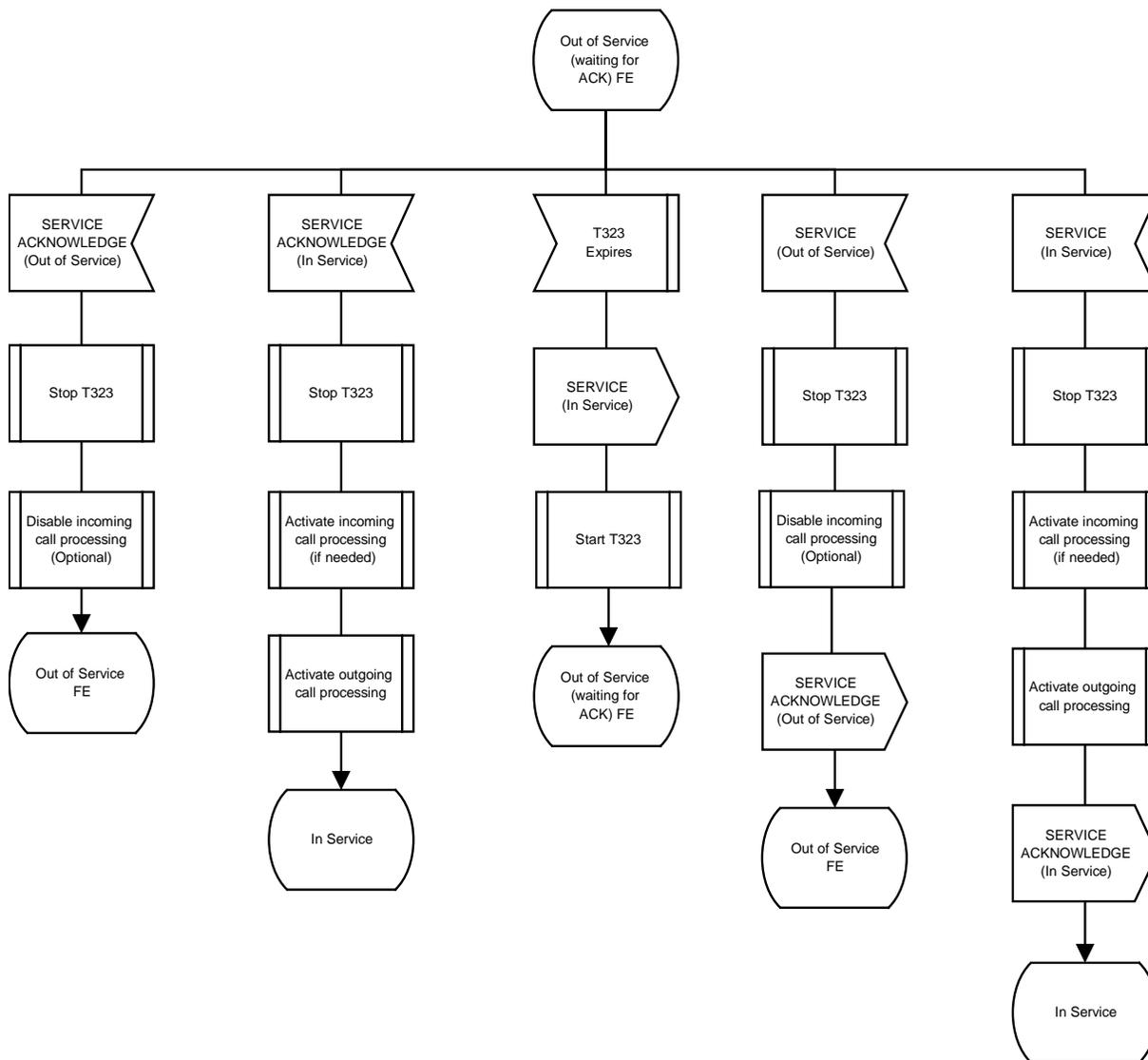


Figure U.7 – SDL SERVICE Out of Service (part 4 of 4)

Annex Y: Emergency Service Calls

(normative)

See ATIS-100628 for the definition and procedures for emergency service calls.